Subsidies for Job Creation: Is Small Best?

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ABSTRACT. Wisdom has it that direct financial assistance to small firms for employment creation may be poor use of resources since these firms have high failure rates. In this paper we identify another feature which works in the other direction, which suggests that small firms will be more responsive to assistance. This is related to these firms relatively poor access to private funds. Recent evidence is reported suggesting that proportionate grant assistance is more effective in small firms, but only in those firms which are new or relatively young. Explanations of this are considered related both to the cost of funds and to other factors.

1. Introduction

Is giving financial assistance to a large firm a better use of resources than spreading the same assistance across many small firms? Despite the burgeoning small firm literature, this question has received relatively little attention. There are numerous examinations of the effects of assistance to small firms, but these focus almost exclusively on explicit small firm measures, including studies of small firm direct investment grants (e.g. Owen, 1992), indirect assistance in the form of small firm loan guarantees (e.g. Cowling and Clay, 1995), start-up assistance (e.g. Maung and Erens, 1991) and that for small firm management development (e.g. Marshall et al., 1993) and advice (e.g. Segal Quince Wicksteed, 1991). The evidence for small firms is reviewed by Storey (1994) who concludes that grants "seem to induce changes which would not have occurred otherwise" (p. 286). However, the question remains as to whether these grants could have induced an even greater effects in large firms?

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The question posed is a simple yet difficult one since there are potentially many differences between small and large firms, including the markets and regions in which they tend to operate and the greater access which large firms may have to economies of scale. In this paper we focus on one aspect of small firms which, other than size per se, Storey (1994) describes as the fundamental distinguishing characteristic, and that is their higher probability of failure. This has two implications for grant assistance. First, small firms are more risky so that there is a higher probability that a supported project in a small firm will yield no return at all.[1] Second, and reflecting this, small firms may have a poorer access to private funds with which to match to proportionate assistance. The first of these appears to make large firms a better option for the policymaker, but in this paper we argue that the second feature actually works in the other direction, so that larger job creation effects may be associated with small firms despite their higher failure rates. Further, we report recent empirical which seems to back-up this view.

The structure of the paper is as follows. In the next section we develop a model and show that there are reasons to believe that grant assistance may have stronger effects in high-risk rather than low-risk firms, despite their higher failure rates. In section 3 we summarise recent empirical evidence which suggests that assistance has greater employment effects in small and younger firms, including start-ups. In section 4 we consider the extent to which our model may explain this pattern of effect, but also consider other possible explanations. Finally, in section 5 we draw conclusions.

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2. The model

We focus on direct financial assistance for job creation, where the assistance is in a proportionate grant form available against capital costs at a fixed rate.[2] We suppose there are two firm types, which we call high-risk, $i = H$, and low-risk firms, $i = L$, and we consider a representative firm i implementing a project with the support of public assistance. We denote project capital stock or scale by K_i which is variable, and which is funded from either public assistance A_i or from private funds F_i. It is assumed that private funds are drawn from risk neutral banks which operate in competitive markets, but that there is symmetric information in this market, so that loan contracts can be set independently for each firm. We later consider the significance of this. Assuming our variables are measured in the same units we write

$$K_i \equiv F_i + A_i \tag{1}$$

Since our argument does not rest on possible factor substitution effects, we assume these away and suppose that optimal project employment E_i^* is a constant proportion b (> 0) of optimal project scale K_i^*, so that the factors are employed in fixed proportions. Thus, we write $E_i^* = b \cdot K_i^*$.[3] Further, we suppose that the project has some probability of failure p_i ($0 < p_i < 1$), where $p_H > p_L$, in which case the project leads to no employment effect. Using (1) this means that the expected employment effect of the project in the with-subsidy position is related to project funds in the following way

$$E_i^* = (1 - p_i) \cdot b \cdot (F_i^* + A_i^*) \tag{2}$$

Since $p_H > p_L$, then (2) suggests that high-risk firms will give a smaller employment effect than than will low-risk firms. However, we show that a higher failure rate will cause other variables in (2) to vary between high- and low-risk firms, and in particular that these other variables suggest a larger employment effect in high-risk firms.

A. *The additionality coefficient*

Equation (2) does not tell us directly about the relationship between the employment effect and assistance because it includes the with-subsidy level of private funds F_i^*, whereas for the purpose of determining this effect it is the unobserved without-subsidy level of private funds, F_i^w, which is relevant. In general, F_i^w will not be the same as F_i^*, because firms may increase their with-subsidy private funds above the without-subsidy level, or may even reduce them in which case they substitute some or even all of the assistance for private funds. To determine this we can define an 'additionality coefficient' d_i ($d_i \geq -1$), which measures the responsiveness of private funds to assistance, as follows

$$d_i = (F_i^* - F_i^w)/A_i^* \tag{3}$$

When $d_i = -1$ then $F_i^* + A_i^* = F_i^w$ and with-subsidy project scale is exactly the same as in the without-subsidy level so that the assistance exactly substitutes for private funds, but otherwise there is some increase in project scale.[4] Substituting for F_i^* in (2) using (3) gives

$$E_i^* = (1 - p_i) \cdot b \cdot (F_i^w + (1 + d_i) \cdot A_i^*) \tag{4}$$

From this we see that the increase in optimal project employment, ΔE_i^*, per unit of assistance, ΔA_i^*, is given by

$$\Delta E_i^*/\Delta A_i^* = (1 - p_i) \cdot b \cdot (1 + d_i) > 0 \tag{5}$$

From (5) the effectiveness of assistance not only depends on the failure rate p_i, but also on the parameter b and the additionality coefficient d_i. We know that $p_H > p_L$, but now we show that there are reasons to believe that the additionality coefficient also varies between high- and low-risk firms, and in particular that $d_H > d_L$.

B. *Employment effectiveness*

First of all, we note that the rate of assistance $g (0 \leq g < 1)$ is given by $g \equiv A_i/K_i$. It is assumed that the assistance is available at the same rate for all firms, so that each type must take-up assistance A_i at this rate. Using this and (1) we can therefore rewrite (3) as

$$d_i = -1 + (1 - K_i^w/K_i^*)/g \qquad (g > 0) \tag{6}$$

Given the assistance rate g, then (6) tells us that the additionality coefficient increases with the ratio of with- to without-subsidy project scale, K_i^*/K_i^w. Thus, to determine the effectiveness of assistance it is necessary to determine the project scale in both positions, and for this it is necessary

to give some objective to the firm. We assume that the firm maximises present value project profits as follows

$$\max_{K_i} Q(K_i) - C(F_i) \tag{7}$$

subject to $K_i \equiv F_i + A_i$ and $g \equiv A_i/K_i$

where $Q(K_i)$ is the project production function, which is continuously defined with $Q_{Ki} > 0$ and $Q_{KKi} < 0$, and $C(F_i)$ gives the present value cost to the firm of private funds.[5] Combining the constraints gives $F_i \equiv (1 - g) \cdot K_i$, so that the necessary condition to (7) gives

$$Q_{Ki} = (1 - g) \cdot r_i \tag{8}$$

where $r_i \equiv C_{Fi}$ denotes the present value marginal cost of private funds, and the right-hand side of (8) is an expression for the user cost of capital. For simplicity, it is assumed that the marginal cost of private funds is constant for any given firm, so that it does not vary with the amount of private funds F_i, and for convenience r_i may be thought of as the private interest rate.[6] Further, since banks make zero expected profits and $p_H > p_L$, then it follows that $r_H > r_L$, so high-risk firms must face a higher cost of capital.

When $g = 0$ then (8) gives the without-subsidy project scale K_i^w, and when $g > 0$ it gives the with-subsidy scale K_i^*. Assuming r_i is defined continuously, then differentiating K_i^*/K_i^w with respect to r_i, and using (8), we get the following result (see Wren, 1996).

$$\partial(K_i^*/K_i^w)/\partial r_i > (=)\ (<)\ 0 \quad \text{as} \quad \eta_i^* < (=)\ (>)\ \eta_i^w \tag{9}$$

where the elasticity $\eta_i = -Q_{Ki}/K_i \cdot Q_{KKi}$ measures the responsiveness of project scale in the with- (η_i^*) and without-subsidy (η_i^w) positions to changes in the user cost of capital. The sign on the first relationship in (9) depends on the sign in the second relationship, which is a technical relationship embodied in the production function. We now examine this.

First of all, consider a homogeneous production function of the form $Q(K_i) = K_i^\alpha$. Then, it is easy to see that $\eta_i = -Q_{Ki}/K_i \cdot Q_{KKi} = 1/(1 - \alpha)$, so that the elasticity in this case is independent of project scale and $\eta_i^* = \eta_i^w$. This is because the homogeneous production function exhibits decreasing returns to scale which are constant, and in this case a reduction in the user cost of capital causes an increase in project scale which in proportionate terms is independent of the initial scale. A more plausible production function exhibits returns to scale which are at first increasing and then decreasing, giving the conventional 'U'-shaped long-run average cost curve. In the Appendix we show that for a production function displaying this property we have that $\eta_i^* < \eta_i^w$. Thus, putting (9) together with (6) and (5), we get:

Proposition: The higher is the marginal cost of private funds to a firm then the greater is the additionality coefficient, and other things constant, the larger is the employment effectiveness of assistance.

The reasoning behind this is as follows. High-risk firms face a higher marginal cost of capital than low-risk firms and implement a smaller project scale in the without-subsidy position. However, the responsiveness of project scale to reductions in the cost of capital is shown to decrease in project scale, so that these high-risk firms generate a larger a response to a reduction in the cost of capital brought about by proportionate grant assistance.

3. Employment effects of assistance

We have shown that both p_i and d_i in (5) are higher for high-risk firms, so that theory gives an ambiguous result concerning the relative effectiveness of grant assistance in high- and low-risk firms. This is therefore essentially an empirical matter, and in this section we summarise some recent empirical results which suggest that grant assistance is more effective in small and younger firms. We subsequently interpret these in the light of our model.

The evidence on which we report in this section is based on a pooled cross-section time-series econometric analysis of data which was first examined by Wren and Waterson (1991). Essentially, this amounted to estimating a partial adjustment mechanism in firm (or establishment) employment L_i as follows

$$\Delta L_i = \lambda \cdot E_i^* - \delta \cdot L_i + \varepsilon_i \tag{10}$$

where the change in firm employment in a period ΔL_i consists of three parts: gross additions to

project scale, where E_i^* is given by (4) and λ is an adjustment parameter; less redundancies from the stock of firm employment which occur at a constant rate of δ; plus a random error term ε_i. Substituting for E_i^* in (10) using (4), then our regression coefficients on assistance terms have the form $\lambda \cdot (1 - p_i) \cdot b \cdot (1 + d_i)$, which we estimate for different types of assistance. Estimation requires knowledge of the without-subsidy level of private funds F_i^w, which is unobservable, so that the procedure was to regress (10) across both assisted and non-assisted firms, and then to check for the constancy of the estimates on the non-policy terms between the two groups.

This data used to estimate (10) comprised assistance payments to 142 manufacturing establishment plants in the North East of England made under regional policy instruments over the period 1975–77.[7] The size distribution of assisted firms is roughly log-normal, so that the mean employment level of the sample is 326 employees but the median employment level is only 75.[8] In addition, there are employment data on 134 non-assisted establishments with comparable characteristics, which form a control group within the estimation. The data include three main types of assistance: fixed rate *capital grants* available on an automatic basis to qualifying projects towards plant, machinery and industrial buildings; variable rate *project grants* available on a discretionary basis to projects with good prospects of job creation; and *rent assistance* available on new factory lettings related to the amount of floor space.[9]

Two characteristics of assisted firms were distinguished in the analysis relating to the size and age of the establishment.[10] First, there are two size groups: 'small' firms which are individual establishment plants with less than 200 employees in 1975 and 'large' firms which comprise all other plants. Second, there are three age groups: 'new' establishments which were set up around the time at which they received assistance (i.e. in the years 1974 to 1976), 'younger' plants which opened no more than ten years before assistance (i.e. 1966–73) and 'older' plants which opened more than ten years before assistance (i.e. pre-1966).

The results of interest from the above studies are reproduced in Table I. This shows the direct net cumulative employment effect for each £1,000 of assistance at constant 1985 prices up to five years after the receipt of assistance. For example, the figure of 0.147 in the Table for the three-year effect indicates that each £1,000 of capital grant assistance received by small firms was on average associated with 0.147 jobs after three years. Put another way, we can invert the figures to get gross Exchequer direct costs per job, and this indicates that £1,000/0.147 = £6,800 (1985 prices) in capital grants was required to generate one job in small firms after three years (i.e. a three-year 'cost per job'). The figures in parentheses in the Table are t-ratios, which give the statistical significance of each coefficient.

First of all, consider the results for the analysis by form of assistance and firm size in part (a) of Table I. The estimates suggest that project and capital grants have significant employment effects in small firms which are still apparent after five years, and in this respect project grants appear more effective than do the automatic capital grants, perhaps because these are more directly related to job creation. Grant assistance to large firms has only weak employment effects, being barely significant after three years and showing a negligable effect thereafter. Rent assistance shows a strong employment effect over five years in firms of all sizes, but the main role of this assistance form may be to determine the location for projects which are in any case expansionary in nature.

Further light on the effects of assistance is shed in part (b) of Table I, which analyses the same data by form of assistance and by the size *and* age of establishment.[11] The results obtained suggest that the strong employment effects associated with small firm project grants and rent assistance arise in part from the support of new establishments. It can also be seen that the effect of project grants diminishes rapidly after three years because these new firms are associated with relatively high failure rates. The last two rows of the Table confirm that both the size *and* age of establishment are important, with small and younger firms showing significantly greater employment effects than do firms which are either large or older.[12]

TABLE I
Estimated time-profile of assisted employment

Scheme and firm type	Number of years after assistance			
	One-year	Two-year	Three-year	Five-year
(a) *By form of assistance and firm size*				
Small firms: capital grants	0.044 (3.6)	0.127 (4.6)	0.147 (4.4)	0.082 (3.9)
Small firms: project grants	0.119 (3.0)	0.682 (5.6)	1.189 (3.0)	0.279 (3.9)
Large firms: capital and project grants	0.017 (0.6)	0.047 (1.3)	0.101 (1.7)	0.004 (0.1)
Rent assistance: all firms	0.069 (1.9)	0.243 (4.8)	0.552 (8.9)	0.531 (6.4)
(b) *By form of assistance, firm size and age*				
Small and new firms: project grants	0.174 (3.2)	0.896 (4.0)	1.273 (4.1)	0.289 (2.6)
Small and new firms: rent assistance	0.029 (1.2)	0.148 (3.2)	0.347 (5.3)	0.448 (4.9)
Small and younger firms: all assistance*	0.081 (5.5)	0.136 (5.2)	0.134 (4.2)	0.212 (5.8)
Large or older firms: all assistance*	0.018 (1.4)	0.048 (1.4)	0.085 (1.5)	0.037 (1.2)

Sources: (a): Table VII, Wren (1994a); (b): Table II, Wren (1994b).
Notes: The Table shows the estimated number of direct net cumulative jobs created per £1,000 of assistance (1985 prices) for different aid and firm types, one, two, three and five years after the receipt of assistance, with t-ratios in parentheses. Firms were assisted over 1975–77. Small firms are individual establishment plants with less than 200 employees in 1975, and large firms are all other plants. New firms were established in the years 1974 to 1976, younger plants opened 1966 to 1973 and older plants opened pre-1966. The estimates in each part of the Table are based on 256 payments of assistance, and the number of cases for the entries shown in part (a) are: 32, 46, 139 and 39; and for part (b): 9, 12, 39 and 196.
* For convenience of presentation, the estimates for small and younger firms in part (b) includes 5 cases of large firms receiving project grants which had estimated coefficients which were not significantly different, and likewise the estimates for large or older firms includes 7 new firm recipients of capital grants.

4. Possible explanations

The empirical results suggest that grant assistance in various forms will have stronger employment effects in those firms which are small, but which also are either new or young (i.e. set-up no more than ten years before the date of assistance). These are precisely the firms with higher failure rates (e.g. Dunne, Robertson and Samuelson, 1989) indicating smaller job creation effects, but the Proposition from our model suggests that the additionality coefficient and effectiveness of assistance will be greater to the extent that these firms face a higher marginal cost of private funds. In this section we consider if this can potentially account for pattern of effect shown in Table I, and then consider other possible explanations.

A. *Cost of private funds*

The evidence that small and younger firms have higher closure rates than other firms is non-controversial, and on this basis we may expect these firms to face higher interest rates as private lenders attempt to cover the higher losses on loans to these firms. However, Storey (1994) notes that "banks' preferred reaction is not to raise interest rates but rather to reduce the availability of loans" (p. 207) through credit rationing. We have assumed that there exists symmetric information between banks and firms, but the argument for credit rationing rests on the existence of asymmetric information. Under this, banks are unable to observe all the relevant characteristics of borrowers, and are therefore unable to set a tailor-made interest rate for each firm. Instead they rely on other means, and the arguments are as follows.

Where banks are poorly informed over investment risks, but projects have the same expected returns, then Stiglitz and Weiss (1981) argue that raising the interest rate is counter-productive since it drives out the low-risk projects and leaves the bank with the high-risks, so that there may be credit rationing. Further, where projects differ in expected returns, De Meza and Webb (1987) show that an equilibrium in low- and high-risk projects can exist, but in which all firms face the same rate of interest. In such cases, collateral may provide

a useful signalling device to the bank since it is more attractive to those firms with low-risk projects (Besanko and Thakor, 1987), and may be used as a method of screening projects. However, notwithstanding these arguments, there are a number of reasons why the assisted small and younger firms face higher costs of private funds than do assisted large or older firms:

(I). As well as higher failure rates, small and younger firms have other features which distinguishes them from other firms and that is their size and their age! These are observable and provide powerful signals to banks on investment risk, and it seems reasonable that the banks would take this into account in their lending.

(II). While some small and younger firms may be unable to obtain private finance, either because of credit rationing or because they are unable to satisfy collateral requirements, this seems unlikely to be the case for financially assisted small firms. This is because they must match private funds to the proportionate grant assistance.

(III). We have focused on external loan finance, but where small and younger firms use other sources of finance then we may argue that these are still more costly to small firms. In the case of retained profits these are a cushion against unfavourable shocks, but since these shocks are likely to more adversely affect small and younger firms, then these have a higher opportunity cost to these firms.[13] In the case of equity finance high fixed costs means that the average cost of this to small and younger firms is likely to be high, and indeed because of this it is argued that there may even be an 'equity gap'.

As a group we may expect small and younger firms to face a higher costs of capital than do other firms because of their higher default risk. The adverse selection arguments rest on a bank's inability to discover other relevant characteristics of borrowers (i.e. to distinguish small firm high-risk projects from small firm low-risk projects), so that higher interest rates for small and younger firms are compatible with credit rationing, as well as with the use of collateral for signalling purposes. The evidence supports this, so that the Wilson Committee (1979) reported that small firms paid an average 2 per cent above the interest rate charged to large firms, and surveys of banks reveal that well capitalised small firms could expect a 3 per cent mark-up above national base rates, compared with 1 per cent for large firms with good track records (Hutchinson and McKillop, 1992). These rates could go as high as 4 per cent above mark-up, but projects requiring a 6 per cent mark-up to cover risk would be refused bank finance, suggesting credit rationing for these projects. This evidence, coupled with the three points given above, suggest that our Proposition can account for the higher employment effectiveness of assistance in small and younger firms.

B. *Other explanations*

The Proposition provides one explanation of larger employment effectiveness in small and younger firms, but there may be other explanations which are either explicit or implicit in our model assumptions. In some sense these may be viewed as caveats to our analysis. One assumption is that the price and technical coefficients embodied in the parameter b in (5) are the same between small and large firms, and we can begin by considering this.

In relation to factor prices it may be that wage costs differ between small and large firms, so that small firms are able to hire more employees for any given level of assistance. Further, we have been concerned with the number of jobs arising from assistance, but there may also be qualitative differences in the types of labour employed between the two types of firm. We have no hard evidence regarding these, but it seems that differences in these between industrial sectors may be of greater significance than between small and large firms.

In relation to technology, differences can arise because of greater factor substitution effects, and there are a number of possibilities here. One possibility is that large or older firms undertake investment for capital replacement or deepening purposes which maintains or even reduces employment, while small and younger firms undertake investment for capital widening purposes which creates wholly new jobs. A reason for this is that small and newer firms are more likely to be operating in growing markets and regions, while large or older firms are likely to have maturer products and processes.[14] A second possibility is that older and larger firms invest in

larger items of plant and machinery which are indivisible in nature. In this case assistance may leave the project scale unchanged in large firms, so that the firm uses the assistance to exactly substitute for private funds, and $d_i = -1$ in (5) for these firms.

So far, the explanations have rested on differences *between* small and younger firms and those which are large or old. However, it may be that the differences occur *within* these groups, so that assisted small and younger firms are intrinsicly different to those small and younger firms which are non-assisted. In our sample we were unable to find differences in the lagged employment variable in (10) between assisted and non-assisted establishments, but this provides less than complete support for the notion that these groups of firms are genuinely comparable. Indeed, under (II) above we have argued that assisted small and younger firms are precisely those firms which do not face capital market restrictions, and are able to match private funds to the assistance. Thus, the lending activities of banks may act as a screening device and ensure that only relatively 'good' projects come forward for assistance (i.e. those that are low risk). Similarly, where firms rely on retained profits then the product market may perform a similar role.

As well as these self-selection effects, it may be that the assistance agencies are able to correctly select projects in small and younger firms which have 'good' characteristics (i.e. a relatively small value of p_i and high values of b and d_i in (5)). There is some evidence of this in Table I since selective project grants give larger employment effects than the non-selective capital grants both in respect of new firms and small firms as a whole. However, for this to explain the entire pattern in Table I we have to find compelling reasons why the assistance agencies are unable to do this in the case of large or older firms, so that at the very least there must be some other factor involved.

5. Conclusions

Conventional wisdom goes that assistance to small firms for employment creation is a poor use of resources, since these firms have higher failure rates than other firms. However, in this paper we identify another factor which works in the opposite direction. It is that firms which face a higher marginal cost of private funds are more responsive to assistance, and all that is really required for this is that firms have the conventional 'U'-shaped long-run average cost curve. We argue that small firms fall within this category. The broad result accords with that of Holden and Swales (1995), who in an oligopoly setting find that "the proportionate output effect for a firm will be larger, the smaller is the firm's initial output" (p. 119). In our case a higher cost of funds leads to a smaller project scale in the without-subsidy position, and a greater proportionate increase in scale from assistance.

We report recent empirical evidence which indicates greater employment effectiveness in small firms, but only those which are new or relatively young in age. While this supports our basic contention, this does not deny that there may be other explanations and we consider these. Finally, we have considered the direct effect of assistance only, so a few words of caution should be exercised. The displacement effect of assistance may be greater for small firms which tend to operate in more competitive markets, and there may be issues about the relationships between small and large firms themselves, such as sub-contracting. Further, while our results suggest that job creation schemes should be orientated towards small firms – and to some extent this has already occurred in policy – the supply of small firm projects showing good employment effects may not be perfectly elastic. It may well be that the best projects are picked-off first, so that any attempt to expand assistance may well bring diminishing returns.

Notes

* The author is grateful for comments received from Martin Robson, David Storey and an anonymous referee, but remains responsible for the paper's content. The model presented here is a version of that in Wren (1996) in reply to Holden and Swales (1996).

[1] Indeed, a focus for debate in the small firm literature has been the extent to which only a relatively small number of small firms contribute to job generation.

[2] Whether the project is concerned with job creation or retention, the problem is essentially the same, since in either case the role of assistance is to raise the firm's employment level above that which would otherwise have obtained. The key difference is whether assistance is given as a lump sum profitability support or as a proportion of some identified

capital project. In this paper we focus on the latter. This broad distinction in the purpose of financial assistance has often been made. Adam Smith distinguishes between 'bounties' and 'premiums', while elsewhere they are described either as 'profitability supports' and 'incentives' or as 'decelerative' and 'accelerative' policies.

[3] We assume the production function displays the property of homotheticity and that relative factor prices are constant. The parameter b captures the technical relationships and factor price terms, so that the underlying assumption is that these terms do not vary between high and low-risk firms. We later consider this assumption.

[4] When $d_i = -1$ then assistance generates no increase in project scale, and this is the case of 'deadweight' spending.

[5] Since assistance is in grant form then the cost of public funds is zero.

[6] Denoting r_i' as the interest rate, then the present value sum to infinity of interest payments on a loan F_i is given by $r_i' \cdot F_i/\theta_i$, where θ_i is the constant discount rate. Hence, we have that $r_i = r_i'/\theta_i$ increases monotonically in the interest rate. An interest rate which varies with the amount borrowed (e.g. an increasing risk premium) does not materially affect our results provided the interest rate schedule for the high-risk lies above that for the low-risk.

[7] The data is pared-down from Wren and Waterson (1991) which estimated the employment effects over three three-year periods: 1975–78, 1978–81 and 1981–84. This is because only those establishments are included for which employment details are known for each of the years 1975, 1976, 1977, 1978 and 1981. Employment data was generally not known for the years 1979 and 1980, so that while the employment effect one, two and three years after the date of assistance is estimated from pooled data, the five-year effect is an average effect based on employment at 1981. A further seven payments of assistance to four establishments under some smaller schemes are included in Wren (1994a), but these were insignificant, and are included in the non-assisted establishments in Wren (1994b).

[8] These employment figures relate to the year 1975. Some idea of the size distribution of assisted firms can be gained as follows: 1–10 employees: 10 establishments; 11–25: 18; 26–50: 18; 51–200: 31; 201–500: 22; and 501+: 43.

[9] Fixed rate capital grants comprise payments of Regional Development Grant under the pre-1984 scheme. Project grants mainly include payments of Regional Selective Assistance, plus some local authority grant assistance. Rent assistance comprises payments by English Estates and a New Town Development Corporation.

[10] Each of these groupings was arrived at by testing the estimated equation for structural breaks. In the case of the size groupings, structural breaks were found on the capital and project grant terms, with just over half the assisted establishments in the small firm group. In the case of the age groupings, payments were summed for each firm and structural breaks were examined beginning with those establishments opening in 1976 compared with all other establishments. This was repeated for 1976 and 1975 compared with all other establishments, and so on, giving us our groupings. For establishments classified as new, the assistance cannot be directly attributed to the start-up of these establishments, but the aid was received around the time of start-up.

[11] To obtain the results in part (b) of the Table the procedure was to estimate the employment effect separately for each fourteen sub-groups by aid type, size and age of firm, and then to aggregate these sub-groups according to a sequence of F-tests until groupings were obtained giving significantly different regression estimates. Potentially, there are eighteen sub-groups – i.e. three aid types, two firm sizes and three age groups – but since the sample contains no large firms opening over 1974–76 and no large firms opening over 1966–73 and also receiving rent assistance, then in fact there are fourteen groups.

[12] The note to Table I shows that the large or older firm group is very much larger than the small and younger group (196 firms compared with 39). Of the former group 50 payments were made to small but older establishments.

[13] Simmons (1989) arrives at the opposite conclusion, arguing that small firms can increase their product prices at a faster rate compared with large firms, but this has been questioned by Keeble, Walker and Robson (1993).

[14] See note 2 on this point.

Appendix

First of all, consider the homogeneous production function $Q(K) = K^{\alpha}$ $(0 < \alpha < 1)$. Then the elasticity of scale, $\varepsilon = K \cdot Q_K/Q$, for this production function is $\varepsilon = \alpha < 1$, which is constant. This function therefore exhibits decreasing returns to scale which are constant.

Second, consider a production function $Q = Q(K)$ for which $\varepsilon = \alpha - \beta \cdot K$ ($\alpha > 1$ and $\beta > 0$), so that the resulting long-run average cost curve is 'U'-shaped. Now, $\varepsilon = K \cdot Q_K/Q$ and if we differentiate this with respect to project scale we get

$$d\varepsilon/dK = [1 - \varepsilon - 1/\eta] \cdot Q_K/Q$$

Substituting $d\varepsilon/dK = -\beta$ and $Q_K/Q = \varepsilon/K$ in this, and rearranging gives

$$1/\eta = 1 - \alpha + \beta \cdot K \cdot (1 + \varepsilon)/\varepsilon$$

and substituting for ε again, we find that $d(1/\eta)/dK = \beta + \alpha \cdot \beta/(\alpha - \beta \cdot K)^2 > 0$, so that $d\eta/dK < 0$. Since $K^* > K^w$ then it follows that $\eta^* < \eta^w$.

References

Besanko, D. and A. Thakor, 1987, 'Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets', *International Economic Review* **28**, 671–689.

Cowling, M. and N. Clay, 1995, 'Factors Influencing Take-Up Rates on the Loan Guarantee Scheme', *Small Business Economics* **7**, 141–152.

De Meza, D. and D. Webb, 1987, 'Too Much Investment: A Problem of Asymmetric Information', *Quarterly Journal of Economics* **102**, 281–292.

Dunne, T., M. J. Roberts and L. Samuelson, 1989, 'The Growth and Failure of U.S. Manufacturing Plants', *Quarterly Journal of Economics* **104**, 671–698.

Holden, D. R. and J. K. Swales, 1995, 'The Additionality, Displacement and Substitution Effects of Factor Subsidies', *Scottish Journal of Political Economy* **42**(2), 113–126.

Holden, D. R. and J. K. Swales, 1996, 'Subsidies, Additionality and Financial Constraints: A Comment on Wren', *Journal of Regional Science* **36**(2), 303–310.

Hutchinson, R. W. and D. G. McKillop, 1992, 'Banks and Small to Medium Sized Business Financing in the United Kingdom: Some General Issues', *National Westminster Bank Quarterly Review* (February), 84–95.

Keeble, D., S. Walker and M. Robson, 1993, 'New Firm Formation and Small Business Growth: Spatial and Temporal Variations and Determinants in the United Kingdom', *Research Series Report 15*, Employment Department, London.

Marshall, J. N., N. Alderman, C. Wong and A. Thwaites, 1993, 'The Impact of Government-assisted Management Training and Development on Small and Medium-Sized Enterprises in Britain', *Environment and Planning C: Government and Policy* **11**, 331–348.

Maung, N. A. and R. Erens, 1991, *Enterprise Allowance Scheme: A Survey of Participants Two Years After Leaving*, Social and Country Planning Research, London.

Owen, G. (1992), 'Aid Regimes and Small Businesses in the U.K.', *Final Report to the Economic and Social Research Council*, Swindon.

Segal Quince Wicksteed, 1991, *Evaluation of the Consultancy Initiatives – Third Stage*, Department of Trade and Industry, HMSO, London.

Simmons, P., 1989, 'Bad Luck and Fixed Costs in Personal Bankruptcies', *Economic Journal* **99**, 92–107.

Stiglitz, J. E. and A. Weiss, 1981, 'Credit Rationing in Markets with Imperfect Information', *American Economic Review* **73**, 393–409.

Storey, D. J., 1994, *Understanding the Small Business Sector*, Routledge, London.

Wilson Committee, 1979, *The Financing of Small Firms*, Interim Report of the Committee to Review the Functioning of the Financial Markets, Cmnd 7503, HMSO, London.

Wren, C. and M. Waterson, 1991, 'The Direct Employment Effects of Financial Assistance to Industry', *Oxford Economic Papers* **43**, 116–138.

Wren, C., 1994a, 'The Build-up and Duration of Subsidy-induced Employment: Evidence from U.K. Regional Policy', *Journal of Regional Science* **34**(3), 387–410.

Wren, C., 1994b, 'Some Anatomy of Job Creation: The Role of Firm Size, Age and the Nature of Opening', *Environment and Planning A* **26**, 973–988.

Wren, C., 1996, 'Reply to "Subsidies, Additionality and Financial Constraints"', *Journal of Regional Science* **36**(3), 501–508.