The Role of the Informal Sector in the COVID Crisis: A Cushion or an Amplifier?

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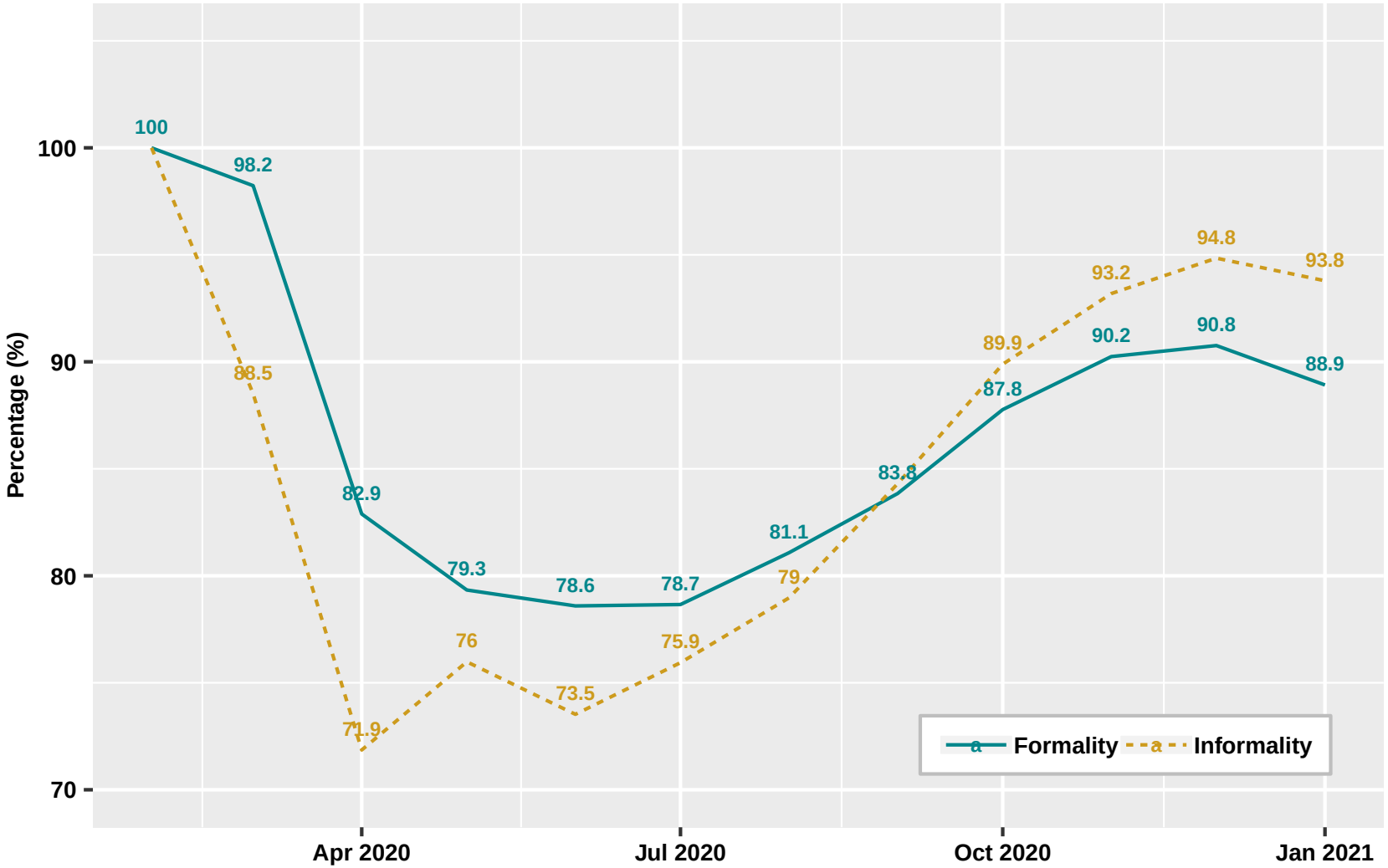
Introduction

- Employment in developing countries has a big component of informality
- Informal workers' income is more fragile to business cycles
- But informal labor market is more flexible than formal one
- Thus it can absorb part of the destruction of formal jobs after a negative shock (Leyva and Urrutia, 2020a)
- However, Covid crisis is different, informal sector has a higher risk of infection, would this time lead the recovery?

Informality was first an amplifier and then leads the recovery



Preview of model

- We propose a SIR model with formal and informal markets
- Agents derive utility from formal, informal consumption and indivisible labor, and are born with a productivity ▸ Household
- The risk of contagion is ▸ SIR
  - Higher the more the agent consumes and work
  - Higher when those activities take place in the informal sector
  - Higher the greater the number of infected agents

- A formal firm is subject to minimum wage and payroll taxes, thus hires workers with a sufficiently high productivity ▸ Formal
- Rest of workers insure with a lottery to become self-employed (informal) or unemployed ▸ Non-Formal
- We calibrate the model to Colombian and Peruvian economies
- Then we simulate economic and epidem. effect of ▸ Government
  - Targeted and non-targeted transfers
  - General and selective lockdowns
  - Lower payroll taxes

Calibration

Table: Calibration

Parameter	Colombia	Peru	Description	Source
β	$0.96^{\frac{1}{52}}$	$0.96^{\frac{1}{52}}$	Discount factor	Eichenbaum et al. (2020)
η	10	10	Elasticity of substitution	Krueger et al. (2020)
γ_f	1.2	0.8	Formal good weighting in consumption aggregator	Match observed data
γ_I	0.8	1.2	Informal good weighting in consumption aggregator	Match observed data
θ	6.25×10^{-4}	6.25×10^{-4}	Labor supply parameter	Match 40 working hours
ψ	0.8	0.8	Productivity of infected people	Eichenbaum et al. (2020)
w	1.26	1.07	Hourly minimum wage relative to median hourly informal wage	GEIH, ENH
τ	0.3	0.175	Payroll taxes	OCDE
λ	2.36	1.54	Exponential distribution for productivity	Match formal employment
u	0.095	0.039	Unemployment rate	DANE, INEI
T	13.96	8.32	Weekly lump sum transfer relative to median hourly informal wage	DNP, MEF
π_0	0.3902	0.3902	Autonomous Infection Intensity	Eichenbaum et al. (2020)
ϕ_c^I	1.5682×10^{-7}	1.5682×10^{-7}	Infection risk from consuming - Informal sector	Match observed data
ϕ_c^f	7.8408×10^{-8}	7.8408×10^{-8}	Infection risk from consuming - Formal sector	Match observed data
ϕ_n^I	2.4884×10^{-4}	2.4884×10^{-4}	Infection risk from work - Informal sector	Match observed data
ϕ_n^f	8.2947×10^{-7}	8.2947×10^{-7}	Infection risk from work - Formal sector	Match observed data
ϕ_d	0.0029	0.0029	Death rate	Match observed data
ϕ_r	0.3869	0.3869	Recovery rate	Eichenbaum et al. (2020)

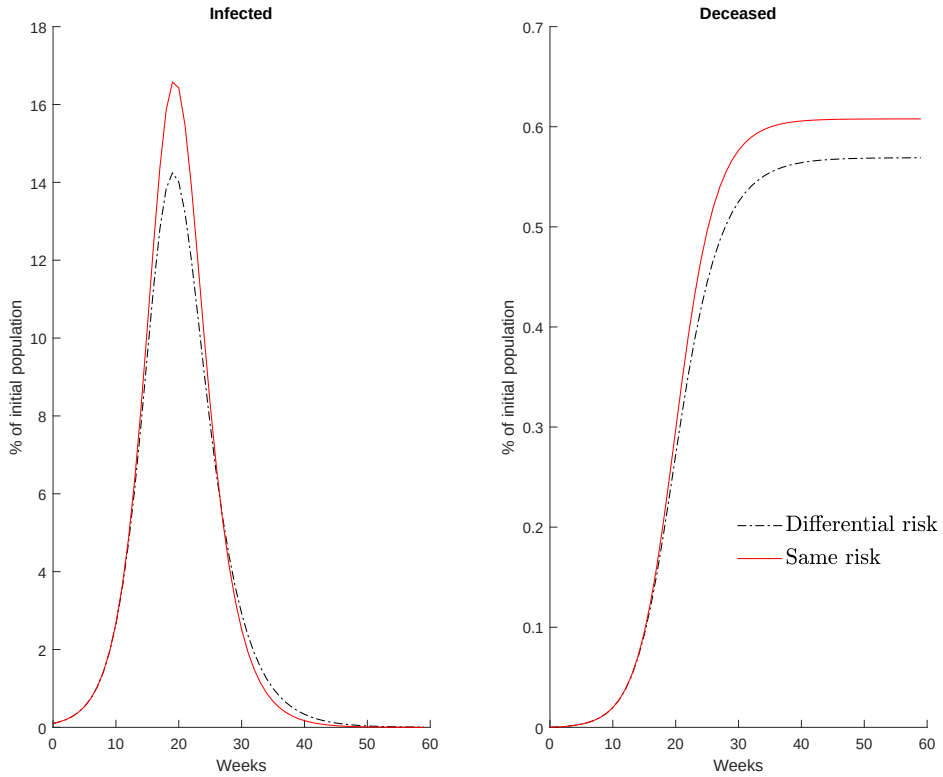
Discussion - Baseline Results Colombia

Table: Baseline results - Colombia

Model	Annual fall Agg. C.	Max. fall Agg. C.	Max. unemployment	Deceased
Baseline	-4.13%	-13.80%	0.25	0.56%
Without reduction in productivity of infected people	-4.04%	-13.51%	0.24	0.57%
Same probability of infection in both sectors	-2.12%	-7.32%	0.17	0.60%
Sticky prices	-4.46%	-14.98%	0.25	0.57%

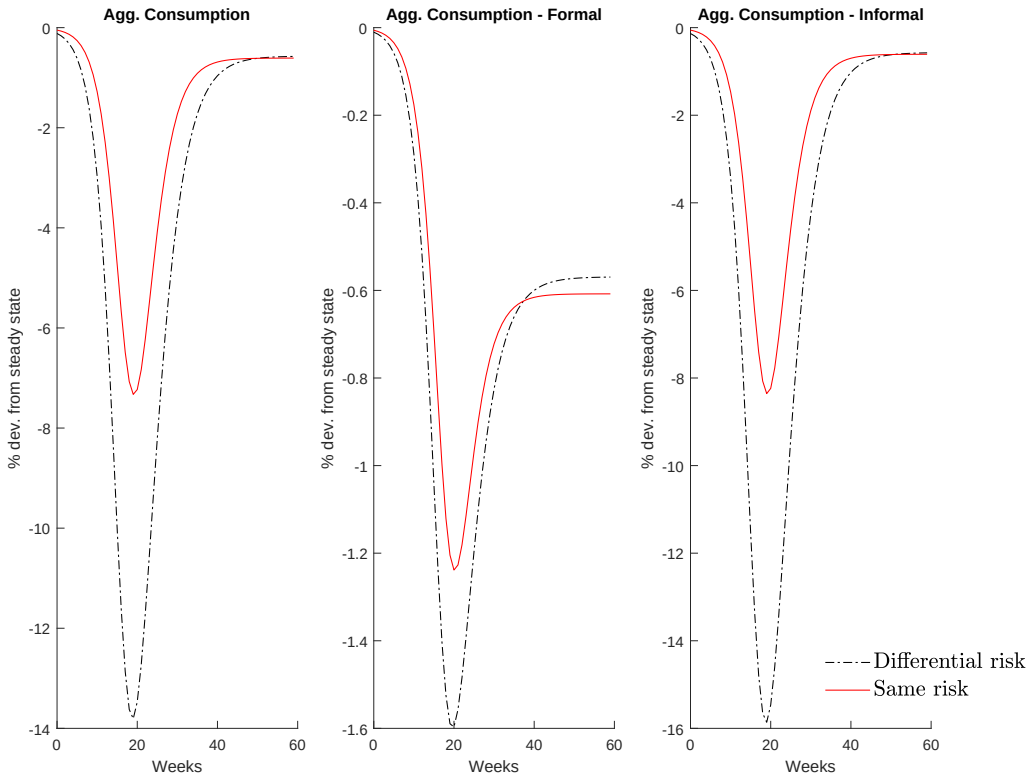
Epidemiological Results - Colombia

- HHs substitute informal for formal consumption to decrease risk of contagion



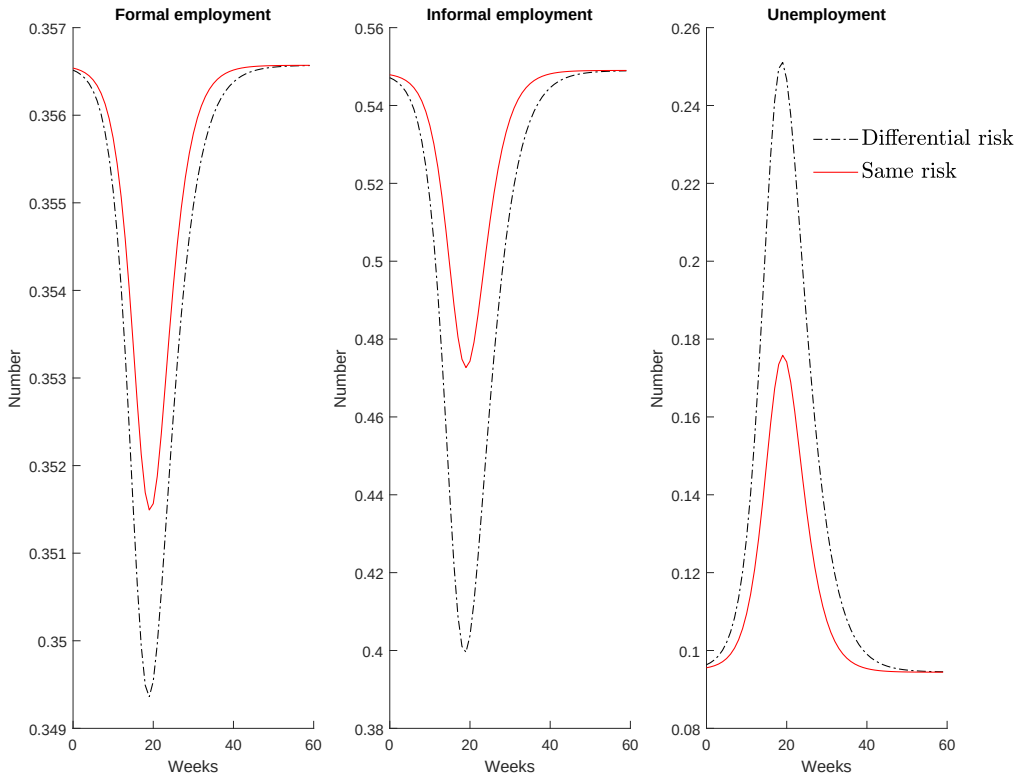
Consumption - Colombia

- The substitution generates a bigger dip in the informal sector that greatly affects total consumption



Employment - Colombia

- Informal employment decreases at a faster pace than formal employment, duplicating effect on unemployment



Lump sum transfers - Epidemiological effects in Colombia

- The greater they are, the smoother is the pandemic
- Same epidemiological effect of targeted and universal transfers

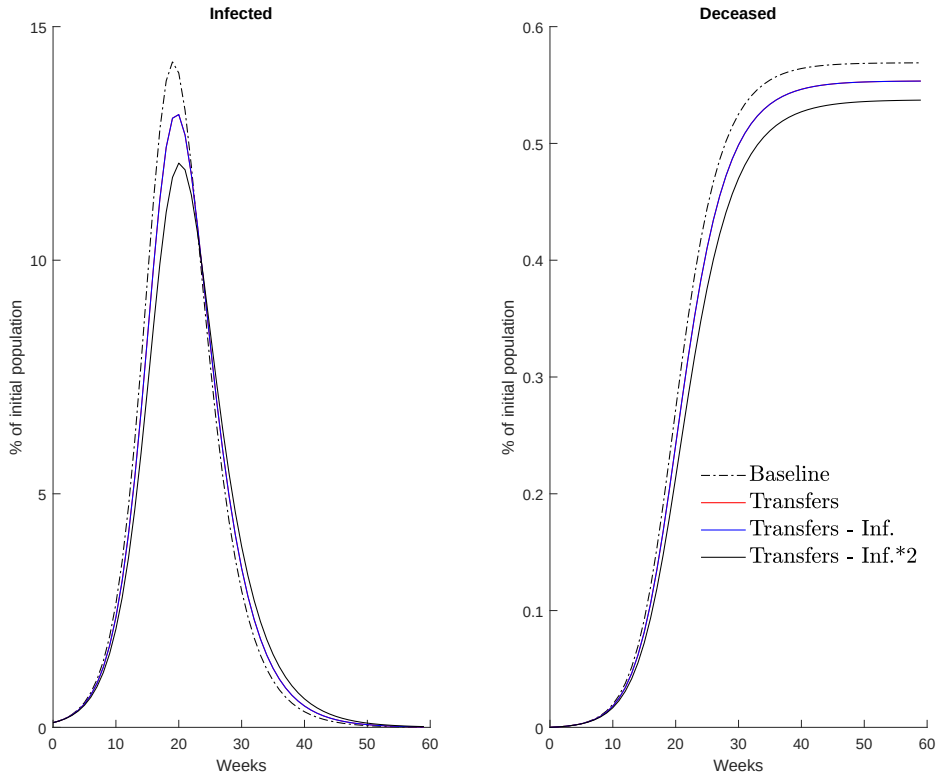
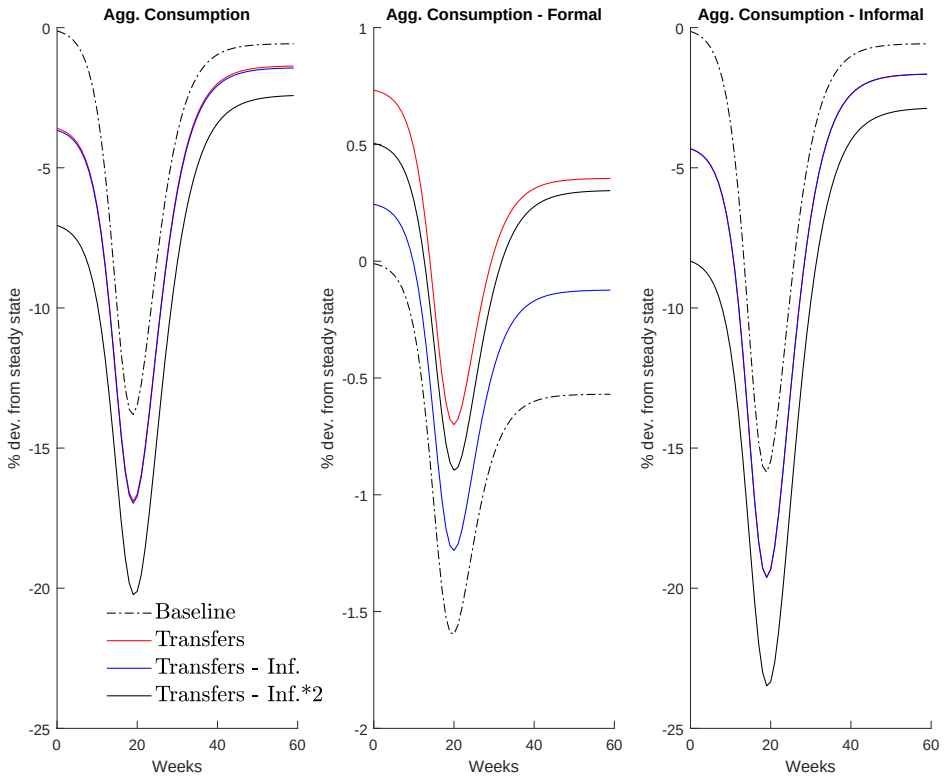


Figure: Epidemiological results of

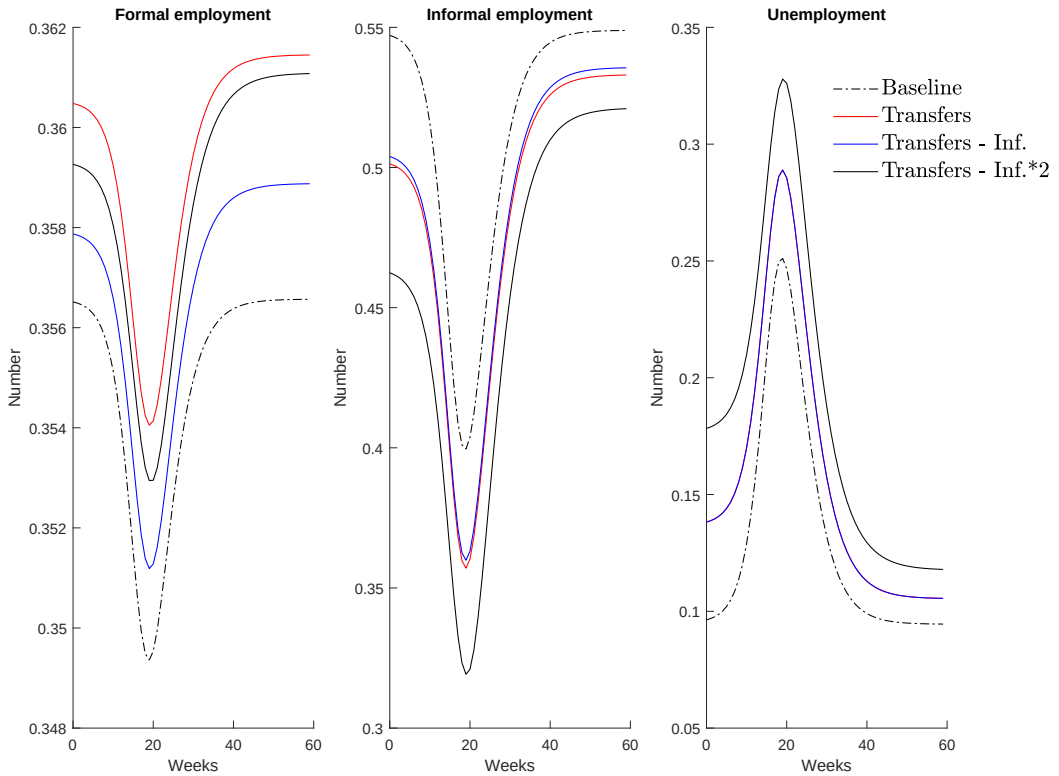
Lump sum transfers - Consumption in Colombia

- HHs use transfers to substitute informal consumption
- More formal consumption with universal transfers



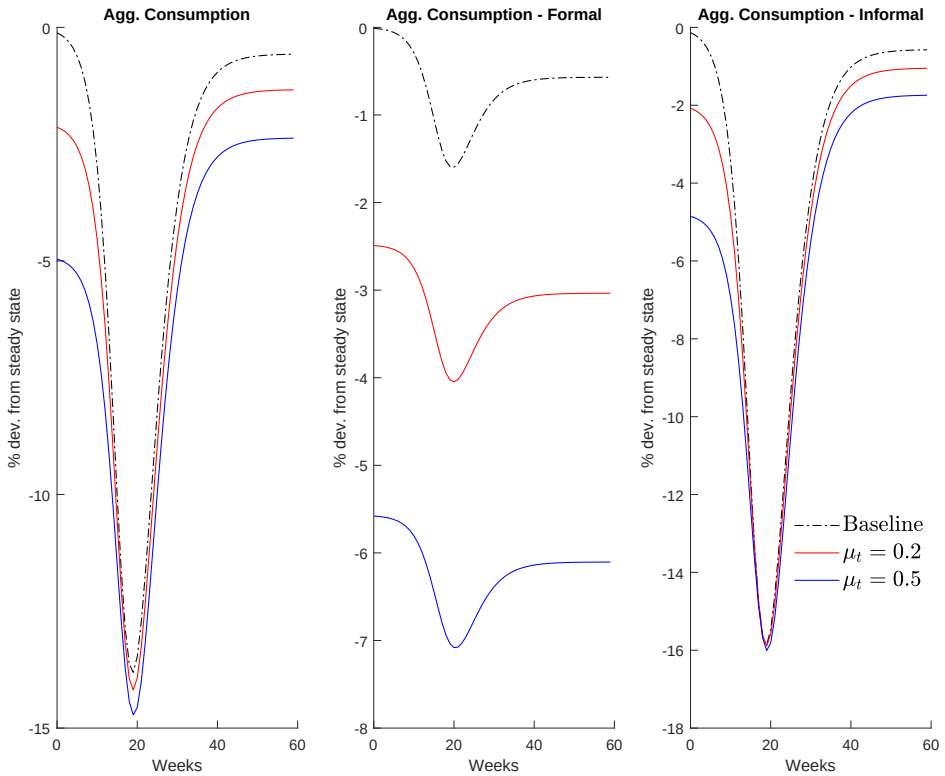
Lump sum transfers - Employment in Colombia

- Price of formal goods increases, encouraging formal employment
- But overall unemployment increases



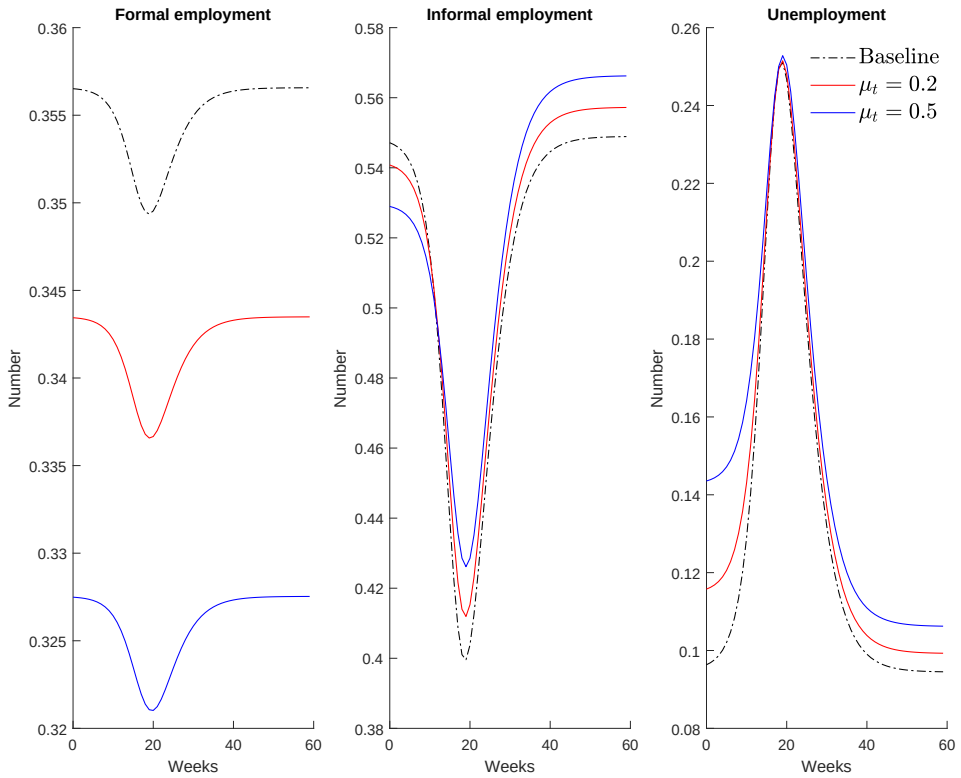
Lockdowns - Consumption in Colombia

- Mostly useful in the first weeks before the peak, reducing informal consumption
- But reductions in formal consumption are permanent



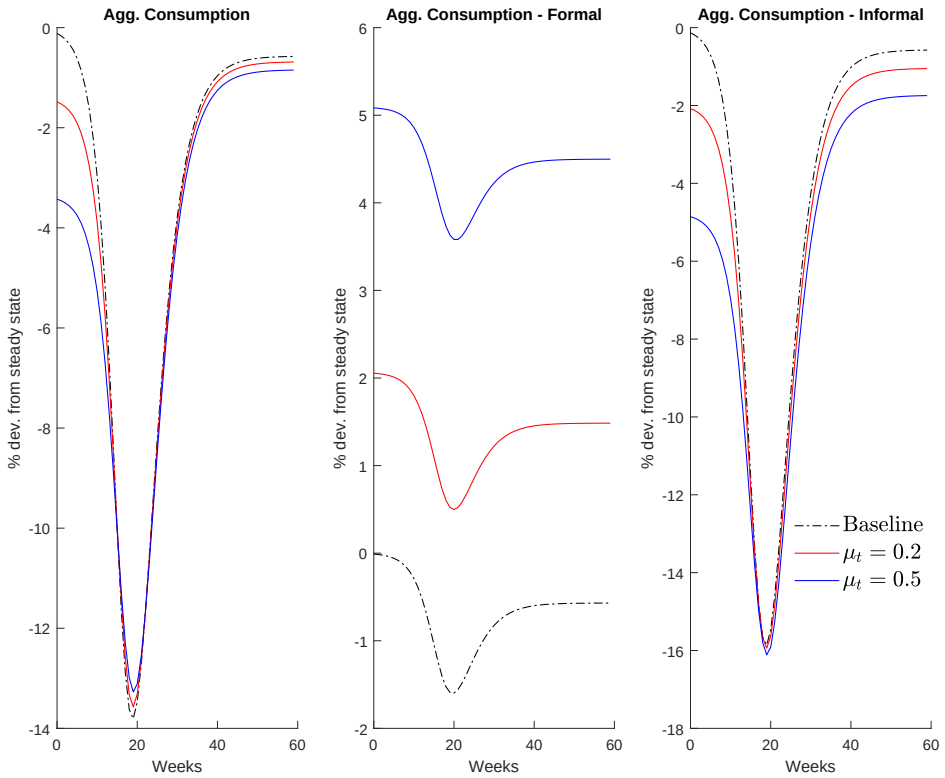
Lockdowns - Employment in Colombia

- By the end of the pandemic, informal employment absorbs lost formal jobs



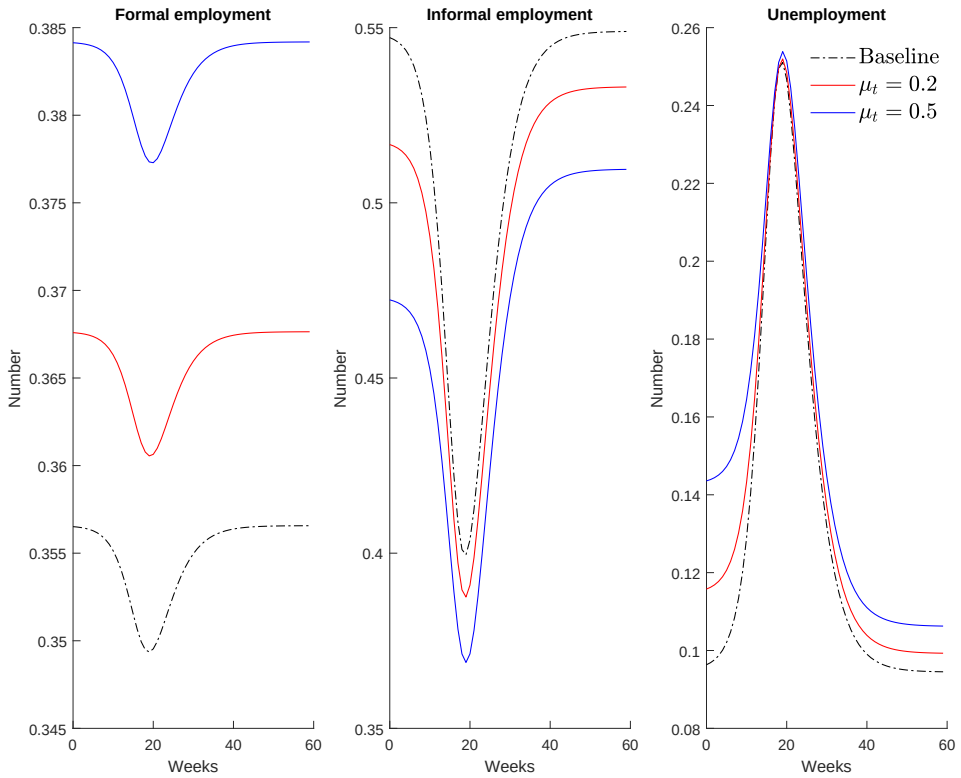
Selective lockdowns - Consumption in Colombia

- Useful to substitute for formal consumption
- Reduces output loss



Selective lockdowns - Employment in Colombia

- Price of formal goods relatively increases, encouraging formal employment



Calibrated lockdown to observed informality

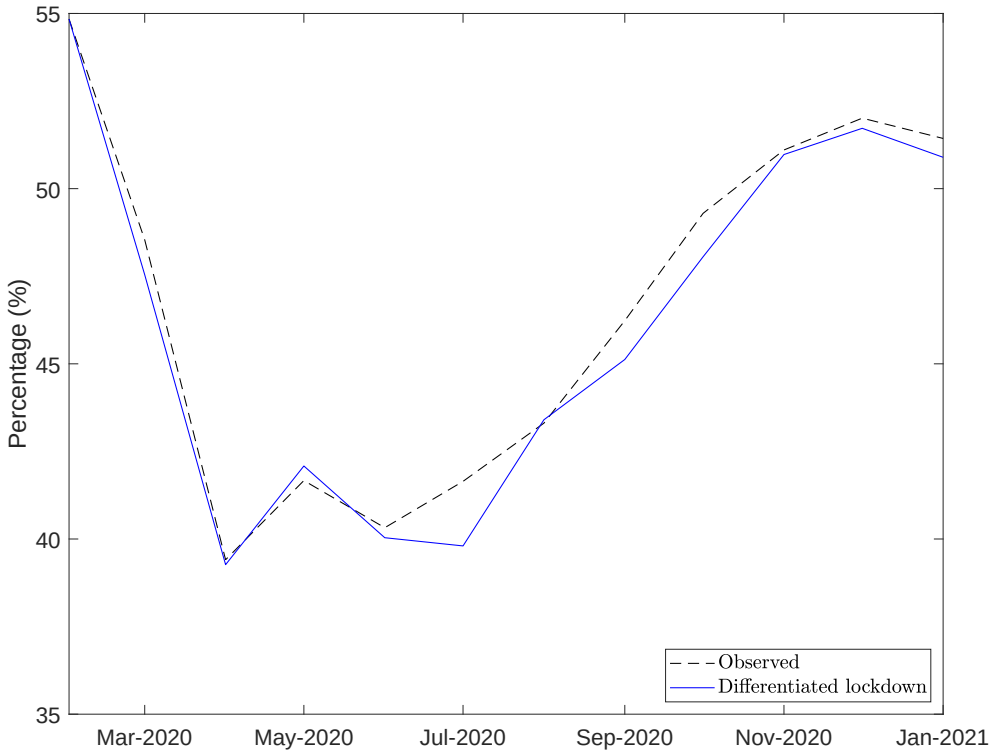


Figure: Comparison

Summary of Results - Colombia

Table: Policy Experiments - Colombia

Model	Annual fall Agg. C.	Max. fall Agg. C.	Max. unemployment	Deceased
Baseline	-4.13%	-13.80%	0.25	0.56%
Lump sum transfers	-6.57%	-17.00%	0.28	0.55%
Lump sum transfers - Informals	-6.57%	-17.02%	0.28	0.55%
Lump sum transfers - Informals x 2	-9.16%	-20.34%	0.32	0.53%
Lockdown, $\mu = 0.2$	-5.11%	-14.18%	0.25	0.56%
Lockdown, $\mu = 0.5$	-6.48%	-14.71%	0.25	0.56%
Targeted lump sum transfers and lockdown	-7.53%	-17.33%	0.28	0.55%
Selective lockdown, $\mu = 0.2$	-4.47%	-13.55%	0.25	0.56%
Selective lockdown, $\mu = 0.5$	-4.98%	-13.27%	0.25	0.56%

Comparison to Peruvian Economy

- Decreasing payroll taxes smooths recession

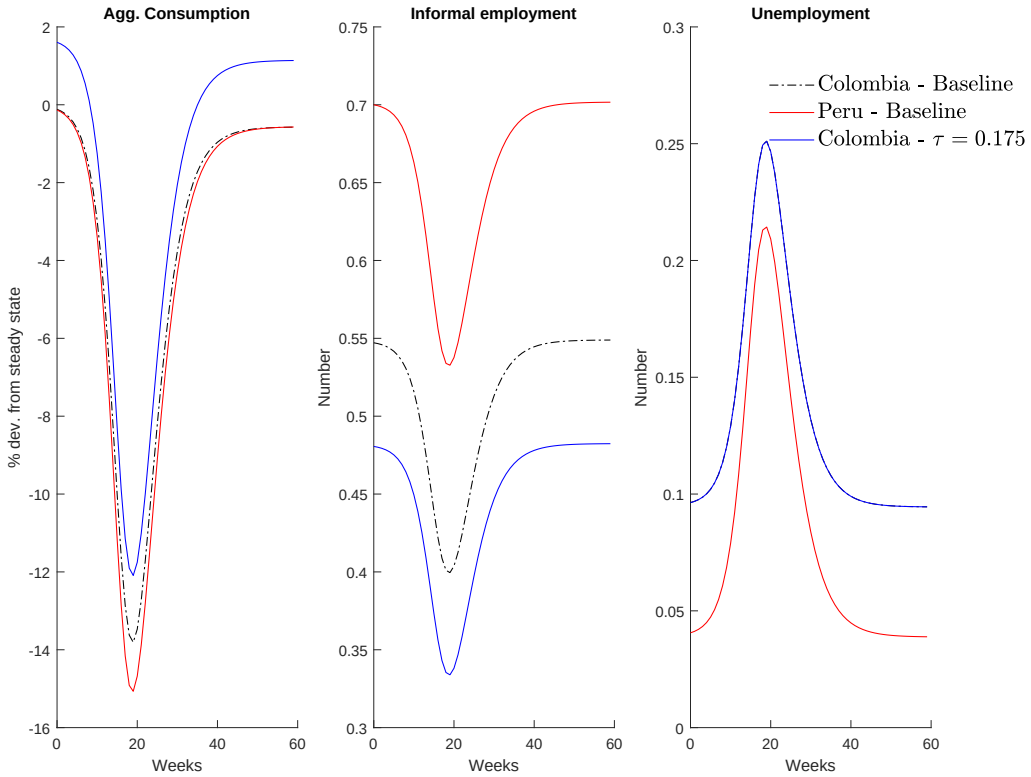


Figure: Consumption and employment.

Discussion

- A higher risk of contagion for the informal sector generates a deeper recession (2pp)
- Flexible formal prices and less distorted labor markets ease the recession (0.3pp)
- Lump sum transfers reduce labor supply
  - Smoothing the pandemic, but deepening recession by 2.4
  - Duplicating them reduces mortality, but duplicates recession
  - Targeting them lowers their cost
- Lockdowns are useful for first weeks
  - Targeting them to informal sector, reduces output loss

Related literature

- SIR models in macroeconomics: Eichenbaum et al (2020), Atkeson (2020), Alvarez et al. (2020)
- Optimal lockdown policies: Acemoglu et al. (2020), Glover et al. (2020), Assenza et al. (2020), Cakmakli et al. (2021)
- SIR models with informality: Hevia and Neumeyer (2020), Alon et al. (2020)
- Non-SIR models with informality: Leyva and Urrutia (2020b), Alfaro et al. (2020), Kandoussi and Langot (2020)

Model: Households

- Time is discrete and horizon is infinite
- There is a continuum $j \in [0,1]$ of individuals, endowed with productivity A^j drawn from cdf $G(A)$, maximizing:

$$U = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t [\log(c_t)^j - \theta n_t^j] \tag{1}$$

where c_t^j and n_t^j denotes consumption and indivisible labor

- Let c_t^{fj} be the consumption of formal goods and c_t^{lj} denotes the consumption of informal good, where

$$c_t^j = [\gamma_f (c_t^{fj})^{\frac{\eta-1}{\eta}} + \gamma_l (c_t^{lj})^{\frac{\eta-1}{\eta}}]^{\frac{\eta}{\eta-1}}$$

Back

Model: Formal Production

- There is a representative formal firm that hires formal labor at a minimum per hour wage w
- It transforms labor into a formal good with price P_f and obtains profits

$$P_f \int_{\hat{A}} A^j dG(A^j) - w(1+\tau) \int_{\hat{A}} dG(A^j) \tag{2}$$

where $\hat{A}$ is the productivity threshold to hire and τ are the payroll taxes

- Threshold is determined by a zero-profit condition

▸ Back

Model: Non-Formal Labor Market

- At the informal sector, all individuals appropriate their own production, assumed to satisfy $y^j_{tl} = n^j_{tl}$

- Non-formal HHs can insure with a lottery a la Hansen (1985):
  - With prob α works in the informal sector
  - With prob $1 - \alpha$ becomes unemployed

▸ Back

Model: Government

- Lump sum transfers T that could be targeted to informals and unemployed
- Confinements modelled as consumption taxes μ
- Budget constraint of HH j becomes

$$(1+\mu)\left(P_f c_f^j + c_l^j\right) \leq I_{A^j \geq \hat{A}} w n_f^j + \alpha + T \tag{3}$$

where $\alpha \cdot n_f^j = 0$

▸ Back

Model: Epidemiology

- Population is divided in four groups:
  - Susceptibles, S_t, who become infected with prob. π
  - Infected, I_t, whose productivity decrease to $\psi < 1$, can die with prob. π_d or recover with prob π_r
  - Recovered who become immune to the disease, R_t
  - Dead, D_t.

- Probability of infection is:
  - Higher the more she consumes and work
  - Higher when consuming and working in the informal sector: $\pi_{x_l} \geq \pi_{x_f}$ for $x \in \{c, n\}$
  - Higher the greater the number of infected people

$$\pi_t = I_t \left(\pi_{c_l} c^s_{tl} c^i_{tl} + \pi_{c_f} c^s_{tf} c^i_{tf} + \pi_{n_l} n^s_{tl} n^i_{tl} + \pi_{n_f} n^s_{tf} n^i_{tf} + \pi_0 \right)$$

Back

Model: Recursive Formulation

- Value funcion v^k for $k = S, I, R$

$$v^{sj} = \max_{c_f^s, c_l^s, n_f^s, \alpha^s} \log c^s - \theta n_f^s - \theta \alpha^s + \beta \left[(1-\pi) v^s + \pi v^i \right]$$

$$v^{ij} = \max_{c_f^i, c_l^i, n_f^i, \alpha^i} \log c^i - \theta n_f^i - \theta \alpha^i + \beta \left[(1-\pi_d - \pi_r) v^i + \pi_r v^r \right]$$

$$v^{rj} = \max_{c_f^r, c_l^r, n_f^r, \alpha^r} \log c^r - \theta n_f^r - \theta \alpha^r + \beta \left[v^r \right]$$

subject to (3)

Solution

- For susceptible F.O.C. with respect consumption of sector $k = f, l$ are:

$$\gamma_k \left(\frac{1}{c^s}\right)\left(\frac{c^s}{c^s_k}\right)^{\frac{1}{\eta}} = \lambda^s_b P_k + \beta\left(v^s - v^i\right) I \pi_{c_k} c^i_k$$

$$\lambda^s_b = \theta + \beta\left(v^s - v^i\right) I \pi_{n_l} \alpha^i G \left(\hat{A}\right)^2$$

- The distortion of last term is not observed in I and R

Discussion - Baseline Results Peru

- A higher share of informal goods in typical bundle increased contagion
- Added to a greater size of the informal sector, led to a greater recession

Table: Baseline results - Peru

Model	Annual fall Agg. C.	Max. fall Agg. C.	Max. unemployment	Deceased
Without reduction in productivity of infected people	-4.49%	-14.77%	0.21	0.56%
Same probability of infection in both sectors	-2.32%	-8.08%	0.13	0.60%
Sticky prices	-5.04%	-16.65%	0.21	0.56%
Baseline	-4.59%	-15.06%	0.21	0.56%

Results - Peru

- Smaller transfers and more flexible markets will allow for a faster recovery

Table: Policy Experiments - Peru

Model	Annual fall Agg. C.	Max. fall Agg. C.	Max. unemployment	Deceased
Baseline	-4.59%	-15.06%	0.21	0.56%
Lump sum transfers	-5.96%	-16.87%	0.23	0.55%
Lump sum transfers - Informals	-5.97%	-16.88%	0.23	0.55%
Lump sum transfers - Informals x 2	-7.39%	-18.74%	0.25	0.54%
Lockdown, $\mu = 0.2$	-5.67%	-15.57%	0.21	0.56%
Lockdown, $\mu = 0.5$	-7.15%	-16.25%	0.21	0.55%
Targeted lump sum transfers and lockdown	-7.04%	-17.35%	0.23	0.55%
Selective lockdown, $\mu = 0.2$	-4.79%	-14.72%	0.21	0.56%
Selective lockdown, $\mu = 0.5$	-5.09%	-14.24%	0.21	0.55%