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The Impact of Recent Welfare Reforms on Labour Supply Behaviour In New Zealand

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THE IMPACT OF RECENT WELFARE REFORMS ON LABOUR SUPPLY BEHAVIOUR IN NEW ZEALAND

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ABSTRACT

New Zealand recently initiated sweeping reforms to its social welfare programmes by cutting benefits and tightening eligibility criteria. One of the objectives of these reforms was to provide incentives for people to enter or re-enter the labour force. Econometric analysis is used in this paper to isolate the actual effects of these benefit reforms on labour supply. Previous research in many counties has often failed to accurately measure the extent of these work disincentives, or to observe variation in these programmes that would allow this empirical analysis to take place. The structure of these benefit programmes in New Zealand, and the nature of these reforms offers a unique opportunity to identify these behavioural responses. Quarterly random samples of individuals between 1985 and 1995 are used to isolate the effects of these reforms, while controlling for a wide variety of other influences. This study finds compelling evidence that these benefit reforms resulted in a substantial increase in aggregate labour supply in this country.

I. Introduction

In December 1990, the New Zealand Government announced a series of reductions in benefits and changes in eligibility criteria under its main social welfare programmes. One of the motivations behind these reforms was the belief that lower benefits and tighter eligibility criteria would increase the labour supply of existing and potential beneficiaries. This study empirically isolates the general effects of income transfer programmes, and the specific effects of these recent benefit reforms, on aggregate labour supply behaviour in this country.[1]

The measurement of the inherent work disincentive effects of social welfare programmes is an issue that continues to confront researchers and policymakers in many countries. Although fairly consistent evidence has been found in the United States that the Unemployment Insurance (UI) and Aid to Families with Dependent Children (AFDC) programmes influence such things as unemployment duration, labor force participation and hours of work (e.g., see Burtless 1990 and Moffitt 1992), considerable uncertainty remains over the magnitudes of these effects. Evidence from the United Kingdom on the effects of their earlier experience with benefit reforms has been mixed (e.g., see Minford 1983 and Micklewright 1986). Furthermore, Bean (1994) has found relatively weak evidence of any link between the generosity of benefits and unemployment rates across Europe.

At least two major problems confront this empirical literature. First, most countries have a myriad of social welfare programmes with rather complicated and interrelated structures. It is often difficult to condense the features of these programmes into a manageable set of regressors that adequately capture potentially complex work disincentives. Even a single welfare programme can create budget constraints with various effective wage rates, notches and discontinuities that impose a considerable burden on the analyst who wants to accurately represent the resulting labour supply choices facing an individual or family (e.g., see Fraker and Moffitt 1988).

Second, regression analysis requires some exogenous variation in these explanatory variables in order to isolate any work disincentives associated with these welfare programmes.

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[1] New Zealand has undergone substantial economic reforms since 1984. See recent reviews of these policy changes and their possible effects on the economy in Silverstone et al. (1996) and Evans et al. (1996).

There are essentially three possible sources for this variation. The first involves the rare opportunity to observe outcomes from a controlled experiment, where programme parameters can be exogenously altered among randomly assigned individuals.[2] The second source of variation concerns aggregate changes in the generosity or structure of these programmes over time. This approach has been used in assessing the effects of welfare reforms in the UK. However, this research has been hampered by relatively short sample periods (i.e., small sample size), the difficulty of boiling complex reforms down to a few proxy variables (i.e, measurement error) and the concern that these regressors may be capturing other aspects of general economic reforms or macroeconomic conditions (i.e., omitted-variable bias). The third source of variation relies on cross-sectional differences in key independent variables. Benefits and other programme characteristics might vary across individuals for a variety of reasons. Moffitt (1989) cautions, however, that any reliance on cross-sectional data may be inappropriate due to a lack of true exogenous variation in these programme parameters. For example, causality in the regression could be reversed. Benefit levels could be set by policymakers on the basis of past labour market performance. Instead of picking up a behavioural response, such regressions could capture the decision-making process in establishing these benefits.

This study offers a unique opportunity to mitigate these two general methodological problems by using data from New Zealand both before and after our recent welfare reforms to estimate their effects on labour supply behaviour. First, the nature of the social welfare system in this country makes it relatively easy to identify the key components of these programmes that might influence labour supply. As we will see, personal and family characteristics map directly into a matrix of both programmes and benefits that face individuals at a point in time. Benefit amounts, for example, do not depend on factors such as pre-unemployment earnings as they do under UI in the US. Many of the "structural changes" in the benefit system that took place over our sample period targeted specific demographic groups over particular periods. Thus, the effects some of the key "non-benefit" changes can be measured as they were phased-in for specific subpopulations.

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[2] For example, see Killingsworth's discussion (1983, pp.392-408) of the labour supply findings from Negative Income Tax experiments.

Second, this study merges both time-series and cross-sectional variation in the relevant data. The reductions in nominal benefits which took place after 1990 were *not* uniform across demographic groups or programmes. For example, the maximum unemployment benefit available to single adults between the ages of 20 and 24 without dependent children fell by 25% in April 1991. The benefit available to married couples without children declined by 3%. Other benefits were not reduced during the same period. It is this variation in both the magnitude and timing of these benefit changes that provides us with something close to the exogenous variation that we need to isolate the associated labour supply responses.

Section II outlines the structure of New Zealand's main social welfare programmes, and the nature of the reforms that have occurred over the last decade. Section III examines the data that will be used in this study, and presents some descriptive statistics on these reforms. Section IV develops a theoretical and empirical framework for this analysis. Section V presents and analyses the regression results. Finally, Section VI draws some general conclusions from this study.

II. Recent Reforms to New Zealand's Social Welfare System

We concentrate in this study on the three main social welfare programmes in New Zealand for the able-bodied or non-disabled population. They are essentially negative income tax programmes that target specific subpopulations. All benefits under these programmes are subject to income tax, and all benefit amounts discussed in this paper are net of tax.

The Domestic Purposes Benefit (DPB) provides income support to single-parented families, and women aged 50 and over who live alone. It terms of categorical eligibility and structure, it is similar to the old AFDC programme in the US. The basic benefit guaranteed to a single parent depends on the number of children in the family. Once earned income exceeds some threshold, this nominal benefit abates at reduction rates that rise from 30 to 70%.

Superannuation benefits are available to people above "retirement age," which changes over our survey period. The benefit amount depends on marital status, and has traditionally been set at around two-thirds of average earnings in the country. Superannuation also has income exemptions and abatement rates (known as Tax Surcharges) that have both changed repeatedly

over our sample period.

By default nearly everyone else is potentially eligible for income support through the Unemployment Benefit (UB) programme. Benefits vary by age, marital status and the number and ages of children in the family. Again, income exemptions and abatement rates similar to those under DPB apply. Unlike the US, there is no time limit on the receipt of unemployment benefits, and workers are not categorically ineligible for these benefits if they work part-time.

In addition to these three main programmes, the Family Support and Family Benefit programmes supplement these basic benefits for families with children.[3] These payments are included in all potential benefits in this study. The only major welfare programme in New Zealand for the able-bodied population ignored in this study is public housing and Accommodation Supplements. During our sample period, New Zealand moved away from a traditional public housing scheme, where individuals queue for the available stock of public housing and pay below-market rents once these accommodations become available. Individuals now receive an Accommodation Supplement which varies by, among other things, housing costs in their regions. Since this policy shift, public housing has been sold and the rents on remaining public housing have increased to market levels. It would be inappropriate to include the cash payments under the Accommodation Supplement in our measures of basic benefits unless we did the same for the monetary equivalent of the earlier in-kind benefits. Since we have no information on who resided in public housing before this policy change, or the value of these in-kind transfers, it was decided that this "benefit" would be treated "symmetrically" over this period and simply ignored in all calculations.

The recent welfare reforms that have taken place in New Zealand are quite diverse. They include specific benefit changes both before and after the general reductions announced in December 1990, and they include various changes in eligibility criteria. For example, the unemployment benefit for those aged 16 or 17 was reduced by 26% in April 1989. The "stand-down" period for UB was increased from 6 to 26 weeks in March 1991. This meant that individuals could be denied a benefit for this period if they left employment voluntarily or were

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[3] The Family Benefit was abolished in April 1991, and these benefits were essentially incorporated into Family Support payments at that time.

dismissed for misconduct. Other work-test provisions were tightened at this time. The minimum age of eligibility for both UB and DPB was raised in 1991 from 16 to 18.

Perhaps the most important "qualitative" change to these programmes occurred with Superannuation. In the 1970's the minimum age of eligibility for basic retirement benefits, funded out of general revenue, was lowered to age 60. By the late 1980's it was clear that this scheme was becoming fiscally unsustainable. In April 1992, the minimum age of eligibility for Superannuation was raised from 60 to 61. Since that time, it has increased in scheduled increments of three months in age for every six months in time. By the end of 1995 the minimum age of eligibility for Superannuation had risen to 62.75 years. These scheduled increases will stop when it reaches age 65 in the year 2001.

III. Data and Descriptive Statistics

The principal data source used in this study is the Household Labour Force Survey (HLFS). The HLFS is a random sample of households drawn each quarter from the general population, and retained in a "rotation group" for eight consecutive quarters. This survey began in December 1985 and the last survey available for this analysis was December 1995. Sample size has varied from 16,000 to 32,000 households over the life of the HLFS. The chief advantages of HLFS data are the frequency of the survey, a relatively large sample size, and the consistency of labor force definitions over time and relative to the standards laid down by the International Labour Office.

Unit record data from the HLFS are unavailable due to confidentiality concerns. However, specific aggregated data were obtained for the purposes of this study. In each quarter, non-disabled individuals between the ages of 16 and 64 were grouped according to various personal characteristics and family circumstances.[4] These attributes were partly chosen to match

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[4] Six characteristics define the "cells" into which individuals fall in each quarter: sex, age (9 categories: 16-17, 18-19, 20-21, 22-24, 25-34, 35-44, 45-54, 55-59, and 60-64), marital status (2 categories: married, and not married), ethnic origin (3 categories: Maori, Pacific Islander and European/Other), education (5 categories: no qualifications, school but no post-school qualification, post-school but no school qualification, school and post-school qualification, and university degree) and number of children in the family (3 categories: no children, one child, and two or more children). This gives us a maximum of 1,620 cells in each quarter. We also know the proportion of individuals in each cell living in families with an infant (ages 0 or 1) or a pre-school child (ages 2 to 4), the average number of children in the cells with two or

the criteria used to determine the income transfer programmes and benefits for which individuals would potentially be eligible. This is an important feature of this research. Unlike other countries where potential benefits might be determined in other ways (e.g., as a proportion of pre-unemployment earnings), eligibility for a specific benefit depends entirely on a person's sex, age, marital status, number and ages of dependent children in the family and the time period in which they are observed. A simple algorithm was constructed for mapping these personal characteristics into the existing matrix of social welfare programmes and after-tax benefits.

The major drawback of the HLFS is the lack of any earnings or income-related data. Non-labour income of the family and the earnings of the spouse would reduce the potential benefit for which an individual would be entitled. In the absence of this family-specific income information, we simply assign the *maximum, potential* benefit to the individual. In other words, it is assumed that if the individual does not work, the only income available is through the social welfare programmes for which he or she is eligible. This is one source of potential measurement error in the computation of the relevant benefits that individuals face in their labor supply decisions. However, the availability of family income data would raise the issue of how this information should be incorporated into the analysis. At one extreme, it could be assumed that non-labour family income, and more importantly, the earnings of the spouse are exogenous. This other family income simply reduces the potential benefit for the individual. Since the labour supply of the spouses may be determined simultaneously, it may be inappropriate to use the current earnings of the spouse to compute this effective benefit. The opposite extreme is used in this paper, where all family income is treated as endogenous.[5]

A second potential problem associated with the lack of earnings-related data in HLFS, is

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more children, the sum of the "weights" used by Statistics New Zealand to extrapolate the sample to the general population, and various labor market outcomes (e.g., proportion in the labour force, average hours worked per week for those employed, and proportion out of the labour and "studying" as their main activity).

[5] To test whether or not our labour supply estimates hinge on the treatment of other family income in this analysis, an alternative data source was used to estimate this same behaviour. This data set, the Household Economic Survey, contains a number of important shortcomings as the primary data set for this project, but it did provide a full range of information on family income. The relevant benefit facing an individual was computed net of current non-labor income of the family and the earnings of the spouse. The results of this analysis, reported in an earlier monograph on this project (Maloney, 1997, Chapter 7), showed that the estimated labour supply effects were quite robust to the inclusion of other family income in the calculation of the relevant benefit.

the absence of any measure of the market wage rates facing the individuals in our data set. For example, it is impossible to demonstrate with the HLFS data alone how average benefit levels have varied relative to average earnings over our sample period. However, an earlier monograph on this project (Maloney 1997) showed that these "replacement rates" essentially mirrored changes in mean real weekly benefits over the sample period. Average real after-tax hourly earnings were relatively constant over these years. The reduced-form labour supply regressions derived in the next section include a number of personal characteristics to proxy for differences in individual earnings capacity. These independent variables (education, age, sex, ethnicity and quarterly dummy variables) indirectly control for the variation in potential market wages across our sample.

Table 1 provides some descriptive statistics on the HLFS data that will be used in this regression analysis. There are 36,818 "cells" of individuals in this data set taken from 41 quarters between 1985:4 and 1995:4. The average cell contains nearly 28 individuals. This implies that these data are based on over one million individual observations. Like all of subsequent regression analysis, the remaining descriptive statistics in this table are weighted by population weights constructed by Statistics New Zealand to extrapolate each sample to the general population. We can return the descriptive statistics as we develop the regression model for this analysis.

One of the keys to this study is the variation in the magnitude of the benefit cuts implemented after 1990. It is believed that these "inter-group" differences in benefit changes will be critical in identifying the associated labour supply effects. Table 2 provides some indication of the dispersion in the overall benefit changes between 1990 and 1995. We took all individuals surveyed in 1990 and calculated the percentage change in their real weekly benefits relative to the benefit they would have faced in 1995. The average benefit cut for all individuals was 9.1%. Yet, less than half of these individuals experienced a reduction in benefits of between 6 and 12%. Almost one-third found their benefits reduced by more than 12%. Nearly one-tenth experienced benefit cuts of more than 18%. Almost one-quarter saw their benefits reduced by less than 6%, with a small number of people (5.5%) actually experienced an increase in real benefits over this 5-year period.

Table 1

Descriptive Statistics from HLFS Sample
1985:4 to 1995:4

Variables	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*
Participation in the Labour Force	0.746	0.234	0.000	1.000
Weekly Hours of Labour Supplied	28.421	13.192	0.000	99.000
Participation in the Labour Force or Education	0.790	0.235	0.000	1.000
Maori	0.099	0.299	0.000	1.000
Pacific Islander	0.038	0.191	0.000	1.000
Married	0.629	0.483	0.000	1.000
Child Aged < 2 in Family	0.091	0.180	0.000	1.000
Child Aged 2 to 4 in Family	0.124	0.216	0.000	1.000
Average Number of Children	0.792	1.097	0.000	8.000
Female	0.504	0.500	0.000	1.000
Age 16 or 17	0.055	0.227	0.000	1.000
Age 18 or 19	0.051	0.221	0.000	1.000
Age 20 to 24	0.127	0.333	0.000	1.000
Age 55 to 59	0.067	0.250	0.000	1.000
Age 60 to 64	0.065	0.246	0.000	1.000
School Qualification Only	0.261	0.439	0.000	1.000
Post-School Qualification Only	0.100	0.300	0.000	1.000
School and Post-School Qualification	0.234	0.423	0.000	1.000
University Degree	0.068	0.251	0.000	1.000
Real Weekly Benefit	$249.22	$86.99	$93.875	$458.37
Rise in Age of Eligibility for UB and DPB	0.025	0.157	0.000	1.000
Rise in Age of Eligibility for Superannuation	0.008	0.057	0.000	0.550
Quarterly Unemployment Rate	7.270	2.292	3.800	11.100
Number of Individuals per Cell	27.994	58.972	1.000	889.000
Number of Cells		36,818		

Notes: All statistics were weighted by population weights constructed by Statistics New Zealand to extrapolate the HLFS to the general population. The only exception is the variable on the number of individuals per cell.

Although benefit cuts between 1990 and 1995 were quite pervasive, they did vary by demographic characteristics. Some of the deepest reductions were experienced by unmarried individuals and youth (ages 16 to 24). Individuals without children and those in their prime working years (ages 25 to 54) saw their benefits reduced by more than the average, but these benefit changes tended to be concentrated around the mean. Youth (ages 16 to 24) experienced the largest dispersion in benefit changes over this period.[6]

Table 2

Dispersion in Real Weekly Benefit Changes
1990 to 1995

Demographic Group	*Mean Change in Benefits*	*Proportion of Individuals with Percentage Change in Benefits in the Range:*					
		< -18%	-12 to -18%	-9 to -12%	-9 to -6%	-6 to 0%	> 0%
All Individuals	-9.1%	0.092	0.234	0.184	0.252	0.184	0.055
Married	-8.1%	0.000	0.132	0.242	0.346	0.280	0.000
Not Married	-11.0%	0.249	0.408	0.085	0.091	0.018	0.148
Without Children	-8.3%	0.149	0.199	0.016	0.257	0.291	0.088
With Children	-10.5%	0.000	0.290	0.456	0.245	0.009	0.000
Ages 16 to 24	-9.4%	0.391	0.060	0.079	0.195	0.052	0.223
Ages 25 to 54	-9.7%	0.000	0.325	0.250	0.281	0.145	0.000
Ages 55 to 64	-6.0%	0.058	0.058	0.018	0.201	0.615	0.051

Notes: Author's calculations based on data from the HLFS, and legislated changes in UB, DPB and Superannuation benefits. All weekly benefits were adjusted to constant 1995:4 dollars by the Consumer Price Index before calculating the percentage change in benefits between 1990 and 1995.

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[6] Weekly benefits for those aged 16 or 17 are *not* recorded as zero after the age of eligibility was raised from 16 to 18 for UB and DPB in 1991. Two new programmes came into existence at this time: the Independent Youth Benefit (IYB) provides emergency assistance for those who cannot be supported by their parents; and the Job Search Allowance provides benefits to youth who have lost their jobs or completed training programmes. Since the vast majority of 16 and 17 year-old beneficiaries ended up on IYB, which offers more generous assistance, this benefit level replaces the basic benefit after 1991. A dummy variable is included in the regression analysis to capture any effects of a tightening in this eligibility criteria.

Figure 1

Notes: Aggregate, seasonally-adjusted labour force participation rate are taken from Statistics New Zealand for all individuals 15 years old and over. Mean weekly benefits are expressed in 1995:4 dollars, and come from the author's calculations for those aged between 16 and 64.

Figure 1 plots mean weekly after-tax benefits facing our sample of individuals between 1985:4 and 1995:4. All figures are in constant 1995:4 dollars. Weekly benefits were in the range of $260 to $270 for most of the period between 1985:4 and 1988:3. A 26% cut in UB benefits for those aged 16 or 17, and a Government decision to hold annual benefit adjustments to the minimum of price or wage inflation over the previous year, contributed to a decline in benefits to around $255 prior to the general welfare reforms announced by the newly-elected National Government in December 1990. These general welfare reforms caused an immediate

fall in benefits to around $235. Although real benefit levels were relatively constant after 1991 under the main social welfare programmes, the "effective" benefits for those aged between 60 and 64 declined as the age of eligibility for Superannuation gradually increased from 60 to 65 after April 1992. The effective benefit for those in this age category is the steadily falling proportion of those still eligible for Superannuation multiplied by this (higher) benefit, plus the steadily growing proportion eligible for UB multiplied by this (lower) benefit. Thus, the effective benefit for this older age group fell steadily after April 1992. The result was a slight decline in average weekly benefits to around $232 by the end of 1995.

Since we ultimately want to know the extent to which these benefits influence labour supply behaviour, we also plot in Figure 1 the aggregate, seasonally-adjusted Labour Force Participation Rate (LFPR) using HLFS data over the same period. There was a decline of about 3 percentage points in participation between 1985:4 and 1989:2. It hovered around the 63.5% level until early 1993 when it began a steady upward climb. About two-thirds of the earlier decline in participation was recovered in the last few years of the sample period.

Inspection of the relationship between these aggregate series does *not* provide clear evidence that these benefit reforms had a positive impact on the LFPR. Of course, these descriptive statistics may not indicate the true relationship between these variables. We are not holding constant the variety of other factors that may be independently influencing labour supply, and we are not taking advantage of the available disaggregate data. One concern here is the cyclical effects of a deep recession in New Zealand prior to and during these benefit reforms, followed by a vigorous recovery in the post-reform period. For this reason, we use disaggregate data and regression analysis to isolate the effects of the *specific* benefit changes that are relevant to the individuals in our sample, and to control for other factors including general macroeconomic conditions that may be independently influencing this behaviour.

IV. A Theoretical and Econometric Framework

We use a simple algebraic representation of the labour supply behaviour of a representative individual. Let L_{it} be the proportion of available time that individual i devotes to market work in period t (i.e., $0 \leq L_{it} \leq 1$). An exogenous, real after-tax wage W_{it} is received for

each hour worked. A real after-tax benefit B_{it} is received for each hour of non-work ($1-L_{it}$). The person optimally allocates his or her time across these two labour force states by maximizing utility:

$$U = \alpha Y_{it} - \frac{\gamma}{2} L_{it}^2 + \delta_{it} L_{it} \quad (1)$$

subject to the following income constraint:

$$Y_{it} = W_{it} L_{it} + B_{it}(1 - L_{it}) \quad (2)$$

where Y_{it} is total disposable income. Utility is written as a quadratic function in L_{it} to allow for an increasing marginal disutility of work.

The first-order condition for utility maximization is given by the following expression.

$$L_{it} = \frac{\alpha}{\gamma}(W_{it} - B_{it}) + \frac{\delta_{it}}{\gamma} \quad (3)$$

If α and γ are positive as expected, then labour supply depends positively on the wage and negatively on the benefit. The variable δ_{it} captures all other personal characteristics and time-specific factors that influence the individual's labour supply behaviour.

We can transform equation (3) into a feasible regression model by making several modifications. First, this simple theoretical model assumes that a dollar in after-tax earnings has exactly the opposite effect on labour supply as a dollar in after-tax benefits. Because of the potential "stigma" of being a beneficiary (e.g., see Moffitt 1983), as well as other theoretical considerations (e.g., see Hillier 1985), we allow for differences in the respective effects of the two income sources on this behaviour. Moreover, we have no information on the potential market wages facing the individuals in our HLFS data. For this reason, we substitute a set of independent variables for W_{it} that capture systematic differences in earnings capacities across both individuals and time. This vector includes personal characteristics like educational

attainment, age, gender and ethnicity, and a complete set of quarterly dummy variables. In this way, we "indirectly" control for the impact of wages on labour supply.

Second, we need to make δ_{it} "operational." Some differences in labour supply behaviour may be related to both personal characteristics and time. Thus, we have a second reason for including factors like educational attainment, age, gender, ethnicity, marital status, the presence and ages of children in the family and time dummies in the regression. In fact, we allow the effects of family circumstances like marital status, and the number and ages of children in the household to vary between men and women. All of these demographic characteristics are included in the vector X_{it}. This means that it will be difficult in this reduced-form specification to differentiate between the indirect (through potential market wages) and direct effects of some of these factors on labour supply. Quarterly dummy variables η_t control for all time-specific, individual-invariant effects on labour supply. The use of these time dummies represents a very generic specification for this regression model. Cross-sectional differences in benefit reforms will be critical in isolating their overall effects on labour supply.

Third, two variables are used to capture changes in the ages of eligibility for the three main social welfare programmes. These covariates are included in the vector Q_{it}. One dummy variable captures the increase in the age of eligibility from 16 to 18 for UB and DPB. This variable takes on a value of one for unmarried 16 or 17 year-olds with children after 1991:2 (when the age of eligibility for DPB was raised), and a value of one for other 16 or 17 year-olds after 1990:4 (when the age of eligibility for UB was raised). This variable is set equal to zero for all other age groups and all other time periods. A second variable rises slowly from zero to one as the age of eligibility for Superannuation was gradually raised from 60 to 65. Our HLFS data are grouped into nine age categories, including those between the ages of 60 and 64. In 1992:2 the age of eligibility for Superannuation was raised from 60 to 61. Since this policy directly affected approximately 20% of the individuals in the 60 to 64 year-old cells, this variable jumped from zero to 0.2 for this age group. This minimum age of eligibility has since been raised in three-month increments every six months until it will eventually reach age 65 in the year 2001. Our policy variable mimics this steady rise in the age of eligibility for Superannuation, reaching 0.55 in 1995:4. Our null hypotheses are that increases in the age of eligibility under all three

programmes will increase the labour supply among the relevant age groups.[7]

Fourth, the natural logarithm of real weekly benefits is included as an independent variable in this regression. This is done to simplify the interpretation of the coefficient on this variable. Dividing this estimated coefficient by the mean of the dependent variable provides an estimate of the labour supply elasticity.[8] Our null hypothesis is that this elasticity will be negative (i.e., benefit cuts will increase labour supply).

Finally, a disturbance term u_{it} is added to this expression to allow for the stochastic nature of this behaviour. The final specification of this regression model is:

$$L_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 Q_{it} + \beta_3 lnB_{it} + \eta_t + u_{it} \qquad \textbf{(4)}$$

The generic dependent variable in equation (4) could be measured in a number of ways. Three different measures of labour supply are used to test the robustness of our findings. Descriptive statistics on the three variables are presented in Table 1. The first dependent variable is the LFPR. Note that this is the proportion of individuals within a cell who are either employed or unemployed at the time of the survey. Thus, it takes on a continuous range of values within the 0-1 interval.[9]

A second dependent variable is defined as the number of weekly hours of labour supplied to the market. The LFPR ignores any variation in the "amount" of labour participants are willing to supply. Benefit reforms could raise aggregate labour supply without affecting the LFPR. Since the HLFS does not provide information on the number of hours the unemployed are

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[7] This rise in the age of eligibility for Superannuation is also reducing the potential benefits for this age group. As individuals are no longer eligible for Superannuation, they become eligible for lower benefits under the UB programme. However, we expect this rise in the age of eligibility for Superannuation will have a larger impact than just the fall in potential benefits. The primary reason is that there is an expectation under the other social welfare programmes that individuals seek employment, while no such obligation is inherent under Superannuation.

[8] It would be impossible to take the natural logarithm of the dependent variable in this sample to give us a direct measure of this elasticity. Participation rates for some groups of individuals in this sample are zero.

[9] This raises the issue of the "censoring" of the dependent variable at zero and one. The failure to incorporate this censoring into the estimation procedure could produce coefficient estimates that are both biased and inconsistent. However, this censoring problem is unlikely to be appreciable in this study. More than 97 percent of the individuals in our sample are located in cells with participation rates between the extremes of zero and one.

willing to work, we multiply the LFPR in each cell by the number of hours worked per week by those employed within the same cell. This assumes that the unemployed want to work the same hours per week as the employed within the same cell.

A third dependent variable "broadens" this notions of labour supply. Current economic activity in the labour market could include both labour force participation and human capital accumulation.[10] It would be easy to show in a simple model of human capital investment that reductions in current (and future) welfare benefits could increase optimal educational attainment. This concern might be particularly relevant given the reforms that were directly targeted at youth. This dependent variable is defined as the proportion of individuals within a cell who were either in the labour force, or reported "studying" as their main activity while out of the labour force. Table 1 shows that this broader measure of economic activity adds an average of 4.4 percentage points to the LFPR.

Weighted, Generalized Least-Squares (GLS) estimation will be used in the regression analysis reported in the next section. Observations will be weighted by "sample weights" constructed by Statistics New Zealand to extrapolate these random samples to the general population. Furthermore, the disturbance term is assumed to contain a component (v_i) that is specific to a given cell of individuals:

$$u_{it} = v_i + \varepsilon_{it} \tag{5}$$

where

$$E(v_i) = 0 \qquad Var(v_i) = \sigma_v^2 \qquad Cov(v_i, \varepsilon_{it}) = 0. \tag{6}$$

For a particular cell, disturbances in different periods are correlated due to this common component:

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[10] Unfortunately, no information is available in the HLFS on the job training of individuals (another source of human capital accumulation).

$$Corr(u_{it}, u_{is}) = \frac{\sigma_v^2}{\sigma_v^2 + \sigma_\varepsilon^2} \qquad for\ t \neq s \tag{7}$$

It is important to note that it would be inappropriate to use a "fixed-effects" estimation technique with these data (i.e., where all variables are deviated from their sample means). The reason is that these data do not constitute a true panel data set. The same individuals are not followed over the entire sample period. Such a data set is commonly referred to in the literature as a "synthetic" panel.[11] Although rotation groups keep the same households in the HLFS for eight consecutive quarters, individuals within these households can "migrate" across cells due to changes in age, education, marital status, number and ages of children in the family. These groups of individuals are essentially *random samples* of all individuals in the population at a point in time who share the same characteristics. This means that the observed labour market outcomes within the cells are sample statistics, and a random effects estimation procedure should be used.

V. Regression Results

The first column of Table 3 reports the parameter estimates for the labour force participation decision. Most of the control variables have the expected signs and are significantly different than zero at conventional test levels. Maori and Pacific Islanders are less likely to participate in the labour force. Marital status, and the number and ages of children in the family have substantially different effects on participation between men and women. Individuals outside the prime working age of 25 to 54 are less likely to be in the labour force. Participation increases with educational attainment. Although dummy variables representing all 41 quarters in this data set are included in the regressions, these results are not reported.

The effects of qualitative changes in welfare programmes on labour force participation are mixed. The increase in the age of eligibility for Superannuation has a strong positive effect on participation. The estimated coefficient of 0.159 is significant at better than a 1% level. This

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[11] See Verbeek and Nijman (1992) for a discussion of estimation techniques using synthetic panel data.

Table 3

Estimated Determinants of Labour Supply
Random Effects Estimation

Independent Variables	*Dependent Variables*		
	Participation in the Labour Force	*Weekly Hours of Labour Supplied*	*Participation in the Labour Force or Education*
Constant	1.557**	78.015**	2.291**
	(0.038)	(1.819)	(0.030)
Maori	-0.051**	-2.820**	-0.053**
	(0.003)	(0.132)	(0.002)
Pacific Islander	-0.042**	-2.828**	-0.018**
	(0.004)	(0.179)	(0.003)
Married	0.193**	11.653**	0.226**
	(0.005)	(0.233)	(0.004)
Child Aged < 2 in Family	0.013	-0.468	0.009
	(0.010)	(0.476)	(0.008)
Child Aged 2 to 4 in Family	-0.038**	-1.225*	-0.045**
	(0.011)	(0.535)	(0.009)
Average Number of Children in Family	0.014**	1.110**	0.039**
	(0.003)	(0.119)	(0.002)
Female	-0.086**	-6.209**	-0.075**
	(0.004)	(0.168)	(0.003)
Female • Married	-0.057**	-6.655**	-0.075**
	(0.005)	(0.231)	(0.004)
Female • Child Aged < 2 in Family	-0.359**	-12.674**	-0.406**
	(0.012)	(0.602)	(0.010)
Female • Child Aged 2 to 4 in Family	-0.138**	-5.478**	-0.131**
	(0.014)	(0.691)	(0.012)
Female • Average Number of Children	-0.026**	-2.558**	-0.019**
	(0.003)	(0.140)	(0.002)
Age 16 or 17	-0.215**	-15.141**	0.010*
	(0.008)	(0.336)	(0.005)

** Significant at a 1% level, two-tailed test.
* Significant at a 10% level, two-tailed test.

Notes: Standard errors are in parentheses. Observations were weighted by population weights constructed by Statistics New Zealand. Dummy variables representing the 41 quarters in this data set were included in these regressions, but these results are not reported. Random effects were based on the 1,383 cells of individuals observed over the sample period.

Table 3 (Continued)

Estimated Determinants of Labour Supply
Random Effects Estimation

	Dependent Variables		
Independent Variables	*Participation in the Labour Force*	*Weekly Hours of Labour Supplied*	*Participation in the Labour Force or Education*
Age 18 or 19	-0.067** (0.006)	-5.836** (0.260)	0.008* (0.004)
Age 20 to 24	-0.005 (0.004)	-1.393** (0.159)	0.023** (0.003)
Age 55 to 59	-0.200** (0.005)	-9.576** (0.204)	-0.215** (0.003)
Age 60 to 64	-0.541** (0.006)	-23.694** (0.238)	-0.537** (0.004)
School Qualification Only	0.072** (0.003)	1.810** (0.142)	0.097** (0.002)
Post-School Qualification Only	0.111** (0.004)	3.225** (0.168)	0.097** (0.003)
School and Post-School Qualification	0.162** (0.004)	5.645** (0.150)	0.147** (0.002)
University Degree	0.173** (0.005)	6.024** (0.201)	0.180** (0.003)
Rise in Age of Eligibility for Superannuation	0.159** (0.011)	7.184** (0.583)	0.144** (0.010)
Rise in Age of Eligibility for UB and DPB	-0.082** (0.004)	-4.590** (0.238)	0.019** (0.004)
Log of Real Weekly Benefits	-0.149** (0.007)	-8.539** (0.349)	-0.290** (0.006)
N	36,818	36,818	36,818
R^2	.823	.848	.852

** Significant at a 1% level, two-tailed test.
* Significant at a 10% level, two-tailed test.

Notes: Standard errors are in parentheses. Observations were weighted by population weights constructed by Statistics New Zealand. Dummy variables representing the 41 quarters in this data set were included in these regressions, but these results are not reported. Random effects were based on the 1,383 cells of individuals observed over the sample period.

suggests that when the full impact of this rise in the age of eligibility from 60 to 65 has occurred in 2001 (when the dummy variable has reached a value of one), labour force participation among those aged 60 to 64 is predicted to increase by 15.9 percentage points (other things held constant). This may seem like an unusually large behavioural response. However, this policy now directly affects just over half of those in this age group. Multiplying the value of this variable in 1995:4 (0.55) by this estimated coefficient (0.159) gives us a predicted increase in labour force participation of 8.7 percentage points. This is less than the actual increase in the LFPR for those between the ages of 60 to 64 of 12.8 percentage points between December 1991 and December 1995. Independent of any associated effects of the *level* of benefits available, raising the age of eligibility for publically-funded retirement benefits has had a considerable impact on the labour force participation of this age group.

Contrary to our original hypothesis, the increase in the age of eligibility from 16 to 18 for both UB and DPB *reduced* labour force participation. The estimated coefficient of -0.082 is also significant at a 1% level. Since these youth are potentially eligible for benefits under other programmes with much tighter eligibility criteria but similar benefit amounts, this dummy variable would capture any increase in participation among 16 or 17 year-olds. Instead, it says that the LFPR of 16 and 17 year-olds *declined* by 8.2 percentage points as a result of this tightening in eligibility criteria. We return to this issue later.

The estimated coefficient on the natural logarithm of real weekly benefits is -0.149. With a standard error of 0.007, this estimated coefficient is statistically significant at a 1% level. This is consistent with our null hypothesis that a reduction in benefits increases aggregate labour supply. A 10% cut in benefits raises participation by 1.49 percentage points. This result can be converted into an elasticity by dividing by the estimated coefficient by the mean of the dependent variable (0.746). This estimated labour supply elasticity is -0.200. A 10% cut in benefits increases the LFPR by 2%.[12]

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[12] This assumes that only current benefits influence current labour supply. However, the effects of benefit changes may not be instantaneous. In regressions not reported in this paper, we allowed for a two-quarter lead period in anticipation of pending benefit changes and a three-quarter lag period to allow for a gradual adjustment in this behaviour. A second-degree polynomial was fitted to the overall effects of benefits on participation. The estimated cumulative, long-term effect is -0.191 and significant at a 1% level. This translates into an estimated elasticity of -0.256.

As we said earlier, the LFPR may not adequately capture the labour supply of the individuals in our sample. It ignores any variation in the amount of labour individuals are willing to work once they are in the labour force. The regression was re-estimated with this new dependent variable on "weekly hours of labour supplied." These results are reported in the second column of Table 3. Note that the estimated coefficients and their standard errors increase substantially in magnitude as we move between the first two columns in this table. The reason is that the "unit of analysis" has changed. Rather than talking about changes in the propensity to participate, we are now looking at changes in hours of labour supplied per week.

The estimated coefficients on the variables for increases in the ages of eligibility have the same signs and statistical significance levels as those found earlier. The higher age of eligibility for superannuation increased aggregate weekly labour supply, while the higher age of eligibility for UB and DPB had the opposite impact.

The estimated coefficient on the log of real weekly benefits is -8.539, and statistically significant at better than a 1% level. We can directly compare this result to the earlier finding on participation by computing the relevant elasticity measure. Dividing this estimated coefficient by the mean of the dependent variable (28.421), gives us an estimated elasticity of 0.300. A 10% cut in benefits increases weekly hours of labour supplied by 3%.[13] The reason for this relatively larger elasticity measure is that this dependent variable captures changes in *both* labour force participation and hours of labour supplied among participants. We find evidence that these benefit cuts resulted in increases in both participation, and hours of labour supplied among participants.

The most surprising results obtained thus far have been the estimated negative effects of tighter eligibility criteria for UB and DPB on both participation and weekly hours of labour supplied. One reason for these unexpected findings may be that these labour supply measures are excessively "narrow" for the affected group of 16 and 17 year-olds. On this basis, the regression was re-estimated with a dependent variable that includes current participation in either

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[13] The estimated cumulative, long-term effect from a second-degree polynomial with two lead and three lag quarters is -9.635 and significant at a 1% level. This translates into an estimated elasticity of -0.339. See footnote 12 for the motivation for this alternative specification of the regression model.

the labour force or education. These results are reported in the third column of Table 3. The estimated coefficient on the rise in the age of eligibility for superannuation remains positive and highly significant. However, the estimated coefficient on the rise in the age of eligibility for UB and DPB is now *positive* and significant at better than a 1% level. This implies that labour force or educational participation among 16 and 17 year-olds *increased* by 1.9 percentage points as a result of this tightening in eligibility criteria. Moreover, the estimated coefficient on the log of weekly benefits (-0.290) has increased in absolute magnitude with this alternative measure of economic activity, and is statistically significant at a 1% level. This translates into an elasticity of 0.367. This figure is larger than the elasticities found earlier on labour force participation (0.200) and weekly hours of labour supplied (0.300). A 10% cut in benefits increases participation in either the labour force or education by 3.67%.[14]

The regressions provide empirical estimates of labour supply responses to both quantitative and qualitative changes in New Zealand's social welfare programmes. To put these responses in perspective, we can multiply these estimated coefficients by the actual changes in these policy variables between 1990 and 1995. The resulting calculations are displayed in Table 4.

Tighter eligibility criteria for UB, DPB and Superannuation had large labour supply effects on the specific age groups directly affected by these policies, but relatively small effects on the overall labour market. For example, the rise in the age of eligibility for Superannuation increased the aggregate LFPR between 1990 and 1995 by less than one-half of a percentage point. The rise in the age of eligibility for UB and DPB raised aggregate participation in the labour force or education by less than one-tenth of a percentage point.

As we saw in the regression analysis, the tighter eligibility criteria for UB and DPB had negative effects on both the LFPR and hours of labour supply. In fact, the estimated positive effects of changes in Superannuation eligibility on participation and hours of labour supply were virtually cancelled out by the negative effects of changes in eligibility for UB and DPB. Yet,

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[14] The estimated cumulative, long-term effect from a second-degree polynomial with two lead and three lag quarters is -0.349 and significant at a 1% level. This translates into an estimated elasticity of -0.442. See footnote 12 for the motivation for this alternative specification of the regression model.

Table 4

Estimated Effects of Benefit Reforms on Labor Supply: 1990-1995

	Change in Participation in the Labour Force	*Change in Weekly Hours of Labour Supplied*	*Change in Participation in the Labour Force or Education*
Rise in Age of Eligibility for Superannuation	0.0047	0.2115	0.0042
Rise in Age of Eligibility for UB and DPB	-0.0040	-0.2249	0.0009
Decline in Log of Real Weekly Benefits	0.0145	0.8291	0.0282
Overall Effects of Benefit Reforms	0.0152	0.8157	0.0333

Notes: The estimated policy effects in this table are the estimated coefficients in Table 3 multiplied by the actual changes in the mean policy variables between 1990 and 1995. The overall effects at the bottom of each column are the summations of these individual policy effects.

both effects were positive with respect to participation in either the labour force or education. We estimate that they are responsible for an increase of slightly more than one-half of a percentage point in this broader measure of economic activity. These results suggest that the rise in the age of eligibility of UB and DPB from 16 to 18 has altered the "composition" of this overall activity by reducing labour force participation in favour of human capital accumulation.

We estimate that the decline in real weekly benefits between 1990 and 1995 resulted in increases of 1.45 percentage points in the aggregate LFPR, 0.8291 in average hours of labour supplied per week, and 2.82 percentage points in aggregate participation in the labour force or studying. The "net effects" of all of the welfare reforms between 1990 and 1995 on these different measures of labour supply are shown in the bottom row of Table 4. We estimate that these overall benefit reforms lead to increases of 1.52 percentage points in the LFPR, 0.8157 in average hours of labour supplied per week, and 3.33 percentage points in participation in the labour force or education. Thus, the vast majority of these overall effects come from the changes in benefits rather than changes in eligibility criteria.

One "check" on these empirical results is to compare these estimated figures to the actual changes in these dependent variables between 1990 and 1995. In other words, what proportion of the observed changes in these labour supply measures can be "explained" by the benefit

reforms that took place over this period? The simple answer is that all of the observed increases in these labour supply measures over this 5-year period can be attributed to these reforms. The actual increases were 1.50 percentage points in the aggregate LFPR, 0.7195 in average hours of labour supplied per week, and 2.11 percentage points in aggregate participation in the labour force or education.

Finally, to compare the labour supply responses across the three measures, we can convert these figures into elasticities by dividing by the means of the respective dependent variables over the sample period. The estimated relative effects of these reforms were 2.04% for the LFPR, 2.87% for weekly hours of labour supply and 4.22% for participation in either the labour force or education.

VII. Conclusions

The findings of this study support the conclusion that recent reforms to social welfare programmes in New Zealand increased labour supply in this country. These results were generated through regression analysis on disaggregated quarterly data between 1985:4 and 1995:4. Both quantitative and qualitative changes to the structure of New Zealand's main social welfare programmes over this period were incorporated in this estimation. Synthetic panel data was used to allow for both time-series and cross-sectional variation in the relevant variables. This is important because benefit changes over the sample period were not uniform across the population.

In accordance with economic theory, benefit cuts increased labour force participation and weekly hours of labour supplied. These effects were reinforced by the rise in the "retirement age." No single demographic group experienced a larger impact from these reforms than those aged between 60 and 64, as the age of eligibility for Superannuation was gradually raised from 60 to 65 near the end of our sample period.

Contrary to our original hypothesis, the rise in the age of eligibility for benefits under the UB and DPB programmes *decreased* labour force participation and hours of labour supplied among those aged 16 or 17. However, subsequent regression analysis suggests that these results were due to an excessively narrow definition of "economic activity." These reforms increased

educational enrollment levels by more than enough to offset any negative effects on labour force participation.

Overall, the benefit reforms implemented in New Zealand since 1990 are estimated to have increased aggregate labour force participation by approximately 1.5 percentage points. Larger *relative* effects are estimated for both hours of labour supplied and participation in either the labour force or education. This estimated rise in labour force participation due to these reforms accounts for the entire increase in the actual LFPR between 1990 and 1995.

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