Wage Formation, Employment and Output
in Barbados

by

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August 1984

1.0 Introduction

An analysis of the labour force and of the determinants of employment is central to the policy maker's understanding of the process of real output determination in any economy. In Barbados, much of the work on the labour force takes the form of one-period employment surveys. A noted example of this is the seminal work by Cumper [1969]. There is a noticeable dearth of studies on what determines employment and wages in Barbados. The exception is the study by Downes and McClean [1982]. However, in our opinion, their interesting and insightful theoretical discourse on the effect of the bargaining process on money wage determination still requires broader empirical support.

The purpose of this paper is to explore the main forces that influence changes in employment, wages and real output in Barbados, in a a simultaneous equation context. The wages and employment functions have been embedded in a larger structural model on the assumption that economic agents use the knowledge they have of the underlying structure of the economy when they are making decisions about employment and wages in the economy. The economy is divided into two sections: a sector of internationally traded goods and services and a non-traded sector. The former encompasses sugar, tourism and manufacturing industries. The latter includes non-sugar agriculture, utilities and all services other than those arising from tourism.

Despite the two separate sectors into which the economy is divided, we also consider the alternative view that wages in the non-traded sector generally follow closely those in the traded sector. As such one can also view the wage determination process in the context of a one sector model. The latter alternative has been adopted in the paper.

2.0 The Model

The wage model combines elements of the augmented Phillips curve analysis and the more recent bargaining models as per Ashenfelter et al (1972), Ormerod (1982), Brooks and Henry (1983), Irfan (1982) and Maclean and Downes (1982). Money wage changes are modelled to be influenced by changes in expected prices, productivity changes, the state of the labour market and union assertiveness. Expectations of future price movements have a direct effect on nominal wage changes. Productivity changes may also be considered as a product of the rising skill levels of the labour force. These tend to cause upward movements in wages over time. Indeed, the productivity variable may also be regarded as a determinant of the efficiency of labour usage. As long as productivity is rising, it pays employers to add additional labour. The effect is to shift the labour demand curve to the right. This, in turn, translates into higher wages if the labour supply curve is upward sloping. The possible lagged response of this variable in the wage determination process is accounted for by a one year lag.

We have not been successful in obtaining a series on trade union membership and so we have been unable to examine the effect of the influence of union pushfullness directly on the wage determination process. Instead, we have had to resort to the use of a proxy for union assertiveness. The proxy that has been used is average real earnings or real wages. The rationale is that the union pursues a real earnings target which exerts an effect on nominal wage demands. Deviations of actual earnings from the desired levels are expected to affect the level of money wage demands, leading to upward pressure on wages if actual real earnings fall below their target value. (See Ormerod (1982)) and (Brooks and Henry (1983)).

The union is expected to view higher future price movements as likely to erode the members' living standards. The higher they perceive this variable, the harder they are likely to push for higher wage demands. However, those demands are expected to be moderated by any slackness in the labour market brought on by recessionary conditions in the economy. The labour market condition is represented by the unemployment rate[1]. Employers are assumed to regard finance costs as increasing their costs of production and hence reducing their expected profit levels. The interest rate variable is therefore expected to exert a moderating effect on the rate of change of money wages[2].

The wage determination process described above may be summarised mathematically as:

$$\dot{W} = F_1(\dot{P}^e, r_d, u, (\dot{Q}/LE)_{-1}, (EN/RPI)) \qquad (1)$$

where $F_1'(\dot{P}^e) > 0$; $F_1'(r_d) < 0$; $F_1'(u) < 0$

$F_1'((\dot{Q}/LE)_{-1}) > 0$; $F_1'(EN/RPI) \gtrless 0$

In equation (1)

W = money wage index in the economy

p^e = price expectations variable

r_d = the prime lending rate

u = the unemployment rate

Q = index of real output (value added)

EN = index of average weekly earnings

LE = employment variable and

RPI = retail price index

Dots on top of variables represent proportional changes.

Intuitively one could consider changes in real output to be the primary determinant of changes in employment in Barbados. However, initial exploration with a three year distributed lag form of real output did not yield plausible results for aggregate employment in Barbados[3]. Aggregate employment is therefore modelled to depend on real value added, previous period's level of employment, real wages and slack conditions in the economy. Equation (2) sets out the functional relationship as:

$$LE = F_2(Q, W/RPI, S, LE_{-1}) \qquad (2)$$

$F_2'(Q) < 0$, $F_2'(W/RPI) < 0$, $F_2'(S) < 0$

and $F_2'(LE_{-1}) \gtrless 0$

where S represents the slack conditions in the economy. It is defined as the difference between actual output and potential output.

Output of tradables reacts to prevailing market prices, the cost of finance and the availability of foreign resources with which to import the required raw and intermediate materials. The variable is therefore, specified functionally as:

$$QT = F_3(PT, r_d, MKI/PKI) \qquad (3)$$

$F_3'(PT) > 0$; $F_3'(r_d) < 0$; $F_3'(MKI/PKI) > 0$

where QT = index of real output in the traded sector

PT = price index for tradable goods

MKI = the value of imports of capital and intermediate goods

PKI = the import price index of capital and intermediate goods

The real value of imports of capital and intermediate goods is used as a proxy for the availability of foreign exchange in the traded sector. The latter, in turn, serves as an index of the sector's productive capacity.

With the non-tradable sector overwhelmingly dominated by the service sector, output of non-tradables is assumed to be demand determined. Real output in the sector is modelled to be functionally related to real domestic expenditure, the relative price of non-tradables to tradables and a time trend that proxies other exogenous influences such as polulation changes. That is:

$$QN = F_4(DE, PN/PT, T) \qquad (4)$$

$F_4'(DE) > 0$; $F_4'(PN/PT) < 0$; $F_4'(T) \gtrless 0$

where QN = index of real output in the non-traded sector

DE = real domestic expenditure variable[3]

PN = price index for non-tradable goods

T = trend variable

The model is completed with a behavioural relationship that explains real private domestic expenditure. Real government expenditure is assumed exogeneous. Real private expenditure is determined by real personal disposable income, the cost of capital and the previous level of real private domestic expenditure. The latter is a proxy for habit persistence. Thus we have:

$$PDE = F_5(YD, r_d, PDE_{-1}) \quad (5)$$

where $F_5'(YD) > 0$; $F_5'(r_d) < 0$; $F_5'(PDE_{-1}) \gtrless 0$

PDE = real private domestic expenditure variable

YD = real personal disposable income

The model as a whole may now be summarised as follows:

$$\dot{W} = F_1(\dot{p}^e, r_d, u, (Q/LE)_{-1}, (EN/RPI)) \quad (1)$$

$$LE = F_2(Q, W/RPI, S, LE_{-1}) \quad (2)$$

$$QT = F_3(PT, r_d, MKI/PKI) \quad (3)$$

$$QN = F_4(DE, PN/PT, T) \quad (4)$$

$$PDE = F_5(YD, r_d, PDE_{-1}) \quad (5)$$

$$DE = PDE + G \quad (6)$$

$$Q = QT + QN \quad (7)$$

where G = real government expenditure.

The five equations and two identities represent a sub-system which, we hope, explains the supply conditions in the Barbadian economy. Although basically a simultaneous equation model, most of the equations are determined independently. The ordinary least squares (OLS) estimator was used to estimate the model in log-linear functional forms. Before discussing the results we present an outline of how the two unobserved variables - expected prices and the slack variable (S) - were determined.

The slack variable, S, represents the extent to which real output falls short of potential or trend output. The trend output Q^*, was represented by the exponential function:

$$\ln Q^* = c + bT \quad (8)$$

where c is a constant and T a time trend variable[5]. From the estimates of equation (8) we were able to calculate the trend value of output. The difference between actual output and the trend value of output each period gave the extent of whatever slack was present at that particular period. The estimates of equation (8) were

$$\ln Q^* = 5.713 + 0.0488T \quad (9)$$

$$(58.370) \quad (7.623)$$

$R^2 = 0.945$

DW = 1.84, F(1.20) = 346.2

t - ratios are in parenthesis below the estimated coefficients.

The estimated function implies an average trend growth rate of real output of about 5% per year over the reference period (1958-80).

Two methods for generating the expected price variable have been adopted. Firstly, naive expected prices are generated by simply representing expected prices with one and two period lags of actual prices in the wage equation. Secondly, extrapolative expected prices (PE) have been calculated by regressing in log-linear form actual prices on one and two period lagged prices.

The estimated function takes the form

$$\ln P = -0.214 + 0.942 \ln P_{-1} + 0.131 \ln P_{-2}$$
$$(-0.785)\ (11.310)\qquad (1.643)$$
$$R^2 = 0.969,\ D.W = 1.903,\ F(2,18) = 280.3$$

The results of the two regimes of expected prices are reported in table 1 and 2. The results for the wage equation are also given in both levels and proportional changes.

3.0 Discussion of Empirical Results

The equations of the basic wage, employment and output mod summarised above are estimated using the ordinary least squares wit the Cochrane Orcutt transformation to correct for first order seria correlation. The results are presented in table 1. In equation 1(a) we find that changes in expected prices, real earnings and to some extent, the unemployment rate are the main determinants of changes in nominal wages. The coefficients of the three variables are all significant at the 5% level. The three variables also carr the expected signs. The size of the coefficients of the expected price variables (less than unity) appear to suggest that expected prices are not fully reflected in money wage claims. There is an implied degree of money illusions on the part of the unions, as should be expected in reality.

The positive sign on the real earnings variable also appe to give the impression that the actual real earnings of workers usually fall below the unions target value. The interest rate variable does not carry the expected sign and is only marginally significant. It enters the equation as the cost of borrowed funds and as such, part of the employers production costs. The positive sign would suggest that the cost of borrowing domestically was no deterrent to firms in their drive for capital and/or technological intensive mode of production. This is indeed not unrealistic to the extent that domestic interest rates have consitently been lowe than international rates during the period that the data covers. Given this scenario it is quite feasible for interest rate movemen to have positive influence on changes in the money wages.

That changes in average productivity does not appear to have much influence on money wage changes may be largely due to the fact that period to period (cyclical) changes in that variable may not have been strong enough to influence nominal wage settlements. It is noted that in the level form, the variable is of the right sign but not significant. In equation 1(b), the variables that were found not to have much influence on nominal wage changes in 1(a) were dropped. The results did not change very much.

The results in level form appear as equation 1(c) in table 1. Prices lagged one and two periods are the main influence on money wages. Both variables carry the right signs and are also highly significant. Also in this form average productivity of labour has a positive although insignificant influence on nominal wages. The real wage variable is significant but the unemployment variable is not. The interest rate variable is very significant although not of the expected sign.

The results with the extrapolative expected prices have been reported in table 2. The results of both proportional changes 2(a) and period levels 2(b) appear to be inferior to those based on the naive price expectation. In 2(a), the expected price variable is not significant, as are the unemployment, interest rate and the productivity variables. Moreover, all three latter variables carry the wrong signs. The same pattern is repeated for the results in level form. In the latter case, the serial correlation in the residuals is also worse than for the comparable equation using the naive price expectations. The constant term included in the calculation of the extrapolative prices may have accentuated the relative serial dependence in the error terms.

The estimates of the employment function generally agree with the a priori expectations (See equation 2, table 1). Variations in real output, slack conditions in the economy and previous period's level of employment explain about 80% of the variations in the employment variable. All the three variables carry the expected signs and are all significant at the 5% level. On the other hand, real wage rate does not appear to have much influence in determining aggregate employment in the economy.

The results for real output of tradables also appear as equation (3) in table 1. The main determinant of output of tradables appear to be the price received for them. Although both the interest rate variable and the real resources expended on the imports of capital and intermediate goods carry the expected signs, they are not significant[7] at the 5% level.

For the non-tradable goods and services, the relative price of non-tradables to tradables carry the expected negative sign and is also significant even at the 1% level; as is the trend variable which represents all other exogenous influences like population changes and improved skills deriving from technological innovatins etc. The effect of real domestic expenditure is marginal given that the variable is only significant at the 10% level on a one-tail test. The fit for the private domestic expenditure variable is reasonably good. Real domestic income and the lagged value of private domestic expenditure are highly significant, and the equation appears to be relatively free of auto-correlation. Although the interest

rate variable is of the right sign, it does not seem to have much influence on real private expenditure.

Concluding Remarks

In this paper, an attempt has been made to investigage statistically the factors that determine wages, employment and output in the Barbadian economy. Despite the use of a simple model some plausible and interesting results have emerged from the analysis.

Lagged prices appear to exert the main influence on aggregate wage determination in Barbados while employment is principally determined by real output, and to some degree, the extent of slack conditions in the economy. Also both absolute prices and relative price seem to bear important influence on real output.

It must be stressed, though, that the use of proxies for some important variables and the problems of data quality (especially those on employment) invite caution on the interpretation of the results. The latter should, therefore, be seen more as indicative and tentative than as confirmed description of the supply conditions in the Barbadian economy.

Notes

1. An alternative variable used is the slack conditions in the economy . This variable is defined later in the text.
2. McClean and Downes (1982) found the interest rate variable to be an important determinant of money wages in Barbados.
3. Reasonably plausible estimates were obtained for the traded sector.
4. The variable is defined as the sum of domestic consumption and investment expenditures.
5. In this form, the anti-log of the coefficient b, minus one gives the trend growth rate over the period.
6. In the next stage of the work we intend to lag the expected (extrapolative) price variable by one period to minimise the serial dependence in the error terms.
7. Another proxy for foreign exchange availabiity that was tried was real export receipts for tradables. The use of this proxy improves the results but we are not comfortable conceptually on the appropriateness of that proxy.

Table 1

Estimates of the Wage, Employment and Output Model
(with Naive Price Expectation)

1(a) $\Delta \ln W = \underset{(3.083)}{-1.704} + \underset{(2.149)}{0.464}\,\Delta \ln P_{-1} + \underset{(2.110)}{0.313}\,\ln (EN/RPI)$

$+ \underset{(1.747)}{0.126}\,\ln (1/u) + \underset{(1.692)}{0.342}\,\ln r_d - \underset{(-0.576)}{0.071}\,\Delta \ln (Q/L)_{-1}$

$- \underset{(-1.092)}{0.226}\,\Delta \ln W_{-1}$

CORC

(rho = -0.35), $R^2 = 0.614$, D.W. = 2.42, F(6,14) = 3.709

1(b) $\Delta \ln W = \underset{(-2.775)}{-1.696} + \underset{(3.699)}{0.457}\,\Delta \ln P_{-1} + \underset{(2.875)}{0.390}\,\ln (EN/RPI)$

$+ \underset{(0.332)}{0.035}\,\ln r_d$

CORC

(rho = -0.16), $R^2 = 0.491$, D.W. = 2.42, F(3,17) = 5.46

1(c) $\ln W = \underset{(-8.196)}{-2.723} + \underset{(4.726)}{0.544}\,\ln P_{-1} + \underset{(3.963)}{0.474}\,\ln P_{-2}$

$+ \underset{(5.304)}{1.55}\,\ln (W/RPI) + \underset{(0.139)}{0.012}\,\ln (1/u) + \underset{(5.227)}{0.958}\,\ln r_d$

$+ \underset{(1.346)}{0.162}\,\ln (Q/L)_{-1}$

CORC

(rho = 0.10), $R^2 = 0.996$, D.W. = 2.357, F(6,14) = 534.8

2. $\ln LE = \underset{(0.815)}{0.718} + \underset{(2.043)}{0.085}\,\ln Q - \underset{(-0.727)}{0.057}\,\ln (W/RPI)_{-1}$

$- \underset{(-1.772)}{0.007}\,\ln S + \underset{(3.109)}{0.721}\,\ln LE_{-1}$

CORC

(rho = 0.125), $R^2 = 0.801$, D.W. = 1.87, F(4,16) = 16.13

Estimates of the Wage, Employment and Output Model
(with Naive Price Expectation)

3. $\ln QT = \underset{(7.598)}{2.852} - \underset{(-1.664)}{0.401}\,\ln r_d + \underset{(4.195)}{0.406}\,\ln PT$

$+ \underset{(1.430)}{0.176}\,\ln (MKI/PKI)$

CORC

(rho = 0.234), $R^2 = 0.875$, D.W. = 1.89, F(3,18) = 42.0

4. $\ln QN = \underset{(2.712)}{2.684} + \underset{(1.555)}{0.236}\,\ln DE - \underset{(-3.609)}{0.468}\,\ln (PN/PT) + \underset{(3.141)}{0.023T}$

CORC

(rho = 0.56), $R^2 = 0.674$, D.W. = 1.99, F(3,18) = 12.40

5. $\ln PDE = \underset{(2.099)}{0.815} + \underset{(2.240)}{0.337}\,\ln YD - \underset{(-0.425)}{0.010}\,\ln r_d + \underset{(3.798)}{0.552}\,\ln PDE_{-1}$

OLS $R^2 = 0.928$, D.W. = 1.84, F(3,18) = 77.54

Table 2

Estimates of the Wage Functions
(with Extrapolative Expected Prices)

2(a) $$\Delta \ln W = \underset{(-2.118)}{-1.475} + \underset{(0.828)}{0.110}\,\Delta \ln PE + \underset{(1.988)}{0.319} \ln (W/RPI) - \underset{(-0.531)}{0.035} \ln (1/u) + \underset{(0.540)}{0.011} \ln r_d - \underset{0.919}{0.012}\,\Delta \ln (Q/L)_{-1} - \underset{(2.197)}{0.240}\,\Delta \ln W_{-1}$$

CORC

(rho = -0.30), $R^2 = 0.357$, D.W. = 2.222, $F(6,14) = 1.30$

2(b) $$\ln W = \underset{(3.094)}{-5.074} + \underset{(1.190)}{0.189} \ln PE + \underset{(2.904)}{0.759} \ln (W/RPI) - \underset{(-0.650)}{0.135} \ln (1/u) + \underset{(0.178)}{0.002} \ln r_d - \underset{(0.166)}{0.003} \ln (Q/L)_{-1}$$

CORC

(rho = -0.97), $R^2 = 0.987$, D.W. = 1.01, $F(5,15) = 231.53$

Appendix

A Note on the Labour Force and Employment Data

Prior to 1975, statistics on the labour force and employment in Barbados had not been collected on a continuous basis. We have had to resort to an indirect way to estimate the complete series for the two variables. To do this, we were aided by the available data from the 1965/66 Labour Force surveys and in the census years of 1960 and 1970.

Information on total population as at December 31 (1958-80) and adult population (aged 15-65) for 1958-69 and 1975-80 was obtained from the Abstract of Statistics (1969, No.6, Barbados Statistical Service) and various issues of the Barbados Economic Report. The latter also provided information on the labour force and the percentage of adults in the labour force for the period 1975-80. The missing portion of the adult population (1970-74) was derived on trend. It was based on the average of the ratio of adults in total population for the five years preceding 1970 and the five years immediately after 1974.

In general one expects the labour force to be predominantly derived from the adult population. As such the available data on the percentage of the labour force in the adult population (participation rate) provided the base from which the labour force data were derived. The labour force participation rate shows a slight drop from about 72.5% in 1960 to 68.7% in 1966. Between 1966 to 1970 the ratio is fairly stable, moving from 68.7% to 68.1% in 1970. Given the relative stability of the

participation rates between the benchmark years one would not expect wide yearly variations in the ratios. The intervening participation rates between 1960 and 1966 were therefore estimated on the trend movement between the two years. The same procedure was adopted to calculate the rates between 1966 and 1970 and thenceforth to 1975 when regular figures became available. The labour force data were subsequently derived from a combination of the participation rates and the series on adult population.

The behaviour of the labour force series derived (Table A1) seems to have some correlation with the overall population movement. For instance, it shows a gradual increase up to 1969 when there was a sharp drop. Between the two years it is observed that overall population registered a sharp drop from 253,600 to 239,500. The main reason for the drop in the labour force may be due to a sharp increase in immigration. Added to this is the fact that differing definitions of those actively looking for work were used in the 1965/66 labour force surveys and during the census.

For instance, the surveys of 1965/66 considered as unemployed, those without work and who had looked for work during the week of the survey. The census considered as unemployed someone desirous of work but who did not work for most of the year.[1] The latter approach would tend to under-estimate unemployment considerably. The two sources of information are therefore, not strictly comparable.

[1] See Ministry of Finance, "Employment in Barbados: Problems and Perspectives", PRELAC Report, September 1977, p.5.

Employment figures were also calculated from the estimates of the proportion of adult population employed, using as benchmarks those years (1960, 1966, 1970 and 1975-80) when data were available. Information indicates that the proportion of adult population employed dropped from 66.9% in 1960 to about 62.2% in 1970, and subsequently to 57.6% in 1980. The lowest ratio occurred in 1975 when 50.9% of the adult population was employed. As was done for the labour force data, the missing employment - adult ratios within the four benchmarks were calculated on trend.

The employment figures reported in Table A1 show a similar pattern of behaviour to the labour force. One notices in this case, however, a distinct cyclical behaviour. Employment drops from 1960 to 1966; thereafter it gradually builds up until 1970 when a sharp drop is registered. It then rises slowly until 1975. Between 1975 and 1976 there is a sharp rise but a downward movement is generally followed between 1976 and 1980.

Table A1

Labour Force and Employment Statistics

	Total Population '000	Adults Total Pop. (Percent)	Adult Population ('000)	Labour Force Adult Pop. (Percent)	Labour Force ('000)	No Employed Adult Pop. (Percent)	Total No. Employed '000	Unemployment Rate (Percent)
1958	229.7	56.6	130.1	70.0	91.0	64.6	84.0	7.7
1959	233.1	56.2	131.0	71.3	93.4	64.9	85.1	8.9
1960	233.1	54.5	127.0	72.5	92.2	66.9	85.0	7.8
1961	234.0	53.6	125.5	71.9	90.0	65.8	82.5	8.3
1962	237.4	53.5	126.9	71.2	90.5	64.6	82.1	8.9
1963	240.5	53.5	128.7	70.6	90.9	63.6	81.7	10.1
1964	242.7	54.1	131.4	70.0	92.1	62.3	82.0	11.0
1965	245.0	54.4	133.3	69.4	92.5	61.2	81.6	11.8
1966	248.2	54.7	135.8	68.7	93.3	60.0	81.5	12.6
1967	250.6	55.3	138.5	68.6	95.2	60.6	84.1	11.7
1968	252.9	56.0	141.5	68.4	96.7	61.1	86.5	10.5
1969	253.6	56.7	143.7	68.3	98.0	61.7	88.7	9.5
1970	239.5	55.5	132.9	68.1	90.5	62.2	82.4	8.6
1971	241.1	58.1	140.1	67.6	94.7	59.9	83.9	11.4
1972	242.8	60.7	147.3	67.1	98.8	57.7	85.6	14.0
1973	244.0	63.3	154.5	66.7	103.1	55.4	86.1	16.9
1974	245.2	65.9	161.6	66.2	107.0	53.2	87.1	19.6
1975	246.1	70.2	164.7	65.7	108.2	50.9	83.9	22.5
1976	246.7	67.6	166.8	62.4	104.1	52.7	87.9	15.6
1977	247.5	67.8	167.7	62.6	104.6	52.6	88.2	15.7
1978	248.2	67.8	168.3	61.0	102.6	52.8	88.8	13.5
1979	248.8	68.7	171.0	63.7	109.0	55.6	95.0	12.8
1980	249.4	69.7	174.2	65.9	114.8	57.6	100.3	12.6

Sources: Barbados Statistical Service, Abstract of Statistics, No. 6, 1969
Ministry of Finance and Planning, Barbados Economic Report, Various Issues