Proceedings of the Harvard University Forum on Islamic Finance: Islamic Finance into the 21st Century
Cambridge, Massachusetts. Center for Middle Eastern Studies, Harvard University. 1999. pp.13-22

Monetary Policy and Economic Growth

An Islamic Perspective

Abdel-Hameed M. Bashir*

ABSTRACT

The role of monetary policy in determining long-run economic growth from an Islamic perspective is explored. The monetary authority regulates the financial sector to allocate resources and finances its budget through seigniorage and *zakat* revenue. It is shown that, in an environment in which financial institutions use capital-augmented technologies to transform resources into output and private agents maximize intertemporal utility over consumption and money balances, a rise in inflation hampers growth and reduces welfare, while financial innovation (or equivalently financial regulation) promotes growth and improves welfare. Therefore, the injunction against fixed interest payments induces the monetary authority in an Islamic economy to develop and innovate alternative financial instruments that do not have fixed nominal values and do not bear predetermined rates of interest.

I. INTRODUCTION

The Islamic injunction against fixed interest payments implies that most of the conventional monetary policy tools are not available to the monetary authority. Consequently, the framework under which macroeconomic policies can be formulated to create a stable economic environment is yet to be addressed.[i] Meanwhile, many important and tenacious questions remain unanswered. For example, how can the government commit to the optimal rate of inflation? What are the welfare costs of inflation? What are the welfare effects of financial innovation? In addition, what is the impact of fiscal and monetary policy on the rate of growth of the economy?

Since many of these questions are not answered, critics argue that the ban on fixed-return securities will force the government to resort to the inflation tax to finance its deficit. Such a policy is believed to exacerbate high inflation and permit large-scale financial repression. On the other hand, the proponents of the Islamic model argue that the ban on fixed return does not necessarily mean that the monetary authority in an Islamic economy is powerless. In a model exemplifying the principal characteristics of an Islamic financial system, Khan and Mirakhor (1987) concluded that there are no fundamental differences between the conventional and the Islamic economic system in the way monetary policy affects economic variables. The central bank would continue to control the supply of high-powered money and the reserve ratios on different types of liabilities and to exert substantial influence on the financial system. Meanwhile, the model did not address a number of issues. First, it did not examine how monetary policy stimulates economic growth. Second, it did not explain how the budget deficit is financed in the absence of fixed-return securities. Third, the model did not address the role of *zakat* in an Islamic economy.[ii]

The purpose of this paper is to examine the impact of monetary policy on long-run growth. The model differs from previous models in many ways. First, no previous study, to the author's knowledge, has investigated the relationship between money and growth in Islamic economics.[iii] Second, it addresses the issue of deficit financing in Islamic economics. Third, it analyzes the welfare effects of inflation and financial innovation. Section II contains a general equilibrium model of growth with *zakat* and profit sharing features. The monetary authority intervenes in the financial sector to allocate resources, while financial institutions use capital-augmenting technologies to transform these resources into output. Sections III and IV investigate the welfare effects of financial innovation and inflation respectively. The main result is that given the capital stock, financial innovation improves welfare, while inflation reduces both growth and welfare. Section V concludes the study.

---

* Bashir is Assistant Professor in the Department of Applied Economics at Grambling State University in Grambling, La.

© 2011 The President and Fellows of Harvard College. All rights reserved.
http://ifp.law.harvard.edu/login/contact

II. THE MODEL

We begin with an economy inhabited by infinitely lived, identical agents, financial institutions known as banks (firms) and the government (monetary authority). Agents, who are endowed with capital at the beginning of their lives, derive utility from consumption and real money balances, and can hold their savings in terms of deposits or real balances.[iv] All deposits in banks are profit- and loss-sharing (PLS) deposits that do not guarantee a fixed return, and the bank does not guarantee their nominal values. Each bank has access to an investment project that requires specialized evaluation and monitoring technology with a large fixed cost. The government issues and distributes high-powered money at the beginning of the period, and usually intervenes in the market to direct monetary policy toward specific goals. Specifically, the monetary authority alters the profit-sharing ratios between banks and their depositors, as well as the reserve ratios on different types of liabilities (see Khan and Mirakhor, 1987). We assume that the marginal utility of money is decreasing in the level of government intervention in the financial markets. Building on Sidrauski (1967), and closely following Roubini and Sala-i-Martin (1992), preferences are modeled over per capita consumption and real balances by:

$$U = \int_0^{\infty} e^{-(\rho - n)t} u(c_t, m_t) dt \tag{1}$$

where $\rho>0$ is the rate of time preference, and n is the exogenous growth rate of the population. Both consumption and real balances are assumed to be normal goods, so per capita utility function $u(c_t, m_t)$ is strictly concave. To achieve closed-form solutions, we assume utility to be of the following form:

$$u(c_t, m_t) = \alpha \ln c_t + \beta(\theta) \ln m_t \tag{2}$$

where θ, $0<\theta<1$, is a policy variable (e.g., profit-sharing ratios between the financial institution and its depositors) while α and β are elasticities of consumption and money respectively. $\beta^{/}(\theta)<0$, which indicates that higher values for θ reduce the marginal utility of holding money.[v] The government alters θ as a monetary policy tool to allocate resources in the economy. Strict regulation of the financial system will give the monetary authority better control over the money supply. Since the policy variable θ represents government regulatory policy in the financial market, without loss of generality, θ becomes an index of how an individual can be induced to invest (see Persson and Tabellini, 1991).

Individuals are assumed to maximize the lifetime utility function (1) subject to the budget constraint:

$$\frac{\dot{K}}{N} + \frac{\dot{M}}{NP} = (1+r)(1-z)K - c \tag{3}$$

where K is capital (PLS deposits), M is money stock, P is the price level, and N is the total number of persons in the economy. The rate of return per unit of investment r (defined below), is endogenously determined, and z is the rate of *zakat* on capital.[vi]

Equation (3) states that per capita saving equals per capita investment plus money accumulation. Note that households can hold either money or capital (deposits at banks and capital are the same) or both. Denoting the per capita asset holding by $x_t = k_t + m_t$, the budget constraint (3) can be rewritten in terms of an asset-accumulation equation of the form:

$$\dot{x} = (1+r)(1-z)x_t - nx_t - R_t m_t - c_t \tag{4}$$

where $R_t = (1+r)(1-z)+\pi$ is the nominal rate of return per unit of investment, π is the inflation rate, and the dot denotes the time derivative. The maximization problem is now given by the current value Hamiltonian:

$$H = e^{-(\rho+n)t}[\alpha \ln c + \beta(\theta) \ln m] + \lambda_t [(1+r)(1-z)x - nx - c - Rm] \tag{5}$$

The optimal allocation optimizes (5) at each date t, provided the implicit price λ_t is correctly chosen. Maximizing with respect to c_t and m_t(5) gives the money demand function:

© 2011 The President and Fellows of Harvard College. All rights reserved.
http://ifp.law.harvard.edu/login/contact

$$m_t^d = \frac{\beta(\theta)c_t}{\alpha R_t} \tag{6}$$

The money demand function depends negatively on the nominal rate of return (i.e., the opportunity cost of holding money), and positively on the level of per capita consumption. The accumulation equation (4) and the first order conditions imply that the per capita growth rate of consumption equals

$$\gamma_c = \frac{\dot{c}}{c} = (1+r)(1-z) - \rho \tag{7}$$

The first term in the right-hand side of (7) is the after-*zakat* (real) rate of return of investment, while the second term is the rate of time preference. Given z and assuming certain parameter value to ρ, θ can be chosen such that γ_c will be positive, indicating that sustained per capita growth is feasible. Equation (7) also reveals an important result of the endogenous growth model. The long-run growth rate is determined by the saving and investment decisions of private agents, or equivalently, by factors that influence saving and investment. These include the rate of return on investment (or equivalently, the profit sharing ratio θ) and the *zakat* rate. The rate of growth of the money supply is then defined as:

$$\gamma_m = \frac{\dot{m}}{m} = (1+r)(1-z) - \rho - \frac{\dot{R}}{R} = \gamma_c - \gamma_R \tag{8}$$

Equation (8) indicates that the growth rate of consumption is equal to the growth rate of the money stock plus the growth rate of profits, i.e., $\gamma_c = \gamma_m + \gamma_R$. In general, r is variable and so is Π^*, the level of profit in the economy. However, competition between firms and government control over θ will tend to equalize profits and rates of return across firms. Only then would the nominal rate of return be constant. A necessary condition for balanced growth is that the growth rates of consumption and money equal a common rate, i.e., $\gamma_c = \gamma_m = \gamma$ (no transitional dynamics).

A. The Firm

To further analyze production and growth in this context, banks are now brought into the model. Banks operate production technologies that are linear in a broad measure of capital, i.e., include physical and human capital (see Barro, 1989). As in Ireland (1994), there may be decreasing returns in either type of capital when applied separately, but there are constant returns in both when applied together. To achieve tractability, we assume that the following process governs production:

$$Y = F(\phi(\theta), K) = \phi(\theta)K \tag{9}$$

where y is the per capita level of output and $\phi(\theta)$ is an intermediation technology (or the state of knowledge).[vii] The intermediation technology is increasing in the profit-sharing ratio, i.e., $\phi'(\theta) > 0$. The linearity of the production function in (9) is rationalized by the fact that K_t is regarded as a composite of human and physical capital. Under such conditions, a constant rate of investment can result in an ever-growing capital stock, and thus steady-state growth. Any policy that raises saving would be sufficient to raise the rate of growth. This certainly rationalizes government intervention in the production process to raise the marginal product of private capital. I assume here that government actions will only influence private production and enhance property rights (i.e., enforce the Islamic laws of contracts).

Alternatively, higher profit-sharing ratios offered to the customers (depositors) will enable banks to mobilize more funds. The more funds they mobilize, the more they invest in R&D and the more intermediation knowledge and techniques they acquire. If this learning process spills over into the economy, banks will be able to collect and analyze information that will allow investors' resources to flow to their most profitable uses. The high incomes generated through risk pooling and efficient resource allocation will feedback and promote economic growth. In an equilibrium with active R&D activity, the expected rate of return for R&D must reflect the opportunity cost of capital [see Grossman and Helpman (1990)]. If we assume the rate of depreciation of capital is

© 2011 The President and Fellows of Harvard College. All rights reserved.
http://ifp.law.harvard.edu/login/contact

zero, then profit maximization will yield the usual condition equating marginal productivity with the rate of return on capital:

$$1+r = \phi(\theta) \tag{10}$$

Substituting equation (11) in equation (8) gives:

$$\gamma_c = \phi(\theta)(1-z)-\rho \tag{11}$$

Equation (11) implies the superneutrality result derived by Sidrauski (1967). Furthermore, equation (11) shows the direct influence of the policy variable θ on the growht rate of the economy. That is, a higher sharing ratio fixed by the monetary authority will boost growth. Equivalently, an improvement in the level of financial innovation, which raises the average and marginal productivity of capital, also raises the growth rate of the economy.

B. The Monetary Authority

In order to complete the model, we assume that the government controls the supply of high-powered money by setting the nominal growth rate of the money supply $\frac{\dot{M}}{M} = \mu$, and follows a time-consistent monetary policy that prevents jumps in the price level.

The government relies on two revenue sources to finance its expenditures: seigniorage and *zakat* revenue. The consolidated government budget constraint is $g_t = \frac{\dot{M}}{P} + Z$, where $\frac{\dot{M}}{P}$ is the revenue from seigniorage and $Z = (1+r)zk$ are the proceeds from *zakat*. Since the issue of interest-bearing securities is not allowed, and no transfers are assumed, the government's budget constraint can be rewritten as:

$$g_t = \dot{m} + m(\Pi + n) + (1+r)zk \tag{12}$$

Rearranging and using the agent's budget constraint (4) and the government's budget equation (12), the equation for capital accumulation can be written as:

$$\dot{k} = (\phi(\theta) - n)k - c - g \tag{13}$$

Since we are assuming that there is no depreciation, breakeven investment is nk and actual investment is $\phi(\theta)k-c-g$. That is, the capital stock accumulates as the difference between net per capita real output and private and public consumption gets larger (i.e., the larger the saving). Given the government budget constraint (12), equation (13) shows that the rate of capital accumulation varies with the rate of inflation. Specifically, it shows that inflation would slow the rate of capital accumulation. Using the nominal growth rate of the money supply $\mu = \frac{\dot{M}}{M}$, and substituting for the per capita demand for real balances, the government budget equation becomes:

$$g_t = \frac{\beta(\theta)c_t}{\alpha R_t}\mu + \phi(\theta)zk_t \tag{14}$$

Substituting (7) into (14) reduces the budget equation to $g_t = m_t\mu + \phi(\theta)zk_t$. The first term in the right-hand side of (14) shows the amount of seigniorage that the government can collect from its inflation tax, which equals the consumer's cost of holding money. The second term in (14) is the proceeds from imposing *zakat* on output. The results further show that by adhering to the optimum quantity of money rule, the government can raise the revenue it requires at a lower tax rate. When the government adopts the optimum quantity of money rule, it can satisfy its budget constraint with any combination of monetary and fiscal policies. This is possible if θ is chosen such that the expected revenue is equal to the expected expenditure.[viii] However, given the marginal utility of holding money, any

© 2011 The President and Fellows of Harvard College. All rights reserved.
http://ifp.law.harvard.edu/login/contact

government action to increase θ would decrease the demand for real balances and reduce the revenue collected from the inflation tax. On the other hand, since the revenue generated from *zakat* is increasing in income, any government action to reduce θ (i.e. the profit-sharing ratios) would decrease output and, hence, the *zakat* revenue. Thus, a tradeoff exists between the welfare cost of inflation and the welfare cost that can be ascribed to decreasing income. To balance these two effects, the monetary authority should adjust its instrument to control the amount of revenue generated from both sources.

III. THE WELFARE EFFECTS OF FINANCIAL INNOVATION

This section analyzes the welfare effects of varying θ on consumption, money demand, and government spending at the steady state equilibrium. As shown by De Gregorio (1991), there are multiple equilibrium paths for such an economy, but the only (bubbleless) equilibrium is where $\dot{k} = 0$. Then for a given k, the steady-state level of consumption is given by:

$$c = (\phi(\theta) - n)k - g \tag{15}$$

Thus equations (7), (14), and (15) will characterize the steady state general equilibrium. In particular, the goods market equilibrium requires c +g = y-nk, where nk is the amount of capital needed for the new generation. The asset market equilibrium has already been implicitly assumed in the preceding discussion. Since the economy is always in the steady state and both c and m enter the utility function, we need to analyze the effects of θ on both consumption and real balances in order to understand how θ effects welfare.

Proposition 1. For a given level of capital stock and inflation, the welfare effect on consumption of increasing θ is positive.

Proof: see Appendix A.

That is, other things being equal, an increase in θ will increase welfare. The effects of increasing θ on money demand are apparent from the following equation:

$$\frac{\partial m}{\partial \theta} = \frac{1}{(1 + \frac{\mu\beta}{\alpha R})}[(\frac{\beta' m}{\beta} - (1-z)\mu\phi' \frac{m}{R} + \frac{\beta}{\alpha R}(1-z)\phi' k] \tag{16}$$

The first two terms in square brackets on the right-hand side of (16) are negative while the third term is positive, indicating the ambiguous effect of θ on money demand.

Proposition 2. For a given level of consumption c, increases in θ reduce the demand for real balances.

Proof: Straightforward from Appendix A.

The intuition here is that an increase in θ is interpreted as financial innovation, which allows people to require lower money balances to carry the same amount of transactions.

Proposition 3. Given the steady state levels of consumption and capital stock, increasing θ has an ambiguous effect on g.

Proof. Assuming a given k, then from equation (14) we have:

$$\frac{\partial g}{\partial \theta} = \mu \frac{\partial m}{\partial \theta} + \phi'(\theta) zk \tag{17}$$

© 2011 The President and Fellows of Harvard College. All rights reserved.
http://ifp.law.harvard.edu/login/contact

Given c, the first term on the right-hand side of (17) reduces to $\mu[(\beta^{/}/\beta)m-(1-z)\phi^{/}m/R]<0$. Since $\phi^{/}(\theta)>0$, the second term is positive. The overall effect of θ on g depends on whether the decline on seigniorage dominates the increase in *zakat* revenue. A government that prefers levying an inflation tax (to finance its deficit) will increase the per capita demand for money by reducing θ, thus reducing the incentives to invest (i.e., hold a PLS deposit). Such behavior will certainly reduce the level of output and hence hampers growth. Moreover, since the economy will grow at a lower rate, both the revenue from *zakat* and the revenue from money creation will decline. By contrast, a forward-looking government will increase θ to mobilize more resources and increase the level of income. By doing so, it can lure the non-productive resources to the financial system and promote growth. In short, one would say that a government that prefers to collect an inflation tax to finance its deficit would tend to reduce the profit-sharing ratio, and hence depress the incentives to hold PLS deposits. Financial institutions would then spend less on R&D activities and become less innovative in attracting and disposing of funds. Since holding money is a close substitute for holding PLS deposits, the per capita demand for money increases. Such behavior will be inflationary and eventually hampers growth.

IV. THE WELFARE EFFECTS OF INFLATION

To investigate the welfare costs of inflation, we first need to characterize the effect of inflation on the policy variable θ. Note that the steady state equation (6) can be rewritten as a function of θ and π. Specifically $\beta(\theta)c/\alpha m = R^{*}$, where R* is the optimal rate defined above.

Proposition 4. *For a given nominal rate of return R, an increase in the rate of inflation reduces θ.*

Proof. Rewriting the steady-state equation (6) and differentiating with respect to π we get:

$$\frac{d\theta}{d\Pi} = \frac{1}{\frac{\beta^{/}}{\beta} R^{*} - \phi^{/}(\theta)(1-z)} \tag{18}$$

The right-hand side of (22) is negative (since $\beta^{/}<0$ and $\phi^{/}>0$). This result indicates that inflation is harmful to innovation and/or to government regulation since it adversely affects θ.

The next step is to use this result to investigate the effects of inflation on consumption, money demand, government spending, and growth. To do this, we use equilibrium equation (6) and the following propositions:

Proposition 5. (*i) For a given capital stock, inflation affects consumption negatively.*
(ii) For a given capital stock, increases in the rate of inflation affect money demand negatively.

Proof: See Appendix B.

The utility function u(c, m) can now be used to show how higher rates of inflation reduce consumers' welfare. To see this, note that $\frac{\partial u}{\partial \Pi} = u_c \frac{\partial c}{\partial \Pi} + u_m \frac{\partial m}{\partial \Pi} <0$, and $\frac{\partial m}{\partial \Pi} < 0$.

Proposition 6. *Given the levels of consumption, real money balances, and capital stock, higher inflation rates reduce growth.*

Proof. Differentiating equation (11) with respect to π to get

$$\frac{\partial \gamma}{\partial \Pi} = \phi^{/}(1-z)\frac{d\theta}{d\Pi} \tag{19}$$

Using equation (18) and $\phi^{/}(\theta)>0$ proves the result.

© 2011 The President and Fellows of Harvard College. All rights reserved.
http://ifp.law.harvard.edu/login/contact

This result shows the traditional tradeoff between inflation and output growth. More specifically, policy measures that are set to finance government spending by seigniorage may end up hampering growth. Countries that use seigniorage to finance their deficits have the difficult job of targeting output growth and financing government spending (using an inflation tax) at the same time.

V. CONCLUSION

The model presented above demonstrates that the injunction against fixed interest payments induces the monetary authority in an Islamic economy to develop and innovate alternative financial instruments that do not have fixed nominal values and do not bear predetermined rates of interest.[ix] The model also proves that financial innovation is welfare enhancing, while inflation reduces welfare and hampers growth. The model further proves that the government in an Islamic economy can effectively implement fiscal policy using *zakat*. The fact that the *zakat* rate is fixed reduces the distortion created by variations in the tax rate.[x] Revenues from *zakat* and from money creation can be used to finance public sector programs and/or to finance the budget deficit. To boost growth, monetary and fiscal policies should be closely coordinated.

APPENDIX A. PROOF OF PROPOSITION 1

Differentiating equations (15), (14), and (6) with respect to θ:

$$\frac{\partial c}{\partial \theta} = \phi\_(\theta)k + (\phi(\theta) - n)\frac{\partial k}{\partial \theta} - \frac{\partial g}{\partial \theta} \qquad \text{(A1)}$$

$$\frac{\partial g}{\partial \theta} = \mu\frac{\partial m}{\partial \theta} + \phi\_(\theta)zk + \phi(\theta)z\frac{\partial k}{\partial \theta} \qquad \text{(A2)}$$

$$\frac{\partial m}{\partial \theta} = \frac{\beta\_(\theta)}{\beta}m + \frac{\beta(\theta)}{\alpha R}\frac{\partial c}{\partial \theta} - \frac{\beta c}{\alpha R^{*2}}\frac{\partial R^*}{\partial \theta} \qquad \text{(A3)}$$

where R* = ϕ(θ)(1-z)+π is the optimal nominal rate of return per unit of investment. If we assume the government will choose θ to determine the optimal demand for real balances, equation (A3) can be rewritten as:

$$\frac{\partial m}{\partial \theta}\frac{\theta}{m} = \frac{\theta}{m}[\frac{\beta\_}{\beta}m + \frac{m}{c}\frac{\partial c}{\partial \theta} - m\,OVERR^*\frac{\partial R^*}{\partial \theta}] \qquad \text{(A3}^{/}\text{)}$$

The expression in (A3$^{/}$) reduces to $\eta_{m\theta}=\eta_{\beta\theta}+\eta_{c\theta}-\eta_{R^*\theta}$, which are gross elasticities that take into account the total effect of changing θ on the demand for real balances.

Substitute (A1) and (A2) in (A3) to get:

$$\frac{\partial c}{\partial \theta} = (\frac{1}{1+\frac{\mu\beta}{\alpha R}})[(1-z)\phi^{/}k + \frac{(1-z)\mu\phi^{/}m}{R} - \frac{\beta^{/}(\theta)m}{\beta}] \qquad \text{(A4)}$$

Given the assumptions on the marginal productivity of capital and the marginal utility of holding money, the right-hand side of (A4) indicates the positive externalities of increasing θ.

APPENDIX B. PROOF OF PROPOSITION 5

(i) Differentiating the steady-state equations (6), (14), and (15) and using the envelope theorem:

© 2011 The President and Fellows of Harvard College. All rights reserved.
http://ifp.law.harvard.edu/login/contact

$$\frac{\partial c}{\partial \Pi} = \left(\frac{1}{1+\mu\beta/\alpha R}\right)\left[\left(\phi^{/} k(1-z) - \mu\,\beta^{/}\, m/\beta\right) + \mu\,\phi^{/}(1-z)\frac{m}{R}\right]\frac{d\theta}{d\Pi} \qquad \text{(B1)}$$

Using equation (18) and the fact that $(\mu\beta^{/}m/\beta)<0$ proves the result. The model also predicts an inverse relationship between inflation and output, as can be seen from the production function (9) and equation (18).

(ii) Differentiating (6) with respect to π we get:

$$\frac{\partial m}{\partial \Pi} = \left[\frac{\beta^{/} c}{\alpha m}\frac{m}{R} - \phi^{/}(1-z)\frac{m}{R}\right]\frac{d\theta}{d\Pi} + \frac{\beta}{\alpha R}\frac{\partial c}{\partial \Pi} - \frac{m}{R} \qquad \text{(B2)}$$

Given equation (22), the first term in equation (B2) (in the square brackets) cancels out with the third term. Applying equation (B1) proves the negative effects of inflation on the demand for real balances.

REFERENCES

Arif, M. *Monetary and Fiscal Economics of Islam* (Jeddah: International Center for Research in Islamic Economics, 1982).

Barro, R. *A Cross-country Study of Growth, Saving, and Government* (Cambridge, MA: National Bureau of Economic Research, 1990).

Barro, R. "Economic Growth in a Cross-section of Countries." *Quarterly Journal of Economics*, 106: 1991.

Bashir, A. and Darrat, A. "Human Capital, Investment and Growth: Some Results from an Endogenous Growth Model." *Journal of Economics and Finance*, 18(1): 67-80, 1992.

Brock, P. "Reserve Requirements and Inflation Tax." *Journal of Money, Credit, and Banking*, 21(1): 106-121, 1991.

Cardoso, E. and Fishlow, A. *Latin American Economic Development* (Cambridge, MA: National Bureau of Economic Research, 1989).

Gomme, P. "Money and Growth Revisited: Measuring the Costs of Inflation in an Endogenous Growth Model." *Journal of Monetary Economics*, 32: 51-77, 1993.

De Gregorio, J. "Economic Growth in Latin America." *Journal of Development Economics*, 39: 59-84, 1992.

-----. "Welfare Costs of Inflation, Seigniorage, and Financial Innovation." *International Monetary Fund Staff Papers*, 34(4): 1991.

Denison, F. *The Sources of Economic Growth in the United States* (New York: Committee for Economic Development, 1961).

Erbas, N. "Inflationary Finance of Budget Deficits as an Automatic Stabilizer." *Journal of Monetary Economics*, 18: 1986.

Greenwood, J., and Jovanovic, B. "Financial Development, Growth, and the Distribution of Income." *Journal of Political Economy*, 98(5): 1990.

Grossman, G., and Helpman, E. "Trade, Innovation, and Growth." *American Economic Review*, 80(2): 1990.

Hayakawa, H. "Intertemporal Optimization and Neutrality of Money in Growth Models." *Journal of Monetary Economics,* 18: 323-328, 1986.

© 2011 The President and Fellows of Harvard College. All rights reserved.
http://ifp.law.harvard.edu/login/contact

Ireland, P. "Money and Growth: An Alternative Approach." *American Economic Review*, 84(1): 47-65, 1994.

Khan, M. and Mirakhor, A. "Financial System and Monetary Policy in Islamic Economy." *Theoretical Studies in Islamic Banking and Finance*. Ed. M. Khan and A. Mirakhor: 1987.

King, R., Plosser, C. and Rebelo, S. "Production, Growth and Business Cycles." *Journal of Monetary Economics,* 21: 195-232, 1988.

Lucas, R. "On the Mechanics of Economic Development." *Journal of Monetary Economics,* 22: 3-42, 1988.

Lucas, R. "Why Doesn't Capital Flow from Rich to Poor Countries?" *American Economic Review,* 80 (2): 1990.

Mankiw, G. "The Search for Growth." *Policies for Long-Run Growth* (Federal Reserve Bank of Kansas City, 1990).

Nguyen, H. "Money in the Aggregate Production Function: Reexamination and Further Evidence." *Journal of Money*, *Credit and Banking*, 18(2): 141-151, 1986.

Park, Y. "Development Lessons from Asia: The Role of Government in South Korea and Taiwan." *American Economic Review*, 80(2): 1990.

Persson, T. and Tabellini, G. "Is Inequality Harmful for Growth? Theory and Evidence." *NBER working paper no. 3599*: 1991.

Plosser, C. "The Search for Growth, in Policies for Long-Run Growth." *Proceedings of A Symposium Sponsored by the Federal Reserve Bank of Kansas City* (Federal Reserve Bank of Kansas City, 1992.)

Romer, P. "Increasing Returns and Long-Run Growth." *Journal of Political Economy*, 94: 1002-37, 1986.

-----. "Endogenous Technological Change." *Journal of Political Economy*, 98(5): 1990.

Roubini, N. and Sala-i-Martin, X. "Financial Repression and Economic Growth." *Journal of Development Economics,* 39: 5-30, 1992.

Sengupta, J. "Growth in NICs in Asia: Some Tests of New Growth Theory." *Journal of Development Studies*, 29(2): 1993.

Sidrauski, M. "Rational Choice and Patterns of Growth in a Monetary Economy." *American Economic Review*: 1967.

© 2011 The President and Fellows of Harvard College. All rights reserved.
http://ifp.law.harvard.edu/login/contact

[i] See the Proceedings of "Policies for Long-run Economic Growth," *A Symposium sponsored by The Federal Reserve Bank of Kansas City*, Jackson Hole, WY, 1992.

[ii] *Zakat* is a 2.5% annual wealth tax paid on non-working capital, profits, saving, and all types of wealth in excess of an exempt minimum known as *nisab*. Although *zakat* is supposed to be given to a designated group in the society, it can also be spent in public programs.

[iii] See M. Arif (1982), *Monetary and Fiscal Economics of Islam*, and the papers cited there.

[iv] Real balances enter the utility function because money reduces transaction costs.

[v] If θ is interpreted as reserve ratio against bank deposits, then $\beta^{/}(\theta)>0$.

[vi] The rate of return per unit invested is calculated using the formula $r = \theta(F(K^*)-K^*)/K^* = \theta\Pi^*/K^*$, where K^* is the optimal level of investment, and $\Pi^* = F(K^*)-K^*$ is the optimal profit at that level of investment.

[vii] The knowledge here is about financial intermediation techniques, which accumulates as a by-product of government intervention to correct market imperfections (effective enforcement of contractual agreements), or by private firms investing on R&D to introduce new mechanisms to raise and disperse funds, (see Grossman and Helpman, 1990, Romer, 1990).

[viii] The budget deficit is equal to the difference between real government expenditures and real *zakat* revenue at time t.

[ix] The monetary policy tools available to the monetary authority in an Islamic economy include the reserve ratio against bank deposits, and the profit-sharing ratios between banks and their depositors and/or borrowers (Khan and Mirakhor, 1987). Variations in these rates will enable the monetary authority to control the amount of funds channeled into the investment process. The central bank in an Islamic economy can also issue and regulate high-powered money.

[x] King and Rebelo (1990) showed that, raising income tax rate from 20% to 30% results in welfare loss in excess of 60% of consumption.

© 2011 The President and Fellows of Harvard College. All rights reserved.
http://ifp.law.harvard.edu/login/contact