Labor Market and Macroeconomic Dynamics in Latin America Amid COVID: The Role of Digital Adoption Policies[1]

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[1]The views in this paper are solely the responsibility of the author and should not be interpreted as reflecting the views of the Inter-American Development Bank.

COVID impact in Latin America

- COVID prompted a dramatic contraction in employment and economic activity, specially in Latin America
- Impact on labor markets different to past recessions
  - Reduction in labor force participation
  - **Reduction in informal employment** (ECLAC, 2021; Leyva and Urrutia, 2023)
- Firms in the region experienced a record collapse in sales
  - Firms exiting
  - Sharp dent on new firm creation
  - More affected: MSMEs (50% of total employment) and high-contact sectors (ECLAC, 2020a)

Digital adoption before and during COVID in Latin America

- Digital adoption by firms and households has steadily expanded
  - Roughly 70 percent of pop. now use the internet in the region
  - Steady growth in share of pop. receiving/making digital payments
- **Digital adoption and usage by businesses and households rose sharply during the pandemic** (Diaz de Astraloa et al., 2021)
  - E-commerce expansion, penetration accelerated dramatically
  - Registration of new sellers in Mercado Libre; sharp growth in online sales and new business websites
- **Many governments actively promoting policies to bolster digital adoption, e-commerce!** (Argentina, Costa Rica)
- Government-backed partnerships between banks, online platforms to support MSMEs online presence and sales (Colombia, Costa Rica)

What we do

- Use a model to analyze the labor market and macroeconomic implications of digital adoption policies in Latin America in the context of the COVID recession and recovery
- Macro search and matching model Extension of Finkelstein Shapiro and Mandelman (JDE, 2021)
- Firm entry/exit, endogenous digital technology adoption
- Formal and informal workers (based on which type of firms do they work), self-employment, LFP, and unemployment
- Take the model to replicate the Mexican labor market
- Policy: permanent reduction in the barriers to adopt digital technology

Main findings

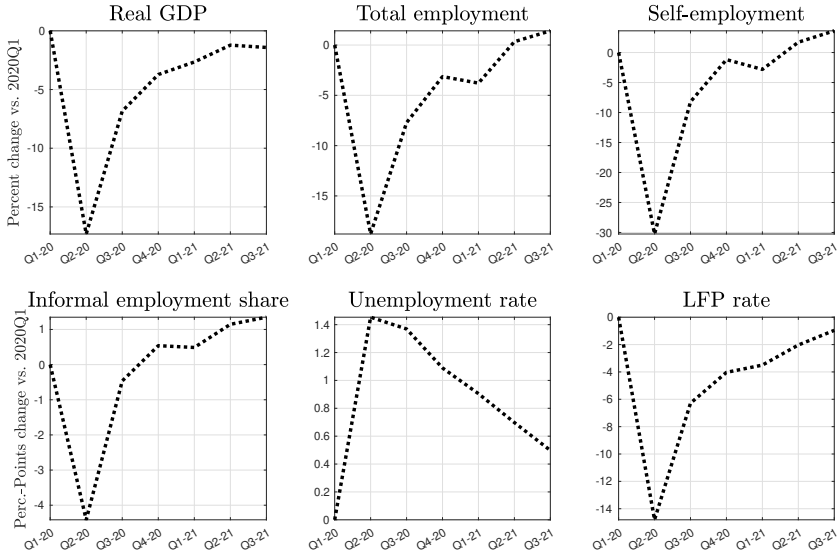
- **Greater digital adoption in the aftermath of the recession** (policy *vis-à-vis* no policy)
  - Bolsters the recovery of GDP, total employment, and labor income
  - Larger expansion in the share of formal employment
  - Long-term: $\downarrow$ total employment and LFP, but $\uparrow$ GDP, labor income, formal employment share
- The policy changes the technological composition of firms and the associated improvement in **average firm productivity**
- Also, it exacerbates the **differential between formal and informal labor income**, both as the economy recovers from the recession and in the long run

Key-policy issues

- COVID situation in Latin America
  - Labor markets took some time to recover
  - **Dynamics of LFP, informality, and firm entry/exit: particularly relevant for labor markets in the region**
  - Digital adoption has expanded and played key role in supporting firms/jobs/econ. activity
- **Consistent message from policy reports: enabling and facilitating digital adoption $\Rightarrow$ important for recovery process**
  - Digital tech. can reduce entry barriers and **support firm creation**
  - Broader goal of fostering adoption of digital tech. among MSMEs
  - **Tighter fiscal constraints amid COVID $\Rightarrow$ need effective policies for recovery, is digital adoption one of them?**

LABOR MARKET AND MACROECONOMIC DYNAMICS IN MEXICO AMID COVID

Mexico: Dynamics during COVID



Source: Saint Louis Federal Reserve Economic Database (FRED) and INEGI. Note: LFP denotes labor force participation.

MODEL DESCRIPTION

Theoretical Framework

- Model features
  - Firm entry/exit, digital tech. adoption by subset of salaried firms
  - Self-employment (informal employment) alongside heterogeneous salaried employment and firms (based on production tech., digital adoption)
  - Endogenous LFP and unemployment
  - Based on Finkelstein Shapiro and Mandelman (JDE, 2021)
- Based on data: digital adoption associated with lower firm-entry barriers $\Rightarrow$ **link digital adoption costs to firm entry costs**
- Solve for full non-linear dynamics: onset of COVID + aftermath

Model structure

- Economy is comprised of households, salaried firms, and self-employed -SE- firms
- SE firm creation is endogenous: dictated by households' labor force participation (LFP) decisions
- Salaried firm entry is endogenous, subject to entry costs (as in Bilbiie, Ghironi, and Melitz, 2012)
- Salaried firms choose technology used, standard or ICT-based: choice over digital adoption
- Total output is composite of salaried-firm and SE output

Salaried firms

- Endogenous measure N of salaried firms
- Prospective new firms must incur sunk cost f_e to enter and operate
- Right after entry, draw idiosyncratic productivity a from distribution $G(a)$
- 2 available technologies (both entail labor search frictions!)
  - Regular (r) $\Rightarrow$ uses salaried labor n_r^r
  - ICT (i) $\Rightarrow$ uses salaried labor n_r^i and n_i^i + ICT capital k_i
  - n_i^i and k_i are complements but n_r^i and (k_i, n_i^i)-composite are imperfect substitutes
- Firms with $a > a_i$ pay fixed cost f_i and use i technology

Salaried firms (continued)

- Technology adoption decision generates two endogenous measures of firms, N_i and N_r
- **Fraction of i firms N_i/N = measure of digital adoption**
- Assumption based on evidence: f_e, f_i are positively related
  - $f_i = \lambda_f f_e$ where $0 < \lambda_f < 1$
  - $\downarrow$ in f_i, which all else equal $\uparrow N_i/N$, associated with $\downarrow$ in f_e
  - Firm digital adoption can help firms overcome barriers to entry
  - Digital form-filing (e-governance) reduces red tape
  - E-banking facilitates payments, credit access
  - Access to e-commerce via digital platforms, expanded market access (goods and inputs)

Digital Adoption Details | Labor Market Details

Households and self-employment

- Utility from consumption, disutility from labor force participation
- Receive salaried income + income from owning salaried and SE firms
- Make decisions over salaried-firm creation (incur sunk costs)
- Labor force participation (LFP) decisions, **including over SE**
  - **Choose measure of searchers s_i, s_r, and s_e** and desired sectoral employment
  - SE produce using own labor n_e
- Choice over SE is affected by search efficiency ϕ_e (proxy for SE entry barriers)

$$n_{e,t+1} = (1 - \rho_e)\left[n_{e,t} + s_{e,t}\phi_e\right]$$

Details

Wages and market clearing

- Real wages are determined via bilateral Nash bargaining
- Unemployment rate is the sum of searchers in each employment category (including SE) divided by total labor force
- Total output is a CES composite of salaried-firm output and SE output

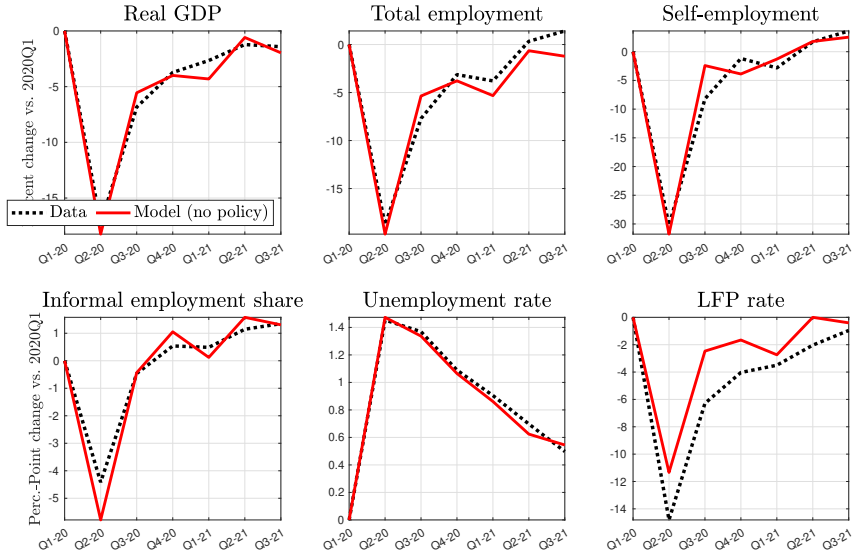
Details

QUANTITATIVE ANALYSIS

Exercise

- Focus on Mexico (minimal policy interventions)
- Calibrate parameter and shocks $\Rightarrow$ replicate behavior of labor market and output at onset of pandemic
  1. TFP
  2. Disutility of labor force participation of r workers and self-employed individuals
  3. Disutility of labor force participation of i workers
  4. Matching efficiency of r employment
  5. Self-employment separation probability
  6. Salaried employment separation probability
- Consider **policy-induced reduction in costs of digital adoption,** $\downarrow f_i$ that $\uparrow$ **firm digital adoption from steady-state by 1%,** N_i/N
- Cost of policy: $\downarrow$ 18% f_i and $\uparrow$ ss value of ICT-inv./GDP from 0.78 to 0.83

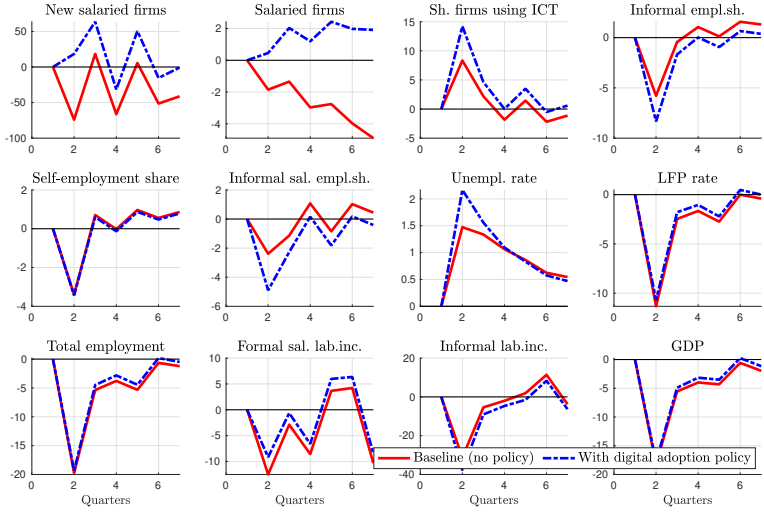
Matching the model with the data



Long-run changes: Greater firm digital adoption (vs. no policy)

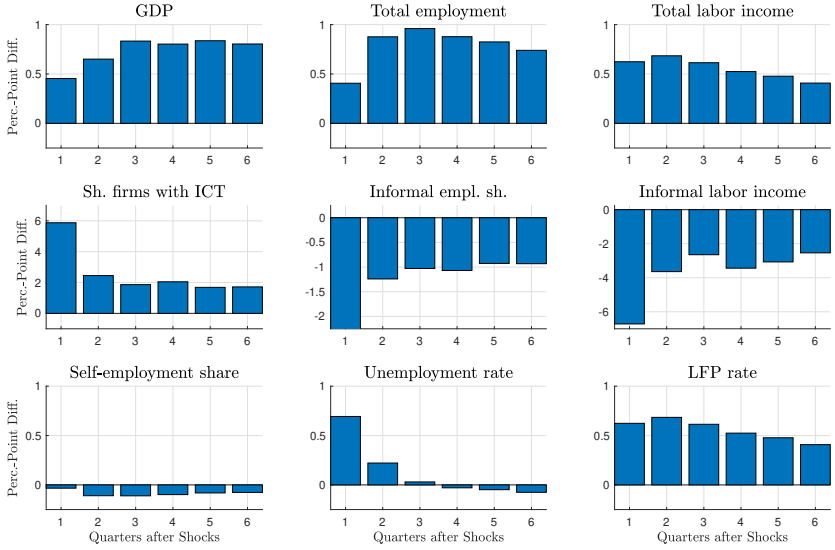
Variable	**Percent change**
Salaried Firms N	32.27
Firms using ICT N_i	35.58
Average firm productivity	0.13
Total output	0.51
Consumption	0.29
i worker real wage	3.20
r worker real wage	2.39
SE total income	-4.61
Informal labor income	-3.73
Total labor income	0.12
	Per.-Pt. change
SE rate	-0.30
Informal employment share	-0.64
i employment share	0.10
Unemployment rate	-0.07
LFP rate	-1.06

Benchmark vs. policy scenario



Note: New salaried firms, Salaried firms, Formal sal. labor income, Informal labor income, Total employment, and GDP are expressed as percentage deviations from the steady state, while Share of firms using ICT, Informal employment share, Informal sal. empl. share, Self-employment share, Unempl. rate, and LFP rate are expressed as percentage point deviations from the steady state.

Benchmark vs. policy scenario: differences

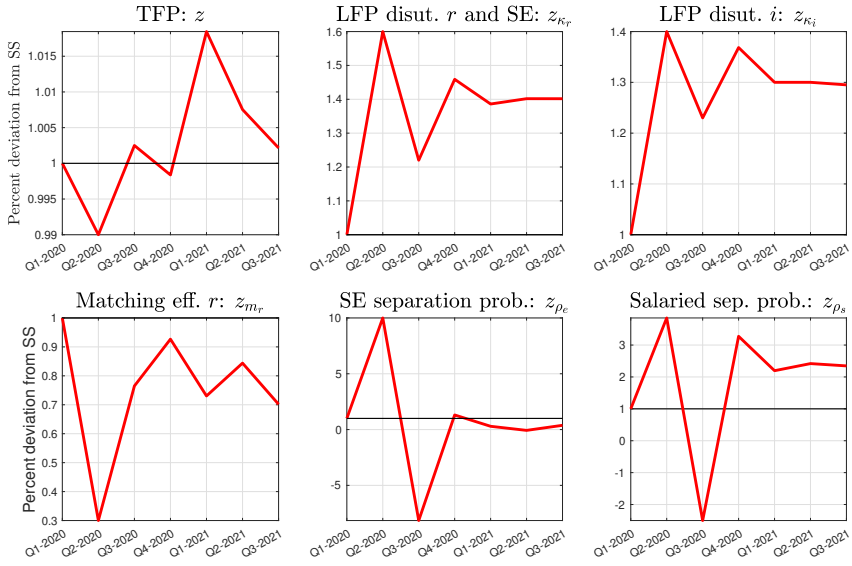


Conclusion

- We use a search and matching model with firm entry and exit where salaried firms can choose to adopt digital technologies and the labor market and firm structure is consistent with the Latin American context
- A permanent $\downarrow$ in the barriers to adopt digital technologies can (1) support earlier labor market and economic recoveries, and (2) improve long-term macro outcomes
- The policy exacerbates the labor income differentials between formal and informal workers and points to a trade-off between improved macroeconomic outcomes and labor income inequality

APPENDIX

Shocks behavior



Optimality conditions

Standard ICT capital Euler equation

$$1 = \mathbb{E}_t \Xi_{t+1|t} \left[mc_{i,t+1} z_{i,t+1} F_{k_i,t+1} + (1 - \delta_i) \right]$$

Optimal decision over allocation of r workers across production of r and i intermediate goods, ω_t

$$mc_{i,t} z_{i,t} F_{n_r^i,t} - w_{r,t}^i = mc_{r,t} z_{r,t} H_{n_r^r,t} - w_{r,t}^r$$

Optimality conditions

Standard job creation conditions

$$\frac{\psi}{q(\theta_{r,t})} = (1-\rho_s)\mathbb{E}_t\Xi_{t+1|t}\left[\begin{array}{c}(1-\omega_{t+1})[mc_{r,t+1}z_{r,t+1} \\ -w^r_{r,t+1}] + \omega_{t+1}[mc_{i,t+1}z_{i,t+1}F_{n^i_r,t+1} \\ -w^i_{r,t+1}] + \frac{\psi}{q(\theta_{r,t+1})}\end{array}\right]$$

and

$$\frac{\psi}{q(\theta_{i,t})} = (1-\rho_s)\mathbb{E}_t\Xi_{t+1|t}\left[mc_{i,t+1}z_{i,t+1}F_{n^i_i,t+1} - w^i_{i,t+1} + \frac{\psi}{q(\theta_{i,t+1})}\right]$$

Back

Households and self-employment

Choose c_t, searchers $s_{e,t}$, $s_{r,t}$, and $s_{i,t}$, and desired empl. $n_{e,t+1}$, $n_{r,t+1}$, and $n^i_{i,t+1}$, and $N_{e,t}$ and N_{t+1} to maximize

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\mathbf{u}(c_t) - \mathbf{h}(lfp_{e,t}, lfp_{i,t}, lfp_{r,t}) \right]$$

subject to the budget constraint

$$\begin{aligned} c_t + f_e N_{e,t} + f_i N_{i,t} = w^i_{i,t} n^i_{i,t} + w^r_{r,t} n^r_{r,t} + w^i_{r,t} n^i_{r,t} + \widetilde{d}_t N_t \\ + p_{e,t} z_{e,t} n_{e,t} + \Pi_{s,t} + \Pi_{y,t} \end{aligned}$$

the evolution of salaried employment

$$n_{r,t+1} = (1 - \rho_s) \left[n_{r,t} + s_{r,t} f(\theta_{r,t}) \right]$$

and

$$n_{i,t+1} = (1 - \rho_s) \left[n_{i,t} + s_{i,t} f(\theta_{i,t}) \right]$$

(continued)

Households and self-employment (continued)

the evolution of self-employment

$$n_{e,t+1} = (1 - \rho_e)\left[n_{e,t} + s_{e,t}\phi_e\right]$$

and the evolution of salaried firms

$$N_{t+1} = (1 - \delta)\left[N_t + N_{e,t}\right]$$

where $n^r_{r,t} = (1 - \omega_t)n_{r,t}$ and $n^i_{r,t} = \omega_t n_{r,t}$ and LFP $lfp_{e,t} = n_{e,t} + s_{e,t}$, $lfp_{i,t} = n^i_{i,t} + s_{i,t}$, and $lfp_{r,t} = n_{r,t} + s_{r,t}$

Note that we define $lfp_{e,t} = n_{e,t} + s_{e,t}$, $lfp_{i,t} = n^i_{i,t} + s_{i,t}$, and $lfp_{r,t} = n_{r,t} + s_{r,t}$

Household optimality conditions

Salaried-firm creation condition

$$f_e = (1-\delta)\mathbb{E}_t \Xi_{t+1|t}\left[\widetilde{d}_{t+1} + f_e\right]$$

Participation decision for r salaried employment

$$\begin{aligned}\frac{\mathbf{h}_{lfp_{r,t}}}{\mathbf{u}'(c_t)}\frac{1}{f(\theta_{r,t})} &= (1-\rho_s)\mathbb{E}_t \Xi_{t+1|t}[w^r_{r,t+1}(1-\omega_{t+1}) + w^i_{r,t+1}\omega_{t+1}] \\ &+(1-\rho_s)\mathbb{E}_t \Xi_{t+1|t}\left(\frac{1}{f(\theta_{r,t+1})} - 1\right)\frac{\mathbf{h}_{lfp_{r,t+1}}}{\mathbf{u}'(c_{t+1})}\end{aligned}$$

Household optimality conditions (continued)

Participation decisions for i salaried employment

$$\frac{\mathbf{h}_{lfp_{i,t}}}{\mathbf{u}'(c_t)}\frac{1}{f(\theta_{i,t})} = (1-\rho_s)\mathbb{E}_t\Xi_{t+1|t}\left[w^i_{i,t+1} + \left(\frac{1}{f(\theta_{i,t+1})} - 1\right)\frac{\mathbf{h}_{lfp_{i,t+1}}}{\mathbf{u}'(c_{t+1})}\right]$$

Participation decision for SE

$$\frac{\mathbf{h}_{lfp_{e,t}}}{\mathbf{u}'(c_t)}\frac{1}{\phi_e} = (1-\rho_e)\mathbb{E}_t\Xi_{t+1|t}\left[p_{e,t+1}z_{e,t+1} + \left(\frac{1}{\phi_e} - 1\right)\frac{\mathbf{h}_{lfp_{e,t+1}}}{\mathbf{u}'(c_{t+1})}\right]$$

Back

Nash wages and unemployment

Bilateral Nash bargaining between firms and salaried workers

$$w^r_{r,t} = \nu \left(mc_{r,t} z_{r,t} \right) + (1 - \nu) \left(\frac{\mathbf{h}'(lfp_{r,t})}{\mathbf{u}'(c_t)} \right)$$

$$w^i_{r,t} = \nu \left(mc_{i,t} z_{i,t} F_{n^i_{r,t}} \right) + (1 - \nu) \left(\frac{\mathbf{h}'(lfp_{r,t})}{\mathbf{u}'(c_t)} \right)$$

$$w^i_{i,t} = \nu \left(mc_{i,t} z_{i,t} F_{n^i_{i,t}} \right) + (1 - \nu) \left(\frac{\mathbf{h}'(lfp_{i,t})}{\mathbf{u}'(c_t)} \right)$$

where $0 < \nu < 1$ is the bargaining power of workers

Total LFP is $lfp_t = lfp_{e,t} + lfp_{i,t} + lfp_{r,t}$ so that the **unemployment rate** is

$$ur_t \equiv \left(s_{e,t} + s_{i,t} + s_{r,t} \right) / lfp_t$$

Total output

A perfectly-competitive firm aggregates total salaried-firm output $Y_{s,t}$ and self-employment output $Y_{e,t}$ according to

$$Y_t = \left[Y_{s,t}^{\frac{\phi_y - 1}{\phi_y}} + Y_{e,t}^{\frac{\phi_y - 1}{\phi_y}} \right]^{\frac{\phi_y}{\phi_y - 1}}, \phi_y > 1$$

Denote by $p_{s,t}$ the relative price of aggregate salaried output, and by $p_{e,t}$ the relative price of total self-employment output

Can show that the (normalized) aggregate price index is $1 = \left[p_{s,t}^{1-\phi_y} + p_{e,t}^{1-\phi_y} \right]^{\frac{1}{1-\phi_y}}$, $Y_{s,t} = (p_{s,t})^{-\phi_y} Y_t$, and $Y_{e,t} = (p_{e,t})^{-\phi_y} Y_t$

Back

Market clearing

Market clearing for each category of salaried output

$$z_{r,t} n^r_{r,t} = N_{r,t} \left(\frac{\widetilde{y}_{r,t}}{\widetilde{a}_{r,t}} \right)$$

$$z_{i,t} F(n^i_{r,t}, n^i_{i,t}, k_{i,t}) = N_{i,t} \left(\frac{\widetilde{y}_{i,t}}{\widetilde{a}_{i,t}} \right)$$

The resource constraint of the economy is

$$Y_t = c_t + (k_{i,t+1} - (1 - \delta_i) k_{i,t}) + \psi v_{r,t} + \psi v_{i,t} + f_e N_{e,t} + f_i N_{i,t}$$

Back

Matching process details

Matching function for employment category $j \in \{r, i\}$

$$m(s_{j,t}, v_{j,t}) = s_{j,t} v_{j,t} / (s_{j,t}^{\xi} + v_{j,t}^{\xi})^{1/\xi},$$

where $\xi > 0$, $s_{j,t}$ are searchers in employment category j, and $v_{j,t}$ are vacancies in that same category

Then, the job-finding and job-filling probabilities are defined as

$$f(\theta_{j,t}) = v_{j,t} / (s_{j,t}^{\xi} + v_{j,t}^{\xi})^{1/\xi}$$

$$q(\theta_{j,t}) = s_{j,t} / (s_{j,t}^{\xi} + v_{j,t}^{\xi})^{1/\xi}$$

where market tightness is $\theta_{j,t} \equiv v_{j,t} / s_{j,t}$

Functional forms

Utility over consumption $\mathbf{u}(c_t) = \frac{c_t^{1-\sigma_c}}{1-\sigma_c}$

Disutility from LFP

$$\mathbf{h}(lfp_{e,t}, lfp_{i,t}, lfp_{r,t}) = \left[\frac{(\kappa_e(lfp_{e,t}) + \kappa_i(lfp_{i,t}) + \kappa_r(lfp_{r,t}))^{1+\frac{1}{\chi}}}{1+\frac{1}{\chi}} \right]$$

Total Output $Y_t = \left[Y_{s,t}^{\frac{\phi_y - 1}{\phi_y}} + Y_{e,t}^{\frac{\phi_y - 1}{\phi_y}} \right]^{\frac{\phi_y}{\phi_y - 1}}$ where $Y_{e,t} = z_t n_{e,t}$

Production by i firms

$$F(.,.,.) = \left[(1-\phi_i) \left(n_{r,t}^i\right)^{\lambda_i} + \phi_i \left[\alpha_k k_{i,t}^{\lambda_k} + (1-\alpha_k)(n_{i,t}^i)^{\lambda_k} \right]^{\lambda_i/\lambda_k} \right]^{1/\lambda_i}$$

where $0 < \phi_i, \alpha_k < 1$ and $\lambda_i, \lambda_k < 1$

Back

Calibration details

- Parameters from literature

$\sigma_c = 2$, $\beta = 0.985$, $\delta_i = 0.025$, $\varepsilon = 4$, $\delta = 0.025$, $k_p = 4.2$, $\nu = 0.5$, $a_{min} = 1$, $z_e = 1$. $\rho_e = 0.044$, $\rho_s = 0.04$, $\phi_y = 5$, $\phi_e = 0.2$, $\lambda_k = 0.3$, $\lambda_i = 0.9$, $\phi_i = 0.47$, and $\chi = 0.26$

- Calibrated parameters

$\lambda_f = 0.00061947$, $\alpha_k = 0.0456$, $\xi = 0.8963$, $\kappa_e = 419.6129$, $\kappa_i = 7166.6$, $\kappa_r = 40.3102$, $\psi = 0.1213$, $f_i = 0.00028$, and $z_i = 1.9686$