

Estimating non-take-up after universalization: A Heckman analysis of Mexico's old-age pension

Israel Vargas Casimiro

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1. Abstract

This study analyses non-take-up and territorial inequalities in Mexico's non-contributory old-age pension after its transition towards universal coverage. Using harmonised ENIGH and CONEVAL data for 2016–2024, a two-step Heckman selection model distinguishes between programme participation among eligible older adults and the pension amount received by beneficiaries. Results indicate that non-take-up declined substantially after universalisation and that territorial disparities in access decreased. Nevertheless, Indigenous-language speakers and older adults below the poverty line remained less likely to participate, while differences in pension amounts persisted across states. These findings show that universal eligibility can reduce barriers to access, but does not fully eliminate inequalities associated with socioeconomic vulnerability and subnational implementation capacity.

2. Research Question and Empirical Problem

Research Question:

Did the universalisation of Mexico's old-age pension reduce non-take-up and territorial disparities in programme access and benefit delivery?

Empirical Problem:

PAM income is observed only for actual beneficiaries >> non-random sample selection >> potential OLS bias.

Econometric solution: Two-step Heckman selection model

3. Data

Sources:

- ENIGH microdata, 2016, 2018, 2020, 2022 and 2024
- CONEVAL poverty data

Study population:

- Adults aged 65 and over
- Harmonised repeated cross-sections for 2016–2024

Sample:

- 133,945 observations
- Survey expansion factors are used to obtain nationally representative estimates

Key information:

- Eligibility according to the programme rules prevailing in each year
- Actual receipt of the Pension benefit
- Monthly Pension income among beneficiaries
- Sociodemographic characteristics
- Poverty and territorial information

Main variables:

- **Selection variable:** PAM participation, ***PAM=1***
- **Outcome variable:** *log of monthly PAM income, log(inc_PAM)*

4. Programme Eligibility and Sample Selection

Eligibility rules changed over time:

- 2016–2018: adults aged 65+ subject to the programme's prevailing eligibility conditions, including limits related to contributory pension income.
- 2020: transition period towards universalisation.
- 2021 onwards: entitlement expanded to all adults aged 65+, regardless of contributory pension status.

Observed participation:

- Among the eligible population, individuals are classified as:
- PAM = 1: receives the pension
- PAM = 0: eligible but does not receive it

Selection mechanism:

- The probability of entering the observed outcome sample depends on actual programme participation.
- PAM income is observed only when PAM = 1.
- Therefore, beneficiaries are a non-random subsample of the eligible population.

5. Heckman Selection Model

Why Heckman?

Pension income is observed only for beneficiaries >> potential sample selection bias.

Selection equation:

$$P(PAM_i = 1|Z_i) = \Phi(Z_i\gamma) \quad (1)$$

Where,

$$PAM_i = \begin{cases} 1 & \text{si } PAM_i^* > 0 \\ 0 & \text{si } PAM_i^* \leq 0 \end{cases}$$

Outcome equation:

$$\log(\text{inc_PAM})_i = X_i\beta + \delta\lambda_i + \sum_c \delta_c FS_{ic} + \varepsilon_i; \text{ if } PAM_i = 1 \quad (2)$$

Exclusion restrictions:

- Indigenous-language status
- Poverty gap

λ_i : inverse Mills ratio correcting for non-random selection.

6. Estimation in Stata

- Two-step Heckman selection model
- **Selection:** PAM participation
- **Outcome:** log monthly PAM income
- Federal-state fixed effects
- Robust standard errors
- Results reported as marginal effects
- Estimated separately for 2016, 2018, 2020, 2022 and 2024

7. Descriptive Evidence

Non-take-up rates from PAM, 2016-2024

Variable	2016	2018	2020	2022	2024
Non-take-up rates					
Total population	44.3	49.8	35	26.2	16.3
Rural	33.5	41.1	24.1	19.8	12
Urban	49.2	53.8	38.5	28.1	17.5
Women	45	49.3	33.4	24.7	15.2
Men	43.2	50.4	37	28	17.6
Illiteracy	36.7	42.1	26.4	20.4	12.5
Basic education	44	49.6	33	24.3	14.4
Medium-high education	58.9	70.2	47.7	31	18.6
Higher education	81.2	77.4	57.7	42.3	26.7
Indigenous language	36.8	44.9	33.6	20.3	13.8
Disability	36.3	41.1	28.9	19.8	12.7
Income under poverty threshold	40.4	46.2	33.6	25.1	16.8
Poverty	39.6	45.4	32	25.3	17.8
Extreme poverty	41.3	45.3	41.9	33.9	35.1
From \$0 to \$2,000	38.6	45.2	34.4	26.4	22
From \$2,000 to \$5,000	43.5	47.7	31.2	23.3	14.3
From \$5,000 to \$10,000	56.4	59.7	36.4	25.9	15.1
From \$10,000 to \$20,000	75.5	74.1	47.8	32.1	17.9
From \$20,000 to \$30,000	74.1	87.2	53.4	34.8	20.9
From \$30,000 to \$40,000	79.2	97.1	71.8	38.6	27.1
More than \$40,000	99	80.2	75.1	49.3	29.4
Average PAM income					
PAM income	576	585	1,292	1,736	2,360



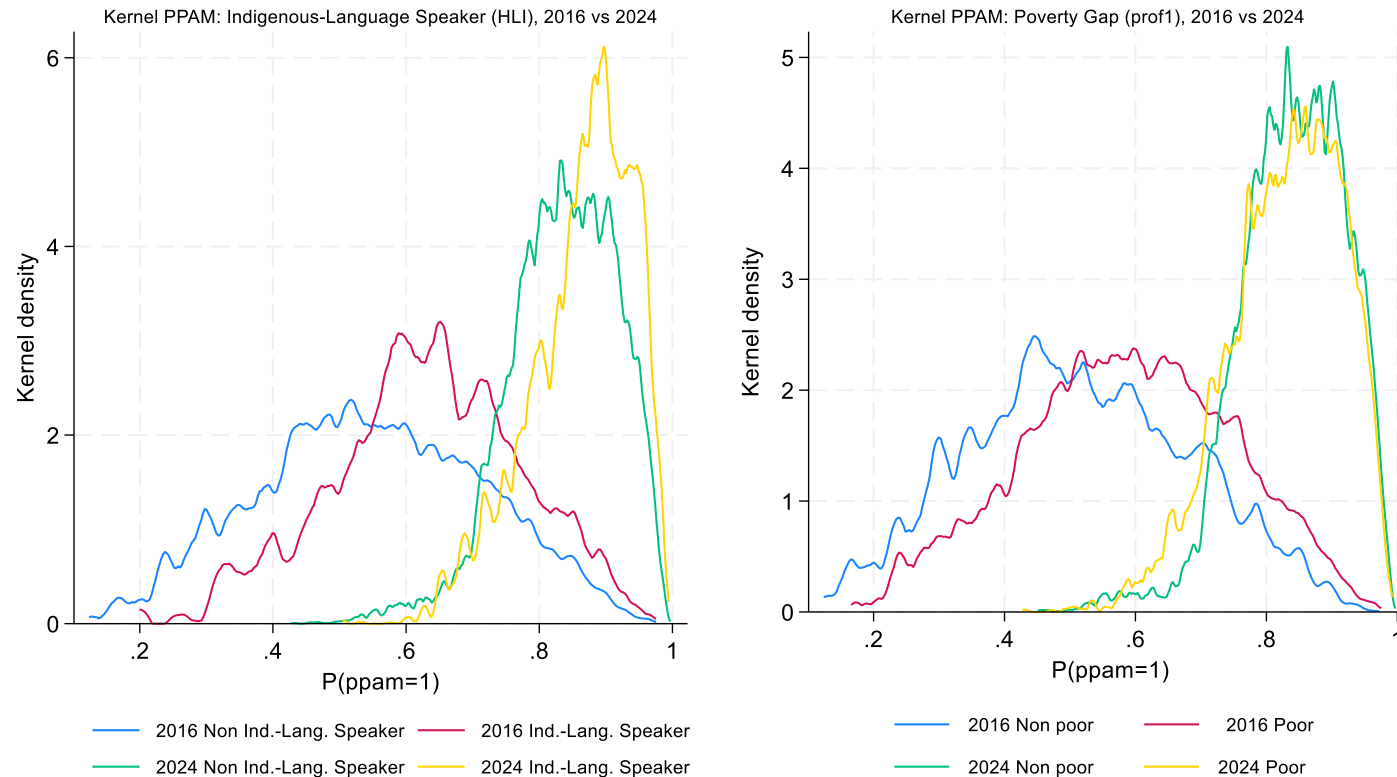
Non-take-up
declined
sharply after
universalisation

Effective programme
coverage increased from
55.7% in 2016 to **83.7%** in
2024.

Source: Own elaboration based on ENIGH and CONEVAL data.

8. Exclusion Restrictions: Graphical Support

Kernel density by Indigenous-language status and poverty condition, 2016 vs 2024



Kernel densities show clear differences in predicted programme participation by Indigenous-language status and poverty condition, supporting the empirical relevance of the exclusion restrictions.

Source: Own elaboration based on ENIGH and CONEVAL data.

9. Selection Equation Results

Stata
command

```
. bootstrap _b, reps(100): heckman ling_pam edad sexo analf rururb ib9.ent lict if pob_ppam==1, select (ppam=edad sexo hli a
> nalf rururb prof1 ib9.ent lict) twostep
(running heckman on estimation sample)

Bootstrap replications (100): .....10.....20.....30.....40.....50.....60.....70.....80.....
> ...90.....100 done
```

Heckman model estimates, 2016-2024
(Pre and Post-universalisation marginal effects)
Selection equation

Variables	Selection equation	
	PAM	PAM
	2016	2018
	(1)	(2)
Indigenous	-0.006*** (0.001)	-0.004*** (0.001)
Poverty	-0.084*** (0.001)	-0.078*** (0.001)
λ	-0.386*** (0.004)	-0.151*** (0.003)
LR test independence (rho=0)	p-val=0.0000	p-val=0.0000

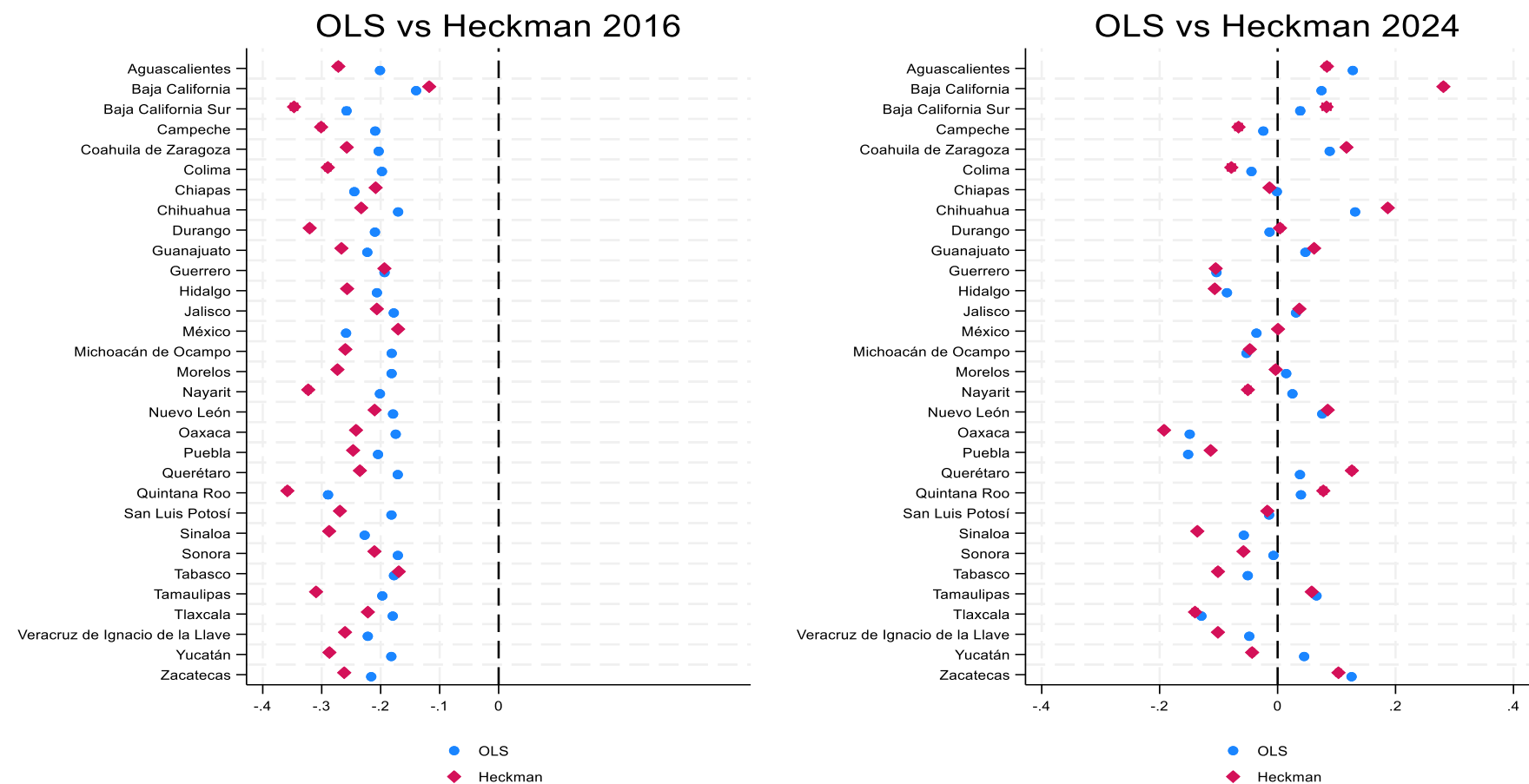
Variables	Selection equation		
	PAM	PAM	PAM
	2020	2022	2024
	(1)	(2)	(3)
Indigenous	-0.045*** (0.001)	0.016*** (0.000)	-0.005*** (0.000)
Poverty	-0.209*** (0.001)	-0.182*** (0.001)	-0.190*** (0.001)
λ	-0.464*** (0.003)	-0.511*** (0.002)	-0.820*** (0.004)
LR test independence (rho=0)	Pval=0.0000	Pval=0.0000	Pval=0.0000

Source: Own elaboration based on ENIGH and CONEVAL data.

Main result: Selection effects are statistically significant in all years, supporting the Heckman correction. Poverty remains the strongest barrier to programme participation, while the effect of Indigenous-language status becomes smaller by 2024. All results were estimated using Stata 19.

10. Outcome Equation Results

Heckman vs OLS: Territorial effects in the outcome equation, 2016 vs 2024



Main result: Heckman estimates show a clear reduction in territorial disparities in observed pension amounts between 2016 and 2024, with state effects becoming more concentrated around zero. Differences between OLS and Heckman also show that correcting for sample selection materially changes the estimated territorial effects

Source: Own elaboration based on ENIGH and CONEVAL data.

11. Conclusions

- Universalisation substantially reduced Non-take-up, but did not eliminate it: the total rate remained at 16.3% in 2024.
- Non-take-up remains concentrated among vulnerable groups: among people in extreme poverty, it reached 35.1% in 2024.
- The Heckman model confirms significant sample selection: programme access is non-random and remains associated with poverty and Indigenous-language status.
- Territorial disparities in observed pension amounts narrowed after universalisation, although cross-state differences relative to Mexico City persisted.