Westpac Institutional Bank

January 2007

Labour force participation in New Zealand – past, present, and future

occasional paper

Contact: Dominick Stephens, Research Economist +64 4 381 1414, dominick_stephens@westpac.co.nz

1) Introduction

The labour force participation rate has confounded New Zealand economists in recent times, rising well beyond levels last seen in the mid-1980s. Long the domain of labour economists and demographers, labour force participation has suddenly become crucial to macroeconomic forecasters. Consider the period between March 2004 and September 2006, when employment grew by 7% and the population grew by just 2%. Astoundingly, the unemployment rate barely changed, falling from 4.2% to 3.8%. Very strong demand for labour over this period was met, to a large extent, by a surge in labour force participation.

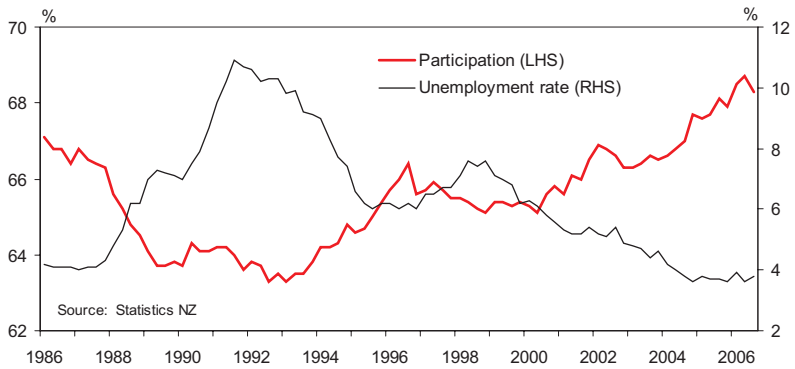
In this paper I investigate the determining factors behind labour force participation, breaking the analysis down by gender and age group. For each age/gender group, I estimate the sensitivity of participation to the aggregate unemployment rate, after controlling for time trends and other factors. I then combine the estimates into an aggregate model. The model jointly determines the aggregate participation rate and unemployment rate, taking employment growth and population growth as exogenous. The model is then used to produce 5-year forecasts of participation.

The key result is that labour force participation is very much a cyclical phenomenon. A 1 percentage point (1ppt) increase in employment is estimated to increase the participation rate by 0.3ppts, and is estimated to reduce unemployment by just 0.6ppts. Far from being inexplicable, most of the recent increase in labour force participation can be explained by strong employment growth, falling unemployment, and a continuation of long-established trends in certain age/gender groups.

The paper also identified the major trends in participation. The aggregate participation is slightly higher than it was in 1986, with strong trend increases in some population groups offsetting strong trend decreases in others. Extrapolating these trends into the future, we show that increasing participation among women aged 55-65 will continue to boost the overall participation rate for another decade at least. However, the aging of the population is dragging the participation rate down. The effect of population aging is accelerating such that the overall trend in participation is almost certainly downwards over the next ten years.

The results have important implications for official forecasts of unemployment. For example, in the current economic environments many economists are projecting low employment growth and rising unemployment over the years to come. My results suggest that a marked slowdown in employment growth would be met by a fall in participation, ameliorating any increase in unemployment.

Figure 1: Labour force participation and unemployment



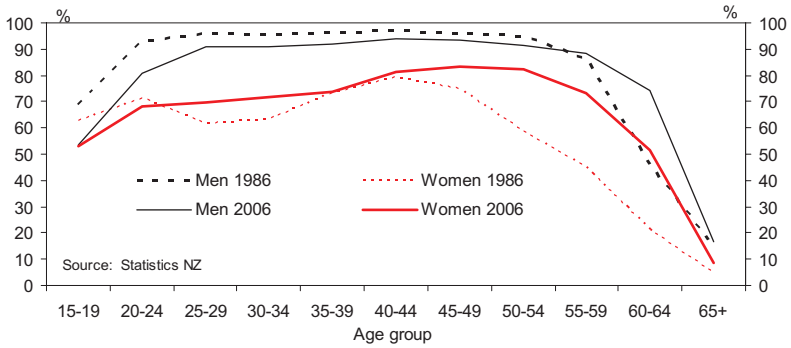
2) Trends in labour force participation since 1986

The labour force participation rate is measured as the proportion of people aged 15 and over who are employed for at least one hour per week, or who are unemployed. In New Zealand, people aged 65 & over are counted in the participation statistics, whereas they are excluded in most OECD countries. This study uses the participation rates measured in the Household Labour Force Survey (HLFS), which surveys around 30,000 individuals in 15,000 households. Households remain in the sample for two years, with one-eighth of the sample rotated out each quarter. Since the overlap between quarters is seven-eighths, quarter-to-quarter comparisons are meaningful.

The first aim of this paper is to add some perspective to the debate about current trends in labour force participation, by breaking the HLFS data down into 5 year age groups, and separating the genders. The youngest group is the 15-19 year olds, and the oldest is the 65 & over category. The participation rate of each group over time is graphed in Figure 14, pages 14-16.

New Zealand's labour force participation rate fell sharply in the late 1980s and early 1990s, but has risen since 1993, roughly mirroring the unemployment rate over the same period. Participation is now only a little higher than it was in March 1986. However, this masks radical changes to who is participating. Figure 1 below compares the participation rate of each group in 1986 to the current participation rate.

Figure 2: Participation rates by age and gender
1986Q2 and 2006Q3

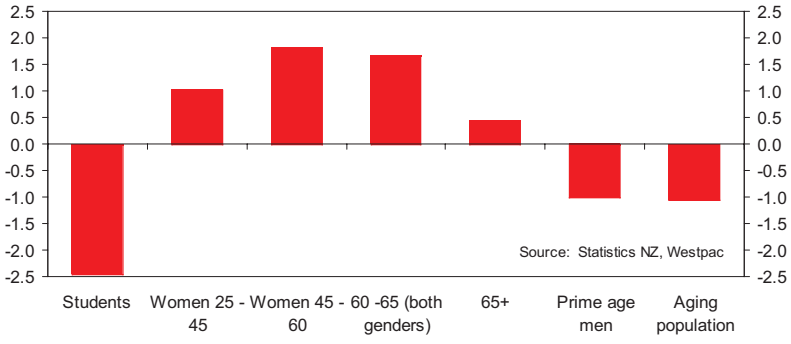


The three most important changes that have occurred since 1986 are:

- An increase in participation of 45 – 59 year old women has added 1.8% to the aggregate participation rate. This is the flow-on effect from radical changes to women's role in the labour force that began in the early- to mid-twentieth century.
- 60-64 year olds of both genders are participating much more, due to a change in the age of eligibility for National Superannuation. This added 1.6% to the aggregate participation rate.
- 15-24 year olds are participating less due to an increase in secondary and tertiary study. This reduced the aggregate participation rate by 2.4%.

The impact that these changes have had on the overall participation rate is shown in Figure 3 below. Small increases in participation among young women and 65&overs of both genders have also increased the aggregate participation rate, while a small decrease in the participation rate of 'prime aged' men has reduced the aggregate participation rate. Population aging has also reduced the aggregate participation rate over the past twenty years, as proportionately more people have moved from high-participation age groups into the lower participation over-55 age groups. Each of these major influences is discussed in more detail in sections 3.1 – 3.7.

Figure 3: Contributions to change in aggregate participation rate since 1986



3.1) The aging population

Population aging has reduced the aggregate participation rate by 1% over the past 20 years. That is, if all age/gender groups had maintained their 1986 participation rates, the aggregate participation rate would have fallen 1% by 2006. There are now proportionately more people in the low-participation categories aged over 55, and fewer people in high-participation categories aged between 25 and 55. The effect of population aging is set to accelerate as the baby-boom cohort passes 60. The projections outlined in section 5.1 suggest that over the next 5 years, population aging will reduce aggregate labour force participation by a further 1%, even if all age/gender groups maintain their current participation rate. Over the next 10 years, the effect of population aging will be 2.5%.

3.2) Students: Males and Females aged 15 – 24

The fall in young people's labour force participation over the past twenty years is probably due to an increase in high school and tertiary education (see Figures 14a-14d, page 14).

Young people's participation is very sensitive to the aggregate unemployment rate. For under 20s, a 1% increase in unemployment reduces labour force participation by 1.4%. Low wages mean that the benefit of participating in the labour force is lowest for young people, while investing in education is the most attractive at young ages. It is not surprising, therefore, that during periods of high unemployment young people tend to pursue opportunities outside of paid work, such as education.

Young people's participation rates are also highly seasonal, and have been seasonally adjusted throughout the analysis in this paper.

Note that the trend towards delaying childbirth has boosted labour force participation for 20-24 year old women (explained in more detail in the next subsection). Balancing this against increasing study has left 20-24 year old women's labour force participation rate little changed since 1986.

3.3) Young women: Females aged 25 – 44

Women aged 25-44 are the people most likely to be engaged in full-time childcare, and are therefore less likely to participate in the paid labour force than similar-aged men or older women. Johnstone (2005) showed that in the 2001 Census, women with no children had similar labour force participation rates to men, whereas women with children had much lower participation rates. For the purposes of this study I am most interested in how these trends have *changed* since 1986.

The labour force participation rate of women aged 25-34 is now higher than it was in 1986, while the labour force participation rate of women aged 35-44 is roughly the same (see Figure 14, pages 14 and 15). This increase in young women's PR is partly due to women having fewer children to care for, as birth rates have fallen. However, there is also tentative evidence that the labour force participation rate of mothers increased between 1986 and 2005, at least for some groups. Table 2 provides rough estimates of the number of pre-school aged children per woman in each age category, comparing 1986 and 2005. For example, in 1986 there were 95,000 preschoolers with mothers aged 25-29, or 0.67 preschoolers per woman. By 2005, there were only 0.46 preschoolers per woman aged 25-29. Table 2 also shows the difference between the male participation rate and the female participation rate for each group – this can be considered a rough estimate of the number of women not in the labour force due to childcare. For 30-34 and 35-39 year olds, the number of (pre-school aged) children per woman *increased*, while the proportion not participating in the labour force due to childcare actually *fell*. This suggests that the labour force participation rate of mothers aged 30-39 has risen.

Table 1: Changing childcare responsibilities for young women

	1986		2006	
	Pre-school aged children per woman	Difference between male and female participation rate	Pre-school aged children per woman	Difference between male and female participation rate
20-24	0.37	20%	0.28	15%
25-29	0.67	35%	0.46	18%
30-34	0.54	33%	0.57	23%
35-39	0.19	24%	0.44	20%

Source: Statistics NZ

Notes: The number of pre-school aged children per woman is the number of children born to women currently in the age-group over the past five years, sourced from Statistics New Zealand's Births Table. The percentage not participating in the labour force due to childcare is simply the difference between the male participation rate and the female participation rate for the age group.

While the participation rate of young women is now higher than it was in 1986, recent data suggests that the upward trend has levelled out. After increasing steadily for a very long time, the participation rate of 20-44 year old women has been roughly stable for the past ten years. Participation rates in each of the age categories have been broadly stable since the mid-90s, with the exception of 30-34 year old women.

3.4) Females aged 45 – 59

By far the biggest change in labour force participation over the past twenty years has been the entry of more women aged 45-59 into the labour force (see Figure 14, pages 15-16). This is the flow-on effect from radical changes to women's life-cycle work patterns that began in the early- to mid-twentieth century. The early-baby-boom generation of women born after World War 2 were more likely remain in the labour force during their child-bearing years than previous generations, and were much more likely to return to paid work after having children. Subsequent generations have been even more likely to return to paid work.[1] As these higher-participation generations enter the 45-59 age categories, participation rates for older women will rise even further, suggesting that this cohort effect has a long way to go. However, the cohort effect cannot produce an upward trend forever. The levelling out already seen in younger women's participation rates will eventually flow through to older age groups – indeed, the participation rate of women aged 45-49 levelled out in 2001, at 82%.

3.5) Males aged 25 – 54

Men aged 25-54 have the highest participation rates of all age/gender groups, at 91% or above (see Figure 14, pages 14-15). But for all of these age-groups, the participation rate has declined gradually over the past twenty years, from 94%-97% in 1986 to 91%-94% today. Of those who were not participating in 1997, 10% were notional job seekers receiving the unemployment benefit, 33% were receiving a sickness benefit or ACC, 18% were full-time students, and 10% were sole parents receiving the DPB (leaving 29% "unknown").[2] We can only speculate as to the reasons for the *change* in men's participation, but the 1997 figures do raise some suggestions:

- An increase in tertiary study may have affected some groups.
- Men may now have an increased role in childcare, either as a non-working partner or as solo parents.
- There has been a large increase in the number of sickness beneficiaries and ACC recipients over the past 20 years.
- The rise in women's wages and labour force participation may have increased spousal income for many men, allowing some to exit the labour force.

Participation rates for men in these age-groups are not very sensitive to the unemployment rate.

[1] This phenomenon is covered in great detail by Johnstone (2005).
[2] Dixon (1999).

3.6) Males aged 55 – 59

Men aged 55-59 have a rather lower participation rate than younger men. Their participation rate fell sharply in the late 1980s, but has since recovered to its former level (see Figure 14q, page 16). The empirical results in section 4 suggest that high unemployment discouraged participation in this group during the late 1980s and early 1990s, and lower unemployment has seen 55-59 year old men returning to the workforce. Outside of the unemployment dynamics, there is evidence of a slight upward trend in participation of 55-59 year old men, amounting to about 1ppt over 15 years.

3.7) The changing age of retirement: Males and females aged 60 – 64

Labour force participation for 60-64 year olds of both genders is now much higher than it was in 1986 (see Figures 14s and 14t, page 16). This is primarily due to a change in the age of eligibility for national superannuation (New Zealand's public pension scheme). In 1992, the age of eligibility began gradually increasing from 60. The transition was complete in 2001, when the age of eligibility reached 65.

The regressions reported in section 4 show that the change in the age of eligibility for superannuation had a strong effect on men's participation.[3] There was no evidence of a separate time trend. For women, the eligibility effect was overlaid with a strong upward time trend, similar to younger women. 60-64 year olds are also very sensitive to cyclical fluctuations in the unemployment rate. A 1% increase in the unemployment rate reduces the participation rate by 1.4% for both men and women.

One often-heard explanation for rising participation among older men is increasing health or life expectancy. However, this explanation fails to explain the decline in participation of older men in the late 1980s. The health explanation is also at odds with international experience and longer-term trends in New Zealand. Hurnard (2005) showed that across a wide range of OECD countries, the participation rate of older men has been in steady, ongoing decline since at least the early-1970s. At the same time as health and life expectancy improved in these countries, wealth increases allowed more men to retire early. The "wealth effect" has dominated the "health effect" across the OECD – and indeed in New Zealand until recently. New Zealand was experiencing a similar downward trend in older men's participation until the 1990s, when the participation rate suddenly increased. Both the empirical evidence in this paper and international experience suggest that the recent increase in older men's participation in New Zealand is temporary and will not be sustained.

3.8) Retirees: Males and females aged 65 & over

The 65+ age group has a relatively low labour force participation rate, currently around 17% for men and 8% for women. This represents a small increase from 1986, when the participation rate was 15% for men and 5% for women (see Figures 14u and 14v, page 16).[4]

The participation rate of over 65s fell between 1986 and 1993, and rose again afterwards. This appears to suggest a strong, lagging relationship with unemployment. However, econometric issues make the relationship between participation of retirees and unemployment impossible to measure with any accuracy (discussed in appendix).

[3] Hurnard (2005), and Kalb and Scutella (2003) have also documented statistical evidence of the effect that changing the age of eligibility for National Superannuation had on participation.

[4] Note that the difference between men and women does not necessarily imply that men are twice as likely to stay in the workforce beyond age 65. The population of women aged above 75 is about 50% higher than the population of men aged above 75. When the participation rate of the "over 65s" is calculated, the female calculation includes in the denominator far more "elderly" people.

4) A model for forecasting labour force participation and unemployment

In this section, a model for forecasting the participation rate is developed. There are three parts to the model, covered in the next three subsections. First, the participation rate of each age/gender group is modelled as a function of unemployment and a linear time trend. Second, the trends in participation are extrapolated into the future. Third, I predict the future age-structure of the labour force to capture the effect of population aging on participation. These ingredients are then combined to produce a model that treats participation and unemployment as endogenous and dependent upon exogenous employment projections.

4.1) The effect of unemployment on labour force participation

In this section I estimate the cyclical effect that the aggregate unemployment rate has on participation rates in each age/gender category. Higher unemployment was found to reduce participation rates, with a 1% fall in the unemployment rate increasing the aggregate participation rate by 0.5%. The youngest and oldest workers are the most sensitive to unemployment.

In theory, unemployment could affect participation in three ways. The "discouraged worker effect" suggests that during periods of high unemployment, some people may pursue other opportunities, such as study or childcare, or they may simply lose hope and give up looking for a job. On the other hand, the "added worker effect" suggests that during periods of high unemployment, if the main breadwinner in a family loses his/her job, other family members may be forced to enter the labour force in order to supplement the family income. International studies find evidence for both effects, but the discouraged worker effect is much larger than the added worker effect.[5] The third effect could be via wages – periods of high unemployment are associated with low wage growth, and low wage growth might discourage participation. Indeed, using growth in real wages instead of unemployment as the explanatory variable in the regressions produced qualitatively similar results. However, it is difficult to *separate* the effect of unemployment from wages in New Zealand, due to the high degree of collinearity between unemployment and wage growth.

For each age category, the participation rate was regressed on the average unemployment rate for the past six months (seasonally adjusted). This specification was chosen mainly because it produced a slightly better fit for most groups than using either the contemporaneous unemployment rate or the first lag of the unemployment rate alone. A further advantage of including the lag of the unemployment rate in the specification is that the risk of simultaneity bias is reduced (discussed below). A linear time trend was included in each regression, as was a lagged dependent. A few of the estimation issues are discussed below.

Unit root tests
Unit root tests suggested that, for most groups, the participation rate is trend stationary (results reported in the appendix). However, a unit root could not be ruled out for men and women aged over 65. Consequently, the regressions on the 65+ age groups should be treated with extreme caution – none of the coefficients can be considered statistically significant.

Seasonality
Tests for seasonality showed that the participation rates for 15-24 year olds were seasonal. Participation rates for these groups were seasonally adjusted before beginning the analysis. No other age/gender group exhibited seasonality.

Stability and structural breaks
It is possible that participation behaviour changed during the sample period for some groups. This is an especially important consideration for groups that have exhibited a strong trend in the past – strong trends in participation must level out at some point, because participation rates are bounded by 0% and 100%. Four groups showed signs of structural change during the sample period, confirmed by Chow tests. Dummy variables were included to capture the effect of structural change in these groups. I tested for mean-shifts as well as for changes in the trend or unemployment coefficients in each case, as detailed below:

- For men aged 20-24, the downward trend in participation became less steep around 2000.
- For women aged 25-29 and women aged 45-49 the upward trend flattened out.

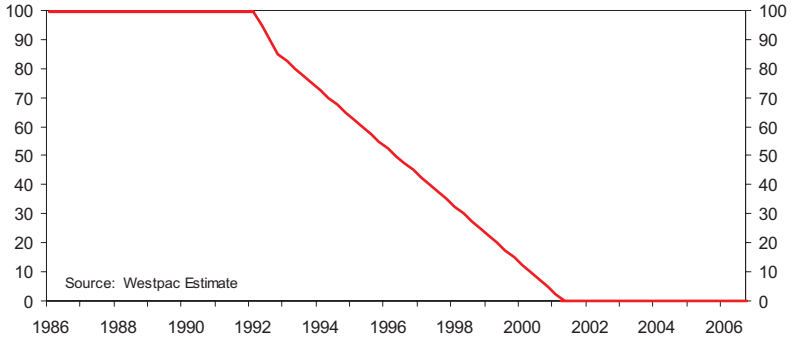
[5] Borjas (1996)

- For women aged 20-24, participation took an unexplained step downward in 1999Q1. This was controlled for using an intercept dummy, with the slope coefficients remaining unchanged.
- Note that a few other groups *appear* to exhibit sudden changes in trend, such as 15-19 year old males. However, Chow tests rejected structural breaks for these groups.

Age of eligibility for National Superannuation

An estimate of the percentage of 60-64 year olds who were eligible to receive national superannuation on the basis of their age was included in the regressions for 60-64 year olds.[6] For men, there was no evidence of a separate time trend, and therefore the time trend was excluded from the regression. For women, there was weak evidence of both a linear time trend and a (small) eligibility effect.

Figure 4: Estimated proportion of 60-64 year olds eligible to receive superannuation



Simultaneity

The unemployment rate is a function of the participation rate. Using unemployment to predict the *aggregate* participation rate would lead to a simultaneity bias in the estimates. However, the risk of simultaneity bias is low when using unemployment to predict the participation rate of an *individual age/gender group*, because the influence that the participation rate of one group has on unemployment is tiny. For example, if there was random variation that caused a 0.5% increase in the participation rate of a single group, the overall unemployment rate would rise by just 0.025ppts. Simultaneity bias is further avoided by using the 6-month average unemployment rate instead of the contemporaneous unemployment rate as a regressor. And finally, simultaneity is known to bias coefficients towards zero. If any simultaneity were present it would make participation seem less sensitive to the unemployment rate than reality. Simultaneity would not threaten the finding that participation is sensitive to the unemployment rate.

[6] Some people become eligible to receive national superannuation before reaching the age of eligibility, if their spouse is above the age of eligibility. This is usually the female partner and may partly explain why the "age of eligibility effect" is harder to detect for women.

Table 2: Regression results

	Lagged Dependent	Unemployment Rate	Trend (per ann.)	Eligibility	Structural Break		
					Date	New UR Coeff	New Trend
Males							
15-19 (s.a.)	0.24	-1.06	-0.55	…	…	…	…
20-24 (s.a.)	0.10**	-0.41	-0.66	…	2000Q1	-0.41	-0.11
25-29	0.20*	-0.15	-0.25	…	…	…	…
30-34	0.53	-0.17	-0.10	…	…	…	…
35-39	0.63	-0.12	-0.08	…	…	…	…
40-44	0.67	-0.10*	-0.08	…	…	…	…
45-49	0.52	-0.03**	-0.07	…	…	…	…
50-54	0.51	-0.23	-0.08	…	…	…	…
55-59	0.58	-0.33	0.07	…	…	…	…
60-64	0.66	-0.47	...	-0.10	…	…	…
65+	0.88	-0.09	0.04	Note: possible unit root			
Females							
15-19 (s.a.)	0.28	-1.00	-0.38	…	…	…	…
20-24 (s.a.)	0.31	-0.02**	0**	…	1999Q1	Levels dummy only	
25-29	0.33	-0.61	0.88	…	1995Q1	-0.22	0.06
30-34	0.55	-0.07**	0.19	…	…	…	…
35-39	0.46	-0.12*	0.02**	…	…	…	…
40-44	0.61	-0.11*	0.02**	…	…	…	…
45-49	0.19*	0.09**	0.47	…	1996Q1	-0.12**	0.17
50-54	0.65	-0.13*	0.27	…	…	…	…
55-59	0.72	-0.23	0.40	…	…	…	…
60-64	0.74	-0.36	0.27*	-0.02*	…	…	…
65+	0.85	-0.06*	0.03	Note: possible unit root			

All coefficients are statistically significant at the 5% level unless marked with an asterisk.

*Statistically significant at the 10% level but not at the 5% level

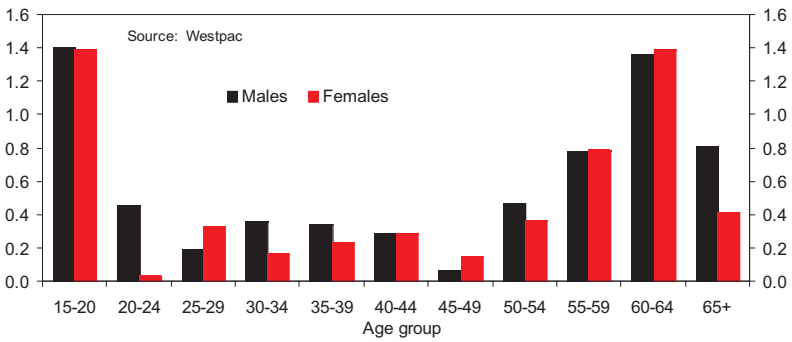
**Not statistically significant at the 10% level

…Not included in regression

The effect of unemployment was negative for all groups, and statistically significant in most cases. For most groups, we can conclude that the participation rate is sensitive to the unemployment rate. The lagged dependent variable was positive and significant for almost all groups, implying a great deal of persistence in participation rates. All time trends ran in the expected direction, and most were statistically significant.

Figure 5 below shows the eventual effect of a 1% change in aggregate unemployment for each age/gender category (the presence of a lagged dependent means that the unemployment rate takes time to affect participation). The youngest and the oldest workers are by far the most sensitive to unemployment, with only small differences between the genders.

Figure 5: Effect on participation rates of a 1% decline in unemployment



4.2) Future trends in participation

The regression results above included estimates of historical trends in participation. These trends cannot continue forever, because participation rates are bounded by 0% and 100%. Indeed, structural breaks showed that for some groups previous trends have levelled out. For the purposes of forecasting, we must make a call as to whether current trends will continue for the next five years, or whether they will level out.

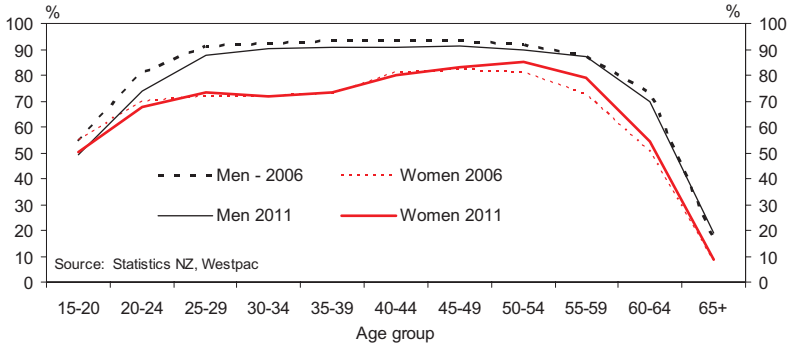
For most age/gender groups – all men and all women aged under 45 – I have extrapolated the latest estimated trend for 5 years. For men under 55 this assumption implies that participation would drop a little further (assuming no change in unemployment), and for men aged 55 and over, participation rises a little. For young women, extrapolating recent trends leads to a small decline in participation for 15-24 year olds, and little change for 25-44 year olds, assuming no change in the aggregate unemployment rate. This is consistent with Statistics New Zealand's "medium participation" projection, which is based on a more sophisticated cohort analysis.[7]

For women aged 45 and over, I have adopted a similar approach to Statistics NZ's cohort analysis. As the higher-participation cohort of women moves into older age categories, the participation rate for those categories steadily increases for a time, before levelling out. The participation rate of 40-44 year olds levelled out in the mid-1990s. The participation rate of 45-49 year old women levelled out at around 82% in approximately 2001. Five years on, the participation rate of 50-54 year old women has recently reached 82%, and the trend can be expected to level out soon. The participation rate of 55-59 year old women can be expected to level out in five years time, and the participation rate of 60-64 year old women can be expected to level out in 10 years time. Adopting trends that correspond to these assumptions gave similar, or slightly higher, participation rates for each age group to Statistics NZ's "medium participation" labour force projection.

Figure 6 below shows the 2011 participation profiles of men and women suggested by these trend extrapolations, assuming no change in the unemployment rate. Despite the strong effect that rising female labour force participation will have, the overall trend in labour force participation over the next five years is downwards, due to the effect of population aging – described in the next section.

In the future, major changes to society might set new trends in motion for labour force participation, but the likelihood of such changes having a major impact within the next five years seems remote.

Figure 6: Projected participation rates assuming no change in unemployment

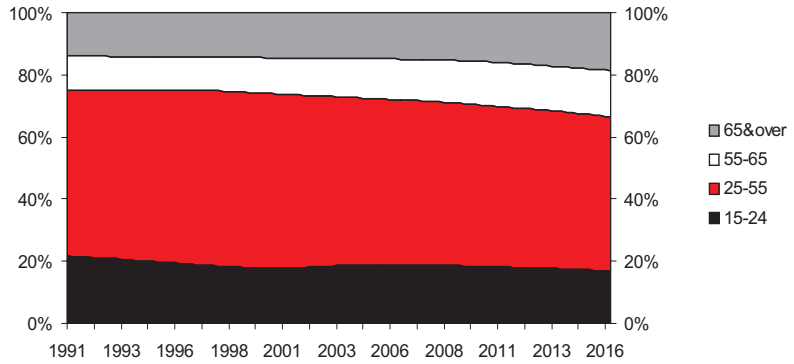


4.3) Population projections

It is relatively simple to produce a 5-year projection of the population in each age/gender category. For example, the number of 20-24 year olds in 2011 will be the same as the number of 15-19 year olds in 2006, less those who die or emigrate, plus those who immigrate. I have taken a very simple approach to "forecasting" deaths and net immigration. For younger age groups, I have assumed that deaths and net immigration will gradually return to its historical average. For older age groups, I have extrapolated historical trends in deaths and net immigration. Details of the population forecasting method is shown in the appendix.

[7] Statistics New Zealand (2005).

Figure 7: Proportions of working age population by broad age category



Source: Statistics NZ, Westpac

Population aging will drag the aggregate participation rate down by around 1ppt over the next five years, and by a total of 2.5ppt over the next decade. Recent increases in participation have occurred against the tide of population aging. But as the effect of population aging accelerates, further increases in the aggregate participation rate will be harder to achieve.

4.4) The forecasting model

This section combines the estimated cyclical response of participation, the estimated trends, and the population projection into a model of the aggregate participation rate. Employment and population change are considered exogenous in the model, while the participation rate and the unemployment rate are endogenous. The model can be expressed by the following equations:

$$PR_t^i = f^i(PR_{t-1}^i, U_t, U_{t-1}, TT_t, Elig_t) \quad (1)$$

$$PR_t = \sum_i (PR_t^i Pop_t^i / \sum_i Pop_t^i) \quad (2)$$

$$U_t = 1 - \frac{Emp_t}{PR_t \sum_i Pop_t^i} \quad (3)$$

Where:

PR_t^i is the participation rate of age/gender group *i* at time *t*;

f^i is the estimated equation for participation of group *i* from section 4.1;

U_t is the aggregate unemployment rate at time *t*;

TT_t is a linear time trend;

$Elig_t$ is the proportion of 60-64 year olds who are eligible to receive national superannuation;

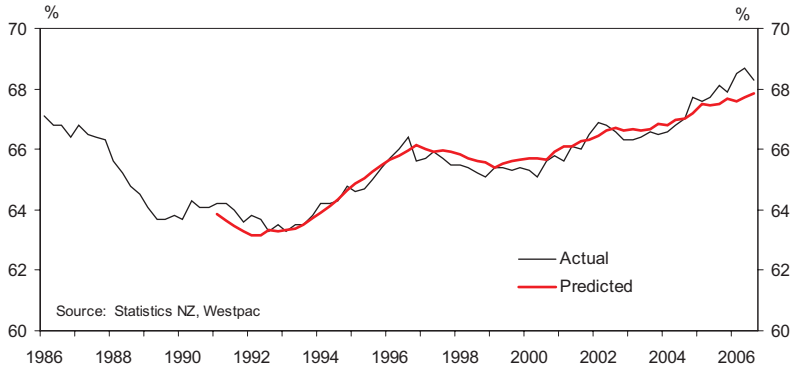
Pop_t^i is the population of age/gender group *i* at time *t*; and

Emp_t is the total number of people employed in New Zealand.

In sample performance

The aggregate model replicates historical variation in participation well. Figure 8 shows a model simulation from 1991Q1 to 2006Q3, compared to actual data from the same period. The projection is based on actual employment and population data, but does not make use of actual participation or unemployment data over the simulation period. Rather predicted values from time *t* are used to produce forecasts for time *t*+1. This is a much tougher test of forecasting performance than a simple series of one-step-ahead forecasts.

Figure 8: Participation rate, actual and predicted values



Out of sample performance

The above was an "in sample" test of forecasting ability – the simulation was based on coefficients estimated over the full sample. An even tougher test of forecasting ability is the "out of sample" test. An early subset of the data is used to re-estimate the regressions. Forecasts are then produced using the re-estimated coefficients (and actual employment data). In this fashion, we reconstruct the past forecasting performance of the model (assuming we had correctly forecast the future path of employment).

Table 3 below shows that the out-of-sample forecasting performance of the model is better than a random walk forecast at all horizons longer than 2 quarters (a random walk forecast is one that assumes participation will remain at its latest level indefinitely). Of course, this performance relies on accurate forecasts of employment. At the very least, this model would produce forecasts of participation that are more consistent with a given employment forecast than a random-walk forecast of participation.

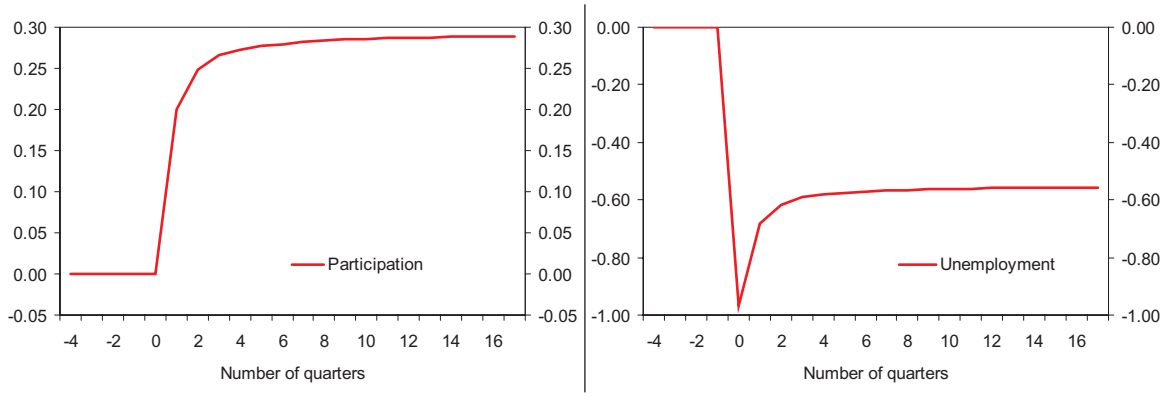
Table 3: Out of sample RMSE of model forecasts, compared to random walk

Sample period:	1986Q1 – 2006Q3						
First out of sample forecast:	1998Q1						
Quarters Ahead	1	2	3	4	8	12	16
Observations	35	34	33	32	28	24	20
RMSE – Model	0.37	0.42	0.46	0.51	0.45	0.78	0.92
RMSE – Random Walk	0.29	0.41	0.51	0.62	1.04	1.27	1.52

Impulse responses

Impulse responses show how the aggregate participation rate and unemployment would respond to an employment shock. Figures 9 and 10 shows the effect of a 1% increase in employment, holding all else equal. The unemployment rate would fall by nearly 1% in the first instance. However, over the following two years the participation rate would gradually rise by 0.3%. The eventual effect on unemployment is 0.6%. This is consistent with recent experience, where employment growth has been strong, unemployment has fallen, and participation has risen.

Figures 9 and 10: Impulse Response from 1% increase in employment



Forecasts

Figures 11 and 12 show three alternative forecasts for the period 2006 – 2011, each based on a different assumption for employment growth. The "low" scenario assumes zero growth in employment for the next five years. The "medium" scenario assumes 1% growth per annum for the next five years, and the "high" scenario assumes 2% growth per annum. The forecast participation rate drops quite sharply in the short term, because the participation rate in 2006Q3 is above the predicted participation rate. The "medium" employment scenario includes a gentle downward move in participation beyond the initial drop mainly due to the effect of population aging. The "high" employment scenario has only a modest increase in the participation rate, since the encouraged worker effect from low unemployment is offset by the downward effect of population aging.

The corresponding low, medium and high forecasts for each age/gender group are shown in Figure 14. Under the medium scenario, the biggest moves would be a further decline in the participation rate of 15 – 24 year olds, and a substantial increase in the participation rate of women aged over 55. However, the outcomes could be quite different under the low or high employment growth scenarios. The age/gender groups that show the greatest difference between the high and low scenarios are those that are most sensitive to the unemployment rate.

Figure 11: Participation forecasts

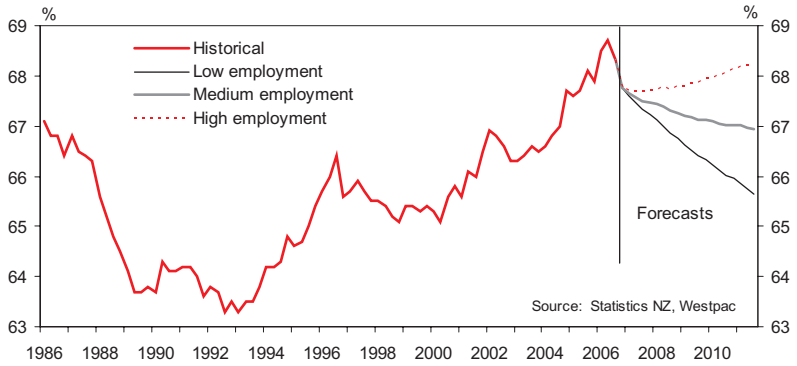
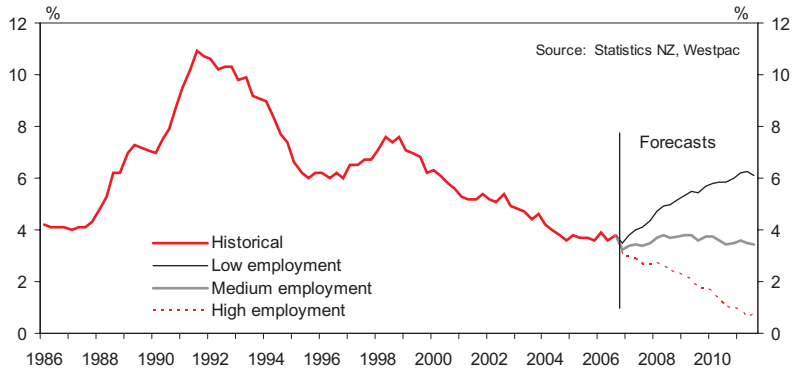


Figure 12: Unemployment forecasts

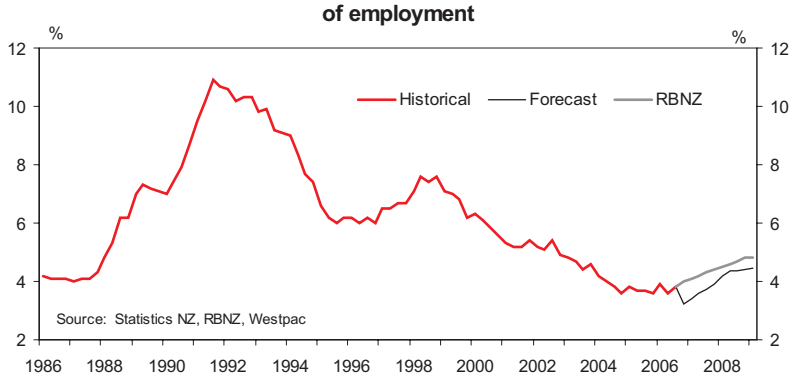


5) Implications and uses of this research

The finding that labour force participation is cyclical has important implications for official forecasts of unemployment, economic growth, and inflationary pressure. For example, official forecasts for New Zealand currently feature a marked slowdown in employment growth and a consequent rise in unemployment, with little change in the participation rate. Our results suggest that the increase in unemployment will be less marked because lower employment growth combined with the aging population would see the participation rate fall. For example, Figure 13 shows the Reserve Bank of New Zealand's (RBNZ) latest unemployment forecast, compared to what the model would predict if the RBNZ's employment forecast was taken as given.[8]

[8] The RBNZ publishes only annual growth rates for its employment forecast. I have interpolated these to the quarterly frequency.

Figure 13: Participation projection using RBNZ forecast of employment



The second implication is that if demand for labour remains strong in coming years, New Zealand will not "run out of workers" immediately. Strong employment growth would entice more workers into the labour market. Nevertheless, there is a limit how much employment growth that the labour force can sustain, especially when the effect of the aging population is considered. The "high employment" scenario suggests that if employment grew at 2% per annum for the next five years, unemployment would eventually reach 0.5%. 2% employment growth per annum can therefore be considered the highest plausible rate, unless the rate of net immigration increases substantially.

The third important implication stems from the degree of persistence in participation. If the participation rate surprises on the upside, which it has done in recent years, it is likely to stay high. Quarter-to-quarter surprises on the participation rate should be taken seriously.

Limitations

The model presented in this paper is a partial analysis, in that it assumes employment is independent of participation and unemployment. However, the paper has achieved its aim of demonstrating that participation in New Zealand is very much a cyclical phenomenon, and that there are important implications for unemployment forecasts. A more complete analysis would integrate the findings from this paper into a more complete model of the macroeconomy, thus allowing for a feedback loop from unemployment to incomes, activity and employment.

The second limitation of this paper relates to the sample period for the estimation. The period between 1986 and 2006 was one of high unemployment by New Zealand standards. As long as unemployment remains at significant levels, then the estimated coefficients will remain reasonable. Should unemployment fall to near-zero levels, the drivers of participation could change. For example, rates of wage growth could become a more significant driver of participation than the unemployment rate. However, this limitation in no way threatens the validity of my conclusion that labour force participation is very cyclical in New Zealand – if anything, it suggests that labour force participation could be more sensitive to the economic cycle than predicted by the model.

6) Conclusion

The results in this paper show that the labour force participation rate in New Zealand is sensitive to the economic cycle. A 1ppt increase in employment was found to encourage more workers into the labour force, increasing the participation rate by 0.3ppts, and limiting any reduction in unemployment to 0.6ppts. This suggests strong increases in participation over the past five years were not inexplicable or necessarily the beginning of a new trend. Rather, strong employment growth can explain most of the rise on participation. The corollary is that should New Zealand enter a period of lower employment growth over the next few years, unemployment would not necessarily rise to the extent projected by official forecasts. Similarly, should strong employment growth continue, New Zealand will not necessarily "run out of workers" – it would be possible to sustain up to 2% employment growth for each of the next five years through rising labour force participation and average migration levels.

Figure 14: Participation rates by age, with projections

NB: scale varies between graphs

Source: Statistics NZ, Westpac

Legend
- History
- Low employment scenario
- Medium employment scenario
- High employment scenario

Figure 14a: Males aged 15-19 (seasonally adj)

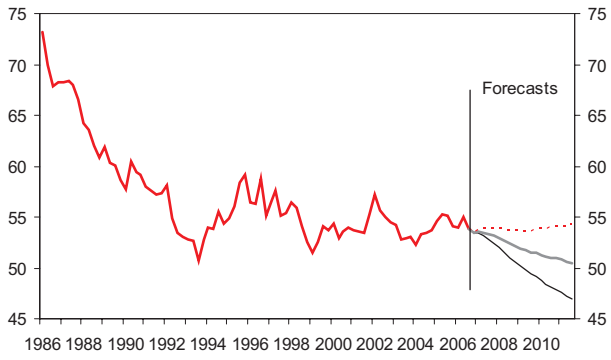


Figure 14b: Females aged 15-19 (s. adj)

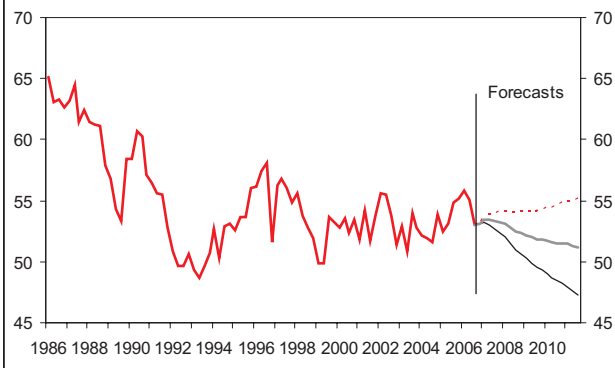


Figure 14c: Males aged 20-24 (s. adj)

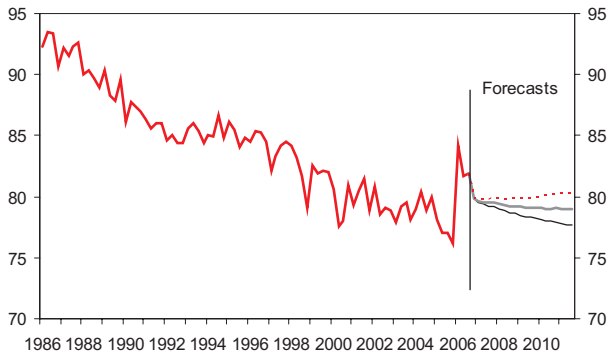


Figure 14d: Females aged 20-24 (s. adj)

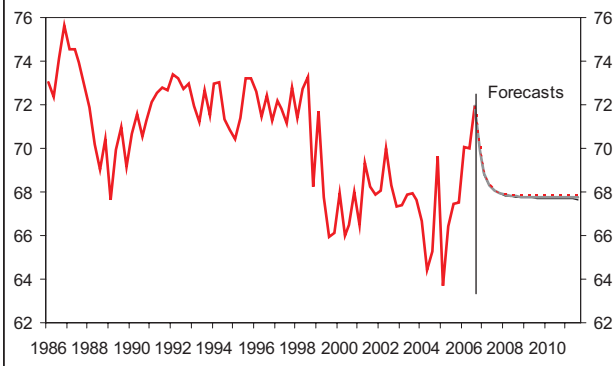


Figure 14e: Males aged 25-29

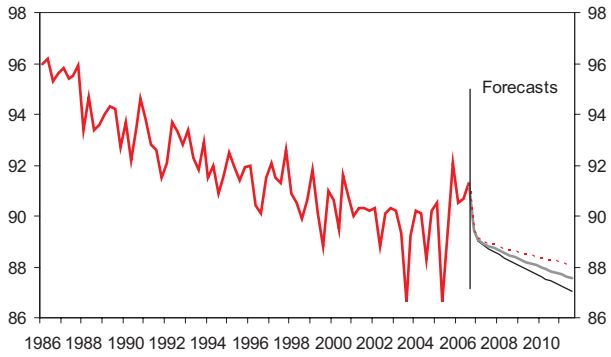


Figure 14f: Females aged 25-29

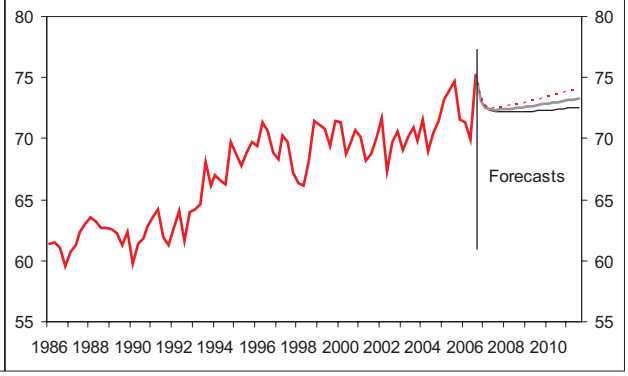


Figure 14g: Males aged 30-34

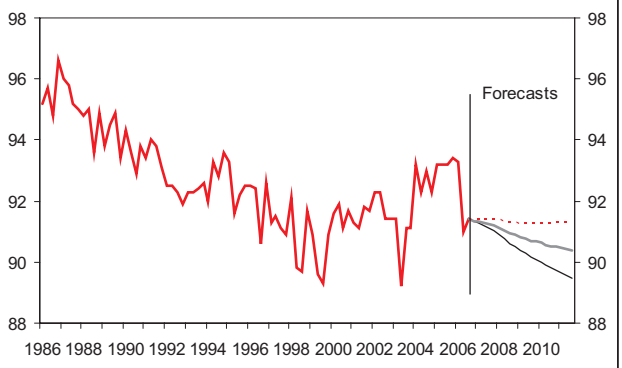


Figure 14h: Females aged 30-34

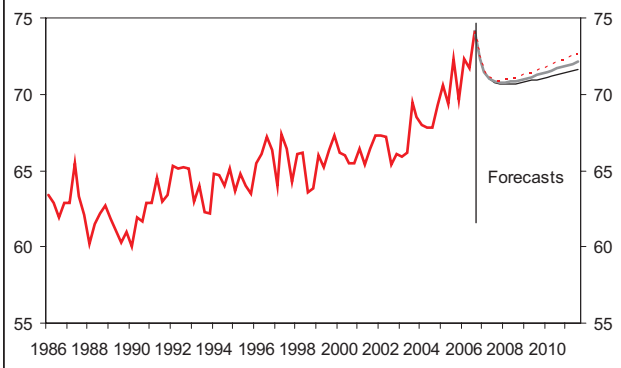


Figure 14i: Males aged 35-39

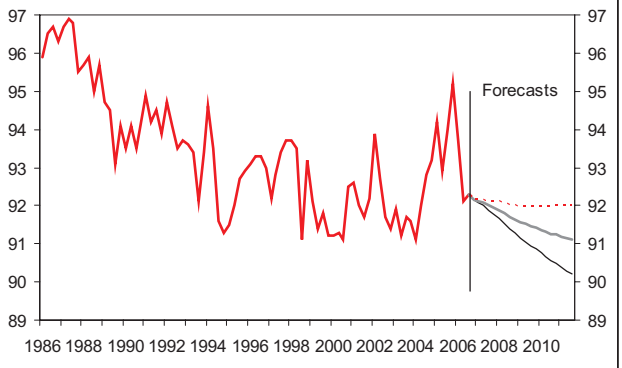


Figure 14j: Females aged 35-39

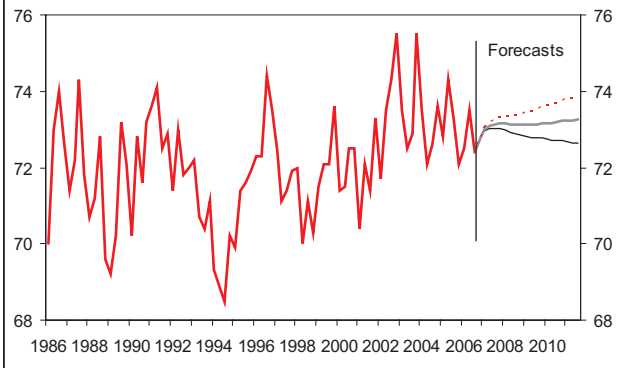


Figure 14k: Males aged 40-44

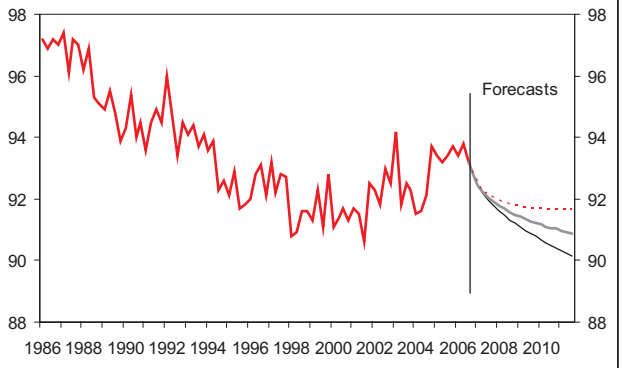


Figure 14l: Females aged 40-44

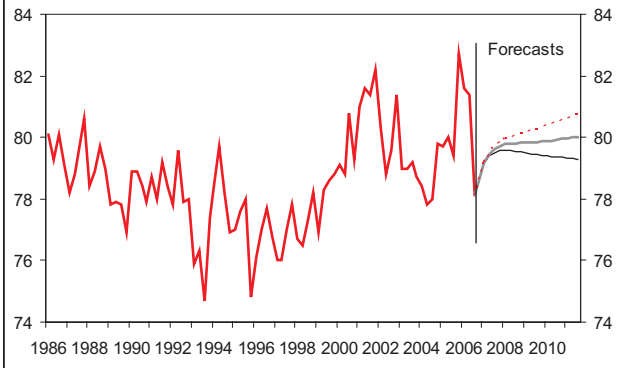


Figure 14m: Males aged 45-49

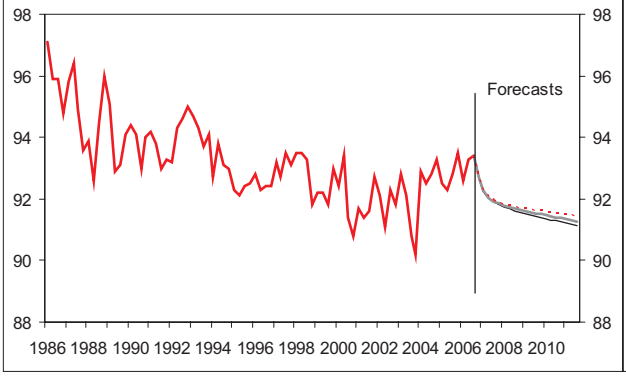


Figure 14n: Females aged 45-49

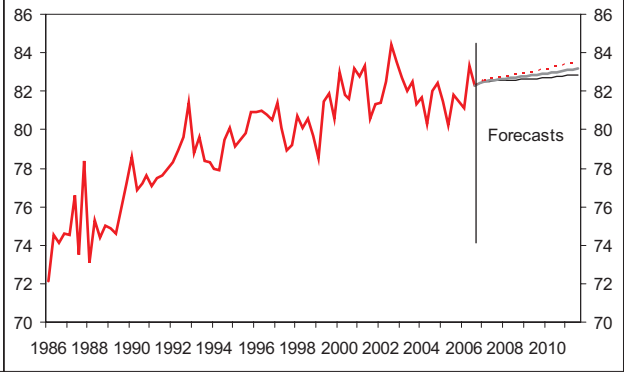


Figure 14o: Males aged 50-54

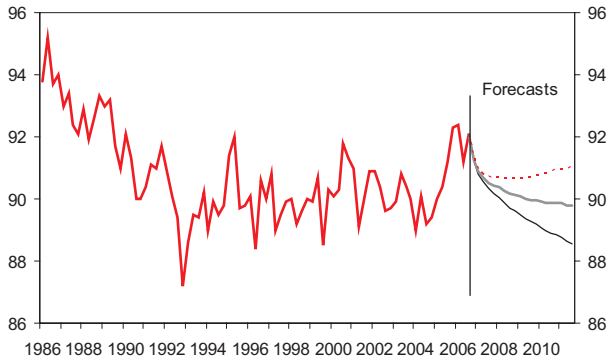


Figure 14p: Females aged 50-54

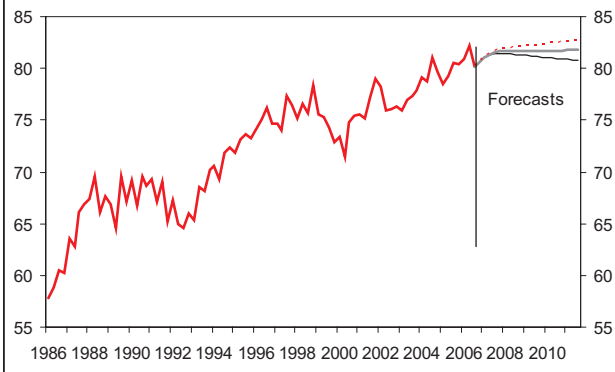


Figure 14q: Males aged 55-59

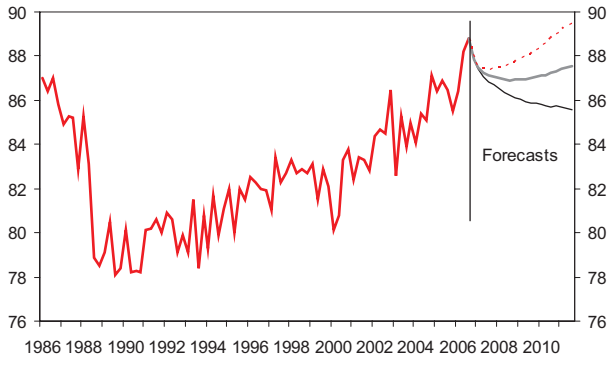


Figure 14r: Females aged 55-59

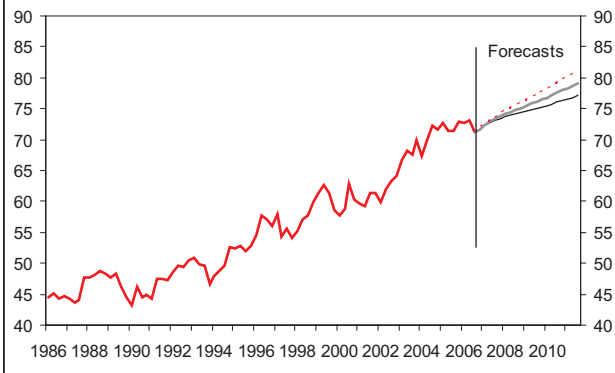


Figure 14s: Males aged 60-64

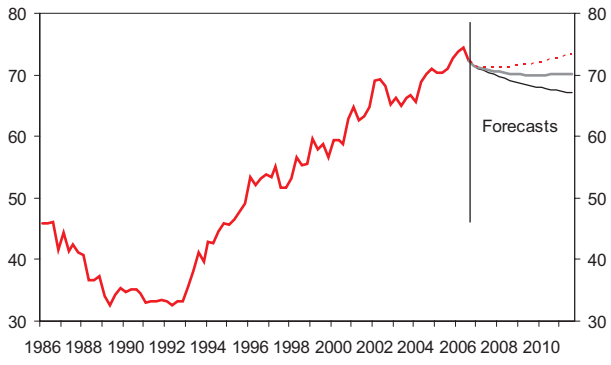


Figure 14t: Females aged 60-44

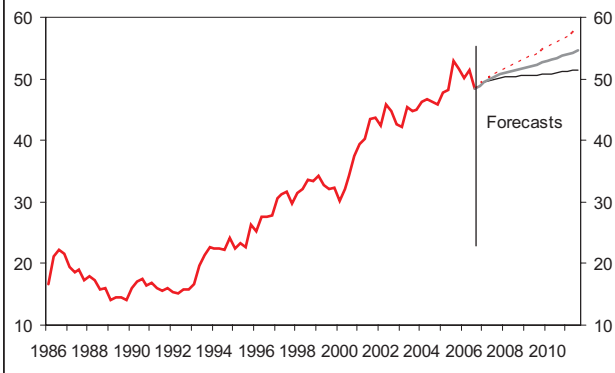


Figure 14u: Males aged 65+

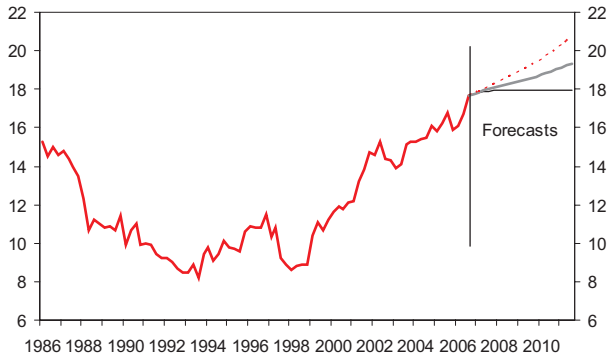
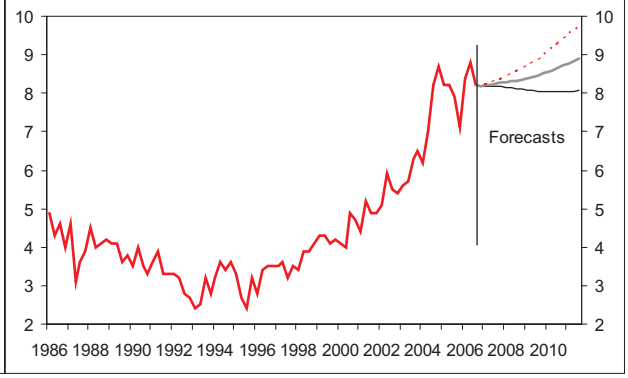


Figure 14v: Females aged 65+



Appendix

A1: Econometric Issues

Unit root testing

The participation rate in most age/gender groups exhibits a great deal of persistence, raising the possibility of non-stationarity. Dickey Fuller tests were used to test for unit roots, with a time trend and a constant, for each group. A unit root was rejected at the 5% level for all groups aged under 55, and was rejected at the 10% level for 55-59 year olds. Unit roots were not rejected at the 10% level for men or women aged 60-64. However, this is not surprising given that the changing age of eligibility for National Superannuation produced a step-shift in participation that would bias a naïve test toward finding a unit root. I am comfortable proceeding with ordinary least squares estimation in levels for all age-groups aged under 65, treating participation rates as persistent but stationary around a linear time trend. Both Legrange Multiplier (LM) tests and Durbin's-*h* tests suggested that there was no positive autocorrelation in the residuals of the equations estimated in section 4.

A unit root process could not be ruled out for over-65s. This implies that the t-statistics are not valid in these regressions, and the coefficients on unemployment reported in table 2 cannot be treated as statistically significant. While I cannot conclude that participation of over-65s responds to unemployment, for the purposes of forecasting I have proceeded with the standard regression. This implies an *assumption* that the participation rate of over 65s is extremely persistent, but is trend-stationary, and that there is a link to unemployment. Again, LM and Durbin's-*h* tests suggested that the residuals were not autocorrelated, and diagnostic tests suggested that the errors were normally distributed, which gives some comfort about the regressions.

Table 4: Diagnostic statistics: Unit root tests on participation rates and Legrange Multiplier tests from regressions in section 4.

	T-statistic from Dickey Fuller test (5% critical value when constant and trend included = -3.46)	LM Test for residual autocorrelation, P-value
Males		
15-19 (s.a.)	-4.810***	0.81
20-24 (s.a.)	-7.141***	0.55
25-29	-6.371***	0.14
30-34	-3.906**	0.02 (neg)
35-39	-3.567**	0.70
40-44	-3.446*	0.00 (neg)
45-49	-5.075***	0.74
50-54	-3.467**	0.25
55-59	-3.450*	0.00 (neg)
60-64	-3.003	0.45
65+	-1.827	0.25
Females		
15-19 (s.a.)	-4.435***	0.31
20-24 (s.a.)	-5.132**	0.01 (neg)
25-29	-4.535***	0.58
30-34	-4.269***	0.09
35-39	-5.246***	0.57
40-44	-4.060**	0.40
45-49	-5.900***	0.03 (neg)
50-54	-4.417***	0.00 (neg)
55-59	-3.037	0.88
60-64	-2.219	0.29
65+	-2.053	0.03 (neg)

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level

(neg) = negative autocorrelation

A2: Population forecasting

Population forecasts were carried out using Statistics New Zealand's Population Estimates, split by gender and broken down into 5-year age groups. The youngest age group is 0-4 years old, the oldest is 90&over. The Population Estimates are based on censuses, so there are slight differences from the working age population given in the HLFS. Over history, the HLFS population in each age category is given by:

$$Pop_t^i = Census_{t-20}^{i-1} + \varepsilon_t$$

Where PR_t^i is the HLFS-based population of age/gender group *i*, $Census^{i-1}$ is the census-based population estimate from the age/gender group that is 5 years younger than group *i*. ε_t is immigration - emigration - deaths + HLFS/census discrepancy. Forecasting each population group into the future involves forecasting ε_t . (Note that the HLFS 65&over category is simply the sum of forecasts of 65-69, 70-75 etc).

All groups aged under 65 exhibited no time trend in ε_t over history. I assumed that ε would remain at its current level for a year before gradually returning to its historical average:

$\hat{\varepsilon}_t = \varepsilon_{2005Q3}$ for t=2005Q4 to 2006Q3;

$\hat{\varepsilon}_t = 0.9\hat{\varepsilon}_{t-1} + 0.1\bar{\varepsilon}$ for t>2006Q3

Since net immigration is the biggest influence on e for these groups, this assumption is roughly equivalent to assuming that net immigration will remain at current levels for a year before gradually returning to historical average levels.

Older age groups exhibited a clear trend over history, due to longer life expectancy. The forecast of ε_t for these groups is given by:

$$\hat{\varepsilon}_t = \hat{\varepsilon}_{t-1} + \beta tt$$

Where βtt is the estimated time trend.

References

Bojas, George (1996) *Labor Economic*s. McGraw Hill.

Callister, Paul (2005) "The changing gender distribution of paid and unpaid work in New Zealand," New Zealand Treasury Working Paper 05/07.

Dixon, Sylvia (1999) "Prime-aged males who are not in the labour force," Department of Labour Occasional Paper 1999/1.

Hurnard, Roger (2003) "The effect of NZs eligibility on the labour force participation rates of older people." New Zealand Treasury Working Paper 05/09.

Johnston, Grant (2005) "Women's participation in the labour force," New Zealand Treasury Working Paper 05/06.

Kalb, Guyonne and Rosanna Scutella (2003) "New Zealand labour supply from 1991-2001: An analysis based on a discrete choice structural utility model," New Zealand Treasury Working Paper 03/23.

Statistics New Zealand (2005) National Labour Force Projections, 2001 (base) – 2051 update. Available at www.statsnz.govt.nz.