Employment growth and Unemployment rate reduction: Historical experiences and future labour market outcomes

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Abstract

The relationship between different macro-labour market drivers and their influence on key outcomes is of considerable interest to labour market analysts as well as policy makers. The relationship between employment growth and the associated reduction in the unemployment rate, for example, is often determined by other labour market indicators such as participation rates and growth in the working age population. The focus of this paper is to introduce a simple integrated macro-labour market forecasting framework developed by the Department of Labour (the Department) to capture these relationships in a systematic and sequential way and provide some useful applications.

I.   Historical Pattern

In Figure 1, it can be seen that employment increased rapidly by about 300,000 from March quarter 2003 to December quarter 2007. During the same period, the unemployment rate also decreased from about 5% to well below 4%. Between March quarter 2008 and December quarter 2009, with the onset of the economic downturn and the Global Financial Crisis (GFC), the employment growth slowed down and the unemployment rate increased. From March quarter 2010 to March quarter 2012, employment levels have grown somewhat but the unemployment rate has remained at around 6.5%.

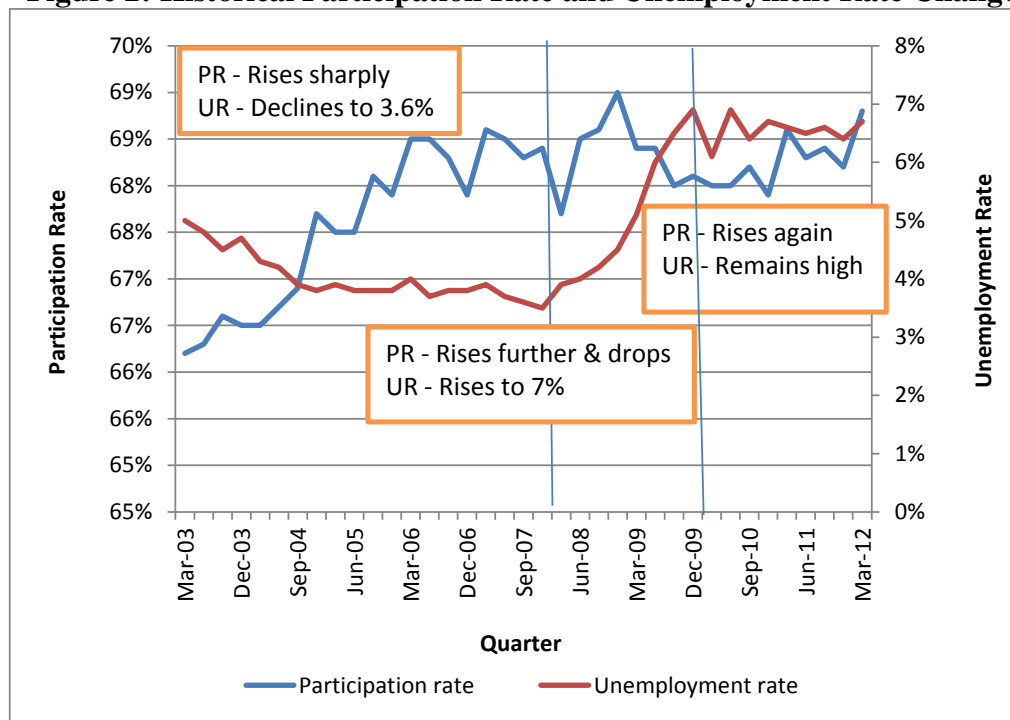**Figure 1: Historical Employment Growth and Unemployment Rate Changes**

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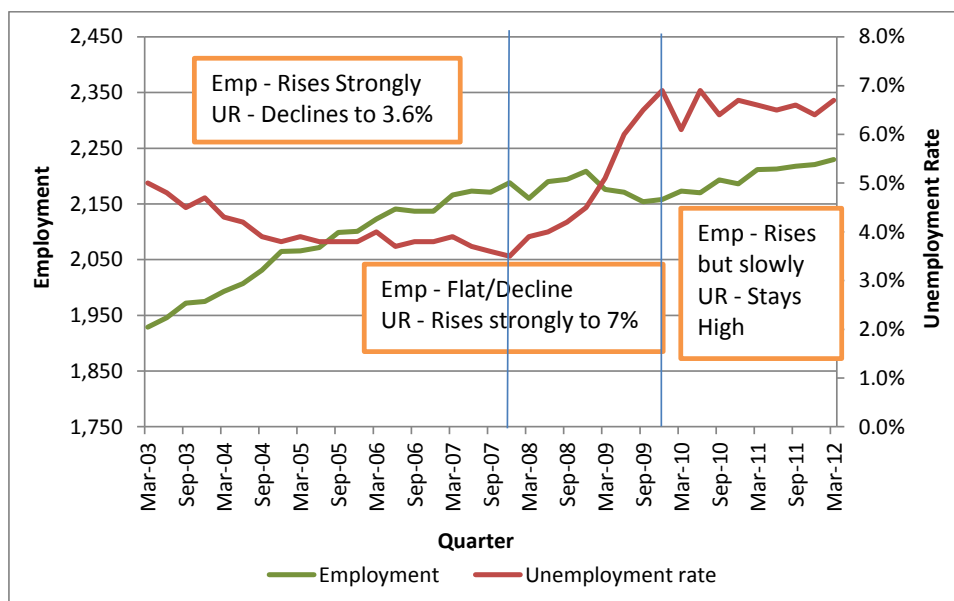
[1] The views expressed are those of the authors and do not reflect the official view of the Department.

Hence the relationship between employment growth and unemployment rate can be summarized as follows:

- During 2003–07, annual employment growth rate of 3% to 4% was enough to drive the unemployment rate down to below 4%.
- Conversely, employment growth of -2% to 1% from 2008–10 led to the unemployment rate rising to 7% in late 2009 and mid-2010.
- Despite annual employment growth of 1% to 2% since then and throughout 2011, the unemployment rate has remained flat and high around 6.5% for much of the 2011 calendar year.

From Figure 2, it could be seen that between March quarter 2003 and December quarter 2007, the participation rate increased quite rapidly. During this period, the unemployment rate also decreased rapidly below 4%. During March quarter 2008 to March quarter 2012, the participation rate remained flat initially but has increased somewhat since December quarter 2010. But unemployment rate rose sharply between December quarter 2007 and December quarter 2009 and has been flat since then except for a small rise in the latest March quarter 2012.

Figure 2: Historical Participation Rate and Unemployment Rate Changes

In summary, the following developments could be seen over the 10 year historical period:

- Participation rate rose from 65% to over 68% while employment growth rate was between 2% to 4% and unemployment rate declined from above 5% to well below 4% during the 2003 to 2007 period,
- Participation rate remained high during the 2007-08 period when employment growth weakened and the unemployment rate rose.

- Over the period from 2008-10 participation rate declined somewhat when the unemployment rate remained flat at above 6.5% and when employment growth was positive but weak.

It appears that the difference between full-time and part-time unemployment rates which averaged about 3% during the 2000-2008 period, rose to well over 4% in 2009 and also above 5% in 2010. This is likely to be influenced by the differential employment growth of full-time and part-time job holders, latter mainly including the youth. The impact of this labour market development on employment growth and its impact on participation rate and unemployment rate require further understanding but is not part of the analysis included in this paper.

II.   Model Structure

The framework below requires limited inputs, GDP and the working-age population being the only exogenous drivers, and is set up in a combined structural and time series estimation framework and in seasonally adjusted terms.

1) Overall Labour Market Components

In the overall labour market, working age population consists of labour force and not in labour force. Labour force includes employment level and unemployment level. Migration along with natural rate of population growth impacts on the working age population.
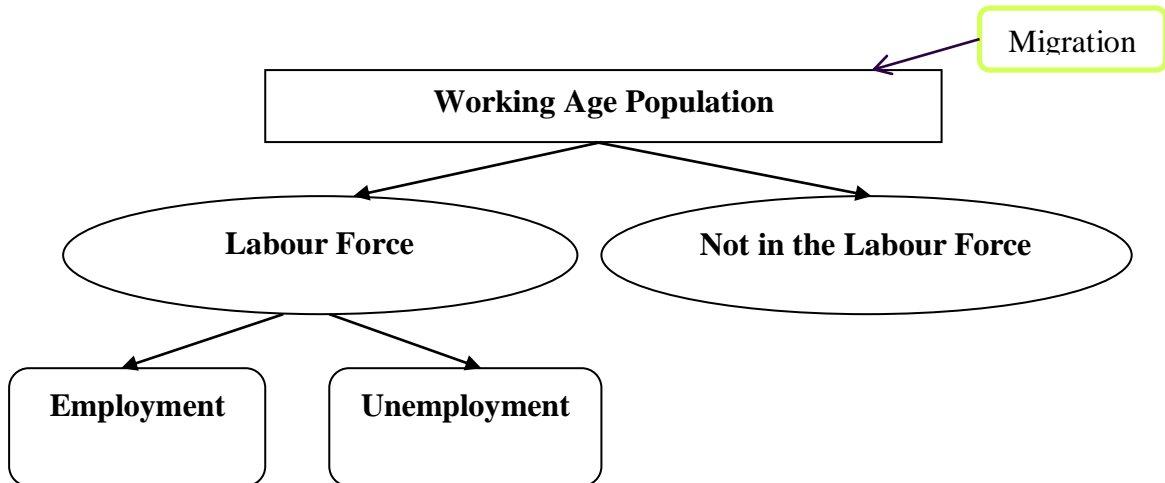
2) Factors Influencing Unemployment Rate Changes

Employment is an important factor that influences unemployment rate changes. When employment increases (or decreases) and labour force is unchanged, unemployment rate decreases (or increases). Working age population is also an important factor that impacts on unemployment rate changes. If working age population changes lead to labour force changes and employment growth is unchanged, unemployment rate changes.

III. Equations of the Model

A. Aggregate analysis of Employment growth, Labour Force analysis and Forecasts:

For the model to forecast unemployment rates, there are two categories of linear time series regression equations. The first equation is to use GDP to forecast employment level. In this equation, the dependent variable is current employment in logarithmic terms, integrated to the order 1. The independent variables are GDP lagged by 3, 5 and 16 quarters in logarithmic terms, integrated to the order 1 (see Appendix A).

B. Disaggregated Participation Rate Analysis and Forecasts:

In order to forecast participation rate of every age cohort using its lags and current & lagged employment rate, we estimated a set of equations. The group of equations consists of 11 equations to forecast participation rates for the full spectrum of 5 yearly age cohorts from age 15 to 65+ covering 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64 and 65+ cohorts, respectively.

In each of these equations, the dependent variable is the participation rate of corresponding age cohort in logarithmic terms, integrated to the order 1. The independent variables may be lagged dependent variable, current employment rate and lagged employment rate in logarithmic terms, integrated to the order 1. The form of the equations is as follows:

$$DLPR_{it} = \alpha_i DLPR_{i,t-p} + \beta_i DLER_{i,t-q} + \in_{it}$$

where i denotes age cohort, t is the quarterly time period, p = 1, 2, 3, …, m and q = 0, 1, 2, …, n.

Figure 3 Participation Rate by Age Cohorts: Historical (2002-2012) and Forecasts (2012-2014)

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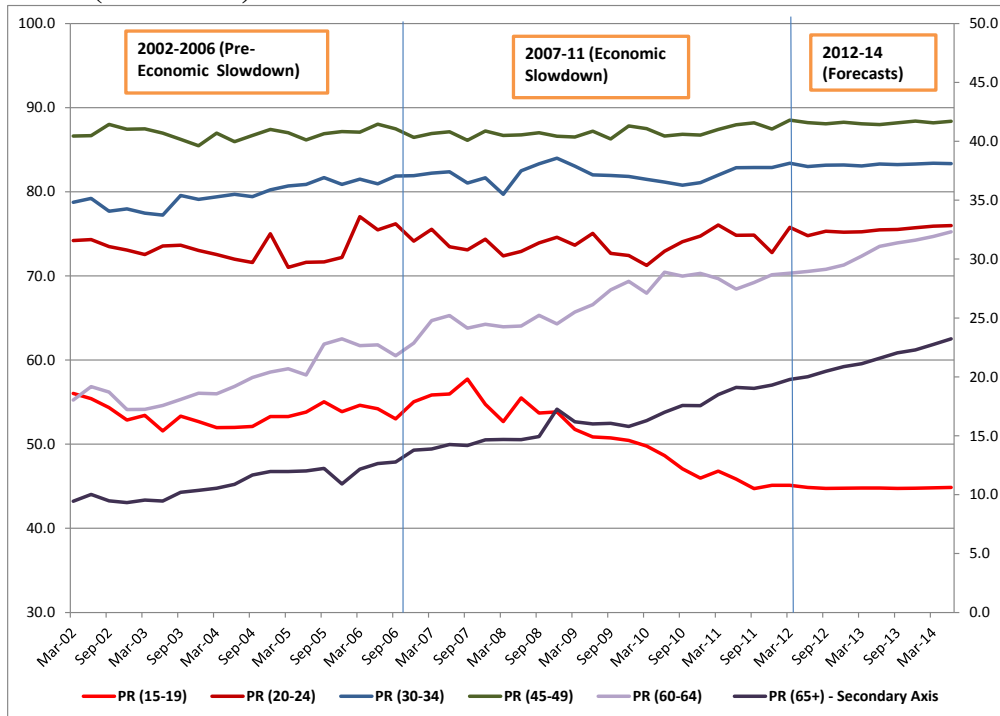
Participation rate is another important factor that affects unemployment rate changes. In Figure 3, the participation rate changes for six out of the eleven 5-yearly age cohorts have been presented for the historical (2002-12 March year) and forecast (2012-14) periods to contrast those age cohorts which had experienced substantial changes with those which had remained fairly stable.

This is based on the analysis of the age cohorts which had seen the greatest changes in the levels and percentages over the past 8 quarters as well as expected over the next 8 quarters (Appendix B: Table 2). The forecasts are based on the equations for disaggregated participation rates reported in Appendix B: Table 1 where the lagged disaggregated participation rates and aggregate employment rates are used to achieve the best fit of each equation. Five out of the 11 equations included lagged aggregate employment rates.

The average values (means) and their volatility measured as the coefficient of variation is summarised in Appendix B: Table 3.
This analysis suggests that:
        (1) the age cohorts which had seen the greatest changes over the two historical sub-periods (2002-06 and 2007-11) are those representing the
            a. "Entrants" to the working age population (15-19 age group)
            b. The post-peak participation rate age cohorts (the 60-64 age cohort in particular) and
            c. The 65+ age cohort which includes the "potential retirees".
        (2) the age cohorts which had seen the least changes over the two historical sub-periods (2002-06 and 2007-11) are those covering the
            a. Pre-peak participation rate (30-34 and 35-39) age cohorts
            b. Peak participation rate (40-44, 45-49 and 50-54) age cohorts and to some extent
            c. The "Trainees" (20-24 and 25-29) age cohorts.

The forecasts based on the equations reported in Appendix B: Table 1 indicate that the decline in the participation rate of the entrants to the labour market (15-19 age cohort) seen during the 2007-11 period in particular may have bottomed out while the participation rate of those in the older age cohorts, both post peak 60-64 age cohort and the potential retiree 65+ age cohort, is likely to continue to rise at recent historical growth rates.

IV.   Results

Baseline results on employment growth, participation and unemployment rates (under a net migration scenario of 5,000)

Using equation 1 of Appendix A, employment levels can be forecast for the next 2 quarters (e.g. from June quarter 2012 to Sept. quarter 2012). In order to forecast unemployment rates further out, we need the forecasts of employment levels from December quarter 2012 onwards. Using the baseline short-term employment forecast model developed by Infometrics for the Department, employment levels could be forecast for quarterly periods until June quarter 2014.

From Statistics New Zealand, we obtained the forecasts of the WAP for the mid-points of the next 9 quarters. The mid-points mean "medium fertility, medium mortality and long-term annual net migration of 5,000". Based on the forecasts of employment levels from June quarter 2012 to June quarter 2014 and the WAP from June quarter 2012 to June quarter 2014, we derive the forecasts of employment rates from June quarter 2012 to June quarter 2014 (see Identity 1 of Appendix A).

Then we use lagged participation rate of every age cohort, current and lagged employment rates to forecast the participation rate of every age cohort (see Appendix B). Finally we obtained forecast participation rates from June quarter 2012 to June quarter 2014 by calculating weighted average of all forecasting participation rates of age cohorts. The weights are the forecast WAPs of corresponding age cohorts.

Then we use the WAP and participation rate forecasts to calculate the forecasts of labour force (see Identity 2 of Appendix A). Next we get forecast unemployment levels using the forecasts of labour force and employment levels (see Identity 3 of Appendix A). Finally we forecast the unemployment rate using the forecast levels of unemployment and labour force (see Identity 4 of Appendix A). As seasonally adjusted data is used in the whole process, the forecast unemployment rate is also seasonally adjusted.

The data related to the baseline forecasts of unemployment rate and the associated employment growth and participation rates could be seen in the following two graphs (Figures 4 & 5) and the two tables (Tables 1 & 2) provided later summarizing these results.

Figure 4: Historical & Forecast Employment growth and Unemployment Rate Changes
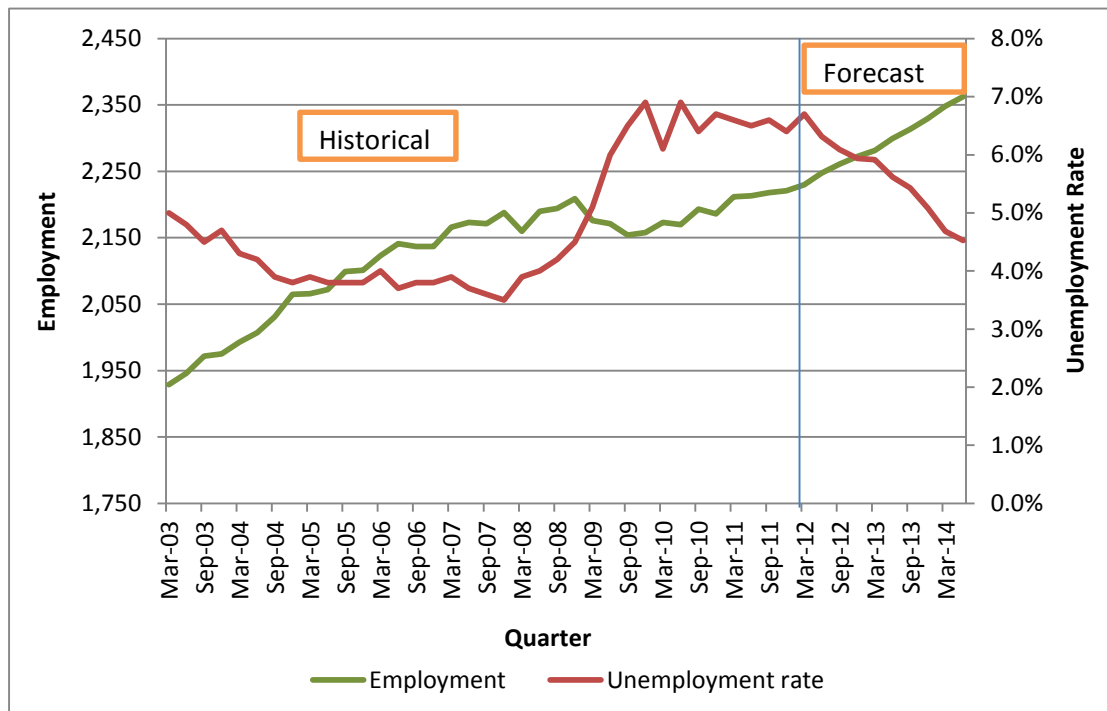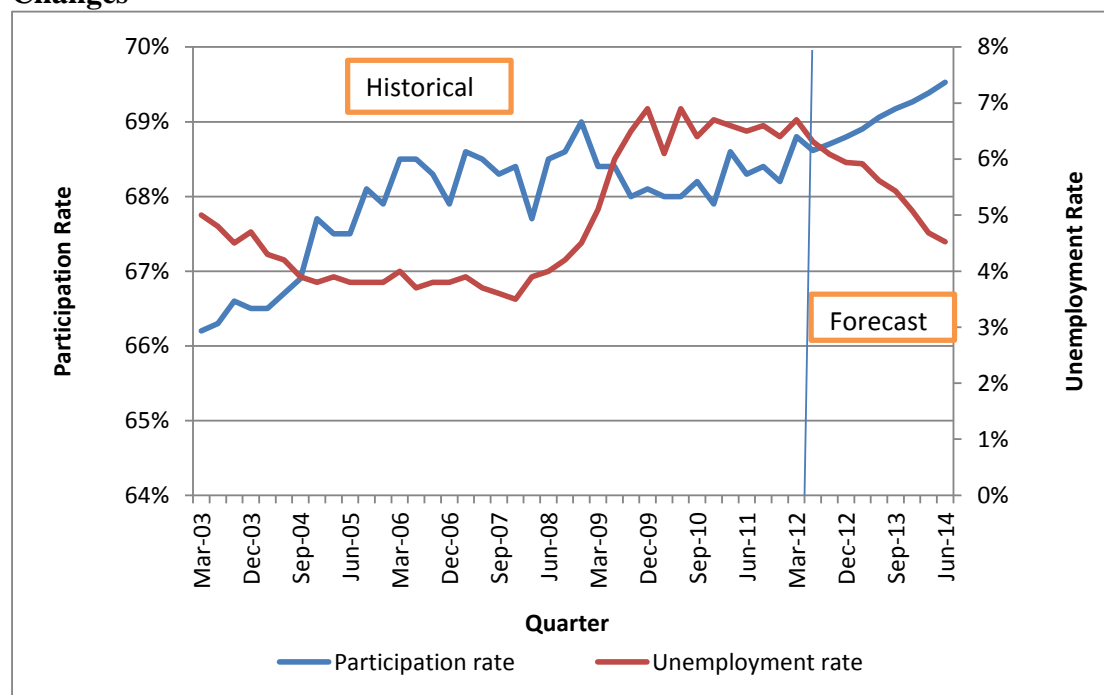
Figure 5: Historical & Forecast Participation Rate and Unemployment Rate Changes

According to Table 1, from June quarter 2012 to June quarter 2014, the forecasts of employment levels are always increasing (see Table 1). During the periods, there are 114,000 more people employed. The corresponding average quarterly growth rate is about 0.60%. The forecasts of WAP are enhancing with the period increase from June quarter 2012 to June quarter 2014. During this period, the increase in the WAP is 62,000. The average quarterly growth rate of WAP forecasts is about 0.22%. The enhancement of employment forecasts is much more than that of WAP forecasts because the growth rate of the former is about three times that of the latter. This leads to 0.41% average quarterly growth rate of employment rates.

Table 1 The forecasts of employment, working age population and employment rate

Quarter	Employment	Working Age Population	Employment Rate
June 2012	2,248,000	3,497,000	64.3%
Sept. 2012	2,261,000	3,504,000	64.5%
Dec. 2012	2,272,000	3,512,000	64.7%
Mar. 2013	2,281,000	3,519,000	64.8%
June 2013	2,300,000	3,528,000	65.2%
Sept. 2013	2,313,000	3,536,000	65.4%
Dec. 2013	2,330,000	3,543,000	65.7%
Mar. 2014	2,348,000	3,551,000	66.1%
June 2014	2,362,000	3,559,000	66.4%

Based on Table 2, the forecasts of PR are increasing from June quarter 2012 to June quarter 2014. The average quarterly growth rate of PR is about 0.16%. During the periods, the enhancements of WAP forecasts and PR forecasts result in the increase of corresponding labour force forecasts. The average quarterly growth rate of labour force is about 0.39%. Because the enhancement of employment forecasts is more than that of labour force forecasts, the forecasts of unemployment level are decreasing from June quarter 2012 to June quarter 2014 except for March quarter 2013. Then the

forecasts of unemployment rate are decreasing from 6.3% in June quarter 2012 to 4.5% in June quarter 2014.

Table 2 The forecasts of participation rate, labour force, unemployment level and rate

Quarter	Participation Rate	Labour Force	Unemployment	Unemployment Rate
June 2012	68.6%	2,399,000	151,000	6.3%
Sept. 2012	68.7%	2,408,000	147,000	6.1%
Dec. 2012	68.8%	2,416,000	143,000	5.9%
Mar. 2013	68.9%	2,425,000	143,000	5.9%
June 2013	69.1%	2,437,000	137,000	5.6%
Sept. 2013	69.2%	2,446,000	133,000	5.4%
Dec. 2013	69.3%	2,454,000	125,000	5.1%
Mar. 2014	69.4%	2,464,000	115,000	4.7%
June 2014	69.5%	2,474,000	112,000	4.5%

V. Summary and Labour Market Implications

The method described here is a simple integrated macro-labour market forecasting framework. It is also a new method to forecast short-term unemployment rate within the Department. It only requires limited inputs, GDP and the working age population. It is useful for purposes of the Department's quarterly Labour Market Update when the implications of the latest GDP releases for the labour market are also discussed (midway between HLFS releases) and for the HLFS preview process (one week ahead of each HLFS release). In addition, the model provides the forecasts of other important labour market components such as participation rate, labour force growth and so on. Based on these forecasts, trends in key macro labour market components and relationship between the macro labour market drivers could be assessed better.

Over the 5 years from 2003-08, there was about 250,000 employment growth or on average about 50,000 annual employment growth. This led to about 1.5% unemployment rate reduction from 5% to 3.5%. During this period, participation rate also rose by 3% from 66% to 69%. Over the 4 years from 2008-12, with the advent of the economic slowdown, there was about 80,000 employment gain or on average, about 20,000 net annual employment growth. This led to the doubling of the unemployment rate to 7% before falling somewhat. During this period, participation rate declined by 1% initially before making up most of this fall.

Over the 2 year forecast period from 2012-14, about 100,000 employment growth or on average about 50,000 annual employment growth associated mainly with the Canterbury re-build could lead to about 2% unemployment rate reduction from about 6.5% to 4.5%. During this period, participation rate also could rise by about 1% from 68.5% to 69.5% limiting further decline in the unemployment rate.

Appendix A: Estimated Aggregate Equations, Derivations & Identities

Equation 1: Forecast employment levels using GDP.

```
Dependent Variable: DLEMP
Method: Least Squares
Date: 05/21/12   Time: 14:37
Sample (adjusted): 1991Q3 2012Q1
Included observations: 83 after adjustments
HAC standard errors & covariance (Bartlett kernel, Integer User bandwidth =
    35.0000)
```

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003753	0.000472	7.952375	0.0000
DLGDP(-3)	0.242872	0.070604	3.439929	0.0009
DLGDP(-5)	0.144392	0.041401	3.487664	0.0008
DLGDP(-16)	-0.230740	0.044176	-5.223246	0.0000

R-squared	0.259160	Mean dependent var	0.004666
Adjusted R-squared	0.231027	S.D. dependent var	0.006481
S.E. of regression	0.005683	Akaike info criterion	-7.455689
Sum squared resid	0.002551	Schwarz criterion	-7.339118
Log likelihood	313.4111	Hannan-Quinn criter.	-7.408857
F-statistic	9.211899	Durbin-Watson stat	2.324589
Prob(F-statistic)	0.000027		

There are some derivations and identities in this forecasting framework as follows:

$$(1) \qquad ER_t = \frac{EMP_t}{WAP_t}$$

$$(2) \qquad LF_t = PR_t * WAP_t$$

$$(3) \qquad UE_t = LF_t - EMP_t$$

$$(4) \qquad UR_t = \frac{UE_t}{LF_t}$$

In which;

EMP_t = Employment level
GDP_t = GDP
WAP_t = Working age population
ER_t = Employment rate
PR_t = Participation rate
LF_t = Labour force
UE_t = Unemployment level
UR_t = Unemployment rate.

Appendix B: Estimated Disaggregated Participation Rate Equations and Analysis of Historical Changes by Age Cohorts

Table 1 of Appendix B: Equations Forecasting Participation Rates by Age Cohorts (based on average net migration=5,000)

Items	Dependent Variables - Changes in lagged Participation Rates (DLPR) by Age Cohorts										
Independent Variables	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**	**55-59**	**60-64**	**65+**
DLPR(-1)	-0.226***	-0.385***	-0.353***	-0.260**	-0.245**	-0.384***	-0.405***	-0.374***			-0.257***
DLPR(-2)			-0.220***				-0.310***				
DLPR(-3)							-0.255**	-0.223**	-0.188***		0.145***
DLPR(-4)				-0.356***		-0.173**	-0.325***	-0.273***	-0.178***	-0.317***	
DLPR(-5)							-0.207**			0.226***	
DLPR(-6)			0.214***								
DLPR(-8)							-0.212**		-0.128***	-0.323***	
DLPR(-9)											0.164***
DLER		0.846***									
DLER(-1)											1.398**
DLER(-2)	0.654***										
DLER(-3)	0.665*				0.266***						
DLER(-4)									0.271***		
DLER(-6)									0.400***		
R-squared	0.109	0.286	0.190	0.209	0.123	0.164	0.259	0.218	0.174	0.284	0.110
Adjusted R-squared	0.082	0.272	0.164	0.193	0.105	0.147	0.210	0.194	0.128	0.226	0.071
F	3.973	20.016	7.359	12.817	6.859	9.515	5.198	8.919	3.794	4.887	2.790
AIC	-4.556	-5.524	-6.315	-6.533	-6.986	-6.750	-7.062	-6.408	-6.135	-5.238	-3.144

Table 2 of Appendix B: Historical and Forecast Participation Rate Changes (Levels and Percentages)

Items	Age Cohort											Weighted Averages
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	
Historical PR Changes (March quarter 2010 to March quarter 2012)												
Level Change	-4.7%	4.5%	1.9%	1.9%	-0.8%	-0.4%	1.0%	0.3%	2.5%	2.4%	3.5%	0.8%
Percentage Changes	-1.17%	0.79%	0.29%	0.30%	-0.12%	-0.06%	0.14%	0.04%	0.39%	0.44%	2.69%	0.15%
Forecast PR Changes (June quarter 2012 to June quarter 2014)												
Level Change	0.0%	1.2%	0.4%	0.3%	0.4%	-0.4%	0.2%	1.0%	2.5%	4.7%	3.2%	0.9%
Percentage Changes	0.00%	0.20%	0.06%	0.05%	0.05%	-0.06%	0.02%	0.14%	0.37%	0.84%	2.02%	0.17%

Table 3 of Appendix B: Participation Rate by Age Cohorts: Historical (2002-2012) and Forecasts (2012-2014)

Averages	PR (15-19)	PR (20-24)	PR (25-29)	PR (30-34)	PR (35-39)	PR (40-44)	PR (45-49)	PR(50-54)	PR(55-59)	PR (60-64)	PR (65+)
2002-06	53.6	73.4	79.8	79.8	82.4	85.7	86.9	84.4	77.1	58.0	11.1
2007-11	50.9	73.8	81.4	82.0	82.8	85.7	87.0	86.2	81.0	67.1	16.3
2012-14	44.8	75.5	82.5	83.2	83.1	85.3	88.2	87.3	84.3	72.7	21.4
Variability*	PR (15-19)	PR (20-24)	PR (25-29)	PR (30-34)	PR (35-39)	PR (40-44)	PR (45-49)	PR(50-54)	PR(55-59)	PR (60-64)	PR (65+)
2002-06	2.3%	2.2%	1.4%	1.9%	0.5%	1.0%	0.8%	1.4%	3.1%	5.0%	12.1%
2007-11	8.0%	1.7%	1.1%	1.2%	0.9%	0.7%	0.6%	0.8%	1.4%	3.7%	10.7%
2012-14	0.2%	0.5%	0.2%	0.2%	0.1%	0.2%	0.2%	0.4%	1.0%	2.6%	5.4%
	Entrants	**Trainees**		**Pre-Peak**		**Peak**			**Post-Peak**		**Retirees**