CHAPTER 8

THE SHORT-RUN DEMAND FOR TOTAL MAN HOURS PAID-FOR

8.1 Introduction

This chapter brings together the model of the short-run demand for workers developed in ch. 3 and the model of the short-run demand for hours paid-for per worker developed in ch. 7. In § 8.2 the results presented in table 4.3 of estimating the workers equation are compared with the results presented in table 7.2 of estimating the hours paid-for per worker equation, and in § 8.3 the results in the two tables are combined to yield an explanation of the short-run demand for total man hours paid-for. From the discussion in § 8.3 the advantages of estimating the workers and hours paid-for per worker equations separately instead of estimating a total man-hours paid-for equation directly are clearly seen. In § 8.4 the economy-wide implications of the rather disaggregate results achieved in this study are discussed, and some tentative conclusions are offered.

8.2 A comparison of the demand for workers and the demand for hours paid-for per worker

In table 4.3 the basic results of estimating eq. (3.9)′ for production workers were presented, and in table 7.2, under the same expectational hypothesis for each industry, the basic results of estimating eq. (7.2)′ for hours paid-for per production worker were presented. The basic idea of the model developed in ch. 7 is the idea that many of the same factors which influence the short-run demand for workers are also likely to influence the short-run demand for hours paid-for per worker, and the results presented in table 7.2 strongly confirmed this idea. Nevertheless, there are some important differences between the workers and hours paid-for per worker equations.

For every industry the estimate of the coefficient α_2 of log HP_{2wt-1} (or, more accurately, log HP_{2wt-1} − log HS_{2wt-1}) in the hours equation (7.2)′ is considerably larger in absolute value than the estimate of the coefficient α_1 of the excess labor variable, log M_{2wt-1} − log $M^*_{2wt-1}H^*_{2wt-1}$ (or, more accurately, log M_{2wt-1} − log M^d_{2wt-1}), in the workers equation (3.9)′. This implies that the reaction of firms to the amount of excess labor on hand (with respect to changing the number of workers employed) is smaller than the reaction of firms to the amount by which the number of hours paid-for per worker differs from the standard number of hours of work per worker (with respect to changing the number of hours paid-for per worker).

It should also be noticed from eqs. (3.9) and (7.2) that the amount of excess labor on hand influences both the change in the number of workers employed and the change in the number of hours paid-for per worker, whereas the amount by which HP_{2wt-1} differs from the standard level HS_{2wt-1} influences only the change in the number of hours paid-for per worker. It was seen in § 5.2 that there seems to be little theoretical reason why $\log HS_{2wt-1} - \log HP_{2wt-1}$ should influence the change in the number of workers employed other than at those times when HP_{2wt-1} equals H_{2wt-1} (i.e., when $\log HS_{2wt-1} - \log HP_{2wt-1}$ and the excess labor variable are the same). If HP_{2wt-1} differs from the standard number of hours of work per worker, the obvious thing for the firm to do is to change HP_{2wt}, and the firm is free to do this as long as HP_{2wt-1} does not equal H_{2wt-1}. When HP_{2wt-1} equals H_{2wt-1} so that $\log HS_{2wt-1} - \log HP_{2wt-1}$ and the excess labor variable are equivalent, the firm must hire more workers if it wants to decrease HP_{2wt}, and this is exactly what the excess labor variable says the firm will do when H_{2wt-1} is greater than HS_{2wt-1}. The results presented in table 5.1 confirmed the view that $\log HS_{2wt-1} - \log HP_{2wt-1}$ is not a significant determinant of the change in the number of workers employed other than at those times when it equals the excess labor variable.

There did seem to be, on the other hand, reasons why the amount of excess labor on hand should influence the change in the number of hours paid-for per worker. If firms view HP_{2w} in a similar manner as M_{2w} in the short run, they may be reluctant because of such things as worker morale problems to decrease HP_{2w}, but they may be more likely to do this if there is a lot of excess labor on hand than otherwise. The results presented in table 7.2 strongly indicated that the amount of excess labor on hand is indeed a significant factor in the determination of the change in the number of hours paid-for per worker.

In summary, then, what the above results suggest is that in the short run firms react to a positive amount of excess labor on hand, other things being equal, by decreasing both the number of workers employed and the number of hours paid-for per worker, and that they react to hours paid-for per worker being greater than the standard level, other things being equal, by decreasing the number of hours paid-for per worker but not by increasing the number of workers employed (unless, of course, HP_{2wt-1} equals H_{2wt-1} so that $\log HS_{2wt-1} - \log HP_{2wt-1}$ and the excess labor variable are the same).

The results presented in tables 4.3 and 7.2 also suggest that expected future changes in output are more important in the determination of the change in the number of workers employed than in the determination of the change in the number of hours paid-for per worker. The size of the estimates of the γ_i $(i = 1, 2, \ldots)$ coefficients is in general larger for the workers equation than for the hours equation, and fewer of the γ_i coefficient estimates are significant in the hours equation than in the workers equation. This is not unexpected, since it should be less costly for a firm to allow rapid changes in the number of hours paid-for per worker to occur than to allow rapid changes in the number of workers employed to occur. Expected future changes in man-hour requirements (and thus expected future changes in output) should, therefore, have less significance for current decisions on the number of hours to be paid per worker than for current decisions on the number of workers to employ.

As was mentioned in § 7.3, with respect to the effects of labor market conditions on employment decisions the degree of tightness or looseness in the labor market appears to have more effect on decisions regarding the number of hours to pay each worker for than on decisions regarding the number of workers to employ. The estimate of the coefficient ψ_1 of $\log U_{2wt}$ in the hours equation (7.2)′ was significant for eleven of the seventeen industries, whereas the estimate of the coefficient ψ_0 of $\log U_{2wt} - \log \bar{U}$ in the workers equation (5.1) was significant for only four industries. All but three of the estimates of ψ_0 were of the expected positive sign, however, and so there is some slight evidence that labor market conditions also influence decisions on the number of workers to employ. What the over-all results suggest, therefore, is that in tight labor markets firms increase the number of hours paid-for per worker more or decrease it less than they otherwise would as an inducement to keep workers from looking for other jobs, and that (perhaps) they also hire fewer worker or lay off fewer workers than they otherwise would since new workers are hard to find and workers once laid off may not be available for rehire when they are needed again. In loose labor markets the opposite takes place: the number of hours paid-for per worker is increased less or decreased more than otherwise, and (perhaps) more workers are hired or more are laid off than otherwise.

8.3 The short-run demand for total man hours paid-for

From the workers equation (3.9) and the hours paid-for per worker equation (7.2) it is easy to derive the equation determining the change in total man hours paid-for, $\log M_{2wt}HP_{2wt} - \log M_{2wt-1}HP_{2wt-1}$. Since

$$\log M_{2wt}HP_{2wt} - \log M_{2wt-1}HP_{2wt-1} = \log M_{2wt} - \log M_{2wt-1} + \log HP_{2wt} - \log HP_{2wt-1}, \quad (8.1)$$

the equation determining $\log M_{2wt}HP_{2wt} - \log M_{2wt-1}HP_{2wt-1}$ can be derived by merely adding eqs. (3.9) and (7.2). In table 8.1 results are presented of adding the estimates in table 4.3 with those in table 7.2 for each industry. The figures in table 8.1 are thus the derived estimates of the total man-hours paid-for equation. By using the results in table 4.3 as the estimates for the workers equation, the unemployment rate is assumed to have no effect on the change in the number of workers employed. In other words, ψ_0 in eq. (5.1) is assumed to be zero. The results discussed above suggest that ψ_0 may be positive, but since the evidence is not strong in this regard and in order to simplify matters somewhat, the results presented in table 4.3 are assumed to be the basic results for workers.

Looking at table 8.1, it is seen that for every industry the derived estimate of the coefficient γ_0 of $\log Y_{dt} - \log Y_{dt-1}$ is less than one. Other things being equal, firms react in the short-run to a certain percentage change in output by changing man hours paid-for by less than this percentage and in most industries by substantially less than this percentage. This result is, of course, as expected from the results of the scatter diagrams in § 3.2.

It is also seen from table 8.1 that for every industry except 231 the derived estimate of the coefficient α_1 of the excess labor variable, $\log M_{2wt-1} - \log M^d_{2wt-1}$, is smaller in absolute value than the derived estimate of the coefficient α_2 of $\log HP_{2wt-1} - \log HS_{2wt-1}$. (For industry 231 the two estimates are nearly equal, with the estimate of α_1 being slightly larger in absolute value.) This implies that firms react more strongly in changing total man hours paid-for when the number of hours paid-for per worker, HP_{2wt-1}, differs from the standard level of hours, HS_{2wt-1}, than when the number of workers employed, M_{2wt-1}, differs from the desired number, M^d_{2wt-1}.

Another way of looking at the reaction is the following. By definition M^d_{2wt-1} is equal to $M^*_{2wt-1}H^*_{2wt-1}/HS_{2wt-1}$, where $M^*_{2wt-1}H^*_{2wt-1}$ is the number of man hours required to produce the output during the second week of month $t - 1$. The number of man hours which are paid-for but

TABLE 8.1

Sum of the coefficient estimates in table 4.3 and table 7.2: derived coefficient estimates for the total man-hours paid-for equation

Industry	est. of cnst.	$\hat{\alpha}_1$	$\hat{\alpha}_2$	coeff. est. of t	$\hat{\beta}_4$	$\hat{\beta}_3$	$\hat{\beta}_2$	$\hat{\beta}_1$	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$\hat{\gamma}_4$	$\hat{\gamma}_5$	$\hat{\gamma}_6$	[a]$\hat{\delta}$	$\hat{\psi}_1$
201	1.080	−.291	−.458	−.105			.192	.118	.516	.235	.188	.196	.304	.102	.142	.038	−.0068
207	1.559	−.203	−.456	.155			.064	.091	.356	.205	.135	.119	.034			.063	−.0027
211	.555	−.520	−.612	−.026					.589	.024	.043					−.010	.0071
212	1.828	−.285	−.583	.065				.053	.386								−.0174
231	.073	−.445	−.439	.107			.032	.065	.313	.067	.108	.073				.020	−.0132
232	.896	−.219	−.355	−.055				.021	.245	.186	.142	.064					−.0123
237	3.791	−.089	−.733	−.016				.129	.259								−.0100
242	1.994	−.089	−.417	−.006	.112	.136	.211	.171	.341	.076	.065						−.0067
271	1.234	−.098	−.304	−.082					.201	.081	.067	.095	.030	.083			−.0005
301	.668	−.277	−.370	−.010					.204	.127	.063	.103					−.0199
311	.568	−.288	−.372	−.021					.309	.125	.176	.116	.076	.056			−.0093
314	.531	−.305	−.393	.103					.738	.250	.290	.144				.211	.0017
324	2.637	−.142	−.574	.026					.266	.039	.026	.052	.051			.008	−.0057
331	2.555	−.217	−.633	.129	.044	.067	.037	.121	.376								−.0158
332	.261	−.232	−.265	.108					.298	.082	.103	.081	.056				−.0132
336	1.369	−.156	−.371	.035				.090	.242	.120	.121	.111	.044	.027			−.0168
341	3.230	−.138	−.660	.035				.038	.277	.089	.044	.036	.022				−.0088

[a] $\hat{\delta}$ is the coefficient estimate of $\log Y_{dt-1} - \log Y_{dt-13}$ under the non-perfect expectational hypothesis.

which are not actually required is $M_{2wt-1}HP_{2wt-1} - M^*_{2wt-1}H^*_{2wt-1}$, and the variable $\log M_{2wt-1}HP_{2wt-1} - \log M^*_{2wt-1}H^*_{2wt-1}$ can be considered to be the "excess man-hours" variable analagous to the "excess labor" variable above. Analogous to eq. (3.9) for workers, an equation determining the change in total man hours paid-for could be specified in which $\log M_{2wt}HP_{2wt} - \log M_{2wt-1}HP_{2wt-1}$ was taken to be a function of current and expected future changes in output and of the amount of excess man hours on hand as measured by $\log M_{2wt-1}HP_{2wt-1} - \log M^*_{2wt-1}H^*_{2wt-1}$. The difference between an equation like this and the equation for the change in total man hours paid-for derived from eqs. (3.9) and (7.2) has to do with the reaction of the firm to the amount of excess man hours on hand. By definition:

$$\begin{aligned}
&\log M_{2wt-1}HP_{2wt-1} - \log M^*_{2wt-1}H^*_{2wt-1} \\
&\quad = \log M_{2wt-1} - \log M^*_{2wt-1}H^*_{2wt-1} + \log HP_{2wt-1} \\
&\quad = \log M_{2wt-1} - \log M^*_{2wt-1}H^*_{2wt-1} + \log HS_{2wt-1} \\
&\qquad + \log HP_{2wt-1} - \log HS_{2wt-1} \\
&\quad = (\log M_{2wt-1} - \log M^d_{2wt-1}) + (\log HP_{2wt-1} - \log HS_{2wt-1}), \quad (8.2)
\end{aligned}$$

which says that the excess man-hours variable is the sum of the excess labor variable and the $\log HP_{2wt-1} - \log HS_{2wt-1}$ variable. If one estimated the man-hours paid-for equation directly using the excess man-hours variable, he would implicitly be assuming that the coefficients of $\log M_{2wt-1} - \log M^d_{2wt-1}$ and $\log HP_{2wt-1} - \log HS_{2wt-1}$ are equal and thus that the reaction of the firm to the two variables is the same. The results presented in table 8.1 suggest that this is not the case, that the reaction of firms to the amount of excess man hours on hand depends on how the amount is distributed between the amount of excess labor on hand and the amount by which HP_{2wt-1} differ from HS_{2wt-1}.

In summary, then, the change in total man hours paid-for is a function of current and expected future changes in output, of the degree of labor market tightness, of the amount by which the number of workers employed differs from the desired number, and of the amount by which the number of hours paid-for per worker differs from the standard level of hours.

8.4 Economy-wide implications

In an attempt to avoid aggregating vastly dissimilar firms and because of data limitations, this study was confined to the examination of short-run employment demand in only seventeen three-digit manufacturing industries.

These industries constitute about eighteen percent of manufacturing by value added and of course a much smaller percent of the total economy. From this small sample it would be inappropriate to draw any firm conclusions about the behavior of the whole economy, but from the consistency of the above results a few tentative conclusions are in order.

Economy-wide contractions are usually defined to be periods of declining seasonally adjusted GNP or some similar aggregate output variable. Since seasonal fluctuations in output account for a large percentage of total short-run fluctuations, during the "seasonally adjusted" contractions actual output is not likely to be continually decreasing since it fluctuates seasonally as well. It was argued in § 2.3.3 that it is inappropriate to use seasonally adjusted data when attempting to estimate the parameters of a production function; a production function is not a relationship between seasonally adjusted inputs and a seasonally adjusted output. In § 3.6 the production function parameter α_{2wt} was estimated from the interpolations of output per paid-for man hour from peak to peak, and the output and man-hours data which were used for the interpolations were seasonally unadjusted. The amount of excess labor on hand, which was constructed from the data on α_{2wt}, was thus the actual amount on hand and not the seasonally adjusted amount. Eqs. (3.9) and (7.2) and the other equations considered in the study were estimated using seasonally unadjusted data. In chs. 4 and 7 eqs. (3.9) and (7.2) were tested to see if the employment behavior of firms is different during general contractionary periods of output or during general expansionary periods than the equations predict it should be. The results were largely negative, and the two equations appear to explain adequately the "cyclical" behavior of the number of workers employed and the number of hours paid-for per worker as well as the seasonal behavior.

In the following discussion an attempt will be made to draw some tentative conclusions from the results achieved in the study about how the seasonally adjusted number of workers employed and the seasonally adjusted number of hours paid-for per worker behave during periods of rising and falling seasonally adjusted output. It should be kept in mind that the discussion which follows is somewhat loose in that the behavior of the actual number of workers employed and of the actual number of hours paid-for per worker is more complicated than that described for the seasonally adjusted numbers. During contractions, for example, the actual amount of output produced and the actual number of workers employed are sometimes rising, sometimes falling, and only on the average can output and employment be said to be falling. It should also be kept in mind that economy-wide contractions are likely to affect individual firms and industries differently, and since firms do not all behave in the same way, how aggregate employment responds to changes in aggregate output will depend on how the changes in aggregate output are distributed among the individual firms and industries.

Assuming then that the results achieved for the seventeen manufacturing industries considered in the study can be extended to the rest of the economy, they have the following implications for the behavior of employment during contractions and expansions. During a contraction as current and expected future changes in output become smaller than would have been the case without the contraction, more workers are laid off than otherwise. Because in the short run the percentage change in the number of workers employed is less than the percentage change in output, positive amounts of excess labor begin to build up. Firms begin responding to the increasing amounts of excess labor on hand by laying off more workers than otherwise, and gradually the number of workers employed is decreased. At the beginning of the contraction the drop in output per employed worker is likely to be quite sharp since the percentage change in the number of workers employed is considerably less than the percentage change in output. As the contractions continue, however, and more and more excess labor builds up, the number of workers laid off increases and so the decline in output per employed worker should be less as the contraction wears on than it was at the beginning.

The same type of thing happens to the number of hours paid-for per worker. As current and expected future changes in output decrease, the number of hours paid-for per worker decreases, but not as rapidly. As excess labor begins building up, the number of hours paid-for per worker decreases more. There are always forces at work, however, bringing the number of hours paid-for per worker back to the standard level, and the former never deviates too far from the latter. In the long run the number of workers is adjusted so that there is no excess labor on hand (which means that the number of hours worked per worker equals the standard level) and so that the number of hours paid-for per worker equals the standard level.

Combining these two results, the implications for the total number of man hours paid-for are the same. The percentage change in total man hours paid-for is less than the percentage change in output, and so at the beginning of expansions output per paid-for man hour drops sharply. As excess labor builds up, however, and more workers are laid off and hours paid-for per worker are decreased more, total man hours paid-for are decreased more, and so the decrease in output per paid-for man hour lessens as the contraction wears on. This conclusion is consistent with the empirical results achieved by Hultgren using seasonally adjusted data, where he found that output per paid-for man hour decreases during contractions, although less so near the end of the contractions.[1]

The implications for expansions are similar to those for contractions. As the expansion begins, current and expected future changes in output are larger than before and more workers are hired. Because the percentage change in the number of workers employed is less than the percentage change in output, part of the increasing man-hour requirements comes from drawing down excess labor. As the amount of excess labor falls (or even becomes negative), more workers are hired than otherwise, and gradually the number of workers employed is increased. Again, at the beginning of the expansion the increase in output per employed worker is likely to be quite sharp as excess labor is decreased rapidly at first, and then as the expansion continues and more workers are hired due to less (or negative) amounts of excess labor on hand, the increase in output per employed worker should lessen.

Likewise, the number of hours paid-for per worker increases as expected future changes in output increase, but not as rapidly. As excess labor falls, the number of hours paid-for per worker increases more, although again there are forces at work to bring the number back to the standard level. The implications for total man hours paid-for are the same. Since the percentage change in total man hours paid-for is less than the percentage change in output, the total number of man hours paid-for increases less at the beginning of the expansion than during the later phases when declining or negative amounts of excess labor on hand cause the increase in the total number of man hours paid-for to be greater. This implies that the increase in output per paid-for man hour should be sharp at the beginning of the expansion and lessen as the expansion continues. This is again consistent with the results achieved by Hultgren, where he found that output per (paid-for) man hour increases during expansions, but less so near the end of the expansions.

During contractions labor markets are likely to be growing looser, and since loose labor markets have a negative effect on the number of hours paid-for per worker (and thus on the number of total man hours paid-for), total man hours paid-for should decrease less from this source at the beginning of the contraction where labor markets are likely to be fairly

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[1] See the summary of Hultgren's findings in § 2.4.3.

tight than during the later phases of the contraction where labor markets are likely to be much looser. This reinforces the conclusion reached above about how output per paid-for man hour should behave during a contraction. During expansions labor markets are likely to be growing tighter, and so total man hours paid-for should increase less from the source at the beginning of the expansion than during the later phases. This again reinforces the conclusion reached above about how output per paid-for man hour should behave during an expansion.

This completes the discussion of the implications the results achieved in this study have for the behavior of the seasonally adjusted number of workers employed and the number of hours paid-for per worker during seasonally adjusted contractions and expansions. The implications seem to be consistent with the results achieved by Hultgren and others for broader sectors of the economy as to how output per (paid-for) man hour behaves during contractions and expansions.