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A STUDY OF GOVERNMENT REVENUE FROM MONEY CREATION IN SOUTH KOREA

by

BYUNG-SUB KWAK

A dissertation submitted to the Graduate Faculty in Economics in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1978

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Abstract

A Study of Government Revenue from
Money Creation in South Korea

by

Byung-Sub Kwak

Adviser: Professor Alvin Marty

Discussion of the effects of money issues is as old as money itself. In modern history of the monetary theory, there are some arguments on the monetary welfare cost incidental to the government revenue from money creation, in the theoretical setting of steady state or transitional period between one steady state and another state steady. In this paper, a survey of the "actual" government revenue from money creation is undertaken. For the work, the theory is combined with institutional and practical aspects of South Korea. Then, the significance of the obtained value of the actual government revenue is examined with respect to its contribution to the aggregate income growth.

In the period studied(1963-1976, Korean high growth era), the actual government revenue from money creation was 1.6 percent of aggregate real income, and the actual revenue is equivalent to 6.1 percent of growth capital formation. From these values and the Harrod-Domar growth model, the calculated amount of aggregate income attributed to inflationary finance is 1.9 percent.

Some comparisons of the actual government revenue with the estimated theoretical-values with the steady state assumption are taken.

Finally, a development of the model with induced growth is attempted with regard to the feedback effect of the induced growth on variable parameters in the model. In the more generalized model the conventional conclusion that inflationary finance is more costful than other sources of raising government revenue does not appear necessary.

Acknowledgements

During the last two years and more of this study numerous persons have given me advice and help as I needed relatively more favors as foreign student. Although I do not list all the persons respectively, my whole-hearted appreciation may go to all of them, needless to say to include Professor Alvin Marty, chairman of my dissertation committee and two other co-chairmen Professor Damodar Gujarati and Professor Michael Grossman.

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CHAPTER I

GENERAL INTRODUCTION

1.1 OBJECTIVES AND FRAMEWORK

Objectives: This dissertation is the result of a study of government revenue through money creation, and the welfare implications of this revenue both with and without considerations of induced economic growth. South Korea, which has had a recent high income growth period of some 15 years, is the region for the study; theoretical discussion is to be confined to the steady state in which expectations are realized.

The words "inflationary finance" or "inflationary tax" will be used interchangeably to mean "government revenue through money creation" or "tax on money" as appropriate to the context. "Induced growth" as used herein shall denote the growth produced by the inflationary finance. Induced growth will be different from autonomous growth, whether or not this growth is a function of the growth rate of the quantity of money.

The following questions will be considered on the basis of Korean data:

1. How important is inflationary finance to the raising of government revenue for economic growth?

2. What and how significant is the collection cost of inflationary finance?

3. What is the optimum expansion rate of the quantity of money with regard to the differential tax analysis?

Framework: As a preparation for discussing the inflationary finance in South Korea, it will be necessary to know some parameter values of the Korean liquidity preference function and characteristics of the nation's monetary system. Chapter 2 will therefore introduce the subject of the government's money creation mechanism; Chapter 3 will be devoted to an analysis of the demand for money. On this basis, the central issues will be developed in Chapters 4-5 and a summary of final conclusions with policy recommendations and suggestions for further study will complete the dissertation. The approach will be therefore institutional, empirical, and theoretical.

1.2 THEORY OF INFLATIONARY FINANCE

Overview: Although discussion of the effects of money issues is as old as money itself, we will confine our attention to the mainstream of the literature of recent decades, where Keynes (1923), Friedman (1953), Bailey (1956), Cagan (1956) and others begin to appear. Some definitions and explanations will be merged into the discussion.

Inflationary Tax: Inflationary tax is a tax which is levied on money, and is paid by depreciation of money which occurred due to the inflationary effect caused by the money creation. That is, the tax is collected by the money creation.

> Keynes wrote: "Printing money is the form of taxation which the public finds hardest to evade and even the weakest government can enforce, when it can enforce nothing else." (A Tract on Monetary Reform, 1923, p. 37).

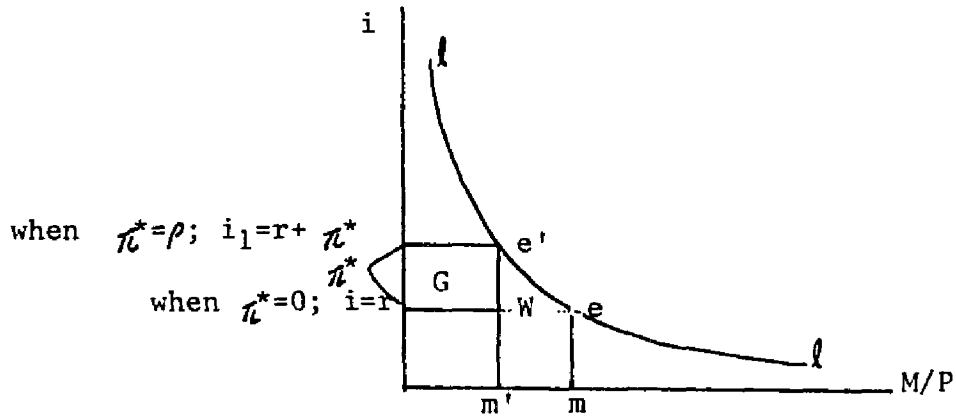
However, the question is: How much can the government collect by the inflationary finance? Is there no limit? It is true that the government can raise much more tax revenue by printing money when people's price expectations lag, but people will adjust their expectations lag, but people will adjust their expectations quickly when the government prints money rapidly. If there is a limit in government's raising revenue in this way, what is the limit? It will be meaningful to ask how significant is the maximum revenue. This question will be considered in Chapter 4 of this paper.

Steady-State-No-Growth Model: The tax rate is the inflation rate in the simplest no-growth model, and the tax base is the money balance of the economy.

If M denotes the nominal quantity of money, and π is the inflation rate, the inflationary tax revenue in nominal terms is $M\pi$, that is, the tax base multiplied by the tax rate. If money is created solely by the government, $M\pi$ is simply government revenue through money creation, and if money creation is shared with other private institutions, the revenue is also shared with others proportionally to the share in total money creation. In this introduction it is assumed, except when otherwise obvious in the context, that all money is created by the government.

When the nominal inflationary tax ($M\pi$) is counted in terms of real value via deflating by the price level, the revenue is $\frac{M}{P}\pi$ with P denoting the price level. Thus, the government revenue (G) in real terms is $G=\frac{M}{P}\pi=m\pi$ with m denoting the money balance in real terms. Since π is simply equal to the growth rate of nominal quantity of money in the steady state no-growth economy, the revenue is identical to $m\rho$ where ρ denotes the growth rate of the nominal quantity of money.

The government revenue is illustrated on Graph 1-1 using the model generally known as Bailey's.



Graph 1-1. Inflationary Finance and its Welfare Cost in the Stationary Economy

As the graph shows, government revenue through money creation (G) is the quantity of real money balances (m) at a constant π^* multiplied by the ininflation rate π^*. (The inflation rate π is the same as the expected rate of inflation π^* in the economy). r on the graph denotes the real rate of interest which is the nominal rate of interest when $\pi=0$.

On the other hand, the welfare cost due to the inflation rate (π) is, as is well known, the area ee'm'm on Graph 1-1. It must be emphasized that the foregoing welfare cost is defined on very narrow assumptions. This welfare cost may be called monetary welfare cost, which is confined only to the welfare aspects about the liquidity of real money balances. It disregards changes of distribution of income, shifting between public goods and private goods or social disruption, etc., which occur by virtue of price changes even though aggregate real income is constant. However, welfare cost on Graph 1-1 will be a good approximation for simplicity when other positive and negative effects are cancelled out.

Utility Comparison: The welfare cost (W) is compared in ratio to the government revenue through money creation (G). The ratio (W/G) is the average welfare cost for the inflationary finance. W is a flow of money which amounts to a flow of commodity proportional to the magnitude of the area, and G similarly. W/G is also a ratio of two flows of commodity. Under what conditions can we compare welfares from two flows of commodity? In other words, under what conditions is it true that $W/G = U(W)/U(G)$? Here, an assumption on the utility function of commodities is necessary. If we know the exact utility function of a commodity, we can say then $U(W)/U(G)$ is determined. $U(W)/U(G)$ will usually not be the same as W/G. But, if we assume marginal utility is constant, then each utility of a commodity will be proportional to the magnitude of the commodity. Then W/G will be identical to $U(W)/U(G)$. When we compare as above, we implicitly assume that the marginal utility of the commodity is constant.

Rational Expectation and the Welfare Cost: Recently, there were acute controversies on whether monetary authorities' change of monetary expansion can affect real output in the condition of the rational expectation hypothesis [see, for example, Barro (1977) and Fischer (1977)].

However, the rational expectation hypothesis combined with the natural unemployment rate hypothesis will be sufficient to support the neutrality of monetary policy in the long run. However, when we consider the welfare cost related to the liquidity balances, monetary policy is not neutral, because liquidity balances will change according to the monetary expansion cannot alter real income. At least in this sense, monetary policy is not neutral.

However, is the welfare cost significant? This question was raised earlier in this introduction. The magnitude of the welfare cost will indicate the answer.

Identification of the Tax Base: Another problem about government revenue through money creation is related to the identification of the inflationary tax base, M, in $G=\frac{M}{P}\pi$. As noted above in the real world all money is not created by the government; there are other monies, e.g., demand deposits of commercial banks. Even the currency in circulation is not itself the base for the government inflationary tax, because part of the currency issued is rolled back to the commercial banks and is again redeposited to the central bank by the commercial banks for their reserves. Thus, a change of currency does not mean government revenue through money creation; this is clear from the following central banks's accounting process.

When the government (including the central bank) issues 10 million dollars for construction of a bridge, the transaction is journalized as:

Government

Bridge	\$10 million	Currency in Circulation	\$10 million

At the next stage 8 million dollars is deposited into a commercial bank, and the commercial bank redeposits 2 million dollars into the central bank for the corresponding legal reserve for the new demand deposit:

Government

Currency in Circulation	Reserve of Commercial Bank
\$2 million	\$2 million

From the above statements, the government revenue through money creation is 10 million dollars, but currency in circulation (including commercial bank's currency holdings) increased only by 8 million dollars. The government revenue is thus the same as the change of the high-powered money (currency in circulation plus commercial banks' reserves). This much J. M. Keynes (1923) perceived already. But there are some adjustments from this high-powered money identification according to the specific institutional aspects of the country.

Alternately, if the government finances its budget deficit only throuth money creation and creates money only for this purpose, the government budget deficit will equal the government revenue. If the government finances its budget by selling bonds to the public, this finance will have no relation to inflationary finance. However, a combination of sources will generally be used for financing the budget deficit. Further, if there are other commercial bank or private deposits to the central bank (e.g., the monetary stabilization account fund - a special reserve which is deposited to the central bank but which is not counted in the reserve base of high-powered money; in Chapter 1 such institutional facts will be considered), then the identification of high-powered money with government tax revenue will be revised so as to adjust for these exceptional reserves to the central bank. Another institutional consideration is that the government itself holds real money balances (demand deposits and currency). In government-central bank consolidated accounting the government's holdings will not be counted as money at all. But in this case the government's holdings do not have an economic significance, for example, they have no inflationary effect. Actually, the government is also an economic agency. Here a special aspect of inflationary finance emerges. In this paper, I write of the government holdings as an asset of the government and discount them by the inflation rate. This computation is based upon the fact that the government keeps a separate accounting system from the central bank, and the government itself is also an economic section as is the business sector. But for simplicity, we may disregard these government holdings unless they are very significant.

Present Values Compared: In the original discussion of the steady state no-growth model, the present value ratio of all future flows of welfare cost (W) to government revenue (G) is the same as any one-period value of W/G because in every term the ratio of W/G is the same in every period. Therefore a series of revenue and cost flows, when discounted to present value terms, has the same ratio as $\frac{W}{G}$ in any one period, since

$$\frac{\sum_{t=0}^{\infty} W_t (1+r)^{-t}}{\sum_{t=0}^{\infty} G_t (1+r)^{-t}} = \frac{\sum_{t=0}^{\infty} W_t}{\sum_{t=0}^{\infty} G_t} = \frac{W_t}{G_t} = \frac{W}{G}$$

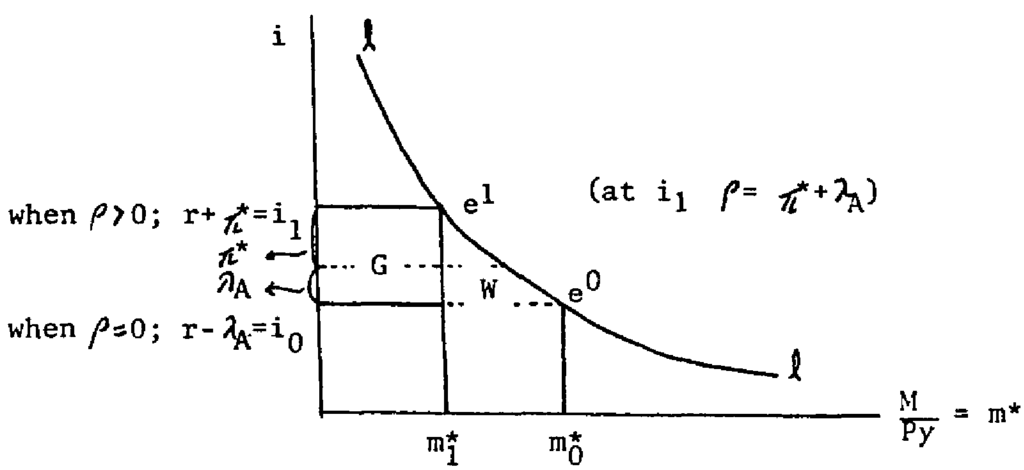
where r is the social rate of discount which was taken as the real rate of interest. The above idea is made explicit in Frenkel's paper [in McKinnon (1976), p. 182].

It is clear that the result is the same whether we calculate the marginal welfare cost from $\frac{W}{G}$ or from $\frac{W/y}{G/y}$:

$$\frac{dW}{dG} = \frac{\partial W}{\partial \rho} \Big/ \frac{\partial G}{\partial \rho} = \frac{\partial (W/y)}{\partial \rho} \Big/ \frac{\partial (G/y)}{\partial \rho}$$

since y is not a function of ρ in the assumption.

Autonomous Growth Model: When a nonzero autonomous income growth rate (λ_A) is introduced into the steady state model, the situation now appears as in Graph 1-2.



Graph 1-2. Autonomous Growth in a Steady State Economy

When there is no change in the nominal quantity of money, the price level decreases by λ_A, and the nominal rate of interest is then i_0, and at the constant nominal quantity of money, the real quantity of money will be m_0^*.

If we attribute to the nominal quantity of money a nonzero expansion rate $\rho (\rho > \lambda_A)$, negative inflation will be replaced by positive inflation.

The new nominal rate of interest will now become $i_1 = r+\pi^*$ as on Graph 1-2. The corresponding government revenue becomes $m_1^*\rho$ and its welfare cost is the area e^1bce^0 on the graph.

Average and marginal costs in the case of autonomous growth will be obtained the same way as in the no-growth case. The average welfare cost is:

$$\frac{W}{G} = \frac{W/y}{G/y} = \frac{W^*}{G^*},$$ and the marginal welfare cost is:

$$\frac{dW}{dG} = \frac{\partial W/\partial\rho}{\partial G/\partial\rho} = \frac{\partial(W/y)}{\partial\rho} \Big/ \frac{\partial(G/y)}{\partial\rho} = \frac{\partial W^*/\partial\rho}{\partial G^*/\partial\rho}$$

(y is still regarded as independent of ρ).

Induced Growth: The above simplification that the marginal welfare cost can be computed by the terms of W* and G* (the ratios of real income respectively) does not hold for the induced growth case because $\partial y/\partial\rho \neq 0$. In other words, when induced growth is considered, $\partial y/\partial\rho$ is no longer zero, and the above simplification is no longer valid, since in general

$$\frac{dW^*}{dG^*} = \frac{\partial(W/y)}{\partial\rho} \Big/ \frac{\partial(G/y}{\partial\rho} = \frac{y(\partial W/\partial\rho) - W(\partial y/\partial\rho)}{y(\partial G/\partial\rho) - G(\partial y/\partial\rho)} \neq \frac{dW}{dG}.$$

Thus, we cannot calculate the welfare cost by the ratios to the real income. We want to know $\frac{dW}{dG}$, not $\frac{d(W/y)}{d(G/y)}$. Thus, we will be able to proceed as follows:

$$\frac{dW}{dG} = \frac{\partial W/\partial\rho}{\partial G/\partial\rho} = \frac{\partial(W^*y)/\partial\rho}{\partial(G^*y/\partial\rho} = \frac{y(\partial W^*/\partial\rho) + W^*(\partial y/\partial\rho)}{y(\partial G^*/\partial\rho) + G^*(\partial y/\partial\rho)},$$

and when all four terms in this last fraction are positive, then this last ratio lies between $\frac{dW^*}{dG^*}$ and $\frac{W^*}{G^*}$. This idea will be used later in Chapter 5.

It should be noted that the inflation rate π changes in general as the induced growth rate λ_I changes.

<u>Capital Formation and the Production Function</u>: Here the relationship between the government of Mundell (1965) and Marty (1967) that the revenue is wholly invested for capital formation. The production function I adopt also follows theirs, which was in turn adopted from the Harrod-Domar model. That is $y = \sigma K$. This production function is legitimate in general for all constant scale production functions under the assumption that labor and other factors of production change proportionately to rate of change of capital stock. For example, if capital increases by 5%, labor and other factors increase 5% respectively, then the output will change proportionately to the capital stock change. That is, $y = \sigma K$. This assumption is not so unrealistic in the developing countries where capital is a constraint factor and there is ample reserve labor force.

<u>Utility from Both Money and Commodities</u>: Induced growth will make available more commodity consumption. Aghevli (1977) has just discussed combining material consumption and the welfare from real money balances; total consumption equals material consumption minus the disutility of holding suboptimal levels of real money balances. I proceed instead in the direction of differential taxation analysis, following the traditional line of investigating only monetary welfare.

We may say that Aghevli assumes the optimum taxation if total utility is maximized, while I assume the utility is maximized if optimal taxation is obtained.

Dynamic Models: Though dynamics are not in the scope of my main discussion of the paper, a brief view is in order for knowing the statics clearly.

Both Cathcart (1974) and Frenkel (1975, 1976) discussed the transitional period between one steady state and another. The two authors differ basically in the formation of the expectations on the rate of inflation during the transitional period. While Frenkel used a relationship between long-run expected rate of inflation and short-run expected rate of inflation, which is used for obtaining the desired real money balances during the transitional period, Cathcart used Cagan's adaptive expectation model in order to derive the time path of the real money balances.

1.3 IS-LM AND THEORY OF INFLATIONARY FINANCE

In Macroeconomics: The final concern in the introduction will be the relationship between the models of inflationary finance and the common model IS-LM. Although it might be appropriate to include a discussion of the relationship between the theory of inflationary finance and the Metzlerian neoclassical models [where real income is fixed at full employment and the price level is permitted to change (Metzler 1950; Mundell 1963; Mussa 1975)], this relationship may be a variant of that between IS-LM and the theory of inflationary finance. Since the relationship will be also self-evident in the neoclassical models themselves and further since Mundell's "Monetary Theory" (1971) discussed the matter along similar lines with more rigor than I intend here. The discuss: regarding Metzlerian models will be omitted in this paper.

The difference between IS-LM and the Tehory of Inflationary Finance ("TIF") stems from the different structures related to their assumptions and so the two may be simply regarded as different models. The prime difference is that TIF deals with the money market only, excluding the goods market, with more or less long-run steady state assumption while IS-LM deals with both markets together in short run.

IS-LM and the Bailey Model: When the Bailey model mentioned above is plotted in the i-y space of the IS-LM model, we observe only one vertical line corresponding to the constant level of real income, as Graph 1-4 illustrates.[1] In the Bailey model, aggregate real output y is exogeneously given, and there is no goods market corresponding to the IS schedule in the IS-LM model.

At the market rate of interest which is generated in the money market under the assumption that real money supply equals the real money demand, the TIF model assumes that the goods market is always in equilibrium.

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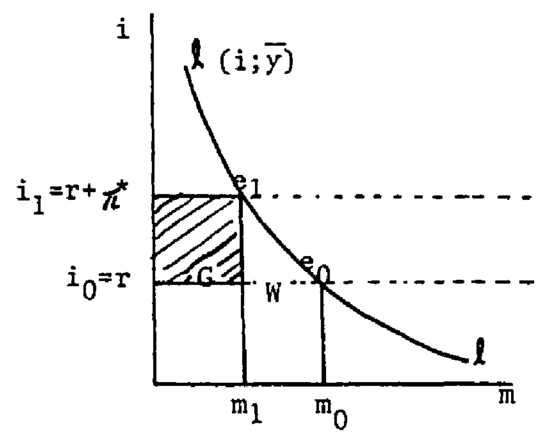
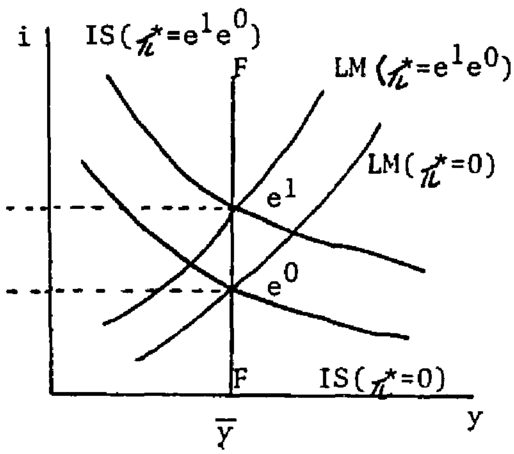
[1] See Martin Bailey (1971) Chapter 4 for patterns of IS-LM in the stationary economy.



Graph 1-3. Bailey Model



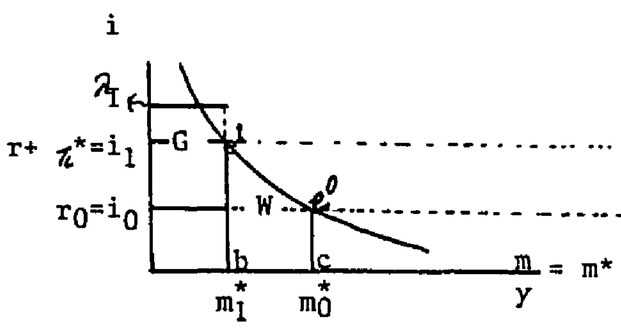
Graph 1-4. Bailey Model in IS-LM Space

On Graph 1-4, FF is the line which shows a fixed real income ($\bar{y}$) and various levels of the money rate of interest. The line is fixed income schedule which is compatible with the Bailey model. That is, when we draw and LM schedule under the condition that real interest rate is fixed at every level of aggregate real income respectively (nominal interest rate is not fixed), the schedule of LM will be like those in Graph 1-4.

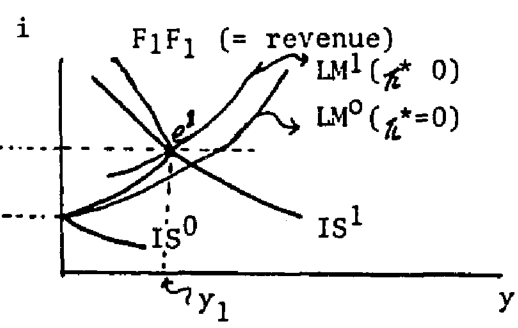
It is obvious from the above graphs that the Baily model ignores the goods market which the IS schedule portrays. If we imagine an IS schedule and plot it n Graph 1-4, the imagined schedule will be one which corresponds to FF at e^0 when the expected rate of inflation is zero, and will shift vertically by any expected rate of inflation. This is assured because of the assumption of neutrality of monetary policy in the rational expectation hypothesis; since the IS schedule is originally plotted over real rate of interest vs. real income, the vertically shifted line will show the same real rate of interest rate corresponding to any real income level. Now, IS will meet e^1 on the graph 1-4, and the distance e^1e^0 will be the expected rate of inflation. However, IS-LM neglects welfare implications of the expansion rate of quantity of money. We see from Graph 1-3 that the welfare cost occurs as the equilibrium changes from e^0 to e^1 on Graph 1-4. Thus even though there is no change in real income in the rational expectation hypothesis, there occurs a welfare cost from a change in liquidity. In Chapter 4, the magnitude and significance of the welfare cost will be dealt with.

In the case of autonomous growth, the FF line will be shifting as real income changes with time; the expected rate of inflation (π^*) is now the difference between the nominal quantity of money expansion rate and the autonomous growth rate. Therefore computation of government revenue and welfare cost should be amended; otherwise the discussion will be the same as in the Bailey case. Thus, the relationship between autonomous growth model and IS-LM model will not be discussed separately.

IS-LM and Induced Growth Model: Graphs 1-5 and 1-6 illustrate the case of induced growth with inflationary finance in relation to IS-LM. For simplicity, it is assumed there is no autonomous growth, and so all growth is produced by the induced growth.



Graph 1-5. Inflationary Finance with Induced Growth



Graph 1-6. Induced Growth in IS-LM Space

The liquidity preference schedule on Graph 1-5 was drawn as a ratio of real money balances to real income with the assumption that the income elasticity of real money balances is unity. $_m{}^*$ on the Graph 1-5 denotes "liquidity preference as a ration to real income."

At a certain point of time, we may observe that the nominal rate of interest (i) equals i_1 and the real money balance is m_1^* as Graph 1-5 indicates. The corresponding point on the rightside graph is e^1. The situation shows that the expansion rate of the nominal quantity of money is: $\rho=\pi^*+\lambda_I$ where λ_I is the induced growth rate of real income in a steady state with a growth rate (ρ) of nominal quantity of money. Here the expansion rate of nominal quantity of money is the rate which maximizes government revenue, and accordingly maximizes induced growth. Government revenue as a ratio to real income will be: $G^*=\rho m_1^*$ on the graph 1-5, and welfare cost as a ratio to income (W*) will be found when the real output (y) equals y_1 on Graph 1-6, where e^1 is the equilibrium point on the LM schedule (of the money market). The line F_1F_1 is the locus of each alternative real revenue and nominal interest rate which are decided by the government's inflationary finance for the induced growth. Since the highest real income growth is designated by e^1 on Graph 1-6, a higher expansion rate of nominal quantity of money would bring about a higher expected rate of inflation, along with a lower government revenue for capital formation, and a lower real income growth rate. Accordingly, the F_1F_1 schedule has negative slope above the point e^1. On the IS-LM space (Graph 1-6), there is no IS schedule which is derived from the left Graph (1-5) just as with the Bailey model. Here also we may imagine IS and LM schedules like IS^0, IS^1, LM^0, and

LM^1 on Graph 1-6 for each point on the F_1F_1 schedule with proper assumptions as in the Bailey case. The welfare cost from the above situation will be the area e^1bce^0 in Graph 1-5, corresponding to the government revenue ρm_1*. The welfare cost with the induced growth will be discussed further in Chapter 5.

CHAPTER 2

THE BANKING SYSTEM IN SOUTH KOREA

This chapter is designed with the purpose of helping to grasp the mechanism of the government's money creation. The same banking system, of course, may be described differently depending upon our point of view. If we study, for example the capital market in Korea, we may as well write about the financial system with focus on the role of banks in issues and trades of securities, and in this case we will give more attention to the securities market than to the banking system. Since the main theme of the dissertation is "government's money creation," the focus will be given to the Bank of Korea, the central bank of the country.

Thus, after the overall structure of the financial system of Korea is delineated in the first section of this chapter, the Bank of Korea's business in relation with its partners, including the government, will be described.

2.1 OVERALL ASPECTS OF THE FINANCIAL SYSTEM IN SOUTH KOREA

As Table 2-1 illustrates, the financial system in Korea, excluding the government, may be divided into two categories: the banking system and the nonbanking financial institutions. The former consists of the central bank (the Bank of Korea) and the Deposit Money Banks. Deposit Money Banks (DMB) are the banks which do the conventional deposit business. Moreover, Deposit Money Banks are separated into the commercial banks and the special banks. Commercial banks are basically similar to

TABLE 2-1

FINANCIAL STRUCTURE IN KOREA

- Financial System
  - Gov't
    - Fin. Minis.
  - Banking System
    - Centl Bank
      - Bank of Korea
    - Deposit Mon. Banks
      - Commer. B's
        - Nat'l City Banks (5)
          - Cho-heung
          - Comm. B of Korea
          - Kor. First B
          - Hanil
          - B of Seoul & Trust Co.
        - Local Banks (10)
        - Foreign Bank Branch Offices (11)
      - Spec. B's
        - Kor. Devel. B
        - Kor. Exch. B
        - Midi. Indus. B
        - Citiz. Nat'l B
        - Kor. Hous.
        - Kor. Exp. Imp.
        - Nat'l Agri. Coop. Fed.
        - Cent. Fed. of Fish. Coop..
  - Nonbanking Fin. System
    - Nonban. Fin. Insti.
      - Short-T Fin. Co.
      - Mutual Cre. Co.
      - Kor. Trust Bank
      - Insu. Co.
      - Kor. Dev. Fin. Cor.
      - Land Bank
      - Nat'l Inv. Fund
      - Post. Savings
      - Cre. Coop.
    - Secur. Mkt.
      - Kor. Stock Exch.
      - Secur. Comp.
      - Kor. Inv. Corp.
      - Comm. Banks Secu. Dept.
      - Kor. Dev. Fin. Corp.
      - Short-T Fin. Co.
    - Priv. Mon. Mkt.

Note: Figures in parentheses denote the number of banks or offices.

those in Europe and the United States. These commercial banks have adopted the branch banking system with nationwide or provincewide networks. As of the end of September 1974, commercial banks in Korea comprise five nationwide city banks, ten local banks, eleven branches of foreign banks. Unlike the system of the United States, there is no distinction between members or non-members of the Federal Reserve System. All commercial banks are regarded as the same as member banks in the United States.

With regard to the city banks, a strong uniformity prevails in their business. Interest rates are agreed upon by the Bankers Association with maximum rates set by the Bank of Korea. This uniformity is facilitated by the fact that more than one half of the equity capital of the banks is held by the government and dividend payments are determined uniformly by the government - the largest share-holder.

Special banks are banks which were established by law for a particular purpose to receive certain government funds. The Korea Development Bank and the Korea Exchange Bank, for example, are special banks which were founded for development financing and for foreign exchange business and trade financing, respectively.[1]

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[1] The role of each special bank and nonbanking financial institutions is self-evident by its name. However, if the role in detail of each bank and institution is of concern, the book, "Financial System in Korea" published by the Bank of Korea , 1974, can be consulted. The whole chapter of this paper was partly based on the book and the Bank of Korea Act.

One of the characteristics of the banking pattern of Korea is that the special banks share considerable part of all banking activities. Table 2-2 illustrates how much the special banks share in all the banking activities in terms of the aggregate assets and number of branches.

TABLE 2-2

AGGREGATE ASSETS AND NUMBER OF BRANCHES BY TYPE OF BANK

(As of the End of 1973)

	Amount (In Billion Won)	Percentage Composition (%)	Number of Branch Offices
Commercial Banks	1,784	47.6	495
Special Banks	1,963	52.4	768
Banking Sector Totals	3,747	100.0	1,263

However, all special banks take various deposits from the public and assume loan activities in the same way as the commercial banks in addition to taking some unique role according to the purpose of existence of the special bank, and so they are subject to money and credit regulations of the government and of the Bank of Korea, as are the commercial banks.

Thus, from the point of view of money creation, the two types of banks are considered in one category, that is, Deposit Money Banks. In the next section, the relationship between the Bank of Korea and Deposit Money Banks will be described without discussing commercial banks and special banks separately.

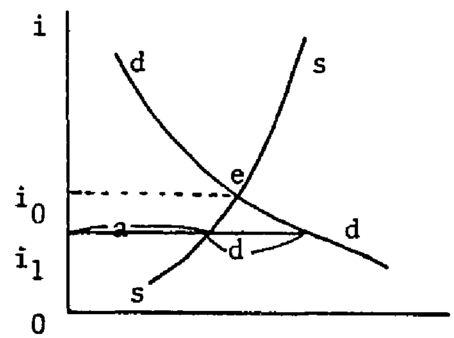
The nonbanking financial system is divided into three parts:

1. Nonbanking financial institutions,
2. Securities market and
3. The private money market.

Nonbanking financial institutions are such financial institutions as insurance companies, and mutual credit companies which are different from the banking institutions by the fact that the former do not take demand deposits, i.e., the typical banking business, and so the liabilities of these institutions do not account for the bulk of the means of payments in the economy.

The securities market is a market of transactions of securities, such as stocks and bonds. The securities market consists of the issue market and the trading market. The issue market is the place where new issues are offered and sold. It facilitates raising of funds for the issuers and provides a wider choice for placing funds for the investors. The trading market is the place where securities already issued are bought and sold. It performs the function of assisting securities in forming their prices, informing the public of those prices, and assuring the liquidity of securities, thereby allowing short-term funds to be invested in long-term securities. The Korea Stock Exchange plays the role of the trading market in Korea.

The private money market is a financial segment which the monetary authorities cannot regulate or control directly. It is often labeled "curb market" or "unorganized money market." One important feature in the financial markets in Korea is the fact that this curb market has traditionally prevailed. It was so partly because the bank interest rates of both deposits and loans tended to be far lower than the interest rate prevailing in the private money market, which reflected the market conditions of the chronically excessive demands for bank funds.



Graph 2-1. Excess Demand for Bank Funds with Lower Pegged Interest Rate

This is illustrated in Graph 2-1: A common demand-supply disequilibrium situation. i_o is the equilibrium nominal interest rate. Since the actual nominal rate is fixed at i_1 which is lower than i_o, excess demand (d) occurs, and so the supply of bank funds (a) at the interest rate i_1 must be rationed. However, there were two events which curtailed the curb market in Korea. The first was the drastic upward adjustment (normalization) of bank rates, in 1965, to the levels almost as high as curb market rates in order to induce private savings into banking institutions. The second event was the presidential emergency decree for economic stability and growth in August 1972, and the following enactment of some acts under which the private money market was led to its virtual demise. Under these acts the government banned any pseudofinancial company or professional brokerage houses in the private money market and encouraged the establishment of authorized financial markets. As a result, corporations' use of the private money market dropped markedly in 1973, as funds flowed out into the short-term money markets. Thus, the private money market in Korea was particularly important as a financing source, but since 1972 the private money market in Korea has not been so important a factor.

Though this non-financial system altogether affects the flow of funds in the economy significantly, the non-financial system is staying outside of the money and credit control of the Bank of Korea and so is not directly related with the government's inflationary finance. The nonbanking financial system will be able to be disregarded in the discussion of government's money creation.

2.2 MONEY CREATION OF THE BANK OF KOREA

The Bank of Korea, founded in 1950, is the Korean Central Bank. The Bank of Korea, like other countries' central banks, functions as the bank of note issue, the bank of banks, the bank for the government, and the bank responsible for formulating and implementing monetary policies.

Each function of the Bank of Korea will be described in terms of the changes in money supply associated with the activities of the Bank.

Currency Issue: As the sole bank authorized to issue currency in Korea, the Bank of Korea has the exclusive right to issue currency in any form, style and denomination. The currency thus issued is given the authority of legal tender to be circulated without limit in the country for all debts, private and public. The bank is not required to maintain any prescribed minimum ratio of gold or foreign exchange against its note issue. This accounts for the fact that Korea is under a completely managed currency system in which the note issue relies ultimately on the decision of the monetary authorities.

The unit of Korean currency is the "won" and the basic exchange rate for dollars by the Bank of Korea is 484 won to 1 dollar as of December 31, 1976.

There are two kinds of currency, that is, paper money and coins, as in the United States.

The Bank of Korea holds a lot of unissued currency, but those unissued currency are not counted as "currency in circulation" since the currency in circulation is counted as the currency which has been issued from the Bank of Korea's counter minus the holding currency of the Deposit Money Banks.

<u>The Relationship of the Bank of Korea to Deposit Money Banks</u>: The Bank of Korea receives deposits from Deposit Money Banks and gives these banks loans and rediscounting.

The deposits from banking institutions consist of the reserve deposits and deposits of the Monetary Stabilization Account.

Reserve deposits are used as the basis for clearing checks and settling interbank balances by which the Bank exercises its function as a central clearing agency as well as those deposits which are used for the legal reserve requirement against the deposits which the Deposit Money Banks received.

The deposits of the Money Stabilization Account were established in 1967 in order to control the temporary excess liquidity position of banking institutions as a complementary instrument to the legal reserve requirement policy. The funds compulsorily deposited in the Monetary Stabilization Account are not regarded as a portion of legal reserve requirements and are subject to a special interest rate of 5 per cent per annum.

The Bank of Korea has a discretionary power to ensure a flexible use of the variable reserve requirements for the purpose of credit control. Changes in reserve requirements, being appliwe compulsorily, are said to have a strong or structual effect on the nation's money and banking system.

In order to curb growing inflationary pressures in the process of rapid economic growth, relatively high ratios of reserve requirements have been imposed upon banking institutions. The trend of changes in reserve requirements ratios is as Table 2-3 on the next page indicates.

One distinctive feature due to the application of high reserve requirements is that until July 1973 the Bank of Korea frequently paid interest on reserve deposits of Deposit Money Banks to compensate for interest losses accrued due to the legal reserve deposits. The Bank of Korea Act article #56 stipulates allowing the interest payment on reserve deposits.

On the other hand, the Bank of Korea conducts credit operations with banking institutions in the form of rediscounts, loans, and purchases of credit documents including promissory notes and bills of exchange according to the terms and conditions under The Bank of Korea

TABLE 2-3

CHANGES IN RESERVE REQUIREMENT RATIOS

In per cent for deposits
Won Currency

Effective From	Time & Savings Deposits			Demand Deposits	
8/2/1962	10			20	
1/1/1964	10			15	
3/1/1964	10			20	
5/1/1964	10			12	
6/16/1965	10			16	
	Long-Term	Short-Term			
12/1/1965	10	12		20	
2/1/1966	15#	20#		35#	
2/16/1967	15#	20#		35#	
11/16/1967	18	25		35	
1/1/1968	18		Applied only to deposits of agricul-TURAL Cooperatives	32	Applied only to deposits of Agricultural Co-operatives
9/16/1968	18	15		32	25
10/1/1968	18	15		32	25
1/1/1971	16	13		26	20
11/1/1971	12	10		18	15
12/16/1972	14	12		19	16
5/16/1973	18	16		22	19
8/1/1974	15	13		19	16
1/1/1975	17	15		21	18
3/1/1975	16	14		23	20
7/1/1975	17	15		24	21
4/16/1976	17	12		24	17

#: For the period from October 1, 1966 to March 31, 1967, 50% of Marginal Reserve Ratio for demand deposits and 45% for Time and Savings deposits were applied.

Source: The Bank of Korea's Monthly Economic Statistics, and the Bank's "Twenty-five Years' History" published in June, 1975.

Act. In addition, the Bank of Korea may grant advances to banking institutions in periods of grave emergency when monetary and banking stability is directly threatened. And the interest rate variations on this credit to banking institutions is used as a monetary policy, as is well known.

Some of the stipulations in the Bank of Korea Act regarding the Bank of Korea's rediscounting, loans, and purchasing credit documents to the banking institutions are as in the following excerpt from the Bank of Korea Act:

Article #69 of the Bank of Korea Act:

The Bank of Korea may conduct the following credit operations with banking instructions:

1. Rediscounting, buying and selling promissory notes, bills of exchange, and other credit documents acquired by banking institutions as a result of operations associated with:

   (i) The production or processing of agricultural, pastoral, fishery or industrial products, provided that the maturities of the documents do not exceed one year from the date of their acquisition by the Bank of Korea.

   (ii) The importation, exportation, purchase, sale or transport of readily saleable products, provided that the maturities of the documents do not exceed six months from the date of their acquisition by the Bank of Korea.

   (iv) Loans to government agencies, provided that the maturities of the documents do not exceed one year from the date of their acquisition by the Bank of Korea, and that the loans in question are legally authorized by the National Assembly and guaranteed by the government.

2. Granting advances for fixed periods, not to exceed one year against the following types of collateral:

   (i) The credit document specified in (1) of this article

   (ii) Negotiable securities representing obligations of, or obligations guaranteed by, the government of the Republic of Korea, etc.

The Relationship of the Bank of Korea to the Treasury: Bank of Korea deals in the receipt and disbursement of treasury funds as the official depository of the funds of the government. The Bank of Korea also makes advances and loans to the Treasury on overdrafts or in other forms, or may make direct purchase of government bonds.

On the other hand, the Bank of Korea conducts business related to issuance, redemption and registration of government bonds on behalf of the Treasury.

The Bank of Korea receives also deposits from the National Investment Fund and funds for promotion of machinery industries which are both government funds.

And the Bank of Korea Act stipulates that the Bank of Korea must make an effort to curtain credit to the government's agencies.

The net annual profit accruing to the Bank of Korea is to be paid into the General Revenue Account of the government, while the net loss accruing to the Bank of Korea is made up for by the government.

Finally, the treasury business of the Bank of Korea is handled not only at the head and branch offices of the Bank of Korea, but also by the Bank's treasury agencies among offices of banking institutions including treasury revenue agencies.

The Relationship of the Bank of Korea to the Nonbanking Financial System: The Bank of Korea ordinarily deals with the banking system, the government and its agencies, foreign governments and its agencies, foreign and international financial institutions, and the United Nations in addition to:

1. Buying ans selling securities as open market operation
2. Lending in case of serious money and credit tightness
3. Buying and selling precious metals like gold bullion from the public. Accordingly, the Bank of Korea is principally prohibited from any kind of business with the nonbanking financial system.

Open Market Operations: In Korea, as in most developing countries, open market operations are not the principal instrument of monetary management. This is so because the short-term securities market is not highly developed in the country as yet. The Bank of Korea has issued Monetary Stabilization Bonds only since 1961 in order to aim the ordinary effects of open market operations, and has managed government securities only under unusually adverse credit conditions. "Open" market operations in Korea actually is usually restricted only to the deposit member banks; the public seldom has direct participation. Open market operations will take more important role in future as the security market is more developed.

Table 2-4 on page 33 reveals that government bonds (which are related with the central bank's open market operations) are negligible as the amount is .2 billion won and the share is about zero; on the debit side of the table. Monetary tabilization Bonds on the credit side of the table shares only 3.9 percent in total liabilities and net worth, and so the bonds will share less than 3.9 percent in the monetary base (currency in circulation plus reserves of deposit member banks, with some adjustments) is less than total liabilities and net worth of the Bank of Korea. These accounts will permit us to infer that open market operations are not main tool of monetary management in Korea.

The Bank of Korea's Foreign Exchange Control: Prior to the establishment of the Korean Exchange Bank in 1967, the Bank of Korea assumed responsibility for all foreign exchange services in Korea, including opening of letters of credit, buying and selling of foreign exchange, etc.

However, the Bank is now engaged only in such foreign exchange business as determining foreign exchange rate,[2] intervening in the foreign certificate market, managing foreign exchange assets as official reserves, etc.

As far as money supply is concerned, Korea has a system of centralization of foreign exchange and so the Bank of Korea holds a major portion of foreign exchange assets in Korea. So, foreign exchange in Korea is principally concentrated into the Bank of Korea through the foreign exchange banks,[3] and so inflow of foreign exchange into Korea increases money supply of won currency, and vice versa.

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[2] A unitary floating exchange rate system has been in effect since 1965 with the intention of allowing the exchange rate to be determined by the demand and supply of foreign exchange in the market. However, the concentration rate which is used when the foreign exchange is concentrated into the Bank of Korea is determined by the Bank of Korea and this concentration rate affects all other foreign exchange rates including customer rates which are quoted by the foreign exchange banks to their customers. Thus by deciding the concentratin rate, the Bank of Korea has influence over the foreign exchange rates determinations.

[3] The foreign exchange banks are the banks which are permitted to do foreign exchange business.

Changes of money supply due to inflows and outflows of foreign exchange, however, is exogeneous in the sense that those changes are not subject to the money supply control of the Bank of Korea. Those changes depend upon the foreign exchange transactions in connection with international trade, investment, service of capital and the like. However, these foreign exchange movements affect money supply considerably. In Korea from 1963 to 1976 changes of money supply due to foreign exchange flows is as Table 2-4 illustrates.

TABLE 2-4. CHANGES OF MONEY SUPPLY DUE TO FOREIGN EXCHANGE FLOWS

(Money=M_1)

	Change of Money Supply Due to Foreign Exchange (A)	Total Change of Money Supply (B)	Ratio of Change Due to Foreign Exchange to Total Change (A/B)
	Million Won	Million Won	%
1963	-7,492	2,555	-293.2
1964	7,489	6,989	107.2
1965	6,799	16,715	40.7
1966	33,206	19,465	170.6
1967	28,659	37,915	75.6
1968	902	54,860	1.6
1969	26,591	74,149	35.9
1970	2,306	55,594	4.1
1971	-72,490	50,373	-143.9
1972	64,723	161,419	40.1
1973	197,080	210,904	93.4
1974	-479,187	215,410	-222.5
1975	-53,373	236,038	-22.6
1976	512,439	362,298	141.4
TOTAL	267,652	1,504,684	17.8

SOURCE: The Bank of Korea's "Economic Statistics Yearbook 1977"

Summary of This Section: The Bank of Korea in Relation to its Money Creation: As a summary of this section in order to make the description so far clear and to help in studying the government's money creation, the statement of conditions of the Bank of Korea will be presented here. Table 2-5 shows that the loans and discounts account shares more than half in total assets. This account will be related with the inflationary finance, as discussed in Chapter 4.

TABLE 2-5

STATEMENT OF CONDITION OF THE BANK OF KOREA

Assets	Amount in Bill. Won	Comp. %	Liabilities & Net Worth	Amount In Bill. Won	Comp. %
Cash & bills	49.9	1.7	Bank notes & coins issued	736.3	25.4
Loans & discounts	1,583.6	54.6			
to banks	686.4	23.7			
to Government	787.2	27.1	Deposits	1,030.3	35.5
to Govt. agencies	110.0	3.8	Reserve deposits	695.3	24.0
			Import guarantees	258.8	8.9
Government Bonds	.2%	0	Private deposits	6.2	.2
			For curren.deposits	34.3	1.2
			Mone Stab. Account	35.7	1.2
Deposits with domestic banks in foreign currency	260.0	9.0	Gov't. deposits	297.6	13.7
Foreign assets	748.2	25.8	Special loan funds from Government	10.8	.4
Foreign securities					
Due from banks abroad	634.6	21.9	Mone. Stab. Bonds	114.4	3.9
Holdings of SDRs	3.8	.1			
Subscrip. to int'l. finan. institu.	54.3	1.9			
Gold & silver bull.	.8	0	For liabilities #	356.6	12.3
Others	1.3	.1			
			Non-resident deposits	184.1	6.3
Fixed assets	98.2	3.4			
			SDRs allocated	12.4	.4
Others	161.1	5.5			
			Liabili. to int'l. finan. institu.	33.8	1.7
			Reserve & profits	95.3	3.3
			Others	157.4	5.5
Total	2,901.2	100.0	Total	2,901.2	100.0

NOTE: #; the foreign liabilities include interoffice a/c, borrowings from foreign banks, for foreign exchange balances, etc.

Source: The Bank of Korea's Economic Stat. Yearbook 1977.

CHAPTER 3

DEMAND FOR MONEY IN SOUTH KOREA

This chapter is devoted to estimating parameters of the demand-for-money function as are required for studying government revenue through money creation as well as its welfare cost. In order to make comparisons and to be consistant with other students of inflationary finance, the generally used Cagan's functional form will be adopted, and the parameters will be estimated with Korean data during the recent development period of 1963-76. No theoretical development is pretended in this chapter. The estimated parameters will permit simple discussions regarding Korean monetary phenomena.

3.1 THE CONVENTIONAL FUNCTIONAL FORM

The demand for real money balances is assumed to be primarily a function of real income and the nominal interest rate. That is,

$$(M/P)^d = f(y, i), \qquad (3\text{-}1)$$

where

M = aggregate nominal quantity of money defined in any manner

P = price level,

d = a superscript meaning "desired,"

y = aggregate real income, and

i = nominal rate of interest

The real quantity of money always adjusts itself to equal the desired quantity of real balances, assuming that people adjust the price level in order to produce the real quantity of money they want even though the nominal quantity of money, M, is determined by the monetary authorities. Thus the demand for real balances is assumed to be equal always to the supply of money. This assumption is confirmed by the following paragraph of Laidler (1969; p. 88):

"...there is quite a bit of evidence that the results for the demand for money are not in fact greatly or importantly altered by taking explicit account of the supply side of the market."

Accordingly,

$$(M/P)^d = (M/P)^s, \qquad (3\text{-}2)$$

where "s" denotes "supplied." Since, with the assumed equality of demand and supply, equation (3-1) may simply be written:

$$M/P = f(y, i) \qquad (3\text{-}3)$$

The identification problem is also avoided by this assumption simply because it makes the system a single-equation system.[1]

The so-called Cagan's functional form of real money balances will be used here. Thus:

$$M/P = y^b e^{-\lambda i + \gamma}. \qquad (3\text{-}4)$$

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[1] For further discussions about the identification problem of the demand for money, see David E. W. Laidler, (1969; pp. 85-88).

Assuming that the nominal interest rate is replaced by the sum of a constant real rate plus the expected rate of inflation, equation (3-4) becomes:

$$M/P = y^b e^{-\lambda(r+\pi^*) + \gamma} \qquad (3\text{-}5)$$

In logarithmic form the equation becomes:

$$\ln (M/P) = \gamma + b\ln y - \lambda(r+\pi^*), \qquad (3\text{-}6)$$

where "b" is a constant referring to the income elasticity of the real money balances

defined as $b = \dfrac{\partial \ln(M/P)}{\partial \ln y}$,

λ is a constant which refers to the semi-elasticity defined as

$\dfrac{\partial \ln(M/P)}{\partial i}$ with $i = r + \pi^*$,

r = the constant real rate of interest,

π^* = the expected rate of inflation, and

γ = a constant parameter.

Empirical evaluation will be discussed in the next section; first we turn our attention to the real rate of interest and the expected rate of inflation, the components of the nominal rate of interest.

In both theory and reality, the real rate of interest is of course not constant - at least in the strict sense.

In Mundell's modell,[2] for example, the real rate of interest varies

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[2] Robert Mundell, "Inflation and Real Interest," JPE, June, 1963, pp.280-283.

in opposite direction to the changes of the price level, while in a more generalized model presented by Mussa,[3] the direction of change of the real rate of interest depends upon the values of the parameters of the functions in the system.

On the other hand, the traditional interest theory proposes a variety of interest concepts. One of which, for example, is the interest concept of the marginal productivity of capital. In studies of inflationary finance, we follow Irving Fisher's well-known monetary concept of interest[4] - that the nominal rate of interest equals the real rate of interest plus the expected rate of inflation. The competitive market interest rate which will properly explain real money balances is not observable in most developing countries, as is well known and mentioned in the previous chapter. What is observable in these countries, on the other hand, is the official nominal interest rate more or less pegged by the monetary authorities.

An attempt was made, following Chorng-huey Wong,[5] to explain the function of demand for real money balances through some other proxy variables for the nominal rate of interest.

Those proxy variables are rediscount rates, legal reserve rates,

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[3] Michael Mussa, "Equity, Interest, and the Stability of the Inflationary Process," JMCB, 1975, p. 440.

[4] Irving Fisher, "The Theory of Interest," Augustus M. Kelly, Published 1970.

[5] Chorng-huey Wong, "Demand for Money in Developing Countries: Some Theoretical and Empirical Results," JME, April (1977), pp. 59-86.

negative of domestic credit income ratio, etc., which measure the degree of credit restraint. However, the proxy variables were not very statistically significant compared with highly significant real income variable. So, the regression results will not be presented here.

It is argued that although the demand for real balances is sensitive to changes in the anticipated rate of inflation it is not sensitive to changes in the real rate of interest because a given change in the market rate due to fluctuations in the real rate of return on capital will affect household consumption vs. savings choices with little impact on the composition of desired asset portfolios, including the demand for money. Moreover, the real rate is said to be remarkably stable despite very high changes of nominal rates by empirical study.[6] Thus, the real rate of interest appearing in the liquidity preference function is assumed to be constant, making the theoretical discussion of inflationary finance-our main theme- much simplified. The average growth rate of aggregate real income will be used simply as a proxy for the real rate of interest.[7]

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[6] Milton Friedman, "A Theoretical Framework for Monetary Analysis," in Milton Friedman's Monetary Framework," ed. by Robert Gordon, University of Chicago, 1970, p. 37.

[7] For the logic with regard to using the growth rate of aggregate real income as the proxy of the real rate of interest, see Milton Friedman (1970) op.cit., pp. 36-38.

The expected rate of inflation will be obtained by means of the adaptive expectation model used by Phillip Cagan:[8]

$$\pi_t^* = (1-e^{-\beta}) \sum_{x=0}^{T} \pi_{t-x} e^{-\beta x} \qquad (3\text{-}7)$$

where π_t^* is the expected rate of inflation at time t, β is the coefficient of expectation defined as $\dot{\pi}^* = \beta(\pi - \pi^*)$, T is an arbitrary limit of the summation, and π_t is the actual rate of inflation at time t.

The expected rate of inflation formed in this way, as is well known, becomes a weighted moving average of past rates of inflation in which greater weight is given to more recent rates of inflation than to those in the more distant past. No doubt other factors (such as a general election in near future) may have some considerable effects. We recognize that these adaptive expectations could not be strictly correct because information other than that captured in the past history of a variable must affect anticipations. These adaptive expectations will almost invariably differ from "rational expectations" (the predictions implied by the model itself, contingent on the information economic agents are assumed to have). Only in a few exceptional circumstances, for example, in the case of the government raising some

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[8] Phillip Cagan, "The Monetary Dynamics of Hyperinflation" in "Studies in the Quantity Theory of Money" ed. by Milton Friedman, 1956, pp. 37-39.

constant amount of revenue through money creation,[9] the adaptive expectational model will coincide with the rational expectation model as Sargent & Wallace demonstrate. Generally, adaptive expectations will be rational if no other information besides the past behaviour of a variable can improve predictions. The adaptive expectations, moreover, are thought to be serviceable approximations.

3.2 ESTIMATION OF DEMAND FOR MONEY

Table 3-1 shows estimates from fitting equation (3-6) to Korean quarterly data for the period of 1963-1976, the development period in South Korea.

TABLE 3-1

$$\ln(M/P) = \gamma + b\ln y - \lambda\,(r+\pi^{e})$$

Definition of M	Coefficient of Expectation, β	Estimated Coefficient of			R^2	DW
		γ	b	λ		
M 1	.1	-1.4	1.164 (33.3) (SE .0473)	6.8 (-2.22)	.9590	1.51*
M 1	.3	-1.8	1.182 (33.3)	.8 (- .55)	.9554	1.40
M 1	.5	-1.9	1.186 (33.3)	-.2	.9552	1.38

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9 Thomas J. Sargent and Neil Wallace, "Rational Expectations and the Dynamics of Hyperinflation," IER, June, 1973, pp. 334-336.

NOTE: The results are obtained with ordinary least squares.

The numbers in parentheses are t values

▲ denotes 5 percent level of significance

* denotes $d_L < d < d_U$

M1 - currency in circulation plus demand deposits in deposit money banks: M1 was chosen because M1 is usually considered as money; M1 is also important in the theory of inflationary finance as will be discussed in the following chapter. The data was calculated by averaging 3 months' end-of-month stocks for the quarter. The data was obtained from the Bank of Korea's Economic Statistics Yearbook - 1977. The unit of M1 used in the regression is billion.

P - Seoul Consumer Price Index: The base year is 1975. The data were calculated by averaging 3 months' end-of-month indexes for the quarter, and the data were obtained from the Bank of Korea's Economic Statistics Yearbook - 1977 as for M1.

y - Aggregate Real Income: Gross National Products in real terms: The raw data were obtained from the Bank of Korea's "National Income in Korea" - 1975, and the data of 1976 were obtained via direct inquiry to the National Income Section, Department of Research, Bank of Korea. The raw data of the quarterly aggregate GNP were deseasonalized by the method in Johnston (Econometric Methods 2nd Edition, pp. 187-188) which involves regressing the raw data on an expended matrix [P D], where P is an appropriate set of powers of time and D is a matrix of seasonal dummy variables. The regression for seasonal adjustment is as follows:

$$y = 1{,}091 + 62\ PA - .3\ PB + .02\ PC + 1{,}057\ DA + 560\ DB + 4{,}189\ DC, \qquad (3\text{-}8)$$

where PA, PB, and PC are the set of variables P which will capture systematic trend component, and D is the set of seasonal dummies which will show the seasonal component. PA is the set of first powers of time, PB is the set of 2nd powers of time, and PC is the set of 3rd powers of time. DA is the 2nd season dummy variable, DB represents 3rd season dummy variable, and DC represents 4th season dummy variable. The deseasonalized series is calculated by subtracting the coefficients of the dummy variables from the relevant season's raw data. Income data only were converted to deseasonalized figures because this data shows great seasonal fluctuations than other data. The 4th season of the year as shown from the results of the regression above shows much higher seasonal value than other three seasons shown by the coefficient of DC in equation (3-8). The reason is that in the country the agricultural sector is predominant; thus the gross national product reflects more seasonal variation.

The permanent income concept is not used, mainly because the income data is only available from the first quarter of 1960 and so probably will be distorted seriously when we calculate the permanent income for 1963-1976, since we need many previous data values in order to calculate the permanent income.

<u>$r + \pi^*$- the constant real rate of interest plus the expected rate of inflation as proxy for nominal rate of interest</u>: This variable was discussed in the previous section. "r" is calculated by averaging the quarterly growth rate of aggregate real income from 1953-1976.

As a reference for comparison, the results from two other methods of treating the lags in the demand function of real money balances are presented in Table 3-1':

TABLE 3-1'

$\ln(M/P) = \gamma + b\ln y - \lambda(r+\pi^*)$ or $\ln(M/P)^* = \gamma + b\ln y - \lambda(r+\pi)$ in the case of the stock adjustment hypothesis

	$\hat{\gamma}$	$\hat{b}$	$\hat{\lambda}$	R^2	DW
Cagan's adaptive	-1.4	1.164 (33.3)	6.8 (-2.22)	.9590	1.51
Stock adjustment[10]	.6	1.150 (12.1)	.049 (.54)	.9579	Durbin's h 2.99
Koyck	1.06	1.100 (11.98)	.79 (2.02)	.9606	(-)

NOTE: The estimates of the Cagan's adaptive model are the same as those in Table 3-1 on page 41, and the general concepts of the stock adjustment and Koyck schemes will be present in almost every econometrics text books.

Note of Table 3-1 is valid also for this table.

"Cagan's adaptive" shows the most probable estimate of the interest coefficient λ. Milton Friedman assumed the value as 2 - 20 per annum,[11] while Martin Bailey estimated the value as 2.3 - 8.7 with the various nations' monthly data.[12]

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10 Damodar Gujarati, "The Demand for Money in India," The Journal of Development Studies, Volume V, No. 1, 1968, pp. 59-64.

11 Milton Friedman (1971), "Government Revenue from Inflation," p. 852.

12 Martin Bailey (1956), "The Welfare Cost of Inflationar Finance," p. 99.

3-3 SOME ANALYSES WITH EMPIRICAL RESULTS

As shown on Table 3-1, the best fit of β which maximizes R^2, the coefficient of determination, is .1 per quarter. The highest value of R^2 (.9590) appears in the first low of the regression results.

Estimates of the income elasticity, b, are somewhat greater than unity as shown on Table 3-1. We will test statistically the null hypothesis that income elasticity of money balances is unity. The t-value for the test is:

$$t = \frac{b-1}{S.E\ (b)}$$

$$= \frac{1.1641-1}{.04733}$$

$$= 3.467 \qquad \text{for } \beta = .1$$

$t_{.99\ df53} = 2.4$; We therefore reject the null hypothesis that income elasticity is unity. The other two estimated values of b's (for β=.3, and β=.5) are both greater than the first, and so in both cases the null hypothesis that b=1 will also be rejected. From this result we may infer that money is a luxury, as did Milton Friedman.

The semi-elasticity, λ, reflects the negative correlation between the values of λ and β. When greater β are used, the price change will have greater influence on the expected rate of inflation; λ will be less, and conversely, because the same change of dependent variable, Ln(M/P), will be explained by less change of π^* when β is lower.

The value of Durbin-Watson statistics for β = .1 shows "inconclusiveness" on serial correlation. Attempts were made to correct the serial correlation, if any, by means of the two-step Cochrane-Orcutt method and the Drubin two step estimator,[13] but the original estimates of the coefficients deteriorated unduly; therefore the estimates after serial correction are not presented here, and the corrected estimates will not be used in the discussion of inflationary finance in the next chapter.

The set of t-values in parentheses in Table 3-1 confirms the argument that income is the predominant variable in explaining demand for money in the developing countries.

When we take the antilog of the estimates in the case $\beta = .1$, from the first row of the table 3-1, we find:

$$M/P = y^{b} e^{-\lambda (r+\pi^{*}) + \gamma}$$

$$= y^{1.2} \exp\ [-6.8\ (.02 + \pi^{*})\ -1.4] \qquad (3\text{-}9)$$

for a quarterly model and M as M1.

The data thus far were taken from the period 1963-1976. We will now examine, using the Chow test, whether the demand for money function was stable or not between the predevelopment period and the development period.

Since we have data from 1960, the test will be the homogeneity of the constant term and slope coefficients together between those values

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13 J. Johnston, Economic Methods 2nd ed., pp. 262-264.

for 1960-1962 and the estimates for 1963-1976. The test is interesting in itself, and helps understanding the liquidity preference function in the circumstances of the economic and institutional changes. The test is as follows:[14]

From the above regression for 1963-1976, the residual sum of squares $e_1'e_1$ is 1.007 with df 53, while the sum of squares e'e which is computed from the 1960-1976 (12 quarter data were added from the data for 1963-1976) is 3.333 with df 65. The test of the null hypothesis that the 12 additional observations obey the same relation as the first is:

$$F = \frac{(e'e - e_1'e_1)/12}{e_1'.e_1/53} = 10.9$$

Since $F_{.01}(12,53) = 2.6$, the Chow test rejects the null hypothesis. Thus, we may infer that there was some change in the demand for money function during the development period compared with the period before the high income growth period. Since the additional observations are not enough in number, above Chow test will be proper because regression with 12 observations may not compute reasonable parameters, but the complete analysis[15] of covariance will be practiced for test of overall homogeneity of intercepts and slope vectors:

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14 Johnston, *op.cit.*, p. 207.

15 Johnston, *op.cit.*, pp. 198-199.

(A) Sum of residuals (differential slopes and intercepts)
= 1.079; df = 62

(B) Sum of residuals (differential intercepts)
= 2.585; df = 64

(C) Sum of residuals (no differentials)
= 3.333; df = 65

(D=B-A) Incremental (differential slope)
= 1.506; df = 2

(E=C-B) Incremental (differential intercepts)
= .748; df = 1

For the F test,

$$F = \frac{(D+E) \; / \; (\text{df of } D + \text{df of } E)}{A/ \; (\text{df of } A)}$$

$$= 43.2$$

Since $F_{.01}$ (3,62) = 3.2, the test rejects the null hypothesis that the overall homogeneity of slope and intercept terms between pre- and post-1963.

The known stability condition for the expected rate of inflation is that the product of the semi-elasticity (λ) and the coefficient of coefficient of expectation (β). From equation (3-9) we see $\lambda = 6.8$, when $\beta = .1$. The product of the two terms is then .68. Since it is less than unity, the expected rate of inflation is stable, that is, it does not produce self-generating inflation. Thus, the possibility that the inflation might become explosive is not a problem for the country if the economy keeps the parameters in the liquidity preference function the same as those of equation (3-9).

3.4 TIME TRENDS OF MONETARY INDICES

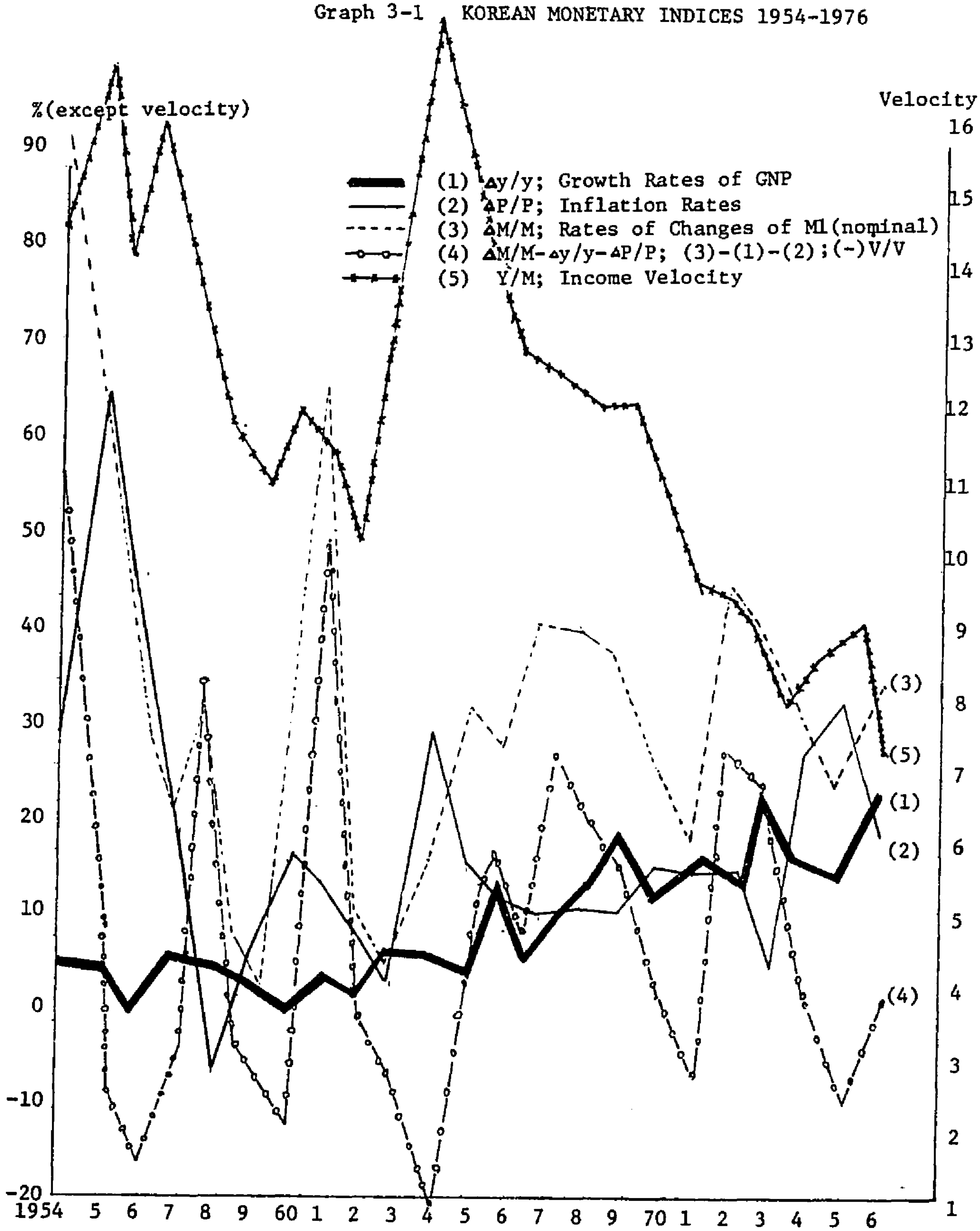
We may now employ the results of estimation to analyze the actual time trends of monetary and related indices during the period under study with a visual graph. It will help us to understand the monetary aspects of Korea during the period of the high growth of aggregate real income.

Equation (3.9) with its estimated parameters indicates a real income elasticity higher than unity. We can then infer that the real balances of money have increased proportionately more than the real income, so long as the expected rates of inflation have not gone up significantly as to increase the income velocity. Since the real money balances are the nominal quantities of money divided by the price level, then if the real quantity of money has increased proportionately more than the real income, this fact implies that growth rate of nominal quantity of money have been greater than growth rates of price level plus growth rates of aggregate real income on the average during the period. The income velocity then declines because of velocity trend is the growth rate of aggregate real income plus the inflation rate minus the growth rate of the aggregate nominal quantity of money. Graph 3-1 shows that income velocity has fallen as expected. These aspects will be analyzed formally as follows:

The estimated liquidity preference function, equation (3-9), taken into logalithmic form, and differentiated with respect to t, yields:

$$6.8\ \dot{\pi}^{*} - .2h = h - \rho + \pi \qquad (3\text{-}10)$$

Graph 3-1 . KOREAN MONETARY INDICES 1954-1976



where $\dot{\pi}^* = \frac{d\pi^*}{dt}$, that is, time derivative of the expected rate of inflation

$h = \frac{dy}{dt}\frac{1}{y}$, that is, growth rate of aggregate real income,

$\rho = \frac{dM}{dt}\frac{1}{M}$, that is, growth rate of nominal quantity of total money (M1), and

$\pi = \frac{dP}{dt}\frac{1}{P}$, that is, inflation rate.

Since by equation (3-7) π^* is a function of past values of π until time t, $\dot{\pi}^*$ is also a function of past values of $\dot{\pi}$. Thus equation (3-10) is:

$$6.8\ f[\dot{\pi}(\sim t)] - .2h = h - \rho + \pi, \qquad (3\text{-}11)$$

where $\dot{\pi}(\sim t)$ denotes all the values of the $\dot{\pi}$ until time t.

From the quantity equation; MV = Py, taking logarithm and differentiating with respect to t, we have:

$$\dot{V}/V = h - \rho + \pi \qquad (3\text{-}12)$$

From equation (3-11) and equation (3-12), we get:

$$\dot{V}/V = 6.8\ f[\dot{\pi}(\sim t)] - .2h = h - \rho + \pi \qquad (3\text{-}13)$$

Equation (3-13) denotes the velocity trend as a function of the change of actual rate of inflation ($\dot{\pi}$), and of the growth rate (h) of aggregate real income. If $\dot{\pi}$ is zero in general, income velocity decreases as the aggregate growth rate of income, (h), is positive. Graph 3-1 shows that the velocity did generally decline during the period 1963-1976, indicating that the price change did not so increase as to reverse the income effect on velocity.

Graph 3-1 illustrates also the possibility of temporarily producing much more government revenue through money creation by utilizing the lag of inflation behind the difference between the growth rate of the quantity of money in nominal terms and the growth rate of real income. The line #4 in Graph 3-1 indicates this aspect of the lag of inflation. In the steady state economy, $\dot{V}/V$ will remain zero, therefore $\rho - \pi - h = (-)\ \dot{V}/V = 0$. The fact that $(-)\ \dot{v}/v$ remained above the zero level indicates the deviation of the actual Korean economy from the steady state, which permits the government to raise more revenue than in the steady state. Thus, $(-)\ \dot{V}/V$ will show the degree of lag of the economy from the steady state.

The growth rate of price level (Graph 3-1, line #2) shows much more stability during the high income growth period compared with the figures of the predevelopment period (before 1963). The growth rate of the quantity of money (line #3) also showed much more stability during the post-1963 period compared with pre-1963 period. The appearance of Graph 3-1 suggests that the parameters of the demand-for-money function have changed between the pre- and post-development periods. The Chow test and covariance analysis of previous section did in fact reject the homogeneity of parameters of the demand function between the two periods 1960-1962 and 1963-1976.

CHAPTER 4

GOVERNMENT REVENUE THROUGH MONEY CREATION IN SOUTH KOREA

In this chapter the precise identity of the actual government revenue will be discussed and calculated with Korean data. Later, the maximum government revenue and its welfare cost will be discussed with combined assumptions of steady state economy and price rigidity. Finally, efficiency considerations will be discussed with marginal welfare cost of inflationary finance.

The main concern throughout the chapter is evaluation of inflationary finance in terms of its significance and efficiency in raising the government revenue.

4.1 ACTUAL GOVERNMENT REVENUE IN A RECENT DEVELOPMENT PERIOD

In the literature, changes of currency are simply assumed as government revenue. There are, however, problems in practical calculation of actual government revenue from inflationary finance because of duality and complexity of the actual monetary system where money issued for government revenue is intermingled with money issued due to other factors. One of the most significant of these factors is foreign exchange as shown on page 32 of Chapter 2. 17.8% of the total change of money supply during the period of 1963-1976 was caused by foreign exchange flows. Another one of these factors is changes of currency due to the government's ordinary tax receipts and expenditure payments. Actually all cash transactions of the Bank of Korea-including the Bank's own expenditure payments and transactions between the central bank and deposit money banks[1]- give rise to changes in the amount of currency issued.

If this were not the case - that is, if all issuing currency were counted as government revenue - we could then obtain the quantity of government revenue through money creation simply by calculating the change of total currency outstanding.

In addition, with less restricted conditions, if all issued money were counted as government revenue, and if the Bank of Korea were engaged in transactions related only to reserve deposits of deposit money banks and individual deposits to the central bank, we could count government revenue through money creation by calculating changes of high powered money defined as currency outstanding plus reserves of the deposit money banks and individual deposits in the central bank. In this case the government revenue through money creation would be identical to the changes in the values shown in the last column of Table 4-1 below.

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1 Deposit money banks are illustrated in Chapter 2, Section 1.

TABLE 4-1.

HIGH POWERED MONEY AND ITS COMPOSITION

	Currency in Circulation		Currency in DMB		DMB's Reserves to BOK		Priv. Sect. Depo. to BOK		Total High Pow. Money
	Won (bill.)	Share %	Won (bill.)	Share %	Won (bill.)	Share %	Won (bill.)	Share %	Won (bill.)
1963	18.3	65.8	3.6	12.9	5.9	21.3	-	-	28.9
1964	24.9	76.4	3.0	9.2	4.7	14.4	-	-	32.6
1965	31.6	65.4	3.6	7.5	11.0	22.8	2.1	4.3	48.3
1966	42.9	53.6	3.6	4.5	31.6	39.5	2.0	2.4	80.1
1967	57.6	52.7	10.4	9.5	39.9	36.5	1.4	1.3	109.3
1968	81.9	52.5	13.8	8.8	56.2	36.0	4.2	2.7	156.1
1969	111.3	51.5	18.6	8.6	82.4	38.1	3.7	1.7	216.0
1970	133.7	44.6	25.2	8.4	136.7	45.6	4.1	1.4	299.7
1971	162.1	56.2	24.7	8.6	99.7	34.6	1.7	.6	288.2
1972	217.7	50.9	27.3	6.4	170.5	39.9	12.0	2.8	427.5
1973	311.4	49.8	42.3	6.8	268.2	43.0	2.2	.4	624.1
1974	410.5	53.0	44.1	5.7	312.1	40.3	8.4	1.0	775.1
1975	507.2	47.1	53.7	5.0	503.3	46.7	12.9	1.2	1,077.1
1976	676.8	47.1	59.5	4.1	695.3	48.4	6.2	.4	1,437.8

Source: The Bank of Korea's "Economic Statistics Yearbook" 1964-1977

Another practical consideration is the fact that the government itself shares the inflationary tax payment because the government also holds money (currency including all deposits) and the value of the government's money holdings depreciates due to the inflation generated by money creation. The government shares the inflationary tax payments according to the proportion of its holdings in the total money supply of the economy; time and savings deposits, however, are excluded from the inflationary tax since we assume indexed interests are paid for those deposit when price level changes.

Thus, the "net government revenue from inflationary finance" (G) is defined as the "gross government revenue through inflationary finance" (G) defined as the amount of money creation which should be counted as government revenue minus the amount of depreciation of the government's money holdings which occurs due to change of price level, $(\Delta \hat{m}^g)$.

Thus, the net government revenue in real terms at time t is written as:

$$\hat{G}_t = G_t - \Delta \hat{m}_t^g$$

$$= G_t - (M_t^g/P_{t-1} - M_t^g/P_t), \qquad (4\text{-}1)$$

where M_t^g denotes the nominal quantity of government's money holdings at time t, P_t the price level at time t, and other notations as above.

It is assumed that interest payments and receipts of government's borrowings and loans are offset each other in order not to influence the balance due to inflation.

The gross government revenue from inflationary finance, G in equation (4-1), will be obtained first, and other term, $\Delta \hat{m}^g$, will be calculated later.

As foresaid, the observable changes of currency in circulation or of high powered money does not represent the level of government money creation through inflationary finance.

Accordingly, government revenue must be observed by extracting only relevant accounts from all those that record money issuings due to all causes. This work is facilitated by the fact that in Korea all currency is issued by the Bank of Korea as described in Chapter 2. Currency is not issued by the Ministry of Finance as by the Treasury in the United States; therefore the government can create money only via the central bank, the Bank of Korea. Thus, we can obtain the quantity of government money creation by examining exclusively transactions of the Bank of Korea.

On the other side of the coin, the gross government revenue, G, can be counted by examining the sources of financing the government's budget, and the noncentral banks' and public's transations with the central bank.

Both ways of computing government money creation should by definition produce identical results. The first method, however, that of obtaining this revenue by examining cash transactions of the Bank of Korea is obviously simpler.

Table 4-2 on page 53 shows the values of relevant accounts (selected from the Bank of Korea's balance sheet) for the government's inflationary money issuings, in both nominal and real terms. Here the central bank's loans both to government agencies and to deposit money banks were included in actual government revenue because those loans have the same economic effects as loans directly to the government from the central bank.

The relevant Article #69 of the "Bank of Korea Act" is described (in excerpt) in Chapter 2, Section 2. Every type of loan extended under this Act by the Bank of Korea to other banking institutions, as well as to government agencies, should be regarded as the government's inflationary finance - even though these loans do not appear on the central government's budget.

On the other hand, deposits made for monetary stability by non-central banks to the central bank, as well as stability bonds[2] which the central bank issued to the deposit money banks, were subtracted from the inflationary finance from the reason that those items have economic effects of reducing the inflationary tax.

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[2] Deposits for monetary stability and stability bonds are described in Chapter 2, Section 2.

TABLE 4-2

ACTUAL GOVERNMENT REVENUE FROM INFLATIONARY FINANCE I

In Billion Won

	Advances to Gov't. from Central Bank (1)	Gov't.Bonds Held by Central Bank (2)	Loans to Gov't. Agencies (3)	Loans & Discounts to DMB (4)	Deposit for Mon. Stabili. (-) (5)	Stabili. Bonds Issued (-) (6)	Total Nominal Gov't. Revenue (7)	Total Real Gov't. Revenue (8=7/P)
1963	-1.6	1.2	2.1	2.9	0	-.4	5.0	11.4
1964	1.7	-.1	-.4	3.2	0	0	4.4	8.3
1965	3.7	0	10.2	-.7	0	0	13.2	33.5
1966	-2.4	0	6.2	-.8	0	4.6	-1.6	-2.4
1967	2.6	-.2	1.6	5.9	7.6	2.3	-.2	-.3
1968	-6.3	.1	7.8	6.9	1.8	-1.3	8.0	9.7
1969	10.3	-.6	4.1	16.3	-8.6	16.2	22.4	23.9
1970	5.1	-.3	-2.0	54.6	.2	21.6	78.8	73.6
1971	-3.9	-.5	2.0	21.8	2.5	20.8	-3.9	-3.3
1972	117.5	22.4	2.0	67.7	3.2	17.9	188.5	148.4
1973	41.5	-22.5	9.0	100.7	2.8	13.8	112.1	82.2
1974	191.4	0	-23.0	386.5	-9.6	-51.4	615.9	358.5
1975	268.0	0	90.0	19.6	67.2	25.2	285.2	130.4
1976	128.6	-11.1	0	.3	-31.6	87.9	61.5	25.3

Source: The Bank of Korea's "Economic Statistics Yearbook" 1964-1977

The other item for calculating the net government revenue, $M_t^g/P_{t-1} - M_t^g/P_t$ in equation (4-1), was obtained from government money holdings at the flow of funds accounts in Korea, and consumer price index. The government money holdings, M^g, consists of the government currency holdings, demand deposits to deposit money banks and deposits with Bank of Korea, including those of government enterprises.

Table 4-3 shows the actual government revenue items of equation (4-1) and two types of ratios: net government revenue aggregate output ratios, and net government revenue gross domestic capital formation ratios.

The sixth row of Table 4-3 is identical to the last column of Table 4-2; both show the gross government revenue through money creation in real terms , G.

Under the assumption that net government revenue is wholly invested for capital formation (following Mundell 1965 and Marty 1967), the 9th row of Table 4-3 shows the net government revenue/gross national product ratio as 1.6 percent on average, and the 11th row of the same table shows the net government revenue/gross domestic capital formation ratio as 6.1 percent on average. From these two ratios we can readily infer the gross domestic capital formation/gross national product ratio as follows:

$$\frac{\Delta K}{Y} = \frac{\hat{G}/Y}{\hat{G}/\Delta K} = \frac{1.6\%}{6.1\%} \doteq .26, \qquad (4\text{-}2)$$

where ΔK denotes change of capital stock, which is assumed to be identical to domestic capital formation, and Y the gross national product in real terms. That is, 26 percent of gross national product on average was invested for capital formation during the period.

To infer the increase in gross national product due to inflationary finance, if the pattern of the above ratios is invariable, we proceed as follows:

TABLE 4-3

ACTUAL GOVERNMENT REVENUE FROM INFLATIONARY FINANCE II

In Billion Won

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	
(1) M^g_t ('62:34)	18	22	27	29	31	33	37	47	43	99	119	177	285	487	
(2) P_t%	44	53	59	68	75	83	94	107	116	127	136	171	219	243	
(3) M^g_t/P_{t-1}	52	50	51	49	46	44	45	50	40	85	94	130	166	223	
(4) M^g_t/P_t	40	42	46	42	42	40	39	44	37	78	88	103	130	200	
(5) m^g (3-4)	12	9	5	7	5	4	5	6	3	7	6	27	35	22	
(6) G	11	8	22	-2	0	10	24	74	-3	148	82	358	130	25	
(7) $\hat{G}$ (6-5)	0	-4	18	-9	-5	6	19	67	-6	141	76	332	95	3	
(8) Y	1328	1422	1530	1719	1853	2087	2400	2589	2827	3023	3507	3811	4129	4768	
(9) $\hat{G}/Y$ %	0	0	1	-.5	-.3	.3	.8	2.6	-.2	5	2	9	2	.1	Ave. 1.6%
(10) GDCF#	225	188	197	317	368	509	714	705	749	668	920	1091	1101	1288	
(11) $\hat{G}$/GDCF# %	0	0	9.0	-2.8	-1.3	1.1	2.6	9.6	-.9	21.2	8.2	30.4	9.	.2	Ave. 6.1%

#: GDCF stands for "Gross Domestic Capital Formation"

Source: The Bank of Korea's "Economic Statistical Yearbook" 1963-1976, and the Bank's "Flow of Funds Accounts in Korea" 1963-1976.

We assume that the gross national product is proportional to the stock of capital as assumed in Harrod-Domar model, and that the capital coefficient , defined at Y = K, is .25, and that the real rate of interest is 7.9 percent per annum as in the previous chapter. The neo-classical growth model then gives the share of capital in total output as

$$\frac{K}{Y}.r = 4 \times .079 = .316 \tag{4-3}$$

And since we assume that $\hat{G}/\Delta K$ is constant, it follows that

$$\frac{\sum^{T}\hat{G}_t}{\sum^{T}\Delta K_t} = \frac{\sum^{T}\hat{G}_t}{K_T} = .061 \tag{4-4}$$

The total capital share, 31.6 percent in equation (4-3), multiplied by the ratio of capital formation by inflationary finance over total capital stock, 6.1 percent in equation (4-4), generates the share of capital formed by inflationary finance, 1.9 percent.

The result shows that aggregate real income level increases by 1.9% due to inflationary finance.

On the other hand, the actual value of welfare cost accompanying the inflationary finance can not easily be obtained because of various lags in the liquidity preference function. There might be welfare benefit rather than welfare cost from inflationary finance during the Korean development period since 1963. Provided the welfare cost is negligible, the 1.9 percent of gross national product attributed to inflationary finance is a credit of the finance.

Some relationships between inflationary finance and its welfare cost under more severe assumptions will be discussed in the next section.

4.2 MAXIMUM GOVERNMENT REVENUE AND ITS WELFARE COST IN A STEADY STATE ECONOMY

In a steady state economy where total quantity of money balances, government money holdings, quantity of money issued by the government as inflationary finance, income, etc. grow at the same constant rate, the share of the government money holdings in the total money supply is constant, as is the ration of inflationary finance to the change in total money supply, compared with same terms, nominal or real.

Thus, net government revenue in equation (4-1) in the previous section may be rewritten as:

$$\begin{aligned} \hat{G} &= G - \Delta \hat{m}^{g} \\ &= \rho ms - \rho mj \\ &= \rho m(s-j), \end{aligned} \qquad (4\text{-}5)$$

where

ρ = growth rate of total money supply,

m = real quantity of total money supply,

s = ration of currency issued for government revenue to the change of total money supply, and

j = ratio of government money holdings to the total money supply

In equation (4-5), ρm represents the total inflationary tax which the whole economy pays, and "s" represents the portion of tax received by the government, and "j" represents the portion of tax paid by the government due to its money holdings. Thus, when "s" equals "j", the

the net government revenue from inflationary finance becomes zero.

Since the ratio of total money supply to aggregate income is independent of the growth of aggregate income in the steady state economy (where real income elasticity of real money balances is unity), equation (4 5) may be transformed by dividing both sides by the aggregate real income:

$$\hat{G}' = \rho m' (s-j), \tag{4-6}$$

where $\hat{G}'$ and m' denote net government inflationary revenue and aggregate real balance, each in ratio to aggregate real income, respectively.

With the so-called Cagan's model of the liquidity preference function $m' = e^{-\lambda(r + \pi^*) + \gamma}$, the total money supply growth rate ρ_{max} generating maximum government revenue is the inverse of the semi-elasticity of real money balance with respect to π^*, the expected rate of inflation, as well known. At the maximum government revenue, the elasticity of real money balance with respect to ρ equals unity; the elasticity of m'(s-j) with respect to ρ is also unity since (s-j) is a constant. Then m'(s-j) will be the liquidity preference function for calculating net government revenue while m' is total liquidity preference function as a ratio to income.

Thus, assuming the liquidity preference function equation (3-9) in Chapter 3 with chosen estimated parameters, the quarterly growth rate of money supply, since we are using a quarterly model, is:

$$\rho_{max} = 1/\lambda = 1/6.8 = 15\% \tag{4-7}$$

At this growth rate of the aggregate money supply, the expected (= actual) rate of inflation, π^*_{max}, per quarter is:

$$\pi^*_{max} = \rho_{max} - \dot{Y}/Y$$

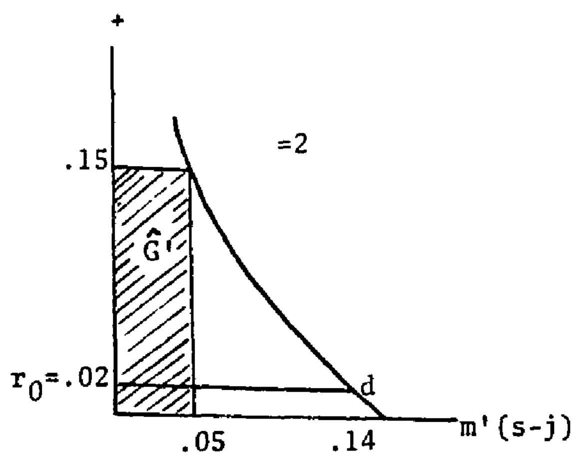
$$= 15\% - 2\%$$

$$= 13\% \qquad (4\text{-}8)$$

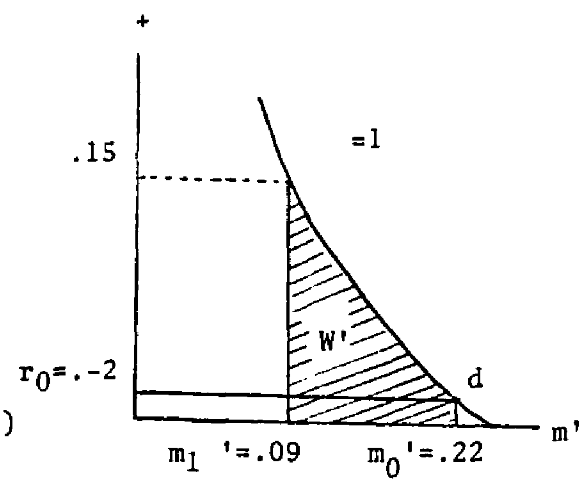
where $\dot{Y}/Y$ denotes quarterly aggregate real income growth rate, and 2% is the actual growth rate in Korea during the period of 1960-1976.

Graph (4-1) on page 59 illustrates the government revenue of equation (4-6) at its maximum in the same scale of units for Korea. It will be compared with the welfare cost later.

On the other hand, welfare cost of inflationary finance as a ratio to income is given generally by:



Graph 4-1. Maximum Government Revenue



Graph 4-2. The Welfare Cost at the Maximum Government Revenue

$$W' = \int_{m_1'}^{m_o'} i(m')\, dm', \tag{4-9}$$

where

m_o' = real money balance as a ratio to income when inflationary finance is zero,

m_1' = real money balance as a ratio to income when inflationary finance is collected,

i = nominal rate of interest as before.

Since i equals $\frac{\gamma - \ln m'}{\lambda}$, as transformed from the liquidity preference function $m' = e^{-\lambda(r+\pi^*)+\gamma}$, equation (4-9) becomes:

$$W' = \frac{-1}{\lambda} \int_{m_1'}^{m_o'} (\ln m' - \gamma)\, dm', \tag{4-10}$$

and applying a suitable integration rule yields:

$$W' = 1/\lambda \left\{ m_1'(\ln m_1' - 1 - \gamma) - m_o'(\ln m_o' - 1 - \gamma) \right\} \tag{4-11}$$

Dividing equation (4-11) by equation (4-6) yields the average welfare cost of inflationary finance as follows:

$$\frac{W'}{\hat{G}'} \quad \frac{m_1' (\ln m_1' - 1 - \gamma) - m_o' (\ln m_o' - 1 - \gamma)}{\lambda \rho m_1' (s-j)} \tag{4-12}$$

At the maximum government revenue, $\lambda\rho$ equals unity, and accordingly the average cost is calculated by

$$\frac{W'_{max}}{\hat{G}'_{max}} = \frac{-2e^{-\lambda\pi^*} + \lambda r + 1}{e^{-\lambda\pi^*}(s-j)} \qquad (4\text{-}13)$$

In reality, the aggregate price level will not fall readily because of institutional, spiritual or other factors, even though prices of some goods may decrease exceptionally. In calculating the values of G', W', and W'/G' with a set of parameters estimated from Korean data, the assumption derived from both the expectation (not realization) of downward stickness of price level and the rigidity of nominal rate of interest may be combined with the steady state assumptions as follows:

It is always regitimate that

$$i = r_0 + \pi^* \text{ and}$$
$$= \dot{M}/M - \dot{Y}/Y.$$

But

$$\pi^* = \pi \quad \text{when} \quad \pi > 0$$
$$\pi^* = 0 \quad \text{when} \quad \pi \leq 0. \quad \text{Thus } i = r_0 + \pi^* = r_0 \quad \text{when} \quad \pi \leq 0.$$

This assumption makes the right-hand segment of the demand curve beyond point "d" on the graphs 4-1 and 4-2 irrelevant, for π^* is never negative in the economy. The maximum aggregate real quantity of money (M1) is indicated by m_0' on the graph 4-2. Real quantity of money changes upward along the liquidity schedule from the point "d" at both graphs. With this generally realistic and simplifying assumption, the welfare cost is simply obtained.

If the growth rate of the nominal quantity of money is less than or equal to the growth rate of aggregate real income, π^* equals zero; thus the welfare cost is nil, and government revenue is $\rho m_0'$ (s-j). If the money growth rate is greater than the growth rate of aggregate real income (making π or π^* positive) the welfare cost is the shaded area below the liquidity preference schedule in Graph (4-2), and government revenue is then $\rho m_1'$ (s-j).

Using the estimated values $\rho_{max} = .15$, $\lambda = 6.8$, $\bar{r} = .02$, $\pi^*_{max} = .13$, $\gamma = -1.4$, and $\pi^* = 0$ when $\rho \leq \bar{r}$, and with calculated values of s = .96 and j = .33 for the Korean development period, equation (4-5), (4-11), and (4-13) now yield:

$$\hat{G}'_{max} = .9\%$$

$$W'_{max} = 1.1\% \qquad (4\text{-}14)$$

$$\frac{W'_{max}}{\hat{G}'_{max}} = 120\%$$

Comparing this .9 percent of maximum government revenue from inflationary finance to the 1.5 percent of actual government revenue suggests lags in the demand for money function which permit more actual revenue in the transition period than the maximum in the steady state.

The average cost, 120 percent, is seriously high. It is so partly because, as seen in equation (4-6), the inflationary tax of as much as 33% (j=.33) levied on the government due to its money holdings was subtracted from government revenue from money creation.

Even this value of 120 percent may be biased in favor of inflationary finance because the area of the right part of the liquidity preference function (beyond the real quantity of money at the constant real rate of interest $\bar{r}$) was not calculated by the assumption of downward expected price rigidity though it is not significant here.

Because of the difficulties in estimating the exact parameters in the liquidity preference function-particularly regarding the interest variable-these calculated values are themselves not very valuable; it will therefore be sufficient to observe that the average cost of inflationary finance is considerably high with the parameters chosen and with the steady state and downward price rigidity assumptions.

We may also qualify a direct comparison of welfare cost with revenue, since with the assumption that marginal utility of commodity is constant, as discussed in page 5 of this paper.

With these results at equation (4-14), the share of capital in aggregate product formed by inflationary finance is obtained as 1.1 percent, compared with 1.9 percent of the share of actual government revenue obtained in the previous section.

The marginal welfare cost of inflationary finance in terms of more precise efficiency consideration will be examined in the following section.

CHAPTER 5

MARGINAL COST AND EFFICIENCY OF INFLATIONARY FINANCE IN A STEADY STATE ECONOMY

As is known, an optimal tax mix equalizes each ratio of marginal change in deadweight loss to marginal change in tax revenue. By analogy, an optimal expenditure mix will equalize each ratio of marginal change in net benefit, as an aggregate of all benefits accrued to all individuals, to the marginal change in expenditure. More general equilibrium will additionally require equalizing both sets of ratios. That is, for all taxes and expenditures,

$$\frac{dW_1}{dG_1} = \frac{dW_2}{dG_2} = \ldots\ldots\ldots\ldots = \frac{dB_1}{dE_1} = \frac{dB_2}{dE_2} = \ldots\ldots\ldots\ldots, \qquad (5\text{-}1)$$

where W_i denotes deadweight loss of tax i, G_i tax revenue from tax i, B_i net benefit total from expenditure i, and E_i expenditure i.

In this paper, we assume that equality between the $dW_i\,/dG_i$ is sufficient to imply all the remaining conditions, or alternatively, that total government revenue is determined from the expenditure side (so that we are to look for the second best of minimizing the welfare loss for a given government revenue). In either case, the issue is that of equilibrium between the marginal cost per unit of the government revenue through money creation and the marginal cost per unit of alternative revenue, since the inflationary tax may be simply considered as one among many other taxes.

Thus, the ratio of marginal deadweight loss to the marginal revenue of inflationary finance will be obtained, and this welfare cost will be compared with the marginal costs of other taxes. An analysis which doesn't consider the cross-effect of inflationary tax may not be general, as Professor Marty pointed out.[3] However, this marginal loss/revenue ratio equalization is perfectly compatible with the modern optimum taxation theories which have been developed by Wicksell (1896), Ramsey (1927), and Boiteux (1956), and have later been re-examined by Baumol (1970), Lerner (1970), Dixit (1970), Sandmo (1974), etc. inasmuch as the proportional tax rule, inverse elasticity rule, or variants from these rules are all intended to equalize the marginal welfare-loss/marginal-revenue ratios.[4] This is true even though there are variety of methods of counting the loss and revenue, for example, whether or not including the production side.

In the first subsection, a formula for the ratio of marginal deadweight loss to marginal government revenue of inflationary finance without induced growth will be noted, generally following the literature, with this paper's definition of government revenue through money creation, and with some advanced mathematical ideas. Numerical values will then be calculated with the derived formula and with Korean data, and these will be compared with those of ordinary taxes.

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[3] Alvin Marty, mimeo, 1975, p. 15.

[4] Avinash Dixit, "On the Optimum Structure of Commodity Taxes", AER, June, 1970, p. 298.

The second subsection will be concerned with a formula for the case with induced growth. The steady state that the income elasticity of real money balances is unity will be maintained.

5.1 MARGINAL COST IN THE ABSENCE OF INDUCED GROWTH

From equations (4-6) and (4-9), the marginal cost of inflationary finance with no induced growth is:

$$\frac{dW}{d\hat{G}} = \frac{dW'}{d\hat{G}'} \quad \text{(since we don't consider income-change due to change of } \rho \text{)}$$

$$= \frac{dW'/d\rho}{d\hat{G}'/d\rho}$$

$$= \frac{\dfrac{dm_1'}{d\rho}\,\dfrac{dw'}{dm_1'}}{\dfrac{d\hat{G}'}{d\rho}} \qquad \text{(by chain rule)}$$

$$= \frac{\dfrac{dm_1'}{d\rho}\,\dfrac{d}{dm_1'}\left[\displaystyle\int_{m_1'}^{m'} i(m')\,dm'\right]}{\dfrac{d[\rho m_1' \;(s-j)]}{d\rho}}$$

$$= \frac{-i(m_1')\;dm_1'/d\rho}{[m_1' + \rho(dm_1'/d\rho)]\;(s-j)} \tag{5.2}$$

Dividing numerator and denominator by m_1' yields the elasticity form as:

$$\frac{dW'}{dG'} = \frac{\eta_{m_1', i}}{(1-\eta_{m_1', \rho})\ (s-j)} \tag{5-3}$$

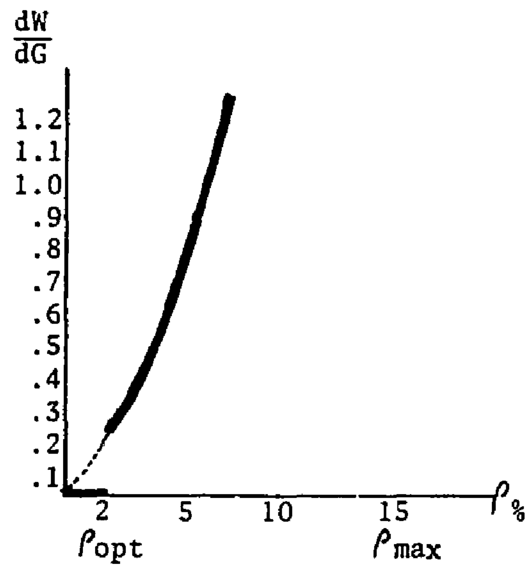
where $\eta_{m_1', i}$ is the elasticity of m_1' with respect to i, and $\eta_{m_1', \rho}$ is the elasticity of m_1' with respect to ρ.

With Cagan's functional form of real money balances, $m' = e^{-\lambda i + \gamma}$, and with the assumption that the constant real rate of interest equals the average growth rate of aggregate real income, both of the elasticities, $\eta_{m_1', i}$ and $\eta_{m_1', \rho}$, are $\lambda\rho$. Thus, equation (5-3) becomes:

$$\frac{dW'}{d\hat{G}'} = \frac{\lambda\rho}{(1-\lambda\rho)\ (s-j)} \tag{5-4}$$

The Graph 5-1 illustrates dW'/dG' vs. ρ with Korean parameters, that is, as $dW'/dG' = \frac{6.8\ \rho}{(1-6.8\ \rho)\ (s-j)}$ On the other hand, with the assumption of downward expectation of price stickiness as in the previous section, the total welfare cost is zero until ρ rises up to the constant real rate of interest, r, equivalent to the autonomous aggregate real income growth rate. Thus, the marginal welfare cost of inflationary finance is also zero when ρ is less than or equal to r. The marginal cost increases rapidly as ρ approaches $1/\lambda$.

Graph 5-1. M. C. with No Induced Growth



At ρ_{max}, that is, at the growth rate of quantity of money which generates the maximum government revenue ($\rho_{max} = i/\lambda = 1/6.8 = .15$), the marginal cost approaches infinity. When ρ is bigger than ρ_{max}, the marginal cost, $dW'/d\hat{G}'$ is negative. The negative marginal cost is interpreted as signifying that the welfare cost continues to rise as government revenue now starts to decline. In the state, therefore, the right-hand segment ($\rho > \rho_{max}$) is irrelevant. The monetary authorities will not maintain $\rho > \rho_{max}$.

On the other hand, knowledge of the marginal costs of other taxes which are obtained on the same conditions as those for the marginal cost of inflationary finance is not available. Nevertheless, there are some estimates of the marginal costs of other taxes calculated with other authors' assumptions. For example, Edgar Browning (1976) gives 9 percent in the case of proportional taxation and 16 percent in the case of progressive taxation as the actual marginal cost of the income tax, including administrative and compliance costs, using United States data, while Harberger (1964) estimates a 5 percent as the highest actual marginal cost of the income tax. All these values of marginal costs of other taxes are less than the 25 percent cost of inflationary finance. The 25 percent is the minimum value of marginal cost for inflationary finance when growth rate of quantity of money is greater then growth rate of aggregate real income, 2 percent, as shown on the graph 5-1.

This result shows that the money growth rate should be equal to the aggregate income growth rate, as is commonly supposed as an actual policy alternative.

At higher growth rate of nominal quantity of money than that which generates maximum government revenue, government revenue will begin to decline. Hypothetically, at an infinite growth rate of money creation, the government revenue through money creation will approach zero accordingly as the real quantity of money balances (which is the tax base) approaches zero.

5.2 MARGINAL COST WITH INDUCED GROWTH

Given the aggregate real quantity of money (M1) as before:

$$m = ye^{-\lambda\rho} + \Upsilon \qquad (5\text{-}5)$$

We now postulate an aggregate production function as before

$$y = \sigma K \qquad (5\text{-}6)$$

with the assumption

$$K = \sum\Delta\tilde{K} + \sum\hat{G}$$

$$= \tilde{K} + \sum\hat{G} \qquad (5\text{-}7)$$

$\Delta\tilde{K}$ is the autonomous investment, and $\hat{G}$ is the amount of induced investment raised by inflationary finance dependent on the growth rate of monetary expansion, ρ.

Since in equation (5-7) K is a function of ρ alone, equation (5-6) implies that y is also a function of ρ. We may choose to write this functional relationship as

$$y = \bar{y}[1+h\ (\rho)], \tag{5-8}$$

$\bar{y}$ being the aggregate product when inflationary finance is zero [that is, $\bar{y}=f(\tilde{K})$], and $h(\rho)$ denotes the function of aggregate real income growth induced by inflationary finance, as a function of ρ.

The growth of aggregate income is assumed to be proportional to the total capital formed jointly by an autonomous capital increase ($\Delta\tilde{K}$) and by the induced capital increase [$\hat{G}(\rho)$], giving the functional form

$$h = \frac{\bar{r}\ \hat{G}(\rho)}{\Delta\tilde{K}}, \tag{5-9}$$

$\bar{r}$ being the growth due to autonomous capital increase when $\hat{G}(\rho)$ is zero. This assumption is rather rational in the steady state where population can be imagined to grow according to total capital growth. While the ordinary growth theory assumes that capital growth adjusts to an exogenous population growth, we presume here the reverse that population growth adjusts to a capital growth.

Particularly in the developing countries, the assumption of population growth adjusting to total capital growth will not be unrealistic, considering a reserve army of labor.

The government revenue through inflationary finance, $\hat{G}\ (\rho)$, is with equations (5-5) and (5-8),

$$\begin{aligned}\hat{G}(\rho) &= \rho\, m(s-j)\\ &= \rho\, \bar{y}(1+h)e^{-\lambda\rho+\gamma}\ (s-j)\end{aligned} \tag{5-10}$$

When equation (5-10) is substituted in equation (5-9), we get:

$$h(\rho) = Z[1+h(\rho)] \tag{5-11}$$

where $Z = \dfrac{\bar{r}\,\rho\,\bar{y}e^{-\lambda\rho+\gamma}(s-j)}{\Delta\tilde{K}}$.

When equation (5-11) is solved for h:

$$h = Z/(1-Z) \tag{5-12}$$

We can see a multiplier effect of inflationary finance from this result.

When h from equation (5-12) is substituted in equation (5-10), we get:

$$\frac{d\hat{G}}{d\rho} = \frac{d\{\rho\,\bar{y}[1+h(\rho)]e^{-\lambda\rho+\gamma}(s-j)}{d\rho} \tag{5-13}$$

Equation (5-13) will generate the marginal government revenue when the growth rate of aggregate real quantity of money, ρ, increases.

On the other hand, the welfare cost as a function of ρ is, with equation (5-10),

$$W = \bar{y}(1+h)\int_{m_1'(\rho)}^{m_0'(r+h)} i(m')\,dm_1' \tag{5-14}$$

Following the process of deriving equations (5-10) and (5-11), we have from equation (5-14):

$$W = \bar{y}(1+h)\frac{-1}{\lambda}\int_{m'(\rho)}^{m'(r+h)} (\ln m' - \gamma)\,dm' \tag{5-14'}$$

$$\frac{dW}{d\rho} = \frac{d\left\{\bar{y}(1+h).1/\lambda \; [m_1'(\ln m_1' - 1 - \gamma) - m_0'(\ln m_0' - 1 - \gamma)]\right\}}{d\rho}, \quad (5\text{-}15)$$

where m_1 is the value of m' at $i=\rho$, and m_0 is the value of m' at $i=\bar{r}+h$.

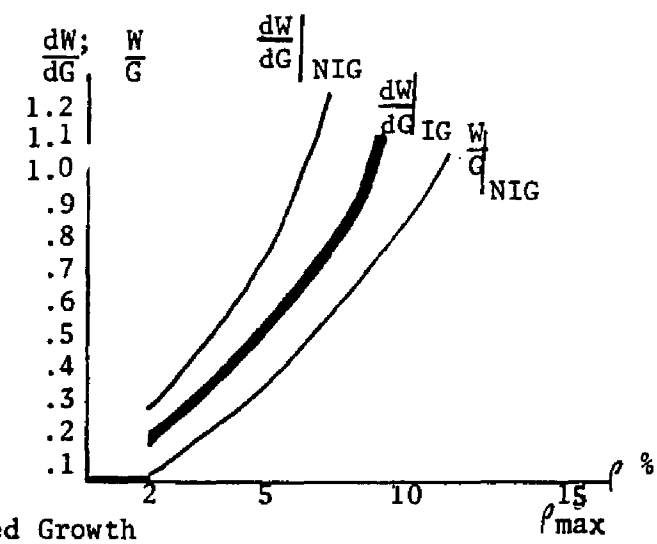
Then, the ratio of the marginal welfare cost (equation 5-15) to the marginal government revenue (equation 5-13) is:

$$\frac{dW}{d\hat{G}} = \frac{dW/d\rho}{d\hat{G}/d\rho}$$

$$= \frac{d\left\{\bar{y}(1+h).1/\lambda.[m_1'(\ln m_1' - 1 - \_m_0' (\ln m_0' - 1 - \gamma)]\right\} /d\rho}{d[\rho\,\bar{y}(1+h)e^{-\lambda\rho+\gamma} \quad (s-j)] \;/d\rho}, \quad (5\text{-}16)$$

with h defined by equation (5-12).

When ρ is zero, that is, when there is no induced growth with inflationary finance, equation (5-16) will be reduced to equation (5-2), the case of no induced growth in the previous subsection. In the case of no induced growth, h is zero, and h is not function of ρ. Thus y is cancelled out in equation (5-16).



Graph 5-2. M.C. with Induced Growth

Roughly evaluating the marginal cost with induced growth, from equation (5-14) and equation (5-13) we have:

$$\frac{dW}{dG} = \frac{\frac{dh}{d\rho}\int + \frac{d\int}{d\rho}(1+h)}{(s-j)\left[\frac{dh}{d\rho}\rho e^{-\lambda\rho+\gamma} + e^{-\lambda\rho+\gamma}.(1+h) + \frac{d(e^{-\lambda\rho+\gamma})}{d\rho}\rho(1+h)\right]}$$

$$= \frac{A+B}{(s-j)\ (C+D+E)}$$

$$= \frac{A+B}{(s-j)\ ((C+F)}$$

But A/C is approximately average cost with no induced growth while B/F is approximately marginal cost in the case of no induced growth. Thus, the marginal cost with induced growth will be valued between the average cost and the marginal cost with no induced growth. As Graph 5-2 illustrates, the marginal cost with induced growth will be less than the counterpart of no induced growth case. Since the value of $\frac{A+B}{C+F}$ is betweeen A/C and B/F, the condition that $\left.\frac{dW}{dG}\right|_{IG}$ is less than $\left.\frac{dW}{dG}\right|_{NIG}$ is A/C<B/F. We see A/C is less than B/F from the graph 5-2. Thus, $\frac{A+B}{C+F}$ is less than B/F (the marginal cost with no induced growth). Thus, when there is induced growth, inflationary finance will be more favourable than in the case of no induced growth. The exact effect of induced growth will depend upon the value of $dh/d\rho$, the induced growth rate change.

CHAPTER 6

CONCLUSIONS

The analysis of inflationary finance is heavily related to the interest rate variable. Although the data for this variable does not fully reflect the competitive market conditions, as noted before, and so a proxy variable (real rate of interest plus expected rate of inflation) has been used, we may offer some conclusions based upon the data obtained, estimation methods, and chosen assumptions:

Firstly, in the period studied (1963-1976), the average actual government revenue from money creation was 1.6 percent of aggregate real income, and 6.1 percent of gross domestic capital formation. From these values, the calculated amount of aggregate income attributed to inflationary finance was 1.9 percent. We may infer that if inflationary finance had not been employed, income growth would have been lower by 1.9 percent during the period.

Secondly, the maximum government revenue feasible in a steady state economy without induced growth is .9 percent, while the associated welfare cost is 1.1 percent of aggregate real income respectively. The welfare cost per unit of government revenue on average is thus 1.1/.9 = 120 percent, and the contribution of the maximum government revenue to total income is 1.1 percent of the income. Both the welfare cost and income increase are so significant that differential taxation analysis is required in order to determine the level of inflationary finance.

Thirdly, in the optimum taxation analysis, the marginal welfare cost of inflationary finance is seriously burdensome when inflation is positive and there is no induced growth, and so our analysis suggests that the monetary authorities should trigger the same rate of monetary expansion as the aggregate real income growth rate in the expectation of downward price stickiness in the real world; beyond the growth rate of aggregate real income the government should resort to other ordinary taxes for raising its revenue. In the case there are no other sources of revenue than inflationary finance, the degree of monetary expansion will have to be decided by the analysis of welfare increase from the increased material consumption compared with the liquidity welfare loss, as Aghevli (1977) proposes.

Finally, when we count induced growth, the results will depend on the magnitude of income growth induced by inflationary finance, considering all the variable parameters in the system and all the feedback effects. The conventional conclusion that inflationary finance is not good even considering induced growth does not appear necessary. Further examination in this direction will be required.

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