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SEF Working paper: 09/2015

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Working Paper 09/2015
ISSN 2230-259X (Print)
ISSN 2230-2603 (Online)

Recessions and Recoveries in New Zealand's Post-Second World War Business Cycles

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April 2015

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Abstract

We compute classical real GDP business cycles and growth cycles, contrast classical recessions with 'technical' recessions, and assess the sensitivity of our peaks and troughs to data revisions. Using this information we find that, on average, real GDP and employment cycles have had an 89% association. Other key findings are (i) New Zealand's average pattern of recovery has differed from that for U.S. NBER cycles, but their most recent recession and recovery paths have been unusually similar; (ii) the strength of New Zealand's business cycle recoveries has been independent of the depth, duration, or severity of the preceding recession; and (iii) investment is an important component of expansions, and in the current cycle it has been residential investment and plant and equipment investment that have been unusually slow to recover their levels at prior business cycle peaks.

JEL Classification: E01, E24, E32

Keywords: Classical business cycles; growth cycles; employment cycles; recessions; economic recoveries; New Zealand

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This April 2015 paper supersedes Reserve Bank of New Zealand (RBNZ) Discussion Paper DP2014/02, Hall and McDermott (2014). In particular, its real GDP and employment data series have been updated to the September quarter of 2014, and the real GDP business cycle results reflect Statistics New Zealand's substantially revised National Accounts data released 18 December 2014.

The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Reserve Bank of New Zealand. We thank an RBNZ Discussion Paper referee for perceptive comments, and acknowledge audience and discussant contributions from a presentation to Motu's Public Policy Seminar Series on 23 October 2013. We are also grateful to Brian Easton for his very helpful insights on key data periods, and for supplying his Haywood and Campbell diffusion index data during our construction of the preferred Hall and McDermott (2011) data series.

Recessions and Recoveries in New Zealand's Post-Second World War Business Cycles

1. Introduction

In the wake of the global financial crisis, New Zealand has recorded a range of positive and negative real GDP growth rates, and markedly variable employment growth rates.

Against this background, we first present classical business cycle turning points and properties for the Hall and McDermott (2011) quarterly real GDP series updated to 2014q3. We then establish the number of two-or-more-quarter negative growth rate (or 'technical') recessions recorded for New Zealand's post-Second World War economy, and offer a set of growth cycle turning points similar to those published by the MIAESR (2013). This enables us to assess the extent to which New Zealand's classical and growth cycle contraction phases have been consistent with its technical recessions. We also explore the sensitivity of our peaks and troughs to Statistics New Zealand (SNZ) data revisions.

Next, we provide a set of classical employment cycle peaks and troughs from a linked quarterly Chapple (1994)-RBNZ-SNZ total employment series dating from 1956q1. This enables us to assess the degree of association between output and employment cycles.

Our assessments are considered in the context of the procedures used by the NBER's Business Cycle Dating Committee (NBER, 2010), who state that most but not all of their identified U.S. recessions consist of two or more quarters of declining real GDP, and that the committee neither relies on a simple rule of thumb such as two successive quarters of negative growth nor on real GDP alone.

The classical business cycle and employment cycle turning points reflect Bry–Boschan (1971) (BB) dating, and the growth cycle turning points reflect HP 1600 detrending and BB-assisted dating. The results for degree of association are obtained from the concordance-based methodology of Harding and Pagan (2002, 2006), as illustrated for New Zealand regional cycles in Hall and McDermott (2007).

From the above results, we can then address questions such as the following: (1) how often in New Zealand's post-Second World War sample period would calling a technical recession have provided potentially misleading signals to decision makers?; (2) would the publishing of growth cycle peaks and troughs have added greater confusion or further enlightenment?; (3) how robust have our classical and technical recession turning points been to revisions in SNZ's data observations and data series?; (4) have New Zealand's classical real GDP and employment cycles been closely associated, and should employment peaks and troughs additionally be taken into account when calling the beginning and end of a recession?; and (5) to what extent have the length, depth and severities of New Zealand's recessions and strengths of recoveries differed over time, and does the length, depth or severity of preceding recessions matter for subsequent economic recovery? Also, (6), how different has the recovery path from New Zealand's most recent recession been?

With respect to these questions, literature on recoveries from recessions has been relatively modest (e.g. Wynne and Balke (1992), Sichel (1994), Balke and Wynne (1995)), but in the context of the recent global financial crisis there has been some resurgence, e.g. IMF (2009), Reinhart and Rogoff (2009), Hall (2010, 2011), Claessens et al., (2011, 2012), Mussa (2010), Bordo and Haubrich (2012), Dominguez and Shapiro (2013), Ng and Wright (2013), and Taylor (2014).

The paper is structured as follows: Section 1 has introduced. Section 2 provides evidence on the three sets of real GDP business cycles, assesses the credibility of calling technical recessions from two or more quarters of negative growth, and considers the robustness of our business cycle turning points to data revisions. In section 3, classical employment cycle turning points and properties are presented and their degree of association with classical output cycles is assessed. Section 4 presents evidence on recession, recovery and expansion phases, assesses whether strength of recovery from recessions can be associated with recession severity, and provides evidence from two recent New Zealand business cycle recoveries. Section 5 concludes. The Appendix provides the Hall-McDermott (2011) quarterly real GDP data updated to 2014q3, and the updated linked quarterly Chapple (1994)-RBNZ-SNZ total employment series dating from 1956q1.

2. New Zealand's real GDP business cycles, and the credibility of calling 'technical' recessions

In 1946, Arthur Burns and Wesley Mitchell (1946, p 3) of the U.S. National Bureau of Economic Research (NBER) advanced their now widely-recognised definition of a business cycle, namely that "Business cycles are a type of fluctuation found in the aggregate activity of nations; … a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general … contractions …". This definition recognises that every business cycle will have a *peak*, a *trough*, an *expansion phase* between its trough and peak, and a *contraction phase* between its peak and trough.

The NBER (2010) also refers to a *recession* as a period between a peak and a trough, though in a more detailed sense consider a recession as a "… significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in production, employment, real income, and other indicators." They further state that most but not all of their identified U.S. recessions consist of two or more quarters of declining real GDP, and that the committee relies neither on a simple rule of thumb such as two successive quarters of negative growth nor on real GDP alone.

There is no universally accepted way of operationalising the measurement of these business cycle characteristics, though two widely utilised types of cycle are the classical cycle and the growth cycle. Empirical results for our updated New Zealand real GDP series are considered for each of these two broad categories of cycle, along with a set of technical recessions called from two or more quarters of negative real GDP growth.

2.1 The Classical business cycles and their properties

A *Classical* cycle is concerned with movements in the *levels* (or log levels) of an aggregate economic series such as real GDP, and since 1971 economists have successfully used computer algorithms to automate the NBER method of dating turning points. It is also the case that for nearly 20 years in New Zealand, either BB or BBQ quarterly adaptations of the simple, transparent, and readily replicated Bry and Boschan (1971) methodology have been used successfully to assist in dating quarterly classical turning points in real GDP, aggregate economic activity and regional economic activity series.

In this paper, our primary focus is on results which come from a BB algorithm, details of which can be found in those previous applications (Kim, Buckle and Hall, 1995; and Hall and McDermott, 2007)[i]. This is in the spirit of what King and Plosser (1994, p 410) have described as the Bry and Boschan general procedure of looking for turning points in a smoothed seasonally adjusted series " … so as not to be misled by 'erratic' movements." Harding and Pagan (2002, p 368, fn 4) have since similarly characterised the smoothing aspect as " … simply aiding in the process of identifying peaks and troughs through the removal of some idiosyncratic variation.", but then went on to suggest that the benefit of smoothing could be 'much reduced' if dating were being done with quarterly data. This led them to write their now-widely used BBQ program, which ignores the smoothing element of the monthly BB program (Harding and Pagan, 2002, pp 368-69). For our quarterly New Zealand real GDP data, we find that for almost all episodes the BB and BBQ programs produce identical results (Table 3). Two exceptions are: (i) BB calls a four-quarter recession from a 1987q4 peak, as against BBQ producing a nine-quarter recession from a peak of 1986q3; and (ii) BB does not call a short two-quarter recession from a 2010q2 peak, whereas BBQ does. In both cases, the difference can be attributed to the absence or presence of the smoothing element. New Zealand introduced a previously announced GST of ten per cent from 1 October 1986, and the resulting two-quarter upward spike in real GDP for 1986q2 and 1986q3 was followed by a major downward spike in 1986q4. We have classified the quarters directly affected by the introduction of the ten per cent GST as 'erratic' movements rather as quarters of recession. Inspection of successive releases of SNZ data for 2010 suggests that any short two-quarter recession from the 2010q2 peak called by BBQ but not by BB is a relatively marginal call, again directly related to excluding or retaining the smoothing element. Hence, on balance, the methodological approach adopted in this paper has been to present preferred turning points as coming from the BB program (which includes BB's smoothing element), and to make transparent periods where the BB and BBQ programs produce different results (e.g. Tables 5, 6).

From our results using the BB algorithm and SNZ's real GDP data release of 18 December 2014, we therefore identify eight peak-to-peak classical real GDP cycles for New Zealand's post-Second World War period (Table 1)[ii]. These cycles have an average expansion phase of almost 6.5 years, and an average contraction phase of just over one year. The average expansion phase has therefore been considerably longer than the average contraction phase, though individual cycles should obviously be considered in the context of New Zealand's business cycles and phases having continued to display considerable variation around averages, especially over expansion phases (Figure 1, top panel). The average expansion phase duration of 25.9 quarters has a standard deviation of 17.1 quarters, and the average contraction phase of 4.2

quarters has a standard deviation of 1.6 quarters.

This considerable individual cycle diversity is not dissimilar to that experienced by Australia. For example, taking New Zealand's cycles for the 1960-2011 period of Australia's monthly classical cycles (MIAESR, 2013), and bearing in mind that the Australian figures exclude the still incomplete expansion phase of their current cycle, the average cycles, expansion and contraction durations have been 6.5, 5 and 1.5 years for Australia, and 8.1, 7.1 and 1.0 years for New Zealand. Their standard deviations are also not dissimilar: 4.2, 4.3 and 0.3 years for Australia and 4.3, 4.2 and 0.4 years for New Zealand.

From the classical real GDP turning points, we confirm that New Zealand's most recent recession commenced with the March 2008 quarter and ended with the March 2009 quarter. The *duration* of this five-quarter recession has been somewhat longer than the average post-Second World War recession of 4.2 quarters; but its 3.2 percentage *depth* (amplitude) has been considerably less than those for the 1951/52 and 1948 recessions, below that for the 1976/78 episode, similar to the depths for the 1982/83 and 1991 recessions, and less than the average depth of 4.0 per cent (Table 2).

But what of the overall *severity* of the eight recessions? The Harding and Pagan (2002) and Pagan (2005, p11) measure of cumulated gain or loss can be used to reflect both the combined duration and depth of a recession, and by this measure, New Zealand's most recent recession has been its fourth most severe. Its cumulated GDP loss of 6.8 per cent has been less than the average loss of 9.9 per cent, and less severe than the losses for 1951/52 (37.2 per cent), 1948 (15.6 per cent) and 1976/78 (12.8 per cent) (Table 2).

2.2 How many technical recessions?

When we compute turning points from the easy-to-follow, frequently–used practice of calling a recession immediately after two successive quarters of negative real GDP growth have been published, we obtain 11 completed peak-to-peak cycles and 12 contractionary phases. This compares with the eight classical cycles and nine contractionary phases computed from the BB method (Table 3). The additional three short technical recessions of two, four and two quarters would have been for 1975q3 to 1975q4, 1989q3 to 1990q2, and most recently for the 2010q3 to 2010q4 period[iii]. Also, the troughs of the 1951/52 and 1988 recessions would have been called two quarters earlier at 1951q4 and 1988q2, and the beginning of the 1967 recession would have been called two quarters later at 1967q3.

On this evidence, do two or more quarters of negative real GDP growth always constitute a recession? The short answer is 'not always', though this should be further seen in the context of this procedure correctly calling six of the nine recessions, and the beginning quarter for eight of the nine recessions. The NBER (2010) provide illustrations as to why their Dating Committee will not accept unconditionally the two-quarter convention, including because they require evidence of a 'significant decline in economic activity spread across the economy', and wish to consider more than just real GDP series and more than just 'product-side' GDP estimates.

Hence, although we show that the commonly-used practice of calling a technical recession can

provide conditionally useful evidence, this procedure can also on occasions signal somewhat different beginning and end points for a recession. For example, the procedure matched exactly six of the nine Classical business cycle contraction phases identified by the Bry-Boschan method, but it also called three additional recessions and called differently by two quarters the timing of a beginning or end point for three of the nine recessions. This suggests that a signal provided by this procedure should not be used on its own for the formal calling of a recession.

2.3 What about growth cycles and growth cycle recessions?

A *growth cycle* reflects fluctuations in aggregate economic activity relative to an appropriate *trend* in the series. There are a considerable number of ways of 'detrending' individual series, and hence of getting the corresponding 'deviations-from-trend' growth cycles.

Here, we first detrend our real GDP series, utilising the well-known HP 1600 procedure previously used successfully for New Zealand series reported in Kim, Buckle and Hall (1994, 1995), and Hall, Kim and Buckle (1998). We then use the BB algorithm to identify turning points in the detrended series (Table 4; Figure 1, bottom panel).

Perhaps not surprisingly, given that movements in New Zealand's real GDP series are relatively volatile by international standards, the use of this growth cycle methodology would have led to calling 15 completed peak-to-peak cycles compared with only eight classical cycles, and would have recorded 16 potential post-Second World War recession periods with an average duration of 1.7 years and a standard deviation of 8.4 months. The average expansion phase is commensurately very much shorter, at 2.3 years relative to 6.5 years for the average classical cycle.

For two reasons, we do not proceed further with assessing this considerably greater number of much shorter cycles, significantly shorter expansion phases, and somewhat longer contraction phases. The first reason is methodological. As emphasised by Harding and Pagan (2002, pp 367-68), establishing classical cycles does not require detrending of the series, a procedure which can lead to growth cycle turning points and 'growth recessions' which vary considerably with the detrending method. Secondly, in a New Zealand empirical context, the illustrative growth recessions presented in Figure 1 may not be particularly useful for medium-term-focussed fiscal and monetary policy makers or for private sector decision makers.

This is not to say, however, that the computation of sample-average growth cycle properties for the purposes of establishing key business cycle facts, to assist the calibration of modern DSGE and other macro models, will not remain a valuable exercise[iv].

2.4 Robustness of our business cycle turning points to SNZ data revisions

In an earlier version of this paper (Hall and McDermott, 2014, Tables 1, 6), our BB method dated New Zealand's most recent recession as commencing with the March 2008 quarter and concluding with the *June* 2009 quarter[v]. However, the BB results presented in this paper (Tables 1, 6, 10) have this recession concluding with the *March* 2009 quarter, corresponding to a recession of five rather than six quarters, and a depth of -3.2% instead of -3.9%. This led to the

average duration for the nine post-War recessions decreasing slightly from 4.3 to 4.2 quarters and the average depth being marginally lower at -4.0% instead of -4.1%.

Another partial example of sensitivity to SNZ data releases is provided in Sleeman (2006, Figure 2, and p 36), in the context of the 1997-98 recession. Her illustration for successive June 1998 quarter real expenditure based GDP releases led her to conclude that successive revisions over just a two year period could lead to a substantial effect on the timing and magnitudes of peaks and troughs in an economic cycle. More recently, in a U.S. context and in a finding similar to that of Hamilton (2011), Ng and Wright (2013, pp 1140, 1142) have suggested that one reason why computer algorithms tend to call business cycle peaks and troughs at around the same time as NBER Dating Committee announcements, is because U.S. real-time data are subject to large revisions.

To what extent, therefore, are the real GDP production-based turning points reported in this paper robust to SNZ data revisions and data series revisions?

We utilise the RBNZ's real-time quarterly real GDP data base described in Sleeman (2006), in association with the methodology developed in Hall and McDermott (2011), to provide robustness-related insights on two questions: (1) have data and data series revisions materially affected our BB turning points?; and (2) has the two-negative-quarter/technical approach to calling recessions been more sensitive to revisions than has the BB algorithm approach? The latter question is illustrated in the context of the 1997-98 and 2008-09 recessions, and the two-quarter recession called for 2010 by the two-negative quarter approach.

On the first question, utilising SNCQ releases from 28/09/2001 to 22/09/2011, and SNDQ releases for 20/12/2012 and 19/12/2013, we find that our BB turning points are relatively robust to data revisions both *within* and *between* the SNCQ and SNDQ series releases (Table 5). In particular from these releases, there is no lack of robustness in BB's calling the 97q2 peak and the 98q2 trough for the 1997-98 recession; nor in not calling a two-quarter recession for 2010. Three sets of exceptions can be noted. These are firstly that the 28/09/2001 release called not only the pre-GST related spike in activity of 1986q3 as a peak ahead of the 1987-88 recession, but also called an additional three-quarter recession from 1989q3 to 1990q1 during the flat activity period of the mid-to late 1980s. Both these calls were then eliminated by the release of 22/12/2005, with the 1986q3 spike having been replaced by the currently called peak of 1987q4. Secondly, also within the SNCQ releases, the trough for the 2008-09 recession was not called from the 26/06/2009 and 23/09/2009 releases, but was then dated at 2009q1 by the 23/12/2010 and 22/09/2011 SNCQ releases. Then thirdly, and further in the context of the 2008-09 recession, calling the end point has not been robust between Table 5's final two SNCQ releases, the two SNDQ series releases, and the initial SNEQ series release. The 2008-09 recession has now reverted to concluding with the March quarter of 2009, rather than having an end point at the June 2009 quarter[vi]. The fact that both individual data and data series revisions have materially affected BB turning points for the 2008-09 recession confirms that for certain recessions, results from even the relatively robust BB algorithm should be treated with some caution until sometime after a recession end-point has been signalled[vii].

For the second question, the simple two-negative-quarter/technical approach allows us to explore implications from real-time data releases back to 26/09/1997. This enables us to get both a longer-term and a much closer to real-time perspective on the effect of data revisions on the 1997-98 recession. First, however, it can be noted that its call from the SNDQ releases of a two-quarter recession from 2010q2 to 2010q4 has not been affected by the substantially revised SNEQ data release of 18/12/2014. Secondly, it is also of note that the end point of the 2008-09 recession, while called consistently at 2009q2 for the SNDQ releases, was again called at 2009q1 by the final three SNCQ releases and by the initial SNEQ release (Table 7). Utilising the technical approach to call the 1997-98 recession in real-time would, however, have led to considerably greater uncertainty, as the earliest releases for that period led to material variation in dating the beginning and end of that recession. For example, no technical recession was called by the SNBQ releases for either 26/06/1998 or 25/09/1998, and the SNBQ releases from 23/12/1998 to 29/09/2000 then called a two quarter technical recession for 98q1 and 98q2. This was followed by three-quarter recessions called for 97q3 to 98q1 from SNCQ releases 21/12/2000 through to 22/09/2011, and for our subsequent SNDQ and SNEQ releases. Hence, while the technical approach has provided dating points for the 1997-98 recession which have been as robust as those from the BB algorithm for revisions associated with SNCQ, SNDQ and SNEQ releases, signals from the closer to 1997-98 real-time SNBQ releases would have created considerable uncertainty for forecasters and policy makers.

Overall, therefore, our turning points are relatively robust to data revisions, especially within data series releases, but for the technical approach there is also material sensitivity to revisions in relation to the 1997-98 recession, and for the BB, BBQ and technical approaches to the 2008-09 recession as between the SNCQ, SNDQ and SNEQ series releases.

3. New Zealand's employment cycles

Although the NBER Business Cycle Dating Committee does not have a fixed definition of 'economic activity', it considers 'economy-wide employment' as a key broad measure when finalising its business cycle turning points. This seems not least when its real GDP and real gross domestic income (GDI) measures are not providing sufficiently clear signals.

We therefore assess whether a measure of New Zealand's total employment might provide insights additional to those provided by our real GDP series. To do this we had to search for a credible quarterly total employment series which could extend back as least as far as the 1950s.

Claus (2011) has recently incorporated labour market indicators, so as to assess seven leading indicators of New Zealand employment, but with the relatively short sample period 1990q1 to 2005q3. Statistics New Zealand's (SNZ) Household Labour Force Survey (HLFS) series extend further back but only as far as 1986q1, and are therefore also too short on their own for our purposes. Fortunately, however, Simon Chapple (1994) has published a number of HLFS-consistent series back to 1956q1, and from this and the corresponding Chapple total employment observations available in electronic form from the RBNZ's website, we are able to use what we refer to as a linked Household Labour Force Survey (HLFS)-consistent Chapple-RBNZ-SNZ total employment series to compute classical employment cycle turning points and associated properties[viii].

The use of this sample period has the advantage of extending quarterly total employment observations sufficiently far back so as to cover six of our eight completed Classical real GDP cycles, i.e. they exclude only the relatively unusual 1948 and 1951/52 contraction phases[ix].

3.1 The Classical employment cycles

Peak-to–peak employment cycles and associated expansion and contraction phases are the same in number as those for our classical real GDP cycles, i.e. six cycles, six expansion phases and seven contraction phases (Table 8; Figure 2). Their *average* durations are also remarkably similar. However, it is also noticeable that while the average durations for employment and real GDP cycles, expansion and contraction phases have remained relatively similar, the average standard deviations for employment cycles and phases have been considerably higher than for their real GDP counterparts.

Moreover, visual inspection of the recessions shaded in the two panels of Figure 2 reveals that the average properties fail to highlight different timings and durations for a number of the individual cycles. For example, employment troughs lag output troughs for six of our seven cycle troughs, but employment peaks have variously led, lagged or been contemporaneous with output peaks. It is also worth bearing in mind that employment peaks have led real GDP peaks on two occasions.

So, can one get a summary guiding rule as to the extent to which employment peaks and troughs might have led, lagged or been contemporaneous with those for real GDP?

3.2 How associated are output and employment cycles?

We have previously used the simple non-parametric concordance statistic of Harding and Pagan (2002, 2006) to establish the statistical significance of associations between New Zealand's aggregate and regional economic activity cycles (Hall and McDermott, 2007). We again follow this methodology.

A concordance statistic describes the proportion of time during which two series for which one has cyclically dated turning points, are in the same phase of expansion or contraction. In our case, we assign a value of one when both the real GDP series (x_i) and the employment series (x_j) are expanding or contracting, and award a value of zero otherwise. Then, following Harding and Pagan (2002), we let $S_{i,t}$ be a binary random variable with value one when the classical cycle for the real GDP series is in an expansion phase and zero when it is in a contraction phase; similarly, $S_{j,t}$ is the binary random variable for the employment series. The index of concordance for these two series then becomes

$$C_{ij} = T^{-1}\left\{\sum_{t=1}^{T}\left(S_{i,t} \cdot S_{j,t}\right) + \sum_{t=1}^{T}\left(1 - S_{i,t}\right)\left(1 - S_{j,t}\right)\right\}$$

where T is the sample size, and C_{ij} is the measure of the proportion of time the two series are in the same phase. By way of interpretation, this means that the real GDP series would be in the

same expanding or contracting phase exactly pro-cyclically if C_{ij} had value one, and exactly counter-cyclical if C_{ij} were to have value zero.

We are, however, interested not only in the magnitude of the concordance statistic but also in its statistical significance. To obtain the corresponding tests for significance, we again follow a procedure suggested by Harding and Pagan (2002), and as outlined more fully in Hall and McDermott (2007, section 2.2). The procedure involves using a GMM estimator, with moment condition

$$E\left(\left(S_{i,t}-\bar{S}_{i,t}\right)\left(S_{j,t}-\bar{S}_{j,t}\right)-a\right)=0,$$

where $\bar{S}_{i,t}$ is the mean of the real GDP time series $S_{i,t}$, and the test of significance is whether $a=0$.

From our concordance statistic measures, we find that our classical employment cycle expansion or contraction phases have been positively associated with the real GDP phases around 89 per cent of the time, and that the strongest statistical significance of 90 per cent occurs where employment cycle turning points lag those of output cycles by one quarter (Table 9). However, it should also be borne in mind that contemporaneous and two quarter lag specifications have statistically significant associations of 88 and 89 per cent respectively.

3.3 Should employment peaks and troughs additionally be taken into account when calling the beginning and end of a recession?

The empirical evidence presented immediately above suggests that while the expansion and contraction phases of real GDP and employment cycles have, *on average*, been closely associated, it has also not been the case for every individual cycle that the expansion and contraction phases for employment have lagged real GDP phases by one quarter.

This suggests that if one is additionally considering movements in total employment for the purposes of calling turning points for a recession, then as a minimum the circumstances particular to that cycle should also be assessed. But it should also be recognised that the above results are preliminary in nature, and there could be benefit from further investigation of the extent to which employment cycle information should or should not be taken into account formally when calling beginning and end periods for New Zealand's recession periods[x].

4. Recessions, recoveries and expansions

In the context of what Robert Hall (2011, pp 431-432) has recently termed the "Great [U.S.] Slump"[xi] that commenced in late 2007, and what some others have referred to as the "Great Recession", there has developed considerable interest in better understanding recessions, and the recovery and expansion phases of business cycles, e.g. IMF (2009), Reinhart and Rogoff (2009), Hall (2010, 2011), Claessens et al., (2011, 2012), Mussa (2010), Bordo and Haubrich (2012), Dominguez and Shapiro (2013), Ng and Wright (2013), and Taylor (2014).

In early work using U.S. data for the period 1950q1 to 1992q4, Sichel (1994) investigated

whether recessions have typically been followed by high-growth recoveries back to pre-recession levels. He concluded in the affirmative (p 276).

Also in earlier work, Wynne and Balke (1992) addressed the question of whether *deep* recessions in the U.S. over the period 1884-1990 had been followed by strong recoveries. They found a statistically significant relationship between the size of the peak-to-peak decline and growth in the twelve-month period following the trough, and that recession length had not significantly affected the strength of recovery.

Against this background, the results reported in sections 4.1 and 4.2 provide a preliminary perspective on the extent to which there may have been associations between the length, depth, or severity of New Zealand's post-Second World War recessions, and recovery and expansion phases[xii]. In section 4.3, we provide brief commentary on the real GDP recession and recovery paths from New Zealand's 1991 and 2008/09 recessions. Then, in section 4.4 we illustrate, as have Sichel (1994), Balke and Wynne (1995), Hall (2010, 2011), and Mussa (2011) for the U.S., and Boivin (2011) for Canada, the behaviour of key GDP expenditure components for New Zealand's post-1991q2 and post-2009q2 recovery phases.

4.1 To what extent have the depths and severities of New Zealand's recessions and strengths of recoveries differed over time?

Depths of recessions, and *strengths* of recovery and expansion phases can be illustrated by amplitude per quarter or equivalent annualised measures (Table 10).

The average annualised amplitude (or *depth*) for New Zealand's nine post-Second World War *recessions* has been -3.9 per cent, though if the two deepest recessions from 1948q1 and 1991q1 are excluded the average is reduced to -3.0 per cent. The average is reduced further to -2.5 per cent if the third deepest recession from 1951q1 is excluded, a figure which is closer to but still greater than the average of -2.2 per cent found by Claessens et al (2012, Table 1) for 21 "advanced" OECD countries for the period 1960q1 to 2010q4.

New Zealand's most recent recession of five quarters has been somewhat longer than the average of 4.2 quarters, its depth of -3.2 per cent has been shallower than the average of -4.0 per cent, and its annualised depth of -2.6 per cent ranks fifth, considerably less than the average of –3.9 per cent, and far less deep than the -8.0 per cent and -6.3 per cent figures for the recessions from 1948q1 and from 1991q1. The two shallowest recessions of 1988 and 1997-98 registered -1.5 and -1.6 per cent respectively (Table 10, top panel).

With respect to *recovery phases* relative to expansion phases, it is first important to make clear the definition used for "recovery". Researchers have variously used the number of quarters from trough back to previous peak (Claessens et al., 2012; Sichel, 1994), and fixed periods such as the initial four quarters (Wynne and Balke, 1992) or initial six quarters (Mussa, 2010). The recovery phases we present are from trough back to previous peak (Table 10, 3rd panel).

Not surprisingly, the average duration of New Zealand's nine completed recovery phases, at 6.6 quarters, is considerably below the average of 25.9 quarters for completed expansion phases. The

average recovery phase is reduced to 5.8 quarters if the exceptionally long 13-quarter recovery from 1978q1 is excluded, but this average is still longer than Claessens et al's (2012, Table 1) advanced OECD country average of 4.3 quarters. However, New Zealand's average recovery amplitude has been 5.1 per cent relative to the 21-country OECD average of 3.1 per cent, and so the annualised average strength of New Zealand's recoveries of 3.8 per cent would also have been greater than that for the 21-country OECD average.

The durations of New Zealand's individual recovery periods have varied from a very short two quarters to a very lengthy 13 quarters. The strength of individual recoveries has also varied considerably, from low annualised rates of 1.2 and 1.6 per cent after the 1988q4 and 2009q1 troughs and the modest rate of around 2 per cent after the 1978q1, 1991q2 and 1998q1 troughs, to an exceptionally strong annualised rate of 10.1 per cent from 1948q4 and a robust 6.8 per cent post-1983q1.

4.2 Does the length, depth or severity of preceding recessions matter for subsequent economic recovery?

Once the trough of a particular business cycle becomes sufficiently clear, the attention of many economic decision makers focuses on the strength of the recovery and the sustainability of the expansion path. For example, could a country expect to see a stronger, more sustained recovery, if it had experienced a short deep recession rather than a prolonged shallow recession? We assess aspects of this issue in two ways.

The first approach is numerical and graphical in nature and assesses New Zealand's growth rates during expansion in the context of growth rates during the previous recession; the second evaluates regression results for our relatively small sample of nine recessions, to see whether a strength of recovery variable is significantly influenced any of our length, depth or severity of recession variables. In both cases, we refer briefly to results from U.S. data which come from similar approaches.

In the first case, our context for assessment involves measures for New Zealand's growth rates during recession and expansion (Table 11), and the finding of Sichel (1994) that U.S. recessions have typically been followed by high growth recoveries.

During New Zealand's nine post-Second World War recessions, the average annualised contraction in real GDP has been 3.8 per cent, followed by steadily increasing real GDP growth over the next two years, from 2.6 per cent during quarters 1 and 2 up to 5.4 per cent during quarters 7 and 8. This two-year recovery pattern is the opposite of that found by Sichel (1994, Figure 1) for average U.S. NBER contractions of around 2.1 per cent from 1950q1 to 1992q4. This opposite recovery pattern is confirmed when the data for Sichel's sample period is updated to be the same as for our New Zealand sample period of 1947q2 to 2012q3. (Figure 3, 1st and 3rd panels)[xiii].

A somewhat modified pattern is evident for New Zealand when its four deepest recessions are excluded from the averaging (Figure 3, 2nd panel; Table 11). Then the average annualised contraction for the five shallower recessions (varying from -1.5 to -2.5 per cent) is also 2.1 per

cent, and the associated average recovery path becomes both more varied and more muted for the initial three years in particular. Overall, though, whether the four deepest New Zealand recessions are included in or excluded from the average, the average pattern of recovery has been in direct contrast to the average experience of immediately strong and subsequently declining recovery rates found for 1950 to 1992 and 1947 to 2012 U.S. NBER cycles. However, by way of contrast with this finding for average recovery paths is the fact that the most recent recession and expansion path to 2014q3 for New Zealand's real GDP has been remarkably similar to that for the U.S. (Figure 4)[xiv].

For our second approach, we adopt an extended form of the linear regression analysis conducted by Wynne and Balke (1992, s 3) for U.S. activity variables. Our three alternative dependent variables for strength of recovery are the growth rate over the first 12 months, the rate of growth over the first two years, and the number of quarters taken to recover the previous peak. The three potential explanatory variables (apart from the constant term) are the growth rate during contraction, the duration of recession in quarters, and the Harding and Pagan (2005) severity of recession measure (Table 12). At the 5% level, none of the growth rate during contraction, duration of recession, or severity of recession variables is a significant explanatory variable for either growth rate in recovery variable[xv]. This result is consistent with Wynne and Balke's finding from their small sample of 14 recessions that duration of recovery has no effect, but contrasts with their finding that the growth rate during contraction is a negatively significant influence at the 1% level on the rate of growth during the first 12 months of recovery in industrial production.

However, and still bearing in mind our very small sample of nine recessions, there is preliminary evidence at the 5% level of significance of a positive relationship between duration of recession (in quarters) and the recovery time (also in quarters) to the previous peak, i.e. the shorter the recession, the shorter the recovery time to previous peak, and vice versa.

4.3 New Zealand's 1991 and 2008/09 recessions, and their real GDP expansion paths

It is well known that no two individual business cycles are the same in all respects, but it is also the case that some cycles may have certain features in common. To illustrate this, we found it informative to examine the contraction, recovery and expansion paths from New Zealand's 1991 two-quarter recession and its most recent 2008/09 five-quarter recession. In a very broad sense, one can say that the 1991 recession was associated with demand-side international (especially U.S. and Australian) contraction phases and contractionary New Zealand monetary and fiscal policies (Reddell and Sleeman, 2008), and a recovery path interrupted in the September 1992 quarter by electricity-generation restrictions. The 2008/09 recession has similarly been associated with global (financial crisis) activity contractions (Australia excepted) and then had its nascent recovery set back a considerable number of quarters by damage and disruption from the September 2010, February 2011, June 2011 and December 2011 Canterbury earthquakes.

These economic events resulted in a severe annualised decline in real GDP of 6.2 per cent during the 1991 recession, followed by an initially strong 1-2 quarter recovery rate of 1.9 per cent, subdued rates of 0.6 and 1.1 per cent during quarters 3 to 6, and the return to a powerful 7.8 per cent growth rate during quarters seven and eight. There was then very good growth rates of

between 5.5 and 3.6 per cent during years three to six of the 24-quarter expansion phase through to 1997q2, when New Zealand's growth rate was affected by the Asian financial crisis (Table 11).

New Zealand's recovery from the 2008/09 recession began weakly with a 0.9 per cent rate during the 1st two quarters and gained considerable momentum during the next two quarters (2.5 per cent). But it then reverted to a weak growth rate (0.9 per cent) for the following six months during which the September 2010 and February 2011 Canterbury earthquakes occurred. Some growth momentum was regained during quarters seven and eight (1.5 per cent) but this was more particularly so during the third year of recovery (2.7 per cent).

The current expansion path is incomplete, though the *production-based* real GDP peak of $49,319m (2009/10 prices) in the December 2007 quarter was regained in the June 2011 quarter ($49,478m) (Table 11, Note ††). This recovery-to-previous-peak of nine quarters is the second slowest for New Zealand's post-Second World War economy, surpassed only by the 13 quarters taken from the 1978q1 trough. However, this nine-quarter recovery is not materially slower than the eight quarters taken for recovery from the 1988q4 and 1952q2 troughs and the seven quarters from the 1991q2 trough (Table 10, panel 3).

So, to what extent has the considerably interrupted recovery from the 2008/09 recession continued to regain momentum and produce an expansion phase at least as sustained as that from 1991q2 to 1997q2? Also, which major GDP expenditure components have been important in sustaining or failing to sustain these two relatively lengthy expansion paths?

4.4 New Zealand's 1991 and 2008-09 recessions: the expansion paths for key real GDP expenditure components

Here, we provide a brief perspective on movements in key real GDP expenditure components which underpin the current recovery and expansion phases, relative to movements of the same components over the post-June 1991 phases (Figure 5).

The cumulated movements in the recoveries of aggregate real GDP expenditure from their post-1990q4 and post-2007q4 business cycle peaks through to those peak levels had, by the end of ten quarters, been broadly similar (Figure 5, 1st panel). Then came the immediate effects from 2010q3 of the 4 September 2010 and 22 February 2011 Canterbury earthquakes. These interrupted what had promised to be a reasonably steady recovery and expansion path. However, since the March 2009 quarter the current expansion path has continued broadly parallel with the equivalent post-1990q4 path. Moreover, the current still incomplete Peak-to-Peak (PTP) cycle of 27 quarters has now exceeded the duration of the completed 26 quarter PTP cycle from 1990q4, terminated in 1997q3 by the Asian Financial Crisis and two successive summers of drought.

But how have the paths of the major components of real GDP expenditure performed during the two cycles? Not surprisingly, their paths have been somewhat different. Two higher level differences were for net exports and for private investment and durables (Figure 5, 2nd panel). For the 1990s expansion, net exports provided an initially modest and then steadily declining contribution. This contrasts with the initially strong contribution during the current expansion but

which has since been followed by a pronounced declining trend and a currently net negative outcome. The paths for the private investment and durables component have had a degree of similarity in shape, but their phase durations and amplitudes have differed markedly. Post-1990q4, private investment and durables provided an initial typically negative contribution and then after ten quarters displayed an increasingly positive contribution. However, from 2007q4 this component produced a particularly prolonged and deeply negative contribution which surpassed its level at the previous business cycle peak only after 20 quarters.

The above suggests that consistently positive contributions from private investment and durables are important for real GDP expansion paths to be sustained. However, which of their sub-components and which other GDP components can be identified as helping to sustain a lengthy expansion path? Firstly, the evidence from both expansion paths is that nondurables consumption has an additionally important role to play. Following an initial period of modestly negative post-peak movements, meaningful net positive contributions are sustained (Figure 5, 3rd and 4th panels). Secondly, it is also clear that net exports have been seen to contribute no sustained net positive contribution to either recovery and expansion path. Not surprisingly, this has also been the case for inventories.

Next, from the sub-components of all sectors investment, it is evident firstly that non-residential investment has not been a significant contributor during either expansion, and secondly that general government investment has essentially been modestly net positive post-2007q4 and similarly net negative for almost all of the post-1990q4 period (Figure 5, 5th and 6th panels). Thirdly, while it took 11 quarters during the 1990s expansion for residential investment to provide a net positive contribution, for the current cycle the cumulated negative contribution of residential investment has been both relatively more substantial and considerably more prolonged. It took 25 quarters for a small net positive contribution to finally emerge. Fourthly, this leaves the "other" investment component (primarily plant and equipment, and transport equipment) as having played a particularly important role through both recessions and expansions. Post-1990q4, it initially provided a modestly negative contribution for four quarters. This was followed by meaningful positive contributions for the remainder of the expansion path. However, post-2007q4, the net negative value in real terms of this component had become over $1500m by the end of quarter 10 and it was only relatively recently, after 22 quarters, that it regained its level at the 2007q4 business cycle peak.

Hence, further sustained increases in the "other" investment component, but also in consumer durables and in consumer non-durables, ideally assisted by greater export volumes, will be necessary if the current 22 quarter (GDP production-based) recovery and expansion phase is to be sustained.

5. Conclusion

We provide an updated quarterly real GDP series for post-Second World War New Zealand. From this series, we present classical and growth cycle turning points, and a set of technical recession periods triggered by two or more successive quarters of negative growth. An associated set of classical employment cycles have also been developed.

From the classical real GDP turning points, we confirm that New Zealand's most recent recession commenced with the March 2008 quarter and ended with the March 2009 quarter. The *duration* of this five-quarter recession has been somewhat longer than the average post-Second World War contraction phase of 4.2 quarters, but its 3.2 percentage *depth* has been considerably less than those for the 1951/52 and 1948 recessions, below that for the 1976/78 episode, and less than the average depth of 4.0 per cent. In terms of its overall *severity*, a measure which reflects both duration and depth, the recession has been New Zealand's fourth most severe. Its cumulated GDP loss of 6.8 per cent has been less than the average loss of 9.9 per cent, and less severe than the losses for 1951/52 (37.2 per cent), 1948 (15.6 per cent) and 1976/78 (12.8 per cent).

We show that the commonly-used practice of calling a technical recession following the publication of two successive quarters of negative real GDP growth can provide conditionally useful evidence, but this procedure can on occasions also provide somewhat different signals as to a recession's beginning and end points. For example, the procedure matched exactly six of the nine classical business cycle recessions identified by the Bry-Boschan method, but it also called three additional recessions and called differently by two quarters the timing of a beginning point or end point for three of the nine recessions. This suggests that the evidence provided by this procedure should not be used on its own for formally calling the beginning and end of a recession.

Movements in New Zealand's real GDP series are relatively volatile by international standards. It's therefore not surprising that the use of growth cycle methodology would have led to calling 16 contraction phases or "growth recessions" rather than nine classical cycle recessions during the post-Second World War period. Publishing individual growth cycle recessions would therefore almost certainly have led to more confusion than clarity for economic decision makers.

On the sensitivity of our real GDP turning points to Statistics New Zealand data revisions, we find that our BB peaks and troughs are relatively robust. However, while the final two Statistics New Zealand SNCQ releases and the recent initial SNEQ release led to the 2008-09 recession concluding with the March 2009 quarter, their SNDQ releases necessitated calling a six-quarter rather than a five-quarter recession. We also document that utilising the technical approach to call the 1997-98 recession would have led to considerable uncertainty, as successive real-time releases were associated with material variations in beginning and end points for that recession.

Utilising our linked quarterly employment series from 1956q1 to establish classical employment cycles, we find that the peak-to–peak cycles and associated expansion and contraction phases are the same in number as those for our classical GDP cycles. However, while average durations have also been remarkably similar, the average standard deviations for employment cycles and phases have been considerably higher than for their real GDP counterparts.

It should also be borne in mind that the average properties fail to highlight different timings and durations for a number of the individual employment cycles. For example, employment troughs lag output troughs for six of our seven cycle troughs, but employment peaks have variously led, lagged or been contemporaneous with real GDP peaks.

From Concordance statistic measures, while the expansions and contraction phases of classical

real GDP and employment cycles have, *on average*, been associated around 89 per cent of the time, it has also not been the case that for every individual cycle that employment expansion and contraction phases have lagged real GDP phases by one quarter. This suggests that if one is additionally considering movements in total employment for the purposes of calling turning points for a recession, then as a minimum the circumstances particular to that cycle should also be assessed.

We have established statistics for the recovery-to-previous-peak phases of each New Zealand business cycle. The durations of these recovery periods have varied from a very short two quarters to a very lengthy 13 quarters, with an average of 6.6 quarters. The strength of the recoveries has also varied considerably, from low annualised growth rates of 1.2 and 1.6 per cent after the 1988q4 and 2009q1 troughs, to an exceptionally strong annualised rate of 10.1 per cent from 1948q4 and a robust 6.8 per cent post-1983q1.

When all recessions are taken into account, the average growth rate for New Zealand's real GDP recoveries has steadily increased over the following two years, from an annualised 2.6 per cent during the immediately following two quarters through to 5.4 per cent during quarters seven and eight. However, when recoveries following the four deepest recessions are excluded, the average recovery path has been both more varied and more muted for the following three years in particular. In both cases, though, the average pattern of recovery has been in direct contrast to the experience of on-average rapid initial expansion and subsequent declining recovery rates found for U.S. NBER cycles over the 1950 to 1992 and 1947 to 2012 periods. By way of contrast, though, New Zealand's most recent recession, recovery and expansion path has been remarkably similar to that for the U.S.

Using our small sample of nine recessions, there is no robustly significant effect of duration, depth, or severity of recession variables on New Zealand's strengths of recovery. However, there is evidence at the 5% level of significance that a shorter (or longer) recession has been associated with a shorter (or longer) recovery from a previous peak.

Finally, we provide a brief perspective on movements in key real GDP expenditure components which underpin the current expansion phase, relative to movements of the same components over the post-June 1991 phase. Investment is an important component of expansions, and in the current cycle it has been residential investment and plant and equipment investment that have been unusually slow to recover their levels at prior business cycle peaks.

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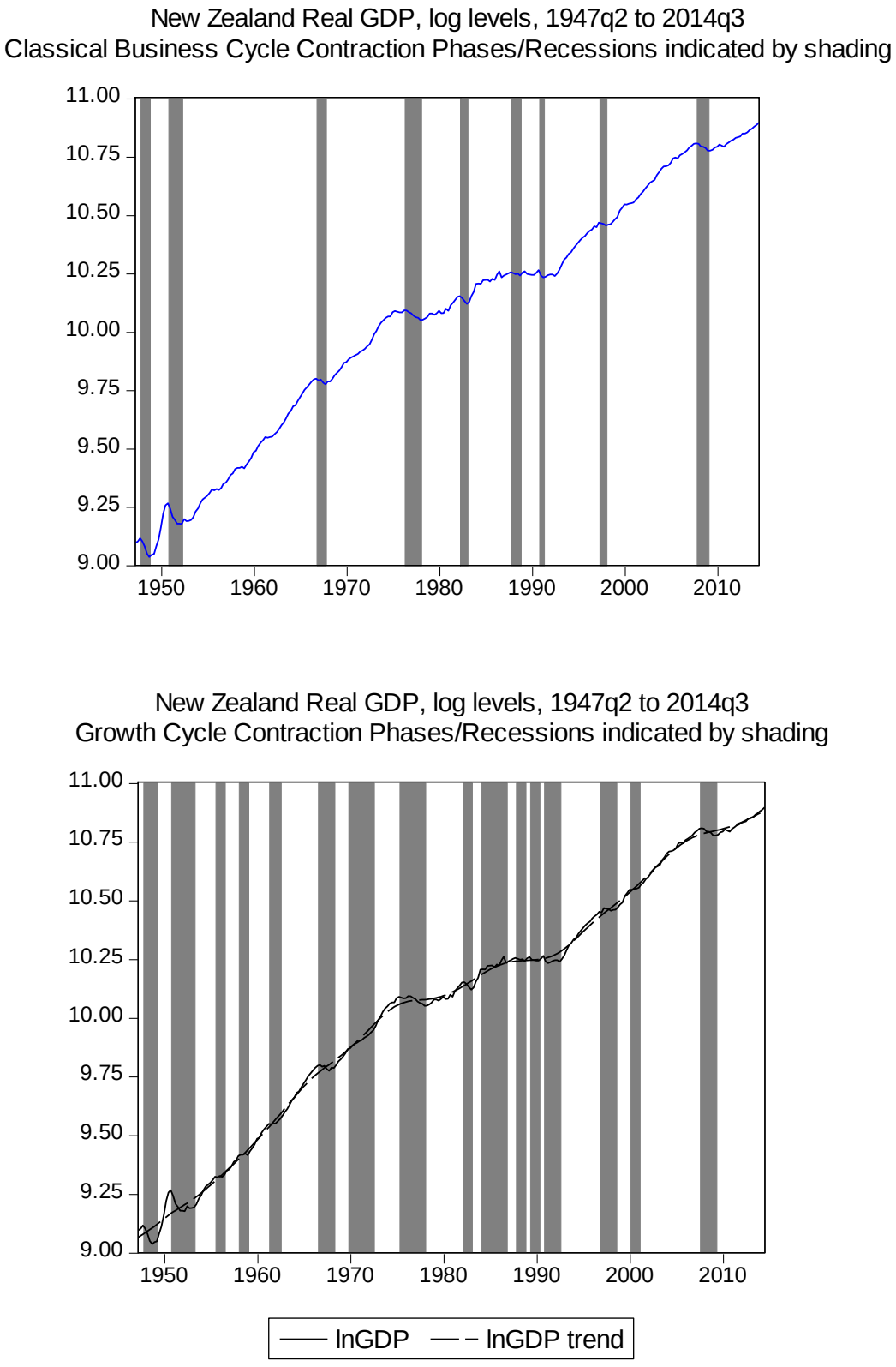
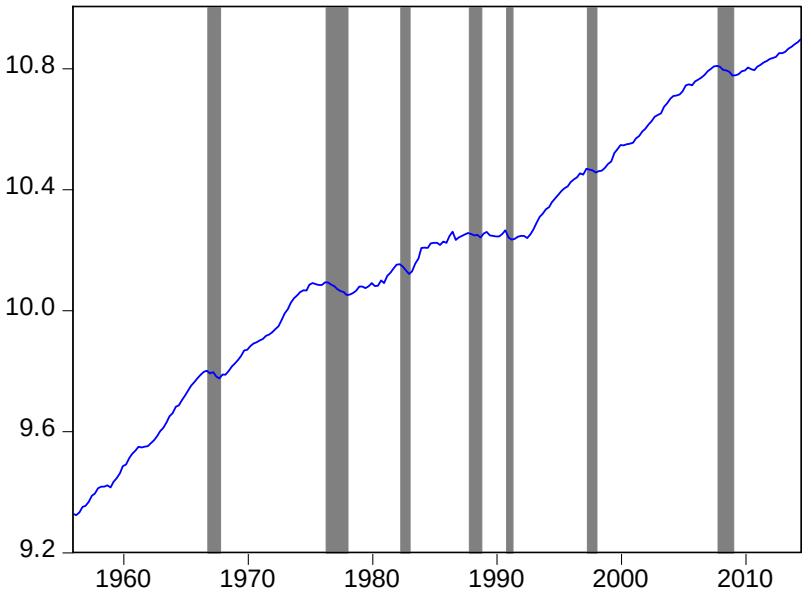


Figure 1. Classical and Growth Cycles, New Zealand's real GDP, 1947q2 to 2014q3

New Zealand real GDP, log levels, 1956q1 to 2014q3
Classical Business Cycle Contraction Phases/Recessions indicated by shading



New Zealand Total Employment, log levels, 1956q1 to 2014q3
Classical Employment Contraction Phases/Recessions indicated by shading

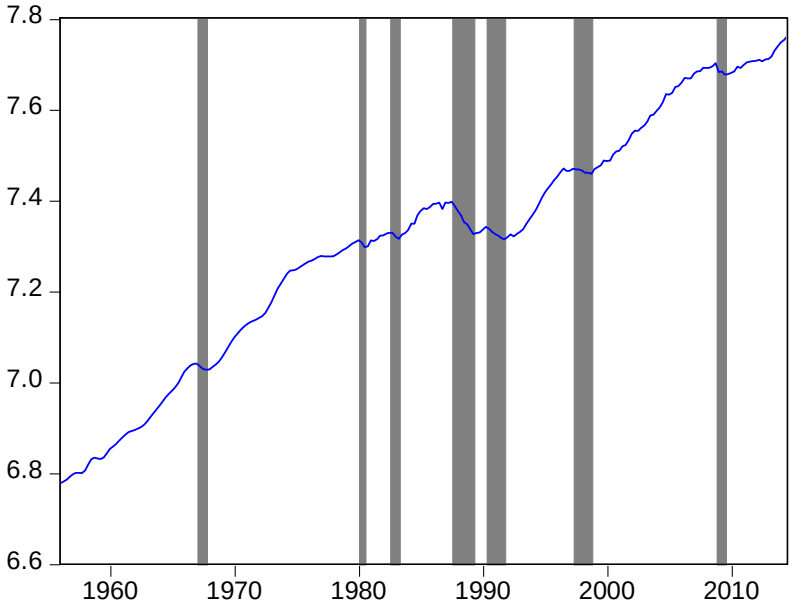


Figure 2. Classical GDP & Employment Cycles, New Zealand, 1956q1 to 2014q3

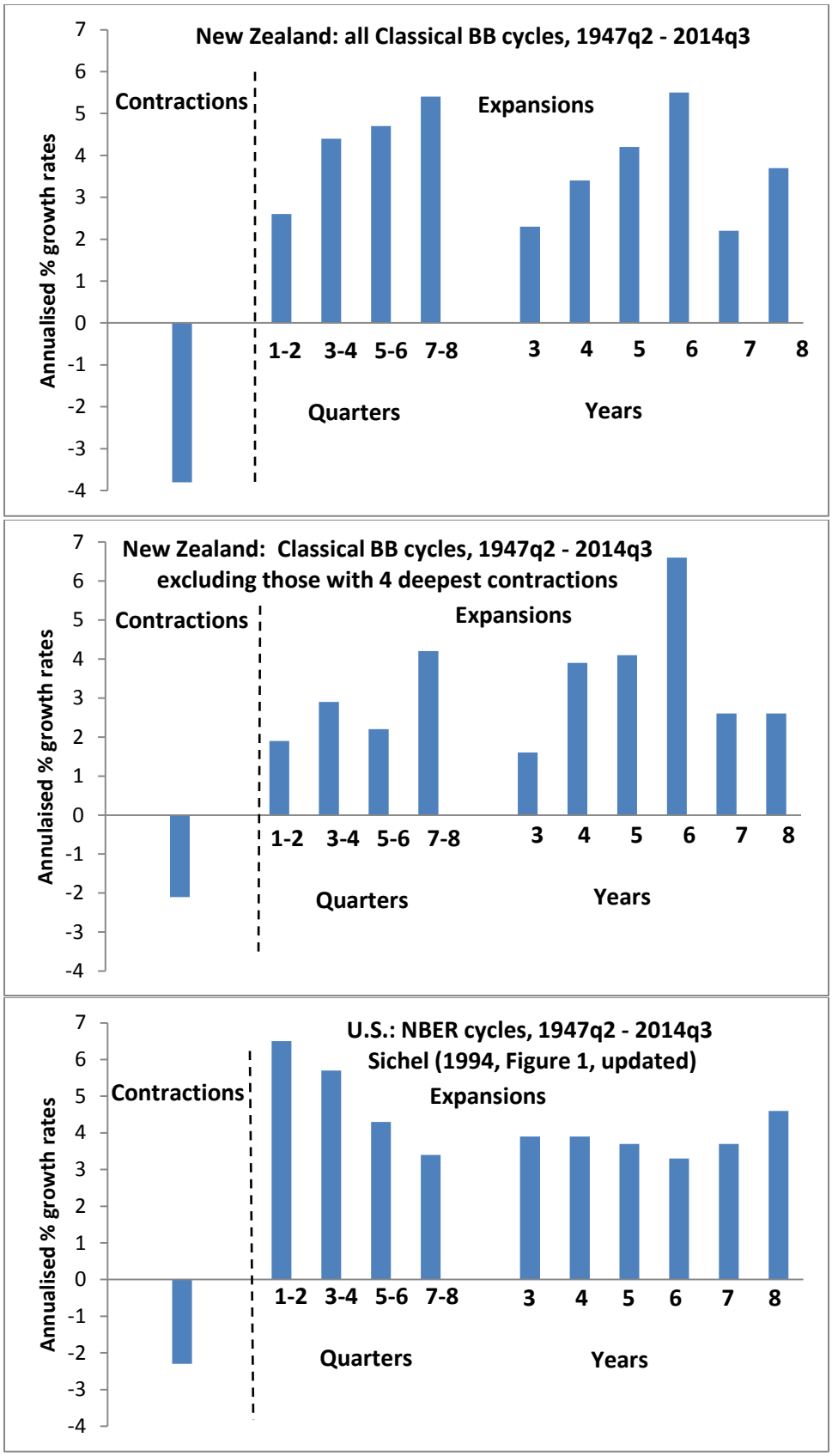


Figure 3. Average growth rates over New Zealand and U.S. real GDP cycles

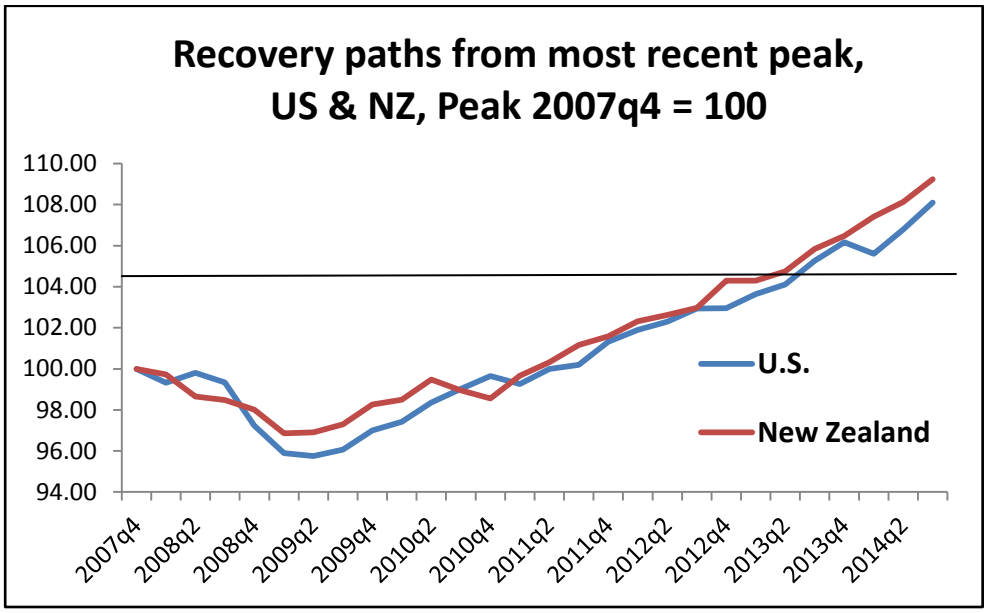


Figure 4. Recovery paths from most recent peak, U.S. and New Zealand, 2007q4 to 2014q3

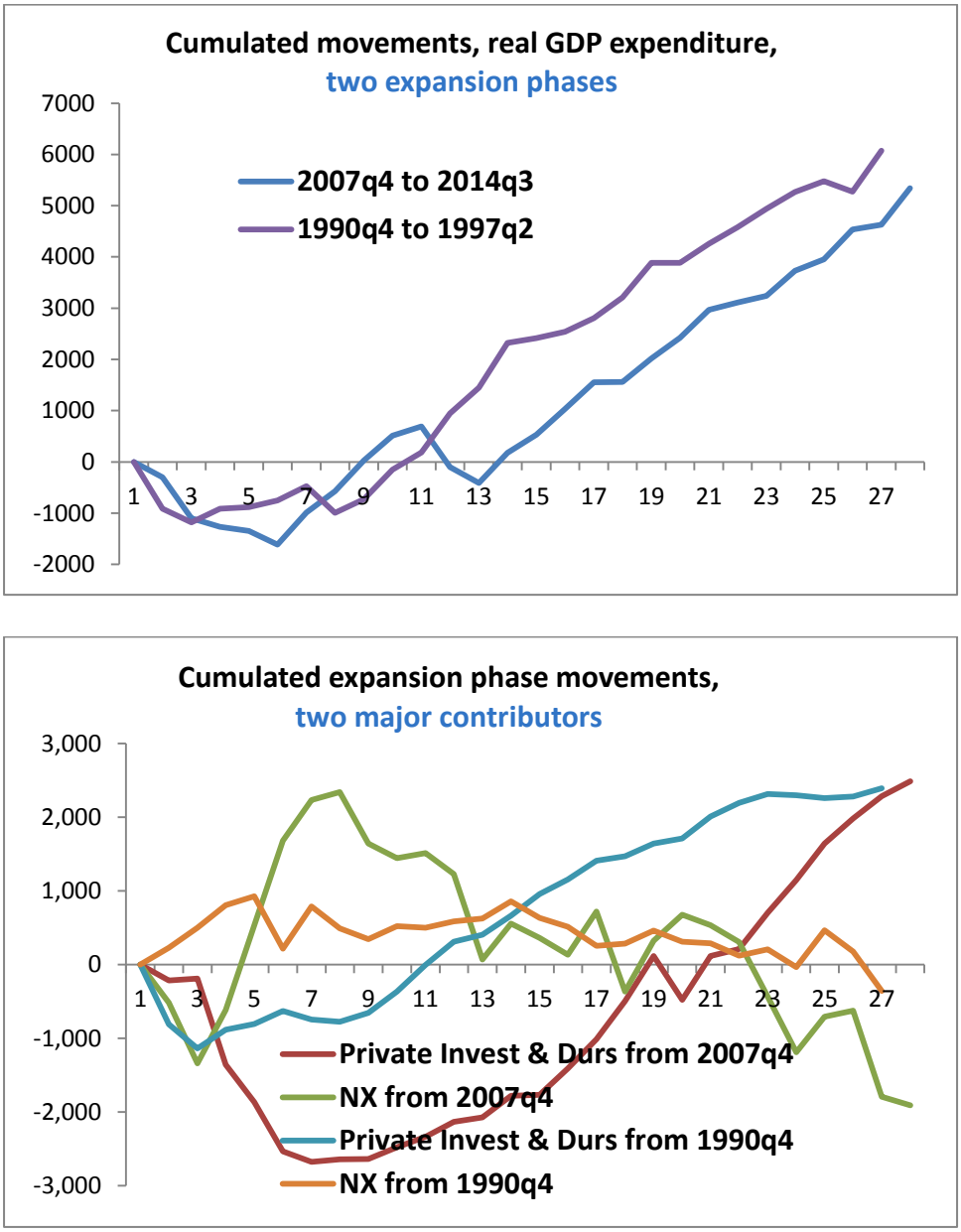
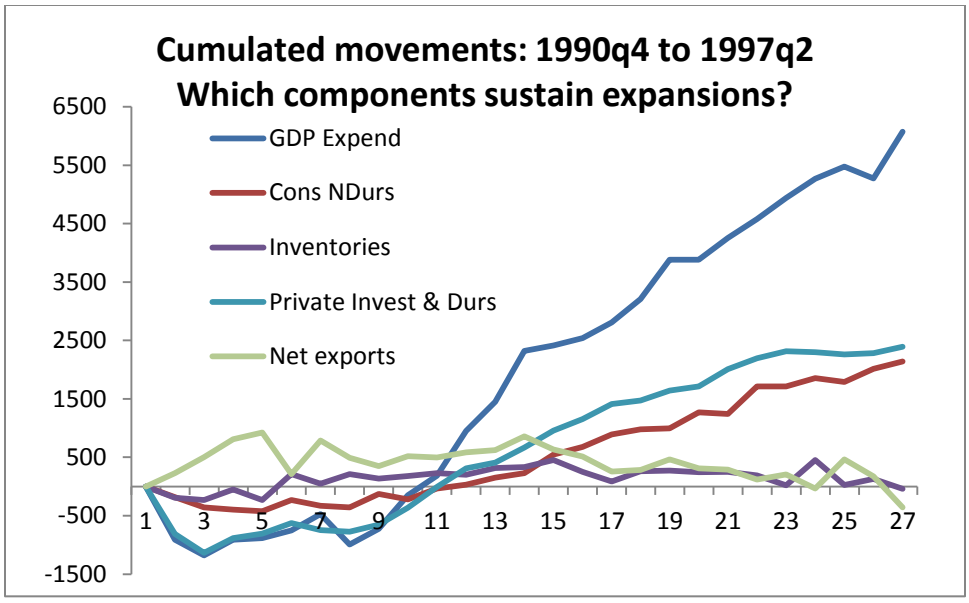


Figure 5. Strength and sustainability of New Zealand's current expansion phase



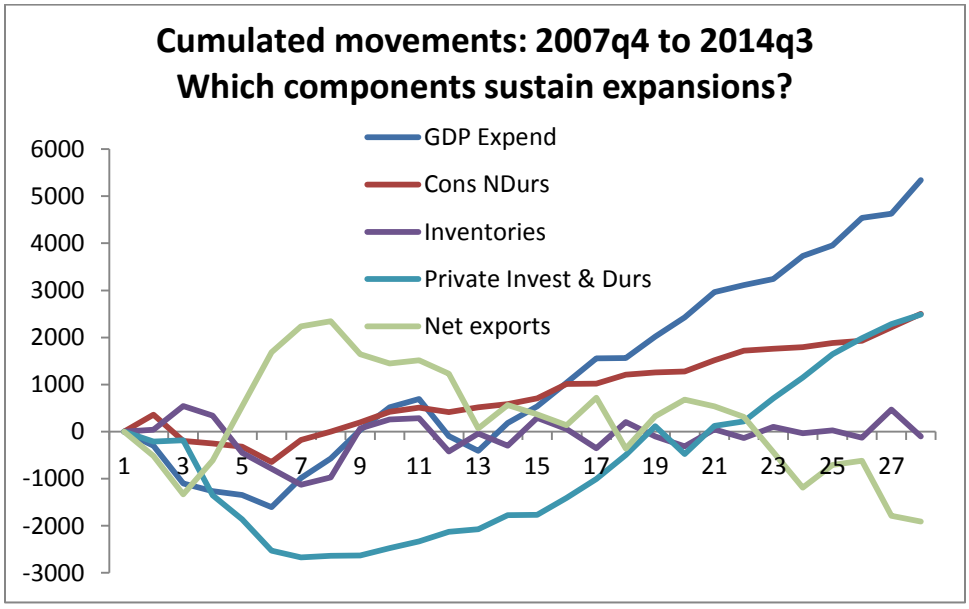
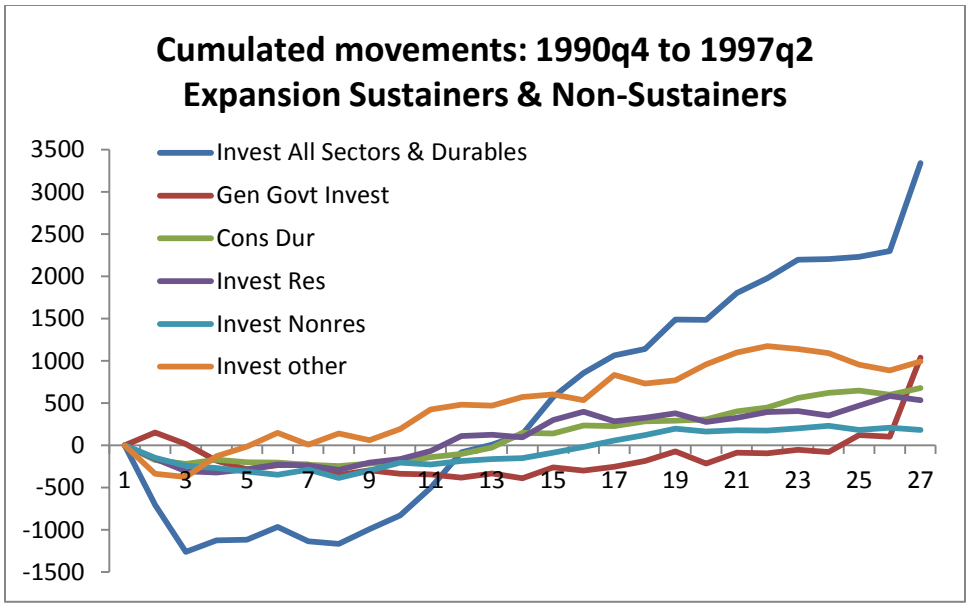


Figure 5 (continued). Strength and sustainability of New Zealand's current expansion phase



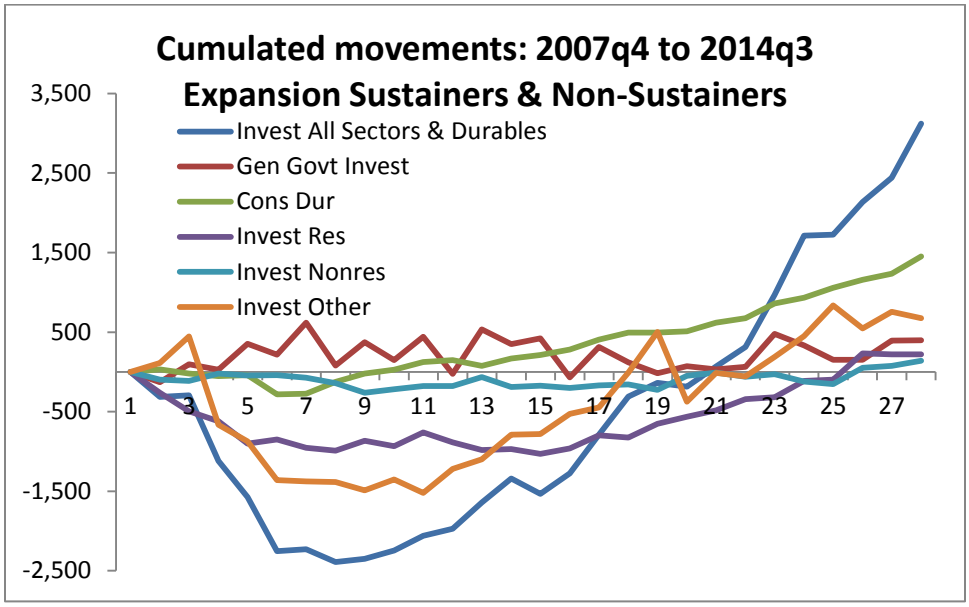


Figure 5 (continued). Strength and sustainability of New Zealand's current expansion phase

Table 1. New Zealand's Classical Real GDP Business Cycles: 1947 - 2014

Classical Cycles					
Dates of peaks and troughs by year and quarter		Duration in quarters			
Peak	Trough	Expansion phase	Contraction phase	Cycle	
				Peak to peak	Trough to trough
1947 December	1948 December		4		
1950 December	1952 June	8	6	12	14
1966 December	1967 December	58	4	64	62
1976 June	1978 March	34	7	38	41
1982 June	1983 March	17	3	24	20
1987 December	1988 December	19	4	22	23
1990 December	1991 June	8	2	12	10
1997 June	1998 March	24	3	26	27
2007 December	2009 March	39	5	42	44
Number of cycle phases/cycles		8	9	8	8
Average duration		25.9	4.2	30.0	30.1
Standard deviation		17.1	1.6	17.4	17.5

Note:
Real GDP Classical cycle turning points reflect Bry-Boschan (1971) dating of updated Hall-McDermott (2011) series.

Table 2. New Zealand's Classical Real GDP Business Cycles: 1947 - 2014

Cycle characteristics							
Phase dates		**Duration**		**Amplitude**		**Cumulated gain/loss**	
Expansion	Contraction	E	C	E	C	E	C
	1948q1-1948q4		4		-8.0		-15.6
1949q1-1950q4	1951q1-1952q2	8	6	23.0	-8.9	78.9	-37.2
1952q3-1966q4	1967q1-1967q4	58	4	62.3	-2.5	1702.9	-4.3
1968q1-1976q2	1976q3-1978q1	34	7	31.8	-4.2	583.2	-12.8
1978q2-1982q2	1982q3-1983q1	17	3	10.2	-3.2	68.8	-4.5
1983q2-1987q4	1988q1-1988q4	19	4	13.6	-1.5	178.5	-2.6
1989q1-1990q4	1991q1-1991q2	8	2	2.4	-3.1	7.4	-4.0
1991q3-1997q2	1997q3-1998q1	24	3	23.5	-1.2	258.4	-1.4
1998q2-2007q4	2008q1-2009q1	39	5	35.2	-3.2	713.1	-6.8
Average		25.9	4.2	25.2	-4.0	448.9	-9.9
Standard deviation		17.1	1.6	18.5	2.7	566.5	11.3

Notes:
E denotes expansion phase; C is contraction phase; durations are in quarters; amplitudes are percentages; cumulated gains/losses are percentages of GDP in first quarter of the phase, computed as in Pagan (2005, 8-12)

Table 3. Should two negative quarters of real GDP growth signal a recession?
1947 - 2014

Date	Two negative quarters		Bry-Boschan turning point sequencing rules			
			BB Classical cycles		BBQ Classical cycles	
	Peak	Trough	Peak	Trough	Peak	Trough
P	1947q4		1947q4		1947q4	
T		1948q4		1948q4		1948q4
P	1950q4		1950q4		1950q4	
T		1951q4		1952q2		1952q2
P	1967q2		1966q4		1966q4	
T		1967q4		1967q4		1967q4
P	1975q2					
T		1975q4				
P	1976q2		1976q2		1976q2	
T		1978q1		1978q1		1978q1
P	1982q2		1982q2		1982q2	
T		1983q1		1983q1		1983q1
P	1987q4		1987q4		1986q3	
T		1988q2		1988q4		1988q4
P	1989q2					
T		1990q2				
P	1990q4		1990q4		1990q4	
T		1991q2		1991q2		1991q2
P	1997q2		1997q2		1997q2	
T		1998q1		1998q1		1998q1
P	2007q4		2007q4		2007q4	
T		2009q1		2009q1		2009q1
P	2010q2				2010q2	
T		2010q4				2010q4

Table 4. New Zealand's Real GDP Business Cycles: 1947 - 2014

Classical Cycles						Growth Cycles					
Dates of peaks and troughs, by year and quarter		Duration in quarters				Dates of peaks and troughs, by year and quarter		Duration in quarters			
P	T	Exp. Phase	Contr. Phase	Cycle		P	T	Exp. phase	Contr. phase	Cycle	
				PTP	TPT					PTP	TPT
47q4	48q4		4			47q4	49q2		6		
50q4	52q2	8	6	12	14	50q4	53q2	6	10	12	16
						55q3	56q3	9	4	19	13
						58q1	59q1	6	4	10	10
						61q2	62q3	9	5	13	14
66q4	67q4	58	4	64	62	66q3	68q2	16	7	21	23
						69q4	72q3	6	11	13	17
76q2	78q1	34	7	38	41	75q2	78q1	11	11	22	22
82q2	83q1	17	3	24	20	82q1	83q1	16	4	27	20
						84q1	86q4	4	11	8	15
87q4	88q4	19	4	22	23	87q4	88q4	4	4	15	8
						89q2	90q2	2	4	6	6
90q4	91q2	8	2	12	10	90q4	92q3	2	7	6	9
97q2	98q1	24	3	26	27	96q4	98q3	17	7	24	24
						00q1	01q1	6	4	13	10
07q4	09q1	39	5	42	44	07q3	09q2	26	7	30	33
Number of cycle phases/ cycles		8	9	8	8	Number of cycle phases/ cycles		15	16	15	15
Average duration		25.9	4.2	30.0	30.1	Average duration		9.3	6.6	15.9	16.0
Standard deviation		17.1	1.6	17.4	17.5	Standard deviation		6.7	2.8	7.5	7.3

Notes:
Classical cycle turning points reflect Bry-Boschan (1971) dating of updated Hall-McDermott (2011) series.
Growth cycle turning points reflect HP1600 detrending, and Bry-Boschan assisted dating.
P = Peak; T = Trough
Exp. = Expansion; Contr. = Contraction; PTP = Peak to Peak; TPT = Trough to Trough

Table 5. New Zealand's Classical Real GDP Business Cycles: 1947 - 2014

BB Dates of Peaks and Troughs: Robustness to SNZ data revisions, selected releases 28/09/01 to 18/12/14

SNZ Release date	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T
SNCQ																				
28/09/01	47q4	48q4	50q4	52q2	66q4	67q4	76q2	78q1	82q2	83q1	86q3	88q4	89q2	90q1	90q4	91q2	97q2	98q1		
22/12/05	47q4	48q4	50q4	52q2	66q4	67q4	76q2	78q1	82q2	83q1	87q4	88q4	-	-	90q4	91q2	97q2	98q1		
26/09/08	47q4	48q4	50q4	52q2	66q4	67q4	76q2	78q1	82q2	83q1	87q4	88q4	-	-	90q4	91q2	97q2	98q1		
23/12/08	47q4	48q4	50q4	52q2	66q4	67q4	76q2	78q1	82q2	83q1	87q4	88q4	-	-	90q4	91q2	97q2	98q1	07q4	
27/03/09	47q4	48q4	50q4	52q2	66q4	67q4	76q2	78q1	82q2	83q1	87q4	88q4	-	-	90q4	91q2	97q2	98q1	07q4	
26/06/09	47q4	48q4	50q4	52q2	66q4	67q4	76q2	78q1	82q2	83q1	87q4	88q4	-	-	90q4	91q2	97q2	98q1	07q4	-
23/09/09	47q4	48q4	50q4	52q2	66q4	67q4	76q2	78q1	82q2	83q1	87q4	88q4	-	-	90q4	91q2	97q2	98q1	07q4	-
23/12/10	47q4	48q4	50q4	52q2	66q4	67q4	76q2	78q1	82q2	83q1	87q4	88q4	-	-	90q4	91q2	97q2	98q1	07q4	09q1
22/09/11	47q4	48q4	50q4	52q2	66q4	67q4	76q2	78q1	82q2	83q1	87q4	88q4	-	-	90q4	91q2	97q2	98q1	07q4	09q1
SNDQ																				
20/12/12	47q4	48q4	50q4	52q2	66q4	67q4	76q2	78q1	82q2	83q1	87q4	88q4	-	-	90q4	91q2	97q2	98q1	07q4	09q2
19/12/13	47q4	48q4	50q4	52q2	66q4	67q4	76q2	78q1	82q2	83q1	87q4	88q4	-	-	90q4	91q2	97q2	98q1	07q4	09q2
SNEQ																				
18/12/14	47q4	48q4	50q4	52q2	66q4	67q4	76q2	78q1	82q2	83q1	87q4	88q4	-	-	90q4	91q2	97q2	98q1	07q4	09q1

Notes:

Data sources for the above GDP Production series, each reflecting a continuous set of quarterly observations from 1987q2:

for the SNCQ series released between 28/09/01 and 22/09/11, the data were accessed on 18/11/2013 from:
http://www.rbnz.govt.nz/research_publications/research_programme/additional_research/2482495.html
These series are from the real-time database described in Sleeman (2006);

for the SNDQ series released 20/12/12, see SNZ Table reference SND105AA, accessed 25/1/13;

for the SNDQ series released 19/12/13, see SNZ Table reference SND103AA, accessed 19/12/13; and

for the SNEQ series released 18/12/14, see SNZ Table reference SNE070AA, accessed 19/12/14.

Observations for all series prior to 1987q2 are computed using the methodology developed in Hall and McDermott (2011).

Table 6. New Zealand's Classical Real GDP Business Cycles: 1955 – 2014*

BBQ Dates of Peaks and Troughs: Robustness to SNZ data revisions, selected releases 28/09/01 to 18/12/14																				
SNZ Release date	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T
SNCQ																				
28/09/01	66q4	67q4	76q2	78q1	82q2	83q1	86q3	88q4	89q2	90q1	90q4	91q2	92q1	92q3	97q2	98q1				
22/12/05	66q4	67q4	76q2	78q1	82q2	83q1	86q3	88q4	-	-	90q4	91q2	92q1	92q3	97q2	98q1				
26/09/08	66q4	67q4	76q2	78q1	82q2	83q1	86q3	88q4	-	-	90q4	91q2	92q1	92q3	97q2	98q1	07q4			
23/12/08	66q4	67q4	76q2	78q1	82q2	83q1	86q3	88q4	-	-	90q4	91q2	92q1	92q3	97q2	98q1	07q4			
27/03/09	66q4	67q4	76q2	78q1	82q2	83q1	86q3	88q4	-	-	90q4	91q2	92q1	92q3	97q2	98q1	07q4			
26/06/09	66q4	67q4	76q2	78q1	82q2	83q1	86q3	88q4	-	-	90q4	91q2	92q1	92q3	97q2	98q1	07q4	-		
23/09/09	66q4	67q4	76q2	78q1	82q2	83q1	86q3	88q4	-	-	90q4	91q2	92q1	92q3	97q2	98q1	07q4	-		
23/12/10	66q4	67q4	76q2	78q1	82q2	83q1	86q3	88q4	-	-	90q4	91q2	92q1	92q3	97q2	98q1	07q4	09q1		
22/09/11	66q4	67q4	76q2	78q1	82q2	83q1	86q3	88q4	-	-	90q4	91q2	92q1	92q3	97q2	98q1	07q4	09q1		
SNDQ																				
20/12/12	66q4	67q4	76q2	78q1	82q2	83q1	86q3	88q4	-	-	90q4	91q2	-	-	97q2	98q1	07q4	09q2	10q2	10q4
19/12/13	66q4	67q4	76q2	78q1	82q2	83q1	86q3	88q4	89q2	90q1	90q4	91q2	92q1	92q3	97q2	98q1	07q4	09q2	10q2	10q4
SNEQ																				
18/12/14	66q4	67q4	76q2	78q1	82q2	83q1	86q3	88q4			90q4	91q2			97q2	98q1	07q4	09q1	10q2	10q4

Notes

* All Peaks and Troughs prior to the peak of 66q4 are as shown in Table 5 for BB dates: i.e., P 47q4, T 48q4, P 50q4 and T 52q2

Data sources are as for Table 5.

Table 7. Dates of Peaks and Troughs associated with Technical Recessions: 1997-98, 2008-09 and 2010

Robustness to SNZ data revisions, selected releases 26/06/98 to 18/12/14						
SNZ Release date	P	T	P	T	P	T
SNBQ						
26/06/98 to 25/09/98	-	-				
23/12/98 to 29/09/00	97q4	98q2				
SNCQ						
21/12/00 to 22/12/05	97q2	98q1				
26/09/08	97q2	98q1	07q4			
23/12/08	97q2	98q1	07q4			
27/03/09	97q2	98q1	07q4			
26/06/09	97q2	98q1	07q4	-		
23/09/09	97q2	98q1	07q4	09q1		
23/12/10	97q2	98q1	07q4	09q1	-	
22/09/11	97q2	98q1	07q4	09q1	-	-
SNDQ						
20/12/12	97q2	98q1	07q4	09q2	10q2	10q4
19/12/13	97q2	98q1	07q4	09q2	10q2	10q4
SNEQ						
18/12/14	97q2	98q1	07q4	09q1	10q2	10q4

Notes:
Data sources are as for Table 5.

Table 8. New Zealand's Classical GDP & Employment Cycles: 1956 - 2014

Real GDP Cycles						Employment Cycles					
Dates of peaks and troughs, by year and quarter		Duration in quarters				Dates of peaks and troughs, by year and quarter		Duration in quarters			
P	T	Exp. Phase	Contr. Phase	Cycle		P	T	Exp. phase	Contr. phase	Cycle	
				PTP	TPT					PTP	TPT
66q4	67q4		4			67q1	67q4		3		
76q2	78q1	34	7	38	41	80q1	80q3	49	2	52	51
82q2	83q1	17	3	24	20	82q3	83q2	8	3	10	11
87q4	88q4	19	4	22	23	87q3	89q2	17	7	20	24
90q4	91q2	8	2	12	10	90q2	91q4	4	6	11	10
97q2	98q1	24	3	26	27	97q2	98q4	22	6	28	28
07q4	09q1	39	5	42	44	08q4	09q3	40	3	46	43
Number of cycle phases/ cycles		6	7	6	6	Number of cycle phases/ cycles		6	7	6	6
Average duration		23.5	4.0	27.3	27.5	Average duration		23.3	4.3	27.8	27.8
Standard deviation		11.4	1.6	11.0	12.9	Standard deviation		17.8	2.0	17.8	16.6

Notes:
Employment cycle turning points reflect Bry-Boschan (1971) dating of linked Simon Chapple (1994)-RBNZ-SNZ Total Employment series
P = Peak; T = Trough
Exp. = Expansion; Contr. = Contraction; PTP = Peak to Peak; TPT = Trough to Trough

Table 9. Synchronisation of New Zealand's Classical real GDP and Employment Cycles: 1956q1 - 2014q3

Employment turning point lagging/leading GDP turning point	Concordance	GMM test	Correlation
Employment lagging by:			
1 quarter	.897	4.99***	.528
2 quarters	.888	4.17***	.488
3 quarters	.853	2.35***	.330
4 quarters	.810	0.57	.133
8 quarters	.762	-0.31	-.067
Contemporaneous	.881	4.01***	.450
Employment leading by:			
1 quarter	.846	2.00**	.292
2 quarters	.811	0.73	.134

Notes:
The GMM test is the *t*-test on the coefficient C in the implicit equation demGDP(t)*demEmp(t+k) – C = 0, where k is the number of quarters by which employment lags/leads GDP, demGDP is demeaned real GDP, and demEmp is demeaned employment.
The GMM estimation was conducted using the Bartlett kernel with a fixed bandwith of 4.The null hypothesis of no concordance between the demeaned binary expansion/contraction phases for the GDP and employment series is rejected for one-tail tests, if the test result is greater than critical values of 2.35 (1 percent level, denoted ***), 1.65 (5 percent level, denoted **), and 1.28 (10 percent level, denoted *).

Table 10. Contractions/Recessions, Expansions, Recoveries
New Zealand's Classical real GDP Business Cycles: 1947 - 2014

Contraction/recession Phases		**Duration (qtrs)**	**Amplitude (%)**	**Amplitude (%)**	
				Per qtr	Per annum
Peak	Trough				
1947q4	1948q4	4	-8.0	-2.0	-8.0
1950q4	1952q2	6	-8.9	-1.5	-5.9
1966q4	1967q4	4	-2.5	-0.6	-2.5
1976q2	1978q1	7	-4.2	-0.6	-2.4
1982q2	1983q1	3	-3.2	-1.1	-4.3
1987q4	1988q4	4	-1.5	-0.4	-1.5
1990q4	1991q2	2	-3.1	-1.6	-6.3
1997q2	1998q1	3	-1.2	-0.4	-1.6
2007q4	2009q1	5	-3.2	-0.6	-2.6
Mean		4.2	-4.0	-1.0	-3.9
Standard deviation		1.6			
Mean (excl. phases 1 & 7)		4.0	-2.7	-0.8	-3.0
Mean (excl. phases 1, 2 & 7)		4.3	-2.6	-0.6	-2.5
Expansion Phases					
Trough	Peak				
1948q4	1950q4	8	23.0	2.9	11.5
1952q2	1966q4	58	62.3	1.1	4.3
1967q4	1976q2	34	31.8	0.9	3.7
1978q1	1982q2	17	10.2	0.6	2.4
1983q1	1987q4	19	13.6	0.7	2.9
1988q4	1990q4	8	2.4	0.3	1.2
1991q2	1997q2	24	23.5	1.0	3.9
1998q1	2007q4	39	35.2	0.9	3.6
Mean		25.9	25.2	1.0	4.2
Standard deviation		17.1			
Mean (excl. phase 1)		28.4	25.6	0.8	3.1
Recovery to prior Peak					
Trough date					
1948q4		5	12.6	2.5	10.1
1952q2		8	8.9	1.1	4.5
1967q4		4	4.0	1.0	4.0
1978q1		13	6.3	0.5	1.9
1983q1		2	3.4	1.7	6.8
1988q4		8	2.4	0.3	1.2
1991q2		7	3.4	0.5	1.9
1998q1		3	1.5	0.5	2.0
2009q1		9	3.5	0.4	1.6
Mean		6.6	5.1	1.0	3.8
Standard deviation		3.4			
Mean (excl. phase 4)		5.8			
Mean (excl. phase 1)			4.4	0.8	3.0

Table 11. Growth rates over New Zealand's Classical real GDP Business Cycles
annualised percentage changes

Peak	Trough	Growth rate during Contractions	Growth rate during Expansions													
			Quarters				Years									
			1-2	3-4	5-6	7-8	1	2	3	4	5	6	7	8	9	10
1947q4	1948q4	-7.7	2.4	13.1	23.1	9.3	7.8	16.7								
1950q4	1952q2	-5.7	2.5	0.8	7.4	7.4	1.7	7.5	4.5	1.3	4.5	5.1	1.6	5.9	6.0	1.2†
1966q4	1967q4	-2.5	2.4	5.7	4.2	6.4	4.1	5.4	2.8	2.6	4.7	7.6	2.6	1.8		
1976q2	1978q1	-2.4	1.3	4.3	-1.0	3.4	2.8	1.2	0.0	6.2						
1982q2	1983q1	-4.3	7.0	10.6	0.1	3.3	8.9	1.7	-0.0	1.8						
1987q4	1988q4	-1.5	3.7	-2.7	-0.4	4.2	0.5	1.9								
1990q4	1991q2	-6.2	1.9	0.6	1.1	7.8	1.3	4.4	5.3	5.5	3.9	3.6				
1997q2	1998q1	-1.6	1.1	4.4	7.4	5.4	2.8	6.5	0.8	4.7	4.7	5.5	2.5	3.3	3.3	
2007q4	2009q1	-2.5	0.9	2.5	0.9	1.5	1.7	1.2	2.7	1.9	3.0††					
Mean		-3.8	2.6	4.4	4.7	5.4	3.5	5.2	2.3	3.4	4.2	5.5	2.2	3.7		
Mean (excl. phases 1, 2, 5 & 7)		-2.1	1.9	2.9	2.2	4.2	2.4	3.2	1.6	3.9	4.1	6.6	2.6	2.6		

Notes:

† For the expansion phase from 1952q2, annualised percentage growth rates for years 11, 12, 13 and 14 are 5.3, 7.1, 5.6, and 5.3.

†† N/A refers to this recovery phase being still incomplete; the *production based* GDP peak of $49,319m (2009/10 prices) in the December 2007 quarter was regained only in the June 2011 quarter ($49,478m).

Table 12. Strengths of Recovery and Measures of Recession

OLS regression results for 9 recoveries, troughs from 1948q4 through to 2009q1

Dependant variable (for strength of recovery)	Constant	Growth rate (%) during contraction	Duration of recession (quarters)	Severity of recession (%)	$\bar{R}^2$
Growth rate (**1st 12 months)**	2.73	-0.51	-0.27		-0.08
	(2.75)	(0.27)	(0.54)		
	1.45	-0.54*			0.05
	(0.78)	(0.27)			
	p 0.1058				
	5.19		-0.40		-0.09
	(2.93)		(0.48)		
	3.63**			-0.01	-0.14
	(1.26)			(0.05)	
Cumulated growth rate (**1st 2 years**)	1.86	-2.16	-0.27		0.31
	(4.84)	(1.12)	(1.02)		
		p 0.1015			
	0.57	-2.19*			0.40
	(3.01)	(1.06)			
	12.35**		-0.82		-0.11
	(5.05)		(0.78)		
	7.35**			0.16	-0.07
	(2.12)			(0.11)	
	p 0.0104				
Recovery to previous peak (quarters)	-0.20	0.03	1.62**		0.40
	(2.57)	(0.32)	(0.60)		
	7.41***	0.22			-0.12
	(1.67)	(0.35)			
	-0.33		1.63**		0.49
	(2.89)		(0.59)		
	5.60***			0.10	-0.03
	(0.55)			(0.05)	

Notes:

( ) are Newey-West HAC standard errors; p denotes p-value

*** denotes significance at 1% level; ** significance at 5% level; * significance at 10% level

Appendix

Table A1. Quarterly real GDP Estimates, 1947q2 - 2014q3
(seasonally adjusted, 2009/10 prices)

Year	Mar	Jun	Sep	Dec
1947		8901.62	8962.29	9084.08
1948	8961.69	8764.39	8501.71	8384.43
1949	8464.34	8486.60	8772.49	9040.46
1950	9512.46	10083.14	10455.46	10551.61
1951	10306.99	9956.94	9826.93	9666.19
1952	9669.38	9654.08	9859.39	9775.71
1953	9786.85	9816.19	9937.38	10178.73
1954	10319.91	10554.08	10720.02	10808.59
1955	10894.97	11024.77	11180.78	11151.70
1956	11215.80	11166.74	11267.23	11475.59
1957	11522.23	11673.00	11912.71	11992.88
1958	12213.71	12272.66	12272.63	12332.91
1959	12247.65	12468.66	12625.10	12826.79
1960	13137.13	13206.18	13487.60	13677.69
1961	13822.71	14002.53	13965.21	14006.05
1962	14032.84	14168.95	14309.48	14506.08
1963	14738.24	14917.46	15181.11	15491.33
1964	15650.55	15980.45	16052.47	16344.76
1965	16605.69	16870.33	17160.98	17352.37
1966	17559.65	17771.52	17935.13	18000.66
1967	17850.22	17926.21	17676.38	17555.45
1968	17782.23	17761.82	17984.11	18267.65
1969	18439.32	18650.62	18910.67	19244.46
1970	19305.95	19546.29	19692.27	19781.82
1971	19907.66	19993.80	20197.90	20300.53
1972	20444.97	20660.60	20851.05	21261.68
1973	21750.76	22072.05	22538.25	22878.39
1974	23099.48	23351.62	23486.00	23478.51
1975	23922.70	24051.00	23972.03	23898.97
1976	23904.07	24122.35	24097.48	23933.08
1977	23811.54	23579.63	23425.72	23344.45
1978	23130.68	23169.76	23278.80	23447.45
1979	23775.76	23778.59	23654.05	23812.55
1980	24057.38	23818.21	23835.19	24271.08
1981	24060.22	24631.97	24905.10	25226.36
1982	25554.69	25612.72	25413.17	25087.67
1983	24794.72	25001.34	25656.59	26089.65
1984	27010.96	27043.51	27022.28	27429.86
1985	27473.73	27477.98	27281.26	27588.37

Table A1. Quarterly real GDP Estimates, 1947q2 - 2014q3 (cont.)
(seasonally adjusted, 2009/10 prices)

Year	Mar	Jun	Sep	Dec
1986	27472.32	28076.62	28512.51	27748.29
1987	27971.89	28112.00	28266.00	28397.00
1988	28289.00	28156.00	28218.00	27970.00
1989	28327.00	28493.00	28171.00	28116.00
1990	28066.00	28061.00	28314.00	28648.00
1991	27954.00	27764.00	27852.00	28033.00
1992	28114.00	28114.00	27912.00	28262.00
1993	28725.00	29363.00	29958.00	30239.00
1994	30700.00	30912.00	31434.00	31841.00
1995	32214.00	32608.00	32901.00	33125.00
1996	33585.00	33884.00	34110.00	34566.00
1997	34430.00	35108.00	35012.00	34921.00
1998	34683.00	34815.00	34872.00	35216.00
1999	35647.00	35942.00	36965.00	37420.00
2000	37953.00	37942.00	38077.00	38136.00
2001	38264.00	38791.00	39102.00	39690.00
2002	40059.00	40633.00	41105.00	41685.00
2003	41923.00	42140.00	43043.00	43569.00
2004	44241.00	44654.00	44717.00	44887.00
2005	45352.00	46239.00	46401.00	46236.00
2006	46868.00	47127.00	47447.00	47850.00
2007	48427.00	48786.00	49204.00	49319.00
2008	49185.00	48657.00	48568.00	48341.00
2009	47768.00	47793.00	47986.00	48463.00
2010	48580.00	49065.00	48802.00	48608.00
2011	49157.00	49478.00	49894.00	50098.00
2012	50464.00	50617.00	50785.00	51434.00
2013	51439.00	51660.00	52201.00	52512.00
2014	52976.00	53325.00	53872.00	

Table A2. Quarterly Total Employment, 1956q1 - 2014q3
(HLFS-consistent, seasonally adjusted, 000)

Year	Mar	Jun	Sep	Dec
1956	877.47	880.24	883.93	889.67
1957	894.61	897.51	897.54	897.04
1958	902.24	914.86	925.17	928.36
1959	926.73	925.22	928.67	937.75
1960	946.13	951.63	957.02	963.83
1961	970.46	976.87	981.81	984.12
1962	986.64	989.38	993.00	998.53
1963	1005.42	1014.91	1023.95	1032.23
1964	1041.10	1050.99	1060.21	1068.30
1965	1076.42	1083.90	1093.93	1109.00
1966	1122.09	1130.64	1137.52	1141.42
1967	1142.04	1134.59	1128.77	1126.24
1968	1127.19	1132.84	1139.32	1146.84
1969	1156.84	1169.82	1183.28	1196.74
1970	1209.22	1219.06	1228.53	1237.27
1971	1244.76	1249.75	1254.15	1257.80
1972	1262.31	1267.80	1276.45	1290.86
1973	1307.29	1327.45	1346.36	1361.68
1974	1376.61	1391.21	1401.39	1402.18
1975	1404.86	1410.95	1417.64	1423.89
1976	1429.31	1432.59	1437.59	1443.76
1977	1446.99	1445.86	1445.74	1445.70
1978	1446.43	1452.48	1459.25	1466.06
1979	1471.65	1479.17	1486.91	1492.29
1980	1498.07	1491.39	1475.60	1477.98
1981	1496.99	1495.81	1501.91	1513.39
1982	1514.23	1520.52	1523.43	1521.97
1983	1509.97	1503.05	1517.18	1522.19
1984	1532.26	1553.58	1553.87	1581.95
1985	1597.94	1607.90	1604.99	1611.15
1986	1622.45	1624.03	1627.64	1604.43
1987	1627.68	1626.52	1630.23	1615.85
1988	1598.07	1582.17	1559.65	1552.34
1989	1533.59	1518.29	1522.07	1524.26
1990	1532.84	1542.75	1536.57	1527.13
1991	1518.85	1513.39	1505.26	1500.67
1992	1508.74	1517.51	1510.80	1519.93
1993	1525.88	1534.54	1552.56	1567.78
1994	1583.26	1599.62	1620.22	1643.67
1995	1663.73	1677.48	1693.92	1710.90

Table A2. Quarterly Total Employment, 1956q1 - 2014q3 (cont.)
(HLFS-consistent, seasonally adjusted, 000)

Year	Mar	Jun	Sep	Dec
1996	1722.77	1740.32	1754.11	1744.87
1997	1745.40	1753.66	1751.36	1750.60
1998	1746.01	1737.90	1738.14	1733.89
1999	1752.61	1759.24	1766.84	1785.27
2000	1783.38	1785.32	1808.45	1821.77
2001	1824.32	1842.54	1847.35	1867.64
2002	1893.70	1906.44	1905.74	1918.30
2003	1928.85	1946.11	1972.01	1975.56
2004	1992.62	2006.59	2030.67	2066.81
2005	2064.03	2072.06	2099.10	2103.23
2006	2119.63	2141.37	2139.08	2139.31
2007	2162.13	2172.82	2174.07	2190.35
2008	2189.53	2189.82	2197.52	2212.21
2009	2169.31	2172.22	2157.41	2159.76
2010	2165.42	2171.88	2195.93	2188.43
2011	2203.66	2215.55	2220.07	2222.61
2012	2223.65	2229.05	2220.62	22230.53
2013	2232.66	2245.44	2275.43	2296.36
2014	2315.73	2327.43	2347.63	

Notes

[i] This BB algorithm was written in RATS by Dr Kunhong Kim. The initial version of the program was written to replicate successfully Bry and Boschan monthly results, and was then adapted for quarterly data to reflect what King and Plosser (1994, p 411) have described as BB's handling of quarterly data in a way similar to that of Burns and Mitchell (1946), " … by simply setting each month of the quarter equal to the quarterly value and proceeding to set the series as monthly."

[ii] Utilising the BBQ method, Hall and McDermott (2009, Table 1) included in their 'benchmark' turning points a peak at 1958q2 and a trough at 1959q1. This reflected the BBQ program not including a smoothing element. The BB program used in this paper includes the smoothing element, and so leads to what was a very marginal call of a 3-quarter 1958-59 contraction by the BBQ method not being called by the BB method.

[iii] Neither the BB nor BBQ methods picked these 1975 and 1989/90 technical recessions, though as stated in section 2.1 above the BBQ method did call 2010q3 and 2010q4 as a two-quarter recession.

[iv] For recent work on the robustness of New Zealand's key business cycle facts, see Hall and Thomson, with McKelvie (2014).

[v] The linked series used in Hall and McDermott (2014) included real GDP production based data from 1987q2 to 2013q3, released by SNZ on 19 December 2013 in their SNDQ series; the series used in this paper reflect the updated and substantially revised SNEQ series released 18 December 2014.

[vi] This exercise was also carried out using the BBQ algorithm (Table 6). Taking into account that the BBQ algorithm is more sensitive to quarterly 'erratic' movements/idiosyncratic variation and/or potentially recessionary periods of frequently alternating negative and positive growth rates, and bearing in mind the exceptions noted for the BB results, the BBQ turning points are perhaps also relatively robust to data revisions *within* the SNCQ and SNDQ series releases. This includes calling the 97q2 peak and the 98q2 trough for the 1997-98 recession, and (unlike the BB algorithm) calling a two-quarter recession for 2010 from the two SNDQ series releases. There is somewhat greater evidence of sensitivity *between* SNCQ and SNDQ, and SNDQ and SNEQ releases.

[vii] For an example in a growth rate context of how substantial revisions to Australia's national accounts during the 1970s showed up initial observations which subsequently turned out to have provided misleading information for Australian Federal Government and private sector decision makers, see Hogan (1979).

[viii] Chapple's HLFS-consistent series were published as de-seasonalised, but our graphing of his employment series showed that there still remained a very significant seasonal pattern. Accordingly, the results we present reflect our having run the employment series through Eviews' X13 program. See Figure 2, bottom panel, and Appendix Table A2 for the resulting X13 seasonally adjusted linked total employment series.

[ix] On the relatively unusual nature of these two cycles, and the cautionary comments on our real GDP series observations prior to 1954, see Hall and McDermott (2011, s 6)

[x] For an assessment of relative timing of 64 time series, including total employment, with respect to a deviation reference chronology over the period 1947-74, see Haywood and Campbell (1976).

[xi] Hall (2011, pp 431-432) defines slumps broadly as "extended periods of low resource utilisation", and identified them specifically as periods when " … the employed fraction of the labor aged 25 through 54 … was less than its normal level of 95.5 per cent of the labor force." Thus, it would last from when employment falls below its normal level during a contraction phase and continue through to when employment regained its normal level during an expansion phase.

[xii] For recent narrative commentary on factors associated with New Zealand's post-Second World War recessions, see Reddell and Sleeman (2008), and brief paragraphs in Hall and McDermott (2009, ss 3, 4, 6; and 2011, s 5.2).

[xiii] This opposite average two-year recovery pattern for the U.S. for the updated period has been maintained, despite the recovery from its most recent 2009 trough having been atypically slow (see, for example, Dominguez and Shapiro (2013), DS). DS have attributed this slowness primarily to successive financial shocks from Europe during 2010, 2012, and especially 2011.

[xiv] Ng and Wright (2013, ss 1,2) are of the view that the three most recent recessions for the U.S. have been distinctively different, through having been associated in important ways with shocks having financial market origins.

[xv] The significance at the 10% level of the growth-rate-during-contraction variable in the one-year and two-year cumulated growth rate equations is attributable to two outlier observations, and especially so to the observations for the 1948 recession.