Optimal Taxation in a Monetary Search Model with Informal Markets

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Motivation and Objectives

- By its nature, transactions in informal markets are made in cash as to leave no traces for the taxing authorities.

- However, not all cash transactions belong to informal activities.

- Agents that engage in informal market activities are evading taxes.

- These agents do not reveal their sources of income, preventing them from formal services like financial ones.

Our objectives:

1. Isolate the demand for currency stemming from the informal sector.

2. Capture how different tax policies affect the composition of formal versus informal activity and its impact to the financial system.
Economic Model

Following RW (2005) there is a DM with a measure of $B$ and $S$

DM Sellers produce a good that they do not consume, they are distinguished by their productivity $\gamma_j$ and they decide whether to produce formally or informally.

DM Buyers cannot produce goods but can use their cash balances to buy and consume.

DM good’s trades are anonymous.

During CM, all agents have the same productivity and trade a general good that everyone can produce and wants to consume.

All markets are competitive and the only asset in both subperiods is divisible fiat money.
Formal vs Informal Trading

1. Goods traded in formal markets are subject to a sales tax

2. Goods traded in informal markets are not taxed

3. The disutility cost of producing in the informal sector increases at a faster rate than in the formal market as production increases

4. Only formal producers can deposit the proceeds of their sales to the bank, obtaining interest income

5. All buyers can borrow from the bank
The CM value function of a **formal** seller is given by:

\[ W^F_S (m_j, D_j) = \max_{X, H, m'_j} \{ U(X) - H + \beta V^F_S (m'_j) \} \]

\[ s.t. \quad X = (1 - \tau_N) H + \phi [(1 + r_d) D_j + m_j - m'_j] \]

Similarly for **informal** sellers
If the net present value of utility flows of a seller of type $\gamma^j$ is larger in the formal market than in the informal one, $V^F_S(m_j) > V^I_S(m_j)$, she will produce formally. Otherwise she produces informally.

This can be summarized as follows:

\[
-a \left[ \frac{\phi P^F_j \alpha \gamma_j}{2a(1 - \tau_N)} \right]^{\frac{2-\alpha}{\alpha}} + \frac{1 + r_d}{1 - \tau_N} \left[ \frac{\phi P^F_j \alpha \gamma_j}{1 - \tau_N} \right]^{\frac{1-\alpha}{\alpha}} > 0
\]

\[
-a \left[ \frac{\phi P^I_j \alpha \gamma_j}{2a(1 - \tau_N)} \right]^{\frac{2-\alpha}{\alpha}} + \frac{\phi P^I_j \alpha \gamma_j}{1 - \tau_N} \gamma_j \left[ \frac{\phi P^I_j \alpha \gamma_j}{2a(1 - \tau_N)} \right]^{\frac{2-\alpha}{\alpha}}
\]
Buyer’s Problem

The DM value function of buyer is given by:

\[ V_B(m_B) = \mu^F \max_{q_B^F, l_j^F} \left[ u(q_B^F, j) + W_B \left( m_B + l_j^F - (1 + \tau_b) P_j^F q_{B,j}^F, l_j^F \right) \right] + \]
\[ + \mu^l \max_{q_{B,j}^l, l_j^l} \left[ u(q_{B,j}^l) + W_B \left( m_B + l_j^l - P_j^l q_{B,j}^l, l_j^l \right) \right] \]
\[ \text{s.t. } (1 + \tau_b) P_j^F q_{B,j}^F \leq m_B + l_j^F \]
\[ P_j^l q_{B,j}^l \leq m_B + l_j^l \]
\[ l_j^F, l_j^l \leq \bar{L} \]

The CM value function of buyer is given by:

\[ W_B \left( m_B; l_j^F, l_j^l \right) = \max_{X, H, m_B^l, j} \{ U(X) - H + \beta V_B(m_B^l) \} \]
\[ \text{s.t. } X = (1 - \tau_N) H + \phi \left[ m_B - \epsilon^F (1 + r_j) l_j^F - \epsilon^l (1 + r_j) l_j^l - m_B^l \right] \]
Government

A benevolent government must fund a positive stream of expenditures. Namely,

$$\tau_N H_t + (M_t - M_{t-1}) \phi_t + \tau_b \phi_t P_j^F q_{B,j}^F \geq G;$$

Fiscal and monetary policies are chosen as to maximize social welfare which is given by:

$$\mathcal{W} = B \int_{\gamma}^{\gamma^*} u(\gamma^j h^\alpha_j) dF(\gamma^j) + B \int_{\gamma^*}^{\gamma} u(\gamma^j h^\alpha_j) dF(\gamma^j) -$$

$$S \int_{\gamma}^{\gamma^*} ah_j^2 dF(\gamma^j) + S \int_{\gamma^*}^{\gamma} h_j dF(\gamma^j) + (B + S)(U(X) - X),$$

subject to a balanced budget constraint and consistent with equilibrium behaviors of buyers and sellers.
Some Properties of Equilibrium

1. A compact support for the distribution of productivities $[\underline{\gamma}, \overline{\gamma}]$ can be chosen so that there exists $\gamma^*$, with $\underline{\gamma} < \gamma^* < \overline{\gamma}$, so that all sellers with $\gamma_j \geq \gamma^*$ choose to produce in the formal sector, similarly, for all $\gamma_j < \gamma^*$ sellers produce in the informal sector.

2. Sellers of every type choose to carry zero real balances to the decentralized market.

3. Buyers choose to carry the same positive amount of money to the decentralized market.

4. As sales tax rates increase the demand for formal goods decreases. This in turn provides more incentives for sellers to produce informally.

5. The size of the informal sector increases with inflation.
Quantitative Experiments

Preferences are given by \( u(q) = \frac{(q+b)^{1-\eta} - b^{1-\eta}}{1-\eta} \) with \( b \to 0 \) and \( U(X) = Z \log(X) \)

We set \( \eta = 0.4 \), \( \beta = 0.96 \) and \( Z = 1.3 \). Moreover, we assume a uniform distribution of abilities with support on the interval \([\underline{\gamma}, \overline{\gamma}]\) and set \( \underline{\gamma} = 0.1 \)

The rest of parameters (\( a, \overline{\gamma} \) and \( \alpha \)) are chosen to match U.S. observables. This strategy yields the following parameters values: \( a = 19.47 \), \( \overline{\gamma} = 2.36 \) and \( \alpha = 0.42 \)

When \( G > 0 \) we follow Aruoba and Chugh (2006) and set \( G = 0.4 \)
Quantitative Results

Table: Increase of 1% from Welfare Maximizing Policies when $G=0.4$

<table>
<thead>
<tr>
<th>$\pi$</th>
<th>$\tau_b$</th>
<th>$\tau_N$</th>
<th>$\frac{P^I q^I}{GDP}$</th>
<th>$\frac{P^F q^F}{GDP}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.7%</td>
<td>16.16%</td>
<td>13.04%</td>
<td>0.07</td>
<td>0.075</td>
</tr>
<tr>
<td>4.7%</td>
<td>16.16%</td>
<td>13.04%</td>
<td>0.059</td>
<td>0.087</td>
</tr>
<tr>
<td>4.7%</td>
<td>17.16%</td>
<td>13.04%</td>
<td>0.07</td>
<td>0.073</td>
</tr>
<tr>
<td>4.7%</td>
<td>17.16%</td>
<td>14.04%</td>
<td>0.07</td>
<td>0.072</td>
</tr>
</tbody>
</table>

A single policy instrument, $\pi$, cannot reduce all frictions of the model. Inflation can not restore all margins.

Size of the informal sector grows as the different fiscal instruments increase, and declines with increases in inflation.

Total amount of available loans in the economy, the sales proceeds of the formal decentralized market, increases with inflation.
Conclusions

1. There are substantial benefits of having a large formal sector since it channels idle cash holding of formal sellers while increasing the amount of credit available to the economy.

2. The size of the informal sector grows as fiscal taxes increase, and declines with inflation and total amount of available loans in the economy increases with inflation.

3. When cash is used for transactions in the informal and formal economy, there is a trade-off between fiscal policies and the inflation tax.

4. Inflation has two effects: (i) distorts the rate of return on money, and (ii) redistributes resources from one type of agents to the other one.

5. Deviations from the Friedman rule are optimal.