INFLATION, CASH FLOWS, AND GROWTH: SOME IMPLICATIONS FOR THE FARM FIRM

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As farm sector prices continue to increase at rates higher than any since World War II, attention is being given to the cause of the price increases and their structural impacts on the farming sector. Land, a major component of farm assets, has been the focus of many studies examining the effects of inflation. Melichar showed current increases in land prices to be consistent with productivity gains. Lee and Rask illustrated that even though current levels of land prices may be justified, firms may have negative cash flows, especially if loans are repaid on level repayment plans. Current inflationary conditions led Robison to conclude that though current land prices may be justified, the benefits and costs are unequally distributed and that, increasingly, persons who in earlier years made land purchases are more able to afford to purchase more, thereby accelerating the trend toward fewer and larger farms.

We demonstrate additional implications of inflation for farm firms. Using present value techniques, we show that even accurately anticipated inflation creates liquidity or cash flow problems for farm firms as capital gains increase in relation to cash returns; moreover, the higher the rate of inflation, the more severe the liquidity or cash flow problem of the firm. We also demonstrate that, to the extent lenders establish borrowing limits based on income, lending limits will be more restrictive with a higher rate of inflation. Hence, the firm's real equity growth rate will be reduced despite profitable investment opportunities. Meanwhile, borrowers who obtained loans when inflation was underanticipated benefit from inflation—their real debts decrease while their net cash flows and equity increases with increases in inflation.

We conclude with two suggestions that may help alleviate the undesirable and disparate consequences of inflation. The suggestions are that lenders (1) institute variable interest rates for long-term loans and (2) adopt increasing rather than constant loan repayment schedules that more nearly match borrowers' income streams with their loan repayments. Support for these two recommendations is deduced in our study.

INFLATION AND FIRM LIQUIDITY

Pricing Nondepreciating Durables

Suppose a decision maker can acquire an asset that is expected to return a net dollar amount R for n periods, after which it can be resold at its original purchase price. If the discount rate for time is r (the rate required by savers to postpone consumption plus an intermediation fee charged by lenders), the maximum price the decision maker can pay is V, an amount just equal to the present value of the net return plus the discounted sale value of the asset. This relationship between the purchase price V and the returns from the asset can be expressed as

$$(1) \quad V = R(1+r)^{-1} + \ldots + R(1+r)^{-n} + V(1+r)^{-n}.$$

One can find a more convenient expression for V by replacing the geometrically weighted income with the net present value of an annuity. Making this substitution and solving for V gives[1]

$$(2) \quad V = R/r.$$

If the decision maker's maximum bid price V exceeds the maximum bid price of all other potential buyers, and equals or exceeds the value of the asset to the owner, V becomes the sale or market price of the asset. Assume the latter is the case—that V represents the most

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Michigan State Agricultural Experiment Station Journal Article No. 9443.

A different version of the article was presented at the Southern Agricultural Economics Association meetings in Hot Springs, Arkansas, February 1980. Subsequently, the authors became aware of a mimeograph by Tweeten which contains many of the same ideas expressed in the first part of that paper, but derived for a continuous model.

[1]Substituting the annuity formula for the geometrically weighted income stream enables us to write

$$V = R\,[1 - (1+r)^{-n}]\,/\,r + V(1+r)^{-n}$$

which after solving for V obtains equation 2.

optimistic buyer's net present value of the asset's returns.[2]

Equation 2 is the familiar capitalization formula. For ease of analysis, assume that financing of the asset is available at 100 percent of asset value. In this special case, with no inflation and interest rate r, the annual borrowing cost of the loan is Vr, an amount just equal to cash income R. The asset would return its interest cost for n periods at the end of which it would be sold at its original value V.

Pricing Capital Assets Under Inflation

Now consider the effects of inflation on the asset described before. Assume that in each period the cash returns from the asset increase by i percent; first period returns equal $R(1+i)$ and n^{th} period returns equal $R(1+i)^n$. Because returns to land are increasing, the asset's value would do so as well. Thus, if the initial purchase price is V, n periods later it would equal $V(1+i)^n$.

Lenders, meanwhile, will not be indifferent to inflation or rising prices. If prices are constant, lenders need be compensated only for time preferences at the discount rate r. If prices are increasing, loan proceeds returned in future time periods will buy less. As a result, lenders will require compensation for losses in buying power equal to the rate of inflation. If without inflation the discount rate were r, with prices increasing at i percent the inflation-adjusted discount rate would equal $(i+r+ir)$. Including these inflationary impacts in our model, we write

$$(3)\quad V^* = \frac{R^*(1+i)}{(1+i)(1+r)} + \dots + \frac{R^*(1+i)^n}{(1+i)^n(1+r)^n} + \frac{V^*(1+i)^n}{(1+i)^n(1+r)^n}.$$

Obviously, the inflationary impacts on income and the asset's value cancel the inflationary impact on the discount rate, so that V^*, the asset's present value under inflation, equals V as long as R^* in equation 3 equals R in equation 1.

Most real estate loans, however, are written on a fixed rate basis; if the new interest rate is $(i+r+ir)$, the loan with 100 percent financing would have interest cost payable each period of $V(i+r+ir)$.

The difference between income $R^*(1+i)$ and interest cost $V^*(r+i+ir)$ on the asset in the first period has significant financial implications. The difference, D, between borrowing cost (opportunity cost) and net returns in the first period is

$$(4)\quad D = (i+r+ir)V^* - (1+i)R^*$$

and because rV^* equals R^*, D can be calculated and written as

$$(5)\quad D = iV^*.$$

The difference between the first period's borrowing cost and net cash returns, as equation 5 implies, is equal to the inflation rate times the asset's value (capital gain) which, of course, is due to inflation. If V^* is 100 percent financed, *outside income* equal to the first period's capital gain will be required to service the debt in the first year if only interest cost is repaid. That is, in the first period, outside income of iV^* will be required to fully pay interest cost (opportunity cost) associated with V^*. In comparison for the capital purchase without inflation, income from the asset just covers the borrowing or opportunity cost.[3]

The preceding analysis does not imply that V^* is a poor investment; rather, part of the

[2]We assert that V equals the market price of the asset if it represents the most optimistic buyer's expected return from the asset. But if V is to be the market price it must also equal or exceed the asset's value to the seller which is determined as follows. He sums the discounted present value of an income stream R which we assume is constant after subtracting the opportunity cost of investing the proceeds of the asset's sale price V at the market interest rate r, an opportunity cost per period of rV. The seller is indifferent between selling and owning the asset if

$$(R-rV)(1+r)^{-1} + \dots + (R-rV)(1+r)^{-n} = 0.$$

Again, we fine a more convenient expression for V by replacing the discounted income stream and the discounted opportunity cost with their present value formulas and writing

$$R\,[1-(1+r)^{-n}]/r - rV\,[1-(1+r)^{-n}]/r = 0.$$

After solving for V, we obtain again

$$V = R/r$$

which is also the buyer's evaluation of the asset's value given in equation 2.

Alternatively, we can argue that the supply of land available for sale is completely inelastic—due entirely to the death or retirement of current land owners. In this case, the market price is what the most optimistic buyer is willing to pay, a price obtained by solving equation 2.

[3]Because 100 percent financing is not likely, we might as what percentage of V^* will be required as a downpayment so that the interest costs on the remaining principal just equal earnings on the asset in the first period.

To find this result, subtract from V^* in equation 4 a downpayment amount DP and set D equal to zero. The result is

$$(i+r+ir)(V^*-DP) - (1+i)R^* = 0.$$

Replacing V^* with R/r and solving for DP, we obtain

$$R^*/r - (1+i)R^*/(i+r+ir) = DP.$$

Then, dividing both sides of the equation by V^* (equal to R^*/r), we obtain an expression for the percentage of V^* required as a downpayment (%DP) as a function of the inflation rate i and the time preference rate r.

$$\%DP = 1 - (r+ir)/(i+r+ir)$$

As expected, the percentage downpayment increases with increases in i as the derivative of %DP with respect to i demonstrates.

$$d(\%DP)/di = r^2/(i+r+ir)^2 > 0$$

A simple example may aid the reader in placing the downpayment requirements in proper numerical perspective. If we let r be a constant time preference for money equal to 4 percent and let i be alternatively 1, 3, 5, 7, and 10 percent, the percentage downpayment requirements became 20, 42, 54, 62, and 69 percent, respectively.

returns from the asset are now received in the form of a capital gain. As an example, divide the first period cash returns $(1+i)R^*$ plus capital gain iV^* by the asset's initial value V^*; the resulting average annual rate of return, AR, is

$$\text{(6)} \quad AR = [(1+i)R^* + iV^*]/V^*$$

and after substitution of R^*/r for V^*, AR can be shown to be

$$\text{(7)} \quad AR = r+i+ir$$

That is, the rate of return to the asset V^* still equals the opportunity cost; however, with inflation, part of the return is in the form of a capital gain which is not available to repay borrowing (opportunity) cost.

Depreciating Durables and Inflation

The cash flow and liquidity implications for the farm firm deduced heretofore are for nondepreciating assets such as land. A logical extension of the analysis is to examine how inflation affects purchases of depreciating durables such as farm machinery. The result is: inflation creates similar cash flow and liquidity problems for purchasers of depreciating assets, but the effects are slightly less severe than those associated with nondepreciating assets.

As an illustration, suppose a decision maker desires to acquire a durable that depreciates, as do its net returns, over time at a real rate of d percent per period. Assume as before a discount rate equal to r; the asset's value is V_d, where

$$\text{(8)} \quad V_d = R(1-d)(1+r)^{-1} + \ldots + R(1-d)^n(1+r)^{-n} + V_d(1-d)^n(1-r)^{-n}.$$

Or, after geometrically summing income and solving for V_d, we can write

$$\text{(9)} \quad V_d = R(1-d)/(r+d)$$

If the durable in equation 9 has 100 percent financing, the loan must be written to retire a part of the principal each payment period. In contrast, with the 100 percent financing of real estate the asset maintains its value. For durables, the asset loses d percent of its previous value each period. Therefore, principal equal to depreciation must be retired in addition to interest on the remaining balance. The reader can verify that without inflation the cash flow in each period will exactly pay interest plus the share of principal to be retired so that the loan balance in period n, for example, equals $V_d(1-d)^n$, the remaining value of the asset.

It should be clear from the previous analysis that even with inflation equation 9 is still the equality for V_d in the period in which returns equal R.

Now the major difference between the purchases of V_d with and without inflation stems from the cash flow problems. We again assume 100 percent financing with a fixed interest rate loan including an inflation-adjusted interest rate. The borrowing cost and principal repayment in the initial period with inflation become $(d+i+r+ir)V_d$ and the income available is $R(1-d)(1+i)$. The difference between principal repayment and borrowing costs and cash income in the first period can be written as

$$\text{(10)} \quad D_d = (i+ir+r)V_d + dV_d - R(1-d)(1+i)$$

where the first term represents interest due, the second term is the required principal payment, and the third term is the cash inflow from the durable.

After simplifying, we obtain

$$\text{(11)} \quad D_d = V_d(i-id).$$

Compare equations 11 and 5, the first period cash flow deficits under inflation associated with the nondepreciating and depreciating durables, respectively. With nondepreciating assets, the deficit is the capital gain. With depreciating assets, the deficit is also the capital gain diminished by the inflated depreciation. Depreciating durables, then, have a slightly improved cash flow pattern in comparison with nondepreciating durables, even though inflation worsens the cash flow pattern in relation to no inflation.

The improved cash flow associated with purchases of depreciating durables in comparison with nondepreciables may help explain why, with inflation, low-equity farmers may find farm machinery purchases a more feasible farm-related investment than, say, land purchases.

Inflation and Windfall Gains

An important question arising from our analysis is: who can afford to purchase assets under inflation when, at least in initial periods, cash returns will not cover borrowing costs? One answer is: borrowers who obtained loans when inflation was underanticipated.

In equation 3 inflation on nondepreciating assets is assumed to be properly anticipated by both borrowers and savers (lenders). Suppose this is not the case. Instead, assume a borrower purchases his asset with a 100 percent loan and fixed interest rate r when inflation is anticipated by both borrowers and lenders to equal zero. Then, immediately thereafter, inflation becomes equal to i percent. This lucky borrower obtains a windfall gain.

Because of inflation, the income stream and asset values increase by i percent each period; but the loan interest rate or discount rate remains at r. Hence, the asset's value and income stream can be written as

$$(12)\quad W+V = R(1+i)(1+r)^{-1} + \dots + R(1+i)^n(1+r)^{-n} + V(1+i)^n(1+r)^{-n}$$

where W is the windfall gain and R, V, i, and r are the same as in equation 3. Thus, subtracting V from equation 1, we obtain

$$(13)\quad W = R[(1+i)-1](1+r)^{-1} + \dots + R[(1+i)^n-1](1+r)^{-n} + V[(1+i)^n-1](1+r)^{-n}.$$

The windfall gain is the present value of the amount by which the inflation rate compounds faster than the time preference rate. It represents a windfall gain to the borrower (or a loss to the lender) for having borrowed 100 percent on the asset when inflation was underanticipated.[4] All of the windfall gain will be realized only if inflation continues at rate i, and the gain could be partly wiped out with the elimination of inflation. Hence, persons who borrowed to acquire assets when inflation was underanticipated may not desire a reduction in inflation rates.

The cash flows in each year for the lucky borrower have important implications. In the first period, borrowing costs equalled rV or R, according to formula 2. But inflation that was not anticipated increases income to (1+i)R instead of R, implying that iR is available to invest elsewhere. In the second period, excess net cash returns would equal $(2i+i^2)R$, and so on. In short, persons who borrowed when inflation was underanticipated have windfall net cash returns available to purchase additional assets. These results are entirely consistent with the fact that two-thirds of land purchases are for expansion purposes (USDA). According to this line of reasoning, then, inflation may well have the effect of increasing the trend toward fewer and larger farms.

An Empirical Example

The preceding theoretical developments suggest that inflation is likely to create cash flow difficulties for persons who purchase long-term assets, unless they have assets generating positive cash flows. To compare this theory with "real world" data, we construct an enterprise budget for one acre of land capable of producing medium yield corn grain. The data used to construct the table were reported by Michigan farmers as part of Michigan State University's record-keeping system, Telfarm, during 1979.

According to the budget estimates, an acre of medium yield corn land at 1979 corn prices would have earned \$61.69. Using equation 2 and letting r equal 5 percent, we find that an acre of medium yield corn grain land would have had a market value of \$1,233.80 (\$61.69 ÷ .05). In 1979, Federal Land Banks in Michigan were offering interest rates adjusted for stock purchases of 9.5 percent for farm real estate loans. If 100 percent of the loan were financed, interest costs in the first year would have been \$117.21 (9.5 percent × \$1,233.80) and the cash flow deficit would have equaled \$55.52 (\$61.69 − \$117.21).

Obviously, a beginning farmer would have been hard pressed to acquire land that produced such large cash flow deficits. Nevertheless, purchases and sales were made at those prices. How? Suppose the farmer who wished to purchase the land described by the data in Table 1 had acquired similar land in 1965 on which he was now earning \$61.69 net income per acre. The earlier purchase provides the following advantage. In 1965, when the land was purchased, it had a market value close to \$377.00 and a fixed interest rate of only 5.8 percent (see Table 2). Thus, even if no principal were repaid during the intervening years, interest cost per acre in 1979 would equal \$21.86 (\$377 × 5.8 percent), producing a cash flow surplus per acre of \$39.83. As a result, 1.4 acres of land purchased in 1965 would provide the surplus cash flows to purchase an acre of the same land in 1979.

TABLE 1. ENTERPRISE BUDGET FOR ONE ACRE OF MEDIUM YIELD CORN GRAIN

GROSS INCOME (100 bu. x \$2.00)	\$200.00	
EXPENSES: [a]		
Labor (6.1 hrs. x \$5.00)	\$ 30.50	
Repairs and Maintenance	9.80	
Seeds	11.33	
Fertilizer	38.25	
Insecticides & Herbicides	12.40	
Fuel	6.00	
Utilities	2.30	
Harvesting, Trucking	6.20	
Corn Drying	14.00	
Other Expenses (including interest on operating debt)	7.53	
	\$138.31	
NET INCOME (Gross Income--Expenses)		\$ 61.69
INTEREST EXPENSE ON REAL ESTATE LOAN (9.5% x \$1,233.80)		\$117.21

[a]Source: Nott, S. B., et al.

[4]Note that convergence is assured by the limit n placed on the loan length even if i exceeds r.

TABLE 2. CASH RENTS FOR CROPLAND, LAND VALUES, INTEREST RATES AND CASH FLOWS

(1) Year	(2) Average Cash Rents [a]	(3) Average Land Values (as of Feb.) [a]	(4) Adjusted Interest Rate on Federal Land Bank Loans [b]	(5) Inflation Rate Proxy (Col. 4-5%)	(6) Cash Flow After Interest Payment [c]
1960	14.08	228	6.3	1.3	$- .28
1961	14.00	239	5.9	.9	- .10
1962	14.58	248	5.9	.9	- .05
1963	14.31	241	5.9	.9	.59
1964	15.42	258	5.8	.8	.46
1965	16.12	271	5.8	.8	.40
1966	17.24	301	6.1	1.1	- 1.12
1967	20.49	328	6.3	1.3	- .17
1968	18.48	350	7.1	2.1	- 6.37
1969	19.15	359	8.1	3.1	- 9.93
1970	18.00	341	9.1	4.1	-13.03
1971	20.21	328	8.3	3.3	- 7.01
1972	19.85	393	7.8	2.8	-10.80
1973	22.77	448	7.9	2.9	-12.62
1974	26.23	563	8.5	3.5	-21.63
1975	28.50	564	9.2	4.2	-23.39
1976	31.17	631	9.2	4.2	-26.88
1977	37.51	786	8.8	3.8	-31.66
1978	38.00	811	8.7	3.7	-32.56
1979	40.00	885	9.5	4.5	-44.08

[a]Source: Various Issues of *Farm Market Real Estate Development.*

[b]Source: Robison and Leatham. Reported interest rates are divided by .95 to adjust for stock purchases.

[c]Calculated as the difference between average cash rents in column 2 and the product of column 3 and 4.

That the cash flow deficits are related to inflation can be demonstrated by the historical series of data in Table 2. These data reflect average land values in Michigan since 1960 and average cash rents, a proxy for net income per acre. Column 4, effective loan rates of Federal Land banks, is a proxy for the discount rate (r+i+ir). If r has been nearly constant at 5 percent, Federal Land Bank loan rates minus 5 percent are approximately equal to i. The correspondence between i reported in column 5 and the cash flow deficit calculated in column 6 is direct: higher inflation rates produce larger cash flow deficits. This evidence seems consistent with the theory presented.

INFLATION AND GROWTH

We have demonstrated that inflation may create cash flow deficits for persons who purchase long-term assets or durables. We now demonstrate further that if lenders extend credit on the basis of income earned, that is, income available for debt servicing, inflation may indirectly reduce the firm's real rate of equity growth.

Consider a simple growth model without inflation (Baker and Hopkin). Define

A = firm's assets which earn returns $(r+\gamma)A$, where γ is the return to management for risk bearing

E = firm's equity

B = firm's borrowings which cost the firm rB.

The firm's equity growth rate g equals returns minus costs divided by equity or

$$(14)\quad g = (r+\gamma) + (\gamma\, B/E).$$

That is, the firm's equity growth rate is the rate of return earned on equity, $r+\gamma$, plus the net return on borrowed funds multiplied by the leverage ratio L equal to B/E. Of course, if borrowed funds can be profitably invested, increasing the leverage ratio will increase the growth rate. But the maximum leverage ratio L is at least partly under the control of the lender, whose principal criterion for lending is returns, $(r+\gamma)A$, which are available for debt servicing. If the lender establishes a repayment period of n years and takes as the maximum annuity payment the firm's returns in the first period, the maximum borrowings equal

$$(15)\quad B = (r+\gamma)A\, a_{\overline{n|}\, r}$$

where $a_{\overline{n|}\, r}$ is the present value of a \$1 annuity, a formula equal to $[1-(1+r)^{-n}]/r$, that converts a constant stream of payments discounted at rate r over n periods into a present value sum.

After substituting the sum of the firm's equity E and borrowings B in equation 15 for the firm's assets A, we obtain:

$$(16)\quad B = (r+\gamma)\, a_{\overline{n|}\, r}\, E \,/\, [1-(r+\gamma)\, a_{\overline{n|}\, r}].$$

Equation 16 states that maximum borrowings equal the present value of an annuity equal to current income per period.

Now inflation must be considered. Recall from the discussion following equation 3 that with or without inflation the asset's value is the current income R divided by the time preference rate. The result implies that income available for debt servicing is still $(r+\gamma)A$, only now the borrowings that this income will support are reduced because the borrowing costs have increased with inflation.

Let B* be the new borrowings permitted by the lender which equal

$$(17)\quad B^* = (r+\gamma)\, a_{\overline{n|}\,(r+i+ir)}\, E / [1-(r+\gamma)\, a_{\overline{n|}\,(r+i+ir)}].$$

Because $a_{\overline{n|}\,(r+i+ir)}$ decreases with increases in i, B* must be less than B; hence the growth rate with inflation, even if properly anticipated, reduces the firm's *real* growth rate.[5]

[5]Let g be defined in equation 14 as the noninflationary equity growth rate with borrowing, B, defined in equation 16. Next, define g* to be the real equity growth rate defined as

$$g^* = r+\gamma + \gamma B^*/E$$

where B* is defined in equation 17.

TABLE 3. THE EFFECTS OF LOAN LENGTH, INFLATION, AND BORROWINGS ON THE REAL RATE OF FIRM GROWTH WITH r ASSUMED TO BE 5 PERCENT AND γ ASSUMED TO BE 1 PERCENT

	Inflation					
Years	0	2	4	6	8	10
	- Percentage Equity Growth Rate -					
10	12.5	11.7	11.0	10.4	9.8	9.4
20	18.9	16.4	14.5	13.0	11.8	10.8
30	23.6	19.3	16.3	14.1	12.5	11.3

Table 3 is constructed to illustrate the impacts of increasing i on the firm's real equity growth rate (ignoring the increases in assets of i percent and thus leaving the real value of the firm unchanged). To construct Table 3, we substitute for B in equation 14 the right side of equation 17, assuming r is 5 percent, γ is 1 percent, and n is alternatively 10, 20, 30, or 40 years, while i varies between 0 and 10 percent. For example, an increase in inflation of from 6 to 10 percent, with 20-year loans, reduces the firm's real growth rate from 13 percent to 10.8 percent.

Similar results can be demonstrated for growth rates when assets are depreciating. The exercise is largely symmetric to the one already developed.

TWO RECOMMENDATIONS FOR LENDERS

A principal cause of the liquidity and cash flow difficulties for persons who purchase and finance long-term assets under inflation is the timing of payments, not the lifetime availability of income from the durables. Assume, for example, that a decision maker purchases a nondepreciating durable which is financed at a rate of i+r+ir percent and that all the borrower is required to pay is interest on the original value of the loan, (i+r+ir)V. As we have already deduced, the first period's cash flow deficit will be equal to the capital gain on the asset, but the second period's cash deficit will be less as income increases with inflation while the opportunity cost on the original borrowing remains constant. At some period j, inflating income equal to $R(1+i)^j$ will equal the borrowing or opportunity cost (i+r+ir)V, and for periods beyond j will exceed the borrowing cost.[6]

If lenders were willing to offer a loan repayment plan more nearly matching the net cash flows of the assets being financed, much of the liquidity difficulty and equity growth rate reduction would be avoided. Assume lenders are willing to do so—that instead of a fixed annuity repayment schedule, they offer a repayment plan whereby loan payments increase at the rate of inflation in income with the first payment equal to net returns on assets $(1+i)(r+\gamma)A$, and so on. The borrowings, B_i, this repayment schedule would support are

$$(18)\quad B_i = \frac{A\,(r+\gamma)\,(1+i)}{(1+r)\,(1+i)} + \dots + \frac{A\,(r+\gamma)\,(1+i)^n}{(1+r)\,(1+i)}$$

and cancelling the inflationary impacts on income and discount rates, we find B_i equal to B, the borrowings available without inflation, i.e., equation 16. This being the case, the borrower could achieve the same leverage and growth rate as he could before inflation. That is, offering a loan repayment plan that matches the borrower's income patterns would allow him to achieve his earlier, preinflation growth rate.

A second means for ameliorating effects of inflation is for lenders to adopt variable interest rate loan plans to finance long-term assets. Robison and Love point out that savers make loan funds available to lenders for shorter periods than lenders offer the funds to borrowers. Thus, if the rate paid to savers increases during the life of the durable loan, lenders may not be able to pass on the increased cost to old borrowers. Instead, they force new borrowers to pay the difference. The result is a subsidy from new to past period borrowers. A variable rate would eliminate this subsidy, forcing old borrowers to assume a more nearly equal cost of loan funds but not unduly discouraging new borrowers from requesting loan funds. Hence, the adoption of a variable interest rate to finance long-term durables would diminish the windfall gain of past-period borrowers and improve equity between new and past borrowers. At least one major real estate lender, the Federal Land Banks, has offered variable rate loans in recent years.

SUMMARY

We have explored some of the important consequences of borrowing to purchase depreciating and nondepreciating durable assets under inflation. The principal effects of inflation are to increase cash flow problems of borrowers. Inflation also reduces the real

[6]The j^{th} time period in which borrowing cost equals income satisfies the equality

$$R(1+i)^j = V(i+r+ir)$$

and after substituting for V, R/r, we write

$$j = \log\,[(i+r+ir)\,/\,r]\,/\,\log\,(1+i).$$

growth rate of the firm if lenders base borrowing limits on the annuity equal to current income from assets.

Loan repayment plans tailored to the cash receipts of borrowers—increasing with inflation—would help greatly to reduce the liquidity and growth problems we have described. We have not addressed the practical problem of estimating future inflation rates.

The unequal distribution of benefits and costs associated with inflation has been demonstrated. Clearly, persons who borrow with fixed interest rates when inflation is underanticipated benefit from inflation in two important ways: their real debts are discounted and their cash flows improve. The latter effect enables them to make additional purchases which are not possible for borrowers who borrow later when inflation is recognized and anticipated.

The adoption by lenders of variables interest rates, which shift the pooled risk of interest rate changes to borrowers, would eliminate some of the windfall gains and losses associated with inaccurately anticipated inflation.

In future studies we hope to examine the tax implications and the uncertainty effects of inflation.

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