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Labor Demand Elasticities & Clinton Health Care Reform

Survey of the Relevant Literature

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Summary

At a White House press conference in October of 1993, Secretary of Labor Robert Reich and Laura D'Andrea Tyson, Chair of the Council of Economic Advisors, released a paper criticizing estimates of job losses from employer mandates to pay for health care reform.[1]

A specific target of their criticism was a study—*The Impact of a Health Insurance Mandate on Labor Costs and Employment*—carried out by Drs. June and Dave O'Neill and published by the Employment Policies Institute. That report, as well as the follow-up study—*Effects of the Employer Mandate in the Clinton Health Plan*—which analyzed the Clinton plan directly, relied on prevailing economic knowledge to model the effects of a mandate. The report assumed that, economy-wide, employers would reduce their workforces by 3 percent for every ten percent increase in costs from the mandate; highly affected industries (those with large numbers of low-wage workers) would respond more drastically and reduce employment by 5 percent.

The White House charged that these response factors ("elasticities") were grossly exaggerated and that the job losses predicted in those reports could only be arrived at by distorting conventional economic theory. To quote from the White House paper:

> ***The assumption about how firms change their employment in response to cost changes is three to six times higher than most conventional estimates.*** The O'Neill study assumes that firms will lay off 3% of their workforce if compensation rises by 10%.
>
> - ***Summary estimates in the economic literature, for example by Charles Brown and Allison Wellington, suggest that the responsiveness of firms to cost changes for low-wage workers is only one-third to one-sixth of the O'Neill assumption (emphasis in original).***[2]

In response to the Clinton Administration's criticism, we asked Dr. Julia Lane of American University to review the literature on employment response. Her findings confirm that the labor market responses assumed in the O'Neill paper are not only well supported by mainstream economic thought, but also are ***conservative in that they represent the mid-point of accepted values.*** Her findings, echoed by Dr. Daniel Hamermesh of the University of Texas at Austin in his foreward, demonstrate that accepted economic thought on labor response calls for a reduction of anywhere between 1.5 and 7.5 percent of employees in response to a 10 percent increase in cost. These widely accepted values evenly bracket the estimates used by the O'Neills—3 and 5 percent—in arriving at their predicted job loss.

[1] Economic Effects on Health Reform, Secretary of Labor Robert Reich and Laura D'Andrea Tyson, Chair of the Council of Economic Advisors, October 6, 1993.

[2] Reich and Tyson, op.cit, page 7 (emphasis in original).

The Institute stands by the O'Neills' findings: the employer mandate in the Clinton plan would result in a *minimum* of 800,000 lost jobs. If the funding for the promised employer subsidies proves to be unavailable (as recent Congressional Budget Office estimates indicate) then the job loss would soar as high as 2.1 million.

On behalf of the Institute, we thank Dr. Lane for her work on this project, as well as Dr. Hamermesh for his gracious foreword. Their confirmation of the validity of the labor response assumptions in the O'Neill papers should not, of course, be construed as an endorsement of the overall findings in those reports.

Carlos Bonilla
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Foreword

The impact on employment of the proposed employer mandate to fund health reform is a crucial issue in judging the merits of the health care plan. The central parameters that we need to measure this impact are the effects of labor costs on employers' demand for workers (labor-demand elasticities) and the effects on workers' desires to forgo leisure to seek employment (labor-supply elasticities). Knowledge of both the immediate and eventual sizes of these responses is desirable.

Julia Lane succinctly summarizes the literature on the eventual impact of higher labor costs on employers' demand for workers. She usefully distinguishes between effects on employment and on hours per worker, pointing out that a major impact will be to reduce the opportunity for part-time work. She correctly indicates that the only good evidence on the potential net effect on employment demand comes from past studies of labor-demand elasticities. Using the much lower estimates of the impact of the minimum wage on low-skilled employment is a mistake. Few workers have sufficiently low wages to be affected by a minimum wage increase coupled with an increased work effort when the minimum wage is raised. Coupled with good estimates of the number of workers affected by the new tax and the elasticity of labor supply, her conclusion that a long-run elasticity of between 0.15 and 0.75 is appropriate can provide the best answer to the central issue of the program's long-term impact on employment.

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I. Introduction

The implementation of the Clinton health care plan will raise the cost to employers of hiring workers. The impact of this cost on employment and workers' wages is not generally known. This impact depends on how responsive employers are to cost changes: the more responsive employers are, the greater the loss of jobs and the lower the net wage received by workers. Economists call the responsiveness the "elasticity of labor demand" and measure it as the absolute value of the percentage change in the amount of labor demanded divided by the percentage change in the cost of labor. An elasticity of .10 says that for a one percent increase in labor costs, labor demand falls (remembering that the measure is an absolute value) by one-tenth of one percent. Similarly, a 10 percent increase in labor costs transates into a 1 percent decline in labor demanded.

Most research into the impact of a health care mandate on labor markets is based on assumptions about this responsiveness of labor demand to such a shock. In a simple view of the world, the elasticities of both demand and supply matter, as evidenced by *Figure 1*. Here the original equilibrium wage and employment levels are altered by the imposition of the tax: employment goes down (from L_0 to L_1); the wage rate the employer pays goes up (from w_0 to w_1'); and the wage rate received by the employee goes down (from w_0 to w_1''). For any given elasticity of labor supply[3], the elasticity of labor demand (η_{LL}) will determine the order of magnitude of these effects.

...if one component of the bundle becomes a required part of compensation, other components will be reduced.

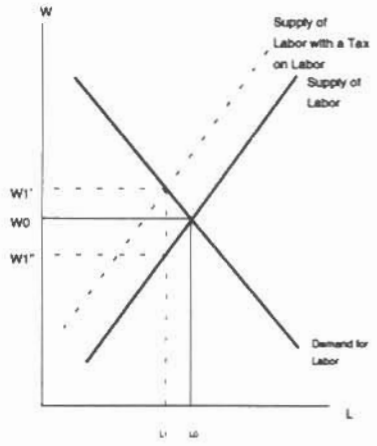
Behind this simple story, however, lie a number of obvious caveats. Labor demand has been relatively ignored as a research area[4], so the literature on labor demand elasticities is sparse compared with that on labor supply. Furthermore, not all elasticities available are relevant, since the primary interest in determining the impact of a health care mandate should be long run in nature. Most studies have also been rather narrow in scope, focusing on industries or regions, whereas the health care mandate would affect the entire economy. There are other important caveats. First, the simple picture above described a tax as a *per unit* tax— for example, an additional cost of 10¢ an hour; but the mandate will be similar to a *lump sum* tax on employment— roughly $2,000 an employee— rather than a tax on hours worked. Thus, studies that have examined the effect of increases in wages (such as minimum wage studies) will have limited applicability. Second, the proposed change is to benefits rather than to wages, and the reaction of firms to changes in the benefit package is even less well known than their reaction to wage changes.

[3] In general, the supply of male labor is thought to be inelastic (not very responsive to changes in the wage rate); it is greater for women but still quite small (Krueger, 1993).

[4] Hamermesh, 1993.

It is entirely possible, for example, that firms will adjust by changing the *components* of compensation—reducing either wages (when legal) or other benefits, rather than changing employment levels or hours worked.

This last point merits elaboratation. Workers typically receive a bundle of rewards for working: wages, vacation time, sick time, health and dental benefits, pension plans, and other "perks." The labor literature suggests that the exact composition of the bundle depends on negotiation between employer and employee.[5] It is possible that if one component of the bundle becomes a required part of compensation, other components will be reduced. Thus there will be a short run increase in costs to employers until the compensation package is adjusted in the long run.



The Market for Labor

Figure 1

Furthermore, since *Figure 1* describes an essentially homogeneous labor market, it is an imperfect characterization of the *aggregate* labor market. Not only is labor heterogeneous, but there is a substantial portion of the labor market already covered by health insurance. The shock will affect that portion differently. A considerable literature even argues that *Figure 1* is not the appropriate tool to use for analysis: the labor market is characterized by imperfectly competitive markets, efficiency wages, implicit contracts or internal labor markets. To summarize, as Krueger points out:

> *"From the outset it should be stressed that there is considerable uncertainty in the economics profession as to how a health care mandate would affect employment. This uncertainty arises because there is uncertainty regarding the proper theoretical framework for modeling the labor market, and because there is considerable uncertainty over the magnitude of the relevant behavioral parameters in any model".*[6]

Note that this study is limited to surveying only the literature on US labor demand elasticities. Furthermore, it focuses only on the literature that is potentially relevant to the health care debate. Thus, I first summarize the available literature on homogeneous labor, restricting the analysis to aggregate studies which treat all labor as essentially identical. Since much of the debate deals with which groups of workers will gain or lose from health care reform, the subsequent section addresses the available evidence on heterogeneous labor—the provision of different *kinds* of labor services. The scanty evidence on the "benefit" elasticity of demand is surveyed, followed by a synthesis of the evidence.

[5] See any respected labor economics textbook-e.g. Hamermesh and Rees, 1993 for an exposition of this point.

[6] Krueger, 1993, p16.

II. Estimates of the Elasticity of Demand for Homogeneous Labor

The elasticity of demand for labor is determined by a series of factors (the Hicks-Marshall laws of derived demand). One of the most important is that the demand for labor will be more elastic (have a greater reponse to a given price change) the more substitutes there are for that labor. Thus, the more employers are able to substitute capital for labor, the more responsive they will be to increased labor costs. Economists measure this ability by the *elasticity* of capital/labor substitution.

The Clinton Plan may thus be seen as increasing the cost of hiring unskilled workers and (possibly) reducing the cost of hiring skilled workers.

Estimates of the wage elasticity of labor demand (η_{LL})[7] are comprehensively surveyed by Hamermesh.[8] The most appropriate estimates of labor demand elasticity for the purposes of this survey are those which use aggregate data. Although these estimates are likely to understate the true magnitude of the response in labor demand to a change in the price of labor (η_{LL}), they may be more useful for the purposes of approximating the effects of the health care mandate since they ignore substitution effects across firms or industries. It should be noted that some studies estimate the change in employment as a result of wage changes while others estimate the change in hours worked. Each is of interest in this context, since the former will estimate the effect on jobs, and the latter the effect on worktime. Several different approaches have been used to estimate wage elasticity of labor demand.

One approach relies on aggregate data to estimate a production function[9]: the consequent estimate of the elasticity of substitution between capital and labor (σ_{lk}) may be multiplied by $1\text{-}s_L$ (the share of labor) to approximate η_{LL}. The value of this approach is limited: the data are poor—in both quality and the time period used, and most of these estimates are based on the demand for hours rather than employment. The best estimates of the wage elasticity of labor η_{LL} derived from this rather fragile approach range from 0.1 to 0.15.

[7] Note that in this elasticity the subscript "LL" denotes the change in the demand for labor in response to the price of labor.

[8] Hamermesh, 1993.

[9] Shown in Appendix A, as cited in Hamermesh *Labor Demand.*

A second approach directly estimates factor demand equations.[10] Caution needs to be used in interpreting these results as well, since if either capital or output are mismeasured, the reliability of the estimates is reduced. Most estimates are for the manufacturing sector, and most estimates are within the range of (0.06, 0.51). In general, elasticity estimates which measure *employment* adjustment are lower than those which measure the adjustment in *hours-worked*.

A percentage increase in the cost of unskilled labor reduces demand for that labor more than a comparable increase reduces the demand for skilled labor.

Hamermesh surveys a third group of studies that use aggregate data to estimate the wage elasticity of labor η_{LL} as part of a production system.[11] Since many studies use the same data base, it is not surprising that the estimates are very similar, ranging for the most part between 0.17 and 0.72.

A very recent study[12] is one of the few to use firm-based data to estimate demand elasticities. The authors' elasticity estimates average 0.5 for hours-worked and 0.4 for employment, but the most interesting contribution in this context is their argument that many earlier estimates are biased down. In particular, they argue that failure to account for measurement error and unobserved heterogeneity... "introduce a negative bias in OLS [Ordinary Least Squares] estimates of the wage... elasticities so that OLS overestimates the long run response of labor to wage changes..".[13] In other words, the estimation routines used in many of the elasticity estimates produce values that are below what an unbiased procedure would yield.

Hamermesh's overall view is that "a reasonable confidence interval for [the absolute value of][14] η_{LL} in the aggregate, is [0.15, 0.75]... If one were to choose a point estimate for this parameter, 0.30 would not be far wrong (*though picking a single estimate is not a good idea*)."[15]

III. Estimates of the Elasticity of Demand for Heterogeneous Labor

i. General Studies

The estimates above were derived assuming that labor is homogeneous—that is, that all workers are identical. But workers are not identical, and the current health care system may be characterized as treating two groups of workers differently in that it covers large numbers of skilled workers and fails to cover many unskilled workers. The Clinton plan may thus be seen as increas-

[10] Shown in Appendix B, as cited in Hamermesh *Labor Demand*

[11] Shown in Appendix C, as cited in Hamermesh *Labor Demand*

[12] Dunne and Roberts, 1993. This study has been criticized by Davis (1994).

[13] Dunne and Roberts, 1993, p24.

[14] Bracketed phrase added.

[15] Hamermesh, 1993, p92. Author's italicization

ing the cost of hiring unskilled workers and (possibly) reducing the cost of hiring skilled workers.[16]

The impact of this will again depend on the Hicks-Marshall law described above: the more substitutes there are for labor, the more elastic the demand and the greater the decline in labor demand. Different groups of workers can act as substitutes for each other (for example, skilled workers can substitute for unskilled): this is called *labor/labor substitution*. The elasticity of demand for different kinds of labor thus depends on several factors: the degree to which it is possible to substitute either physical capital or other employees for the type of worker considered ($\sigma..$); the elasticity of demand for blue collar workers (η_{BB}); and the elasticity of demand for white collar workers (η_{WW}).

In other words, increases in the cost of labor have a lower effect on the demand for older workers, reflecting their increased skills.

A number of studies of heterogeneous labor have been surveyed by Hamermesh.[17] Although there are problems associated with classifying blue collar workers as unskilled and white collar workers as skilled, he finds that the elasticity of demand is greater for unskilled than for skilled workers in every study surveyed. A percentage increase in the cost of unskilled labor reduces demand for that labor more than a comparable increase reduces the demand for skilled labor. Most estimates for unskilled workers are between 0.3 and 2.0; most for skilled workers are between 0.2 and 1.0. Estimates for different educational and occupational categories are harder to summarize, but are generally consistent with the estimates reported above.

Different groups of workers can act as substitutes for each other (for example, skilled workers can substitute for unskilled)...

Younger workers, who are also likely to be less skilled, consistently display greater elasticities of demand for their services than do older, prime age workers. The elasticity of demand for teenagers and young adults range from 0.13 to almost 1.0; for adult workers the range is .25 to almost .40. In other words, increases in the cost of labor have a lower effect on the demand for older workers, reflecting their increased skills. Hamermesh summarizes the elasticity estimates as follows:

> *"The overwhelming implication is that own-wage demand elasticities decrease with skill. This was generally true comparing white and blue-collar, educated and less-educated, and older and younger workers. Cautious extrapolation of this generalization is needed; but the results should provide a framework for prediction to researchers and students of public policy wishing to examine issues in the demand for workers for whom no estimated elasticities are available."*[18]

[16] Krueger, 1993.

[17] Shown in Appendix C: as cited in Hamermesh's *Labor Demand*.

[18] Hamermesh, p126.

ii. Minimum Wage Studies

A great deal of evidence has been presented regarding the elasticity of demand for minimum wage workers, who tend to be low skilled. Katz and Krueger (1992), Card (1992) and Card and Krueger (1993), for example, have claimed that increases in the minimum wage have not reduced employment, suggesting that the elasticity of demand for this group of labor is zero. As Krueger points out, however:

Even if the minimum wage debate were relevant to the health care debate, the results have been criticized and the models re-estimated with different results.

> *"...I am not sure it [the minimum wage literature] applies to a health care mandate. The reason for my skepticism is that the leading models that explain the findings of no or positive employment effects of a minimum wage rise involve monopsony and search models. A minimum wage increase makes work more rewarding, and may thus enable firms to fill vacancies and reduce turnover, whereas a health care mandate that extends to nonworkers as well does not have the advantageous supply side effects of a minimum wage."*[19]

Even if the minimum wage debate were relevant to the health care debate, the results have been criticized and the models re-estimated with different results: Neumark and Wascher (1992) find employment elasticities for teens and young adults of between 0.08 and 0.28; Taylor and Kim (1993) estimate employment elasticities to be in the range of 0.7 to 0.9. Each of these results were significantly different from zero.

IV. Estimates of the "Benefit" Elasticity of Demand

The elasticities discussed in the preceding sections generally refer to the responsiveness of employers to increases in wages. However, since the Clinton health care reform basically mandates that employers pay a fixed premium per employee, it imposes a fixed cost on employment rather than hours worked. Intuitively, this should have different effects on employment and hours worked—firms would be less likely to hire workers and more likely to extend the working hours of the currently employed.

Unfortunately, as Hamermesh[20] points out, not much is known about the substitution of employment for hours—especially not for one group of workers versus another. It is not even clear that the research that has been done in this field is relevant for the health care reform debate. It is quite possible that voluntarily provided employer benefits are negotiated between employer and employee either as a form of implicit contract between the two or as a result of the different tax

[19] Krueger, 1993, p25.

[20] Hamermesh, 1993, p196.

treatment such benefits receive. Thus the wage and employment impacts of a health benefit mandate may well be different from a health benefit agreement.

There are several issues here. As was discussed earlier, voluntarily provided benefits can be adjusted up or down as the employer and employee wish. If benefits are mandated, however, then the employer has less flexibility over the compensation package during an economic downturn: other components will be cut. Furthermore, part of the reason for employers to offer and employees to want fringe benefits is the differential tax treatment that these receive relative to wages. Since the tax treatment could change under the Clinton plan, so could the employer/employee agreement on the best compensation bundle.

Thus the wage and employment impacts of a health benefit mandate may well be different from a health benefit agreement.

Hamermesh cites little evidence based on U.S. data for the "benefit" elasticity of demand. This is primarily due to the almost complete lack of data on firm provided fringe benefits. Results from other developed countries suggest that the elasticity of hours worked in response to increases in the benefit/wage ratio range from 0.01 to 0.04; the elasticity of employment is greater, ranging from 0.05 to 0.28. Again, there is likely to be a difference between benefit agreements and benefit mandates.

A recent study of child care workers[21] finds that fringe benefit increases do significantly reduce the hours worked by part-time workers, and that insurance benefits have an effect more than twice that of other options. Although the estimation procedure used in this study does not directly calculate elasticities, the authors find that an increase in benefits equalt to 1% of the wage bill reduces part-time hours as a proportion of full-time hours by roughly 0.4 percentage points.

If benefits are mandated, however, then the employer has less flexibility over the compensation package during an economic downturn: other components will be cut.

These results suggest that jobs will indeed be affected more than hours worked. There is likely to be a substitution away from part-time workers and toward full time workers, although the order of magnitude of this effect is impossible to determine given current data.

[21] Montgomery and Cosgrove, 1993.

V. Conclusion

There is no one appropriate elasticity to use in analyzing the effects of increased wage costs. Hamermesh suggests a range between 0.15 and 0.75 is appropriate; Krueger in his recent study used a range between 0.25 and 0.75. Recent evidence from Dunne and Roberts suggests that these ranges might even be understated. Certainly, if one is looking at the impact of a wage increase on unskilled workers, the range is likely to be higher. Thus a choice of an elasticity of between .15 and .75 would certainly both be conservative and consistent with the vast majority of the empirical literature and would include the estimates used in the reports prepared by the O'Neills.

Thus a choice of an elasticity of between .15 and .75 would certainly both be conservative and consistent with the vast majority of the empirical literature.

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Appendix A

Estimates of σ using Data on Aggregates or Large Industries

Study	*Description*	σ_{lk}
Dhrymes (1969)	Total private hours, quarterly, 1948-60; MP condition	0.75
Hamermesh (1983)	Private nonfarm, quarterly, 1955-78; MP condition, attention to measuring labor cost	0.47
Drazen, Hamermesh, and Obst (1984)	Manufacturing worker-hours, quarterly, 10 OECD countries, mostly 1961-80; MP condition	0.21
Lucas and Rapping (1970)	Aggregate production-worker-hours, annual, 1930-65; MP condition, supply-demand system	1.09
Black and Kelejian (1970)	Private nonfarm worker-hours, quarterly, 1948-65; MP condition, supply-demand system	0.36
Liu and Hwa (1974)	Private worker-hours, monthly, 1961-71; MP condition, supply-demand system	0.67
Beach and Balfour (1983)	Manufacturing operatives worker-hours, quarterly 1956-78; U.K.; MP condition, supply-demand systems	(0.49, 0.79)
Lewis and Kirby (1988)	Nonfarm employment, quarterly, 1967-87; Australia; MP condition	0.78
Rudebusch (1986)	Nonfarm business worker-hours, quarterly, 1952-81; MP condition, disequilibrium supply-demand model	1.16
Quandt and Rosen (1988)	Private worker-hours, annual, 1932-83; MP condition, disequilibrium supply-demand model	0.69
Hall, Henry, and Pemberton (1990)	Total employment, quarterly, 1966-88; U.K.; disequilibrium supply-demand model	6.86

Appendix A, Continued

Study	*Description*	σ_{lk}
Brown and de Cani (1963)	Private nonfarm worker-hours, annual, 1933-58; capital-labor ratio	0.47
David and van de Klundert (1965)	Private worker-hours, annual, 1899-1960; capital-labor ratio	0.32
Schaafsma (1978)	Manufacturing employment, annual, 1949-72; Canada; capital-labor ratio	0.42
Symons (1985)	Manufacturing employment, quarterly, 1961-76; U.K.; KL and import prices	2.40

Appendix B

Estimates of η_{LL} or η'_{LL} Based on Factor-Demand Equations Using Data on Aggregates or Large Industries.

Study	*Description*		
			$-\eta_{LL}$
Tinsley (1971)	Private nonfarm, quarterly, 1954-65; KL prices.		
		Employment:	0.04[a]
		worker-hours:	0.06[b]
Chow and Moore (1972)	Private worker-hours, quarterly 1948:IV-1967; KL prices, large forecasting model		0.37[c]
Kollreuter (1980)	Manufacturing worker-hours, quarterly, 1971-77; West Germany; KL prices		0.20
Clark and Freeman (1980)	Manufacturing production workers, quarterly, 1950-76; KL prices.		
		Employment:	0.33
		worker-hours:	0.51
Bucher (1984)	Employment, quarterly, 1963-80;	KL prices.	
		France:	-3.61
		West Germany:	0.63
Chetty and Heckman (1986)	Manufacturing production-worker hours, quarterly, 1947-69; KL prices; accounts for aggregation, entry/exit, supply-demand model		3.88
Michi (1987)	Manufacturing production-worker hours, quarterly, 1950-78; KL prices; accounts for aggregation, entry/exit, supply-demand model		(-0.02, 0.34)
Flaig and Steiner (1989)	Manufacturing employment, quarterly, 1963-86; 1963-86; West Germany, KLM prices		0.14
Hsing (1989)	Manufacturing, annual, 1953-78; KL prices, tests of functional form		0.70

Appendix B, Continued

Study	*Description*		$-\eta_{LL}$
Coen and Hickman (1970)	Private worker-hours, annual, 1924-40, 1949-65; KL prices		0.18
Bruno and Sachs (1982)	Manufacturing, annual, 1956-78, U.K.; system of output, factor-price frontier and labor-demand equations		0.08[a]
Epstein and Denny (1983)	Manufacturing worker-hours, annual, 1947-76; KLM prices, complex dynamics		0.07[b]
Nickell (1984)	Manufacturing, quarterly, 1958-74; U.K.; LEM prices; careful specification of expectations		0.19
Heckman and Sedlacek (1985)	"Tasks," annual, 1968-81; KLEM prices; transformed labor-demand relation.		
		Manufacturing:	0.49
		Nonmanufacturing:	0.93
Franz and Konig (1986)	Manufacturing, quarterly, 1964-83; West Germany, KLM prices		0.96
Kokkelenberg and Bischoff (1986)	Manufacturing production-worker-hours, quarterly, 1959-77; KLE prices, nonstatic expectations about K adjustment; interrelated adjustment of KL.		0.13
Pencavel and Holmlund (1988)	Blue-collar, manufacturing and mining, annual, 1950-83; Sweden; KLEM prices		0.75
Pencavel (1989)	Aggregate, annual, 1953-79; U.K.		
		KLM prices:	0.40
		With K stock:	0.51
		With alternative wages:	0.03

Appendix B, Continued

Study	Description		
Nadiri and Rosen	(1973)Manufacturing employment, quarterly, 1948-65; interrelated adjustment of E,H,K,K utilization, inventories.		
		Production workers:	-0.11
		Nonproduction workers	0.14
Schott (1978)	All industry, annual, 1948-70; U.K.; KL prices interrelated adjustment of K,E,H.		
		Employment:	0.82
		Hours	0.25
		short run	$-\eta_{LL}$
Harris (1985)	Engineering worker-hours, quarterly, 1968-81; U.K.; KL prices, interrelated adjustment; special attention to capital		0.21
Nadiri (1968)	Manufacturing, quarterly, 1947-64; K held constant.		
		Employment:	0.12
		Hours:	0.14
Meese (1980)	Private production-worker employment, quarterly, 1947-74; KL prices, K held constant		1.73
Layard and Nickell (1986)	Aggregate, J.K.; import prices, K held constant:		
		annual, 1954-83	0.93
		quarterly, 1957-83	1.19
Andrews (1987)	Aggregate, annual, 1950-79; U.K.; supply-demand system, KLEM prices; K held constant		0.51
Burgess (1988)	Manufacturing, quarterly, 1964-82; U.K.; EM prices international competitiveness; K held constant		1.85
Harris (1990)	Private worker-hours, quarterly, 1965-87; New Zealand; K held constant		0.24

Appendix B, Continued

Study	*Description*	
Nickell and Symons (1990)	Manufacturing employment, quarterly, 1962-84; MP condition, K held constant; attention to measuring w	1.92
		$-\eta'_{LL}$
Symons and Layard (1984)	Manufacturing employment, quarterly, 1956-80; 5 OECD countries; LM prices; no Y or K	1.54
Wadhwani (1987)	Manufacturing employment, quarterly, 1962-81; U.K.; KLM prices; no Y or K	0.38[b]
Kennan (1988)	Manufacturing production-worker-hours, monthly 1948-71; MP condition, supply-demand system; no Y or K	11.58
Begg et al. (1989)	Employment, annual, import prices, attention to dynamics; no Y or K.	
	U.K., 1953-85;	0.40
	Japan, 1953-86	0.45

[a] Estimates are calcualted at the sample end points.

[b] 1971 elasticity

[c] Explosive dynamics

Appendix C

Estimates of η_{LL} Based on Equation Systems Using Data on Aggregates or Large Industries (Group I.c Studies)[a]

Study	Description	η_{LL}
Berndt and Wood (1975)	Manufacturing, annual, 1947-71; KLEM, translog cost	0.45
Berndt and Khaled (1979)	1947-71; KLEM, translog cost	
	Homogeneous, neutral technical :	0.46
	Heterothetic, nonneutral change:	0.17
Norsworthy and Harper (1981)	1958-77; KLEM, translog cost, complex dynamics	0.74
and Anderson (1981)	1948-71; KLEM, translog cost, concentrates on endogeneity	0.42
Morrison and Berndt (1981)	1952-71; KLEM, translog cost	0.35[b]
Pindyck and Rotemberg (1983)	1948-71; KLEM, translog cost, concentration on adjustment paths	0.57
Segerson and Mount (1985)	1958-81; selected years; KLEM and management, AIDS and other systems	(0.50, 0.62)
Morrison (1986)	1949-80; KLEM, translog cost, various specifications of expectations on quasi-fixed capital	(0.03, 0.12)
Chung (1987) estimation methods	1947-71; KLEM, translog cost, alternative	(0.66, 0.95)
Diewert and Wales (1987)	1947-71; KLEM, various functional forms, translog cost	(0.19, 0.72)
McElroy (1987)	1947-71; KLEM, translog cost, concentration on stochastic optimization	0.34

Appendix C , Continued

Study	Description	$-\eta_{LL}$
Griffin and (1976)	GregoryManufacturing employment, quality (education) adjusted, 1955, 1960, 1965, 1969; 9 OECD countries; KLEM, translog cost	0.23
Fuss (1977)	Manufacturing worker-hours, annual, 1961-71; Canadian regions; KLEM, translog cost	0.49[c]
Magnus (1979)	Enterprise sector, annual, 1950-76; Netherlands, KLE, translog cost	0.30
Pindyck (1979)	Aggregate, annual, 1963-73; 1973-71; 10 OECD countries; KLE, translog cost	0.43
Tarhouni (1983)	Aggregate, annual, 1962-78; KL, translog production	
	Egypt:	0.64
	Libya:	0.35
Garofalo and Malhotra (1984)	Manufacturing, production-worker-hours, states 1974-77; KLE, translog cost	0.74
Morrison(1988)	Manufacturing, annual; KLEM, generalized Leontief.	
	U.S., 1952-81:	0.41
	Japan, 1955-81:	0.66

[a] Unless otherwise noted, parameter estimates refer to the last year or quarter in the sample, here and in translog estimates in Tables 3.4 through 3.10.

[b] Estimate at the sample midpoint.

[c] Estimate for Ontario.