

When You Can't Afford to Wait for a Job: The Role of Time Discounting for Own-Account Workers in Developing Countries

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Motivation

- ▶ In non-rich countries, 40% of all working individuals are own-account workers (OAW). ▶ occupations
- ▶ On average, those individuals earn less than observably similar wage workers. ▶ earnings gap
- ▶ Complex category: some are true entrepreneurs, some are constrained.

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Open questions

1. Why choose OAW if $\text{expected income as OAW} < \text{expected income as employee}$?
2. Under which conditions is this occupational choice a constrained one?

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What we do

- ▶ Simple framework to explore the trade-off: OAW now vs. searching for a better paid job later.

People may choose OAW when they: (1) have urgent consumption needs and
(2) cannot get by in the short-term without labor income since
(3) searching for a job that pays more takes time.

Roadmap

Step 1 Define an occupational choice rule

Step 2 Estimate the labor market parameters using survey data for Brazil

Step 3 Infer the subjective time discount from the observed choice

Step 4 Relate the subjective time discount to measures of urgent consumption needs

Step 1 Define an occupational choice rule

Present value of a wage job $\rho \cdot W(w) = w + \delta \cdot (U - W(w))$

Present value of unemployment $\rho \cdot U = b + \lambda \cdot \int_{w_r}^{\infty} (W(w) - U) dF(w)$

Reservation wage $w_r = b + \frac{\lambda}{\delta + \rho} \cdot \int_{w_r}^{\infty} (w - w_r) dF(w)$

Present value of own-account work $\rho \cdot OAW = y$

OAW is chosen if $y > b + \frac{\lambda}{\delta + \rho} \cdot \int_{w_r}^{\infty} (w - w_r) dF(w)$

1 Define an occupational choice rule

$$\text{OAW is chosen if } y > b + \frac{\lambda}{\delta + \rho} \cdot \int_{w_r}^{\infty} (w - w_r) dF(w)$$

- ▶ OAW is more frequent if autonomous productivity is high...
- ▶ ... but also if present value of looking for a job is lower.

Low-pay OAW can be optimal if jobs are scarce (λ is small) and unstable (δ is big), or present consumption is urgent (ρ is big).

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The occupational choice rule rewritten as function of the discount rate

$$\text{OAW is chosen if } \rho > \frac{\lambda}{y - b} \cdot \int_{w_r}^{\infty} (w - w_r) dF(w) - \delta$$

- ▶ The lowest discount rate justifying OAW, given worker productivity and market conditions.

A sufficiently high urgency for consumption (the "necessity" parameter) can rationalize the choice for OAW for any value of y .

2 Estimate the labor market parameters using survey data for Brazil

- ▶ If I were to look for a job, how much could I expect to earn?
- ▶ For how long would I need to search? How long would such job last?

2 Estimate the labor market parameters using survey data for Brazil

Data source A: a household budget survey (POF 2017/18 edition)

- ▶ Cross-section survey (58k households, 178k individuals).
- ▶ Rich set of income, personal finance, and material living conditions.

Data source B: a labor force survey (PNAD 2017Q1 to 2018Q4)

- ▶ Rotating panel, 5 consecutive quarters (187k households, 560k individuals per quarter).

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- ▶ Rotating panel, 5 consecutive quarters (187k households, 560k individuals per quarter).

Both sources are meant to cover the same population

- ▶ Run by same statistical office;
- ▶ Nationally representative, common statistical stratification;
- ▶ Basic set of socioeconomic attributes (age, gender, race, education, geography);
- ▶ Robustness check: reweighting PNAD to match moments from POF does not change our results.

Population of interest

- ▶ 125 million working-age individuals (14-64) living in urban areas. [▶ descriptive statistics](#)
- ▶ For reference, Brazil total population is 208 million.

2 Estimate the labor market parameters using survey data for Brazil

Using parameters estimated from micro data, we can calculate the lower bound discount rate compatible with each individual's decision to adopt OAW:

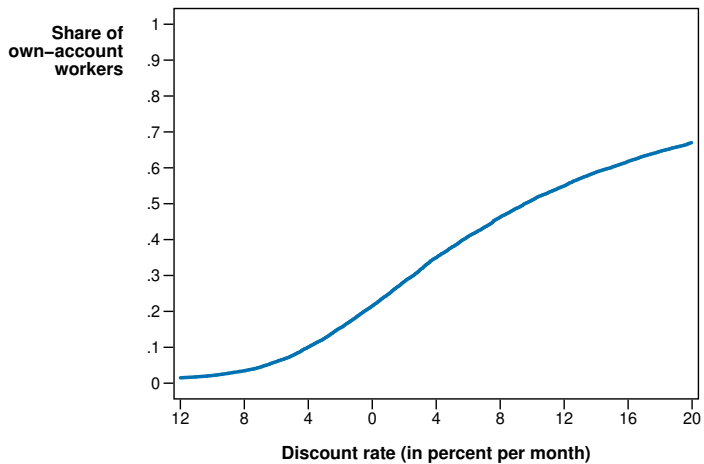
$$\rho > \frac{\lambda}{y - b} \cdot \int_{w_r}^{\infty} (w - w_r) dF(w) - \delta$$

↓

$$\hat{\rho}_i > \frac{\mathbb{E}(\lambda | X_i)}{y_i - \mathbb{E}(b | X_i)} \cdot \left[\mathbb{E}(w | w > w_r, X_i) - \mathbb{E}(w_r | X_i) \cdot \mathbb{P}(w \geq w_r) \right] - \mathbb{E}(\delta | X_i)$$

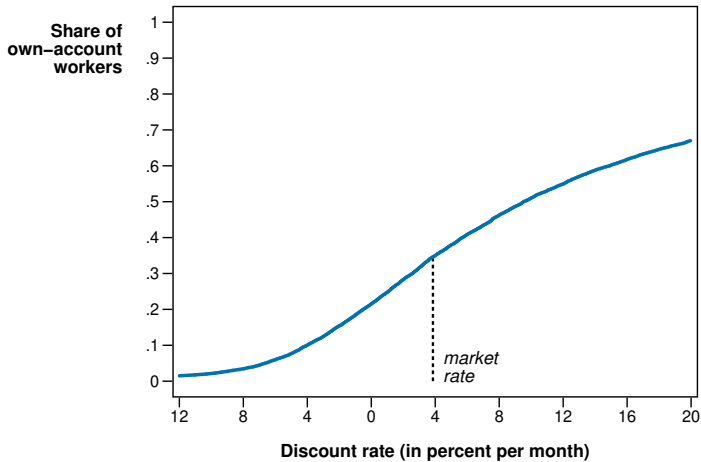
1. y_i is directly observable for own-account workers.
2. $\mathbb{E}(\lambda | X_i)$ is fit with an unemp. duration model and with $\mathbb{P}(w \geq w_r)$. ▶ duration models
3. $\mathbb{E}(b | X_i)$ is assumed to be zero, the most frequent value.
4. $\mathbb{E}(w | w > w_r, X_i)$ is fit with a Heckman selection model. ▶ selection-corrected wage regression
5. $\mathbb{E}(w_r | X_i)$ is fit with a quantile regression at the 10th centile. ▶ reservation wage quantile regression
6. $\mathbb{P}(w \geq w_r)$ is calculated for a normal distribution of wages.
7. $\mathbb{E}(\delta | X_i)$ is fit with a job duration model. ▶ duration models

3 Infer the subjective time discount from the observed choice

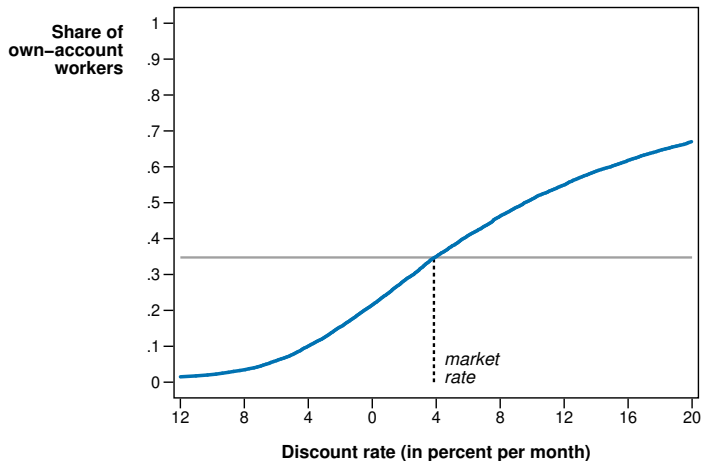


3 Infer the subjective time discount from the observed choice

▶ market rate

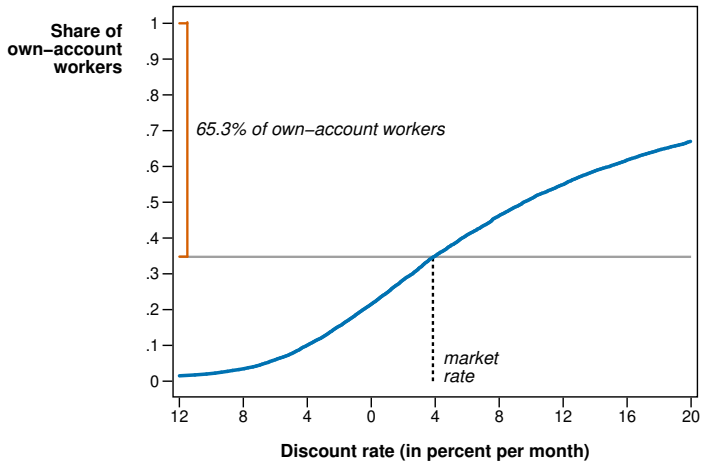


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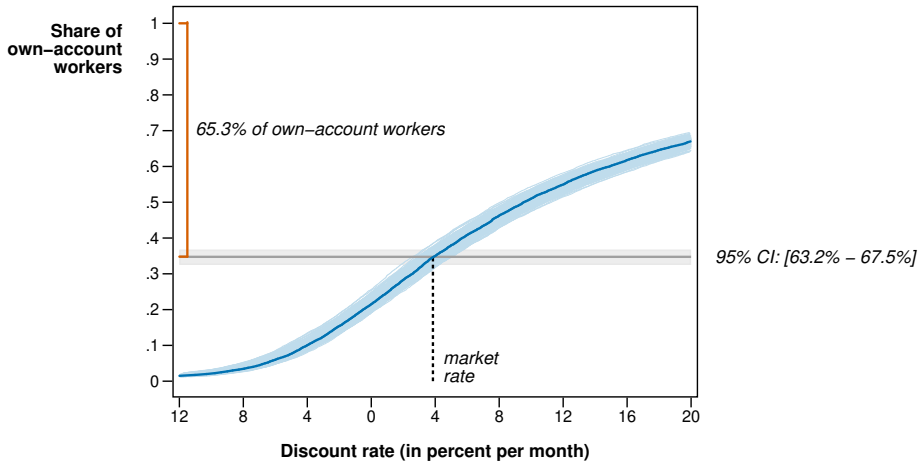


3 Infer the subjective time discount from the observed choice

► robustness to reservation wage

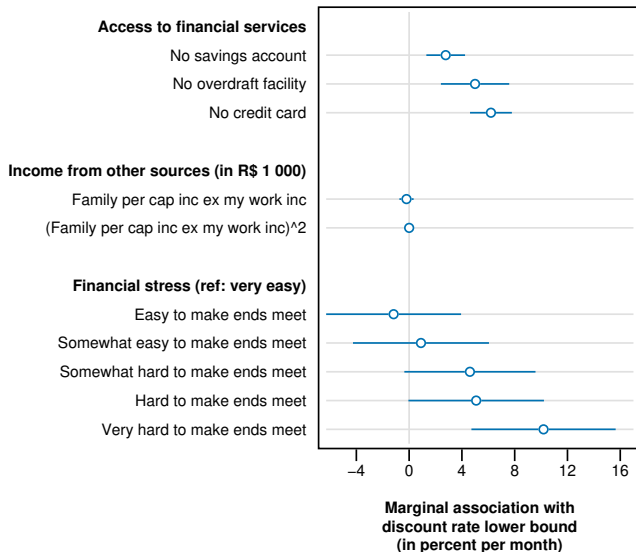


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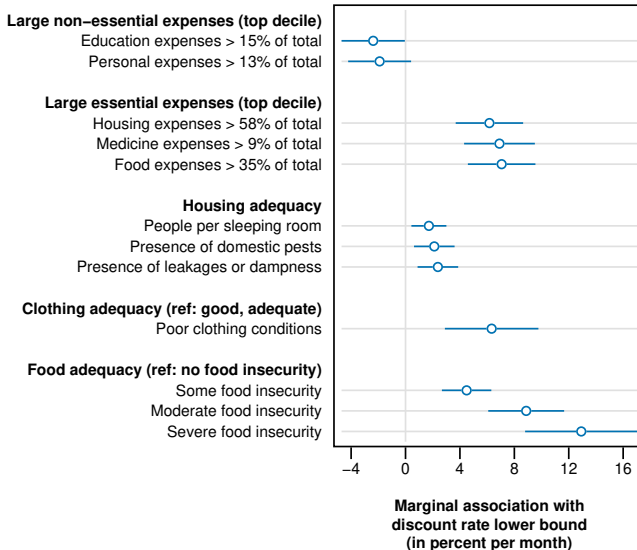
4 Relate the time discount to measures of consumption needs (1/2)

► estimates



4 Relate the time discount to measures of consumption needs (2/2)

► estimates



When is the OAW occupational choice a constrained one?

- ▶ If the lowest discount rate compatible with this choice is above the market's.

Why?

- ▶ Combination of pressing needs (high importance of consuming today)
- ▶ and restricted borrowing (not using the market's rate).

Main result

- ▶ Under this criterion, 2/3 of OAWs in Brazil are constrained.

Policy implications

- ▶ Many rational workers can be stuck in low-pay OAW in the presence of frictional labor markets, urgent consumption needs, and restricted financing options.

Thank you for your attention

Thiago Scarelli

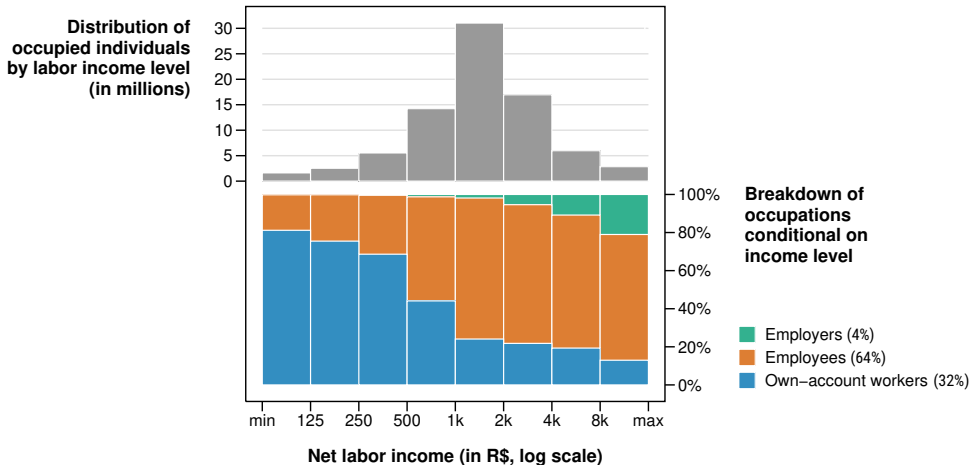
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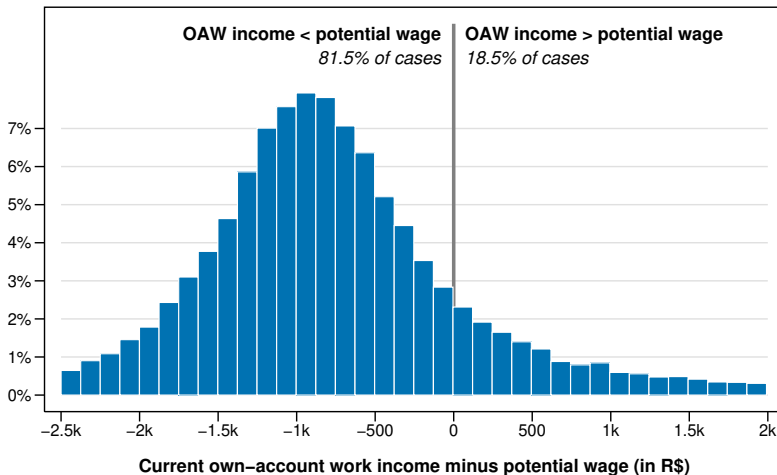
Distribution of Occupations and Labor Income Level (Brazil, urban areas, 2017-18)

► motivation



Estimated Labor Income Penalty for OAW (Brazil, urban areas, 2017-18)

► motivation



Descriptive statistics for employees and OAWs (Brazil, urban areas, 2017-18)

[data description](#)

	All		Employees		Own-Account Workers	
<i>Gender and ethnicity (in %)</i>						
Female	52.3	(0.16)	44.4	(0.30)	52.4	(0.46)
Nonwhite	54.7	(0.43)	53.3	(0.51)	58.0	(0.62)
<i>Education level (in %)</i>						
Less than primary school	28.1	(0.32)	17.2	(0.33)	37.1	(0.57)
Primary school	19.2	(0.22)	14.8	(0.30)	18.7	(0.42)
High school	37.1	(0.28)	44.3	(0.43)	33.8	(0.53)
College or above	15.6	(0.37)	23.8	(0.55)	10.5	(0.53)
<i>Age group (in %)</i>						
Age 14-24	24.0	(0.21)	18.8	(0.31)	9.4	(0.30)
Age 25-34	20.9	(0.22)	27.9	(0.39)	19.9	(0.40)
Age 35-44	21.0	(0.22)	25.5	(0.37)	26.5	(0.46)
Age 45-54	18.8	(0.20)	18.4	(0.31)	26.3	(0.47)
Age 55-64	15.3	(0.21)	9.4	(0.24)	17.9	(0.42)
<i>Income from main occupation (in R\$)</i>						
Average net work income	.	.	2 284.8	(31.81)	1 443.5	(25.35)

Estimation of potential wages with adjustment for selection (1/3)

► estimation

	Main equation Log wage	Selection equation P(state = employee)
<i>Ethnicity and gender (ref: Nonwhite female)</i>		
White female	0.093*** (0.016)	−0.002 (0.018)
Nonwhite male	0.082*** (0.013)	0.473*** (0.016)
White male	0.264*** (0.015)	0.270*** (0.019)
<i>Age and education (ref: 14-24, less than prim. school)</i>		
14-24, primary school	−0.076* (0.038)	0.382*** (0.036)
14-24, high school	−0.004 (0.036)	0.599*** (0.039)
14-24, college or above	0.237*** (0.054)	0.995*** (0.075)
25-34, less than primary school	0.194*** (0.039)	0.211*** (0.044)
25-34, primary school	0.203*** (0.040)	0.384*** (0.047)
25-34, high school	0.264*** (0.035)	0.683*** (0.039)
25-34, college or above	0.666*** (0.042)	1.047*** (0.046)

Estimation of potential wages with adjustment for selection (2/3)

▸ estimation

	Main equation Log wage	Selection equation P(state = employee)
<i>Age and education (ref: 14-24, less than prim. school)</i>		
35-44, less than primary school	0.317*** (0.038)	−0.021 (0.043)
35-44, primary school	0.306*** (0.041)	0.303*** (0.047)
35-44, high school	0.468*** (0.036)	0.516*** (0.040)
35-44, college or above	0.963*** (0.042)	1.006*** (0.051)
45-54, less than primary school	0.454*** (0.038)	−0.184*** (0.041)
45-54, primary school	0.505*** (0.041)	−0.044 (0.049)
45-54, high school	0.673*** (0.038)	0.266*** (0.044)
45-54, college or above	1.152*** (0.050)	0.868*** (0.058)
55-64, less than primary school	0.577*** (0.039)	−0.543*** (0.044)
55-64, primary school	0.625*** (0.049)	−0.322*** (0.059)
55-64, high school	0.870*** (0.048)	−0.130* (0.051)
55-64, college or above	1.445*** (0.056)	0.254*** (0.061)

Estimation of potential wages with adjustment for selection (3/3)

► estimation

	Main equation Log wage	Selection equation P(state = employee)
<i>Current schooling status (ref: Not currently studying)</i>		
Attending school		−0.584*** (0.033)
Attending college or above		0.114*** (0.022)
<i>Household position (ref: Head, with partner, no kids)</i>		
Head, with partner, with kids		0.037 (0.028)
Head, no partner, no kids		−0.044 (0.031)
Head, no partner, with kids		−0.075* (0.031)
Partner, no kids		−0.231*** (0.031)
Partner, with kids		−0.249*** (0.028)
Child		−0.491*** (0.029)
Other young hh member		−0.489*** (0.046)
Other adult hh member		−0.344*** (0.033)
<i>Number of household members by age</i>		
N. kids (less than 15 years old)		−0.034*** (0.007)
N. young members (15-21)		−0.011 (0.008)
N. adult members (22-64)		0.013* (0.007)
N. elderly members (65+)		−0.044** (0.015)
<i>Heckman selection model ancillary parameters</i>		
Errors correlation	−0.815***	(0.009)
Standard deviation of errors	0.751***	(0.009)

Estimation of reservation wages: quantile regressions at .05, .10, and .15 (1/3)

► estimation

	Quantile 0.05 Log wage	Quantile 0.10 Log wage	Quantile 0.15 Log wage
<i>Ethnicity and gender (ref: Nonwhite female)</i>			
White female	0.071*** (0.018)	0.066*** (0.011)	0.050*** (0.009)
Nonwhite male	0.221*** (0.018)	0.216*** (0.010)	0.184*** (0.009)
White male	0.296*** (0.019)	0.300*** (0.010)	0.256*** (0.010)
<i>Age and education (ref: 14-24, less than prim. school)</i>			
14-24, primary school	0.393* (0.156)	0.333*** (0.043)	0.414*** (0.081)
14-24, high school	0.763*** (0.150)	0.617*** (0.021)	0.551*** (0.080)
14-24, college or above	0.880*** (0.264)	0.895*** (0.092)	0.899*** (0.087)
25-34, less than primary school	0.666*** (0.162)	0.528*** (0.074)	0.457*** (0.088)
25-34, primary school	0.836*** (0.155)	0.741*** (0.024)	0.691*** (0.081)
25-34, high school	1.121*** (0.150)	0.895*** (0.023)	0.809*** (0.080)
25-34, college or above	1.365*** (0.152)	1.164*** (0.024)	1.118*** (0.082)

Estimation of reservation wages: quantile regressions at .05, .10, and .15 (2/3)

► estimation

	Quantile 0.05 Log wage	Quantile 0.10 Log wage	Quantile 0.15 Log wage
<i>Age and education (ref: 14-24, less than prim. school)</i>			
35-44, less than primary school	0.611*** (0.151)	0.578*** (0.103)	0.577*** (0.082)
35-44, primary school	0.788*** (0.170)	0.801*** (0.030)	0.727*** (0.083)
35-44, high school	1.240*** (0.150)	0.959*** (0.023)	0.882*** (0.080)
35-44, college or above	1.592*** (0.151)	1.373*** (0.028)	1.310*** (0.081)
45-54, less than primary school	0.681*** (0.151)	0.670*** (0.031)	0.628*** (0.081)
45-54, primary school	1.030*** (0.154)	0.835*** (0.028)	0.751*** (0.081)
45-54, high school	1.202*** (0.150)	0.961*** (0.024)	0.872*** (0.080)
45-54, college or above	1.570*** (0.152)	1.397*** (0.031)	1.378*** (0.081)
55-64, less than primary school	0.599*** (0.179)	0.518*** (0.065)	0.520*** (0.099)
55-64, primary school	0.938*** (0.157)	0.696*** (0.037)	0.659*** (0.083)
55-64, high school	1.099*** (0.150)	0.893*** (0.026)	0.838*** (0.080)
55-64, college or above	1.436*** (0.152)	1.351*** (0.058)	1.270*** (0.081)
<i>Current schooling status (ref: Not currently studying)</i>			
Attending school	−0.408*** (0.116)	−0.401*** (0.105)	−0.458*** (0.039)
Attending college or above	−0.125*** (0.019)	−0.061*** (0.010)	−0.066*** (0.010)

Estimation of reservation wages: quantile regressions at .05, .10, and .15 (3/3)

► estimation

	Quantile 0.05 Log wage	Quantile 0.10 Log wage	Quantile 0.15 Log wage
<i>Household position (ref: Head, with partner, no kids)</i>			
Head, with partner, with kids	0.049* (0.025)	0.060*** (0.014)	0.019 (0.014)
Head, no partner, no kids	-0.065** (0.025)	-0.065** (0.020)	-0.093*** (0.017)
Head, no partner, with kids	-0.045 (0.024)	0.007 (0.013)	-0.058*** (0.016)
Partner, no kids	-0.104*** (0.027)	-0.068*** (0.018)	-0.089*** (0.022)
Partner, with kids	-0.049* (0.023)	-0.040 (0.028)	-0.078*** (0.015)
Child	-0.324*** (0.029)	-0.334*** (0.013)	-0.356*** (0.020)
Other young hh member	-0.400*** (0.046)	-0.405*** (0.031)	-0.410*** (0.023)
Other adult hh member	-0.184*** (0.020)	-0.165*** (0.016)	-0.214*** (0.015)
<i>Number of household members by age</i>			
N. kids (less than 15 years old)	-0.052*** (0.007)	-0.033*** (0.004)	-0.025*** (0.005)
N. young members (15-21)	-0.060*** (0.010)	-0.045*** (0.005)	-0.039*** (0.005)
N. adult members (22-64)	-0.001 (0.006)	0.001 (0.005)	-0.000 (0.004)
N. elderly members (65+)	-0.086*** (0.015)	-0.045*** (0.013)	-0.052*** (0.007)

Estimation of employment and unemployment duration using an exponential transition model with two-types mixture for unobservable components (1/3)

► estimation

	Out of wage work transition hazard		Unemp to wage work transition hazard	
	hazard ratio	s.e.	hazard ratio	s.e.
<i>Ethnicity and gender (ref: Nonwhite female)</i>				
White female	1.062**	(0.022)	1.127**	(0.045)
Nonwhite male	0.976	(0.017)	1.873***	(0.059)
White male	0.965	(0.021)	1.652***	(0.066)
<i>Age and education (ref: 14-24, less than prim. school)</i>				
14-24, primary school	0.742***	(0.030)	1.042	(0.068)
14-24, high school	0.456***	(0.020)	0.986	(0.065)
14-24, college or above	0.274***	(0.025)	1.397**	(0.149)
25-34, less than primary school	0.757***	(0.032)	1.104	(0.094)
25-34, primary school	0.551***	(0.024)	1.170	(0.100)
25-34, high school	0.346***	(0.015)	1.100	(0.078)
25-34, college or above	0.222***	(0.011)	1.107	(0.100)

Estimation of employment and unemployment duration using an exponential transition model with two-types mixture for unobservable components (2/3) estimation

	Out of wage work transition hazard		Unemp to wage work transition hazard	
	hazard ratio	s.e.	hazard ratio	s.e.
<i>Age and education (ref: 14-24, less than prim. school)</i>				
35-44, less than primary school	0.678***	(0.029)	0.920	(0.072)
35-44, primary school	0.489***	(0.025)	0.957	(0.087)
35-44, high school	0.323***	(0.014)	0.969	(0.073)
35-44, college or above	0.192***	(0.010)	1.001	(0.101)
45-54, less than primary school	0.637***	(0.027)	0.813*	(0.072)
45-54, primary school	0.473***	(0.026)	0.798*	(0.088)
45-54, high school	0.347***	(0.017)	0.790*	(0.080)
45-54, college or above	0.207***	(0.011)	0.754*	(0.108)
55-64, less than primary school	0.726***	(0.033)	0.586***	(0.063)
55-64, primary school	0.581***	(0.033)	0.453***	(0.081)
55-64, high school	0.456***	(0.024)	0.500***	(0.080)
55-64, college or above	0.353***	(0.019)	0.333***	(0.077)
<i>Current schooling status (ref: Not currently studying)</i>				
Attending school	1.411***	(0.047)	0.765***	(0.043)
Attending college or above	0.926**	(0.024)	1.294***	(0.053)

Estimation of employment and unemployment duration using an exponential transition model with two-types mixture for unobservable components (3/3)

▸ estimation

	Out of wage work transition hazard		Unemp to wage work transition hazard	
	hazard ratio	s.e.	hazard ratio	s.e.
<i>Household position (ref: Head, with partner, no kids)</i>				
Head, with partner, with kids	0.899***	(0.027)	0.963	(0.068)
Head, no partner, no kids	1.042	(0.036)	0.852*	(0.063)
Head, no partner, with kids	0.975	(0.033)	0.882	(0.078)
Partner, no kids	1.037	(0.036)	0.925	(0.074)
Partner, with kids	0.971	(0.029)	0.946	(0.063)
Child	1.257***	(0.039)	0.674***	(0.047)
Other young hh member	1.263***	(0.074)	0.800*	(0.077)
Other adult hh member	1.132**	(0.048)	0.845*	(0.067)
<i>Number of household members by age</i>				
N. kids (less than 15 years old)	1.064***	(0.008)	1.039**	(0.014)
N. young members (15-21)	1.077***	(0.010)	1.002	(0.019)
N. adult members (22-64)	1.014	(0.008)	0.993	(0.014)
N. elderly members (65+)	1.017	(0.016)	0.927*	(0.030)
<i>Ancillary mixture parameters</i>				
Hazard ratio for high type	6.186***	(0.248)	3.325***	(0.096)
Share of high type	0.418***	(0.012)	0.662***	(0.021)

Association between the estimated discount lower bound of OAWs (% per month) and the material conditions of their household (1/3)

► coefficients figures

	Model A	Model B	Model C	Model D
	other inc. sources	budget conditions	living conditions	full specification
<i>Access to financial services</i>				
No savings account	3.63*** (0.75)	.	.	2.77*** (0.75)
No overdraft facility	6.89*** (1.32)	.	.	5.00*** (1.32)
No credit card	8.23*** (0.81)	.	.	6.20*** (0.81)
<i>Income from other sources (in R\$ 1 000)</i>				
Family per cap inc ex my work inc	-1.13*** (0.27)	.	.	-0.20 (0.27)
(Family per cap inc ex my work inc) ²	0.02*** (0.00)	.	.	0.00 (0.01)

Association between the estimated discount lower bound of OAWs (% per month) and the material conditions of their household (2/3)

▶ coefficients figures

	Model A		Model B		Model C		Model D	
	other inc. sources		budget conditions		living conditions		full specification	
<i>Financial stress (ref: very easy)</i>								
Easy to make ends meet	.	.	−0.99	(2.58)	.	.	−1.18	(2.61)
Somewhat easy to make ends meet	.	.	1.74	(2.59)	.	.	0.90	(2.63)
Somewhat hard to make ends meet	.	.	7.93**	(2.50)	.	.	4.61	(2.53)
Hard to make ends meet	.	.	10.98***	(2.60)	.	.	5.08	(2.62)
Very hard to make ends meet	.	.	19.73***	(2.70)	.	.	10.19***	(2.79)
<i>Large non-essential expenses (top decile)</i>								
Education expenses > 15% of total	.	.	−2.79*	(1.18)	.	.	−2.38*	(1.19)
Personal expenses > 13% of total	.	.	−0.95	(1.17)	.	.	−1.90	(1.18)
<i>Large essential expenses (top decile)</i>								
Housing expenses > 58% of total	.	.	7.53***	(1.27)	.	.	6.17***	(1.27)
Medicine expenses > 9% of total	.	.	8.21***	(1.35)	.	.	6.91***	(1.33)
Food expenses > 35% of total	.	.	8.38***	(1.28)	.	.	7.07***	(1.27)

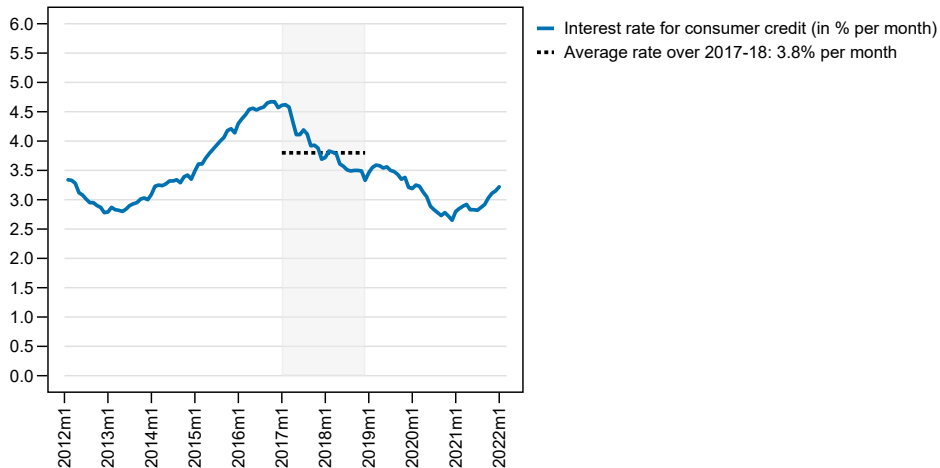
Association between the estimated discount lower bound of OAWs (% per month) and the material conditions of their household (3/3)

▶ coefficients figures

	Model A		Model B		Model C		Model D	
	other inc. sources		budget conditions		living conditions		full specification	
<i>Housing adequacy</i>								
People per sleeping room	.	.	.	.	2.40***	(0.68)	1.72**	(0.66)
Presence of domestic pests	.	.	.	.	2.41**	(0.77)	2.11**	(0.76)
Presence of leakages or dampness	.	.	.	.	3.01***	(0.76)	2.38**	(0.76)
<i>Clothing adequacy (ref: good, adequate)</i>								
Poor clothing conditions	.	.	.	.	7.95***	(1.76)	6.33***	(1.75)
<i>Food adequacy (ref: no food insecurity)</i>								
Some food insecurity	.	.	.	.	7.65***	(0.91)	4.49***	(0.93)
Moderate food insecurity	.	.	.	.	13.87***	(1.37)	8.87***	(1.42)
Severe food insecurity	.	.	.	.	19.10***	(2.00)	12.92***	(2.11)
<i>Model statistics</i>								
Adjusted R ²	0.135		0.148		0.148		0.166	
Number of observations	20 424		20 424		20 424		20 424	

Recent evolution of average interest rates for consumer loans

► baseline



Time discount lower bound under alternative proxies for the reservation wage

► baseline

