

Sources and Implications of Labor Market Informality

The Case of Minimum Wage Policies

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Mandatory Minimum Wage

Definition

- Definition:
price floor on the wage rate of workers (or class of workers).
- Advantages:
 - Good targeting of low income wage earners.
 - Relative easy policy to implement, monitor and describe.
 - Rich scientific and policy literature.
- Disadvantage:
 - Negative employment effects, i.e. reduction of employment due to the price increase of labor services.
 - Frequently, the target population is the most affected by negative employment effects.

Mandatory Minimum Wage

Issues

- 1 How do employment effects and wage effects impact workers' **overall welfare**?
 - Not obvious since the positive impact of a wage increase may be offset by the negative impact of a reduction in employment.
 - The welfare evaluation should take into account both aspects.
 - It is an inherently dynamic issue because agents transit between employment and unemployment.

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- 2 Does the minimum wage impact only 'minimum wage workers' or **other workers**, too?
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 - It is an inherently dynamic issue because agents transit between employment and unemployment.
- 2 Does the minimum wage impact only 'minimum wage workers' or **other workers**, too?
 - Minimum wages changes may 'spill-over' to wages above minimum wage (equilibrium effects).
 - As a result, welfare impacts may involve workers beyond the target population.
- 3 What happens in labor markets with **high informality**?
 - In labor markets with negligible informality, negative employment effects are limited to an increase in unemployment or in non-participation.
 - In labor markets with high informality, there is an **additional outside option: working informally**. Potentially very different employment and welfare effects.
 - Empirical regularity: minimum wage affects wages in the informal sector, too (**"lighthouse effect"**)

What Model?

A **theoretical framework** to study minimum wage impact in a labor market with high informality must generate:

- 1 If minimum wage is binding, a significant proportion of formal workers **at exactly the minimum wage**
- 2 An equilibrium with a **significant proportion** of jobs with different formality status
- 3 Transitions between formal and informal jobs in **both directions**
- 4 Higher formal wages on average but also significant **overlap** between formal and informal wages distributions
- 5 If informality is present, **lighthouse effect**

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Claim: an appropriately specified **search model of the labor market** can accomplish all of these. Moreover,

- ① It is a model susceptible to be **identified and estimated** with standard labor market data
- ② The estimated model can generate:
 - ① counterfactual **policy experiments**, taking into account equilibrium effects
 - ② a **measure of overall welfare**, taking into account both wage and employment effects

Literature

- Informality
 - Huge
- Minimum Wage
 - Huge
- Estimating Dynamic Models to Evaluate Policies
 - Much smaller, in particular in applied micro, but present and established
 - Dynamic Discrete Choice models:
 - Keane and Wolpin (JHR, 2002); Keane and Wolpin (IER, 2010); Chan (Econometrica, 2013); Low, Meghir, Pistaferri, Voena, (NBER, 2022)
 - Search models:
 - With minimum wage: Van Den Berg (Econometrica 1998 and IER, 2003), Flinn (Econometrica, 2006), Eckstein, Ge, and Petrongolo (JAppEconometrics, 2011), Flinn and Mullins (ReStud, R&R)
 - With informality: Albrecht, Navarro, and Vroman (EJ, 2009), Bosch and Esteban-Pretel (JDE, 2011), Narita (RED, 2018), Bobba, Flabbi, Levy and Tejada (JMetrics, 2021), Bobba, Flabbi, and Levy (IER, 2022)
 - With both: Meghir, Narita and Robin (AER, 2015), Dix-Carneiro, Goldberg, Meghir, Ulyssea (Econometrica 2025), [this paper](#).

Model

Environment

- *Definition:* In a search model of the labor market
 - Workers **search** for jobs, firms search to fill vacancies
 - Process is costly and **takes time**
 - **Departure** from a **perfectly competitive** model where workers and firms meets instantly and at no cost
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 - Inherently **dynamic** process
- *Formally*: Not trivial but tractable, both theoretically and empirically
 - **Search-matching-bargaining model**
 - Stationary, in continuous time, agents live forever facing discount rate ρ
 - Four Labor Market States:
 - 1 Unemployed;
 - 2 Informal Employee;
 - 3 Formal Employee;
 - 4 Informal Self-employed.

Assumptions

- 1 Labor market structure determines the extent of the **frictions** in the meeting of labor supply and labor demand. When unemployed, searchers receive:
 - Employee job offers at rate λ , π_f of them at formality regime f , where $f = 1$ if formal, $f = 0$ if informal. If accepted, they terminate at rate η_f .
 - Self-employment opportunities at rate γ . They terminate at rate δ .

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- 4 Preferences determine the **objective function**
 - Linear utility: in income $w_f(x)$ (if employed), y (if self-employed), and in the flow value of the labor market state $\beta_u, \beta_s, \beta_1$
 - Discounted over time at rate ρ

Value Functions

- Present discounted value of being an **unemployed searcher (U)** is:

$$\begin{aligned}(\rho + \lambda + \gamma)U &= \beta_u + \lambda \left\{ \begin{array}{l} \pi_1 \int \max [E_1[w_1(x)], U] dG_1(x) \\ + \pi_0 \int \max [E_0[w_0(x)], U] dG_0(x) \end{array} \right\} \\ &+ \gamma \left\{ \int \max [S(y), U] dR(y) \right\}, \quad \pi_1 + \pi_0 = 1\end{aligned}$$

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- The value of a salaried **employee producing x with formality status f** ($E_f[w_f(x)]$) is:

$$(\rho + \eta_f)E_f[w_f(x)] = w_f(x) + f \times \beta_1 + \eta_f U$$

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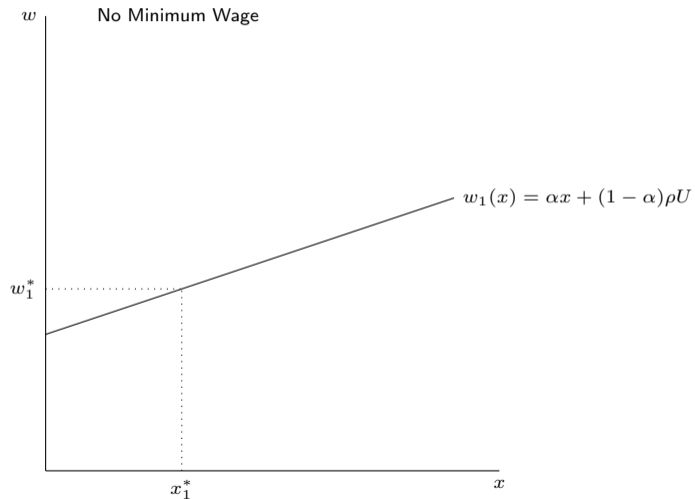
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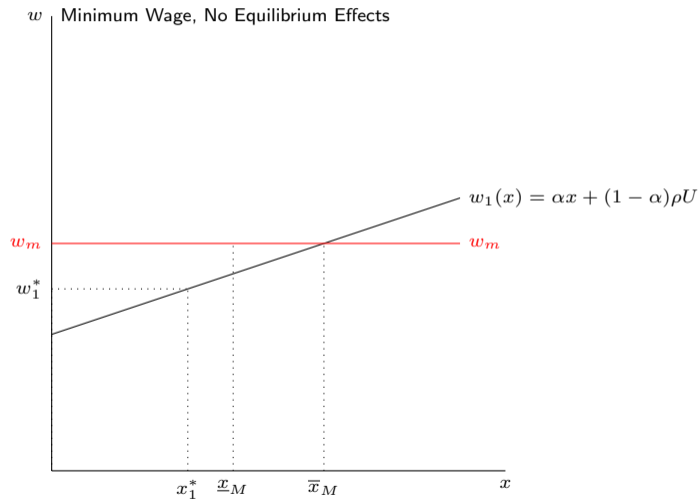
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- Spillover (or equilibrium) effects are generated by the outside option U :
 - Minimum wage **matters for informal wages**
 - Minimum wage **matters at any wage level**

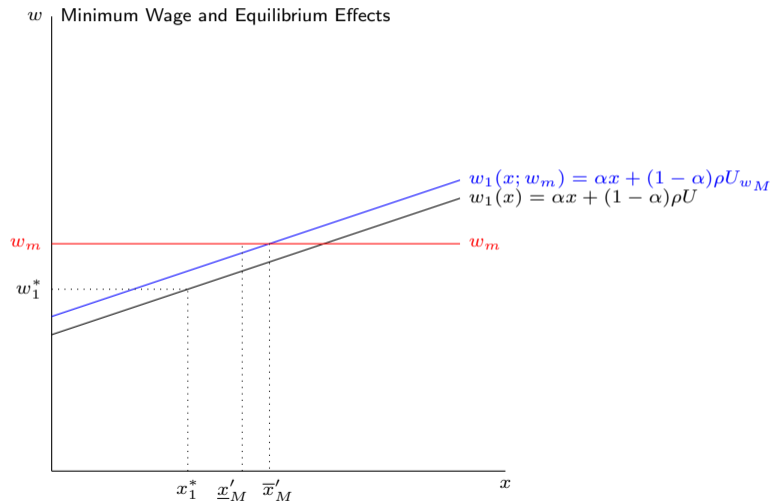
Equilibrium without Informality



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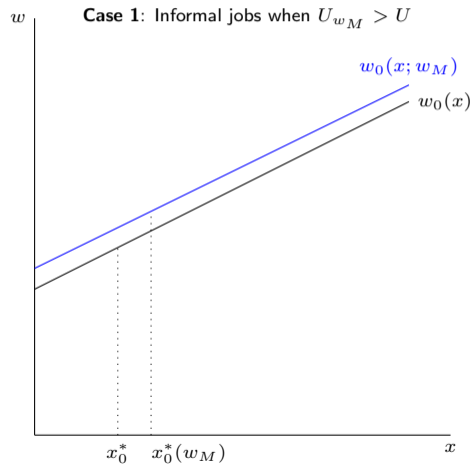
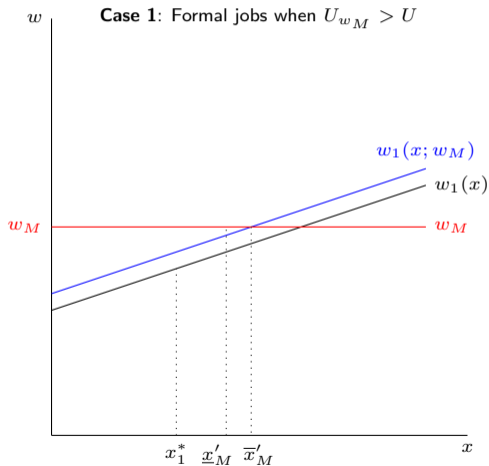


Equilibrium without Informality



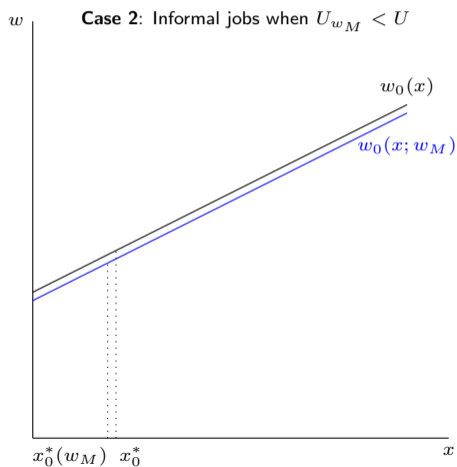
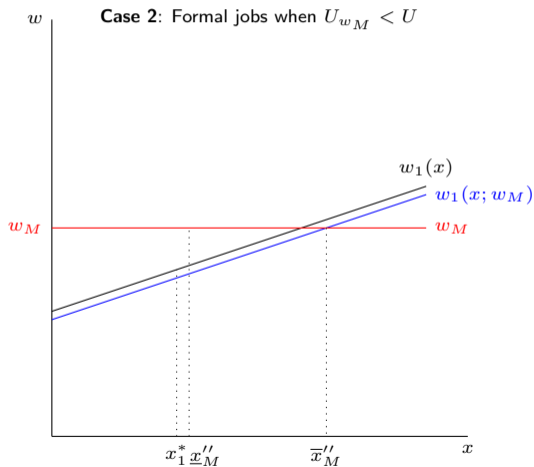
Equilibrium with Informality

Negative Employment Effects: both Formal and Informal



Equilibrium with Informality

Negative Employment Effects: Formal



Equilibrium Definition

Definition

Given:

- 1 The primitive parameters $\{\rho, \lambda_f, \eta_f, \gamma, \delta, \alpha\}$, $f = 0, 1$;
- 2 The distributions of wage offers $G_f(x)$, $f = 0, 1$ and self-employment income opportunities $G(y)$;
- 3 The institutional parameters $\{t, w_M, c\}$ and utility parameters $\{\beta_u, \beta_1, \beta_s\}$;

the *steady state equilibrium* is a value U that satisfies the Bellman equation (1), together with the invariant distribution of individuals across labor market states.

Workers and firms' behavior **endogenously** determine:

- 1 Realized wage and duration distributions
- 2 Employment level
- 3 Informality level
- 4 Minimum wage coverage

Empirical Implications

Does the model generate the relevant empirical features we discussed?

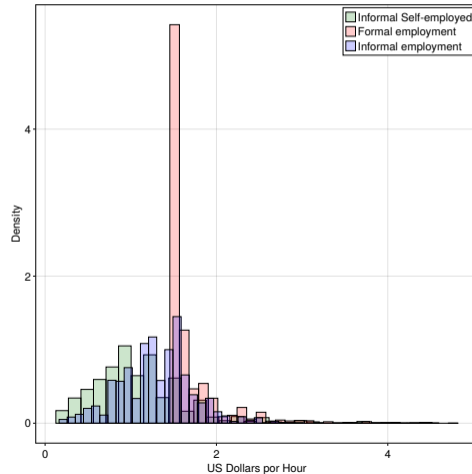
- ① An equilibrium with a **significant proportion** of jobs with different formality status
 - Yes, depending on productivity x , workers are willing to accept an informal job, even if they know they could find a formal one
- ② Transitions between formal and informal jobs in **both directions**
 - Yes, ex-ante identical workers may end up in both labor market states, generating transitions in and out of employment and in and out of formality.
- ③ Higher formal wages on average but also significant **overlap** between formal and informal wages distributions
 - Yes, if $E_1(x) > E_0(x)$ and if there is enough dispersion in the distributions
- ④ If binding minimum wage present, a significant proportion of formal workers **at exactly the minimum wage**
 - Yes, all offers in the productivity range between \underline{x}_M and \bar{x}_M are accepted and pay w_M .
- ⑤ If minimum wage and informality present, **lighthouse effect**
 - Yes, value of outside option is affected by minimum wage and affect bargaining of wages at informal jobs.

Data

- Data source: *Gran Encuesta Integrada de Hogares (GEIH)* for Colombia in 2023
- Estimation Sample:
 - Objectives:
 - population for whom minimum wage potentially binding
 - homogeneous enough to be consistent with modeling assumptions
 - Selection criteria:
 - full-time workers
 - all adult household members, not only head of household
 - 18 and 30 years old
 - at most high school education
 - male
 - Issue: capture minimum wage earners
 - monthly nominal wages for full-time workers show a clear spike exactly at the minimum wage (44% at 1,160,000 pesos)
 - we allow for rounding at 1,100,000 and 1,200,000 pesos, adding 10%
 - 6% formal wages below min wage is captured by measurement errors
 - Total number of observations:
 - 7,384

Data

Figure: Labor Income Distributions by Labor Market State



Data

Table: Descriptive Statistics

Moment	Value
u	0.254
s	0.253
e_1	0.317
e_0	0.176
$P[w = w_M e_1]$	0.497
$E[y s]$	1.079
$SD[y s]$	0.460
$E[w e_1]$	1.628
$SD[w e_1]$	0.276
$E[w e_0]$	1.302
$SD[w e_0]$	0.366
$E[t u]$	5.125
$E[t s]$	37.426
$E[t e_1]$	20.555
$E[t e_0]$	18.006

Identification

- Hazard rates can be identified non-parametrically from durations
- To identify the structural parameters, distributional assumptions on $G_f(x), R(y)$ are necessary [Flinn and Heckman, 1982]:
 - We assume lognormality, with parameters $(\mu_f, \sigma_f), (\mu_y, \sigma_y)$
- Under the assumption:
 - Accepted wages and self-employment opportunities identify the lognormal parameters
 - Measurement errors in wages, assumed lognormal, are identified from formal wages below minimum wage
 - Durations and proportion in labor market states identify arrival and termination rates
 - Preferences parameters are jointly identified with the discount rate. We fix it at 10% a year and recover preferences from equilibrium equations

Estimation Method

- We can estimate directly by **Maximum Likelihood**
- Example contribution: observed (accepted) wage in formal job

$$f_{j,e_1}(w_j | w_j > \max\{\rho U - \beta_1, w_M\}, j \in e_1) = \begin{cases} \frac{1+t}{\alpha} \frac{g_1\left(\frac{(1+t)(w_j - (1-\alpha)[\rho U - \beta_1])}{\alpha}\right)}{\tilde{G}_1((1+t)[\rho U - \beta_1])} & \text{if } w_M < \rho U - \beta_1 \\ \frac{1+t}{\alpha} \frac{g_1\left(\frac{(1+t)(w_j - (1-\alpha)[\rho U - \beta_1])}{\alpha}\right)}{\tilde{G}_1((1+t)w_M)} & \text{otherwise} \end{cases}$$

Estimation Results

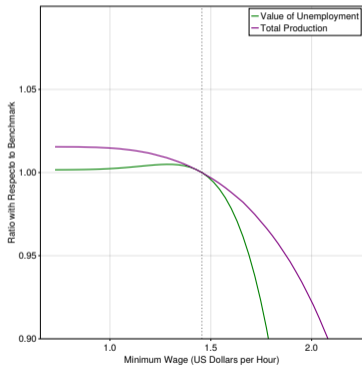
Table: Estimated Parameters

Parameter	Estimate	Standard Error
Frictions and Terminations		
λ_1	0.078	(0.0111)
λ_0	0.050	(0.0033)
γ	0.033	(0.0016)
η_1	0.049	(0.0007)
η_0	0.056	(0.0012)
δ	0.027	(0.0004)
Productivity Distributions		
μ_y	-0.069	(0.0528)
σ_y	0.462	(0.0134)
μ_1	1.202	(0.4855)
σ_1	0.255	(0.088)
μ_0	0.815	(0.0737)
σ_0	0.349	(0.0253)
Labor Market States Utility		
β_u	-3.542	(3.9667)
β_1	0.303	(2.8986)
β_s	0.321	(0.1761)
Measurement Error		
σ_ϵ	0.043	(0.0251)

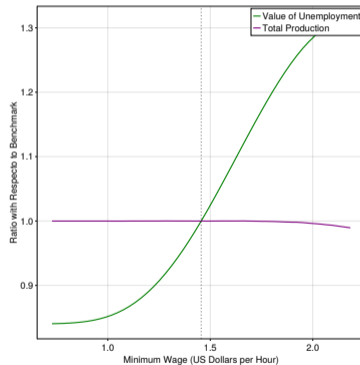
NOTE: Bootstrap standard errors in parenthesis.

Policy Experiments: Changing the Minimum Wage

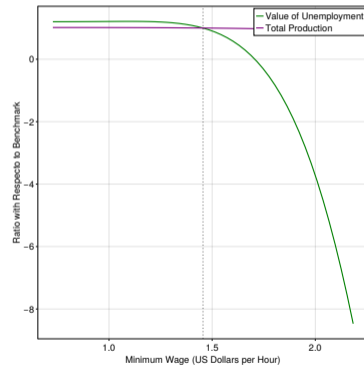
Figure: Unemployment Value and Production



(a) Endogenous Vacancy Creation



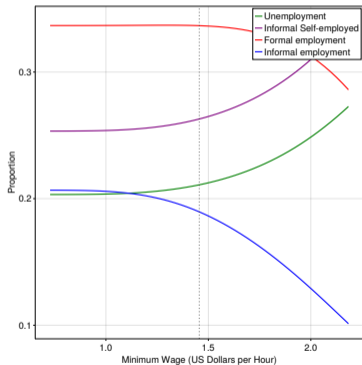
(b) Exogenous Arrival Rates



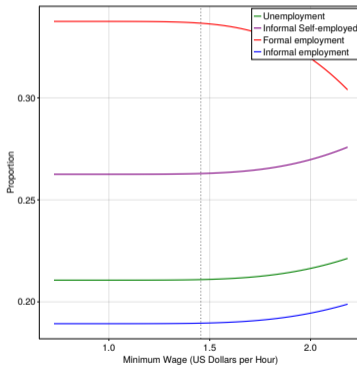
(c) No Self-Employment

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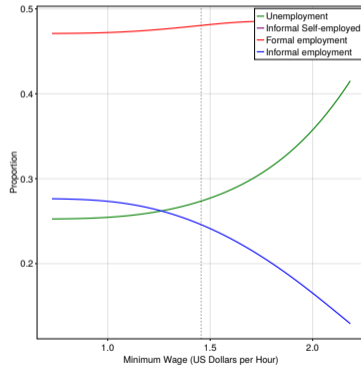
Figure: Labor Market States



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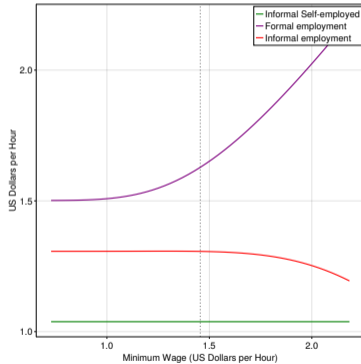
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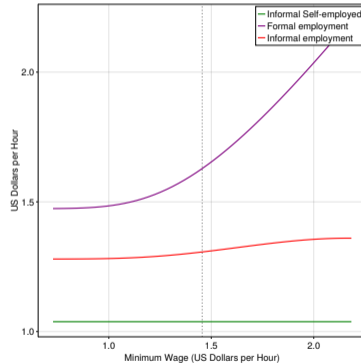
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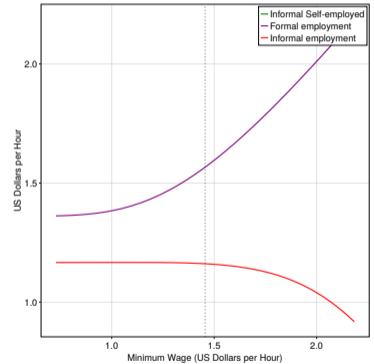
Figure: Accepted Wages



(a) Endogenous Vacancy Creation



(b) Exogenous Arrival Rates



(c) No Self-Employment

Conclusion

- We show the importance and the advantages of developing and estimating a **dynamic model to evaluate minimum wage policies** in a market with high informality
- We develop a **search-matching-bargaining model**, allowing for labor market informality.
- We estimate it on labor market data for **Colombia**
- We find that:
 - Potentially, a positive '**optimal**' **mandatory minimum wage exists**
 - **Differentiating** between **informal self-employed and informal employees** makes a significant difference in evaluating policies
- Given the relative modest data requirements, this approach could be **extended** to many other Latin American and Caribbean countries.