

Rates of Return, Investment Behaviour and Monetary Policy*

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I. Introduction

It is hardly an exaggeration to allege that the explanation of investment behaviour in macroeconomic models has been achieved with less than complete success. There are several reasons for the fact that the investment function still remains somewhat of an enigma. One of the more important of these is undoubtedly attributable to the elusive nature of the expected rate of return on investment projects or the marginal efficiency of capital. It is obvious that the calculation of the anticipated investment returns are fraught with uncertainties. But even the associated costs are often not known when the investment decision is made, as its implementation takes time and the prices of equipment to be purchased, for example, may change in the meantime.

A second obstacle in the way of our understanding of this aspect of the economy is posed by the lack of clear perception of the interrelationship between the financial and the real sectors of the economy. The markets for funds, in particular the share market, provide the stage where the two main actors, namely the portfolio investor and the entrepreneur, may have read scripts which deviate in important aspects. The entrepreneur compares the rate of return expected from an investment project with the cost of funds. When the former exceeds the latter, the firm is offered an incentive to add to its capital stock. The cost of funds for the entrepreneur in the capital market is identical to the required rate of return of the other actor, namely that of the portfolio investor. In *Tobin's* financial model the author fails to pay tribute to this vital feature of economic reality when he combines the rates of return which investors in real and financial assets expect, in a simple investment criterion. Investment decisions in the *Tobinian* world require us to amalgamate share-

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holders and managers of the firm. They ignore the possibility that the two investors may differ in their assessment of the profitability of a given investment project. When investment evaluations of the two groups differ, *Tobin's* theory of the supply price of capital has to be rejected.

A third difficulty arises for the economist who attempts to model investment demand. The relevant variables, constituting the two rates of return, viz., marginal efficiency of capital, market value of capital and reproduction costs of capital, are not observable. The approximation of these variables in empirical investigations has turned out to be a major stumbling block for the estimation of investment functions.

This problem of computation is confounded by another issue. It is generally held that the monetary and the real sectors of the economy interact in an important way in the investment area, the conduit being the array of rates of return of financial and real asset. Suppose we start from an equilibrium structure of rates of return, and the bond rate falls. Bonds are now less attractive compared to other investment opportunities, say, the holding of common stock, resulting in a re-shuffling of portfolios. In this way additional funds are channelled into the stock market, permitting the financing of the envisaged investment projects. Provided the monetary authorities are able to control one or more of the financial rates, they possess a lever to influence investment activity. In order that this nexus may be exploited for policy purposes, a behavioural relationship between the rates of return germane to investment decisions and those on competing financial assets has to be established. Work in this area appears to be in its infancy.

It is the purpose of this paper, first, to critically analyse the relationship between the marginal efficiency of capital, the supply price of capital and the valuation factor of capital, q , when appropriate attention is given to the existence of two distinct groups of investors. Secondly, the empirical implementation of this model is discussed. Finally, the behavioural content of this approach and its usefulness as an instrument of monetary policy are evaluated.

II. A Closer Look at the Supply-Price-of-Capital Model

The supply price of capital has been expounded by *Tobin* in several of his writings¹ and it has found its way into several macroeconometric models.²

¹ See, for example, *J. Tobin*, *Money, Capital and Other Stores of Value*, reprinted in: *J. Tobin*, *Essays in Economics*, Vol. 1. Macroeconomics, Chicago 1971, pp. 217 - 228.

² *A. K. Ando* and *F. Modigliani*, *Some Reflections on Describing Structures of Financial Sectors*, in: *G. Fromm* and *L. R. Klein* (eds.), *The Brookings Model: Perspective and Recent Development*, Amsterdam 1974, pp. 525 - 563.

His theory represents a break with the Keynesian tradition of assuming perfect substitutability between government bonds and capital which allowed *Keynes* and his followers to equate “the” interest rate with the marginal efficiency of capital and thus to ignore the share market.

1. Lenders and Borrowers with Identical Earnings Expectations

The correct interpretation of the *Tobin*-Model requires us to distinguish, as already mentioned, two groups of investors. On the one hand we have the financial or portfolio investors who populate the capital market as lenders of funds. Entrepreneurs on the other hand seek to borrow funds on the capital market in order to carry out their investment plans. The interaction of lenders and borrowers determines the supply price of capital via the evaluation of physical capital in the market for equities; both exert their influence thus through the variable q . Let us first look at the behaviour of lenders.

2. Lenders

Tobin defines the supply price of capital as “the rate of return that the community of wealth-owners require in order to absorb the existing capital stock (valued at current prices), no more no less, into their portfolios and balance sheets.”³ Assuming now that the physical capital stock is valued in the market for equities, a relationship between the supply price of capital and the rate at which a constant stream of earnings expected to accrue to the shareholders is discounted, may be derived.

Let $V(t)$ be the market value of the homogenous capital stock at time 0 as evaluated by shareholders, $X_r(t)$ its earnings stream expected by shareholders, and r_k the rate at which this stream is discounted by the equity holders, then

$$(1) \quad V(t) = \int_0^{\infty} X_r(t) e^{-r_k t} dt$$

Integration and rearrangement of terms results in

$$(2) \quad r_k = \frac{X_r}{V}, \text{ provided } X_r(t) = X_r \text{ for all } t > 0$$

$V(t)$, the “existing capital stock (valued at current prices)” is conventionally defined as the market valuation of titles to capital goods, that is, as the market value of equity capital. The market for equities, where claims to the capital

³ *J. Tobin, Money, Capital and Other Stores of Value*, p. 226.

stock are traded, is in equilibrium, when at the prevailing rate of return the quantity of capital demanded (represented by the market value of equities) equals the quantity held. It is this situation to which *Tobin* refers in the above definition of the supply price of capital, and as equations (1) and (2) show, the supply price of capital is also that rate at which the future stream of earnings is discounted. It is worthwhile to repeat that the supply price of capital is the rate at which equity holders discount the expected future stream of earnings accruing to a unit of the capital stock.⁴

3. Borrowers

Thus far only part of the supply price of capital story has been told. The element which next deserves our attention is the marginal efficiency of capital, R . It relates the expected permanent earnings stream of $X_R(t)$ dollars of a unit of the capital good, as it is calculated by the entrepreneur, to its costs P in the following way:

$$(3) \quad P(t) = \int_0^{\infty} X_R(t) e^{-Rt} dt$$

or

$$(4) \quad R = \frac{X_R}{P}, \text{ again when } X_R(t) = X_R \text{ for all } t > 0$$

Equation (4) defines R as the marginal efficiency of capital relative to replacement costs. It is, like the supply price of capital, a discount rate.

Who determines this rate of discount? According to equation (3) this rate depends on the costs of currently produced capital goods, P , and the expected earnings stream, X_R . The first of these factors is beyond the control of the entrepreneur. Production techniques, final demand conditions and market structure are amongst the more important variables influencing the expected earning stream. Given these parameters, firms contribute their managerial talent and some other firm-specific elements like patents, goodwill, knowledge of the market etc. To a certain extent therefore, the firm exercises control over X_R and thus over the discount rate R for given prices of capital goods.

⁴ A considerable amount of confusion exists in the literature regarding the definition of the term "supply price of capital". *Keynes* used this term in the sense of a market price or the reproduction costs of a unit of capital. (See his *General Theory of Employment, Interest and Money*, London 1936, p. 135). It is therefore measured in monetary units and continued to be used in this way by researchers. The *Tobinian* supply price of capital, however, is a discount rate.

4. Lenders and Borrowers Meet in Efficient Capital Markets

Provided the objective of the firm is to maximise its shareholders' wealth (if it is not, shareholders withdraw their funds from any such firm), a comparison of the supply price of capital and of the marginal efficiency of capital equips the managers of the firm with the following investment-decision rule. Adopt the investment project when R exceeds r_k , abandon it, when the reverse is true. This criterion implies, that the present value of the project from the point of view of the shareholders exceeds its costs. Clearly this theory requires that shareholders are cognizant of all relevant information relating to firms' profitability. It is claimed that the assumption of efficient capital markets takes care of this essential condition. Furthermore when shareholders and entrepreneurs have the same earnings expectations, we get

$$(5) \quad X_r = X_R$$

Combining equations (2), (4) and (5) we obtain

$$(6) \quad \frac{V}{P} = \frac{R}{r_k} = q$$

The ratio of the market value of capital to its reproduction costs – *Tobin's* famous q –, is apt to drive a wedge between the marginal efficiency of capital and the supply price of capital. When the market valuation of capital exceeds its replacement value, q is greater than one and the marginal efficiency of capital surpasses the supply price of capital and vice versa for $V < P$. This appears to imply that it is immaterial whether we compare V with P or r_k with R , since both rules can be taken to be equivalent in their informative content.

This interpretation was suggested by *Tobin* and it has retained this connotation either explicitly or implicitly⁵ is subsequent studies by other authors.

5. Divergent Earnings Expectations

Support for this claim is derived from the efficient market hypothesis. In fact the assumption that capital markets are efficient is generally believed to form an integral part of *Tobin's* financial model. It says, as far as it is relevant here, that all informations on earnings available to shareholders are reflected in current share prices.

⁵ See for example, *R. Sheldon*, Some Measurement Issues Connected with *Tobin's* Financial Model, in: Research Paper No. 7624, Federal Reserve Bank of New York, p. 4 or *B. Bosworth*, The Stock Market and the Economy, in: *Brookings Papers on Economic Activity*, 2: 1975, p. 284.

Let us leave in abeyance for a moment the nature of the empirical evidence pertaining to the efficiency hypothesis. The supply-price-of-capital model, in general, requires financial agents to calculate the expected earnings stream associated with additions to the capital stock and to evaluate the securities issued to finance these new investments. Shareholders no doubt encounter great problems when they try to assess the earnings capacity of the existing capital stock. This task, however, appears to be simple when compared with the toil of calculating expected profits to be derived from capital which, as yet, exists only as a blue-print. Differences in risk, factor prices, and technology between existing and new capital as well as uncertainty about price expectations contribute to the elusive nature of such computations, regardless of whether they are carried out by potential lenders or by entrepreneurs.

Compatibility of profit estimates by equity holders and by managers of the firms might then occur only by accident.⁶ Although the entrepreneurs' profit calculations are fraught with uncertainties, they no doubt possess far superior (inside) information about the quality of investment projects than do lenders. The former may believe that it is in their best interest to exaggerate the earnings potential of envisaged projects, in order to obtain finance and to keep the cost of finance low. The protection of their financial investments requires lenders therefore to make their own project evaluations. The salient point to be stressed here is that lenders cannot be expected to have access to the same data basis to which borrowers have. Under these circumstances it appears advisable not to assume identical earnings expectations associated with new investment projects on the part of shareholders and of managers of the firms.⁷

⁶ Although, as already mentioned, *Keynes* did not introduce the share market explicitly into his system, he nevertheless was aware of the two groups of portfolio investors and managers in this market as the following paragraph lucidly demonstrates:

"As a result of the gradual increase in the proportion of the equity in the community's aggregate capital investment which is owned by persons who do not manage and have no special knowledge of the circumstances, either actual or prospective, of the business in question, the element of real knowledge in the valuation of investments by those who own them or contemplate purchasing them has seriously declined." (*J. M. Keynes*, op. cit., p. 153).

The sentiment of the whole chapter "The state of Long-Term Expectations", from which this quote is taken, provides a few warning lights to those who obscure the distinction between the two groups by assuming efficient capital markets.

⁷ After having written this I came across an article by *H. E. Leland* and *D. H. Pyle*, Information Asymmetries, Financial Structure and Financial Intermediation, in: *Journal of Finance*, May 1977, pp. 361 - 387 in which they relate what they call "informational asymmetries" between lenders and borrowers (entrepreneurs) to the capital structure of firms and the existence of financial intermediation.

Even if shareholders were able to achieve the aim of an unadulterated examination of the investment projects, there remains ample scope for divergence as between shareholders and firms regarding the expected earnings stream associated with the investment projects. Remember, expected earnings are determined on the basis of subjective probability distributions. When lenders are in a buoyant mood and borrowers are more cautious, or vice versa, their earnings expectations diverge. Of course, the likelihood of this situation to arise increases when both participants do not have access to the same information.

The opposite behaviour may be enticing to entrepreneurs under certain conditions. If they are led to believe by observations of takeover activities that revealing the true earning potential of a project might alert business pirates then it is in their interest to keep a low profile, as long as sufficient funds are forthcoming at the lower published rates of return.

Casual observations lend some support to our view. First, the relatively rapid economic growth in post-war Germany can be attributed in part to the fact that real capital investment was primarily financed through banks and not through stock market. To the extent that it was and still is, the widespread ownership of shares by banks in Germany was also conducive to bringing the earnings expectations of portfolio investors into line with those of firms. Banks as suppliers of funds have the power to look into firms' books and the expertise to scrutinize the earnings potential of new projects. This tends to narrow, if not eliminate, any gap that might exist between lenders' and borrowers' earnings assessments. When bank-financing dominates, there is little room for those entrepreneurs who otherwise could foist grossly inflated profit information upon uninformed lenders.

In Anglo-Saxon capital markets banks have traditionally provided predominantly short-term funds and the share market played the role as the source of long-term funds. The hypothesis here is that banks are better judges of the profitability of investment projects than ordinary share investors. This suggests that *Tobin's* financial model could indeed be more gainfully employed in capital markets in which banks are the backbone for long-term capital rather than in economies where share markets provide the main source of investable funds.

Secondly, the prices of new shares often deviate immediately from the envisaged issue-price. One possible, but of course, not the only, reason for the difference in the two prices could originate in incongruent earnings expectations.

Thirdly, it is not uncommon that institutional investors subscribe heavily to certain share issues. Either the portfolio managers might have a more sanguine opinion than the entrepreneur and other financial investors about the profitability of the investment project or certain aspects of the project concerning its future earnings potential have only been revealed to these institutions, but not to the market as a whole. Whatever the reasons may be, in both instances the prices for new shares quoted in the market do not reflect adequately the assessment of the marginal efficiency of capital of the envisaged investment projects.

Fourthly, the evidence concerning the efficient market hypothesis is usually taken to imply that the earnings estimates made by borrowers and lenders are compatible. The evidence supporting the efficient market hypothesis provides hardly any comfort for the view that the capital market functions more satisfactorily than has been outlined here. It needs to be stressed that we are concerned in *Tobin's* financial model with financing decisions pertaining to additions to the existing capital stock. To the best of my knowledge the expected earnings or share prices considered in tests for market efficiency are generated by the firms' existing capital stock, and the conclusions reached do not necessarily carry over to the case we are dealing with, namely expected earnings or share prices of additions to the capital stock. Furthermore, in a broad sense the notion that capital markets are efficient implies that all available and relevant information is reflected in share prices. It says nothing about the quality of the information, in particular about the value of the earnings projections made by entrepreneurs and disseminated in the stock market. If these reservations are correct, then it is reasonable to distinguish between earnings expectations of lenders and borrowers when the stock market provides the main source of funds.

6. Consequences of Divergent Earnings Expectations for Tobin's Financial Model

The following consequences of our analysis for the supply-price-of-capital model appear to emerge. First, the assumption of share-price maximization is no longer tenable. When entrepreneurs conceal the true qualities of investment projects or collude with selected financial investors not to reveal pertinent information to the capital market as a whole, all or some of the shareholders' wealth is reduced. Retrospectively it is a difficult task for lenders, if not an impossible one, to find out whether they have been deceived, since any discrepancy of anticipated and of realized rates of return could be explained with reference to the investment risk involved.

Secondly, we have to abandon the idea that the investment decisions criteria can be epitomized in one variable, be it q or r_k . It is consequently misleading, if not incorrect, to include the variable q , defined as the ratio market value to reproduction costs of capital, as an argument in the investment function, as, for instance, *von Furstenberg* has done.⁸ Now any discrepancy between the marginal efficiency of capital and the supply price of capital may also be the result of differing views of firms' shareholders and entrepreneurs regarding earnings prospects of new investment projects as can be seen from equations (2) and (4).

Let me illustrate the inconsistency to which these criteria give rise with the following fictitious example. When lenders require a ten percent return on their funds, and they believe that the investment project promises to pay a perpetual return of $X_r = \$100$, the market valuation of the project is \$1000. Let me further assume that the firm knows about the true quality of the investment and expects X_R to amount to only \$90. With costs of the project only slightly below \$1000, the market valuation factor q exceeds one. Consequently the investment projects is feasible. As the marginal efficiency of capital, however, is below the supply price of capital, the venture should be abandoned. It has become clear that the investment decision rules provide us with conflicting signals; they are obsolete.

III. Empirical Implementation

1. Marginal and Average Supply Price

Despite the plethora of recent attempts to implement *Tobin's* financial model empirically, one hardly gains the impression that we are anywhere close to solving the task. The main reason for the state of the art has to be seen in the fact that data for none of the crucial variables, marginal efficiency of capital, supply price of capital, market value of capital or replacement costs of capital, are available. As the supply price of capital is a marginal concept, it is necessary to define all variables in their relationship to additions to the capital stock. For instance, the reproduction costs of capital are those outlays which are required in the future to replace the worn out or obsolete equipment to be installed now.

A qualification of this view is necessary when the market value of the existing capital stock falls below its replacement costs. Disinvestment occurs

⁸ *G. M. von Furstenberg*, Corporate Investment: Does Market Valuation Matter in the Aggregate, in: *Brookings Papers on Economic Activity*, 2: 1977, pp. 347 - 397.

in this situation up to the point where the two valuations of the remaining capital stock are brought into equality. Under these circumstances, the costs of the replacement investment are in general well-defined, and the calculation of the supply price of capital on the basis of the existing capital stock as an average concept is appropriate.

Having demonstrated the need for a distinction between, and a calculation of, a marginal and an average supply price of capital, a re-interpretation of the informative content of the variable q appears to be called for.

As far as the sustenance of the existing capital stock is concerned, a q -value of at least one is required in order to induce the firm to carry out the necessary replacement investments. The capital stock of those firms shrinks, for whom the replacement costs exceed the market value of the capital goods. Assuming that capital is no longer homogenous, an average (of all capital goods taken together) q -value of one or even greater than one is compatible with the existence of disinvestment. The empirical approaches which make the market value and/or the replacement costs of the existing capital goods the basis for the calculation of the variable q can only claim to have explained whether or not disinvestment takes place. Neither the level nor the movements of the q -value can be meaningfully related to additions to the capital stock.

In the case of additions to the capital stock, net investment occurs so long as the q -values of some investment projects exceeds one. It is then conceivable that in this situation the q -value for all new investment projects taken together is one or even less than one, and net investment be still positive.

Differences in risk, technological progress, inflationary expectations, and factor price changes may account for differences in the market price and the replacement costs of existing and new capital goods so as to make the valuation set derived from the old capital stock irrelevant for the calculation of the profitability of additions to this stock.

To the best of my knowledge none of the studies of this topic recognizes the problems arising from the distinction between old and new capital. Some, however, do acknowledge the need to distinguish between the average and the marginal supply price of capital as far as the empirical implementation is concerned.

2. Measurement of Tobin's Q

The approach to empirically implement *Tobin's* financial model which has received most attention, attempts to estimate the variable q , which is defined as the ratio of market value of capital to its replacement costs. As equation (6)

shows, the variable q and its development over time provide indirect evidence for the constellation of the marginal efficiency of capital and the supply price of capital. When q exceeds the value one, the former rate of return is greater than the latter and capital investment is desirable.

A number of investigators have collected data for market values and reproduction costs of the existing capital stock, thereby disregarding the marginal aspects of the model. To the extent that the market value of corporations reflects the increased profitability of future additions to their capital stocks, the marginal angle receives attention although the expected earnings emanating from old and new capital are amalgamated. The papers by *C. W. Bischoff*,⁹ *J. H. Ciccolo*,¹⁰ *G. M. von Furstenberg*,¹¹ *J. Tobin* and *W. C. Brainard*¹² and *W. C. Brainard*, *J. B. Shoven* and *L. Weiss*¹³ are amongst the studies in this category.

Typically, stock market valuations of firms are obtained by adding up their values of common stock, preferred stock and debt capital, taking care that interest-bearing financial assets held by the corporations are deducted. The resulting market value of non-financial assets then includes not only the capital stock but as well the value of inventories, land, the market capitalization of intangible assets such as good-will, monopoly rights, patents, knowledge of the market, firm-specific human capital and the like.

The replacement costs of the existing capital stock, the numerator of q , are measured as the current costs of reproducing it. Problems of computation arise as already mentioned when technical progress and changing relative prices render carbon-copy replacements of existing capital assets obsolete.

It becomes obvious from our discussion that the measurement bases for the capital stock in the numerator and the denominator of the variable q are incongruous. A measurement bias results.

In defense of the practice of calculating an average market-value-to-replacement-cost ratio, it is argued that the desirability of an investment project is correctly signalled through changes in this ratio, as current share

⁹ Business Investment in the 1970s: A Comparison of Models, in: Brookings Papers on Economic Activity, 1971: 1, pp. 13 - 59.

¹⁰ Four Essays on Monetary Policy, unpublished Ph. d. dissertation, Yale University, 1975.

¹¹ Corporate Investment, pp. 350 - 359.

¹² Asset Markets and the Cost of Capital, in: Economic Progress, Private Values and Public Policy, *B. Balassa* (ed.), Amsterdam 1977, pp. 235 - 262.

¹³ *W. C. Brainard*, *J. B. Shoven* and *L. Weiss*, The Financial Valuation of the Return on Capital, in: Brookings Papers on Economic Activity, 1980: 2, pp. 453 - 502.

prices reflect expectations of future earnings. Quite apart from the fact that this approach neglects the expectations aspect concerning future replacement costs, an important point appears to be missed by this argument. Anticipated earnings are derived from existing capital goods, not from new investments. This view assumes that they do not differ, an assumption we are reluctant to accept as having general validity.

For identical earnings expectations of lenders and borrowers and, provided a satisfactory way could be found to overcome the measurement problems, *Tobin's* financial model, as epitomized in the valuation ratio q , embodies all information required to make investment decisions. Furthermore, it could be exploited by the policy-maker to influence the level of investment activity. A look at equation (6) confirms this view. For a given value of the marginal efficiency of capital, q varies inversely with r_k . Provided the supply price of capital can be linked with other financial rates of return over which the authorities exert control, the basis for an efficient monetary policy is laid.

3. Implementation of the Supply Price of Capital and the Marginal Efficiency of Capital

An alternative approach attempts to find suitable empirical proxy-values for the supply price of capital which lenders require and for the rate of return on capital, accruing directly to entrepreneurs. *P. J. Corcoran*¹⁴ develops an empirical investigation along these lines. It shares with the above mentioned studies the deficiency of basing the calculations on the existing stock of capital goods. The rate of return on capital, *Tobin's* R , is estimated as total capital income divided by total replacement costs of all capital assets. In order to estimate the rate of return required by financial investors as defined by equation (2), *Corcoran* calls it the cost of capital, total capital income is divided by the sum of the market values of corporate equity and net debt capital. This approach is quite similar to the procedure followed by *G. M. von Furstenberg*,¹⁵ however, the analysis now also comprises total capital income.

The spread between the return on and the cost of capital is taken to signal incentives for capital formation.

¹⁴ *P. J. Corcoran*, Inflation, Taxes and Corporate Investment Incentives, in: *Quarterly Review*, Federal Reserve Bank of New York, Autumn, 1977, pp. 1 - 10.

¹⁵ *Corporate Investment*, pp. 350 - 366.

4. *The Cost of Capital in the MPS-Model*

A common characteristic of the studies discussed so far is that they remain strictly within the boundaries of *Tobin's* financial model. This is different with the rate of return on capital goods in the MPS model. The concept of the reproduction cost of capital here is explicitly eliminated, because, so the argument goes, it cannot be meaningfully applied to describe a production process with vintage capital and changing relative prices.¹⁶ Without this variable, the required rate of return on capital goods equals the ratio of the marginal efficiency of capital in dollar value to the market value of capital goods. This result may be obtained by multiplying both sides of (6) by P . This procedure eliminates the variable q and leaves us with

$$(7) \quad V = \frac{X}{r_k}$$

The marginal efficiency of capital is approximated in this formulation by the expected stream of earnings accruing to the existing capital stock which, if discounted by the required rate of return on capital (r_k) equals the market value of capital.¹⁷ In order to generate empirical data for the unobservable supply price of capital r_k , we may either collect data for V and X in the way as described above or approximate r_k by some other available variable.

For an unlevered stream of expected income the capitalization rate may be approximated, for example, by the dividend-price ratio. As this assumption would be difficult to reconcile with the presence of leverage so prevalent amongst nonfinancial corporations, the cost of capital in the MPS model has been estimated by a weighted average of the dividend-price ratio (which is measured in real terms) and the real interest rate on corporate bonds.¹⁸ For a given pay-out-ratio, dividend payments are assumed to be proportional to expected profits.

¹⁶ See A. K. Ando, *Some Aspects of Stabilization Policies, the Monetarist Controversy, and the MPS Model*, in: *International Economic Review*, October, 1974, p. 548. For residential structures the concept of the reproduction costs of a unit of housing, that produces a given amount of the service housing, can usefully be employed. This is so because during the generation of housing services in general no other factors of production are required. The analysis here, however, is concerned with equipment and producers' structures.

¹⁷ A. K. Ando and F. Modigliani, *Some Reflections* p. 539.

¹⁸ This explanation of the derivation of the cost of capital is given in A. K. Ando, F. Modigliani, R. Rasche and S. J. Turnovsky, *On the Role of Expectations of Price and Technological Change in an Investment Function*, in: *International Economic Review*, June 1974, pp. 396. A recent version of the cost of capital in the MPS model which is identical to the supply price of capital contains, in addition, a variable reflecting uncertainty.

Past, current, and expected profits are linked in a distributed lag function. It is important to note, however, that the expected stream of earnings is generated by existing capital goods, not by those entrepreneurs plan to acquire. Although the MPS investment function for equipment capital explicitly recognizes the fact that existing and new capital may differ, due to, for example, technical progress (putty-clay hypothesis) or changing relative prices, it fails to capture the essential features of the cost of capital associated with new investment. True, the dividend-price ratio may presage future earnings. But it is hardly a beacon for investment decisions when the market assesses optimistically the earnings potential of the existing capital stock but is less sanguine about the profitability of additions to the capital stock, because for example, uncertainty about the expected inflation rate raises the risk premium of the required rate of return on new investment relative to that on existing capital.

The real rate of interest functions as the other component of the supply-price-of-capital proxy. The inflationary premium in the nominal corporate bonds rate is removed by subtracting from the nominal rate the expected quarterly CPI-changes. Does the real bond rate, calculated in this way, really provide relevant information on the cost of capital? Entrepreneurs require, in order to make investment decisions, estimates of price expectations for the entire economic life of the planned investment project. The cost of debt finance which appears to be appropriate at present when the inflation premium in nominal interest rates correctly reflects anticipated price changes, might eventually erode the capital basis of the firm in subsequent quarters when inflation rates turn out to be lower than the ones which were originally expected. As the nominal interest rate and the maturity of the debt instrument which finances the investment in part or wholly, are fixed, the firm's interest payments rise in real terms. Depending on how the unanticipated inflation rate affects the marginal efficiency of capital, the investment might no longer remain a profitable venture. When the time horizon applicable to price expectations and the economic life span of the capital good are not compatible, the real rate of interest on debt-finance becomes an unknown variable.

In the MPS model the cost of capital enters the investment function via the rental price of the services of capital goods. The decision to invest, depends, *inter alia*, on a comparison of the anticipated ratio of prices of current output to prices of investment goods, and on the rental price.¹⁹

¹⁹ A. K. Ando et al., *On the Role of Expectations*, p. 395.

IV. The Supply Price of Capital and Monetary Policy

The inclusion of a financial variable like the supply price of capital or the market valuation factor q or the cost of capital, in investment functions fulfils a dual purpose. First, such a variable contributes to the explanation of investment behaviour. For this purpose it suffices to compute values for r_k or q from observable data. The various methods have been discussed in the previous section. Secondly, although this approach has merits of its own, it would deserve less attention than it receives if these financial variables were merely exogenously given. *Tobin* and others²⁰ leave no doubt that the supply price of capital and consequently the market valuation factor are endogenous to the system and under the control of the monetary authorities. The structure of the MPS model suggests that monetary policy actions first influence short-term interest rates and then long-term rate which subsequently affect the supply price of capital. The suggested nexus follows from theoretical considerations to be sketched out in the next paragraph. The strength of the link could conceivably be estimated by relating r_k to relevant rates of the structure of interest rates. Such an estimated behavioural relationship would greatly assist in the implementation of monetary policy. Thus, when monetary policy is designed judiciously, investment activity can be influenced. Let us look at how the supply price of capital is supposed to interact with other policy-determined financial variables.

The most careful and explicit approach to solving this task has been made by *Tobin* in his famous article "A General Equilibrium Approach to Monetary Theory."²¹ His money-security-capital model expresses best the linkage between the real and the financial sectors of the economy. As *Tobin's* approach forms the basis of the financial sector of the MPS model,²² it has been elevated to a position of special importance. The reader is assumed to be familiar with its basic features. Here we suggest to concentrate on the crucial aspects of the transmission process of monetary policy actions.

An expansionary monetary policy, in order to be successful, has to alter the yield differential between the rate of return on capital and that on

²⁰ For example the *W. C. Brainard* and *J. Tobin*, Pitfalls in Financial Model Building, in: *American Economic Review, Papers and Proceedings*, May 1968, "... the valuation of investment goods relative to their cost in the prime indicator and proper target of monetary policy. Nothing else, whether it is the quantity of "money" or some financial interest rate, can be more than an imperfect and derivative indicator of the effective thrust of monetary events and policies." p. 104.

²¹ First published in *Journal of Money Credit and Banking*, February 1969, pp. 15 - 29: reprinted in: *J. Tobin, Essays in Macroeconomics*.

²² *A. K. Ando* and *F. Modigliani*, Some Reflections, especially pp. 540 - 541.

government securities, which in equilibrium is fully accounted for by a risk premium and the relative supplies of assets. For example, an open market purchase of bonds lowers their rate of return and makes shares a more attractive investment for wealth owners than bonds. During this process of portfolio adjustments, share prices rise and the supply price of capital falls. Expansionary monetary policy thus stimulates investment.

This view is predicated on two assumptions. The first requires that current output prices are not rising as fast as capital goods are appreciating by the stock market. The other premise implies that expansionary monetary policy does not generate price expectations which prevent the real interest rate from falling. Both premises are interrelated and they will therefore be discussed together. According to *Tobin's* view, an anticyclically motivated rise in the money stock creates an excess supply in the money market, drives up bond prices, lowers the bond rate and results in a reshuffling of portfolios so that equity prices soar. A spill-over of the excess liquidity into markets for goods does not occur.

Those who explain the inflationary process as being mainly caused by an excess of the money supply over the money demand find it difficult to accept this theory. They view the direct linkage between excess money balances and spending on current output as equal in importance to that between money and spending on financial assets. With the current degree of awareness of monetarist ideas amongst financial investors, an easy monetary policy which attempts to lower interest rates now in order to boost stock market prices, would probably prove to be counterproductive.

In this case the market would assess the inflationary potential of an expansionary monetary policy and it would anticipate a restrictive phase in the future, when, in the view of the market, the inflationary consequences of this policy stance become obvious. As the market discounts such future events, share prices would tend to fall.

For a number of reasons can thus the intentions of the policy maker be thwarted. First, when current output prices and expected earnings rise along with the money stock, the supply price of capital is no longer policy determined. Secondly, when an expansionary monetary policy fails to stimulate the stock market, it has no impact on the supply price of capital.

Our analysis so far took it for granted that the bond rate responds in the desired way to monetary policy actions. However, a situation might arise when an easy monetary policy is not successful in lowering interest rates on government securities, the supply price of capital does not fall. A possible explanation to justify this case which immediately comes to mind in the

framework of *Tobin's* model, concerns price expectations. They are taken by *Tobin* as an exogenous variable. The nature of this assumption is basically retained in the MPS model. Here, price expectations are approximated by a distributed lag function of current and past price changes. As past, but not current, prices are exogenous to the system, the price-expectations generating mechanism is to a good part exogenously determined.

Only due to this assumption is it possible for monetary policy to control, through open market operations for example, the real (sic!) interest rate on bonds. The evidence supporting this view is fairly thin, as most, if not the overwhelming majority, of the investigations which studied the relationship between interest rates and price expectations, have found that nominal, not real rates, vary with price expectations. The empirical support which *Tobin* and *Brainard*²³ quote, namely that the real rate is not constant, does not further the neo-Keynesian case. It is not the real rate's variability but its systematic response to monetary policy actions which would tip the scales in favour of their theory.

Regarding the determination of nominal interest rates, neo-Keynesians and Monetarists could not be farther apart in their thinking. Neo-Keynesians, as already mentioned, view the real rate as endogenous and controllable by monetary policy and take price expectations as given, whereas Monetarists regard it as exogenously determined and consider price expectations as mainly determined by monetary policy.

The attempt to endogenize price expectations, for example, through an expectations generating mechanism which is based on the idea that expectations are formed in accordance with the theory which explains prices in the model, however, would tend to emasculate monetary policy. The implications of invoking rational expectations for *Tobin's* model as well as for those based on this approach are thus quite grave. In this context it appears to be appropriate to mention the long time span which is required for a change in the long-term interest rate (which is the policy instrument), to have an impact on the cost of capital. When the Central Bank is intent on reducing the supply price of capital, it supplies whatever amount of base money is necessary to achieve the lower short-term interest rate target. The short rate is linked to the long term rate through a term structure relationship. The long rate in turn influences the expected real rate of return on equity which signals changes in the cost of capital to firms. A policy aimed at reducing the cost of capital can be expected to fail when the excess liquidity, created by the Central Bank

²³ W. C. *Brainard* and J. *Tobin*, *Asset Markets*, p. 225.

to reduce short-term rates, has its main impact on price expectations during this drawn-out transmission process. Under these circumstances the nominal long-term rate rises along with price expectations leaving the real rate of return on equities out of the realm of influence of the policy-maker.

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Zusammenfassung

Die Verzahnung von Kapitalertrag, Anlageverhalten und Geldpolitik

Dieser Beitrag untersucht die Rolle von *Tobin's* Modell des Kapitalangebotspreises im Hinblick auf Investitionsentscheidungen sowie die Probleme, die mit seiner

empirischen Anwendung und seiner Brauchbarkeit für geldpolitische Zwecke verbunden sind.

Die Meinung, daß Kreditgeber (Finanzinvestoren) und Kreditnehmer (Unternehmer) auf dem Kapitalmarkt den Ertrag, den der Markt erfordert, mit der Grenzleistungsfähigkeit des Kapitals für neue Investitionsprojekte vergleichen, basiert auf der Annahme, daß sie gleichen Zugang zu den Informationen wie bei Sachinvestitionen haben. Offensichtlich spiegelt diese Behauptung die ökonomische Wirklichkeit aber nicht korrekt wider. Folglich kann das Investitionskriterium nicht länger durch eine einzige Variable wie mit *Tobin's q* ausgedrückt werden.

Versuche, den Angebotspreis der Kapitalbereitstellung oder einiger seiner Komponenten empirisch zu belegen, sind kritisch zu betrachten. Die meisten Untersuchungen versäumten, den Unterschied zwischen dem durchschnittlichen und dem marginalen Kapitalangebotspreis herauszustellen, und keine Untersuchung befaßte sich mit der letzteren Ertragsrate. Eine Untersuchung des Zusammenhangs zwischen dieser erforderlichen Ertragsrate und den geldpolitischen Aktivitäten offenbart gewichtige Fehler im Verhältnis dieser Größen zueinander. Wenn einzelne geldpolitische Aktivitäten die laufenden Absatzpreise und Inflationserwartungen sowie die Aktienmarktkurse beeinflussen, entartet der Kapitalangebotspreis zu einer unbeweglichen geldpolitischen Bestimmungsgröße.

Summary

Rates of Return, Investment Behaviour and Monetary Policy

This paper examines the role of *Tobin's supply-price-of-capital* model for investment decisions, the problems associated with its empirical implementation and its usefulness for monetary policy purposes.

The notion that lenders (financial investors) and borrowers (entrepreneurs) in the capital market compare the rate of return required by the market with the marginal efficiency of capital of new investment projects, is predicated on the view that they have access to the same set of informations pertaining to these investments in real capital. It appears that this assumption does not correctly reflect economic reality. Consequently the investment criterion can no longer be epitomized in a single variable such as *Tobin's q*.

The attempts to empirically implement the supply price of capital or some of its components are critically appraised. The majority of the investigations fails to distinguish between the average and the marginal supply price of capital and none provides empirical observations for the latter rate of return. An examination of the link between this required rate of return and monetary policy actions reveal grave defects in this relationship. When discretionary monetary policy actions influence current output prices and inflationary expectations along with share market prices, the supply price of capital degenerates into an immovable policy indicator.

Résumé

L'engrenage du revenu du capital, du comportement en matière de placement et de la politique monétaire

Cet article étudie le rôle du modèle de *Tobin* du prix de l'offre de capital en considération des décisions d'investissement ainsi que les problèmes liés à son application empirique et à son utilité à des fins de politique monétaire.

L'idée que les bailleurs de fonds (investisseurs financiers) et les emprunteurs (entreprises) comparent sur le marché des capitaux le revenu produit par le marché au rendement de la dernière tranche de capital dans de nouveaux projets d'investissement se fonde sur l'hypothèse qu'ils ont un accès aux informations égal à celui relatif aux investissements en biens corporels. Cette allégation ne reflète apparemment pas correctement la réalité économique. Il s'ensuit que le critère d'investissement ne peut s'exprimer plus longtemps à travers une seule variable comme le « q » de *Tobin*.

Les tentatives de justification empirique du prix de l'offre de capital ou de certaines de ses composantes sont critiquables. La plupart des recherches négligent la mise en évidence du prix moyen et du prix marginal de l'offre, et aucune étude ne s'intéresse au dernier taux de rendement. Un examen des connexions entre ce taux indispensable et les mesures de politique monétaire révèle des lourdes erreurs dans les rapports mutuels de ces grandeurs. Lorsque des mesures ponctuelles de politique économique influent sur les prix de vente courants, sur les anticipations d'inflation et sur les cours des actions, le prix de l'offre de capital dégénère en une détermination invariable de la politique monétaire.