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FORECASTING AID TO FAMILIES WITH DEPENDENT CHILDREN CASELOADS AND PAYMENTS IN DELAWARE

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The purpose of this paper is to present a model which was developed to forecast Aid to Families with Dependent Children (AFDC) caseloads and payments in Delaware. The model consists of a caseload equation, a payments equation, and three labor market equations. The model, which was fitted statistically using quarterly data for the period 1958-1976, forecasts significantly better than trend type models. In addition, the model, unlike trend type models has the potential for forecasting turning points and can be used to simulate the impact of proposed policy changes.

INTRODUCTION

The steadily rising demands being placed on state and local governments for more services and the subsequent "fiscal crisis" in many states have led to the need for improving the forecasting, planning, and monitoring of revenue and expenditure flows. In this regard, the State of Delaware has recently passed legislation to implement zero based budgeting and is making use of an econometric model to forecast state tax revenues (Latham).

An increasing proportion of the state's operating budget is being claimed for the funding of the state's public welfare programs. Between 1950 and 1976 the state's annual expenditures on public welfare, as a percent of the state's operating budget, rose from 2.38 percent to 7.79 percent (Delaware Department of Health and Social Services 1950-1977, U.S. Bureau of the Census 1950-1977). In the 1977 fiscal year, 49 percent of the state's payment outlays for public welfare were allocated to the Aid to Families with Dependent Children (AFDC) Program (Delaware Department of Health and Social Services 1950-1977).

Given the size of the AFDC program and the operating procedures implemented by the state, the Delaware Division of Social Services recognized the need for developing a model to forecast AFDC caseloads and benefit payments. The purpose of this paper is to present a model which was developed to forecast AFDC caseloads and payments in Delaware.

THE MODEL

The model used to forecast AFDC caseloads and payments consists of three sets of equations: (a) a caseload equation, (b) a payments equation and (c) three labor market equations.

The Caseload Equation

The model posits AFDC caseloads to be a function of (a) labor market conditions which affect the need for households to seek assistance, (b) growth in the potentially eligible AFDC population, (c) the economic attractiveness of AFDC participation, and (d) the formal legal framework which determines the accessibility to the AFDC program.¹ Specifically, the following caseload equation is proposed:

$$\text{Case} = a_0 - a_1 \text{NDE} + a_2 \text{RTSE} - a_3 Q_2 - a_4 Q_3 - a_5 Q_4 + a_6 \text{LF} + a_7 \text{C Max G} + a_8 \text{NFC} + e_1$$

where:

Case is the quarterly AFDC caseload in Delaware,

NDE is the quarterly employment in nondurable manufacturing industries in Delaware $X(1 - \text{Unemployment rate})$,

RTSE is the quarterly employment in retail trade and service industries in Delaware $X(1 - \text{Unemployment rate})$,

Q_2 is a dummy variable which assumes a value of 1 for the second calendar quarter and zero otherwise,

Q_3 is a dummy variable which assumes a value of 1 for the third calendar quarter and zero otherwise,

Q_4 is a dummy variable which assumes a value of 1 for the fourth calendar quarter and zero otherwise,

LF is the quarterly labor force in Delaware,

C Max G is the maximum AFDC grant for a family of four in 1967 dollars,

NFC is a dummy variable used to denote the stringency of nonfinancial eligibility criteria (1 for the years 1967-76, 0 for the years 1958-66), and

e_1 is the error term.

Variables NDE and RTSE are intended to measure labor market conditions facing AFDC household heads. AFDC household heads are predominantly female with relatively low levels of formal education. Hence, the types of employment for which they are potential entrants are limited. To attempt to determine the segment of the labor market for which AFDC household heads are potential entrants, a comparison was made between the mean years of school completed by AFDC household heads in 1970 and the mean years of school completed by persons employed in different occupation-industry categories in 1970 as reported in (U.S. Bureau of the Census 1972b). Specifically, it was assumed that AFDC household heads could enter only those occupation-industry categories in which the mean years of school completed by those employed in these categories were equal to or less than the mean years of school completed by AFDC household heads.

Using this criterion, over 94 percent of all jobs for which AFDC household heads were potential entrants in Delaware in 1970 were contained in nondurable manufacturing and retail trade and service industries (U.S. Bureau of the Census 1972a), and these are the only two sectors retained.

Structural shifts in these two sectors of the labor market affect the need for public assistance among AFDC household heads. It is posited that the AFDC caseload varies inversely with employment in the nondurable manufacturing sector because the hourly wage rate, hours worked per week, and weeks worked per year are all sufficiently high in this sector to generate annual earnings above the AFDC breakeven point. On the other hand, it is posited that the AFDC caseload varies directly with employment in the retail trade and service sector because the jobs available to AFDC household heads in this sector are characterized by low wage rates, low hours worked per week and few weeks worked per year. In combination, these factors result in low annual earnings. As a result, AFDC household heads working in the retail trade and service sector do not have annual earnings above the AFDC breakeven point, and remain partially dependent on AFDC.

The probability that AFDC household heads will become employed in the two sectors depends not only on the size of employment in the two sectors but also upon aggregate labor market conditions. To adjust for this variation, the sector employment variables are multiplied by $(1 - \text{unemployment rate})$.² Finally, the variables, Q_2 , Q_3 and Q_4 are included to measure the seasonal variation in employment.

It is posited that as the population size increases, the pool of

potential AFDC cases expands, other things being equal. However, since population data are not available for Delaware on a quarterly basis for the sample year, the labor force (LF) is used as a proxy for population. It should be noted that there are some problems associated with using this proxy. If during periods of sustained unemployment, such as during the mid-1970's, people drop out of the labor force, a decline in the labor force would be associated with increasing AFDC caseloads. If this is the case, the coefficient would be smaller and the level of significance lower than would be expected if the population and labor force series moved together.

The variable C Max G is the maximum AFDC grant for a family of four in 1967 dollars. This variable is designed to measure the economic attractiveness of participating in the AFDC program. As the real AFDC grant level increases, other things being equal, it is expected that AFDC household heads will substitute AFDC participation for market work. However, it should be noted that C Max G is also an indicator of the financial eligibility criterion. That is, an employed household head who also meets the other non-financial eligibility criteria is eligible for AFDC assistance if the household has income below the maximum AFDC grant level. Thus, C Max G is also measuring financial eligibility and is not capturing a pure work-welfare substitution effect.³

The variable NFC is designed to measure the stringency of non-financial eligibility criteria. From its inception in 1935 until 1967, no major changes were made in the non-financial eligibility criteria of the AFDC program in Delaware. However, beginning in 1967, several changes were made which substantially broadened the potential AFDC population. In 1967, residence requirements were eliminated by a ruling of the Third U.S. District Court.⁴ In 1970, coverage was extended to children in foster homes and to households with an unemployed father (U.S. Department of Health, Education and Welfare). Because these changes were implemented over such a short time period, they are highly intercorrelated and the separate effect of each on the AFDC caseload cannot be estimated. Because of this problem, the effect of these changes is measured by a single dummy variable (1 for the years 1967-76, 0 for the years 1958-66). It is posited that the relaxed eligibility criteria increase the AFDC caseload, other things being equal.

The Payments Equation

Conceptually, the total quarterly AFDC payment is simply the product of the number of cases and the average AFDC grant per case. However, the average AFDC grant per case varies with the composition of the caseload with respect to family size and income levels. Hence, if the average grant level were used in the equation to forecast total payments, it would be necessary to develop an equation to forecast the average grant level. Instead of developing a separate equation for the average grant level, the maximum grant level for a family of four is used. This variable has the virtue of being stable except for statutory changes which are known in advance of the forecast period and, hence can be incorporated into the forecast.

The final payments equation is as follows:

$$\log \text{Pay} = \log b_0 + a_9 \log \text{Max G} + a_{10} \log \text{Case} + e_2$$

where:

Pay is the total quarterly AFDC payments,

Max G is the maximum grant for a family of four,

Case is the quarterly caseload, and

e_2 is the error term.

The Labor Market Equations

To use the caseload and payments equations for forecasting, independent estimates must be made for the variables NDE, RTSE and LF.⁵ These estimates are obtained using the following equations:

$$\text{NDE} = c_0 + a_{11} \text{NDE}_{t-1} + a_{12} \text{Time} + e_3$$

$$\text{RTSE} = d_0 + a_{13} \text{RTSE}_{t-1} + a_{14} \text{Time} + e_4$$

$$\text{LF} = e_0 + a_{15} \text{LF}_{t-1} + a_{16} \text{Time} + e_5$$

where Time is a time trend variable, the e_i 's are the error terms, and the other variables are as defined above. The subscripts (t-1) denote that the variables have been lagged one year. This technique was selected over alternative techniques as proposed by the Bureau of Labor Statistics (1969) and by Barnes *et al.* The equations used generally forecast as accurately as the alternative techniques. Furthermore, their estimation and use in forecasting is somewhat simpler, an important consideration since the equations have to be updated periodically.

THE ESTIMATING EQUATIONS

The equations were estimated using quarterly time series data for Delaware for the period from the first calendar quarter 1958 through the last calendar quarter of 1976. Data on employment were obtained from the Delaware Department of Labor and on the AFDC caseloads and expenditures from the Delaware Department of Health and Social Services (1958-1977). The Consumer Price Index data were obtained from the U.S. Department of Labor (1946-1977) and data on the maximum grant from unpublished information maintained by the Delaware Division of Social Services.

Because of serial correlation, the equations were *rho* corrected using the Cochrane-Orcutt method. The final results of the fitted equations are as follows:

$$\begin{aligned} \text{Case} = & -3858.62 - 306.54 \text{NDE} + 110.86 \text{RTSE} - 503.30 \text{Q}_2 \\ & (19.57) \quad (5.72) \quad (4.26) \\ & -663.58 \text{Q}_3 - 546.05 \text{Q}_4 + 64.23 \text{LF} + 6.04 \text{C Max G} \\ & (4.94) \quad (4.73) \quad (6.74) \quad (4.27) \\ & +819.38 \text{NFC} \\ & (4.70) \end{aligned}$$

$$R^2 = .9901 \quad \text{DW} = 2.04 \quad \text{df} = 68$$

Figures in parentheses are t statistics

$$\log \text{Pay} = 1.98 + .69 \log \text{Max G} + \log 1.01 \text{Case} \\ (10.77) \quad (32.98)$$

$$R^2 = .9870 \quad \text{DW} = 1.88 \quad \text{df} = 73$$

$$\text{NDE} = 7.62 = .84 \text{NDE}_{t-1} + 1.30 \text{Time} \\ (10.60) \quad (2.76)$$

$$R^2 = .82 \quad \text{DW} = 1.97 \quad \text{df} = 73$$

$$\text{RTSE} = 11.27 + .77 \text{RTSE}_{t-1} + .14 \text{Time} \\ (8.22) \quad (2.12)$$

$$R^2 = .9737 \quad \text{DW} = 1.95 \quad \text{df} = 73$$

$$\text{LF} = 56.42 + .70 \text{LF}_{t-1} + 1.45 \text{Time} \\ (11.90) \quad (5.74)$$

$$R^2 = .9790 \quad \text{DW} = 2.01 \quad \text{df} = 73$$

In the caseload equation, all of the coefficients have the expected signs and are statistically significant at least at the .005 level. Together the independent variables explain about 99 percent of the variation in caseloads. Likewise, in the payments equation, the coefficients have the expected signs and are statistically significant at least at the .005 level. Together the independent variables explain about 99 percent of the variation in payments. In the three labor market equations, all of the

variables have the expected signs and are statistically significant at least at the .05 level. The coefficients of determination range from .82 to .98.

APPLICATION OF THE MODEL

Although the explanatory power of each of the equations assessed separately is good, this by itself does not mean that the model is capable of accurate forecasting. To evaluate the performance of the model, caseloads and payments were simulated for the first four quarters after the last sample quarter used to fit the equations, i.e. for the period from January, 1977 through December, 1977. The forecasted caseload and payment levels are close to the actual levels, as is seen in Table 1. The average absolute errors of the forecasts, in percentage terms, are 1.02 percent for caseloads and 4 percent for payments.

While the model appears to forecast quite well in an absolute sense, the question arises as to how the forecasts of this model compare with the forecasts using alternative techniques. A method commonly used to forecast caseloads and payments is the simple autoregressive or pure time dependent model. This type of equation was fitted to the caseload and payments data for the period January, 1958 to December, 1976. The results are as follows:

$$\text{Case} = -285.66 + 133.87 \text{ Time}$$

$$t = 26.15 \quad R^2 = .90$$

$$\text{Pay} = 674110 + 69033.42 \text{ Time}$$

$$t = 19.58 \quad R^2 = .84$$

In using these equations to forecast caseloads and payments for the period January, 1977 to December, 1977, the average absolute errors are 7.74 percent and 18.25 percent, respectively. These errors could not be appreciably reduced either by changing the sample period or the functional form. Furthermore, the simple trend model obviously cannot predict turning points.

Table 1. Actual and Forecasted AFDC Caseloads and Payments in Delaware by Quarter, 1977

Quarter/Year	Caseload		Payments	
	Actual	Forecasted	Actual	Forecasted
1/77	10,373	10,543	\$6,709,198	\$6,454,248
2/77	10,428	10,288	6,709,613	6,421,099
3/77	10,449	10,331	6,736,540	6,446,868
4/77	10,478	10,519	6,728,491	6,486,265

In addition to forecasting, the model can be used to evaluate the relative contribution of the different variables to caseload changeover specified time periods as follows:

$$\Delta \text{Case} = a_1 \Delta \text{NDE} + a_2 \Delta \text{RTSE} + a_3 \Delta Q_2 + a_4 \Delta Q_3 + a_5 \Delta Q_4 + a_6 \Delta \text{LF} + a_7 \Delta \text{C Max G} + a_8 \Delta \text{NFC}$$

where the Δ 's denote the changes in the variables over the specified period.

Similarly, the model can be used to simulate caseload and payment levels under alternative assumptions about the levels of the explanatory variables. In this regard, the model has been used to simulate the impact of changing the maximum grant level on AFDC caseloads and payments. The maximum AFDC grant level in Delaware remained constant from 1968 through 1977. During this same period the Philadelphia area Consumer Price Index rose from 104.8 to 183.5 (U.S. Department of Labor 1946-1977). To adjust AFDC benefits for these price level increases, the Delaware Division of Social Services in early 1978 proposed to increase the maximum AFDC grant level by 67 percent. The forecasting model was used to simulate the caseloads and payments under alternative increases in the maximum AFDC grant level. The point estimates of these simulations are shown in Table 2.

SUMMARY AND CONCLUSIONS

This paper presents a model which was developed to forecast AFDC caseloads and payments in Delaware. The model posits AFDC caseloads to be a function of labor market conditions which affect the need for households to seek assistance, growth in the potentially eligible AFDC population, the economic attractiveness of AFDC participation and the formal legal framework which determines the accessibility to the program. AFDC payments were posited to be a product of the maximum grant level and the caseload.

The caseload and payment levels forecasted by the model are close to the actual levels. The model was used to simulate caseloads and payments for the calendar year 1977. The average absolute forecast errors for the caseload and payments were 1.02 percent and 4 percent, respectively. In comparison, simple trend models forecasted caseloads with an average absolute error of 7.74 percent and payments with an average absolute error of 18.25 percent.

The model developed is preferable to trend type models for several reasons. First, the model forecasts more accurately than trend models. Second, because it is based on statistically sig-

Table 2. Simulated Impact of Changing the Standard of Need in Delaware on AFDC Caseloads and Payments

Standard of Need	Standard of Need as a Percent of 1977 Standard	Caseload	Percent Change in	
			Caseload ^a	Payments
\$455	100	10,500		\$25,808,480
500	110	10,650	1.43	27,976,392
546	120	10,800	2.86	30,144,305
591	130	10,969	4.30	32,312,217
637	140	11,099	5.70	34,480,129
682	150	11,249	7.10	36,673,850
728	160	11,399	8.60	38,867,571
760	167	11,504	9.60	40,416,080
774	170	11,549	10.0	41,087,100

^aDenotes percentage increase from the level forecasted under the current standard of need of \$455.

nificant relationships between economic variables and the caseload and payment variables, it has the potential for forecasting turning points. Finally, the time and skill required to use the model is only marginally greater than that required for trend models.

Nevertheless, it is not suggested that the model be used blindly and in isolation. Specifically, it is suggested that the employment and labor force forecasts of the model occasionally be checked against employment forecasts made using the techniques proposed by Barnes, *et al.* and the U.S. Department of Labor (1969). Finally, the user of the model should constantly be on the alert for structural changes and be prepared to incorporate such changes into the model.

FOOTNOTES

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¹The AFDC program is a categorical public assistance program. The most significant entry restrictions are: (a) the household must contain at least one child under 22 years of age, (b) the household must be headed by a female or unemployed male, and (c) the household's income must be below the specified standard of need. Given the categorical nature of the program, it would have been appropriate to include certain specific demographic variables such as the number of female headed households with dependent children and family dissolution rates as explanatory variables in the caseload equation. However, continuous data for such variables are not available on the state or even the national level.

²This adjustment factor is appropriate because at times over the study period the aggregate unemployment rate and the sector employment variables moved in the same direction.

³Most previous studies of public assistance participation rates (Albin and Stein, Kasper, Spall and McGoughran, and Winegarden) have implicitly assumed that the grant level measures a pure substitution effect. However, this is incorrect since in specifying the grant level the state is simultaneously defining the financially eligible population.

⁴Although the U.S. Supreme Court did not eliminate residence requirements until 1969, Delaware for all practical purposes, began implementing the decision in 1967.

⁵The values of all of the other variables are known in advance of the forecast period with the exception of the Consumer Price Index which is used in adjusting C Max G. It is obviously beyond the scope of this model to attempt to forecast the Consumer Price Index. In making the forecasts, the level of the Consumer Price Index to use for the forecast period is subjectively determined after examining the forecasted price

level increases of various aggregate forecasting models. It should be noted that the caseload forecast is fairly insensitive to rather broad movements in the Consumer Price Index.

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