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Discussion papers

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ON THE EFFECTS OF INFLATION:
THE DEBTOR-CREDITOR HYPOTHESIS
RECONSIDERED

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I Introduction

The 1970's was a period of unusually high and variable international inflation. It is beyond any doubt that there were significant interactions between inflation, functioning of the financial markets and allocation of economic resources in Western economies. Though no unanimous views have emerged with regard to the social consequences of inflation in terms of the overall welfare, most studies point to substantial redistribution effects within the private sector as well as between the private and public sectors.[1)]

The redistributional effects of inflation largely rest on the debtor-creditor position of each individual or each sector. Though the income tax system generates many of the various channels for redistribution between the government and the private sector, the inflation tax on government debt plays a role, too. It is plausible, however, that the mechanism of redistribution of wealth based on the debtor-creditor position is not so significant in non-regulated, well-functioning financial markets if the actual rate of inflation is predictable enough. It is conceivable that the redistributional effects would be due to temporary under- and overestimations of the future rate of inflation and would cancel each other out over time, on the average. The experience of the 1970's suggests, however, that the debtor-creditor hypothesis has to be taken more seriously. There are two reasons for this. First, due to supply shocks, unpredictable changes in the exchange rates and shifts in economic policy regimes, the actual inflation rate has been relatively variable and presumably hard to forecast accurately. Moreover,

expectations generally seem to lag significantly behind the actual price development. Second and not less importantly, due to regulation or interest rate cartels in financial markets like in oligopolistically competitive banking sectors, the interest rates on nominal loan contracts have not been fully adjusted for inflation. This holds especially for the European economies. But the recent results reported by Carmichael and Stebbing (1983) of the "inverted Fisher hypothesis" using U.S. and Australian data suggest that (stated in after-tax terms) the nominal rates of interest, both short-term and long-term, are independent of the rate of inflation. Whatever the reason is for this observation, it seems to leave ample scope for the redistributional effects of inflation on the basis of ownership of financial assets and financial claims.

This study tries to look into the debtor-creditor mechanism using Finnish data for 1967-1982. This is a period when even the before-tax real rates of interest on borrowing and on deposits used to be negative, though by now Finland has moved a long way in the process of deregulation of financial markets. Low interest rates were linked to the targets of the central bank policy through direct controls of the average lending rates of commercial banks. On the deposit side, there was (and still is) a price cartel between the banks. In conjunction with an internationally high rate of inflation, these conditions created strong incentives for investing in real rather than monetary assets through indebtedness. Obviously, this way has not been open to a significant part of deposit-holders. They are the losers.

In this paper, we want to ask whether and to what extent the stockholders of leveraged firms have actually been in a position to benefit from inflation. We propose that due to rigid borrowing rates there have been

significant net monetary gains in the case of long-term ownership of shares, we derive an appropriate formula to measure the real rate of return on equity and we measure its dependence on the actual rate of inflation.

It is very clear that by concentrating on the real return on shares we only give a partial picture of the redistributional effects of inflation. A significant portion of funds has been invested in other types of "equities" like housing or other real assets. Hence, we presume that there have been significant redistributional mechanisms within the group of deposit-holders for the benefit of those who have been net debtors. If anything, our empirical results give rise to serious qualifications for the message of Feldstein (1980) that inflation is unquestionably bad news for the stock market. At least in the regimes where the nominal loan contracts do not include sufficient inflation premiums the opposite has been the case with long-term ownership of shares. By the same token, though the effects of inflation on the economic growth and welfare are complex and hard to evaluate, our results suggest a tentative conclusion that due to redistributional effects associated with long-term share-ownership, the required rate of return on capital has been abnormally low. Hence, in the case of Finland at least, inflation has created a strong investment incentive and a driving force for capital formation. Whether this is desirable from the efficiency points of view is a different matter.

II Interaction of Inflation and Ownership of Shares

Shares represent a claim on real assets, the nominal appreciation of which is understood to provide a hedge against inflation for the shareholders. But as discussed by Feldstein (1980), there are a number of mechanisms by which inflation interferes with the return on capital in an unindexed corporate tax system. These negative effects are typically associated with increased effective tax rates on capital income derived from personal accounts.

However, in the analysis of the interaction of inflation and the ownership of shares there is an important aspect which has been very much neglected. For a new shareholder who enters the market during times of high inflation, the situation is very different as compated to the case of a long-term shareholder. We take it for granted that under rational valuation of shares no new-comer can benefit from inflation which is anticipated by all market participants with the same confidence. The markets would value shares given this common information. The new-comers can benefit only from inflation which is unanticipated. From the long-term shareholders' point of view the situation is different. Suppose that it is the general understanding at some point in time that inflation will start to accelerate. Now only those shareholders who owned the shares prior to that date can benefit from the net monetary gains in leveraged firms.[2)]

From the above discussion it is evident that the stock market data are most useful in studying the effects of unanticipated inflation on stock returns. But problems arise when one wants to look into the effects of

anticipated inflation. Most important, one has to make an assumption about expectations formation to estimate the anticipated inflation. Then the results one obtains are obviously conditional on the specific expectations hypothesis one is working with.

In this paper we select another starting point from which to study the effects of inflation on stock returns. Tobin (1969) and Yosikawa (1980) consider the implications of the fact that actually capital can be thought to be valued in two different markets, i.e. in the stock market and in the market for capital goods. Over the long run, these valuations coincide, but in the short run they may deviate from one another. While the stock market valuation is a natural starting point for the analysis of the immediate effects of changes in unanticipated inflation, the valuation of equity claims in terms of prices of capital goods will provide information about whether or not the nominal appreciation of the replacement value of firms' capital actually has provided an efficient hedge against the realized inflation. From the point of view of long-term shareholders, the latter approach seems to be the right one. To the extent net monetary gains exist, they are reflected, ex post, in the latter valuation. The next section provides the appropriate formula for the real rate of return on equity, measured in this sense.

III The Real Rate of Return on Equity Capital

Define the value of a firm's equity in current prices as

$$(1) \qquad S = M + p_K K - D$$

where M = monetary assets, D = monetary liabilities, and $p_K K$ = the real capital measured by the replacement value. Now following the earlier work of the author (1979), the expected real rate of return on equity over a given period can be expressed as

$$(2) \qquad r_s(\pi^*) = \sum_i x_i r_i(\pi^*) \qquad (i = M,K,D)$$

where $x_M = M/S$, $x_K = p_K K/S$, and $x_D = -D/S$, where π^* is the expected rate of price inflation over that period and where $r_i(\pi^*)$ is the expected real rate of return connected with item i.

The actual rate of return can be obtained from (2) by inserting π, the actual rate of inflation, instead of π^*. Then the inflation neutrality of equity returns can be defined as

$$(3) \qquad \frac{\partial r_s(\pi)}{\partial \pi} = 0$$

Suppose that there are potential forecast errors with respect to the rate of inflation, i.e.

$$(4) \qquad \pi^*/\pi = \beta \lessgtr 1$$

such that the market rates of return on financial assets and liabilities can be written as $i^M = r^M + \beta\pi$ and $i^D = r^D + \beta\pi$ where r^M and r^D are the noninflationary rates of return. Alternatively, the same relationships are obtained under interest rate regulation, which tends to make $\beta < 1$. Then the actual real rates of return are

$$
\begin{aligned}
r_M(\pi) &= r^M + (\beta - 1)\pi \\
r_R(\pi) &= r^R \\
r_D(\pi) &= r^D + (\beta - 1)\pi
\end{aligned} \tag{5}
$$

One can now write the real rate of return on equity in three alternative but equivalent ways

$$r_S(\pi) = \sum_i x_i r_i(\pi)$$

$$= (r^M M + r^R R - r^D D + (1 - \beta)\pi(D - M))/S \tag{6a}$$

$$= (r^M M + r^R R - r^D D + (\pi - \pi^*)(D - M))/S \tag{6b}$$

$$= (r^R R + i^M M - i^D D + \pi(D - M))/S\,. \tag{6c}$$

Hence, in the regime of nominal interest rigidity, the inflation gain on equity is positively related to net monetary liabilities ((6a)) but could be eliminated by appropriate indexation of the nominal rates ((6c)). Alternatively, the real rate of return on equity is positively related to the product of unanticipated inflation and the net monetary liabilities, which are fixed in nominal terms ((6b)). It is the expression (6c) which is most straightforward for empirical work, because there one does not need to measure the rate of unanticipated inflation, as in (6b), or obtain an estimate for the "Fisher parameter" β, as in (6a).

IV Empirical Results

The empirical work reported in this paper is based on the data set of revised balance sheet and income statement figures of 28 large manufacturing firms in Finland and described in more detail in Kanniainen and Hernesniemi (1986). Basically, in construction of this data set the replacement values of fixed assets were estimated using the so-called perpetual inventory approach, which required re-estimation of the annual cost of depreciation. For example, due to valuation problems caused mainly by inflation the reported balance sheet figures for the fixed capital of the firms amount to no more than 41 % on average of the estimates obtained through the revision procedure. Moreover, the inventory figures had to be re-estimated to counteract the effect of the inventory allowance.

The appendix provides our estimates for the inflation-adjusted, ex post real rate of return on equity in the firms included in our study (the right hand column). The average figure amounts to 8.3 %, though there is substantial dispersion between different firms. One arrives at these figures by starting from the left-hand column, which gives the estimates for the real rate of return on real assets of firms (i.e. fixed assets and inventories), after corporate taxes.[3] Again the variability between different firms is very high. The average figure is 5.2 %.[4] By adjusting the numerator for the interest rate turns in (6c) and the denominator for debt, one obtains the next column, the rate of return on equity unadjusted for the inflationary gains. It may not be any surprise to some readers that for most firms in the forest industry, these figures are actually negative. This is due both to the low profitability and high indebtedness of the Finnish forest industry.

Given the observations presented in the appendix, the question is: why do the shareholders continue to hold shares of the firms having negative rates of return on equity? The next column gives the answer in terms of the net monetary gains due to inflation. On the average, the annual net monetary gains amount to 6.6 %. The fourth column makes one more adjustment needed for proper measurement of the real rate of return on equity. It is the real capital gain or loss due to the excess of nominal appreciation or depreciation of capital goods over the consumer price index. This effect was, or simplicity, abstracted from in section III of the paper, but because it represents a change in the net wealth of shareholders it is included, too. On the average, the real capital gains amount to 1.0 % during the period 1967-1982.

The inflationary gain (column 4 in the appendix) would only have been eliminated by a sufficient inflation premium on debt, though this would of course not have eliminated the tax distortions involved. Given both the inflationary and tax distortions, one wants to raise the question: to what extent was inflation actually reflected in the real rate of return on equity during the period 1967-82 when the latter is calculated net of the corporation tax but before any personal taxes on capital income (and the wealth tax in Finland)? To study this the following regression equation is formed

$$(7) \qquad y_{it} = \gamma_0 + \gamma_1 x_{it} + \varepsilon_{it} \qquad \begin{matrix} i = 1,\ldots,N \\ t = 1,\ldots,T \end{matrix}$$

where y_{it} is the real rate of return on equity adjusted for inflation for a firm i in year t, and where x_t is the rate of inflation in year t,

measured by the consumer price index. Note that by working with equation (7) we are not actually testing directly any hypothesis of market behavior like asset valuation or asset pricing. Equation (7) aims at measuring the statistical relationship between the realized real rates of return and the realized rate of inflation. To estimate the parameters γ_0 and γ_1 we allow for heteroskedasticity between firms but assume that the disturbances are independent between firms. Moreover, we allow for the possibility that the successive disturbances follow a time-wise autoregressive model, as suggested by Kmenta (1971) chapter 12. The autocorrelation coefficients are not restricted to be equal over firms. Hence, we work with the assumptions

$$
\begin{aligned}
&\varepsilon_{it} = \rho_i \varepsilon_{i,t-1} + u_{it} \\
&E(\varepsilon_{it}\, \varepsilon_{jt}) = 0 \qquad\qquad i \neq j \\
&E(\varepsilon_{it}^2) = \sigma_i^2 \qquad (8) \\
&u_{it} \sim N(0, \sigma_{ui}^2) \\
&E(\varepsilon_{i,t-1} u_{jt}) = 0 .
\end{aligned}
$$

Thus we have $\varepsilon_{it} \sim N(0,\ \sigma_{ui}^2 (1 - \rho_i^2)^{-1})$ and $E(\varepsilon_{it}\, \varepsilon_{is}) = \rho_i^{t-s} \sigma_i^2$. The variance-covariance matrix of ε_i's, say Ω, can now be consistently estimated and using Aitken's generalized least squares estimation method one obtaines estimates for the parameters of the model i.e.

$$
\tilde{\gamma} = (X' \Omega^{-1} X)^{-1} (X' \Omega^{-1} Y) \qquad (9)
$$

where $\tilde{\gamma} = [\tilde{\gamma}_0\ \tilde{\gamma}_1]'$, $Y = [y_{11}, \ldots, y_{1T}, \ldots, y_{N1}, \ldots, y_{NT}]'$

and where X is the matrix of the explanatory variables in (7).

The estimation results based on pooled cross-section time-series data are given in the table below.

Table. The Effect of Inflation on the Real Rate of Return on Equity in a Sample of Finnish Manufacturing Firms, 1967-1982. Pooled Cross-Section Time-Series Results (t-values are given in parenthesis).

$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{e}_{yx}$	$\bar{R}^2$	SEE
0.019	0.727	0.850	0.315	0.094
(1.78)	(7.42)			

$\hat{\rho}_{min} = -0.30$	$\hat{\sigma}^2_{min} = 0.0018$	$S_R = 3.9527$	$F = 1.517$
$\hat{\rho}_{max} = 0.85$	$\hat{\sigma}^2_{max} = 0.0231$	$S_U = 3.2695$	

The estimation results suggest that over the period 1967-82 inflation has given rise to a substantial increase in the rate of return on equity, prior to personal taxes on capital income. Note the significance of the estimate of γ_1 as measured by the t-value. The elasticity (e_{yx}) evaluated at the means of the variables obtains the value 0.850. It appears that there are differences in the disturbance terms between the firms. Hence, it is reasonable to ask whether there are firm-by-firm differences also in the parameters γ_0 and γ_1. Comparison of the residual sum of squares (S_R) obtained from the pooled regression (7) to the sum of the residual sum of squares of firm-by-firm estimations (unrestricted sum of squares, S_U) gives the relevant F-statistic, which is 1.517.[5] Though we can reject the null hypothesis of constant γ_0 and γ_1 for the firms at the 5 % level, we are not able to rejct it at the 1 % level.[6]

One can note the potential implications of omitted variables for the estimation. If the disturbance terms include same omitted variables, there would be potential efficiency gains in utilizing the information in the covariance structure of the disturbances between different firms. However, the high t-value for $\hat{\gamma}_1$ does not point to a need for additional efficiency for our purposes.

V Final Remarks

The above results point to the important role of the financial structure of firms in determination of the return on equity during inflationary periods under rigidity of interest rates on nominal loan contracts. We have found a significant positive relationship between the real rate of return on equity (including distributed and undistributed corporate profits) and realized inflation. This finding seems to be in contrast to many other studies. But our current data are not informative about the behavior of the effective tax rates on capital income and hence about the implied transfers of income between the government and the shareholders. Obviously there is substantial variability in the marginal tax rates of different individuals depending on the mixture of cash dividends and capital gains derived from owning shares and on the tax brackets they belong to. However, it seems plausible that the conclusions obtained in this study do hold qualitatively even if the personal taxes on capital income are taken into account.

Footnotes:

1) Empirical calculations of the redistributional effects can be found in Bach and Stephenson (1974) and in Fischer and Modigliani (1978) for U.S. data and in Lützel (1985) for German data.

2) In the case of the Finnish financial system, debt of leveraged firms typically has been in the form of bank loans fixed in nominal terms.

3) Hence the real rate of return on real assets is obtained as the ratio of the operating income adjusted for the estimated cost of depreciation (but including the interest on debt) to the revised replacement value of capital (fixed assets and inventories). In an unindexed tax system the after-tax real rate of return is affected by inflation through the tax allowances. In the Finnish case, the distortions due to historic cost depreciation are partly eliminated through the accelerated rates applied in calculation of the depreciation allowance. Firms apply FIFO accounting, but they are entitled to a special inventory allowance. There are two aspects in the deductibility of the rate of interest. First, the interest deductions overestimate the cost of debt because of deductibility of the nominal cost instead of the real cost. But second, an adverse effect comes from non-deductibility of the cost of internal equity.

4) Apart from unanticipated shock effects (which do not play any significant role in the figures of the appendix because the data are averages over 16 years) the differences between different firms can be attributed both to differences in the riskiness of projects and to the market structure. Indeed, the industrial organization paradigm seems to explain the persistent differences in the rate of return in terms of the degree of competition, or less precisely, in terms of the openness of the various sectors with respect to foreign competition, cf. Ylä-Anttila (1985).

5) The F-statistic can be calculated as follows

$$F = \frac{(S_R - S_U)/(2N - 2)}{S_U/(NT - 2N)}$$

where N = number of firms and T = number of years.

6) On the basis of available tables for the critical values of the F-statistics this conclusion is a bit uncertain, however. Actually, one would expect variations to some extent between different firms because their debt/equity ratios, for example, vary due to different financial policies. Still, the estimate we got for γ_1 is a useful average figure when compared to the firm-by-firm estimates from unpooled data. When estimated firm-by-firm, the standard deviations of the estimates were larger than those from the pooled data as one would expect given that there were only 16 observations for each firm but 448 in the pooled data.

Appendix Estimates of the real rate of return on equity and its components in 28 Finnish manufacturing firms: annual averages in 1967-1982.

(1) firms
(2) real rate of return on capital (r^R, the income of financial assets included)
(3) unadjusted real rate of return on equity
(4) inflation gain on net monetary liabilities (% of the value of equity)
(5) real capital gains/losses (% of the value of equity)
(6) real rate of return on equity adjusted for inflation and real capital gains/losses

(1)	(2)	(3)	(4)	(5)	(6)
1. Ahlström Oy	0.06143	0.02225	0.06336	0.013296	0.09893
2. Enso-Gutzeit Oy	0.00556	-0.06840	0.08007	0.012265	0.02687
3. Oy Finlayson Ab	0.01050	-0.03012	0.04287	0.000537	0.01325
4. Oy Fiskars Ab	0.05856	-0.02175	0.07998	0.023717	0.08193
5. Huhtamäki Oy	0.07150	0.03131	0.06735	0.009691	0.10825
6. Kajaani Oy	0.02000	-0.03250	0.09767	0.013049	0.07818
7. Oy Kaukas Ab	0.03887	-0.01993	0.09446	0.015856	0.09043
8. Kemi Oy	0.02656	-0.02718	0.07931	0.011929	0.06400
9. Kone Oy	0.12769	0.06868	0.07076	0.011540	0.15075
10. Kymi Kymmene Oy	0.02693	-0.02800	0.07519	0.010750	0.05793
11. Lassila & Tikanoja Oy	0.09400	0.47125	0.03009	0.006333	0.08343
12. Oy Lohja Ab	0.07650	0.05593	0.03822	0.004002	0.09806
13. Oy Nokia Ab	0.09025	0.06750	0.03618	0.013804	0.11594
14. Oulu Oy	0.01175	-0.04743	0.05101	0.008658	0.01237
15. Kustannusosakeyht. Otava	0.10881	0.04437	0.04685	0.004859	0.09606
16. Outokumpu Oy	0.02006	-0.01637	0.05646	-0.004426	0.03568
17. Oy Partek Ab	0.05312	0.03193	0.03791	0.007134	0.07712
18. Rauma-Repola Oy	0.06450	0.02660	0.07061	0.019208	0.11856
19. Oy W. Rosenlew Ab	0.04981	0.00250	0.05561	0.011752	0.06987
20. Oy Wilh. Schauman Ab	0.04200	-0.03312	0.11007	0.011327	0.08825
21. G.A. Serlachius Oy	0.09868	0.06837	0.16238	0.018166	0.24881
22. Oy Strömberg Ab	0.07093	0.05031	0.06613	0.003435	0.11987
23. Suomen Sokeri Oy	0.07675	0.05560	0.06627	0.009316	0.13112
24. Suomen Trikoo Oy Ab	0.01525	-0.01587	0.02957	0.004977	0.01868
25. Tamfelt Oy	0.03500	0.01306	0.02507	0.009378	0.04762
26. Tervakoski Oy	-0.01618	-0.08675	0.06172	0.013356	-0.01162
27. Oy Wärtsilä Ab	0.08056	0.02868	0.06728	0.005517	0.10137
28. Yhtyneet Paperiteht. Oy	0.04275	-0.00056	0.08532	0.015049	0.09962
the average	0.05220	0.00670	0.06599	0.010160	0.08291
standard deviation	0.058	0.089	0.050	0.060	0.114

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