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Ernst R. Berndt, Jonathan R. Kesselman,
and Samuel H. Williamson

UNIVERSITY OF WISCONSIN ~ MADISON

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*Department of Economics, University of British Columbia; Department of Economics, University of British Columbia, and Poverty Institute; Department of Economics, University of Iowa.

ABSTRACT

Policymakers and economists have ignored the induced substitution away from labor inputs implicit in investment tax incentives for stabilization. As an alternative, employment tax credits (ETCs) might expand employment directly through their substitution effects in the production process. These effects arise in addition to the expansionary macro effects of either tax-reduction policy. This paper reviews the background of the ETC and its various formulations. One form is a marginal employment tax credit (METC), which channels subsidies to firms for expanding employment beyond some specified base magnitude.

Theoretical analysis is undertaken for the alternative policies. Special attention is devoted to the METC form, which may be rejected by the firm in certain years. A set of policy experiments is then pursued, based on estimates of the cost function for the U.S. manufacturing sector, 1962-1971. The simulations distinguish among three inputs--capital services, blue-collar labor, and white-collar labor. They also permit output to respond to increased demand at the lower, subsidized price.

Removal of the investment tax incentives of this period is found to depress capital and white-collar labor utilization. However, it may sufficiently raise blue-collar employment so that total man-hours worked rise. Replacing the investment tax incentives with an ETC or METC of equal tax-revenue cost yields similar and stronger effects. The positive impact on total man-hours becomes determinate.

The policy experiments further explore the relative effects of instituting various specifications of the ETC and METC alone. For given tax revenues forgone, the METC on wage bill is found to carry the greatest employment expansion.

TAX CREDITS FOR EMPLOYMENT RATHER THAN INVESTMENT

I. Introduction

Fiscal stabilization policy developments of the last generation have followed closely in the tradition of Keynesian macroeconomic theory. From Keynes's original formulation on down to contemporary textbooks, aggregate demand, output, and employment levels have been mechanically linked. Fiscal policy has been viewed as a means of expanding aggregate demand; tax incentives for investment merely focus additional demand in the capital-goods sector. Substitution between capital and labor, while present in neoclassical macro growth models, has typically been ignored in models of short-run income determination. Substitution towards labor by policy-induced changes in the wage-rental ratio has not been a widely discussed approach to the problems of inflation and unemployment.

The accelerated depreciation allowances and investment tax credits of the 1960s affected relative factor prices. Yet, these policies were proposed fundamentally for their stimulus to aggregate demand. In his 1963 Economic Report (p. xv), President John F. Kennedy urged these incentives for "stronger markets and enlarged investment, to provide jobs for the unemployed and for the new workers." Encouragement of capital expansion was believed to provide additional opportunities for labor rather than to displace labor as a productive input. The idea of more direct tax stimulation for employment appears not to have been explored during policy formulation of the 1960s.

Despite their Keynesian policy motivation, investment tax incentives have been analyzed extensively within a neoclassical framework. Still, policies affecting the prices of other inputs, such as labor, have received scant attention. This paper will examine a fiscal policy tool called an employment tax credit (ETC), along with a variant called a marginal employment tax credit (METC). Somewhat analogous to an investment tax credit (ITC), the ETC would affect the price of labor and could assist in stabilizing the economy. Theoretical comparisons between ITC and ETC approaches will be made. The METC presents some unusual problems for economic theory and therefore receives careful theoretical treatment. The analysis focuses on the factor-substitution effects of the policies and abstracts from their expansionary income effects. Our empirical analysis will constrast ETC effects with ITC effects for the manufacturing sector of the U.S. economy between 1962 and 1971. The ETC alternatives explored here will be set equal in tax-revenue cost to the investment incentives that they might have supplanted in that period.

II. Background of Employment Tax Credits

Employment tax credits have been advocated previously under the labels "employment subsidies" and "wage subsidies." Most of these proposals have been limited to employment of a particular category of workers. With a wage rigidity in the affected region or sector, wage subsidization has been shown to be superior to capital or output subsidization (Borts; Lind and Serck-Hanssen) or to tariff protection (Bhagwati and Ramaswami). Wage subsidies have been proposed in the following contexts: 1) depressed regions of a developed country (Buchanan and Moes; Borts and Stein); 2) ghetto areas of cities (Crandall and MacRae); 3) urban sectors of a developing country (Hagen); and, in a rather different context, 4) income maintenance (Kesselman, 1969, 1973; Weiner et al.), and job training of low-wage workers (Hamermesh).

Several countries have implemented varieties of the ETC aimed at specific sectoral, regional, or demographic groups of workers. In Britain, the Regional Employment Premium and Selective Employment Tax provided labor incentives by location and industry, respectively (Archibald). In the U.S., ETCs with a strong training incentive have been enacted under Job Opportunities in the Business Sector, AFDC Work Incentive Program, and Training Incentive Payments Program in New York City (MacRae, Crandall, and Smith). Categorical programs induce firms to substitute eligible types or locations of workers for ineligible ones. Their net effect on economywide employment is thereby muted (Ahluwalia). Indirect evidence on employment shifting under the AFDC-WIN form of the categorical ETC is available (Greenston and MacRae).

Because the categorical approach allows substitution among categories of labor rather than inducing an overall employment increase, universal coverage is more appropriate for economywide stabilization. Also, the universal approach avoids the contentious political and equity issues arising with the limitation of eligible groups. A form of a universal ETC was originally proposed by Nicholas Kaldor in a forgotten paper published in 1936. Kaldor demonstrated that an ETC is the most preferred policy for reducing unemployment under a set of plausible assumptions. The ETC concept was further explored by Ragnar Frisch in 1949. Legislative interest in a universal ETC was evidenced in a bill introduced by Senator Jacob Javits in 1971.[1] More recently, the U.S. Department of Labor suggested a "Job Tax Credit" to the Ford Administration in early 1975.[2]

III. Types of Employment Tax Credit

An ETC offers the firm a tax credit proportional to some measure of its employment. One type of ETC would provide a credit equal to a specified amount per man-hour employed.[3] This ETC would lower the price of labor to the firm and would also lower the price of unskilled labor relative to skilled labor. Whether the skilled or the unskilled group gains more of the induced employment depends on the relevant own and cross price elasticities of demand. An alternative type of ETC would provide a credit equal to a specified percent of wage bill of the firm.[4] Since this type of ETC does not change the relative wage rates of the various skill groups, it is more occupationally neutral than the dollar amount per man-hour type. The percent-of-wage-bill approach could be administered with currently reported tax-return or social-insurance data.[5] The amount-per-man-hour approach would demand the collection of additional information.

One way to achieve greater employment stimulus with the same tax revenues forgone by an ETC would be to channel credits to firms for increasing employment. Such a formulation will be called a marginal employment tax credit (METC).[6] Either an amount per man-hour or a percent of wage bill could be applied to the firm's employment increase above a specified base. The firm's base--in man-hours or wage bill--could be defined as last year's magnitude or as a more complex function of previous years' magnitudes. The METC parallels an ITC more closely than does the ETC. Both the METC and the ITC subsidize new purchases of the subsidized input. An asymmetry arises because all units of labor must be rehired each period, whereas only part of the firm's capital stock is newly purchased. Thus, investment flow (net of replacement purchases) is analogous to marginal or additional employment by the firm.[7]

It has been argued that an METC-type program discriminates against older firms (Brown). This objection is not valid, as the METC really favors fast-growing firms regardless of their ages. At the aggregate level, this effect renders the METC pro-cyclical.[8] A similar but less severe pro-cyclical tendency accompanies an ETC. Discretionary application of an ETC or METC could reverse the pro-cyclical effect. Alternatively, the base or the tax-credit rate could be linked by a formula to an aggregate measure of economic utilization, such as the unemployment rate.

Problems of program definition would accompany an ETC or METC policy. For example, an METC might offer incentives for mergers or fictitious reorganizations of firms. Well-designed rules are needed to avoid such undesirable reactions. A firm acquiring another pre-existing operation might be required to include its previous employment (or wage bill) in its own base calculations. In general, though, the measurement of work hours and wage bill is simpler than the measurement of investment--especially when the latter needs to be differentiated by equipment and structures. For this reason, the problems of program definition may not be as severe as those accompanying investment tax incentives.

The effectiveness of an ETC or METC in expanding employment depends crucially on lowering net wage rates paid by employers. Worker bargaining could thwart this objective by shifting part of the credits into increased market wage rates. This problem lies beyond the scope of our paper; briefly, an METC formulated as an amount per man-hour appears less vulnerable in this respect than does the percent-of-wage-bill specification.[9]

IV. Theoretical Analysis

We now investigate the response of a representative firm to employment tax credits, using a comparative statics framework. Technology of the firm is assumed to be constant-returns-to-scale with positive marginal products and isoquants strictly convex. The firm is assumed to produce a given output at minimum cost and to face perfectly elastic input supplies.

Analysis of the firm's response to an ETC is straightforward. In the face of an exogenous change in effective input prices, the firm chooses a new cost-minimizing mix of inputs. Competition in the product market implies zero profits for the firm in the new equilibrium. It follows that in the presence of an ETC, output price must be lower. Neoclassical analysis of investment tax credits follows a similar procedure.

Unlike the case of the ETC, the firm will not always find it advantageous to accept the METC.[10] Clearly, a firm will accept the METC if its employment without the credit available would have exceeded its current base. The firm may also accept the METC if its employment without the credit would have been less than the base. If the base is sufficiently large, the firm will not accept the METC. We illustrate the conditions for this to occur with a two-input case; extension to multiple inputs is considered later.

In Figure 1, we assume that the firm wishes to produce on isoquant V^* at minimum cost. Without loss of generality, costs can be measured in units of capital (K). Assume that C_oD is an isocost curve reflecting the market prices of the inputs. The steeper curve EF reflects the changed input price ratio on <u>marginal</u> units of labor receiving the METC subsidy. In particular, EF has been constructed tangent to isoquant V^* at S. The intersection of EF and C_oD at point I defines the base Z_o at which the firm will be indifferent to the METC, since its production cost will equal C_o with or without the credit. With a base of Z_1, less than Z_o, it will minimize its net production costs C_1 by taking the METC and producing with the input mix of point S. With a base of Z_2, greater than Z_o, it will minimize production costs C_o by rejecting the METC. The firm will then produce with the input mix of point R.[11]

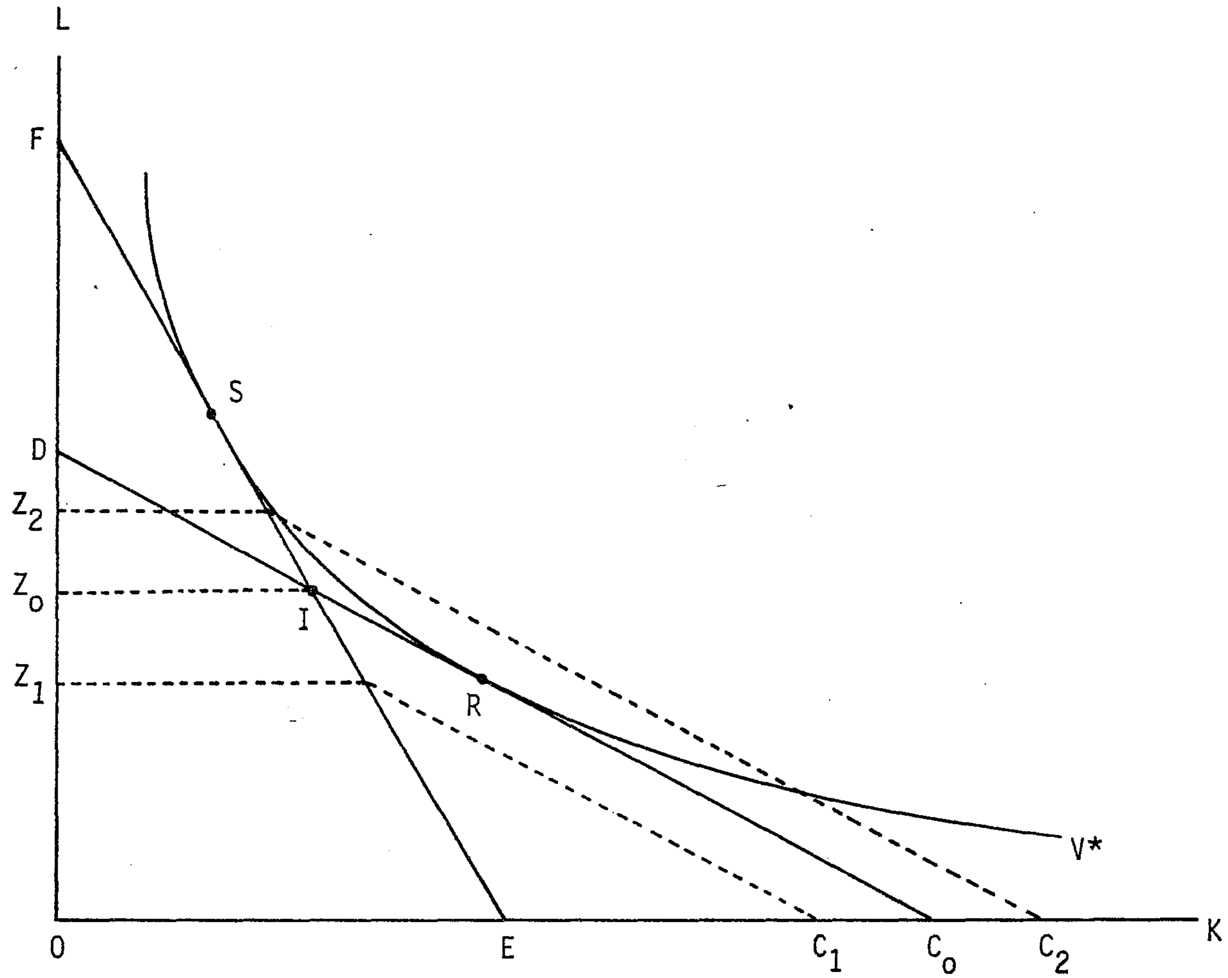

FIGURE 1

The first-order conditions for cost minimization are that the firm's choice of inputs will equate marginal factor prices with marginal revenue products. Under an METC the marginal factor price for labor has two possible values. A lower price applies to units of labor exceeding the firm's current employment base, which are subsidized, while the higher market price must be paid on labor units below the base. An alternative input criterion would equate average factor price with marginal revenue product. This, however, would not be consistent with cost minimization in the presence of an METC. It should be noted that with an investment tax credit a potential divergence between average and marginal prices of capital exists. This problem has traditionally been avoided by positing the existence of an active rental market for capital services.[12]

A more ambiguous problem is how the firm evaluates the marginal revenue products of its inputs. Since marginal physical products are well-defined, the problem is to model pricing in the output market. Define the firm's gross cost of inputs at market prices and its net cost as gross cost minus the METC transfers. Define average cost (AC) and average net cost (ANC) accordingly. Given the output quantity V^* with base Z_o as shown in Figure 1, at lower outputs than V^*, the firm will accept the METC. Marginal cost assumes a lower value at output greater than V^* (MC') than at smaller outputs (MC). Figure 2 illustrates these results.

Any single profit-maximizing firm facing perfectly elastic demand for its output would like to produce an indefinitely large amount at any price above MC'.[13] This indicates that marginal-cost

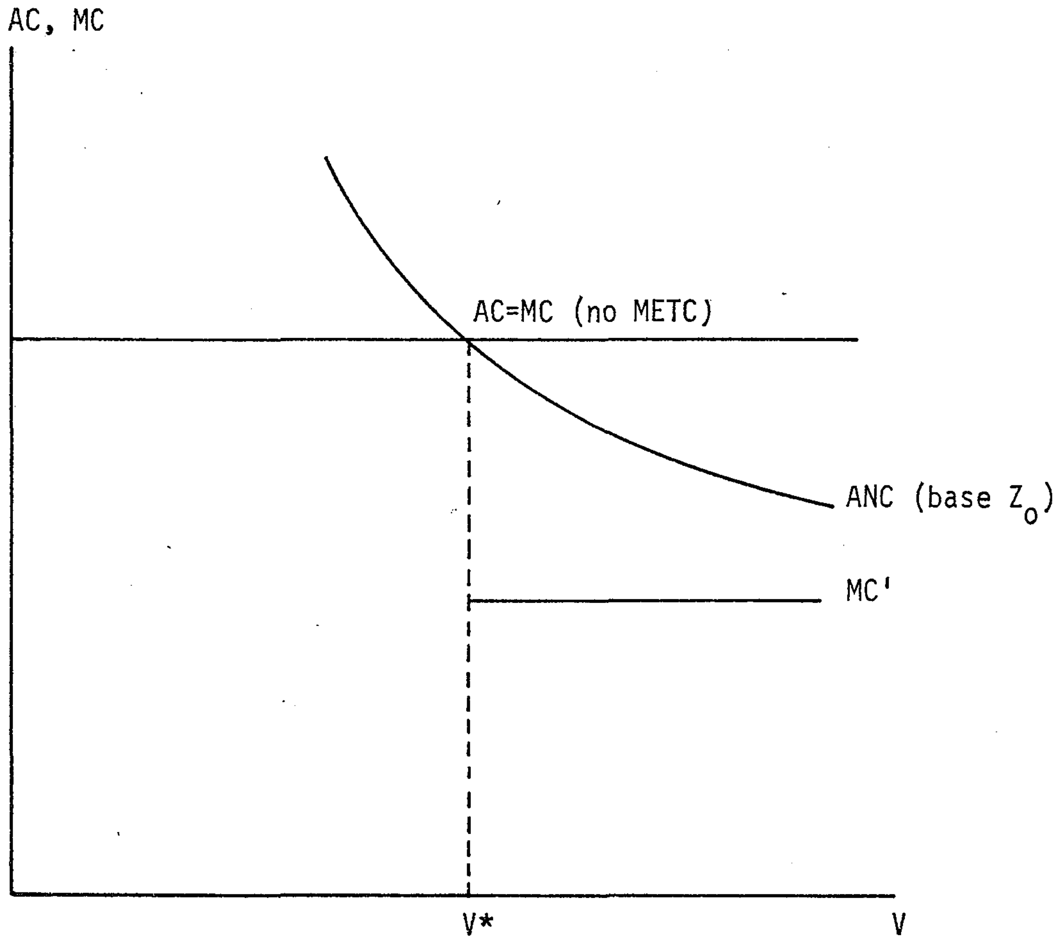

FIGURE 2

pricing under an METC may yield a monopoly solution. Pricing output at marginal cost with the METC would yield a loss for each firm under decreasing marginal costs. The METC allows this to occur even with constant-returns-to-scale technology. These results demonstrate the difficulty with a marginal-cost pricing assumption.

An alternative pricing assumption is for firms to produce up to the point at which price equals average net cost. Any single firm can reap a profit by producing more for sale at that common price. But as has been shown, this would lead to inconsistent results for the industry. Competition in the sale of a homogeneous product does mean, at least, that all firms must offer the same price. And equilibrium in a competitive market with no rents must carry zero profits. This suggests that all firms in an industry will either aceept or reject the METC in a given year.[14] Competitive behavior in the industry drives output price to the lower of AC and ANC. This yields a decision rule for the firm's acceptance of the METC in a given year:

$$AC \leq ANC \rightarrow \text{reject METC,}^{15}$$

$$AC \geq ANC \rightarrow \text{accept METC.}$$

The proposed METC-acceptance decision rule for the firm requires one further result. If the firm faces an METC, then the condition $AC > ANC$ must imply that its employment exceeds its base. We present a proof of this proposition for the multiple input case with endogenous output.

Our proof is offered for **the amount-per-man-hour type of subsidy.** Some notation is helpful here. In general, without-METC prices and quantities will be unprimed, with-METC variables primed. The output price is P (=AC) if the METC is rejected and P'(=ANC) if the credit is accepted. The market price of the ith input, X_i, is denoted P_i. All labor inputs belong to a subset M of inputs eligible for METC and are measured in man-hours. Subsidized units of labor inputs carry METC inclusive prices:

$$P_i' = P_i - A, \quad i \varepsilon M , \tag{1}$$

where A is the per-man-hour amount of subsidy. The number of man-hours hired by the firm under the METC is:

$$\bar{X} = \sum_{i \varepsilon M} X_i' . \tag{2}$$

The firm's total costs without the METC are $\sum_i P_i X_i$, and its total net costs with the METC are $\sum_i P_i X_i' - A(\bar{X}-Z)$. The output-pricing rules yield:

$$PV = \sum_i P_i X_i , \tag{3}$$

$$P'V' = \sum_i P_i X_i' - A(\bar{X}-Z) . \tag{4}$$

Figure 3 illustrates, in two dimensions, some points that hold more generally. For any given output (isoquant V'), compare the market cost of purchasing the with-METC choice of inputs (point S) with the market cost of purchasing the non-METC choice of inputs (point T). In this case we find $C_1 > C_o$ and in general:

$$\sum_i P_i X_i' > \sum_i P_i X_i , \tag{5}$$

a result of convexity and cost-minimization. Point R is the firm's input choice for output level V with no METC. Point S is its input choice for output level V', which we now associate with an METC.

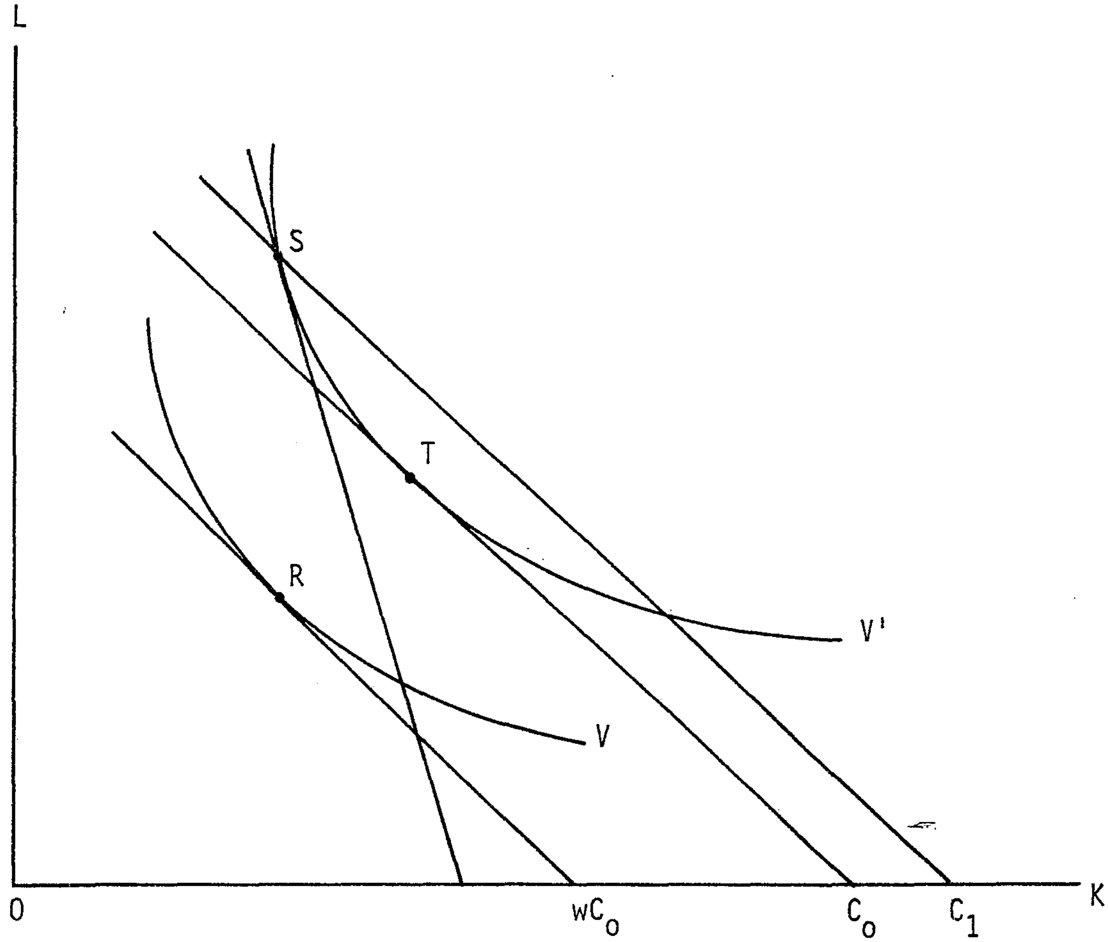

FIGURE 3

Point T is the input choice the firm would choose for output V' at market prices for input. From equation (5), we have in market terms that Cost(S) > Cost(T). When the METC is accepted, AC > ANC, which implies P > P' with the zero-profit assumption. The level of output with the METC would be:

$$V' = \frac{1}{w}V , \qquad 0 < w \leq 1 , \tag{6}$$

where w is an inverse monotonic function of the price elasticity of demand for output.[16] Constant returns to scale implies $Cost(T) = \frac{1}{w} Cost(R)$. Together these results imply that $Cost(S) > \frac{1}{w} Cost(R)$, or

$$\sum_i P_i X_i' > \frac{1}{w} \sum_i P_i X_i \; . \tag{7}$$

We now proceed to the theorem establishing that acceptance of the METC implies employment greater than the firm's base.[17]

<u>Theorem</u>: $P > P' \rightarrow \bar{X} > \bar{Z}$.

<u>Proof</u>: If $P > P'$

$PV > P'V$

$PV > wP'V'$ from (6)

$\sum_i P_i X_i > w[\sum_i P_i X_i' - A(\bar{X}-\bar{Z})]$ from (3) and (4)

$\sum_i P_i X_i - w\sum_i P_i X_i' > - wA(\bar{X}-\bar{Z})$

$\sum_i P_i X_i - w\sum_i P_i X_i' < 0$ from (7)

$wA(\bar{X}-\bar{Z}) > 0$

$\bar{X} > \bar{Z}$ for $0 < w \leq 1$ and $A > 0$ Q.E.D.

V. Estimation and Simulation Techniques

The foregoing results can be assembled into a system for simulating the effects of an ETC or METC. To do this, we need to specify the form of a production or cost function and to estimate the technological possibilities for input substitution. We also need to make certain behavioral assumptions about price elasticity of demand for output, supply elasticities of inputs, and speed of the firm's adjustment.

We assume that technology in the U.S. manufacturing sector can be closely approximated by a twice-differentiable production function with constant returns to scale. The three inputs entering the production process are production workers (B for blue collar), nonproduction workers (W for white collar), and physical capital (K). Corresponding to such a production function there exists a cost function. We specify the form of this cost function to be translog:

$$\ln C = \ln \alpha_o + \ln V + \alpha_B \ln P_B + \alpha_W \ln P_W + \alpha_K \ln P_K$$
$$+ \frac{1}{2} \gamma_{BB} (\ln P_B)^2 + \gamma_{BW} \ln P_B \ln P_W + \gamma_{BK} \ln P_B \ln P_K$$
$$+ \frac{1}{2} \gamma_{WW} (\ln P_W)^2 + \gamma_{WK} \ln P_W \ln P_K + \frac{1}{2} \gamma_{KK} (\ln P_K)^2 \quad , \qquad (8)$$

where C = total cost at market prices

P_B = price of blue-collar labor (in efficiency units)

P_W = price of white-collar labor (in efficiency units)

P_K = rental price of capital services.

Linear homogeneity in prices imposes the restrictions:

$$\left.\begin{aligned} &\alpha_B + \alpha_W + \alpha_K = 1 \\ &\gamma_{BB} + \gamma_{BW} + \gamma_{BK} = 0 \\ &\gamma_{BW} + \gamma_{WW} + \gamma_{WK} = 0 \\ &\gamma_{BK} + \gamma_{WK} + \gamma_{KK} = 0 \ . \end{aligned}\right\} \tag{9}$$

With zero profits, revenue equals cost:

$$PV = P_B B + P_W W + P_K K = C \ . \tag{10}$$

Subtracting ln V from both sides of (8) and substituting $\ln P = \ln (C/V)$, we obtain an equation relating output price to input prices and the technological parameters:

$$\begin{aligned} \ln P = {} & \ln \alpha_o + \alpha_B \ln P_B + \alpha_W \ln P_W + \alpha_K \ln P_K \\ & + \tfrac{1}{2} \gamma_{BB} (\ln P_B)^2 + \gamma_{BW} \ln P_B \ln P_W + \gamma_{BK} \ln P_B \ln P_K \\ & + \tfrac{1}{2} \gamma_{WW} (\ln P_W)^2 + \gamma_{WK} \ln P_W \ln P_K + \tfrac{1}{2} \gamma_{KK} (\ln P_K)^2 \ . \end{aligned} \tag{11}$$

Let us assume that input prices are exogenous (supplies of inputs are infinitely price-elastic) and that firms adjust to their desired input levels instantaneously. Using Shephard's Lemma and logarithmically differentiating (8) with respect to input prices, we obtain the derived demand equations:

$$\frac{\partial \ln C}{\partial \ln P_B} = \frac{P_B B}{C} = \alpha_B + \gamma_{BB} \ln P_B + \gamma_{BW} \ln P_W + \gamma_{BK} \ln P_K \tag{12a}$$

$$\frac{\partial \ln C}{\partial \ln P_W} = \frac{P_W W}{C} = \alpha_W + \gamma_{BW} \ln P_B + \gamma_{WW} \ln P_W + \gamma_{WK} \ln P_K \tag{12b}$$

$$\frac{\partial \ln C}{\partial \ln P_K} = \frac{P_K K}{C} = \alpha_K + \gamma_{BK} \ln P_B + \gamma_{WK} \ln P_W + \gamma_{KK} \ln P_K \ . \tag{12c}$$

Since the left-hand variables in (12) are cost shares, only two of the three equations are independent.

The data series on P_B, P_W, and P_K have been discussed in Berndt and Christensen (1974). In order to adjust for changes in the quality of labor over 1962-1971, we have multiplied the raw man-hours series for blue-collar and white-collar workers by an index of educational attainment (denoted E) to form the series B and W in units of billions of efficiency man-hours. The efficiency wage rates P_B and P_W are then formed as the wage bills (including estimated supplementary benefits) divided by B and W. The index K is the capital stock measured in billions of 1958 dollars, while P_K is the associated rental price.[18] We construct the output price P as a Divisia index of P_B, P_W, and P_K. Output quantity is then computed as total cost divided by P. The historical data are presented in Table 1.

We estimate the output price frontier equation (11) and two of the three derived demand equations in (12) by the method of maximum likelihood.[19] Parameter estimates and asymptotic t-ratios based on equations (11), (12a), and (12b) subject to the restrictions (9) appear in Table 2. Allen partial elasticities of substitution and price elasticities of factor demand for selected years, based on the parameter estimates, are presented in Table 3.[20]

The estimates of Allen elasticities of substitution have particularly interesting distributional implications.[21] Since B and K are substitutes (σ_{BK} = 1.24) while W and K are complements (σ_{WK} = -.45), the imposition of an investment tax credit (ITC) that lowers P_K induces greater demand for W and reduced demand for B, given the level

Table 1

Historical Data for U.S. Manufacturing 1962-71

Year	P_B	P_W	P_K	B	W	K	P	V	E
1961[a]	2.561	3.427	.255	26.250	10.126	85.120	117.205	1.055	1.028
1962	2.637	3.574	.255	27.785	10.412	85.691	120.530	1.098	1.036
1963	2.702	3.687	.267	28.169	10.623	86.837	124.156	1.115	1.043
1964	2.763	3.948	.268	29.043	10.818	88.630	128.246	1.144	1.051
1965	2.838	4.001	.283	31.091	11.179	91.888	131.895	1.206	1.058
1966	2.942	4.162	.292	33.464	11.873	97.667	136.732	1.290	1.067
1967	3.032	4.363	.274	33.164	12.430	105.618	139.462	1.317	1.077
1968	3.212	4.626	.302	34.043	12.920	111.949	148.703	1.364	1.086
1969	3.381	4.881	.292	34.868	13.346	117.130	154.544	1.406	1.096
1970	3.561	5.194	.273	32.770	13.252	122.898	160.256	1.367	1.106
1971	3.785	5.486	.244	31.842	12.715	126.573	165.748	1.334	1.116

Note:

[a]The historical data for 1961 were used to form the wage bill base for 1962 in simulations of the METC; the 1961 data were not employed in estimating the parameters of the model.

Table 2

Maximum Likelihood Parameter Estimates and Asymptotic t-Ratios[a] for U.S. Manufacturing 1962-71

Parameter	Estimate	Asymptotic t-Ratio
$\ln \alpha_0$	4.308	535.94
α_B	.628	36.20
α_W	.076	5.04
α_K	.296	44.09
γ_{BB}	.067	1.18
γ_{BW}	-.088	-1.79
γ_{BK}	.021	2.12
γ_{WW}	.156	3.59
γ_{WK}	-.068	-8.54
γ_{KK}	.046	14.66

Note:

[a] R^2 figures (1 minus error sum of squares over total sum of squares in each equation) are .9999 (equation 11), .4053 (12a), .9232 (12b), and .8917 (12c). Test for autocorrelation: Null hypothesis of zero autocovariance matrix with alternative of diagonal first-order autocovariance matrix (for details of test, see Berndt and Savin); the chi-square test statistic is .31, while the .05 critical value with two restrictions is 5.99. Thus the null hypothesis cannot be rejected.

Table 3

Estimated Allen Partial Elasticities of Substitution and Price Elasticities of Demand

Allen Partial Elasticities of Substitution	1962	1965	1968	1971
σ_{BB}	-.593	-.600	-.608	-.630
σ_{WW}	-.583	-.588	-.595	-.600
σ_{KK}	-3.329	-3.347	-3.417	-3.719
σ_{BW}	.431	.436	.448	.485
σ_{BK}	1.232	1.234	1.242	1.277
σ_{WK}	-.441	-.431	-.431	-.477
Price Elasticities of Demand				
ε_{BB}	-.327	-.329	-.332	-.338
ε_{BW}	.122	.125	.131	.155
ε_{BK}	.205	.204	.200	.183
ε_{WB}	.238	.239	.244	.260
ε_{WW}	-.164	-.168	-.175	-.192
ε_{WK}	-.073	-.071	-.069	-.068
ε_{KB}	.679	.677	.677	.685
ε_{KW}	-.124	-.123	-.127	-.153
ε_{KK}	-.555	-.554	-.551	-.533

of output. Thus, investment tax incentives favor white-collar workers and adversely affect blue-collar workers. The net effect of an ITC on total employment depends on the magnitudes of the relevant elasticities. Based on the results of Table 3, the net employment effect of the ITC for given output will be negative. Table 3 also indicates that the two types of labor are mildly substitutible (σ_{BW} = .45).

To check the reliability of our estimated translog model, we simulate over the historical period. Specifically, we simulate the price of output ($\hat{P}$) by exponentiating (11). We obtain simulated values for the derived demands $\hat{B}$, $\hat{W}$, and $\hat{K}$ by rearranging equations (12) in terms of P, V, P_B, P_W, and P_K. We then compare the simulated series $\hat{P}$, $\hat{B}$, $\hat{W}$, and $\hat{K}$ with the historical data. The mean absolute errors are .01 percent for $\hat{P}$, .83 percent for $\hat{B}$, .90 percent for $\hat{W}$, and 1.36 percent for $\hat{K}$. We conclude that our model simulates the historical period with reasonable accuracy.

VI. Policy Experiments

A. Investment Tax Credits

We are now prepared to illustrate the relative effects of ITC, ETC, and METC policies through a series of simulations. Our first task is to determine the effects of removing certain investment tax incentives during 1962-1971. We compute a new P_K assuming that there were no investment tax credits or increases in depreciation allowance provisions since 1961.[22] From hereon, the ITC will denote these investment incentives. Given this new P_K along with the historical

P_B, P_W, and V, we solve for P, B, W, and K. The estimated tax revenue gain from eliminating the ITC averaged $875 million per year over 1962-1971.[23] Accelerated depreciation provisions initiated prior to 1962 are not considered here, although they carry larger costs in tax revenue.

The results of eliminating the ITC for four selected years in the period 1962-1971, while holding output constant, appear in the top panel of Table 4. Total employment of labor (B + W) would have been about 0.7 percent higher over the period. Employment of blue-collar workers (B) would have been about 1.1 percent higher, while employment of white-collar workers (W) would have fallen about 0.3 percent. Use of capital services (K) would have decreased about 3 percent, but because of its relatively inelastic demand the income to capital would have been more than 2 percent higher. The price of output would have been about 0.8 percent higher.

If price elasticity of demand for output (η) is assumed to be unitary, output would have been lower without the investment incentives. The results appear in the bottom panel of Table 4. Even with reduced output, the employment of blue-collar labor would have been about 0.2 percent higher over the period. Total man-hours, however, would have been about 0.2 percent lower.

B. Employment Tax Credits

We now examine the effects of simultaneously dropping the ITC and instituting an ETC. The next four simulations set the cost of an ETC equal to the estimated revenue cost of the ITC for each year in the period 1962-1971. Tables 5 and 6 report simulations based on two

Table 4

Simulated Effects of Eliminating ITC[a]
(percentage changes)[b]

Year	ΔP_K^c	ΔP	ΔV	ΔB	ΔW	ΔK	$\Delta(B+W)$
$\eta=0$							
1962	1.799	.298	0	.367	-.131	-.985	.231
1965	6.978	1.133	0	1.398	-.482	-3.674	.890
1968	8.046	1.269	0	1.575	-.538	-4.182	1.000
1971	5.261	.743	0	.948	-.349	-2.701	.570
$\eta=-1$							
1962	1.799	.298	-.297	.069	-.428	-1.279	-.067
1965	6.978	1.133	-1.120	.262	-1.597	-4.753	-.240
1968	8.046	1.269	-1.253	.302	-1.785	-5.383	-.266
1971	5.261	.743	-.738	.203	-1.084	-3.418	-.172

Notes:

[a]ITC includes investment tax credits and increases in depreciation allowance provisions since 1961.

[b]The denominators employed here and in following tables are the set of simulated variables $\hat{P}$, $\hat{B}$, $\hat{W}$, and $\hat{K}$ and historical variables P_B, P_W, P_K, and V.

[c]In these simulations $\Delta P_B = \Delta P_W = 0$.

types of ETC--an amount per man-hour and a percentage of wage bill--and two values of the price elasticity of demand for output (η). Table 5 presents the combined effects of deleting the ITC and instituting an equal-cost ETC. Table 6 shows the effects of enacting each ETC alone.

Cases 1 and 2 in Table 5 illustrate the effects of substituting the two ETC policies for the ITC when output is unchanged ($\eta = 0$). Factor employments are quite similar under the two ETC specifications. As expected, the amount-per-man-hour form is more favorable to B as against W than is the percent-of-wage-bill form, but the difference is very small. This may primarily reflect the fact that the mean wage rates of our two labor classes do not span the entire wage range to be found in U.S. manufacturing. Over the period P_B was approximately 70 percent of P_W.

One effect of replacing the ITC with an equal-cost ETC is to increase the price of output (P). Cases 3 and 4 examine the two ETC forms when output responds to the price change, with unitary output demand elasticity. Again, the two ETC specifications yield very similar factor employments, as seen in Table 5. Compared with cases 1 and 2, the reduced output implies less expansion of employment. Instituting an ETC alone without removing the ITC would lower the output price and thereby give a larger stimulus to employment.

The impact of an ETC alone can be approximated by netting out the effects of the ITC from those of the simultaneous policy changes. For each case, entries from the appropriate panel of Table 4 are subtracted from the corresponding entries of Table 5. The results

Table 5

Simulated Effects of Replacing ITC with an Equal-Cost ETC[a]
(percentage changes)

Year	ΔP_B	ΔP_W	ΔP_K	ΔP	ΔV	ΔB	ΔW	ΔK	$\Delta(B+W)$
Case 1: $\eta=0$, amount-per-man-hour ETC									
1962	-.200	-.147	1.799	.146	0	.415	-.154	-1.101	.259
1965	-.815	-.578	6.978	.514	0	1.599	-.579	-4.139	1.011
1968	-.824	-.572	8.046	.645	0	1.779	-.639	-4.649	1.121
1971	-.661	-.456	5.261	.239	0	1.103	-.434	-3.075	.655
Case 2: $\eta=0$, percent-of-wage-bill ETC									
1962	-.182	-.182	1.799	.146	0	.405	-.144	-1.085	.254
1965	-.735	-.735	6.978	.514	0	1.553	-.535	-4.068	.989
1968	-.737	-.737	8.046	.645	0	1.728	-.590	-4.573	1.097
1971	-.585	-.585	5.261	.239	0	1.058	-.389	-3.006	.636
Case 3: $\eta=-1$, amount-per-man-hour ETC									
1962	-.200	-.147	1.799	.146	-.146	.268	-.300	-1.245	.113
1965	-.820	-.581	6.978	.512	-.509	1.083	-1.086	-4.629	.498
1968	-.829	-.576	8.046	.641	-.637	1.131	-1.273	-5.260	.477
1971	-.663	-.457	5.261	.238	-.237	.864	-.670	-3.306	.417
Case 4: $\eta=-1$, percent-of-wage-bill ETC									
1962	-.182	-.182	1.799	.146	-.146	.258	-.290	-1.229	.108
1965	-.739	-.739	6.978	.512	-.509	1.037	-1.041	-4.559	.476
1968	-.742	-.742	8.046	.641	-.637	1.081	-1.224	-5.184	.454
1971	-.587	-.587	5.261	.238	-.237	.818	-.626	-3.237	.397

Notes:

[a]The ETC is made equal in cost to the ITC in each year.

are presented in Table 6. The employment gains from instituting an ETC alone are very small if output is unchanged, as in cases 1 and 2. Employment expansion is substantially larger, about 0.7 percent in total man-hours, when output is responsive to price, as in cases 3 and 4.

The preceding policy experiments have restricted each ETC to equal the tax-revenue cost of the ITC it replaces in each year. The revenue costs were \$201 million in 1962, \$984 million in 1965, \$1.265 billion in 1968, and \$1.115 billion in 1971. Depending upon the year and the labor input, the tax credit rate amounts to between one-half and three-and-one-half cents per man-hour.[24] The effects of more costly ETC programs can be approximated by scaling up the effects in Table 6 in proportion to the increased program cost. For example, a \$2.5 billion amount-per-man-hour ETC with $\eta = -1$, similar to case 3, carries twice the ITC cost of 1968. Its employment effects would also be double those of case 3, or about a 1.6 percent increase in total employment.

C. Marginal Employment Tax Credits

The METC policy channels subsidies to the firm for additional employment beyond a base magnitude. Therefore, the same revenue cost can finance a larger percentage change in the price of subsidized units of labor in an METC than in an ETC. This should provide a stronger substitution toward employment of labor, so long as the firm "accepts" the METC, a problem treated in Section IV. Our simulations consider only the more easily administered percent-of-wage-bill METC formulation. This might be called an METC on wage bill.

Table 6

Simulated Effects of Instituting an Equal-Cost ETC[a]
(percentage changes)

Year	ΔP_B[b]	ΔP_W	ΔP	ΔV	ΔB	ΔW	ΔK	$\Delta(B+W)$
Case 1: $\eta=0$, amount-per-man-hour ETC								
1962	-.200	-.147	-.152	0	.048	-.023	-.116	.028
1965	-.815	-.578	-.619	0	.201	-.097	-.465	.121
1968	-.824	-.572	-.624	0	.204	-.101	-.467	.121
1971	-.661	-.456	-.504	0	.155	-.085	-.374	.085
Case 2: $\eta=0$, percent-of-wage-bill ETC								
1962	-.182	-.182	-.152	0	.038	-.013	-.100	.023
1965	-.735	-.735	-.619	0	.155	-.053	-.394	.099
1968	-.737	-.737	-.624	0	.153	-.052	-.391	.097
1971	-.585	-.585	-.504	0	.110	-.040	-.305	.066
Case 3: $\eta=-1$, amount-per-man-hour ETC								
1962	-.200	-.147	-.152	.151	.199	.128	.034	.180
1965	-.820	-.581	-.621	.611	.821	.511	.124	.738
1968	-.829	-.576	-.628	.616	.829	.512	.123	.743
1971	-.663	-.457	-.505	.501	.661	.414	.112	.589
Case 4: $\eta=-1$, percent-of-wage-bill ETC								
1962	-.182	-.182	-.152	.151	.189	.138	.050	.175
1965	-.739	-.739	-.621	.611	.775	.556	.194	.716
1968	-.742	-.742	-.628	.616	.779	.561	.199	.720
1971	-.587	-.587	-.505	.501	.615	.458	.181	.569

Notes:

[a]Cost of ETC is equal to cost of ITC that existed in same year in millions of dollars: 201 in 1962, 984 in 1965, 1265 in 1968, and 1115 in 1971.

[b]In these simulations $\Delta P_K=0$.

Implementation of an METC requires the definition of a base rule, Z_t. Because the quantities in the base rule involve previous periods' behavior, time subscripts "t" are introduced. We consider the simplest rule for an METC on wage bill:

$$Z_t = \mu(P_{B,t-1}B_{t-1} + P_{W,t-1}W_{t-1}), \qquad 0 < \mu \leq 1 .$$

The base in period t is proportion μ of the firm's gross wage bill in the preceding period.[25] Our simulations take the period to be a year and are dynamic in the sense that each year's base depends on the solution values of inputs for the previous year.[26]

Three cases of an METC on wage bill appear in Table 7. Each policy has been constrained to carry the same revenue costs as the ITC in the same year.[27] Note that Table 7 displays the effects of instituting each METC alone, without removal of the ITC, and in this sense is comparable with Table 6.[28] The percent-of-wage-bill ETC is a polar case of the METC on wage bill with μ=0. Hence, to see the effect of increasing μ, the simulated METC cases can be compared with the ETC cases having the same η value. Cases 5 and 6 are comparable with case 2 in Table 6, and case 7 is comparable with case 4 in Table 6. Clearly, the higher is base parameter μ, the larger is the equal-cost marginal input-price change affordable from given revenues.

Use of the METC on wage bill can greatly increase the employment effects over those of an amount-per-man-hour ETC. With output constant, movement from an ETC (case 2) to an METC with μ=.5 (case 5) roughly doubles the impact on demands for each input in each year. Further increasing μ from .5 to .9 (case 6) about triples again the METC

Table 7

Simulated Effects of Instituting an Equal-Cost METC on Wage Bill[a]
(percentage changes)

Year	$\Delta P'_B$[b]	$\Delta P'_W$[b]	ΔP	ΔV	ΔB	ΔW	ΔK	$\Delta(B+W)$
Case 5: $\eta=0$, $\mu=.5$								
1962	-.337	-.337	-.152	0	.070	-.025	-.185	.044
1965	-1.366	-1.366	-.634	0	.291	-.097	-.733	.186
1968	-1.350	-1.350	-.656	0	.281	-.096	-.719	.178
1971	-1.144	-1.144	-.499	0	.215	-.079	-.598	.129
Case 6: $\eta=0$, $\mu=.9$								
1962	-1.064	-1.064	-.155	0	.224	-.077	-.585	.141
1965	-4.339	-4.339	-.631	0	.954	-.305	-2.337	.615
1968	-4.037	-4.037	-.598	0	.849	-.298	-2.173	.537
1971	-4.815	-4.815	-.473	0	.914	-.353	-2.560	.545
Case 7: $\eta=-1$, $\mu=.5$								
1962	-.338	-.338	-.153	.152	.223	.127	-.035	.197
1965	-1.373	-1.373	-.624	.614	.914	.514	-.142	.806
1968	-1.356	-1.356	-.624	.612	.902	.513	-.131	.797
1971	-1.152	-1.152	-.503	.498	.719	.416	-.117	.630

Notes:

[a] See note 1 of Table 6.

[b] In these simulations $\Delta P_K=0$, and $\Delta P'_B$ and $\Delta P'_W$ are percentage changes in the price of marginal man-hours exceeding the firm's base.

effects on employment. In most years, the METC with μ=.9 raises total employment by more than 0.5 percent.[29] When output has unitary price elasticity of demand, the gain in employment in moving from an ETC (case 4) to an METC with μ=.5 (case 7) is more modest.[30] However, the total employment impacts in these cases are larger. The output expansion in the case 7 METC allows both blue-collar and white-collar employment to expand.

D. Output Price Effects

Our simulated policy experiments carry some implications for inflation through changes in the average price of output (ΔP). Since the simulations do not include monetary behavior or a full macro model, the conclusions are limited to effects on producers' cost. We have already seen that replacing the ITC with an equal-cost ETC (Table 5) implies an increase in the average output price. Consequently, the ETC must involve a larger tax distortion--or efficiency loss--than the equal-cost ITC provisions. A similar statement can be made for the METC.

Now we compare the output price effects of instituting various ETC and METC policies alone (Tables 6 and 7). On average, the policies reduce output price by about 0.5 percent--close to the average annual revenue cost of \$875 million divided by the average annual gross production costs (PV) of \$180 billion. For any given year there is notably little difference in ΔP across program types. The one exception is the METC with μ=.9 (case 9, Table 7), which has less price-depressing effect in two of the years charted. This measures the efficiency loss from the relatively greater price distorting effect of this tax policy. It is a relatively modest cost for the substantially greater employment-expanding effects of a high-μ METC.

E. Summary and Extensions

The policy experiments simulated here portray a history alternative to the actual experience. Let us assume that an ETC or METC had been employed with the same revenues that went to investment tax incentives from 1962 to 1971. Total employment would have been nearly .5 percent to more than 1 percent higher in many of the years. All of the increase would have been in blue-collar employment, with some offsetting decreases in white-collar employment. Use of capital services would have been from 1 to 6 percent lower during the period. The price of output might have been as much as .5 percent higher.

The differential effects of instituting various ETC and METC policies alone are notable in some cases. There is a modest gain in total employment expansion from specifying an ETC as an amount per man-hour rather than as a percent of wage bill. The net effects of either approach depend strongly on the expansion of output in response to its lower market price. Use of the METC on wage bill can lead to much larger employment expansion, especially when the base represents a large proportion of the current year's wage bill. All of the policies depress output price and by nearly the proportion their revenue costs bear to total production costs. Thus, the policies do not entail major efficiency costs.

Our policy experiments have utilized a number of restrictions that might usefully be extended in future research. Several areas are suggested:

1. This study is confined to the manufacturing sector of the U.S. economy. As data become available for other sectors, their behavior under ETC policies might be investigated.

2. Supplies of all factors are assumed to be infinitely price elastic. Empirical supply elasticities might be utilized in the simulations, although endogenous input prices pose problems for estimation of the translog cost function.

3. Firms are assumed to respond instantaneously to changes in input prices. More realistic production models, which reflect adjustment costs, might be applied to these tax policy experiments.[31]

4. Our analysis abstracts from macro income effects of the alternative tax policies. The simulations might be performed within a full macro-econometric model that reflects differential spending propensities for the three factor incomes.

5. We examine fixed-cost programs of the ETC and METC and the simplest base rule for the METC. The stabilization properties of discretionary application, tax-credit formulae tied to economic aggregates, and more complex base rules remain to be explored.

6. Simulation of the METC assumes that all firms grow at the same rate as total output in the manufacturing sector grows. Otherwise some firms will accept the METC in the same year that others reject it.[32] Simulations on a panel sample of firms would overcome this aggregation assumption.

Appendix

1. Price of Capital Services

The rental price of capital services is based on the development of Christensen and Jorgensen. The service price for capital equipment is computed as:

$$P_t^e = \left[\frac{1 - u_t X_t^e - \kappa_t + y_t}{1 - u_t}\right]\left[q_{t-1}^e r_t + q_t^e d_t^e - (q_t^e - q_{t-1}^e)\right] + q_t^e j_t$$

and that for structures as:

$$P_t^s = \left[\frac{1 - u_t X_t^s}{1 - u_t}\right]\left[q_{t-1}^s r_t + q_t^s d_t^s - (q_t^s - q_{t-1}^s)\right] + q_t^s j_t ,$$

where e and s refer to producers' durable equipment and nonresidential structures, respectively, t to the time period, and

u = effective rate of corporate income taxation,

X^e, X^s = present value of depreciation allowances per dollar of investment in e or s,

κ = effective rate of investment tax credit,

$y = \kappa u X^e$ in 1962 and 1963, zero all other years,

q^e, q^s = price indexes for investment in e or s, U.S. manufacturing,

r = before-tax nominal rate of return,

d^e, d^s = depreciation (assumed geometric) rate on e and s; d^e is 0.135 and d^s is 0.071,

j = effective rate of property taxation.

Values of these variables for 1962-1971 are presented in Table A1. The variables I^e and I^s represent gross investment in e and s, U.S. manufacturing, in billions of 1958 dollars.

2. Cost of Investment Incentives

The simulations required an estimate of the present value of tax revenues forgone due to the imposition of the investment tax credit and changes in depreciation allowances. The cost was computed as the difference in the service prices P_t^e as observed historically and then with $\kappa = 0$, $X^e = 0.6438$ for 1962-1971, multiplied by nominal gross investment in e. The ITC changes considered for 1962-1971 do not affect any components of P_t^s. This cost calculation can also be written:

$$\left[\frac{\kappa_t + u_t(X_t^e - 0.6438) - y_t}{1 - u_t}\right] I_t^e q_t^e \,, \; t = 1962, \ldots , 1971.$$

The resulting values are reported in footnote 23.

Table A1

Data Used to Construct Capital Service Prices

Year	u	X^e	X^s	k	r	q^e	q^s	j	I^e	I^s
1962	.4655	.6438	.5080	.0365	.0823	1.042	1.022	.0178	7.537	2.672
1963	.4742	.6438	.5080	.0454	.0822	1.042	1.043	.0179	8.093	2.917
1964	.4816	.6982	.5080	.0466	.0945	1.056	1.067	.0183	9.565	3.070
1965	.4731	.6982	.5080	.0526	.1092	1.075	1.096	.0184	11.686	3.833
1966	.4640	.6982	.4873	.0517	.1202	1.105	1.134	.0176	13.730	4.632
1967	.4489	.6982	.4909	.0514	.1106	1.144	1.172	.0172	13.171	4.533
1968	.5042	.6982	.5080	.0563	.1061	1.167	1.218	.0178	12.949	4.263
1969	.4948	.6982	.5080	.0409	.1166	1.204	1.321	.0181	14.027	4.486
1970	.4366	.6982	.5080	.0191	.1021	1.255	1.432	.0178	13.511	4.063
1971	.4473	.7360	.5080	.0307	.0787	1.310	1.540	.0180	11.827	3.010

Notes

[1]Also see the accompanying technical study by Roberts and Thunen.

[2]"Labor Letter," The Wall Street Journal, 7 January 1975, p. 1. An METC on wage bill appears to have been the primary proposal; a description and an analysis of this form follow later in the text.

[3]This paper will treat the subsidy rate on man-hours or wage bill directly, rather than indirectly through the tax-credit rate. The two are related through the rate of corporate income taxation.

[4]A third approach is the income-maintenance specification of a wage subsidy, developed by Kesselman (1969). The firm's credit would be proportional to man-hours but inversely related to wage rates. This method carries stronger incentives to substitute low-skill workers into the production process. Since it requires man-hour records by wage-rate class, this method is more difficult to administer.

[5]Temporary reduction or elimination of the employer contribution to Social Security could provide a convenient mechanism for implementing an ETC. However, to the extent that these contributions are shifted onto workers, the efficacy of an ETC would be weakened.

[6]The policy implications of an METC were also discussed by Kaldor.

[7]See White for discussion of a marginal investment tax credit.

[8]The pro-cyclical tendency of an METC could be somewhat mitigated by specifying the base as a function of the firm's total wage bill rather than wage bill net of the credit.

[9]Use of a wage-bill base permits bargaining to inflate the wage bill without any necessary increase in employment.

[10]The overtime wage subsidy contains related issues for a worker's supply behavior under a convex budget constraint, analyzed by Kesselman (1971). Utility maximization in that case permits a more decisive model than do cost minimization and profit maximization in the METC case.

[11]Surprisingly, it is difficult to create the three-dimensional analogue to this analysis. With two of the inputs being subsidized categories of labor, the base must be compared with the sum of the labor inputs.

[12]See Hall and Jorgensen.

[13]This abstracts from the adjustment costs of rapid expansion and the effects on the firm's employment base in future years. See also footnote 15.

[14]Another way to avoid this problem is to assume that all firms grow at the same rate.

[15]Equality of AC and ANC is assigned to rejection of the credit. This portrays the effect of a higher employment on future years' base levels of the firm. Other than this borderline case, any dynamic maximizing behavior of the firm is neglected in this study. When the firm accepts the METC in any given year, it does not reckon the impact on future years' credits via its employment base. This is rational in the presence of uncertainty about and discounting of future events and generous credit carry-over provisions.

[16]If η is the arc price elasticity of demand, then

$w = \frac{P'(1-\eta) + P(1+\eta)}{P'(1+\eta) + P(1-\eta)}$. Note that $w = P'/P$ when $\eta=-1$.

[17]An analogous proof can be made for the percent-of-wage-bill METC. In that case, $\bar{X}$ pertains to the market wage bill of the firm at with-credit input choice; Z pertains to a base measured in wage-bill dollars. Thus, the firm's acceptance of a percent-of-wage-bill METC does not ensure that its total employment will rise above its level in the base year(s). A natural example is the case in which money wage rates have risen above their base-period rates.

[18]We are grateful to the Office of Productivity Analysis, U.S. Bureau of Labor Statistics, and to Laurits R. Christensen and Dale W. Jorgensen for providing us with updated data to 1971.

[19]For further details of the translog cost function and estimation procedures, see Berndt and Wood.

[20]It is noted that the monotonicity and curvature conditions are satisfied at each observation.

[21] These results differ in magnitude from those reported in Berndt and Christensen (1974) but agree in sign. The differences can be attributed to an alternative set of estimating equations (based on translog cost function rather than translog production function) and a different time period (1962-1971 rather than 1929-1968).

[22] Depreciation allowance provisions were changed in 1964 and 1971, and an ITC was introduced in 1962. Our new P_K series follows the procedure originally employed by Hall and Jorgensen. Further details are provided in the appendix.

[23] The cost by year for 1962-1971 was estimated in millions of current dollars as: 201, 266, 735, 984, 1167, 1142, 1265, 1145, 727, and 1115. See the appendix for details of this calculation.

[24] In comparison, employer contributions to Social Security in 1971 were nearly twenty cents per hour for the average worker. See footnote 5.

[25] See footnote 8.

[26] The simulations are not dynamic, however, in the sense of footnote 13.

[27] Similar to the case of the ETC, the effects of a more costly METC on wage bill can be approximated by scaling up the Table 7 effects in proportion to the increased costs in a given year.

[28] The simulated effects of <u>replacing</u> the ITC with an equal-cost METC can be readily obtained by <u>summing</u> the corresponding entries in Tables 4 and 7.

[29] **<u>Replacing</u> the ITC with such an METC would have raised total employment by 0.4, 1.5, 1.5, and 1.1 percent in the four years, respectively. See footnote 28.**

[30] An "equal-cost" METC simulated with $\mu=.9$ when $\eta=-1$ was not accepted by the firm in some years and is not presented in the table.

[31] The work of Nadiri and Rosen suggests that firms adjust their labor inputs more quickly than their capital inputs. This findings favors ETC policies as against ITC policies for stabilization purposes.

[32] The aggregation assumption works because of the constant-returns-to-scale technology.

References

Ahluwalia, Montek S. "Taxes, Subsidies, and Employment." Quarterly Journal of Economics 87 (August 1973): 393-409.

Archibald, G. C. "On Regional Economic Policy in the United Kingdom." In Essays in Honour of Lord Robbins, edited by M. Peston and B. Corry, pp. 224-45. London: Weidenfeld and Nicholson, 1972.

Barth, Michael C. "Universal Wage-Rate Subsidy: Benefits and Effects." In The Economics of Federal Subsidy Programs, Part 4, A Compendium of Papers, Joint Economic Committee, U.S. Congress, pp. 497-540. Washington, D.C.: U.S. Government Printing Office, 1972.

Berndt, Ernst R., and Laurits R. Christensen. "Testing for the Existence of a Consistent Aggregate Index of Labor Inputs." American Economic Review 64 (June 1974): 391-404.

Berndt, Ernst R., and N. Eugene Savin. "Estimation and Hypothesis Testing in Singular Equation Systems with Autocorrelated Disturbances." Econometrica, forthcoming 1975.

Berndt, Ernst R., and David O. Wood. "Technology, Prices, and the Derived Demand for Energy." Review of Economics and Statistics, forthcoming 1975.

Bhagwati, Jagdish N., and V. K. Ramaswami. "Domestic Distortions, Tariffs, and the Theory of Optimum Subsidy." Journal of Political Economy 71 (February 1963): 44-50.

Borts, George H. "Criteria for the Evaluation of Regional Development Programs." In Regional Accounts for Policy Decisions, edited by W. Z. Hirsch, pp. 183-218. Baltimore, Md.: Johns Hopkins Press, 1966.

Borts, George H., and Jerome L. Stein. Economic Growth in a Free Market. New York: Columbia University Press, 1964.

Brown, A. J. "The 'Green Pepper' on the Development Areas." National Institute Economic Review 40 (May 1967): 26-33.

Buchanan, James M., and John E. Moes. "A Regional Countermeasure to National Wage Standardization." American Economic Review 50 (June 1960): 434-38.

Christensen, Laurits R., and Dale W. Jorgensen. "The Measurement of U.S. Real Capital Input, 1929-67." Review of Income and Wealth Series 15 (December 1969): 293-320.

Crandall, Robert W., and C. Duncan MacRae. "Economic Subsidies in the Urban Ghetto." Social Science Quarterly 52 (December 1971): 492-507.

Greenston, Peter M., and C. Duncan MacRae. "Categorical Wage-Bill Subsidies: Theory and Application." Working Paper 3603-03. Washington, D.C.: The Urban Institute, 1973.

Hagen, Everett E., "An Economic Justification of Protectionism." Quarterly Journal of Economics 72 (November 1958): 496-514.

Hall, Robert E., and D. W. Jorgensen. "Tax Policy and Investment Behavior." American Economic Review 57 (June 1967): 394-414.

Hamermesh, Daniel S. Economic Aspects of Manpower Training Programs. Lexington, Mass.: Heath Lexington Books, 1971.

Javits, Jacob. "Statements on Introduced Bills and Joint Resolutions, S. 2632." Senate, October 1, 1971. Congressional record, 92nd Cong., 1st sess., v. 117: 34431-34432.

Kaldor, Nicholas. "Wage Subsidies as a Remedy For Unemployment." Journal of Political Economy 44 (December 1936): 721-42.

Kesselman, Jonathan R. "Labor-Supply Effects of Income, Income-Work, and Wage Subsidies." Journal of Human Resources 4 (Summer 1969): 275-92.

Kesselman, Jonathan R. "Conditional Subsidies in Income Maintenance." Western Economic Journal 9 (March 1971): 1-20.

Kesselman, Jonathan R. "A Comprehensive Approach to Income Maintenance: SWIFT," Journal of Public Economics 2 (February 1973): 59-88.

Lind, Truls, and Jan Serck-Hanssen. "Regional Subsidies on Labour and Capital." Swedish Journal of Economics 74 (March 1972): 68-83.

MacRae, C. Duncan; Robert W. Crandall; and Ralph E. Smith. "Wage Subsidy Research: Existing Models and Programs." Final Report. Washington, D.C.: The Urban Institute, 1972.

Nadiri, M. Ishag, and Sherwin Rosen. "Interrelated Factor Demand Functions." American Economic Review 59 (September 1969): 457-71.

Roberts, B.F., and Richard N. Thunen. "Employment Tax Credit: Proposal for Stabilization Policy." Senate, October 1, 1971. Congressional record, 92nd Cong., 1st sess., v. 117: 34434-34436.

United Nations. Economic and Social Council. Economic and Employment Commission. Price-Wage-Tax-Subsidy Policies as Instruments in Maintaining Optimal Employment, by Ragnar Frisch. United Nations [Document] E/CN.1/Sub.-2/13. 1949.

Weiner, Neil S.; Robert D. Lamson; and Henry M. Peskin. "Report on the Feasibility of Estimating the Effects of a National Wage Bill Subsidy." Research Paper P-545. Arlington, Va.: Institute for Defense Analysis, 1969.

White, William H. "Illusions in Marginal Investment Subsidy." National Tax Journal 15 (1962): 26-31.