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Determinants of entrepreneurship and self-employment for older people in Chile

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Abstract: In most countries self-employment rates move up along with age. This may reflect that people are expelled from wage-work as they age, facing more precarious job conditions. However, labour statistics tabulated by age might be affected by survival bias, that is, older people who remain in the labour force might differ from those who exit the labour force. To attack this problem, we estimate bivariate probit models with sample selection using Chilean data to assess the effect of aging on self-employment choices, controlling for the decision to remain working. We find that the age gradient in self-employment almost vanishes for all groups once we control for observable characteristics and for potential selection bias. These results suggest that self-employment is more frequent among older people mainly because of differential labour market exits between wage workers and self-employed, and not necessarily because of large transitions to self-employment at older ages.

Keywords: entrepreneurship; mature-aged entrepreneurship; old-age entrepreneurship; senior entrepreneurship; self-employment; older workers; bivariate probit models with sample selection; Chile.

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1 Introduction

Understanding transitions towards entrepreneurship and self-employment at mature ages has become increasingly important as work lives are extended into older ages. There is a vast retirement literature on the determinants of the transition out of the labour force (see Gómez-Gras et al., 2010, and studies cited in Coile, 2016, and in Fisher and Ryan, 2018). However, there is much less work on transitions from wage and salary work into self-employment at older ages (Zissimopoulos and Karoly, 2009).

The evidence for developed countries indicates that a growing proportion of older people, especially the most educated and those in good physical and mental health, prefer to stay in the labour market beyond legal retirement ages in order to keep contributing to their families' financial security and to society overall. Unlike developed countries, in Latin America older people remain working after retirement mainly due to small pensions. There is, however, also a fraction of retirees who stay in the labour market by choice; this is more likely for more educated workers (CEPAL/OIT, 2018).

In the case of Chile, Vives et al. (2016) show that older people who stay in the labour force have more precarious employment than younger workers, usually being self-employed. Consequently, their descriptive evidence shows a rising pattern of self-employment rates at older ages. They argue that this pattern suggests that "as people age, they are expelled from wage-work, especially from formal wage-work". However, some of these older workers have been self-employed for all their careers while others have made the transition to self-employment later in their life, often as part of the transition to retirement (see Zissimopoulos and Karoly, 2007, for a similar analysis for the USA).

It is necessary, therefore, to complement this descriptive evidence with a more rigorous analysis showing the effect of aging on work choices conditional on individual characteristics. Labour statistics tabulated by age might suffer from *survival bias*, that is, older people who *remain* in the labour force might be different from those who exit the labour force in terms of observable and unobservable characteristics.

To address these issues, we estimate bivariate probit models with sample selection using cross-sectional household survey data from Chile to assess the main determinants of self-employment – either owning a business or being a self-employed worker-at mature ages (50+ years' olds) by sex. These models allow for selection on unobservables by estimating the selection equation (the decision to remain working) and the outcome equation (the self-employment choice) together. Thus, they control for the potential bias that may arise because self-employment choices are only observed for those who remain working.

We find that the rising pattern of self-employment rates at older ages almost vanishes once we control for sample selection. There is no statistically significant difference between the probability of self-employment of people from all age categories or by sex, except for 60–64 years old males compared to the 50–54 baseline category (9.5%

increase). This result indicates that self-employment is more common among older workers mainly because of differences between those who remain active in versus those who exit the labour market and not necessarily because of a large transition from wage work to self-employment as they age. Hence, we cast doubt on the commonly held thought that older people are expelled from wage-work as they age, forcing them into self-employment. In other words, we find no evidence that most of older Chilean workers are using self-employment as a 'bridge occupation' before retirement or as a way to continue generating income when they are forced out of the formal job market.

Among other determinants of entrepreneurship/self-employment at older ages, we find a negative effect of a retirement pension on the probability of self-employment and an inverted u-shaped relationship between education and self-employment for both men and women. There is also a sizeable and statistically significant effect of health status on entrepreneurship and self-employment, which is less important for women. Living in an urban area negatively affects the probability of self-employment compared to rural residents with the same characteristics and region.

By analysing the case of Chile, this study contributes to the literature that uses occupational choice models to understand senior citizens' entrepreneurial career decisions, as in Zissimopoulos and Karoly (2007, 2009), Solinge (2014), Biehl et al. (2014), and Kautonen et al. (2013, 2017). See the review on this topic in Seco Matos et al. (2018).

The rest of the paper is organised as follows. Section 2 presents the univariate probit models and the bivariate probit models with sample selection used in the paper. Section 3 describes the data and the selected sample used to estimate the models. Section 4 presents the results and Section 5 concludes.

2 Econometric model

The empirical analysis is based on bivariate probit models with sample selection (Wynand and Bernard, 1981; Greene, 1993; Jones and Latreille, 2011). We model the decision-making process in two stages. In the first, adult i chooses whether to work ($E_i = 1$) or to remain unemployed or inactive ($E_i = 0$). Conditional upon the decision to work, the adult chooses to work as a self-employed – either by owning a business or being a self-employed worker – ($S_i = 1$) or to work for someone else ($S_i = 0$). Hence, the model consists of the following equations:

$$\begin{aligned} &\text{Employment Equation}: \quad E_i^* = Z_i\gamma + U_i \\ &\qquad\qquad\qquad\qquad E_i = 1 \; if \; and \; only \; if \; E_i^* > 0 \; and \; 0 \; else \end{aligned} \tag{1}$$

$$\begin{aligned} &\text{Self-Employment Equation}: \quad S_i^* = X_i\beta + \varepsilon_i \\ &\qquad\qquad\qquad\qquad S_i = 1 \; if \; and \; only \; if \; S_i^* > 0 \; and \; 0 \; else \end{aligned} \tag{2}$$

$$\begin{aligned} &\text{Sample Selection}: \quad S_i \; is \; only \; observed \; if \; E_i = 1 \\ &\qquad\qquad\qquad\qquad [U_i, \varepsilon_i] \sim N_2(0, 0, 1, 1, \rho) \end{aligned} \tag{3}$$

where E_i^* is a latent index representing the net utility of working versus remaining unemployed or retiring from the labour force, and S_i^* is a latent index representing the

net utility of self-employment versus wage work. We do not directly observe E_i^* *or* S_i^*, instead, we observe the dummy E_i for the whole sample and the dummy S_i for the subsample who decides to work ($E_i = 1$). The terms Z_i and X_i are vectors of observables such as age, education level, sex, among others; γ and β are vectors of parameters to be estimated; and U_i and ε_i are the unobservables. The term ρ is the correlation between U_i and ε_i. If ρ equals 0, the selection is of no consequence, and the unconditional probit model for the self-employment equation would yield unbiased results. In that case, we could just estimate the following model using the subsample of workers for whom $S_i = 1$ for those who are self-employed and $S_i = 0$ for those who are wage workers:

$$\begin{aligned} &\text{Unconditional Probit}: \quad S_i^* = X_i\beta + \varepsilon_i \\ &\qquad\qquad\qquad\qquad S_i = 1 \; \textit{if and only if} \; S_i^* > 0 \; \textit{and} \; 0 \; \textit{else} \end{aligned} \tag{4}$$

On the contrary, if $\rho \neq 0$, we need to jointly estimate equation (2) with the selection equation (1). In that case, the likelihood function is:

$$L = \prod_i^n = \underbrace{\Phi\left(-Z_i\gamma\right)^{(1-E_i)}}_{\Pr(E_i=0)} * \underbrace{\Phi_2\left(Z_i\gamma, -X_i\beta, -\rho\right)^{(1-S_i)*E_i}}_{\Pr(E_i=1,\, S_i=0)} * \underbrace{\Phi_2\left(Z_i\gamma, X_i\beta, \rho\right)^{S_i*E_i}}_{\Pr(E_i=1,\, S_i=1)} \tag{5}$$

To help identify the latter model, we need an exclusion restriction in the employment equation (1), namely at least one variable shifting the probability of employment $(P_{E_i} = \Pr(E_i = 1 / Z_i))$ independently from the conditional probability of choosing self-employment $(P_{S_i} = \Pr(S_i = 1 / E_i = 1, X_i))$. Accordingly, we use the dummy variable $Enroll_i$ in (1) as a plausibly exogenous source of variation in P_{Si}. This variable indicates whether adult i is currently enrolled in the Chilean pension system or not. Being enrolled is defined by having contributed for at least one month during their work history, either because they were obligated to do so as formal workers or because they have freely chosen to contribute to their individual accounts as independent workers. Those who have worked in the past are more likely to be enrolled compared to those who have not worked at all or who have worked informally or fully independently. Hence, this dummy captures the long-term attachment to the labour force of adults.

3 Data

To estimate the model, we use cross-sectional household survey data from the CASEN 2017, a nationally representative survey conducted by the Ministry of Social Development. This survey is used to calculate Chile's official poverty rate and income distribution since 1990. The CASEN 2017 is the last survey available before the COVID-19 pandemic, and its full sample contains 216,439 observations.

To construct the descriptive graphs, we select 115,921 observations from people between 25 and 70 years old and who have complete data for the covariates used in this paper. To estimate the model, we restrict the sample further to adults between 50 and 70 years old at the time of the survey. The resulting sample size is 50,807 observations.

We define self-employment ($S_i = 1$) as the combination of self-employed workers and business owners. The CASEN asks people who stated they worked during the past week: 'In your main job or business, ¿do you work as?' Respondents who declare working for

themselves, independently, without a boss, and without using paid personnel, are classified as 'self-employed workers'. Respondents who state they have their own business or firm, either formal or informal, and who hire and pay for the services of one or more workers, either formally or informally, are classified as 'business owners'. All other workers are employees who work for someone else $S_i = 0$).

This definition of self-employment is in line with the one used by ILO, OECD and the World Bank, except that we do not consider unpaid family workers as self-employed, as these institutions do.[1] We believe that in Chile unpaid family workers are closer to the informal salaried workers than to self-employed category. Either way, the results are not sensitive to recoding those workers as self-employed (results upon request).

Table 1 Descriptive statistics

Variable	*n*	*mean*	*sd.*	*min.*	*max.*
Employment characteristics					
Employed (d)	50,807	0.581	0.493	0	1
Self-employed* (d)	29,526	0.344	0.475	0	1
Age groups					
50–54 years old** (d)	50,807	0.294	0.456	0	1
55–59 years old (d)	50,807	0.254	0.435	0	1
60–64 years old (d)	50,807	0.229	0.42	0	1
65+ years old (d)	50,807	0.222	0.416	0	1
Education level					
No schooling/some primary** (d)	50,807	0.246	0.431	0	1
Complete primary/some high school (d)	50,807	0.313	0.464	0	1
Complete high school/some college (d)	50,807	0.296	0.456	0	1
Complete college or more (d)	50,807	0.145	0.352	0	1
Health status					
Bad/very bad** (d)	50,807	0.089	0.285	0	1
Regular (d)	50,807	0.472	0.499	0	1
Good/very good (d)	50,807	0.44	0.496	0	1
Other observables					
Retirement pension, $100k	50,807	0.413	1,223	0	30,000
Enrolled in pension system (d)	50,807	0.76	0.427	0	1
Male (d)	50,807	0.463	0.499	0	1
Urban (d)	50,807	0.793	0.405	0	1

Notes: (*) Owning a business or being a self-employed worker.
(**) base category.
(d) dummy variable.

Table 1 presents descriptive statistics for the list of variables used in the model. Regarding the dependent variables, around 58% of the selected samples are employed at the time of the survey. From those who are employed, 34% are self-employed –self-employed workers or business owners – and 66% work for someone else. As explanatory variables common to equations (1) and (2), we use four age

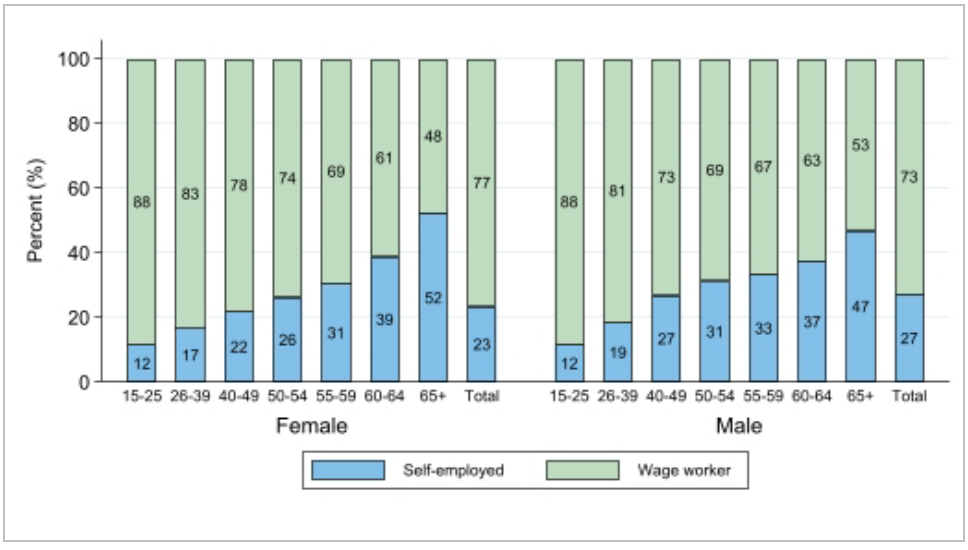
categories, four education levels, three self-reported health status categories, the amount of the retirement pension (being equal to zero for those who have not retired yet), and gender and urban dummies. The distribution is somewhat similar across age categories, with more people concentrated within the 50–54 groups (29.4%). The mean retirement pension (including zeros for those who are not retired) is around CH$ 41,300 monthly (nearly US$50). Forty-six percent of the samples are men. There is a substantial number of adults having not completed elementary school (24.6%), whereas only 14.5% of the sample are college graduates or more. Around 9% of the selected sample report having bad or very bad health, and 44% report good or very good health condition. Most adults live in urban areas (79%), and 76% of the sample report being enrolled in the Chilean pension system.

4 Results

4.1 Descriptive evidence and univariate probit models

Figure 1 shows how the proportion of self-employment increases as people get older, especially for women. As discussed previously, this age gradient does not necessarily reflect that the transition from wage work to self-employment increases with age. It could just be reflecting that older people who remain active in the labour market differ from those who retire, in terms of observable and unobservable determinants.

Figure 1 Proportion of self-employed and wage workers over age cohorts (see online version for colours)



To control for observable determinants, we move a step forward and estimate univariate probit models for the decision to be self-employed versus working for someone else (the unconditional probit model depicted in equation (4)). Table 2 presents the semielasticities (d(lny)/d(x)) from these probit models, estimated separately by gender. Column 1 shows the results without any controls except for age categories. Hence, they correspond to the

graphs above, but using the subsample of 50–70 year-old workers. We see that the probability of self-employment for males increases by 6.5% as we move from the 50–54 group (the baseline category) to the 55–59 group. This percentage rises to 17.7% and 40.4% for those in the 60–64 and 65+ categories, respectively. The age gradient is even more pronounced for women: 14.8%, 39%, and 68.6% increase compared to the baseline category, respectively. Column (4) presents the preferred model, which includes all the observable determinants and region dummies. Adding more observable determinants such as retirement pension size, gender, education level, health status, and urban and region dummies does not change these percentages significantly (columns 2 to 4).

Previous probit models ignore potential sample selection bias that may arise because the self-employment status (S_i) is only observed for those who remain working (Jones and Latreille, 2011). In other words, these models implicitly assume that adults who remain working do not differ in terms of unobservable determinants from adults who retire out of the labour market and hence are no longer in the data sample. However, when looking at older adults (50–70 years old), it is likely that there are unobserved determinants that influence their decision and ability to remain in the labour force and to choose self-employment (e.g., taste for more flexible hours, unobserved health conditions, liquidity constraints, among others).

4.2 Bivariate probit models with sample selection

To address the potential bias mentioned above, Table 3 presents the semielasticities from bivariate probit models with sample selection [equations (1)–(3)], separately estimated by gender. These models allow for selection on unobservables by estimating the selection and the outcome equations together. Therefore, they control for the potential selection bias. We include all observable determinants used in Table 2. For comparison with previous estimates, Column (1) repeats the semielasticities from the preferred probits shown in column (4) of Table 2. Column (2) shows the semielasticities of the selection equation – the employment equation (1) – and column (3) presents the semielasticities of the self-employment equation.

The first feature to notice is the sign and magnitude of ρ in Table 3. This parameter is highly positive and statistically significant for both men (0.946) and women (0.923). These findings show that the unobservable determinants that exert a positive effect on employment positively affect self-employment. This evidence indicates that the results from univariate probits presented in Table 2 suffer from sample selection bias. Hence, we should rely on the bivariate probit models in order to have more robust conclusions.

As expected, the employment equations [column (2)] show that the probability of working declines as people age. This effect is more pronounced for women than men; this may be because the retirement age in Chile is younger for women (60) than men (65). Compared to the 50–54 baseline category, the probability of employment decreases by 8.8% (55–59), 28.9% (60–64), and 79.4% (65+) for women of the same education level, health status, and other observable characteristics. In contrast, men stay longer in the labour force and thus, their age-slope is less steep: the probability of work declines by 3.2% (55–59), 9.1% (60–64) and 41.2% (65+) as they age.

The size of the retirement pension reduces the probability of being employed for both men and women. If the monthly pension increases by CH$10k (nearly US$11), the employment probability decreases by 0.7% for men and 0.21% for women, on average.

Table 2 Probabilty of self-employment by gender-probit models semielasticities

	(1)		*(2)*		*(3)*		*(4)*	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
55–59 years old (d)	0.065**	0.148***	0.054**	0.141***	0.050*	0.140***	0.055**	0.145***
60–64 years old (d)	0.177***	0.390***	0.156***	0.359***	0.147***	0.355***	0.157***	0.353***
65+ years old (d)	0.404***	0.686***	0.353***	0.638***	0.346***	0.637***	0.351***	0.638***
Complete primary/some high school (d)			–0.004	0.013	0.000	0.015	0.028	0.038
Complete high school/some college (d)			–0.105***	–0.088**	–0.097***	–0.077**	–0.039	–0.039
Complete college or more (d)			–0.261***	–0.523***	–0.243***	–0.499***	–0.176***	–0.455***
Health status, regular (d)					–0.057	–0.183***	–0.065	–0.185***
Health status, good or very good (d)					–0.128***	–0.261***	–0.145***	–0.272***
Retirement pension, $100k			0.037***	0.041	0.037***	0.043*	0.039***	0.050**
Urban (d)							–0.194***	–0.298***
Region dummies	No	No	No	No	No	No	Yes	Yes
N	17,981	11,545	17,981	11,545	17,981	11,545	17,981	11,545

Notes: the base category variables are 50-54 years old, no schooling/some primary, and health status, bad or very bad.
(d) dummy variable.
*p < 0.1, **p < 0.05, and ***p < 0.01.

Table 3 Probabilty of self-employment by gender-bivariate probit models semielasticities

	(1)		*(2)*		*(3)*	
	Probit model		*Bivariate probit model*			
			Employment equations		*Self-employment equations*	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*
55–59 years old (d)	0.055**	0.145***	–0.032***	–0.088***	0.039	0.064
60–64 years old (d)	0.157***	0.353***	–0.091***	–0.289***	0.095***	0.048
65+ years old (d)	0.351***	0.638***	–0.412***	–0.794***	–0.070*	–0.131**
Complete primary/some high school (d)	0.028	0.038	0.066***	0.069***	0.117***	0.195***
Complete high school/some college (d)	–0.039	–0.039	0.078***	0.190***	0.069**	0.292***
Complete college or more (d)	–0.176***	–0.455***	0.131***	0.478***	–0.028	0.117**
Health status, regular (d)	–0.065	–0.185***	0.302***	0.248***	0.231***	0.072
Health status, good or very good (d)	–0.145***	–0.272***	0.424***	0.389***	0.273***	0.114*
Retirement pension, $100k	0.039***	0.050**	–0.070***	–0.210***	–0.078***	–0.120***
Urban (d)	–0.194***	–0.298***	–0.032***	0.142***	–0.193***	–0.120***
Enrolled in pension system (d)			0.449***	0.947***		
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes
rho_star					0.946***	0.923***
rho_se					0.009	0.008
N	17,981	11,545	23,502	27,305	17,981	11,545

Notes: The base category variables are 50–54 years old, no schooling/some primary, and health status, bad or very bad.
(d) dummy variable.
*p < 0.1, **p < 0.05, and ***p < 0.01.

The employment equations also suggest that more educated and healthier people are more likely to work. Compared to the elementary-dropout baseline category, the probability of employment increases by 6.6% (high school dropouts), 7.8% (high school graduates), and 13.1% (college graduates) for men with the same observable characteristics. These numbers are more pronounced for women: 6.9%, 19%, and 47.8%, respectively. Men with better health are substantially more likely to work than those who declare having poor or very poor health (30.2% for regular health and 42.4% if they are in good or very good health). Women have a similar health impact gradient: 24.8% and 38.9% for regular and good/very good health, respectively.

Urban men are 3.2% less likely to work than rural ones with the same characteristics and from the same region. In contrast, urban women are 14.2% more likely to work than those from rural areas.

The dummy variable $Enroll_i$, which acts as an exclusion restriction, is highly statistically significant in both models, for both men and women, but its magnitude is higher for the latter: women who are enrolled in the pension system are 94.7% more likely to work than those who are not enrolled, while this percentage is 44.9% for men.

4.3 Determinants of entrepreneurship and self-employment

4.3.1 Main results

Column (3) in Table 3 presents the semielasticities of the self-employment equations, which are the main results of the paper. These semielasticities enable us to assess the magnitude of the main observable determinants of entrepreneurship and self-employment at older ages.

The age gradient in the self-employment probability almost vanishes in the bivariate models, which was not the case in previous probit models shown in columns (1). There is no statistically significant difference between the probability of self-employment for people of either sex in the 50–54 baseline category and those in the 55–59 year-old group. Moreover, the age gradient becomes negative in the 65+ group, again for both sexes. Thus, the apparent effect of age in probit models turns out to be an effect of selection: increases in age appear to increase self-employment mainly because it decreases the probability of working so extremely. The only exception is for 60–64 years old men, since their self-employment probability significantly increases by 9.5% compared to the 50–54 baseline category.

These results support the hypothesis that most of the increased self-employment at older ages is due to differential retirement from wage-work compared to self-employment, and not due to massive shifts into self-employment from wage-work while aging. These findings contradict Vives et al. (2016), who interpret the increase in self-employment at older ages in Chile as evidence of large transitions from wage-work to self-employment. As mentioned, labour statistics tabulated by age might suffer from *survival bias*, that is, older people who *remain* in the labour force might be different from those who exit the labour force in terms of observable and unobservable characteristics. Our bivariate probit models with sample selection address this issue.

Our results are more in line with Fuchs (1982) and Zissimopoulos and Karoly (2007), who use panel data from the USA to show that the growth in self-employment rates at older ages reflects a combination of higher rates of retirement out of wage work compared with self-employment as well as transitions from wage work to self-employment while aging.

An increase in the retirement pension reduces the probability of self-employment for both men and women, even conditioned on working status. If the monthly pension increases by CH$10k (nearly US$11), this probability decreases by 0.78% for men and 0.12% for women on average. This result suggests that there are not any liquidity constraints in the decision to work for oneself, which makes sense given that self-employment is not a capital-intensive activity.

There is an inverted u-shaped relationship between education and the probability of self-employment for both men and women. In the case of men, education increases this probability by 11.7% (high school dropouts) and 6.9% (high school graduates), but it has no effect for college graduates. These percentages are higher for women but also having a u-shaped form: 19.5%, 29.2%, and 11.7%, respectively.

The effect of good health on self-employment is sizeable and statistically significant for men. Men with regular health are 23.1% more likely to choose self-employment than those with the poorest health condition. This percentage rises to 27.3% for men with good or very good health. In contrast, there is no significant difference between women with regular health and those with the poorest health. Only women who declare that they have good or very good health have a – barely – significant increase in their probability of self-employment (11.4% compared with women in the baseline category). This evidence suggests that health status shapes the type of labour activity and the labour force participation chosen by older men. Meanwhile, in the case of women, their health status mainly acts as an impediment for remaining in employment in the first place.

The positive relationship between health status and self-employment that we document is not consistent with Zissimopoulos and Karoly (2007), who find that poor health pushes older workers in the USA into self-employment. This contradiction may arise from differences in job flexibility, labour market conditions, and pension systems between Chile and the USA.

Overall, our main results reveal both push and pull factors that affect the probability of self-employment. The senior entrepreneurship literature classifies entrepreneurial motivations into two groups: negative and positive factors (Seco Matos et al., 2018). Individuals may get into self-employment due to negative factors such as job loss or lack of better income alternatives (‘push’ hypothesis); or due to positive factors such as desiring independence and work autonomy (‘pull’ hypothesis). In our results, higher education levels and better health status are pull factors, whereas a small retirement pension is a push factor. Age discrimination in the labour market does not appear to be a strong push factor into self-employment, although further analysis is needed to rule out this possibility.

4.3.2 Policy simulations of the effects of the PGU reform and the pension bill

In this section we use the estimates from the bivariate probit model presented in Table 3 to simulate the effects of the recently created Universal Guaranteed Pension (‘Pensión Garantizada Universal’ or PGU) on predicted self-employment rates.[2] We also simulate the effects that would be created the pension bill presented by the current government in November 2022. This bill would increase the amount of the PGU substantially and pensions in general.[3]

Table 4 reports employment and self-employment rates simulated for six example cases with the following characteristics: 65 year-old men and women, who have completed primary school or have some secondary education, are regularly healthy, live

in an urban area in the Metropolitan Region, and are enrolled in the pension system. The only difference between the example cases is in their monthly base pension and total pension they receive at their retirement age, which arises from differences in the percentage of time they contributed to the system and their final salary.[4] The table presents three scenarios:

1 The baseline scenario, which is before the reforms, in 2021.

2 The PGU reform scenario, as of August 2002, after the PGU was enacted.

3 Pension bill scenario, which estimates what would be the impact of that bill should it be passed.

Table 4 Policy simulations of the PGU reform and the pension bill

	(A1)	*(B1)*	*(C1)*	*(A2)*	*(B2)*	*(C2)*
Baseline		*Men*			*Women*	
Monthly base pension	$0	$74,598	$285,356	$0	$63,734	$243,799
Monthly PBS	$176,096	$0	$0	$176,096	$0	$0
Monthly APS	$0	$153,173	$88,412	$0	$156,512	$101,181
Monthly total pension	$176,096	$227,771	$373,768	$176,096	$220,246	$344,980
Pr(Employment)	*0.555*	*0.521*	*0.424*	*0.244*	*0.216*	*0.148*
Pr(Self-employment)	*0.238*	*0.228*	*0.201*	*0.126*	*0.119*	*0.101*
PGU reform		*Men*			*Women*	
Monthly base pension	$0	$74,598	$285,356	$0	$63,734	$243,799
Monthly PGU	$193,917	$193,917	$193,917	$193,917	$193,917	$193,917
Monthly total pension	$193,917	$268,515	$479,273	$193,917	$257,651	$437,716
Pr(Employment)	0.544	0.494	0.357	0.233	0.194	0.108
Pr(Self-employment)	0.234	0.22	0.182	0.123	0.113	0.089
Δ% Monthly total pension	10.1%	17.9%	28.2%	10.1%	17.0%	26.9%
Δ% Pr(Employment)	*–2.0%*	*–5.2%*	*–15.8%*	*–4.5%*	*–10.2%*	*–27.0%*
Δ% Pr(Self-employment)	*–1.7%*	*–3.5%*	*–9.5%*	*–2.4%*	*–5.0%*	*–11.9%*

Notes: The table shows wage-work and self-employment rates simulated for men and women who are 65 years-old, who have either completed primary school or some secondary school, are regularly healthy, live in an urban area in the Metropolitan Region, and are enrolled in the pension system, who differ in the amount of monthly base pension they will receive at their retirement age. Columns (A1) and (A2) report the cases of men and women, respectively, with a zero monthly base pension. Columns (B1) and (B2) report those who only contributed to the pension system for 50% of their work history, and who will receive CH$400,000 monthly at their retirement age. Columns (C1) and (C2) are those who contributed for 80% of their work history and who will receive CH$960,000 monthly at their retirement age. The Chilean government presented these examples to show the effects of the pension bill on the pensions received by different people. See https://www.gob.cl/sistemamixto/ejemplos/.

Table 4 Policy simulations of the PGU reform and the pension bill (continued)

	(A1)	*(B1)*	*(C1)*	*(A2)*	*(B2)*	*(C2)*
Pension bill		*Men*			*Women*	
Monthly base pension	$0	$74,598	$285,356	$0	$63,734	$243,799
Monthly PGU	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000
Monthly social insurance		$67,828	$99,260		$78,791	$141,196
Monthly total pension	$250,000	$392,426	$634,616	$250,000	$392,525	$634,995
Pr(Employment)	0.506	0.412	0.266	0.199	0.127	0.05
Pr(Self-employment)	0.224	0.197	0.157	0.115	0.095	0.067
Δ% Monthly total pension	42.0%	72.3%	69.8%	42.0%	78.2%	84.1%
Δ% Pr(Employment)	*–8.8%*	*–20.9%*	*–37.3%*	*–18.4%*	*–41.2%*	*–66.2%*
Δ% Pr(self-employment)	*–5.9%*	*–13.6%*	*–21.9%*	*–8.7%*	*–20.2%*	*–33.7%*

Notes: The table shows wage-work and self-employment rates simulated for men and women who are 65 years-old, who have either completed primary school or some secondary school, are regularly healthy, live in an urban area in the Metropolitan Region, and are enrolled in the pension system, who differ in the amount of monthly base pension they will receive at their retirement age. Columns (A1) and (A2) report the cases of men and women, respectively, with a zero monthly base pension. Columns (B1) and (B2) report those who only contributed to the pension system for 50% of their work history, and who will receive CH$400,000 monthly at their retirement age. Columns (C1) and (C2) are those who contributed for 80% of their work history and who will receive CH$960,000 monthly at their retirement age. The Chilean government presented these examples to show the effects of the pension bill on the pensions received by different people. See https://www.gob.cl/sistemamixto/ejemplos/.

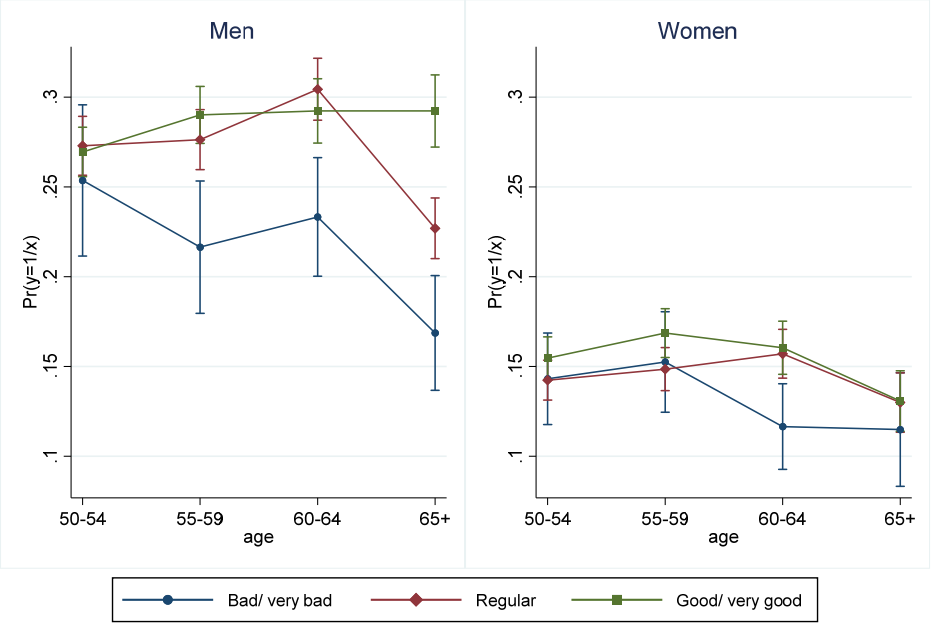
Under the PGU reform scenario, the model predicts a decrease in the employment rates in the range of –2.0% to –27% and a decline in self-employment rates between –1.7% to –11.9% for the example cases. Under the Pension Bill scenario, the expected effects are around three times larger on average, which is caused by its significant pension increases. These are significant negative impacts on the work effort of older people, which should be considered when evaluating these reforms.

4.3.3 Adding interactions between health and age

In this section we explore if the effect of aging on the probability of self-employment varies with health status. We use the bivariate probit model presented in Table 3 but add interactions between the age-category dummies and the three health-status dummies used previously (bad/very bad; regular, good/very good health). Figure 2 plots the age gradients for the probability of self-employment resulting from this exercise. There is a remarkable difference in the age gradient between men 60–64 and 65+ years old with good/very good health compared to those with regular or bad/very bad health status. The probability of self-employment for the healthy senior men does not decay with age. In contrast, there is an abrupt decrease in this probability for the less healthy. In the case of women, the pattern is similar, but the decrease in this probability occurs earlier, between 55–59 and 60–64 years old. This evidence suggests that senior men and women with health issues leave the work force and hence, are not able to use self-employment as a

'bridge occupation", that is, as a transition process from career employment to full retirement (Wang et al., 2008).

Figure 2 Probability of self-employment by age, sex and health status (see online version for colours)



5 Conclusions

This paper estimates bivariate probit models with sample selection to find the main determinants of entrepreneurship/self-employment at older ages in Chile. We focus on the effect of aging on self-employment choices, controlling for the decision to remain in the labour force.

The graphic analysis presented in Section 4 shows that self-employment rates rise at older ages. However, the bivariate probit models indicate that, once we control for observable characteristics and for the potential selection bias, this age gradient almost vanishes for all groups, except for 60–64 year old men. These findings suggest that self-employment is more common among older people mainly because of differential exit rates between wage workers and the self-employed, and not because of a large transition from wage work to self-employment as people age.

However, we still do not know the underlying reasons as to why the self-employed generally retire later than wage workers. Is this a pure voluntary choice or they are somewhat forced to keep working as they age because of financial motives? The negative effect of the retirement pension on the probability of self-employment suggests that one's financial situation could be a factor. This question is particularly important from a policy perspective, given that older self-employed workers are less likely to be in the pension system compared to wage workers. However, there are also other questions: are wage

workers being pushed out from the labour market and compelled to retire due to a lack of flexibility in wage jobs? This is another issue raised by our paper that needs to be addressed by looking deeply at labour market conditions and individual worker trajectories.

Overall, our results cast doubt on the commonly held thought that older Chileans are forced out from wage-work into self-employment as they age. In other words, we find no evidence that older Chilean workers are generally using self-employment as a 'bridge occupation' before retirement. Instead, most self-employed workers tend to have been so for much or all of their working lives, although longitudinal analysis would further add to understanding this situation.

Our models also reveal a negative effect of the retirement pension on the probability of self-employment; an inverted u-shaped relationship between education and self-employment; and an important effect of good health status on self-employment choices, mainly for men. Living in an urban area negatively affects the probability of self-employment for both men and women with the same characteristics and from the same region.

We use the estimated models to simulate the effects of the PGU (current policy) and the Pension bill (proposed policy) on the labour outcomes of senior workers. These simulations suggest remarkable crowding out effects on the work effort of older people, which should be considered when evaluating these reforms. It also suggests additional nuance in evaluation; effects should be judged depending on social preferences on the optimal retirement age and its interaction with health conditions of older workers.

To conclude, we would like to highlight the relevance of doing further research using longitudinal data to determine whether the mature-age labour transitions in Chile are mostly voluntary or a response to diminishing job opportunities and other labour market and family constraints faced by older people. These are important questions that we need addressing in order to design better social security policies for these individuals and their families.

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Notes

1 ILO and OECD define the self-employed as "employers and persons working on their own account: persons who operate their own economic enterprise or follow a profession or trade on their own account, whether they employ other persons or not, and also unpaid family workers" See https://www.oecd.org/statistics/data-collection/Population%20and%20Labour%20Force%20Definitions-Eng.pdf. For The World Bank, self-employed workers include 'four sub-categories of employers, own-account workers, members of producers' cooperatives, and contributing family workers'. Meanwhile, the Global Entrepreneurship Monitor (GEM) "adopts the occupational perspective of entrepreneurship, even though it looks further than individuals officially registered as self-employed. Entrepreneurship can also be seen from the behavioral perspective, for example by identifying employees within organisations who behave entrepreneurially (also known as intrapreneurship or corporate entrepreneurship)". See https://www.gemconsortium.org/wiki/1149.

2 The former Chilean government created the PGU in January 2022 to replace the PBS ('Pensión Básica Solidaria') and the APS ('Aporte Previsional Solidario'). See Ley 21419, 'Crea la Pensión Garantizada Universal y Modifica los Cuerpos Legales que Indica', Enero 2022. Biblioteca del Congreso Nacional, Chile. https://www.bcn.cl. Additional explanation is available at https://www.chileatiende.gob.cl/fichas/102063-que-es-la-pension-garantizada-universal-pgu.

3 Mensaje Reforma de Pensiones N°180-370, Noviembre 2022. Biblioteca del Congreso Nacional, Chile, https://www.bcn.cl.

4 The Chilean Government gave these examples to show the effects of the pension bill on pensions throughout the population. See the footnote of Table 4 for additional discussion.