Interest Rates and Factor-Use Proportions in Agriculture

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Abstract: Interest rates on formal agricultural loans in most low income countries are less than rates of inflation and below rates charged on commercial loans. Many development economists have criticized cheap credit because they felt it induced farmers to use too much capital (such as tractors) at the expense of labour. This argument is an extension of neoclassical economics where interest rates strongly influence investment decisions. Four arguments are evaluated that might be used to support this line of thinking under conditions where rural financial markets are fragmented: low interest rates reduce the cost of capital inputs relative to other inputs, low interest rates result in borrowers using discount rates on future benefits from capital inputs that are also too low, cheap loans are often tied to the use of capital inputs, and low interest rates cause lenders to concentrate loans in the hands of producers who use relatively large amounts of capital inputs. These supporting arguments are weak and that low interest rates probably have relatively little impact on farmers' decisions about factor-use proportions Low interest rates have more important impacts on income distribution, the costs of financial intermediation, financial savings, and the vitality of financial systems.

Introduction

The traditional notion that cheap credit encourages substitution of capital[2] for agricultural labour has pervaded the development literature for at least three decades (e.g., Barker, 1978, p. 144; Johnston and Cownie, 1969, p. 574; Mellor, 1966, p. 325; and Staatz and Eicher, 1984, p. 18). Various authors have implied that factor-use distortions are the most undesirable result of cheap credit. In the following discussion, we challenge this supposition and argue that cheap credit causes more substantial problems, such as its effects on income distribution, the costs of financial intermediation, incentives to save, and the performance of financial institutions.

Neoclassical Theory

The idea that cheap credit causes overinvestment in capital surfaced in the development literature in the 1960s. The genesis of the idea lies in neoclassical theory and the idea is consistent with the stress laid by the Keynesians on the importance of interest rates in investment decisions. In the neoclassical theory, interest rates coordinate production, consumption, and investment considerations (e.g., Fisher, 1930). Coordination between firms and households occurs through an overarching interest rate that emerges from the workings of an integrated financial market operating with minimal transaction costs. In this "perfect" financial market, a dominant interest rate is the standard to which market participants equate their marginal economic decisions. Expected changes in prices are assumed to be nil.

Given these conditions, the effects of changes in the interest rate on producer factor-proportion decisions can be shown with a simple example. Assume that a firm uses only labour and capital in production and has only two investment alternatives, purchasing units of capital or buying financial assets. Further assume that the firm manager is a profit maximizer, can substitute capital and labour for one another in production, and adopts the market rate of interest as the firm's internal discount rate on future earnings. Also assume that the firm is in equilibrium and has equated the ratio of the marginal value product of labour to the price of labour with one plus the marginal yield expected from investments in additional units of capital and one plus the market rate of interest. This dominant interest rate is the economy-wide opportunity cost of resource use and is also equivalent to the rental price of capital. Finally, assume that firms in disequilibrium are free to borrow or lend funds to bring themselves into equilibrium and that firms face diminishing marginal returns to additional use of both labour and capital.

Under these conditions, a decline in *the* market rate of interest (*ceteris paribus*) would cause producers to use more of both labour and capital to lower the expected marginal yields of these two factors of production to the new market rate of interest. Producers would have an additional incentive to use more capital if their discount rate were tied to and also declined with *the* interest rate. The lower discount rate would increase the present value of future returns from capital investments. Under these circumstances, a lower interest rate (*ceteris paribus*) would induce producers to increase their use of capital more rapidly than labour. The extent of the tilt in favour of capital would depend on various elasticities, the technical efficiencies of labour and capital, and the degree to which additional aggregate demands for labour and capital would change relative prices.

The extent to which neoclassical theory helps clarify the factor-proportions issue in less developed countries (LDCs) is questionable. For example, in most LDCs, a single, dominant interest rate never exists in financial markets. Also, in application of the theory, price changes are generally ignored, so that borrowers are assumed to face nominal and real rates of interest that are equal (e.g., Shaw, 1973). Yet, in recent years, substantial inflation in most LDCs has caused wide divergences between the two rates. Recent attempts to target funds to specific groups have resulted in high transaction costs for some borrowers and for most formal financial intermediaries. As part of loan rationing, intermediaries shift some of their transaction costs to new clients, those borrowing small amounts, and those having limited collateral (Gonzalez-Vega, 1984; Ladman, 1984). This results in still further differences among borrowers in effective marginal costs of borrowing. The lack of an overarching interest rate and the existence of financial markets that are far from "perfect" make it inappropriate to apply neoclassical interest rate theory to LDCs without modifications.

Another complicating factor is that neoclassical theory considers capital only as a production input and does not cover individuals who may hold capital items, such as tractors, as stores of value. When interest rates are low on formal loans and deposits, asset holders are induced to hold a portion of their savings in the form of capital items, even though such physical assets are underutilized or unutilized in production. This, however, reflects a deliberate portfolio choice by asset holders rather than a productive (factor-proportions) choice by entrepreneurs.

Other Supporting Arguments

Four additional arguments might be used to support the factor-distortion arguments. The first is that borrowers have blurred financial vision; they use some blended price of capital and interest rates on loans in making capital-use decisions. Second, borrowers might mimic the interest rates set on a loan in fixing their individual discount rates; if this occurs and interest rates on loans are low, the borrower would be too farsighted and would overestimate the current value of future benefits from capital use. Third, governments and lenders may promote the use of modern agricultural technology through preferential interest rates on loans "tied" to the purchase of capital inputs; this might cause distortions in factor-use proportions if loans can be effectively tied to capital use. Fourth, interest rates that are too low result in excess loan demand and induce lenders to concentrate cheap credit into large loans to borrowers who use relatively large amounts of capital.

Blurred Prices

A close association exists between borrowing and capital acquisition because producers may have insufficient funds to buy capital items and lenders are more eager to finance goods that add to visible collateral. As a result, an expansion in the *volume* of loans will likely increase the amount of capital purchased by borrowers. One must be careful, however, to separate the effect on capital use of increased access to loans from possible impacts of changes in interest rates. In addition, one might plausibly assume that an expansion in credit volume will increase farmers' use of most factors of production, including labour.

One might argue that because loans and capital acquisitions are closely associated, borrowers may become confused over the difference between the price of the loan and the price of the capital item; the borrower may blur the distinction between these two prices and end up with a blended price. This might result in borrowers making capital-use decisions on the basis of the size of their periodic loan repayments and cash flow. The lower the interest rate, the more eager a producer with blurred price vision would be to buy capital.

Whilst some producers may make decisions in this way, doing so is inconsistent with profit-maximizing behaviour. A firm's cash flow is not a direct indication of the profitability of capital use. Changes in interest rates on loans affect the overall profitability of borrowers' firms but do not change the relative profitability of a firm's enterprises or of specific inputs. Those making the blurred price argument must assume that many borrowers who purchase capital items are not profit maximizers. The blurred price argument is not robust.

Mimicked Rates

One might argue that borrowers mimic a low interest rate on formal loans in setting personal discount rates. This would cause borrowers to be farsighted and to overestimate the present value of future benefits from investments in capital.

That argument has several limitations. The first is that no obvious reason exists to assume that borrowers in fragmented financial markets behave in this way. One would not expect a 70-year-old borrower to apply the same discount rate to benefits from a capital investment with a 20-year economic life that a 30-year-old would use on the same investment, even though they paid the same rate of interest.

Why buyers of capital would mimic only the low interest rates applied on formal loans is also unclear. Numerous LDC borrowers have loans from both formal and informal sources or only from informal lenders. The explicit and implicit nominal interest rates on these loans may range from zero on loans from relatives to reasonably high rates on other unsecured small loans. Again, no *a priori* reason exists to explain why the borrower should use any rate that exists in fragmented financial markets in setting personal discount rates. The mimic argument appears to have even less vitality than the blurred price argument.

Loan Tying

Another argument supporting the traditional line of reasoning focuses on lender rather than borrower behaviour. One might argue that borrowers are economically rational, but that lenders enforce loan conditions that are not in the borrower's best interest by tying the use of the loan to purchases of additional capital. The lender may do this to obtain secure collateral or to promote more capital use as part of government or donor attempts to modernize agriculture. Lenders and policy makers may feel that borrowers are unable to forecast correctly the benefits of more capital use and that a carrot (low interest rate loans) and a stick (tying the loans to capital purchases) are required so that private and social benefit-costs are closely attuned.

On first glance, the tying argument appears to be strong. Many of the formal loans made in LDCs are justified on the basis of the borrower buying capital inputs. However, a relationship may or may not exist between the reason used to justify a loan and changes in borrower uses of marginal liquidity provided by a loan. One must measure fungibility, additionality, and substitution to evaluate the ability of the lender to tie loans (Pischke and Adams, 1980). One cannot determine a loan's impact on a borrower's pattern of expenditures by looking at the justification given for a loan. In many cases, the tying of loans is a charade by lenders and borrowers to allow policy makers to feel that they have control over resource allocation.

The correct gauge of the degree of loan tying is additionality. It measures the differences between borrowers' and nonborrowers' activities. Zero capital additionality occurs if a household-firm borrows a given amount to buy a capital input but diverts the use of all this additional liquidity to other expenditures. Zero additionality may also be realized through financial substitution. For example, a household-firm may plan to buy a tractor with or without a loan. A loan to buy a tractor would simply add to household funds, which could then be spent on any activity. If these additional funds were used to buy labour, zero additionality in capital would occur, but 100 percent additionality in the purchase of labour. Because of the large number of participants involved, the geographical dispersion of lending activities, and the multiple sources and uses of liquidity in most borrowing household-firms, lenders cannot control most diversion and financial substitution.

In fact, forcing a large measure of additionality on borrowers would be undesirable. Realizing 100 percent additionality would mean that, without a loan, household-firms were unwilling to put any of their discretionary liquidity into the activity specified in the loan contract. If borrowers were economically rational, they would be forced to invest in an activity very low on their list of expenditure alternatives. In contrast, a large measure of financial substitution would show that the lender was funding activities high on the list of things that household-firms wanted to do whether or not they receive a loan.

The fungibility of financial instruments can be only partially neutralized by lending in kind. If farmers are forced to take a loan in kind, however, they may find that selling the borrowed good in the informal market and using the proceeds to buy other goods (that bring more satisfaction) is in their best interests. Even in those cases where the loan in kind cannot be resold (e.g., a tubewell), the

loan may still result in a large measure of financial substitution. Fortunately, the workings of informal markets neutralize some of the inefficiencies caused by loan tying. With the heterogeneity that exists in rural firms and regions, for credit planners to tie loans to activities with economic returns as high as those daily discovered by borrowers is impossible. Rational borrowers probably evade the intent of loan tying when doing so is in their best interests.

Loan Concentration

Recent research has shown a close inverse relationship between loan concentration and the rate of interest charged on agricultural loans in LDCs. Gonzalez-Vega (1984) has termed this the "Iron Law of Interest Rate Restrictions": the lower the real rate of interest charged on loans, the more concentrated will be loan portfolios. Given this, one might argue that cheap loans tend to go to firms that are more capital intensive than the firms denied loans.

Firms receiving major amounts of the cheap credit tend to be relatively large, with managers who have easy access to the financial system. One might argue that lending more funds to these capital-intensive firms would distort the overall use of resources across firms (those with and without loans) in favour of capital. This might occur even if the capital-intensive firms with access to additional funds did not alter their factor proportions.

If loans are heavily concentrated in capital-intensive firms, the amount of capital used by these borrowers might increase because of the "loan volume" effect. Because of the very weak effects of interest rates on the combinations of inputs that borrowers choose to use, one should not expect significant distortions in factor use in individual borrowing firms because of low interest rates.

Clearly, low interest rates force lenders to concentrate cheap loans in the hands of firms inclined to be capital intensive. Whether the end result of this loan concentration is any significant change in factor-use proportions in agriculture over what would exist with higher interest rates is not clear. Fungibility probably neutralizes most potential distortions.

More Significant Problems

While difficult to prove empirically, interest rates on loans probably have very weak effects on borrowers' factor-proportion decisions. The price of inputs, expected yields, and product prices are far more important determinants of the combination of inputs producers use. While factor proportions have received most of the attention paid to the adverse effects of low interest rates, recent research has shown that other issues are more important. These are the impacts of low interest rates on income distribution, on the costs of financial intermediation, on the willingness of people to hold wealth in financial form, and on the vitality of the financial system.

Negative real rates of interests, loan concentration, and in some cases substantial amounts of loan defaults are resulting in large transfers of purchasing power to wealthy borrowers through formal rural financial markets in LDCs (e.g., Vogel, 1984b). In Brazil, Mexico, and India, these yearly income transfers can be measured in billions of US dollars. In some countries, the workings of financial markets are having a stronger adverse impact on income distribution than any other force. Very little has been said about this; it deserves much more attention.

Low interest rates also cause major increases in both lenders' and borrowers' costs (Cuevas and Graham, 1984; Ladman, 1984). Low interest rates force lenders to ration and target loans, thus increasing their transaction costs, which also forces many borrowers to incur additional loan transaction costs to gain access to loans. Inflated transaction costs undermine the lender's financial integrity and exclude potential borrowers from access to formal credit.

Low interest rates on loans also force intermediaries to pay even lower rates on deposits. The intermediary cannot mobilize savings and lenders are forced to depend on the government and donors, which, in turn, makes the lender susceptible to political intrusions. Politics further impedes loan collection and encourages default.

An efficient financial market should mobilize private savings. Opportunities and incentives to save through financial markets are strong forces in increasing a country's overall savings performance, but, in most LDCs, financial markets do not provide those opportunities. Low nominal rates of interest combined with inflation result in negative returns for those who hold financial assets. With the small volume of savings going into financial intermediaries at those low rates, the intermediary has little incentive to improve deposit services. Recent research on rural savings behaviour shows a

much larger latent voluntary savings capacity than has hitherto been thought to be the case (Vogel, 1984a).

Development economists should take a more comprehensive view of the adverse effects of low interest rates on rural development. The superficial attention that has been given in the past to how interest rates and the operations of financial markets affect factor proportions is a minor issue compared to other (largely neglected) results of LDCs' cheap-credit policies.

Notes

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[2]We restrict our use of the term "capital" to physical inputs, such as tractors, that contribute to output in several production periods.

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Discussion Opening—*Gregory D. Hanson*

The three papers have examined input use issues that are critical in the countries discussed and in many other developing countries as well. In terms of cost control, the allocation of machinery and credit (and, to an extent, fertilizer) has, during the 1980s, become critical in the USA. Whilst the papers describe conditions in the poorer countries, the treatment of issues is thus equally provocative for economists from the wealthier countries. This is particularly true from an appropriate technology ("less is more") cost structure perspective.

The unifying problem of all three papers is what can be done to reduce the expensiveness of key inputs; i.e., expensive manufactured fertilizer, expensive machinery, and expensive credit. A secondary problem, treated explicitly, concerns the distribution effects of government subsidies to those inputs. Is it fair to subsidize manufactured fertilizer for cash crops and not food crops, machinery only on large farms, or credit only to large farmers? In each case, the authors have emphatically indicated that the answer is "no".

Recommendations in the papers are unmistakable. In terms of physical technology, the call is for an integrated nutrient supply based on nitrogen fixation and farmyard manure, ox hiring and hand hoeing, and the elimination of a state apparatus to subsidize credit. Compelling arguments are made for the employment of better farm management arts that provide enhanced farm planning, more timely applications of labour and cultivation practices, and more self-directed use of full-cost credit.

Two other comparisons that can be made amongst these papers relate to the authors' use of empirical data and economic theory. One is hard pressed to discover evidence of *either* in the paper on the allocation of fertilizer. Other than a few general approximations, few data are produced in the discussion of credit subsidies; however, limited general use was made of neoclassical first-order conditions. The treatment of tractor versus ox power provided an empirical base constituted by two observations each of 81 farmers and indicated that more extensive use of enterprise budgeting, production function estimation, and covariance analysis had been made in a background study. The reader, however, was provided with few statistical results. Quite simply, more solid effort is needed in the presented material regarding both data and theory.

My primary concern, however, is with the degree of generalizations offered. For example, Ackello-Ogutu states that crop production recommendations in LDCs are *ad hoc* and reflect research stations' agronomic biases. He further states that integrated nutrient supply with use of sewage effluent and slurry from biogas plants would not impose further strains on transport, storage, and credit facilities. Based upon a very limited sample of farmers in one region of Kenya, Oluoch-Kosura suggests that public support for tractor hiring service be diverted to alternative programmes. With essentially no empirical support provided, Adams and Gonzalez-Vega state that [only] superficial attention has been given to interest rate effects on factor use and that this is a minor issue compared to other effects of cheap credit.

In each case, the authors may be correct; however, their generalizations have not been adequately supported. Certainly a longer paper would have permitted the presentation of more data and the application of theory; however, the question is one of balance for the permitted length.

The effects of product price incentives, risk behaviour, future land scarcity, and the implications of long-run results merit close examination. The vision of a small-farm future with essentially no manufactured fertilizer or machinery is, to a considerable extent, unsettling for many economists. Sensitivity testing of model results is increasingly recognized to be imperative, as is the crucial requirement of good data.

The authors have provided a challenging set of questions rather than conclusions; they should be commended for thinking in an unorthodox way. The focus on labour-intensive technology, cost control, management effectiveness, and distribution effects of government subsidies should be highly commended. I hope that the concerns raised here will prove useful to further work on these critical issues.

Discussion Opening—*Syed M. Ahsan*

While generally agreeing with Ackello-Ogutu's recommendations, I feel that certain issues need additional clarification. I disagree that over the long term, as the author claims, seed-fertilizer technology is not a viable strategy for raising productivity. In many LDCs, fertilizer use *is* cost efficient. In other words, soil conservation goals, raising productivity, and fertilizer use need not be mutually inconsistent, especially over the long term. Research and extension services are complementary to any form of farm management programme. Greater breakthroughs are only possible through development and introduction of seeds that are suitable to soil, climate, and economic conditions of the poorer agricultures. To remove the emphasis on seed technology would thus be a serious mistake. I would further emphasize the possible gains from a price support strategy. Witness Japan with high productivity, very high guaranteed prices, and other policies (e.g., risk shifting by means of crop insurance). High farm prices would imply hardships; subsidies would be in order.

Since the details of the analytical work (leading to the conclusion that animal drawn equipment performs better than tractors) are not given in Oluoch-Kosura's paper, I can only stress the need for careful work in this area. Is the conclusion similar to those obtained elsewhere? Data problems and statistical tests need to be carefully handled. The author correctly looks into the labour absorption aspects of the land preparation technology. I would only raise the dynamic nature of the problem. Presumably, changes in the rate of urban job creation, population trends, and skill levels would change the benefits of any particular land preparation technology.

Overall, the message is clear. The first two papers both point our attention to the need to devise techniques suitable to the prevailing conditions in the underdeveloped agricultures.

In Adams and Gonzalez-Vega's paper, the question of the appropriate technique in a given situation is an extremely important one. Once the optimal technique is known, the policy issue is how to induce farmers to adopt it. The question of whether agricultural credit is a useful policy instrument in this regard is not examined. The main difficulty in getting directly observable benefits of credit (cheap or otherwise) is the inevitable misallocation via nonfarm uses. In many LDCs (witness Bangladesh and India), the household sector has little access to institutional credit outside home construction loans (and these are typically available only to the urban upper middle class and above). The immediate reform needed in the financial system is to remove this imbalance and find ways of making modest nonfarm consumer credit available.

Negative real interest on deposits in LDCs are not primarily due to cheap rural credit, at least not in Bangladesh. Household savings are typically lent to the private business sector. Most of the capital for rural credit is sanctioned directly by the monetary authorities, with and without international assistance. Low recovery rates (and perhaps low interest earned) make it harder for the credit system to maintain the real value of loanable funds unless new capital is authorized by the state. Thus, in many countries, cheap rural credit (or, for that matter, housing construction loans) has little to do with supposedly low rates of domestic savings mobilization.