THE UNEMPLOYMENT PROBLEM IN PUERTO RICO

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Introduction

This paper includes a general description of the Puerto Rican unemployment problem in the context of its overall development policy. Its main purpose is to develop empirical models to explain the overall unemployment rate and employment in the manufacturing sector. The intention is to reassess the minimum wage issue, by taking advantage of a recent revision in Puerto Rico's income and product accounts data (Junta de Planificación, 1990). For Puerto Rico, since 1970, there have apparently been only two such previous studies (Santiago, 1986; Andic and Cao-García, 1987) and both conclude that increases in the minimum wage have caused increased unemployment and disemployment. This study presents evidence for a different conclusion.

A brief panorama is offered on the development policies pursued in the post-war period as it can be helpful to understanding the unemployment problem. Also, this study takes a demand side perspective. Marginal supply factors, such as a lengthening of search time before accepting employment, due to social welfare policies (Mann and Smith, 1988), or searching for a second job to increase income (or taking a second job and thus displacing another person) are undoubtedly part of the overall picture, but are not included. Major supply factors, such as population size and the labor force participation rate are considered, but appear not to have much influence.

The World Bank estimated Puerto Rico's 1987 per capita income at $5,530 (1989, p. 230), placing it in the "upper-middle-income" category. Despite considerable post-war industrial development based on importing capital from the U.S., and promoted by "Operation Bootstrap", Section 931,

and later 936 of the Internal Revenue Code (permitting profit transfers to the U.S. without federal taxation), the island's comparative advantage in tourism was not fully exploited.

Other Caribbean islands have had great success with a tourism centered strategy. "The richest Caribbean countries are the ones with the largest tourist industries; countries like the Bahamas (in 1986, with an average income of over $9,000, or the Cayman Islands (over $12,000)" (The Economist, Aug. 6, 1988, Survey p. 15). Another neglected sector has been agriculture (Weisskoff, 1985, p. 151; Dietz, 1986, p. 274).

Puerto Rico's Unemployment Problem

Unemployment has been severe in Puerto Rico. An unweighted average of overall unemployment rates for 1948-89 is 0.145, and at present it hovers around 15 percent. In this period, the Puerto Rican average rate exceeded the average rate for U.S. minorities of 0.101, and for the U.S. as a whole of 0.055. The standard deviations of 0.042, 0.034, and 0.018, respectively, show the greatest variation for the Puerto Rican unemployment rate. Puerto Rico's rate has exhibited pronounced cyclical fluctuations, a positive trend, a peak value of 0.235 in 1983, and a minimum value of .103 in 1969 and 1970. Without the migration of Puerto Ricans to the U.S. mainland the rate would perhaps be higher, at least in some years.

The structure of Puerto Rican employment has changed dramatically since 1948. Table 1 illustrates the sectoral composition of employment over time, for indicated activities.

A drastic decline of agricultural employment, from 36.7 percent in 1948 to only 3.9 percent in 1989, has been the main change. The proportion of employment in manufacturing hardly changed, despite a development strategy geared to its promotion. But proportional employment in services and public administration increased greatly, the former from 12.8 to 21.2 percent, and the latter from 7 to 23.1 percent. Other sectors showed changes of no more than five percent. Employment increased by about 318,000 from 1948 to 1989, but non-agricultural employment did not grow fast enough to keep the unemployment rate from exhibiting an upward trend. Agricultural employment dropped by approximately 181,000 persons from 1948 to 1989.

TABLE 1

SECTORAL COMPOSITION OF EMPLOYMENT: ACTIVITY EMPLOYMENT AS A PROPORTION OF THE LABOR FORCE, AND AS NUMBER OF PERSONS, IN 1948 and 1989

SECTOR	PROPORTION:		EMPLOYMENT: (in thousands)	
	1948	**1989**	**1948**	**1989**
AGRICULTURE	.367	.039	216	35
CONSTRUCTION	.058	.057	34	52
MANUFACTURING	.175	.174	103	158
TRADE	.146	.196	86	178
TRANSPORTATION, COMMUNICATION, AND PUBLIC UTILITIES	.051	.056	30	51
SERVICES	.128	.212	75	192
PUBLIC ADMINISTRATION	.070	.231	41	209
OTHER INDUSTRIES	.005	.034	3	31
TOTAL EMPLOYMENT (FISCAL YEAR)			588	906

Source: Puerto Rico Department of Labor and Human Resources.

These figures do not reveal the interindustry indirect employment effects generated by the manufacturing sector, which in 1982 approximately equaled direct employment. However, the employment multiplier has apparently been falling over time (Stewart and Chico Pamias, 1990, p. 9 and 14), indicating the manufacturing sector's decreased effectiveness regarding overall employment generation.

The experience of other developing countries indicates that manufacturing alone cannot solve the employment problem (Todaro, 1989, p. 245). However, since Puerto Rico's development strategy focused almost

exclusively on the manufacturing sector, one would at least require the present relative share of manufacturing employment be greater than in 1948. As indicated above, direct employment in manufacturing has not increased in relative terms since that year. In 1983, of around 130,000 manufacturing jobs existing at the time, about 62 percent were directly linked to Section 936 companies (Stewart and Lane, 1985, p. 53). Though the current figure may be closer to 70 percent, Section 936 appears to leave much to be desired as an incentive program to generate employment. Tourism, which does not appear separately in Table 4, accounted for only 57,253 direct and indirect jobs in 1988 (Junta de Planificación, 1988, p. 7), reflecting its low priority in the manufacturing oriented development strategy.

Explaining Puerto Rico's High Unemployment Rate

Various explanations have been advanced to account for Puerto Rico's persistently high unemployment rate. On the supply side, Curet (1986, p. 123) emphasizes population growth. Stewart and Lane (1985, p. 41) stress the fall in outmigration following 1975. Despite outmigration, the population of potential labor force age (14 and over in 1948-70 and 16 and over thereafter) fell only in 1951-1954 (by 29,000 persons) and in 1971 (by 88,000 persons). By 1955, the 1950 population had been surpassed, and by 1972, it was only 1,000 short of the 1970 figure. The general pattern is one of steady population growth, reaching 2,329,000 persons of labor force age in 1989. However, the link between the population of working age and the labor force participation rate is at times ambiguous, and even if it were not, the demand side would still have to taken into account to explain unemployment.

On the demand side, aside from the minimum wage issue, other explanations have been offered (summarized in Dietz, pp. 277-281). Two of them are the cyclical sensitivity of industries located on the island, and the increasing capital intensity of production, particularly in manufacturing. However, to the extent these are valid, they fail to consider why alternative sources of employment, in other sectors, have not taken up the slack.

Apparently, the root of the employment problem lies in a too slow growth of investment and output, which in turn reflects the inadequate attention given to promoting sectors other than manufacturing. It may also be a consequence of generally negative savings rates in Puerto Rico (King, 1990, p. 6) The statistical evidence presented below shows a strong link between the unemployment rate and the level of output.

The Minimum Wage Rate in the Puerto Rican Context

Only in the period 1984-89 did the minimum wage coincide completely with the U.S. Fair Labor Standards Act minimum. In previous years there was a structure of minimum rates, or "wage orders", with some at the mainland level, and others with lower rates, at times established with the participation of local industry committees. Given very high unemployment rates, the unemployment resulting from an attempt to gain or regain a job at a certain legal rate would not necessarily be eliminated by seeking employment at a lower rate, or even in the uncovered sector. It is likely that disequilibrium exists in all segments of the labor market. The Mincer-Gramlich model (Gramlich, 1976, p. 413) assumes that unemployment arises because those unemployed due to the minimum wage in the covered sector do not move into the equilibrating uncovered sector. This view might be applicable to the conditions of the U.S. labor market but may not be valid for high unemployment areas such as Puerto Rico. One might conjecture that supply exceeds demand at all above subsistence level wage rates, where the subsistence level is defined to take into account transfer payments under the welfare system. At below subsistence rates, supply is nil. With excess supply disequilibrium in virtually all labor markets, one can conceptually simplify the labor market to one sector.

Since 1974, amendments to the FLSA for Puerto Rico resulted in more and more covered workers earning the U.S. minimum wage or close to it with the passage of time. On December 31, 1979, 36.6 percent of covered workers (totaling 318,170 persons) earned under $2.30, the U.S. minimum at the time; the rest were at the minimum. Only 7.4 percent earned less than $2.00 (U.S. Department of Commerce, 1979, p. 636). The U.S. minimum is likely to be highly correlated with the average of Puerto Rico minimum wage rates, since all the rates tend to rise simultaneously when changes are enacted.

High unemployment rates have also kept average wage rates down. In Puerto Rico, the average wage is much closer to the minimum than in the U.S. (U.S. Department of Commerce, 1979, p. 637). The minimum wage rate, as measured in this study, correlates very highly with two measures of the average wage rate in manufacturing, and with a measure of the overall wage rate. With the average hourly wage rate of production workers, the R^2 is .976. With another manufacturing wage rate variable, labeled WGEDMFG (the average annual employee compensation in the manufacturing industry), the R^2 is .971. Finally, with a measure of the

economy wide wage rate (employee compensation per year), the R^2 is .901. With such high correlations, the use of the minimum wage rate as a proxy for the overall average wage rate, can perhaps be justified. For this reason, in the empirical models explaining the overall unemployment rate, the minimum wage is used alone rather than as a ratio to the average rate. The use of a ratio has been the practice in many studies of the problem in the U.S. context (Brown, et al., 1982, pp. 499-500).

A Theoretical and an Empirical Model of the Unemployment Rate

The one sector labor market model defines unemployment as the difference between the supply and demand for labor:

(1) $U = S - D$

where U = unemployment, S = labor supply, and D = labor demand. Therefore, the unemployment rate (urate) is:

(2) $urate = (S - D)/S$

The derivation of a labor demand function using a Cobb-Douglas production function, under the assumption of profit maximization with two fixed-price inputs, yields the well-know result that the log of labor demand is a linear function of the log of the ratio of the wage rate and the price of capital, and of the log of output (Intriligator, pp. 285-86). These variables will be included as part of the specification of the empirical model.

Ideally the variables should be measured in real terms; however, interpreting coefficients or elasticities becomes less straightforward with this type of adjustment. An alternative is to use the implicit price deflator for gross product as another independent variable in the model.

In Puerto Rico, high unemployment rates probably imply a rapid adjustment by of firms' actual level to their desired level of employees, so presumably no specific adjustment process or lag structure is required for the demand side in an empirical model, particularly if annual data is used for estimation.

One empirical problem is constructing an adequate measure of the price of capital. Clark and Freeman (1980, pp. 519-20), provide a comprehensive method of measurement to derive the user cost of capital.

In the present study, however, the unadjusted implicit price deflator for gross domestic investment is used as a proxy for the cost of capital. The output measure used here is Puerto Rico's gross domestic product.

The minimum wage rate is measured on a fiscal year basis since the other variables used are also measured this way. DFUSMINW, the minimum wage rate variable used in this study, is created by taking a weighted average of the minimum rates that apply during a given fiscal year, where the weights correspond to the relative length of time (weeks) a given minimum applies.

The major difficulty in using (2) as the theoretical model underlying the empirical model, lies with the supply function. The supply of labor depends on the wage rate, but also on the unemployment rate itself, as demonstrated in many studies, in terms of discouraged and added worker effects (e.g., Bowen and Finegan, 1969). Possibly, this difficulty could be overcome with a simultaneous equation model, in which both the unemployment rate and the labor force participation rate are endogenous. However, the problem will be dealt with, in this study, in an ad hoc fashion.

The empirical model explaining the unemployment rate can be specified on the basis of the following considerations. From the demand side, the relevant independent variables are the minimum wage rate, the cost of capital, and output. From the supply side, the relevant variables are the minimum wage rate, and depending on the equation, either the labor force participation rate lagged one period (making it an exogenous supply variable) or the size of the population, age 16 years and over. As control variables, included are the time trend and the implicit price deflator for gross product. A non-logarithmic format is used, as it permits the effect of unit changes in the minimum wage rate and output to be quickly seen. The discussion is summarized in equations (3) and (4), which represent the respective empirical models to be estimated, and where the expected sign of the variable's coefficient is also indicated.

$$\text{(3) puratet} = a_1 + a_2(\text{DFUSMINWt}) + a_3(\text{PBIt}) + a_4(\text{INDIBRt}) + a_5(\text{PFt-1}) + a_6(\text{trend}) + a_7(\text{INDPBt}) + \text{et}$$

(? over a_2, - over a_3, - over a_4, - over a_5, ? over a_6, ? over a_7)

$$\text{(4) puratet} = b_1 + b_2(\text{DFUSMINWt}) + b_3(\text{PBIt}) + b_4(\text{INDIBRt}) + b_5(\text{POB 16 t}) + b_6(\text{trend}) + b_7(\text{INDPBt}) + \text{ut}$$

(? over b_1, ? over b_2, - over b_3, - over b_4, + over b_5, ? over b_6, ? over b_7)

where the variables are:
PURATE: the overall unemployment rate
DFUSMINW: the adjusted FLSA minimum rate in dollars, as it applies in the U.S.
PBI: gross domestic product (in millions of current dollars)
INDIBR: proxy for the price of capital, measured as the implicit price deflator for gross domestic investment (1954 = 1.000)
PF: overall labor force participation rate
POB 16: population of persons age 16 and over (in thousands)
TREND: the time trend variable
INDPB: the implicit price deflator for gross product (1954 = 1.000)
e, and u: random error terms
a1...a7; b1...b7: coefficients
t: subscript denoting time (year).

The expected sign of the minimum wage coefficient is stated as unknown. Even if the elasticity of demand for labor is negative, the supply response is generally of unknown sign, due to the dependence of the labor force participation decision on the unemployment rate (Brown et al., p. 505).

The coefficients of PBI and INDIBR are expected to have negative signs. Increased production, ceteris paribus, raises the demand for labor, and a higher price of capital, ceteris paribus, leads firms to substitute capital for labor. Previous year labor force participation, to the extent it is correlated with current year participation, serves to control for the labor supply response to changes in the unemployment rate. Considered in its own right it is likely to reflect behavior of the previous year unemployment rate. As previous year unemployment falls, ceteris paribus, previous year participation rises, and its effect on the current year unemployment rate reflects the relationship between previous and current unemployment rates.

These two unemployment rate variables are likely to be positively correlated so, ceteris paribus, the expected sign of the coefficient of PF (lagged one period) is negative.

For the population variable, POB 16, the expected coefficient sign is positive. In a demand deficient economy, increased population may mean increased unemployment. But since labor force participation is an intervening variable between population and the unemployment rate, it is possible the predicted relationship will not always hold. Nevertheless, it is included as a supply side control variable in some of the regressions. For estimation purposes, the empirical models (3) and (4) are assumed conforming to the properties of the classical normal linear regression model, and are fitted via ordinary least squares.

Results of Estimating the Empirical Model

The regression output given in Table 2, corresponds to (3) above:

TABLE 2
REGRESSION EXPLAINING PUERTO RICO UNEMPLOYMENT RATE ACCORDING TO THE EMPIRICAL MODEL (3).

LEAST SQUARES
DEPENDENT VARIABLE: PRURATE FROM 1974 UNTIL 1989
TOTAL OBSERVATIONS:16 DEGREES OF FREEDOM: 9
R2 .9267902 RBAR2 .87798378
SSR .10300198E-02 SEE .10697974E-01
DURBIN-WATSON1 .27708578

NO	LABEL	LAG	COEFF.	T-STATISTIC	SIGNIF LAVEL
1	CONSTANT	0	-.7885240	-1.622962	.1390460
2	DFUSMINW	0	.4084502E-01	1.349842	.2100351
3	PBI	0	-.3193405E-04	-4.091652	.2710333E-02
4	PF	1	.2133548	.3738172	.7171946
5	TREND	0	.3167420E-01	2.640061	.2691110E-01
6	INDPB	0	.1193581	2.026099	.7339556E-02
7	INDIBR	0	-.5771423E-01	-1.341453	.2126385

Data sources: PBI, PF, INDPB and INDIBR, Junta de Planificaci6n, 1990; DFUSMINW, adjustment of data in Weidenbaum, p. 156.

The minimum wage rate variable, DFUSMINW, has a positively signed coefficient, with a significance level of .21, not statistically significant even at the ten percent level in a two tail test. Three variables have statistically significant coefficients at the ten percent level or better: PBI, gross domestic product; TREND, the time trend; and INDPB, the implicit price deflator for gross product. The coefficients of the latter two are positively signed, and as expected the coefficient of gross product is negative, at -.000032.

The magnitude of this coefficient is quite realistic, since it shows a required increase in gross domestic product of $1 billion dollars ($1,000 million), holding the other variables constant, to reduce the unemployment rate by 3.2 percent. For 1989, Puerto Rico's gross domestic product is estimated at $14.44 billion, so that a 3.2 percent reduction in the unemployment rate, ceteris paribus, would require, on the basis of this regression result, a one year growth of about seven percent, all of it in real output. For the sake of judging the feasibility of this growth, note that real gross domestic product grew at 6.2 percent in 1987 and 6.4 percent in 1988, but slowed to 3 percent in 1989. However, the trend and inflationary effects are also positive, and if they persist it would require an even larger nominal output growth to achieve the stated reduction in the unemployment rate.

This regression is estimated for the period 1974-89, when the program to reduce minimum wage differentials was put into effect, culminating in 1984, when all minimum wages were equaled at the mainland level. The R^2 of 0.93 indicates that these independent variables explain a rather high proportion of the variation in the annual unemployment rate. The Durbin-Watson statistic, at 1.28, gives no evidence of autocorrelation. The coefficient of the PF, the labor force participation rate lagged one period, is positive but not significant, while the coefficient of INDIBR, the implicit price deflator for gross domestic investment is negative and not significant.

From this regression, apparently there is no acceptable evidence supporting a positive relationship between the minimum wage rate and the unemployment rate. On the basis of not rejecting the null hypothesis, rather than just looking at the positive sign, the conclusion is that there is no relationship at all between these two variables. However, it is legitimate to ask to what extent this particular result depends on the specification adopted. There are, as illustrated below, specifications where the minimum

wage rate coefficient is positive and significant. However, the conclusion reached after looking at the following results is merely that the coefficient is unstable. It is still not possible to believe with a reasonable degree of certainty the minimum wage rate is, ceteris paribus, positively related to the unemployment rate.

Table 3 presents the different coefficients of the minimum wage rate variable, DFUSMINW, and the corresponding t values and significance levels, in alternative regressions based on (3) and (4), where the changes relative the regression in Table 2 are indicated, for two different estimation periods:

TABLE 3
SPECIFICATION SENSITIVITY OF THE COEFFICIENT OF DFUSMINW

COEFFICIENT	T-VALUE (SIGNIFICANCE LEVEL)	SPECIFICATION CHANGE
Estimation period 1974-89:		
.065	1.90 (.09)	POB 16 replaces PFt-1
.064	1.76 (.11)	both POB 16 and PFt-1 included
.010	0.66 (.52)	PBI and TREND are the only other independent variables
.005	0.28 (.78)	PBI, PFt-1, and TREND are the only other independent variables
.008	0.44 (.67)	PBI, PFt-1, TREND, INDPB are the only other independent variables
.052	1.14 (.28)	PBI, POB 16, TREND, INDPB, only other independent variables
.063	1.70 (.12)	PBI, PFt-1, INDIBR, INDPB, are the only other independent variables
Estimation period 1971-89:		
.033	1.46 (.17)	none
.067	3.03 (.01)	POB 16 replaces PFt-1
.066	2.08 (.06)	both POB 16 and PFt-1 included
.032	2.00 (.06)	PBI and TREND are the only other independent variables
.006	0.31 (.76)	PBI, PFt-1, and TREND are the only other independent variables

Table 3 Cont.

.018	1.31 (.21)	PBI, TREND, and INDPB are the only other independent variables
.006	0.37 (.71)	PBI, PFt-1, TREND, INDPB, are the only other independent variables
.021	0.61 (.55)	PBI, POB 16, TREND, INDPB, are only other independent variables
.058	1.59 (.14)	PBI, PFt-1, INDIBR, INDPB, are only other independent variables.

As can be seen from the above table, there is considerable variation in coefficient size, ranging from 0.005 to .067, and in t values and significance levels (which ranged from 0.01 to 0.78), depending upon the specification and estimation period. There is no conclusive econometric evidence the minimum wage is positively related to the unemployment rate in Puerto Rico. This does not rule out the possibility some particular jobs may be eliminated as a result of minimum wage rate increases, even though there may be no net effect. Additional evidence is provided below, where the estimation period extends from 1953 to 1989 (see Table 4).

Effects on Manufacturing Employment

Since the supposedly positive effect of increases in the minimum wage rate on the unemployment rate can be mitigated by withdrawal from the labor force (or, in the Puerto Rican context, by migration to the mainland), it is useful to examine the effect on employment. Do increases in the minimum rate cause disemployment, particularly in the important manufacturing sector? For this analysis, a demand side model is pertinent. Supply side variables can be ignored, since with high unemployment rates, employment responds directly to demand.

The empirical demand side model specifies manufacturing employment as a function of the minimum wage rate, output in the manufacturing sector, and the price of capital. Control variables are the price level, the time trend, and the average wage rate in the manufacturing industry. The basic empirical model (with expected signs indicated above the respective coefficients) is:

$$(5)\ MFGEMPt = c1 + c2(DFUSMINWt) + c3(PBIMFGt) + c4(INDIBRt) + c5(INDPBt) + c6(WGEDMFGt) + er$$

(-) (+) (+) (?) (?)

where (for fiscal years):

MFGEMP = number of persons employed in the manufacturing sector, in thousands
DFUSMINW = the adjusted minimum wage rate, in dollars
PBIMFG = net manufacturing domestic income, in millions of dollars
INDIBR = implicit price deflator for gross domestic investment (1954 = 1.000)
INDPB = implicit price deflator for gross domestic product (1954 = 1.000)
WGEDMFG = average annual employee compensation in the manufacturing industry, in dollars
er = random error term
c1...c6 = coefficients
t = time subscript

The expected sign of the minimum wage variable is negative, whereas it is uncertain in the unemployment rate model. Since there are no supply side effects here, a negatively sloped demand curve implies a fall in employment as the exogenously determined wage rate increases. Also, the model includes WGEDMFG, the average compensation in the industry. This is desirable because in manufacturing the spread between the minimum and average wage rates is greater than for the economy as a whole. However, the sign of its coefficient is uncertain because an increase in the average wage can result from events exogenous to the manufacturing industry (implying a negative sign), or as a result of increased employment in that industry (implying a positive sign). The sign of the output variable (PBIMFG) is positive, as more employment is expected in response to greater output. The sign of the capital price variable (INDIBR) is also positive, as increases lead to substitution of capital for labor. The remaining two variables have coefficients with uncertain signs.

The model is assumed conforming to the classical normal linear regression assumptions and is estimated via ordinary least squares. Table 4

gives the estimation results for the basic model with data from 1974 to 1989. The coefficient of the minimum wage rate variable is positively signed (opposite to what is expected) and not statistically significant. The only variable with a significant coefficient is PBIMFG, net manufacturing income. As expected, it has a positive sign. The R^2 is .84 and there is no statistical evidence of autocorrelation.

TABLE 4

ESTIMATION OF THE BASIC EMPIRICAL MODEL (5) EXPLAINING MANUFACTURING EMPLOYMENT.

LEAST SQUARES
DEPENDENT VARIABLE: MFGEMP
FROM 1974 UNTIL 1989
TOTAL OBSERVATIONS: 16 DEGREES OF FREEDOM: 10
R2 .84404006 RBAR 2.76606008
SSR 195.33008 SEE 4.4196163
DURBIN-WATSON 1.67836705

NO	LABEL	LAG	COEFF.	T-STATISTIC	SIGNIF LAVEL
1	CONSTANT	0	166.9594	-1.622962	.1390460
2	DFUSMINW	0	1.439888	1.349842	.2100351
3	INDIBR	0	15.56814	-4.091652	.2710333E-02
4	PFPBIMFG	0	.1182383E-01	.3738172	.7171946
5	INDPB	0	-34.98466	2.640061	.2691110E-01
6	WGEDMFG	0	-.3992564E-02	2.026099	.7339556E-02

Data sources: INDIBR, PBIMFG, INDPB, and WGEDMFG, Junta de Planificación, 1990; MFGEMP, Puerto Rico Department of Labor and Human Resources; DFUSMINW, adjustment of data in Weidenbaum, p. 156.

A fundamental issue is whether other specifications and estimation periods would change the minimum wage rate result. A variety of alternative regressions were computed, and none showed the predicted effect. These are not presented here since the coefficient, in cases where it appeared with the expected negative sign is never significant, even remotely. This result may be due to relatively inflexible overall labor

requirements in the industry, implying a very inelastic demand curve for labor. Another explanation may be manufacturing has few workers who, if there were no minimum, would have earned less than the minimum. If so, it may be difficult to detect the minimum's employment effects (Brown, et al., p. 512). In any case, production requirements seem to be the major determinant of employment.

Comparison with Other Studies

Two previous recent studies of the effects of the minimum wage rate in Puerto Rico have been mentioned. One (Andic and Cao-García, 1987) was sponsored by the Puerto Rico Manufacturers Association. They concluded that increases in the minimum wage rate cause increased unemployment. Their model explaining the unemployment rate has only one independent variable, the minimum wage rate, and the regression results for the estimation period 1967-86 (p. 28) shows an R^2 of 0.795557, and a coefficient of 5.0485033, with a t-value of 2.83 and a significance level of 0.011.

From the methodology used in this paper, it is clear that the above result could change if alternative estimation periods or specifications were used. Similarly (p. 45) they found that increases in the minimum wage rate cause increased unemployment (they did not use employment as the dependent variable) in the manufacturing sector. Again, only one independent variable, the minimum wage rate, is used as a regressor. For the estimation period 1968-86. the regression shows an R^2 of 0.576035, and a coefficient of 2.9308937, with a t-value of 2.53 and significance level of 0.022. This also contrasts with the results obtained in the present study.

The other study (Santiago, 1986) uses multivariate time series analysis to distinguish the post-1974 period, characterized by the tendency to approach mainland minimum wage rate levels in all covered industries, from the preceding period. The empirical results (using data from quarter I, 1953 to quarter IV, 1982) indicate upward shifts in the unemployment rate and downward shifts in the employment-population ratio due to the period change (p. 304). This result also holds when the cyclical movement of the economy is taken into account, using quarterly U.S. GNP as a proxy for Puerto Rico gross product or gross domestic product (p. 307).

Using regression analysis, a different conclusion emerges when comparing the pre and post-1974 periods. Table 5 presents the results for

regressions explaining the Puerto Rico unemployment rate using annual data for 1953-89, and introducing a dummy variable, D74, to control for the post-1974 period effect. D74 is measured as one for the years 1974-89 and as zero for the years 1953-73. The other variables have been discussed above.

TABLE 5

REGRESSION EXPLAINING PUERTO RICO UNEMPLOYMENT RATE, WITH DUMMY VARIABLE TO DISTINGUISH BETWEEN PRE AND POST*-1974 PERIODS.

LEAST SQUARES
DEPENDENT VARIABLE: PR*ORATE
FROM 1953 UNTIL 1989
TOTAL OBSERVATIONS 37 DEGREES OF FREEDOM 30
$R2R^2$ .77581175 RBAR2 .73097410
SSSSR .11373167E-01 SEE .19470633E-01
DURBIN-WATSON .83690595

NO	LABEL	LAG	COEFF.	T-STATISTIC	SIGNIF LAVEL
1	CONSTANT	0	-.1617708	-1.234313	.2266681
2	DFUSMINW	0	-.1296271E-01	-.4743717	.6386697
3	PBI	0	-.1730781E-04	-3.235092	.2958039E-02
4	INDPB	1	.5438556E-01	.9040766	.3731578
5	INDIBR	0	.1021979	2.256489	.3148436E-01
6	PF	1	.3135819	1.399047	.1720535
7	D74	0	.1214842E-02	.5996460E-01	.9525815

Data source for prior to 1971: Junta de Planificaci6n, 1985; for afterwards, see Tables 2 & 4).

Table 5 Cont.

COCHRANE*-ORCUTT
DEPENDENT VARIABLE: PR*ORATE
FROM 1954 UNTIL 1989
TOTAL OBSERVATIONS 36 DEGREES OF FREEDOM 28
R^2 .92178343 $RBAR^2$ .90222929
SSR .39673965E-02 SEE .11903476E-01
DURBIN-WATSON 1.61902830

NO	LABEL	LAG	COEFF.	T-STATISTIC	SIGNIF LEVEL
1	CONSTANT	0	-.1368043	-1.082038	.2884665
2	DFUSMINW	0	.4443563E-01	1.695396	.1010946
3	PBI	0	-.1959281E-04	-3.965241	.4612172E-03
4	INDPB	0	.2110794	3.772368	.7709694E-03
5	INDIBR	0	-.5703138E-01	-1.632689	.1137313
6	PF	1	.1080901	.4561932	.6517699
7	D74	0	.1593446E-01	.9642694	.3431656
8	RHO	0	.8496518	9.129748	.6903283E-09

Both the least squares and Cochrane-Orcutt estimates (the latter motivated by statistical evidence of autocorrelation) give non-significant coefficients for the minimum wage rate variable, at the ten percent level in a two tail test. The coefficient is negative in the first regression and positive in the second. The coefficient of the D74 variable is not significant in either, indicating no period effect as such.

In Table 6, similar regressions explaining manufacturing employment are presented. Again, a sign change occurs, but in neither the least squares or the Cochrane-Orcutt estimated regression is the coefficient of the minimum wage rate variable significant, at the ten percent level or better in a two tail test. D74 is included to control for period change, and is not significant in either regression.

TABLE 6

REGRESSION EXPLAINING PUERTO RICO MANUFACTURING EMPLOYMENT, WITH DUMMY VARIABLE TO DISTINGUISH BETWEEN PRE AND POST-1974 PERIODS

LEAST SQUARES
DEPENDENT VARIABLE: MFGEMP
FROM 1953 UNTIL 1989
TOTAL OBSERVATIONS 37 DEGREES OF FREEDOM 31
R2 .77194782 RBAR2 .73516521
SSR 3912.6728 SEE 11.234556
DURBIN-WATSON .66018169

NO	LABEL	LAG	COEFF.	T-STATISTIC	SIGNIF LAVEL
1	CONSTANT	0	61.71354	3.337549	.2207543E-02
2	DFUSMINW	0	23.94289	1.521529	.1382631
3	INDIBR	0	-76.15732	-2.688539	.1144357E-01
4	PBIMFG	0	-.5103992E-02	-.9453207	.3518056
5	INDPB	0	94.54177	3.584328	.1142170E-02
6	D74	0	21.19816	1.774265	.8584229E-01

Data source for prior to 1971: Junta de Planificación, 1985; for afterwards, see Tables 2 & 4).

Table 6 Cont.

COCHRANE*-ORCUTT
DEPENDENT VARIABLE: MFGEMP
FROM 1954 UNTIL 1989
TOTAL OBSERVATIONS 36 DEGREES OF FREEDOM 29
R2 .94138964 RBAR2 .92926335
SSR 969.69383 SEE 5.7825356
DURBIN-WATSON 1.75858679

NO	LABEL	LAG	COEFF.	T-STATISTIC	SIGNIF LAVEL
1	CONSTANT	0	296.1052	3.065872	.4662534E-02
2	DFUSMINW	0	-6.915713	-.5551088	.5830772
3	INDIBR	0	6.020974	.3789091	.7075155
4	PFPBIMFG	0	.1147405E-01	2.514102	.1773710E-01
5	INDPB	0	-46.95617	-1.820178	.7906790E-01
6	D74	0	.1515157E-01	.2002590E-02	.9984159
7	RHO	0	.9797792	14.74182	.3718993E-08

Conclusion

Apparently there is no solid evidence supporting a positive relation between the minimum wage rate and the unemployment rate. Many specifications and estimation periods indicate that the null hypothesis is not rejected. There also appears to be no evidence for a negative relation between the minimum wage rate and manufacturing employment; again, the null hypothesis is not rejected in the specifications and estimation periods used in this study.

Arguments against increasing the minimum wage tend to focus on possible unemployment or disemployment effects. Given the results of this study, another aspect can be stressed. Increases in the minimum wage rate benefit those who earn at this rate. In the U.S., there are many at this rate who are not part of poverty-level households, but in Puerto Rico where minimum wage jobs are a significant portion of total employment, and where heads of households tend to be strongly represented, there are obvious poverty mitigating benefits to increasing this rate.

In Puerto Rico, reducing the high rate of unemployment has to rely on policies other than affecting the minimum wage. One result of this study is the unemployment rate is strongly influenced by aggregate output, and a policy implication is measures to increase the rate of growth of gross domestic product will have an impact on lowering the unemployment rate. However, manufacturing led development, while it offered some hope in the past, cannot currently be relied upon to do the job. Other sectors must be developed. Tourism and agriculture have been mentioned, but also sectors such as retail trade could be a source of significant growth. In their Puerto Rico locations, large retail outlets, such as U.S. based department stores, tend to experience among the highest profit rates. However, there are not many of these chains. Their profit levels suggests a lack of competition, indicating room for other firms in this sector, capable of generating more jobs. Moreover, given Puerto Rico's dependence on the U.S. economy, and it's vulnerability to recessions initiated on the mainland, it is desirable to try to diversify its export markets. In 1989, Puerto Rico's total exports were valued at more that $16.3 billion dollars, of which over $14.2 billion went to the U.S., and only about $2 billion to other countries. Surely there must be some way to bring the unemployment rate down to acceptable levels.

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