

5-10-2011

OPTIMAL INFLATIONARY AND RESERVE REQUIREMENT POLICIES: A STUDY OF AN ECONOMY WITH AN INFORMAL SECTOR

Hamid Ali

The American University in Cairo

Recommended Citation

Ali, Hamid (2011) "OPTIMAL INFLATIONARY AND RESERVE REQUIREMENT POLICIES: A STUDY OF AN ECONOMY WITH AN INFORMAL SECTOR," *International Journal of Banking and Finance*: Vol. 8: Iss. 1, Article 2.

Available at: <http://epublications.bond.edu.au/ijbf/vol8/iss1/2>

This Journal Article is brought to you by the Faculty of Business at ePublications@bond. It has been accepted for inclusion in International Journal of Banking and Finance by an authorized administrator of ePublications@bond. For more information, please contact [Bond University's Repository Coordinator](#).

The International Journal of Banking and Finance, Volume 8 (Number 1) 2011: pages ???

OPTIMAL INFLATIONARY AND RESERVE REQUIREMENT POLICIES: A STUDY OF AN ECONOMY WITH AN INFORMAL SECTOR

Hamid E. Ali
The American University in Cairo

Abstract

Governments in developing economies often resort to taxing bank money balances through imposition of high reserve requirements and also by relying on seigniorage to finance their deficits. In the context of those practices, this research reported in this paper attempts to answer the following questions: First, why do developing economies with an informal sector resort to inflationary measures to finance their activities? Second, how does a government induce an agent to choose the formal economy? It is demonstrated, for the first question, that in the trade-off between inflation and reserve requirements, the optimal policy is maximum inflation and minimum reserve requirements that will increase the steady-state utility of an optimizing agent. Regarding the second question, the agents prefer the informal economy if policy relies on a maximum reserve requirement.

Key Words: Informal market, Financial development, Financial repression, Seigniorage

JEL Classification: J33, J61, H2

1. Introduction¹

This paper addresses the unintended consequences on the informal and formal sectors of an economy from regulations on bank reserve and inflation financing observed in several

¹ I am greatly indebted to Professor Scott Freeman and Professor Bruce Smith for their academic tutelage and intellectual nourishment. I express my deepest gratitude for their many constructive comments and for fine-tuning my thoughts with involved and extensive discussions. My thanks also go to my colleague, Dilip K. Ghosh, to the editors of this journal and to the anonymous referees for their critical suggestions that have resulted in this revised version of the paper. This author is solely responsible for any errors that may remain.

developing countries. As a matter of public policy, the terms “informal sector” and “informal economy” are synonymous, and they refer to a marginally unregulated economy that sometimes not only subordinates itself to the formal economy, but also provides income and a safety net for the economic agent (ILO 2003; ILO 2005; Castells and Portes 1989). These informal economic arrangements are a rational response by micro-entrepreneurs to defeat over-regulation by government (de Soto 2000). Moreover, greater shares of national wealth in developing countries are uncounted; the average size of the informal sector in developing economies is 41 percent of gross national income (GNI) (Schneider 2002). Effectively, it can be noted that there is increasing interdependence between the formal and informal sector, because policy designed to target the formal sector has broader implications for the social welfare of economic agents in the informal sector.

Governments in developing economies with informal sectors often resort to taxing money balances through imposition of high reserve requirements on bank deposits; they also rely on seigniorage to finance their deficits.² So, to finance its expenditures, the government uses either bank reserves or seigniorage. A higher reserve requirement implies crowding-out of private capital while by using seigniorage the government creates money from thin air, which drives inflationary pressure. In such policy trade-offs, there is a continuous tension between the macroeconomic stability programs advised by the IMF and domestic needs of the developing economies to meet their social and economic obligations. Consequently, countries are trapped in cycles of severe reserve requirements and anti-inflationary measures that have unintended consequences for economic growth and development. Therefore, the conventional prescriptions derived from neo-liberal policies have failed to address the existence of the informal economy and the ways in which it complicates a government’s fiscal and monetary options and further represses the financial sector.

² Deficits are part of government expenditures, since the government will pay for debt services. Using the terms “deficits” or “expenditures” will not alter the underlying results. With that caveat or clarification, the term “deficits” instead of “expenditures” is used consistently throughout the paper. Also, for simplicity, we allow government to finance deficits through money creation, holding taxes constant.

The first attempt to address this financial repression was made by McKinnon and Shaw (1973), who defined financial repression as the set of regulatory restrictions that limited the capacity of the financial intermediaries to achieve their full potential. However, financial development is important in promoting economic growth (Stiglitz and Uy 1996; Levine 1997; Beck, Levine, and Loayza, 2000). For example, based on the findings from surveys of formal and informal financial institutions in Ghana, Malawi, Nigeria, and Tanzania, Nissanke and Aryeetey (2006) stated that the continuous poor performance of financial systems could be *partly* explained by the high degree of financial market fragmentation. On the basis of evidence in a recent study by Lu and Yao (2009), it has been argued that the rise of privileged and unprivileged sectors in the economy can be regarded as a consequence of financial repression. Any government action has implications for the welfare of the agent when the government finances its deficits through money creation and reserve requirements. Steel *et al.* (1997) have contended that informal financial institutions are an important vehicle for mobilizing household savings, and this study has recommended that informal finance be better integrated into financial development strategies.

Freeman (1987) and Freeman and Haslag (1993) have used an overlapping generation framework in a financially-repressed environment, which provides an important baseline for subsequent theoretical research on optimal reserve requirements. This paper extends Freeman's and Haslag's models into the financially repressive dual economy model to answer the following questions: First, why do developing economies with informal sectors resort to inflationary measures to finance their activities? Secondly, how does a government induce the agent to choose the formal economy? In our case, the model is applied to an environment in which homogenous agents hold different assets in two markets—formal and informal—allowing government to finance deficits through a reserve requirement and money creation or seigniorage.

Consistent with the findings of Freedman and Haslag, we demonstrate that for the first question, on the trade-off between inflation and reserve requirements, the optimal policy is maximum inflation and minimum reserve requirements that will increase the steady-state utility of an optimizing agent. Regarding the second question, the agents

prefer the informal economy if policy relies on a maximum reserve requirement. Therefore, the government is not only optimizing inflationary policy but also inducing the agent to favor the formal economy by minimizing the reserve requirement. The agent uses the storage technology in the informal sector because the optimizing agent predicts that the government is inclined to regulate and suppress financial intermediaries.

The best response of the agent in the informal sector is to hide some goods, because the agents do care about the weighted average rate of return on the assets. In a dual economy with formal and informal sectors with an expanding nominal stock of money, the reserve requirement not only serves as a tax on deposits, but also keeps the agent from using the most productive capital to match the return from the informal sector. The reserve requirements will not induce growth in the financial sector. Instead, it does the opposite and promotes the informal sector. The heavier the degree of financial regulation, the bigger the scope of the informal economy, and the less seigniorage the government can collect.

We use a relatively simple model expounded in Section 2 to arrive at the conclusions. Section 3 describes the maximization of welfare, and examines policy analysis. Section 4 discusses the steady states under different policy regimes, and Section 5 is the conclusion of this paper.

2. The Model

This model is an overlapping-generation model following Eastman *op cit*. We provide an appendix that includes further details on the model derivation. There are three types of assets: money, capital, and informal goods. Assets are held either because they are required (money balances) or because they have a high rate of return (capital). We describe the evolution of the economy from time $t = 1$ onward. The economy is populated by agents who each live for two periods. In each period $t \geq 1$, N_t two-period-living agents are born. We assume that $N_t = nN_{t-1}$ for each period t , where n is population growth with a positive constant and implying that total endowment of the economy grows at this rate. Agents maximize the twice-continuously differentiable additive utility

function $U(c_1) + V(c_2)$, where c_i denotes the agent's consumption in i period of life of the economy's sole consumption good. The function $U(c_1) + V(c_2)$, is strictly concave and strictly increasing in each argument. Let U' denote the derivative of $U(c_1) + V(c_2)$, with respect to c_i . The marginal rate of substitution $\frac{U'}{V'}$ approaches 0 as $\frac{c_1}{c_2}$ approaches infinity, and approaches infinity as $\frac{c_1}{c_2}$ approaches 0. An agent born in period $t \geq 1$ is endowed with y units of consumption goods when young, and with nothing when old.

Asset Allocation Decisions

There is storage technology in the informal sector. An agent stores h_{2t} of his savings in the informal sector at time t and returns $f(h_{2t})$ units of goods at $t+1$. The minimum requirement to invest in capital technology is $k > y$. This assumption forces the agent to use intermediation; if the rate of return on capital is x and by assumption ($x > n$), the return on capital is higher than the money rate of return. If the economy is growing, then money supply should grow and the rate of return of intermediated capital x should grow even faster as well (Champ and Freeman 1994).

We assume that the current old generation holds the fiat money, which is an intrinsically worthless piece of paper. The monetary authority can determine the growth of the money supply:

$$M_t = zM_{t-1}$$

z is the rate of growth of fiat money. The government uses seigniorage to finance its expenditures. The government requires that a fixed fraction γ of all deposits at financial intermediaries must be held as a reserve of fiat money. $(1-\gamma)$ is a fraction of agent's investment in the intermediated capital market with rate of return x .

Behavior of Young Agents

Taking the price level sequence $\{p_t\}$, as given, we define h_{1t}, h_{2t} as the value of agent (fiat money and intermediated capital) and stored goods in the informal sector respectively. Young agents at each date t choose h_{1t}, h_{2t} to maximize:

$$U(c_{1t}) + V(c_{2t})$$

subject to

$$c_{1t} + h_{1t} + h_{2t} \leq y \quad (1)$$

$$c_{2t} \leq \rho h_{1t} + f(h_{2t}) \quad (2)$$

The stock of fiat money available in this intermediated economy is

$$M = N_t \gamma h_{1t} p_t \quad (3)$$

where γh_{1t} is required reserve and $N_t \gamma h_{1t}$ is aggregate reserves. The price sequence evolves over time to keep up with inflation. Given that the intermediated stock of fiat money is nominal, it was multiplied by the price sequence to obtain the real value of money (Champ and Freeman 1994). M is the nominal stock of fiat money.

Competitive Equilibrium

The agent's problem can be transformed as follows: The young agent allocates his endowment, and diversifies the allocation of assets in formal and informal markets, because the agent cares about the weighted rate of returns. The entire endowment is allocated for current consumption when young, and saving when old, in the informal and formal market. Let h_{1t}, h_{2t} denote the total savings of a young agent at time t in the formal and informal sectors, so that the young agent chooses $h_{it}, E[0, y]$ to maximize:

$$U(y - h_{1t} - h_{2t}) + V(\rho h_{1t} + f(h_{2t})) \quad (4)$$

The first-order condition:

$$\max_{h_1, h_2} U(y - h_{1t} - h_{2t}) + V(\rho h_{1t} + f(h_{2t})) \quad (5)$$

$$\frac{U'(y - h_{1t} - h_{2t})}{V'(\rho h_{1t} + f(h_{2t}))} = \rho \quad (6)$$

$$\frac{U'(y - h_{1t} - h_{2t})}{V'(\rho h_{1t} + f(h_{2t}))} = f'(h_{2t}) \quad (7)$$

In the competitive equilibrium, the agent equalizes the marginal rate of substitution to the rate of return in both economies. Given $h_{1t}(\rho)$, any policy that lowers the rate of return has a negative implication for the welfare of the agent, which requires further characterization to the welfare property of our model.

d. Characterization of Stationary Equilibrium

The market-clearing condition is the real rate of return on fiat money using equation (3):

$$\frac{p_t}{p_{t+1}} = \left(\frac{m_t}{N_t h_{1t}} \right) \Big/ \left(\frac{m_{t+1}}{N_t h_{1t}} \right) = \frac{n}{z} \quad (8)$$

Under the assumption ($n < x$), if money is not dominated in the rate of return, then the agent has no reason to use the storage technology in the informal sector. Moreover, no agent or intermediaries will choose to hold any more fiat money than legally required. The rate of return on saving is the weighted average of the rates of return on money and capital in the formal economy:

$$\rho = \gamma \frac{n}{z} + (1 - \gamma)x \quad (9)$$

We can deduce from this equation the following rules:³

- i) Formal sector, if $z = 0 \rightarrow \rho = (1 - \gamma)x$
- ii) Informal sector, if $z = 0 \rightarrow \rho = f'(h_{2t})$

Results (i) and (ii) imply that if $z = 0 \rightarrow f'(h_{2t}) = (1 - \gamma)x$. This simply means that if $z = 0$, the rates of return in the formal and informal sectors are the same. If the fiat money is

not growing, then the government is running a balanced budget, and the agent is indifferent and will allocate its endowment to either markets. However, the government does create money as a device to alter the welfare and assets allocation between the formal and informal markets. Also from equations (6) and (7), we define the rate of return in the informal sector:

$$f'(h_{2t}) = \gamma \frac{n}{z} + (1 - \gamma)x \quad (10)$$

Finally, the government's budget constraints require that

$$g = \left(1 - \frac{1}{z}\right)M_{1t} \quad (11)$$

The deduction from the government budget constraint has greater public policy implications as the result of corner solutions.⁴ For equation (11), the deduction, if $z = 0 \rightarrow g = -\infty \rightarrow$ is unrealistic, so we make further assumptions to maximize the welfare of the future generation of the current young by setting $\frac{1}{z} = \phi$ to optimize in equation 12 as a counter-reaction of the agent to the government action. The government is always faced with trade-offs between inflation and reserve requirements, as a matter of public policy. Our response to our research question—which policy maximizes the welfare of the economic agent?—is that excessive inflationary policy is preferred to extreme reserve requirements. It is true that the extreme cases remain as extreme, and they rarely occur; the bottom line is that inflationary policy is the second-best public policy.

3. Maximizing the Welfare of the Future Generation

The future generation chooses $\frac{1}{z} = \phi, \gamma$ to maximize its welfare.

$$\max_{\gamma, \phi} U(y - h_1(\rho) - h_2(\rho)) + V(\rho h_1(\rho) + f(h_2(\rho))) + \lambda((1 - \phi)\gamma h_1(\rho) - g) \quad (12)$$

³ Thanks to the anonymous referee on this point.

⁴ Thanks to the anonymous referee for this suggestion.

$$\lambda = \frac{(x - n\phi)V'}{(1 - \phi)\left(h_1 - \gamma(x - n\phi)\frac{\partial h_1}{\partial \rho}\right)} > 0 \quad (13)$$

The economy on the right side of the Laffer curve, conducting monetary policy through reserve requirements to gain seigniorage, will lower the rate of return in money.

Given that the government finances its expenditures through money creation, equation (13) shows the steady-state utility of the agent under an inflationary policy regime. Since we define $\frac{1}{z} = \phi$, for simplicity, we need to define $\frac{\partial \rho}{\partial \phi}$ to determine the sign of equation (13). After canceling the terms out in further equations, we get equation (26):

$$\frac{\partial \rho}{\partial \phi} = (n\gamma) \quad (14)$$

$$\frac{\partial \ell}{\partial \phi} = n\gamma h_1 V' - \lambda \left(\gamma h_1 - (1 - \phi)\gamma^2 n \frac{\partial h_1}{\partial \rho} \right) \quad (15)$$

Using λ from equation (13) in equation (15), we obtain equation (16):

$$\frac{\partial \ell}{\partial \phi} = \frac{h_1^2 \gamma (n - x)}{(1 - \phi)\left(h_1 - (x - n\phi)\gamma \frac{\partial h_1}{\partial \rho}\right)} < 0 \quad (16)$$

For the government to finance its expenditures, the optimal repression is to set ϕ as low as possible, which is to say, zero, i.e., $\frac{1}{z} = \phi = 0$. Given that the level of current government expenditure is constant, the optimal policy is to set $z \rightarrow \infty$, which will relax the constraint on reserve requirements and create more opportunity for the agent to obtain the most productive capital in the formal sector. The optimal seigniorage should be obtained by the policy that minimizes the reserve requirement and maximizes inflation, which is consistent with the findings of Freeman and Haslag.

Policy to Induce Agents into the Formal Sector

The agent's criteria to choose either sector depend on the rate of return ρ and $f'(h_{2t})$, so if $\rho > f'(h_{2t})$, the agent will prefer the formal sector to the informal economy. If $\rho < f'(h_{2t})$, the agent will prefer the storage technology in the informal economy to saving in the formal economy. Conducting the policy experimentation as shown in Table 1, we consider the extreme case of conducting monetary policy and its implication for the rate of return in both sectors. Government monetary policy will change the composition of assets held by the agent in both markets through rate of return.

Using rate of return in the informal economy in equation (10) we obtain equation (17):

$$\frac{f'(h_{2t}) - x}{n\phi - x} = \gamma \tag{17}$$

Solving for government expenditure in terms ϕ, γ and setting either maximum reserves or minimum reserves, we obtain the comparative results in Table 1 below:

$$\phi = (1 - \frac{g}{h_1}) \tag{18}$$

Table 1: Comparative static under extreme policy regimes

	Rate of return in the formal sector	Rate of return in the informal sector
Policy of infinite inflation	$\rho = x - \frac{gx}{h_1}$	$f'(h_2) = x - \frac{gx}{h_1}$
Policy of maximum reserve requirement	$\rho = n - \frac{ng}{h_1}$	$f'(h_2) = n - \frac{ng}{h_1}$

4. The Steady State under Policy Regimes

From Table 1 we conclude that for government to induce agent to hold assets in the formal sector, the optimal policy is a combination of infinite inflation and minimum reserve requirement. However if the government conducts its policy towards maximum reserve requirement, such a policy promotes the informal sector, because agent will favor storing his/her goods rather than allocating one's portfolio in the formal economy with a lower rate of return.

Most governments of developing economies do not rely heavily on reserve requirements, in order to avoid further growth of the informal sector. Promoting the size of the informal economy is not in the interest of the government; this could be one of the reasons that developing economies use inflationary policy. We might say that the IMF prescription for holding maximum reserve requirements is not really helpful to the economies that rely on seigniorage as their main source of revenue. This could be one of the sources of the resistance and tension between the global institutional demand and what country-level policymakers need.

5. Conclusions

In economies with developed financial intermediation, where the size of the informal sector is small to be negligible, the agents prefer the informal economy if policy relies on a maximum reserve requirement. The government that minimizes the reserve requirements is not only optimizing inflationary policy but also inducing the agent to favor the formal economy. In searching for Pareto improvement, using open-market operations remains a reasonable mechanism designed to offset the transfers of wealth between generations when the government is paying a return on reserves. Open-market operations will reward deposit in the formal economy and mitigates the need to use the informal economy unless the rate of return is equalized between the two sectors. This issue is left for future research.

Author information: Hamid Ali is an assistant professor in the School of Global Affairs and Public Policy at the American University Cairo, Egypt. He may be contacted at: P.O. Box 74, New Cairo 11835, Egypt. E-mail: hali@aucegypt.edu.

Appendix

$$U(c_{1t}) + V(c_{2t})$$

subject to

$$c_{1t} + h_{1t} + h_{2t} \leq y \quad (1)$$

$$c_{2t} \leq \rho h_{1t} + f(h_{2t}) \quad (2)$$

The stock of fiat money available in this economy is

$$M = N_t \gamma h_{1t} P_t \quad (3)$$

2.b Competitive Equilibrium

The agent's problem can be transformed as follows. Let h_{1t}, h_{2t} denote the total savings of a young agent at time t in the formal and informal sectors, so that the young agent chooses $h_{1t}, E[0, y]$ to maximize:

$$U(y - h_{1t} - h_{2t}) + V(\rho h_{1t} + f(h_{2t})) \quad (4)$$

The first-order condition:

$$\max_{h_1, h_2} U(y - h_{1t} - h_{2t}) + V(\rho h_{1t} + f(h_{2t})) \quad (5)$$

$$\frac{U'(y - h_{1t} - h_{2t})}{V'(\rho h_{1t} + f(h_{2t}))} = \rho \quad (6)$$

$$\frac{U'(y - h_{1t} - h_{2t})}{V'(\rho h_{1t} + f(h_{2t}))} = f'(h_{2t}) \quad (7)$$

2.c Characterization of Stationary Equilibrium

The market clearing condition is the real rate of return on fiat money from (3):

$$\frac{p_t}{p_{t+1}} = \left(\frac{m_t}{N_t h_{1t}} \right) / \left(\frac{m_{t+1}}{N_t h_{1t}} \right) = \frac{n}{z} \quad (8)$$

$$\rho = \gamma \frac{n}{z} + (1 - \gamma)x \quad (9)$$

Also from equations (6) and (7) we define the rate of return in the informal sector:

$$f'(h_{2t}) = \gamma \frac{n}{z} + (1 - \gamma)x \quad (10)$$

Finally, the government's budget constraints require that

$$g = \left(1 - \frac{1}{z} \right) \gamma h_{1t} \quad (11)$$

3. Maximizing the Welfare of Future Generations

$$\max_{\gamma, \phi} U(y - h_1(\rho) - h_2(\rho)) + V(\rho h_1(\rho) + f(h_2(\rho))) + \lambda((1 - \phi)\gamma h_1(\rho) - g) \quad (12)$$

$$\begin{aligned} \frac{\partial \ell}{\partial \gamma} = & -U' \frac{\partial h_1}{\partial \rho} \cdot \frac{\partial \rho}{\partial \gamma} - U' \frac{\partial h_2}{\partial \rho} \cdot \frac{\partial \rho}{\partial \gamma} + \rho \frac{\partial h_1}{\partial \rho} \cdot \frac{\partial \rho}{\partial \gamma} V' + V' h_1 \frac{\partial \rho}{\partial \gamma} \\ & + f'(h_2) \frac{\partial h_2}{\partial \rho} \frac{\partial \rho}{\partial \gamma} V' + \lambda \left((1 - \phi)h_1 + (1 - \phi)\gamma \frac{\partial h_1}{\partial \rho} \frac{\partial \rho}{\partial \gamma} \right) \leq 0 \end{aligned} \quad (13)$$

Using envelope theorem we cancel out the following terms:

$$-U' \frac{\partial h_1}{\partial \rho} \cdot \frac{\partial \rho}{\partial \gamma} + \rho \frac{\partial h_1}{\partial \rho} \cdot \frac{\partial \rho}{\partial \gamma} V' = 0 \quad (14)$$

$$-U' \frac{\partial h_2}{\partial \rho} \cdot \frac{\partial \rho}{\partial \gamma} + f'(h_2) \frac{\partial h_2}{\partial \rho} \cdot \frac{\partial \rho}{\partial \gamma} V' = 0 \quad (15)$$

From equation (9) we get $\frac{\partial \rho}{\partial \gamma} < 0$

$$\frac{\partial \rho}{\partial \gamma} = \left(\frac{n}{z} - x \right) = (\phi n - x) < 0 \quad (16)$$

$$\frac{\partial L}{\partial \gamma} = -(x - n\phi)h_1V' + \lambda((1 - \phi)h_1 - (1 - \phi)\gamma (x - n\phi) \frac{\partial h_1}{\partial \rho}) \leq 0 \quad (17)$$

$$\lambda \frac{\partial L}{\partial \gamma} = 0 \quad \text{If } \lambda \geq 0$$

$$\lambda = \frac{(x - n\phi)V'}{(1 - \phi) \left(h_1 - \gamma (x - n\phi) \frac{\partial h_1}{\partial \rho} \right)} > 0 \quad (18)$$

Since the government finances its expenditures through money creation, equation (19) shows the steady-state utility of the agent under this policy regime.

$$\begin{aligned} \frac{\partial \ell}{\partial \phi} = & -U' \frac{\partial h_1}{\partial \rho} \cdot \frac{\partial \rho}{\partial \phi} - U' \frac{\partial h_2}{\partial \rho} \cdot \frac{\partial \rho}{\partial \phi} + \rho \frac{\partial h_1}{\partial \rho} \cdot \frac{\partial \rho}{\partial \phi} V' + V' h_1 \frac{\partial \rho}{\partial \phi} \\ & + f'(h_2) \frac{\partial h_2}{\partial \rho} \frac{\partial \rho}{\partial \phi} V' + \lambda \left(-\phi h_1 + (1 - \phi)\gamma \frac{\partial h_1}{\partial \rho} \frac{\partial \rho}{\partial \phi} \right) \end{aligned} \quad (19)$$

Using envelope theorem the following terms in (20) and (21) will cancel out.

$$-U' \frac{\partial h_1}{\partial \rho} \cdot \frac{\partial \rho}{\partial \phi} + \rho \frac{\partial h_1}{\partial \rho} \cdot \frac{\partial \rho}{\partial \phi} V' = 0 \quad (20)$$

$$-U' \frac{\partial h_2}{\partial \rho} \cdot \frac{\partial \rho}{\partial \phi} + f'(h_2) \frac{\partial h_2}{\partial \rho} \cdot \frac{\partial \rho}{\partial \phi} V' = 0 \quad (21)$$

Since we define $\frac{1}{z} = \phi$, for simplicity we need to define $\frac{\partial \rho}{\partial \phi}$ to determine the sign of equation (19). After canceling out the terms in equations (20) and (21) we get equation (26):

$$\frac{\partial \rho}{\partial \phi} = (n\gamma) \quad (22)$$

$$\frac{\partial \ell}{\partial \phi} = n\gamma h_1 V' - \lambda \left(\gamma h_1 - (1 - \phi) \gamma^2 n \frac{\partial h_1}{\partial \rho} \right) \quad (23)$$

Using λ from equation (21) in equation (26) we obtain equation (24):

$$\frac{\partial \ell}{\partial \phi} = \frac{h_1^2 \gamma (n - x)}{(1 - \phi) \left(h_1 - (x - n\phi) \gamma \frac{\partial h_1}{\partial \rho} \right)} < 0 \quad (24)$$

Using the rate of return in informal economy in equation (11) we obtain equation (25):

$$\frac{f'(h_{2t}) - x}{n\phi - x} = \gamma \quad (25)$$

References

- Auernheimer, L. (1974). The honest government's guide to the revenue from creation of money. *Journal of Political Economy* 82, 595-606.
- Beck, T., Levine, R., and Loayza, N. (2000). Finance and the source of growth. *Journal of Financial Economics* 58(1-2), 261-300.
- Castells, M. and Portes, A. (1989). *World Underneath: The Origins, Dynamics, and Effects of the Informal Economy*. Baltimore: Johns Hopkins University Press.
- Champ, B. and Freeman, S. (1994). *Modeling Monetary Economies*. New York: John Wiley & Sons.
- de Soto, H. (2000). *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*. London: Bantam.

- Freeman, S. (1987). Reserve requirement and optimal seigniorage. *Journal of Monetary Economics* 19, 307-314.
- Freeman, S. (1996). On the optimality of interest-bearing reserves in economies of overlapping generations. *Economic Theory* 7, 557-565.
- Freeman, S. and Haslag, J. (1993). On the optimality of interest-bearing reserves in economies of overlapping generations. Research Paper 9328, Federal Reserve Bank of Dallas.
- International Labor Office (ILO). 2005. Report to the Government on employment injury insurance in Cambodia: Legislation, financing and administration 91Sources
-, (2003). Conclusions on decent work and informal economy. Report of the Director General.
-, 2002. Decent work and the informal economy, Report VI, 6th item on the agenda, International Labor Conference (ILC), 90th Session, Geneva
- Levine, R. (1997). Financial development and economic growth: Views and agenda. *Journal of Economics Literature* 35(June), 688-726.
- Lu, Susan and Yao, Y. (2009). The effectiveness of law, financial development, and economic growth in an economy of financial repression. *World Development* 37(4), 763-777.
- McKinnon, Ronald I. (1973). *Money and Capital in Economic Development*. Washington, DC: Brookings Institution
- Nissanke and Aryeetey. (2006). Institutional analysis of financial market fragmentation in sub-Saharan Africa. WIDER Research Paper No. 2006/87. Helsinki: World Institute for Development Economics Research.
- Samuelson, Paul A. (1958). An exact consumption loan model with or without the social contrivance of money. *Journal of Political Economy* 66, 467-482.
- Schneider, F. (2002). Size and measurement of the informal economy in 110 countries around the World. Working paper. Rapid Response Unit, World Bank.
- Shaw, Edward (1973). *Financial Deepening in Economic Development*. New York: Oxford University Press.
- Stiglitz, J. and Uy, M. (1996). Financial market, public policy and the East Asian miracle. *The World Bank Research Observer* 11(2), 249-276.
- Steel, W., Aryeetey, E., Hetige, H. and Nissanke, M. (1997). Informal financial markets under liberalization in four African countries. *World Development* 25(5), 817-830.