



# Informality, financial development and macroeconomic volatility



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## HIGHLIGHTS

- Effect of financial development (FD) and informality on consumption volatility is studied.
- FD beyond a point increases relative consumption volatility.
- Working capital constraint important in above result.
- Informality helps reduce volatility by weakening the effect of FD.

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## ABSTRACT

In a dynamic stochastic general equilibrium model with heterogeneous agents, this note shows that beyond a certain low level, financial development is associated with higher relative consumption–income volatility in the presence of a working capital constraint. Informality on the other hand lowers relative consumption volatility by weakening the working capital requirement channel of financial development.

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## 1. Introduction

Many countries especially developing ones have large informal sectors. Recent estimates by [Schneider et al. \(2010\)](#) show that the size of the informal economy in 2007 equals an average of 16.6% in rich OECD countries, and about 35.1% on average in developing countries. Informality is defined as “unreported income from the production of legal goods and services, either from monetary or barter transactions, hence all economic activities that would generally be taxable were they reported to the tax authorities” ([Schneider and Enste, 2000](#)).

Two other well documented features of developing countries are high consumption to income volatility (usually  $> 1$ ) and under

developed credit markets. In this paper I study the effect of informality on relative consumption to income volatility for different levels of credit market development. The idea is that informal sectors usually find it difficult to borrow in formal credit markets owing to the fact that they hide all or part of their income in order to evade taxes and other forms of regulatory burden. This then limits their capacity to pledge assets or income to be used as collateral against borrowing. Highly developed credit markets and better debt enforcement mechanisms imply that all sectors in the economy have greater access to credit. What does this mean for the relationship between informality and aggregate consumption to income volatility?

## 2. The model

The economy is populated by two types of agents, entrepreneurs and households. Entrepreneurs are of two types: formal and informal. Both produce a homogeneous good using labor

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and technology but the informal sector hides part of their output in order to avoid paying taxes and they operate with an inferior technology and higher labor share in keeping with the literature.

$$\text{Max } E_t \sum_t \gamma^t \ln c_{i,t}, \quad (1)$$

where  $i = 1, 2$  stands for formal and informal entrepreneurs respectively.

The entrepreneurs produce according to the following production technology,

$$y_{i,t+1} = A_{i,t} (l_{i,t})^{\nu_i}, \quad (2)$$

where  $y_{i,t+1}$  is output at date  $t + 1$ ,  $l_{i,t}$  is labor input at date  $t$  and  $A_{i,t}$  is a productivity shock that is known at date  $t$  and follows an AR1 process. The fact that production occurs with a lag gives rise to a working capital requirement whereby entrepreneurs have to hire labor in advance.

The informal entrepreneurs, who engage in tax evasion, operate on a lower scale for fear of getting caught. This does not afford them the full economies of scale that they could have otherwise realized. As a result they are on average less productive than the formal sector. The formal sector's productivity is given by  $A_{1,t} = A_t$ . The informal productivity can then be characterized by  $\phi = A_{2,t}/A_{1,t}$  such that  $\phi \leq 1$ .

Entrepreneurs face the following borrowing constraint,

$$R_t b_{i,t} \leq (1 - \alpha)\theta y_{i,t}, \quad (3)$$

where  $R_t$  is the gross interest rate,  $b_{i,t}$  is the amount of borrowing by the entrepreneurs,  $\alpha$  is the fraction of output hidden from the authorities where  $\alpha = 0$  for the formal entrepreneurs and varies from 0 to 1 for the informal sector.  $\theta$  is the fraction of output the households can recover if the borrower defaults and can be taken to represent the level of development of the formal credit markets in the economy.  $\theta = 0$  corresponds to an economy with no credit markets at all while  $\theta = 1$  represents complete debt enforcement and hence most developed financial markets.

The two entrepreneurs differ in the flow-of-funds constraints they face since one of them hides part of their income. Specifically, the informal sector's budget constraint is given by,

$$c_{2,t} + R_t b_{2,t-1} + w_t l_{2,t} = (1 - \tau)(1 - \alpha)y_{2,t} + (1 - p)\alpha y_{2,t} + p(1 - \tau)\alpha y_{2,t} + b_{2,t} + \frac{t}{2},$$

where  $(1 - \alpha)y_{2,t}$  is the portion of the income on which tax is paid. With a probability  $(1 - p)$  they retain their hidden income  $\alpha y_{2,t}$ , however, with probability  $p$  they are caught evading taxes on the other part and are made to pay the same leaving them with,  $(1 - \tau)\alpha y_{2,t}$ . So consumption and wage bill in the left is financed by expected income, transfers and net borrowing in the right.  $w_t$  is the real wage rate and I assume perfect labor mobility for simplicity such that wages are equalized across sectors. Along those lines it is important to note here that I do not distinguish between formal and informal labor. Households supply labor to the entrepreneurs and are paid the market wage rate,  $w_t$ .  $t/2$  is the share of government transfers received by this sector since they do pay part of their taxes and are therefore not completely invisible.

The budget constraint of the formal entrepreneurs is given by,

$$c_{1,t} + R_t b_{1,t-1} + w_t l_{1,t} = (1 - \tau)y_{1,t} + b_{1,t} + \frac{t}{2}.$$

They do not evade taxes and their consumption and investment on wage bill in the left hand side is financed by their after tax income and transfers  $(1 - \tau)y_{2,t} + t/2$  and net borrowing  $(b_{2,t+1} - R_t b_{2,t-1})$  in the right hand side.

Entrepreneurs choose consumption, labor input, output and borrowing  $(c_{i,t}, l_{i,t}, y_{i,t+1}, b_{i,t})$  to maximize utility subject to

the production technology, the flow-of-funds and borrowing constraints.

**Households**

Households do not own any production technology but they supply labor and lend to the entrepreneurs. The household's problem is given by,

$$\text{Max } E_t \sum_t \beta^t \left( c_{3,t} - \frac{l_{s,t}^{1+\frac{1}{\eta}}}{(1+\frac{1}{\eta})} \right) \quad (4)$$

where  $c_3$  is household consumption and  $\beta$  is the household discount factor and  $\beta > \gamma$  such that entrepreneurs are more impatient than households.

Households are subject to the flow-of-funds constraint

$$c_{3,t} + R b_{3,t-1} = w_t l_{s,t} + b_{3,t}.$$

Households choose consumption, labor input and lending  $(c_{3,t}, l_{s,t}, b_{3,t})$  to maximize utility subject to their flow-of-funds constraint above.

**Government**

There is a government which taxes the entrepreneurs and uses part of the revenues to finance wasteful consumption while the remaining is transferred back to the entrepreneurs. Government consumes a fraction  $\psi$  of the total formal output of the economy,

$$g = \psi((1 - \alpha)y_1 + y_2).$$

Tax revenue generated from the two sectors is used to finance government consumption and transfer payments made to the entrepreneurs such that,

$$g + t = \tau(y_1 + (1 - \alpha)y_2) + p\tau\alpha y_2.$$

Market for labor clears when the total labor demanded by the formal and informal sectors is equal to the total labor supplied by the households such that,

$$l_{1,t} + l_{2,t} = l_s(w_t).$$

The bond market clears such that the total amount borrowed by the formal and informal entrepreneurs equals the total amount of lending by households.

$$b_{1,t} + b_{2,t} + b_{3,t} = 0.$$

The aggregate resource constraint is then given by,

$$c_{1,t} + c_{2,t} + c_{3,t} + g_t + t = y_{1,t} + y_{2,t}$$

where  $y_t = y_{1,t} + y_{2,t}$  is the true total output in the economy. I assume here that the informal sector is completely measured.

The necessary and sufficient conditions that characterize the solutions to the problem of the entrepreneurs and households are then given by the relevant flow-of-funds constraints, the technology and borrowing constraints and the first order conditions of the entrepreneurs and households.

### 3. Model solution

If  $l_i^{ss} = \frac{l_2}{l_1}$  be the share of informal over formal labor in the economy, then the first order conditions with respect to labor of the formal and the informal sector can be used to arrive at a steady state value for  $l_i^{ss}$  in terms of the parameters of the model.<sup>1</sup>

$$l_i^{ss} = \left( (1 - \alpha) + \frac{(1 - \tau p)\alpha}{\gamma(1 - \tau) + (\beta - \gamma)\theta} \right)^{\frac{1}{1-\nu_1}}. \quad (5)$$

Note that  $\delta l_i^{ss}/\delta p < 0$  and  $\delta l_i^{ss}/\delta \tau > 0$ . So the size of the informal sector depends negatively on enforcement and positively on tax rates. These relations are confirmed by the literature on

<sup>1</sup> The agents' optimization problem as well as derivation of  $l_i^{ss}$  is included in unpublished Appendix.

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