An Essay on Financial Liberalization

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Part I. Corporate Financial Policy, Valuation of the Firm and Financial Liberalization

I. Introduction

The first part of the essay presents a multiperiod financial model for valuation of the firm in which financial markets are imperfect and risk is admitted through stochastic demand and cost functions of the firm. In the valuation model, the nonneutrality of corporate income tax (Feldstein [5]), the effect of leverage on probability of bankrupcy (Scott [12]), and the selective credit policy of the monetary authority are explicitly recognized. The model is useful in understanding the liberalization of domestic financial markets at the firm specific micro level.

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* The author is Assistant Professor of Economics, Sogang University. The research is supported by the grants from the United Board for Christian Higher Education in Asia, and the Yenching Institute of Harvard University.

II. Basic Model

The economy is described at the level of the individual firm. The firm finances investment by both debt and equity and the method of financing depends on the corporate income tax and credit subsidy among others. Although the risks inherent in the ownership of financial assets will determine the supply of capital to firms, we assume that the financial markets are segmented and that there exists a set of favored firms with priviledged access to subsidized bank credits. We assume that the Capital Asset Pricing Model holds for the market valuation of firm's earnings and that the ratio of the going price of the reproducible real capital assets to their reproduction cost reflects financial risks of leverage as perceived in the market.

The model employs the following notations:

P: the price of the firm's output, y

J: corporate tax rate on profits(interest is deductible)

b: the proportion of capital financed by debt

$i(b)$: cost of debt finance (a weighted average of interest rates on various types of debt instruments)

r: default-free rate of interest

k: capacity requirement per unit of output

W: money wage divided by labor productivity

P_m: the price of raw materials

$C(W,P_m)$: variable cost per unit of output.

1. Product Markets

In each period t, the demand function faced by the firm is given as follows:

$$P_t = F(y_t) + u_t,$$

where u_t is the random parameter. We assume that $F'(y_t)<0$, $\frac{d(yF(y))}{dy}<0$ and $E(u_t)=0$. Since $F'(y_t)<0$, the firm's price behavior coincides with that of a monopolist. At the beginning of each period, the firm decides the optimal level of output on the basis of prevailing demand expectations. We assume that $\{u_t\}$ is serially independent and identically distributed over time. (Hereafter we omit subscript t.)

The variable cost per unit of output, $C_t(W,P_m)$, is assumed to be invariant to the level of output but stochastic. It reflects an unanticipated change in productivity as well as in imported factor prices. Let

$$C_t(W,\ P_m)=\bar{C}(1+\delta_t),$$

where δ_t is the random parameter. We assume that $E(\delta_t)=0$ and $\{\delta_t\}$ is also independent and identically distributed over time. We will see that this uncertainty in noncapital factor markets is important in the determination of firm's risk level.

2. Financial Markets

We assume that the financial market is imperfect and that the official loan rate of interest on the bank credit, i_o, is determined outside the system. (i_o is assumed to be set by policy makers in the absence of well developed open capital markets.) It is below the equilibrium rate of interest obtained under the full liberalization of financial markets. The loan rate of interest in private loan markets, i_p, is assumed to be higher than i_o and the cost of debt finance $i(b)$ will be an weighted average of i_o and i_p. Throughout the paper we postulate the following hypothesis, the concept of which has been developed by Claudio Gonzalez-Vega (McKinnon [9]).

> *The Iron Law of Interest-Rate Restrictions:* As a ceiling imposed on loan rates of interest becomes more restrictive, the size of the loans granted to borrowers who are rationed declines and the size of the loans granted to borrowers who are not rationed increases.

The firms successfully bidding for these low cost loans tends to be: (1) large firms having economies of scale in reducing transaction costs, (2) firms with an established credit record, (3) firms with visible collateral... financial assets, real estate, etc., and (4) multienterprise firms in large scale diversified manufacturing and trading enterprise, where the threat of default is minimal.

The firms described above usually have monopoly power in the product market. Since these firms invest in industrial activities which are risky, and relatively illiquid, their investment portfolio includes non-productive urban real estate to balance their portfolio. The real estate not only serves as an easily visible collateral, but mitigates the problem of discontinuity caused by bankrupcy of the firm. We assume that the firm in our model has priviledged access to low cost bank credits and its debt is fully secured even upon bankrupcy. The firm's creditors are assumed to be paid a full amount of debt plus interest payments $ibk+qbk$ even if

$$P-C(W,\ P_m)\leq ibk-\frac{qk(1-b)}{1-J}.$$

In other words, we assume that the liquidation proceeds of firm's nonproductive assets in their investment portfolio is large enough to secure its debt obligation upon bankrupcy.(1)

III. Main Propositions

The firm's valuation formula is

$$V=\frac{(Y-ibky)\ (1-J)+ibky+bqky+(1-b)qky}{1+W(r,i(b))}$$

where $Y=Py-C(W,P_m)y$ and $W(r,i(b))$ denotes an weighted average of the cost of debt $i(b)$ and the rate of time preference (risk-free rate of interest, r) of stockholders.

Since $qky=V$, we have

$$V=\frac{\{(F(y)+u-C(w,P_m)\ (1-J)+ibk\}y}{W(r,i(b))}.$$

Notice that

$$E(V)=\frac{y[F(y)-\bar{C}-ibk]\ (1-J)+ibky}{W(r,i(b))},$$

$$\mathrm{Cov}(V,X)=\frac{y[\mathrm{Cov}(u,X)-\bar{C}\mathrm{Cov}(\delta,X)]\ (1-J)}{W(r,i(b))},$$

where X is the total monetary return on all assets in the economy. Since the Capital Assets Pricing Model holds,

$$CEQ(V)=\frac{y\ F(y)-\bar{C}-ibk\ (1-J)+ibky-\lambda y\ \mathrm{Cov}(u,X)-\bar{C}\mathrm{Cov}(\delta,X)\ (1-J)}{W(r,i(b))}$$

where λ is the market price of risk. Let

$$M(y,b)=\frac{CEQ(V)}{W(r,i(b))}.$$

The firm decides the optimal level of output by maximizing $M(y,b)$. If we assume that the firm always finds its optimal debt/equity ratio b for any level

(1) In the case of multienterprise firms, reallocation of internal funds helps to mitigate the burden of contractual interest payments when the net receipt of the firm is negative,

of output y (Feldstein [5]), we have

$$\frac{dM(y,b)}{dy}=\frac{\partial M}{\partial y}\bigg|_{b=\text{constant}}+\frac{\partial b}{\partial y}\cdot\frac{\partial M}{\partial b}\bigg|_{y=\text{constant}}=\frac{\partial M}{\partial y}\bigg|_{b=\text{constant}}.$$

Therefore, the optimal level of output y^* satisfies the following necessary condition:

$$\overline{MR}(y^*)=\bar{C}+ibk\left(\frac{-J}{1-J}\right)+\operatorname{Cov}(u,X)-\bar{C}\operatorname{Cov}(\delta,X) \tag{1}$$

where $\overline{MR}(y^*)=E[MR(y^*)]=\dfrac{d(y^*F(y^*))}{dy}$.

To derive our main propositions, we need the following assumptions:

Assumption 3.1: $\operatorname{Cov}(u,X)>0$. In other words, the firm's demand risk is systematically related to the cash flow of all assets in the economy.

Assumption 3.2: $\operatorname{Cov}(\delta,X)<0$. The variation of the firm's cost parameter in the non-capital factor markets is negatively correlated with the monetary return on all assets in the economy.

The Assumption 3.2 is derived from the following three observations: (1) duration of labor contract is usually of long-term nature, (2) there has been a positive relationship between the general economic activity and labor productivity, (3) the state of economic activity is adversely affected by the external supply shock (the rise in the price of raw materials).

Assumption 3.3: The rise in the official loan rate of interest, i_0, towards its equilibrium level will decrease the firm's contractual interest payments $i(b)$ per unit of capital.

We provide the following heuristic arguments to justify the above assumption. Suppose there are two classes of firms. The firms in the first class have easy access to official credit market. The firm in our model is the favored firm and belongs to the first class. The firms in the second class are rationed borrowers in the official loan market and they have to rely on private loan market to finance their investment. The Iron Law of Interest-Rate Restriction states that the favored firms increase b as i_0 falls. Let the unfavored firms satisfy the following aggregate portfolio conditions:

$$i_u=\phi(b_u,\ b_f,\ e_u,\ e_f),$$
$$e_u=\psi(b_u,\ b_f,\ e_u,\ e_f),$$
$$b_u=f(i_u,\ e_u),$$

where i_u (e_u) denotes the cost of debt (equity) finance of the unfavored firms and b_u (b_f) denotes the debt as a proportion of capital of unfavored (favored) firms.

Since debt and equity are competing assets from the investor's viewpoint, we have

$$\phi_1>0,\ \phi_2<0,\ \phi_3>0,\ \phi_4>0,$$
$$\psi_1>0,\ \psi_2<0,\ \psi_3>0,\ \psi_4>0.$$

The sign of ϕ_2 (ψ_2) reflects the increased riskiness of heavier leverage.

Since b_f increases, i_u must fall if the equity financing is not easy in the absence of well-developed open capital market. But as i_u falls b_u will increase and the increased leverage of the unfavored firms will reduce the relative riskiness of favored firms. This will in turn increase the supply of debt of the favored firm, and i_f, b_f may increase.

In fact, the Assumption 3.3 includes the well-known premise that the heavier leverage of favored firms in the repressed financial market induces the increased leverage and capital cost of the unfavored firms.(2)

When the financial markets are liberalized, it will increase the efficacy of the financial system diversifying social risks. Consequently, it will decrease the market price of risk, λ. We call it the 'diversification effect.' The 'leverage effect' is concerned with the rise of the official loan rate toward its equilibrium rate and the subsequent decrease in the contractual interest payments of the favored firm (see Assumption 3.3). We have the following proposition:

Proposition 3.1: When the financial markets are liberalized, the firm will increase the optimal level of output, y^* and the expected price, $E(P)=F(y^*)$ will decrease under the Assumptions 3.1～3.3.

Proof. From the necessary condition (1) and the assumptions on $F(y)$, it is obvious that both of the diversification effect and the leverage effect will increase the level of output and decrease the firm's expected price. Q.E.D.

(2) The above premise was empirically tested in Nam, Sang Woo [10].

IV. Concluding Comments

We provided the valuation model of the firm who has priviledged access to official credit markets in a repressed financial system. Assuming that the firm has monopoly power in the product market, we examine the changes in the level of output and the price charged by the firm when the financial markets are liberalized. It must be obvious that the assumption on the composition of the firm's investment portfolio is necessary to avoid the discontinuity problem caused by bankrupcy.

Part II. Inflation and Financial Liberalization

I. Introduction

High and unstable rates of inflation have been the major cause of financial repression in most of semi-industrial less developed countries. The second part of the essay stems from our concern to examine the non-adaptations in the current capital market as well as in the labor market to the presence of high rate of inflation. The institutional consequences of financial liberalization in the periods of volatile rate of inflation will also be examined.

Liviatan and Levhari [8] stress the importance of viewing the bond market in conjunction with other assets and income which are subject to inflation risks. We extend their conclusion and examine the interaction of taxation inflation and market forces to the extent that they affect the efficacy of financial intermediation. Although we will derive our results mainly in a Fisherian two-period model of consumption-savings decision, we do not impose any restriction on an agent's risk-time preferences other than usual regularity conditions.

This part consists of four sections. After the introductory section, we present our basic model and main propositions. In section III, the implications of the results for the Korean financial structure are briefly examined. The final section consists of concluding comments.

II. Basic Model and Main Propositions

We consider an exchange economy in a stochastic environment. The real sector or the production sector of the economy is taken as exogenous so that the technological rate of return on the unit of physical capital r and the real income as well as the income expectations of agents are given exogenously. We assume that the economic agent consumes a single perishable commodity (or composite commodity) in terms of which his real income is measured. Each agent has a preference ordering over present consumption, c_1 and future consumption, c_2 and his preferences conform to the von Neumann-Morgenstern axioms for rational choice under uncertainty. Each agent transfers a real stock of money into the future period since this economizes on transaction costs. We represent an agent's utility function, $U=U(c_1, c_2;\ m)$ as a continuous, twice differentiable cardinal utility function and assume that cash balances, m yields direct utility. Each agent also holds a part of his wealth in the non-monetary asset B as a means of saving for future consumption and decides upon the optimal amount and composition of his portfolio according to his joint time-risk preferences.

Let y_{1i} and y_{2i} denote real income of the representative agent, i in the current and future period respectively. Let $\bar{M}_i$ be the nominal stock of money initially held by ith agent in the current perod (period 1). Also, let P_1 and P_2 denote the price of the composite commodity in each period. We assume that the bond and the physical capital are perfect substitutes from the investor's viewpoint so that the real return on the unit of bond, B is the same as r. The agents are uncertain about the future real income and future price level. Although, the stock of money available in the economy is subject to stochastic disturbances, we will for the moment assume that it is fixed over time. Each agent has a subjective probability distribution $F_i(y_{2i}, P_2)$ of what the future income and price will be. The agent's perception of technological uncertainty associated with productivity changes, of price uncertainty that arises from imported factor price inflations, and of any institutional change that affects economic activities are properly taken into account in his subjective probability assessments of future states of nature.(3)

The budget constraints of the representative agent in our economy are expressed by the following two equations (hereafter we omit the subscript i):

$$P_1(y_1-c_1)+\bar{M}-M=B,$$

(3) Each state of nature corresponds to particular realization of future real income and the rate of inflation.

$$M+i(\pi)B+P_2(y_2-c_2)=0,$$

where $\pi=\frac{P_1}{P_2}$, the reciprocal of the rate of inflation and $i(\pi)$ denotes a schedule of contingent claims as a function of π. If the agent holds B units of bond and if the rate of inflation in the future period turns out to be π', he will receive $i(\pi')B$ as a reward for holding B. Notice that we are, in fact, assuming the existence of a complete set of markets to cover inflation risks.

Let $i(\pi)\pi=rk(\pi)$. The agent is viewed as

$$\begin{aligned}&\text{maximizing} \quad E_F[U(c_1,c_2;m)],\\ &\text{subject to} \quad \pi m+rk(\pi)+y_2-c_2=0 \text{ and } y_1-c_1+\bar{m}-m=b,\end{aligned}$$

where $\bar{m}=\frac{\bar{M}}{P_1}$, $m=\frac{M}{P_1}$, and $b=\frac{B}{P_1}$. The subscript F means that the expectation is taken with respect to the agent's subjective probability distribution, $F(y_2,\pi)$. The extent of escalation of return to bond is expressed as $k(\pi)$. It is clear that the escalating clause in wage contract is already incorporated in the conditional probability distribution, $F(y_2|\pi)$.

When $k(\pi)=1$ for almost all $\pi\epsilon(0,1]$,(4) the bond market is fully indexed, and therefore $rk(\pi)-r$ can be regarded as a premium(5) for holding a unit of indexed bond, b when $\pi=\frac{P_1}{P_2}$.

Let $K\equiv\{k(\cdot)|E[k(\pi)]=1,\ k\epsilon C_1(0,1]\}$ denote a set of feasible schedules of contingent claims that our economic agent can choose to his benefit. Then each agent solves his problem by

$$\begin{aligned}&\text{maximizing} \quad E_F[U(c_1, m+rk(\pi)b+y;\ m)],\\ &\text{subject to} \quad k(\pi)\epsilon K.\end{aligned}$$

Let $V(k,c_1,c_2)=E_F[U(c_1,c_2;\ m)]$. Then by the Envelope Theorem,

$$\frac{dV}{dk}=\frac{\partial V}{\partial k}\bigg|_{\substack{c_1=\text{constant}\\ m_1=\text{constant}}}+\frac{\partial m}{\partial k}\cdot\frac{dV}{dm}\bigg|_{k=\text{constant}}+\frac{\partial C_1}{\partial k}\cdot\frac{dV}{dC_1}\bigg|_{k=\text{constant}}.$$

It we assume that c_1 and m are chosen in an optimal way once k is determined, we have

$$\frac{dV}{dk}=\frac{\partial V}{\partial k}\bigg|_{\substack{c_1=\text{constant}\\ m_1=\text{constant}}}.$$

Therefore $k^*(\pi)$ is optimal for him if $k^*(\pi)$ solves

(4) The range of π is $(0,1]$. 'Almost all' means 'except on a set of probability zero.'

(5) The 'premium' used here differs from the usual notion of risk premium appearing in the literature (Arrow [1]).

maximizing $\int_0^1 \int_y U(c_1, m\pi + rk(\pi)b + y; m)\, dF(y, \pi)$
subject to $k(\pi) \epsilon K.$

Since $F(y|\pi)F(y) = F(y, \pi)$, we use Euler's condition and derive the following necessary condition:

$$\frac{\partial}{\partial k} \int_y U(c_1, m\pi + rk(\pi)b + y;\ m) F(y|\pi)\, dy - \mu = 0,$$

where μ is a Lagrangian multiplier corresponding to the constraint $k(\cdot)\epsilon K$, and depends on $E[k(\pi)](=1)$.

Leaving to the reader the obvious economic meaning of μ, we have

$$rb \int_y U_2(c_1, m\pi + rk(\pi)b + y; m) F(y|\pi)\, dy = \mu.$$

Since μ does not depend on π, and since the above condition holds for almost all $\pi\epsilon(0, 1]$, we differentiate the above equation with respect to π. We have

$$\begin{aligned} & r^2b^2 \int_y k'(\pi)\ U_{22}(c_1, m\pi + rk(\pi)b + y; m) F(y|\pi)\, dy \\ & + rb \int_y U_2(c_1, m\pi + rk(\pi)b + y; m) \frac{\partial F(y|\pi)}{\partial \pi} dy \\ & + rbm \int_y U_{22}(c_1, m\pi + rk(\pi)b + y; m) F(y|\pi)\, dy = 0. \end{aligned}$$

Integrating by parts the second term of the above equation,

$$\begin{aligned} & \int_y U_2(c_1,\ m\pi + rk(\pi)b + y; m) \frac{\partial F(y|\pi)}{\partial \pi} dy \\ & = U_2(c_1,\ m\pi + rk(\pi)b + y; m) \frac{\partial F(y|\pi)}{\partial \pi} \Big|_0^\infty - \int_y U_{22}(c_1,\ c_2) \frac{\partial F(y|\pi)}{\partial \pi} dy. \end{aligned}$$

But $\frac{\partial F(\infty|\pi)}{\partial \pi} = 0 = \frac{\partial F(0|\pi)}{\partial \pi}$. Therefore, we have a closed form for $k^*(\pi)$:

$$k^*(\pi) = \frac{\int_y U_{22}(c_1, m\pi + rk(\pi)b + y; m) \frac{\partial F(y|\pi)}{\partial \pi} dy - m \int_y U_{22}(c_1,\ c_2) F(y|\pi)\, dy}{rb \int_y U_{22}(c_1, m\pi + rk(\pi)b + y; m) F(y|\pi)\, dy},$$

where we have assumed that the agent is risk averse, i.e.,

$$\frac{U_{22}(c_1, c_2; m)}{U_2\ (c_1, c_2; m)} > 0.$$ (6)

The concept of risk-aversion that we have used is a direct extension of Sandmo's, except that now it also depends on the amount of cash balances

(6) See Sandmo [11].

which will be used as a medium of exchange in future transactions.

Suppose the future real income y of the agent is fully indexed by one way or another.[7] Then obviously $\frac{\partial F(y|\pi)}{\partial \pi}=0$. Assuming that he is risk averse, we have

$$k^{*\prime}(\pi)=-\frac{m}{rb}.$$

Therefore $k^{*\prime}(\pi)<0$ for the saver (lender) and $k^{*\prime}(\pi)>0$ for the dissaver (borrower) in the present period.

The economic interpretation of the above condition is straightforward. Risk averse savers (dissavers) require a positive (negative) premium when the rate of inflation is sufficiently high and accept negative (positive) premium on the unit of bond that they hold (supplied) when the rate of inflation is low enough so that the inflation risk is partly compensated by the less-than-expected erosion of the real value of money that they transfer to the future period.

When $m=0$, $k^{*\prime}(\pi)=0$. Since $E[k^*(\pi)]=1$, $k^*(\pi)=1$ a.e.[8] and the economy will be fully-indexed. We now have the following proposition:

Proposition 2.1: Suppose that all other than financial sectors of the economy is fully indexed. If agents hold non-interest-bearing monetary assets (currency and demand deposits), there will be a tendency that the bond market will become thin in an inflationary period.

Notice that the existence of monetary assets, without which we do not think of any transaction of goods and assets in the economy, inhibits the full indexation of the economy. Furthermore, Proposition 2.1 remains true even in the absence of fixed (and operating) costs of running markets for contingent claims.

Suppose now that the future real income of the agent is not yndexed. Again assuming that he is risk averse, we have

$$k^{*\prime}(\pi)=\frac{\int_y U_{22}(c_1, m\pi+rk(\pi)b+y;m)\frac{\partial F(y|\pi)}{\partial \pi}dy-m\int_y U_{22}(c_1,m\pi+rk(\pi)b+y;m)F(y|\pi)dy}{rb\int_y U_{22}(c_1, m\pi+rk(\pi)b+y;m)F(y|\pi)dy}.$$

For the borrower (dissaver in the present period),

(7) We spell out this point in the later part of this section.

(8) A.e. means almost everywhere.

$$k^{*\prime}(\pi)<0 \text{ if } (1) \ \frac{\partial F(y|\pi)}{\partial \pi}>0,$$

$$k^{*\prime}(\pi)>0 \text{ if } (2) \ \frac{\partial F(y|\pi)}{\partial \pi}\leq 0,$$

$$\int_y U_{22}\left\{\frac{\partial F(y|\pi)}{\partial \pi}-mF(y|\pi)\right\}dy>0.$$

For the lender (saver in the present period),

$$k^{*\prime}(\pi)<0 \text{ if } (3) \ \frac{\partial F(y|\pi)}{\partial \pi}\leq 0,$$

$$k^{*\prime}(\pi)>0 \text{ if } (4) \ \frac{\partial F(y|\pi)}{\partial \pi}>0,$$

$$\int_y U_{22}\left\{\frac{\partial F(y|\pi)}{\partial \pi}-mF(y|\pi)\right\}dy>0.$$

The mathematical expression $\frac{\partial F(y|\pi)}{\partial \pi} \underset{(\leq)}{>} 0$ implies that as the rate of inflation, inverse of π, increases, it is more likely from the agent's viewpoint that his future real income will increase (fall), which becomes quite clear if we draw the conditional density function $F(y|\pi)$. We now have completed the proofs of the following propositions:

Proposition 2.2: Suppose the increase in the future price level affects real income of agents in such a way that the conditions (1) and (3) are satisfied. Then there will be a tendency for the market for contingent claims to develop, and at a market equilibrium, lenders will get a positive premium if the rate of inflation is high enough and negative premium if the rate of inflation is sufficiently low.

Secondly, and possibly less interesting:

Proposition 2.3: Under the assumption that the borrower's real income falls and the lender's real income rises as the future price level increases, there will be a tendency for the market for contingent claims to develop, and at equilibrium, lenders will get a negative premium if the rate of inflation is high enough, and a positive premium if the rate of inflation is sufficiently low.

Finally, we have the following proposition:

Proposition 2.4: Suppose an increase in the future price level affects real income of all agents in the same direction. Then there will be a tendency in the economy that the bond market will become thin.

The last proposition is a restatement of the well-known proposition in the theory of financial institutions (Wilson [14]). If inflation affects future income of agents in the same way, the inflation risk becomes non-diversifiable social risk and even the financial market would not be able to diversify the inflation risk.

Before we turn to an economic interpretation of Propositions 2.2 and 2.3, the following factual observations need to be stated: In the real world, the economy is far from being indexed. Economic agents usually contract wage and salary in nominal terms for periods longer than the time it takes the unanticipated inflation to occur. Tax brackets and other legally fixed payments are not indexed. Nominal rather than real returns on capital (including human capital) are taxed. The wide use of a system of nominal taxation increases real taxes and intensifies its differential treatment (e.g. progressivity) of taxable incomes. These institutional non-adaptations to the rate of inflation in other than financial sectors in the economy are factors affecting future real income of agents in our model.

The ultimate effects of system of nominal taxation depend on how the government uses its increased tax proceeds and on the way in which real wages and relative prices adjust to the inflation in combination with the nominal tax system. Suppose the government uses its tax proceeds to finance public projects having a stream of risky benefits and costs. Let t and t' be the nominal and inflation adjusted real tax rate, respectively. Let ΔT be the additional benefits (measured in terms of the composite commodity) derived from the increased financing of the projects, out of increased revenue, which was made possible under the system of nominal taxation in an inflationary period.

Then the wealth of the agent in the future period is

$$w = m\pi + rk(\pi)b + y_2 + \{(t'-t)y_2 + \Delta T\}.$$

The terms in the bracket express the changes in future real income of agents under the system of non-indexed nominal taxation. If we let $y_2 + \{(t'-t)y_2 + \Delta T\} = y_2'$ and replace $F(y_2, \pi)$ by $F(y_2', \pi)$, the effect of nominal taxation can be well taken care of.

One typical way in which the causes of inflation directly affects the distribution of real income among agents is deficit financing of government or 'functional inflation,' which transfers real resources from the private sector to government uses. In cases where corporations undertake public projects, functional inflation also affects the distribution of financial resources between the household sector and the corporate sector. The government pays money in exchange for goods and causes variation of the price level in the economy. Let Δm represent real money paid in exchange for Δy units of real income acquired by the government. The wealth of the agent in the future period becomes

$$w = m\pi + rk(\pi)b + (y_2 - \Delta y) + \Delta m.$$

This way, the injection of new money and the reductions in the stock of real money transferred from the previous period not only changes a price level, but redistributes real income among agents. We can now modify our model to take into account aspects of 'government deficit financing.' As far as functional inflation affects future real income and causes variations in the price level, it has been already reflected in an agent's subjective probability distribution, $F(y_2, \pi)$. Since the injection of new money into the economy also causes randomness in the stock of real cash balances, m, we must now assume that each agent has a subjective probability distribution $F(y_2, \pi, \Delta m)$.

To prove Propositions 2.2 and 2.3 in an economy where the stock of money is subject to stochastic disturbances, we make a rational expectations assumption that the rate of inflation contains finer information than the stock of money. Then

$$\begin{aligned} F(y_2, \pi, \Delta m) &= F(\Delta m)\ F(y_2, \pi \mid \Delta m) \\ &= F(\Delta m)\ F(\pi \mid \Delta m)\ F(y_2 \mid \pi, \Delta m) \\ &= F(\Delta m)\ F(\pi \mid \Delta m)\ F(y_2 \mid \pi) \\ &= F(\pi, \Delta m)\ F(y_2 \mid \pi). \end{aligned}$$ (9)

If we first integrate an agent's utility function over the range of Δm, the remaining steps are exactly the same as before, and our Propositions remain true when the money stock of the economy changes over time.

Wilson[14] has argued that social risks can be shared by both taxation and market forces, and therefore it is important to consider joint effects of taxation and market forces. We showed how a system of taxation, inflationary finance, non-indexed wage contracts, and major 'quantity risks' that are associated with productivity, technology and resources supply can be modelled to examine their influences on the operation of financial markets.

(9) For a rigorous proof of this formula, see Chung [4].

III. Implications for the Financial Structure of Korea

In the previous section, we have implicitly assumed that there always exists a set of agents who save in the current period and another set of agents who borrow in the present period and repay their dept in the future. When we look at the historical flow-of-funds data, we find corporations are always a deficit sector and households a net supplier of funds to the financial system. It is the financial transactions between the corporate and household sectors that we examine in this section. Notice that we can safely ignore the government sector since economic agents in our model have their own expectations of what will be future changes in the use of budgetary policies, of the effects of inflationary finance, and of the revision of tax laws. In fact, each agent has been assumed to have a subjective probability assessment of future states of his economic environment as they (states of nature) affect his real income and the amount of monetary assets he plans to hold in the future.

To interpret the Propositions that we have derived in the previous section, we first test the sign of $\frac{\partial F(y_H|\pi)}{\partial\pi}$ and $\frac{\partial F(y_C|\pi)}{\partial\pi}$, where y_H and y_C denote real labor income of households and real (after tax) profits of corporations, respectively. For this purpose, we classified the urban households into five different income classes bearing in mind that households in the low quintiles of the income distribution can hardly afford savings. As measure of the price level, we used the consumers price index (CPI) since, in Korea, the rate of change of the CPI will best approximate the price expectations of economic agents.

It would be almost impossible to estimate the magnitude of $\frac{\partial F(y_H|\pi)}{\partial\pi}$ without imposing any other assumption. We assume that the set of conditional distributions $F(y_H|\pi)$ can be ordered by a 'stochastic dominance' relation. Then in a linear regression model, if the estimated coefficient of the rate of change in the CPI (inverse of π) is negative, $\frac{\partial F(y_H|\pi)}{\partial\pi}<0$ and conversely when it turns out to be posivive, we have $\frac{\partial F(y_H|\pi)}{\partial\pi}>0$. To estimate conditional expection of y_{Hi} given π (y_{Hi} being real labor income of households in the i_{th} quintile of income distribution), we have included other important independent variables. They are the urban unemployment rate and the rate of change of the CPI in the previous period. The basic results of our regression are presented in Yoon [15]. The sign of the coefficient for the rate of change of the CPI is negative for any quintile of income distribution. Also, it shows that inflation erodes more of the real labor income of households as we move toward the upper quintiles of income distribution. Since the households in the upper income classes save a greater proportion of their real income, we can *a fortiori* conclude that $\frac{\partial F(y_H|\pi)}{\partial \pi}<0$.

The sign of the coefficients for the rate of change in the previous CPI is positive for each quintile of income distribution. It supports the hypothesis that it takes time for workers to revise their wage-salary contract to keep up with the rising price index and for government to take any tax reform measure as the price level increases. The sign of this coefficient shows the existence of a time lag for institutional adjustments to the rate of inflation which we have elaborated in the previous section.

To find the sign of $\frac{\partial F(y_c|\pi)}{\partial \pi}$, we used the results of regressions for functional shares of national income. y_c was taken to be the the real (after tax) business profits (notice that we also assumed the existence of stochastic dominance relation of the set of conditional probability distributions, $F(y_c|\pi)$). The sign of the estimated coefficient for the rate of change of the CPI is positive as appeared in Yoon [15]. Therefore, we accept the hypothesis that $\frac{\partial F(y_c|\pi)}{\partial \pi}>0$. It is interesting to notice that the sign of the coefficient for the rate of change of the CPI is negative when we run the regression for real wage income. We again confirm that $\frac{\partial F(y_H|\pi)}{\partial \pi}<0$.

Since we have tested the assumption made in Proposition 2.2, we are now in a position to state the following rather surprising result:

Proposition 3.1: If the domestic financial markets are liberalized, the rate of interest on the representative nominal asset (the one year time and savings deposit) will be greater than the real rate of return on physical capital plus the rate of price increase if the rate of inflation is higher than ordinary people expect, and it will be less than the real rate of return on physical capital plus the rate of price increase if the inflation rate is lower than ordinary people expect.

The above Proposition states that when the high rate of inflation is caused by an unanticipated event (or an event that agents assigned a very small probability), there will prevail too high a nominal interest rate at a market equilibrium. It will be higher than the rate of interest on 'index-link' loans.[10] The converse statement is true when the rate of inflation is unexpectedly low.

Apart from these observations, we have to remember that the statistical test for the sign of $\frac{\partial F(y_C|\pi)}{\partial \pi}$ is of aggregate nature, and we cannot exclude the possibility that real profits of some firms are eroded when the rate of inflation is unexpectedly high. It could well be the case that when domestic inflation is caused by an unanticipated increase in the foreign prices of raw materials, the very high interest rate that will obtain at market equilibrium may present too great a financial expense to these firms.

Perhaps a second best policy is to set an upper bound on the rate of interest (it should be high enough to attract household savings) and to narrow down the range of the rate of price increase. If the rate of inflation is not high enough, the equilibrium interest rate will be below the upper bound, and an agent's savings-portfolio decisions can be well taken care of. If the upper bound is not high enough and if the government fails to control inflation, the uniform rate of interest charged over the set of variable rates of inflation will distort savings-portfolio decisions and cause misallocation of resources.

IV. Concluding Comments

The substance of this part is the presentation of a set of propositions in a simplified model of an exchange economy, showing how the financial markets operate in inflationary periods. In a money-using economy, financial markets can diversify inflation risks only if inflation has contrary influences on the income expectation of those who borrow and those who save. When this is not the case the market becomes thin and fails to serve its social function. Empirical applications of our model to the Korean financial structure is attempted to provide insights into the effects of liberalization of domestic financial markets.

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(10) Loans for which $k(\pi)=1$ for all π. See Section II.

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