A CLOSER LOOK AT THE NAIRU

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ABSTRACT

This research will attempt to analyse the usefulness of the concept of the NAIRU (Non-Accelerating Inflation Rate of Unemployment, hereafter NAIRU). The history and development of the NAIRU will be analysed. There will be specific reference to the New Zealand economy and the policy implications of the NAIRU for New Zealand. The policy decisions in New Zealand such as the Reserve Bank Act and the Employment Contracts Act will be studied in an attempt to discern any implicit NAIRU goals. The aim is to find if the NAIRU is effective as a policy tool, and to understand the implications of the concept both if it is valid, and if it is invalid. The research will derive a NAIRU value empirically for the New Zealand economy. Comment will be made on the empirical techniques used by economists in their estimation of the NAIRU. In conclusion an understanding of the NAIRU, its validity, and its use to New Zealand policy makers, recommendations for further study will also be made.

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DEDICATION

This Thesis is dedicated to Brig. Mrs. Kathleen Blackman (Gran). Her encouragement, love and support are greatly appreciated. Throughout the years she has been interested and supportive of me.

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INTRODUCTION

Recent commentators have 'scorned' the use of the NAIRU as a policy tool. Attempts have been made by New Zealand economists to work with the NAIRU concept. Recent policy history in New Zealand has suggested an implicit NAIRU despite the negative political implications that a positive unemployment rate has. Many economists have worked for nearly five decades on the Phillips curve (the empirical relationship that started the NAIRU) and the NAIRU itself. The general consensus in economics has been towards a Phillips curve relationship between inflation and unemployment, with no trade-off in the long run and a natural rate of unemployment or NAIRU. With new views as to the validity of the NAIRU as a concept gaining exposure, the pressure is on to explain domestic government monetary policy which previously explicitly, or implicitly, used the NAIRU as a guideline. With New Zealand's recent economic reforms and a strong control over domestic monetary policy, this thesis seems relevant. The question: Is the NAIRU invalid? If so what are the implications for the New Zealand economy?

1.1 HYPOTHESIS

The NAIRU concept is implicitly tied to New Zealand's domestic economic policy. If the concept of the NAIRU is invalid, it has serious implications for the New Zealand economy.

1.2 METHODOLOGY

The literature review will analyse the NAIRU and the Phillips curve explaining their history and development. New Zealand's macroeconomic policy will also be analysed. The questions will be asked: Where did the policy come from? What was its prime motivation? Did this motivation change with the Reserve Bank Act? Other regulations will be considered as possibly containing the NAIRU concept.

The empirics of the NAIRU will be shown in a simplified form. The New Zealand economy will be looked at, with an attempt to derive an estimate for a unique NAIRU for the New Zealand economy. The estimation technique will attempt to use a time varying approach. The New Zealand data will be used with the Staiger, Stock and Watson model for the Phillips curve (Staiger et al 1997:41-42) and their equation for the NAIRU of:

$$U^* = -\mu / (\beta_1 + \beta_2)$$

That is derived from the Phillips curve equation that Staiger, Stock and Watson (1997:41-42) use:

$$\Delta\pi_t = \mu + \beta_1 U_{t-1} + \beta_2 U_{t-2} + \gamma X_t + V_t$$

Where $\mu = -(\beta_1 + \beta_2)U^*$

This model will need statistics for New Zealand, detailing unemployment figures for a given time period. Also needed, will be policy details relating to the Reserve Bank Act, Policy Targets Agreements, Goods and Services Tax, the Fiscal Responsibility Act, benefit changes and 'work schemes' for the same period.

The data will be modelled according to the approach made by Staiger, Stock and Watson to find an estimate for the NAIRU over a time period and then for a sequence of years. These rates could then be compared to policy decisions made by the government. Some conclusion can then be drawn.

The data that will be used, in the New Zealand NAIRU estimation section, will be drawn from the Household Labour Force Survey, Statistics New Zealand, and the Reserve Bank. This information is regarded by some authors contained in the literature review as being the most reliable data set available for New Zealand on employment and unemployment. The data should be able to test the hypothesis, given an adequate definition of the NAIRU concept, and the policy implications that it contains. The data will be drawn from information collected, and specifically designed to be an aid to research in the areas of employment and unemployment in New Zealand. This suggests that the information will be receptive to the research proposed.

1.3 IMPORTANCE OF RESEARCH

There is, and has been, significant political interest in employment and unemployment issues. This research could be a valuable aid to, and criticism of, previous policy decisions and the motivations behind them and may suggest possible future policy decisions. The research will further develop an hypothesis on the relevance of the NAIRU and apply this to New Zealand situation. The methods could also be used in other areas of research, such as research into economic growth. There are also important social issues contained within the subject matter of this research, and this study may help to show motivations behind the policies that affect these social issues. Should this research prove or disprove the hypothesis it will enable policy makers to see mistakes made, and may even finalise the debate over the accuracy of past policy decisions. It has the potential also to reduce the political nature of the debate over the relationship between inflation and unemployment.

1.4 LIMITATIONS AND ASSUMPTIONS

The data was not difficult or more expensive to gather than anticipated. Some of the factors that influence the economy will be only briefly touched on. Discussion on social benefits and costs will only be briefly stated in this thesis. Many economists discuss other institutional factors, such as microeconomic conditions in the labour market, at length, and this thesis will not be entering into this debate.

The political nature of the implications of the NAIRU concept and the Phillips curve, were not be a hindrance to the collection of data and information. Assumptions made in the model about the rationality or near rationality of consumers may be unrealistic and the appraisal of policy may not be easy to perform.

The literature has recently been scathing of the use by economists of the NAIRU hypothesis. Writers argue that the research thus far completed provides little evidence that such a rate actually exists, nor they say can any economist come up with a good enough reason for continuing on with debate over the NAIRU. With this in mind the debate about the validity of the NAIRU itself may be deemed by some, to be irrelevant.

1.5 CONTRIBUTION TO KNOWLEDGE

Implications, of past policy decisions in New Zealand with regard to employment and unemployment, may be able to be critiqued through this research. This research may provide information as to possible future policy decisions, which suggests an important contribution to the current state of knowledge.

This study will also develop further a NAIRU model specifically using New Zealand data. This model would be developed through this research, acknowledging and using the NAIRU and Phillips curve concepts. This research will further contribute to the debate over the connection between economics and policy.

CHAPTER TWO

ORIGIN AND ROLE OF THE NAIRU

This chapter will define the NAIRU or Non-Accelerating Inflation Rate of Unemployment. The history and development of the concept of the NAIRU, from Phillips' original work that indicated a negative relationship between inflation and unemployment, to Laubach and other modern economists, who have worked on the econometric aspects of the NAIRU, will be discussed

2.1 WHAT IS THE NAIRU?

The Non Accelerating Inflation Rate of Unemployment (NAIRU) is a concept that was derived from the Phillips curve. When a long run Phillips curve is examined, a specific rate of unemployment can be seen whereby inflation will have no tendency to either accelerate or decelerate. Eisner (1997:96-97) described a good explanation of how the NAIRU concept was derived from the Phillips curve.

> The "Phillips curve was a short-run relation that shifted with changes in expectations of future inflation. If...policy aimed at keeping aggregate demand sufficiently high to maintain any rate of unemployment below the natural rate, the short-run curve would keep rising and with it actual inflation...Ultimately the higher nominal aggregate demand would translate into no change in real demand or the policy makers would give up in the face of run away inflation...unemployment would then be back at its natural rate and inflation would stop accelerating but would stay at its new higher rate until unemployment was raised above the natural rate and the process was, painfully reversed. The long-run Phillips curve was thus in effect vertical at the...NAIRU."

To derive the concept of the NAIRU theoretically, an analysis of the determinants of inflation needs to take place. This is presented in the definition by Layard et al (1994:11)

> "If...nominal income [is] growing at a constant rate, rising inflation will...lead to rising unemployment. Eventually the higher unemployment will stop inflation rising...unemployment and inflation will stabilise. The level of unemployment at which inflation stabilises is the equilibrium level of unemployment...There is indeed a long-run equilibrium at which both unemployment and inflation will be stable. We shall call this the long-run NAIRU...There is however some short-run NAIRU, which would be consistent with stable inflation and which of course, depends on last year's unemployment. In this view of the world there is short-term 'hysteresis', in the sense that past events affect the current short-run NAIRU. But there is no long-term hysteresis."

This is what we understand today by the concept of the NAIRU. How can we formulate the NAIRU mathematically? The model that Tootell uses in his analysis of the labour market is expressed in a formula as follows:

$$\%\Delta P_t = \alpha + \beta(Ur_t) + \gamma(\%\Delta P_t^E) + E_t$$

Where ΔP is the change in prices, Ur is the unemployment rate, and ΔP^e is the expected change in the price level. Where the NAIRU is simply $Ur^* = -(\alpha/\beta)$[1]

Tootell (1994:33) expressed expected inflation as a weighted average of lagged inflation with coefficients summed to equal one. This then gives a simple formula to calculate a NAIRU from

$$NAIRU = -(\alpha/\Sigma\beta i)$$

[1] Where $\%\Delta P_t = \beta(Ur - Ur^*)$, where P is prices, and β is assumed to be less than zero.

The NAIRU was also at times called the Natural Rate of Unemployment. When Heap defined a model of the NAIRU he called it the Natural Rate of Unemployment, and established a model of the natural rate of unemployment. His model is as follows (Heap 1980:611-612):

$$Pt = a - bUt + Pet$$

Where Pet = Pt-1, the expected inflation is equal to the inflation from the previous time period, Ut is the unemployment rate. This gives us:

$$Pt-Pt-1 = a- bUt$$

If unemployment decreases below an equilibrium level of unemployment then the acceleration of inflation becomes apparent. The natural rate then is defined:

$$U^*t = U^*t-1 + C\ (Ut-1 - U^*t-1) + et$$

If et =0 then the equation further reduces to:

$$U^*t - Ut-1 = C\ (Ut-1 - U^*t-1)$$

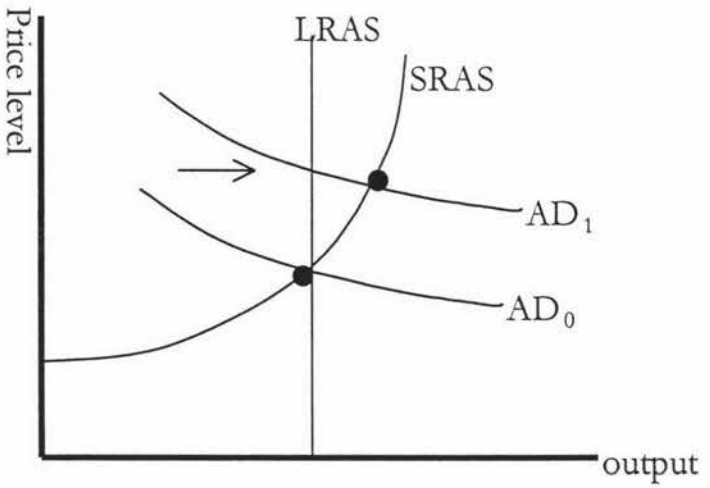
Where U^*_t is the natural rate of unemployment (NAIRU) at time period t The term et then indicates the random error that creeps into a statistical concept. This random error term is also known as the 'white noise' term, where white noise signifies irrelevant extraneous information created by the natural processes of the model. This relationship shows that if the rate of unemployment in the previous period is greater than that period's natural rate this would lead to the NAIRU increasing. Heap (1980:613) further noted that if the proportion of the labour force that is structurally unemployed is changed, then so too will the NAIRU.

2.2 THE POLICY IMPLICATIONS OF THE NAIRU

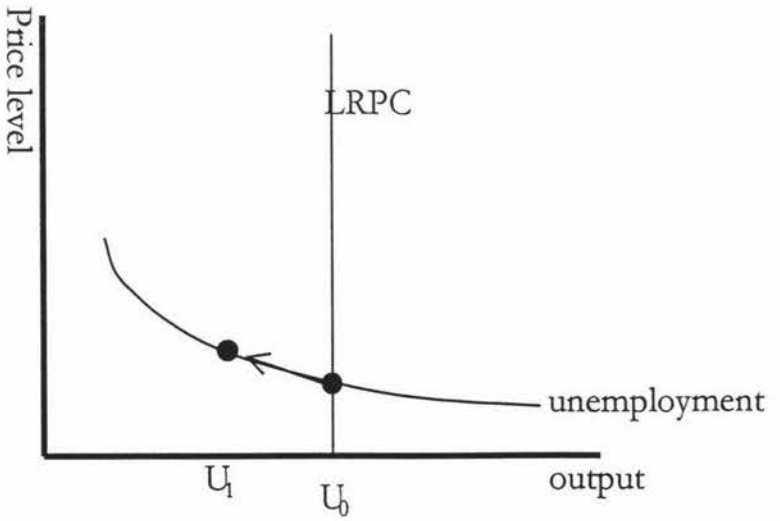
Why then is this concept of the NAIRU (or natural rate of unemployment) important in modern macroeconomics?

The NAIRU implies that aggregate demand policy has no long-run effects. The concept makes the existence of a positive unemployment rate a non-negotiable issue in economic policy. The ineffectiveness of demand sided policies in the long run can be seen in Figure One. When the aggregate demand curve shifts to the right in graph A there is pressure to increase prices and output will increase in the short run. An increase in output would therefore increase employment. If this same policy is attempted in the long-run, the ineffectiveness of it is apparent in graph B. The unemployment level falls below the NAIRU, inflation then accelerates due to the vertical nature of the long-run Phillips curve.

FIGURE ONE
(Stiglitz 1997:372)



B



The NAIRU can be a good tool for policy makers to use. Stiglitz (1997:3) pointed this out in his article in the *Journal of Economic Perspectives.* The existence of a rate that identifies where inflation control policy should be aimed to control inflation would be an invaluable tool for the macroeconomic policy makers. The NAIRU describes how an economy behaves when it is not in equilibrium (Stiglitz 1996:4). If unemployment decreases to a level below the NAIRU by as little as 1% for a year then inflation will increase by an amount between 0.3 to 0.6%. This suggested to Stiglitz that there would only be a small negative effect if unemployment were less than the NAIRU. Tootell, another well-known economist agrees with Stiglitz but looks only to the importance of monetary policy. Tootell (1994:31), when debating the importance of monetary policy and how the concept of a NAIRU affects monetary policy, stated that "knowledge of the level of NAIRU is important to monetary policy formation; it helps define the short run trade off between unemployment and inflation." Crosby and Olekalns further highlighted the importance of the NAIRU to monetary policy makers when they stated: "Having a view about the level of the NAIRU is an important component in the design of monetary policy", (Crosby et al 1998:123).

The policy implications were important to Heap also. Heap (1980:611) noted the implications of the natural rate of unemployment hypothesis. He found that if policy makers try to decrease unemployment below the NAIRU it led to accelerating inflation. The objective for policy makers should then be, to "ensure the natural rate of unemployment." (Heap 1980:611)

The relationship that brought about the NAIRU was the Phillips curve. On the importance of this relationship to economics, and policy decisions Samuelson, said, "any criticism of the guide posts which does not explicitly take into account the Phillips Curve concept, I have to treat as having missed the fundamental point of all economic policy discussions" Leeson (1997:144).

2.3 THE ORIGINS AND DEVELOPMENT OF THE NAIRU

The origins of the NAIRU go back to the debate over what policy to prescribe to solve the two economic problems, inflation and unemployment. Commentators commentated on the length of time this debate has raged among exonomists, "the concept of a relationship between inflation and unemployment has a long prehistory, stretching back at least to the eighteenth century" Leeson (1997:118). The, economic history of the debate is littered with significant events, not the least of which was the Great Depression. This spurred economists into a fervour, with many as noted by Leeson, reacting to the poor and destitute. They would, he noted "rally around the 'Keynesian' cry of spend, spend, spend." Leeson (1997:121) This, led to "a generation of economists...obsessed with the depression of the nineteen thirties" (Leeson 1997:122).

It was after the heady spending days, of the thirties and forties, that inflation became more of an issue for economists. Leeson also noted this occurrence when saying that just prior to the nineteen fifties nearly all economists saw inflation as "an unmixed evil." (Leeson 1997:135) It was around this time that Samuelson spoke again, calling for, as Leeson stated (1997:142) "full employment [that] would be compatible with reasonable price stability without the wage and price controls that Galbraith (and, from a different perspective, Rostow) advocated."

It was up to Phillips, an engineer, to make the relationship into a model which future economists could develop and argue over. What Phillips set up in his hypothesis in 1958 was "In disequilibrium, the price of a commodity will rise or fall according to the extent of excess demand or excess supply. Unemployment can be used as an indicator of excess demand in the labour market and...one would expect high unemployment to be associated with low-wage inflation and vice versa" (Chapple 1996:222). Phillips set up the relationship between inflation and unemployment. Phillips, as cited by Chapple (1996:222-23) also noted the policy implications of this

> "It seems from the relation fitted to the data that if Aggregate Demand were kept at a value that would maintain a stable level of product prices the associated level of unemployment would be a little under two and a half percent [assuming an increase in productivity of two percent per year]. If as is sometimes recommended, demand were kept at a level which would maintain stable wage rates the associated level of unemployment would be about five and a half percent."

Leeson noted (1997:49-50) the novelty of Phillips relationship and further stated the objective of Phillips.

> "Phillips' dynamic stabilisation exercise was a path-breaking application of engineering and optimal control techniques to economic systems. The theoretical Phillips Curve...contained a proportional, integral, and derivative (PID) mechanism to dampen the swings of the business cycle."

This corresponds to the continuing historical desire for economists to solve the boom and bust cycle and the unemployment and inflation that follow. Both inflation and unemployment are capable of creating distortions in the economy. What did Phillips do with his curve? Leeson (1997:50) noted the process that Phillips went through in his approach.

> "The empirical Phillips Curve (1958) connected the counter-clockwise autocorrelated movements of wage change and unemployment observations as the unregulated British economy boomed...and then retreated into a recession...Phillips then averaged these 1861-1913 observations into six 'crosses' to derive a single, representative, inverse and non-linear curve."

Leeson (1997:95) went on to note further advances that Phillips made in his theory. "Phillips pioneered the introduction of adaptative inflationary expectations into this type of macroeconomics...But, as is well known, when the trade off interpretation of the Phillips curve unambiguously broke down, it was replaced, or augmented, by a family of short-run curves, along each of which inflationary expectations were held constant."

The debate over what policies to prescribe was still raging. With both a pro- and an anti-Keynesian side arguing over whether to spend money to fix the unemployment problem, or not. The inflation and unemployment policy prescription debate in the 1960's was fought along the pro- and anti-Keynesian lines until another economist's ideas came to the fore. This event, and those which immediately preceded it are noted by Leeson (1997:130).

> "The victorious fiscalists co-opted Phillips's apparent empirical regularity and transformed it into a menu of contemporary policy choice. Thus the Phillips curve, at first in its long-run trade off form, but later in its expectations –augmented form, came to dominate macroeconomic policy for over three decades. Ironically, the Natural Rate Expectations-Augmented Phillips...Curve was launched into prominence by an...anti-Keynesian during his 1967 American Economists Association presidential address, in the run-up to the campaign that would elect the loser of the 1960 U.S. presidential election."

The anti-Keynesian mentioned was Milton Friedman. The influence of his presidential address is still seen in economics textbooks around the world. Friedman's address used the Phillips relationship, and expanded on 'solving' the problems with it. Friedman's influence on economics was only to grow in the coming years and his presidential address somewhat eclipsed the initial work of Phillips a decade earlier.

Friedman, in an historical analysis of the NAIRU and the Phillips curve, described the early development of the Phillips curve concept. He acknowledged Phillips as the pioneer in the field and Friedman (himself) as the one who continued on the tradition. Friedman talked of the three stages of development that he saw the Phillips curve had gone through. The third stage was in its infancy, when Friedman commented, but he saw its future development. The "relation between inflation and unemployment has gone through two stages since the end of WWII and is now entering a third. The first stage was the acceptance of a hypothesis associated with the name of A. W. Phillips (1958) that there is a stable negative relation between the level of unemployment and the rate of change of wages" (Friedman 1977:454). Policy makers could then exploit this as there was a stable trade off. However Friedman (1977:455) noted that, at this first stage, there were problems with the development of the Phillips curve. "Empirical estimates of the Phillips curve relation were unsatisfactory."

Friedman then went on to discuss the second stage of development of the Phillips curve concept. It was stage two that Friedman had some input into. This stage led to the first formulations of the Natural Rate Hypothesis, which developed into the NAIRU concept. This stage, Friedman noted, saw the

development of a distinction between the long and the short-run theoretical versions of the Phillips curve Friedman (1977:456). He also commented on the third stage of the development of the Phillips curve. This stage saw the rapid development of the NAIRU as a concept. It also saw the growth of criticism of the entire model. It was the stage where empirical results were accommodated into the shape of the Phillips curve. Questions arose and were tested as to the nature of the curve itself (Friedman 1977:459-460).

Leeson noted the comments of Samuelson and Solow on the work of Phillips and the development of the Phillips curve in an American context. This was the first time that the possibility of an inherent instability in the short run, and the possibility of using government policy to move the curve were mentioned:

> "Phillips's findings are remarkable...with minor exceptions, the same relationship that fits for 1861-1913 also seems to fit about as well for 1913-1948 and 1948-1957...the English data shows a quite clearly non-linear hyperbolic relation...they then translate the Phillips diagram into American context, concluding that there has been an apparent shift in our Phillips curve...they conclude by discussing measures hopefully designed to move the American Phillips curves downward and to the left" (Leeson 1997:143).

The Phillips curve relationship has been debated ever since it was first proposed. Leeson described the history that was made by Phillips's work. When the paper was published, Leeson suggested that this settled the argument over the inflation, unemployment relationship that had gone on for years.

> "Phillips's article was...presented in an highly original and eye-catching manner, it appeared to contain great explanatory power over a long period of data, and it resolved the dilemma that Samuelson et al had been grappling with since the 1930's. The Phillips Curve episode also revealed an imbalance in the development of political economy, namely the failure to develop a choice theoretic model of behaviour in the political market place" (Leeson 1997:147).

The theoretical development of the Phillips curve concept, and the NAIRU that was expressed within the relationship, was proceeding along separate lines from the empirical work being done in this area. The first noticeable break of the two was from Phillips himself, who always kept the theory of the relationship separate from the empirical study of economies in the search of the Phillips curve relationship. This was evident in the abstraction that was made in 1961.

This abstraction was to enable the theoretical side to the Phillips curve to develop. The development of the theoretical side to the Phillips curve would then enable policy makers to decide what path to take, without having to worry about the still burgeoning study into the empirical nature of the Phillips curve. Chapple pointed to this "Phillips in his Economica 1961 article uses a linear approximation for his Phillips curve." (Chapple 1996:223)

Samuelson and Solow further defined the theoretical side to the relationship. In 1960 Samuelson and Solow added new concepts to the relationship, concepts that many still use today. "Samuelson and Solow in 1960 go on to 'discuss the possibility of what would now be described as path dependence or Hysteresis'...in terms of a low-pressure economy building up larger amounts of structural unemployment. The result...would be an upward shift in our menu of choice, with more and more unemployment being needed just to keep prices stable." (Chapple 1996:227)

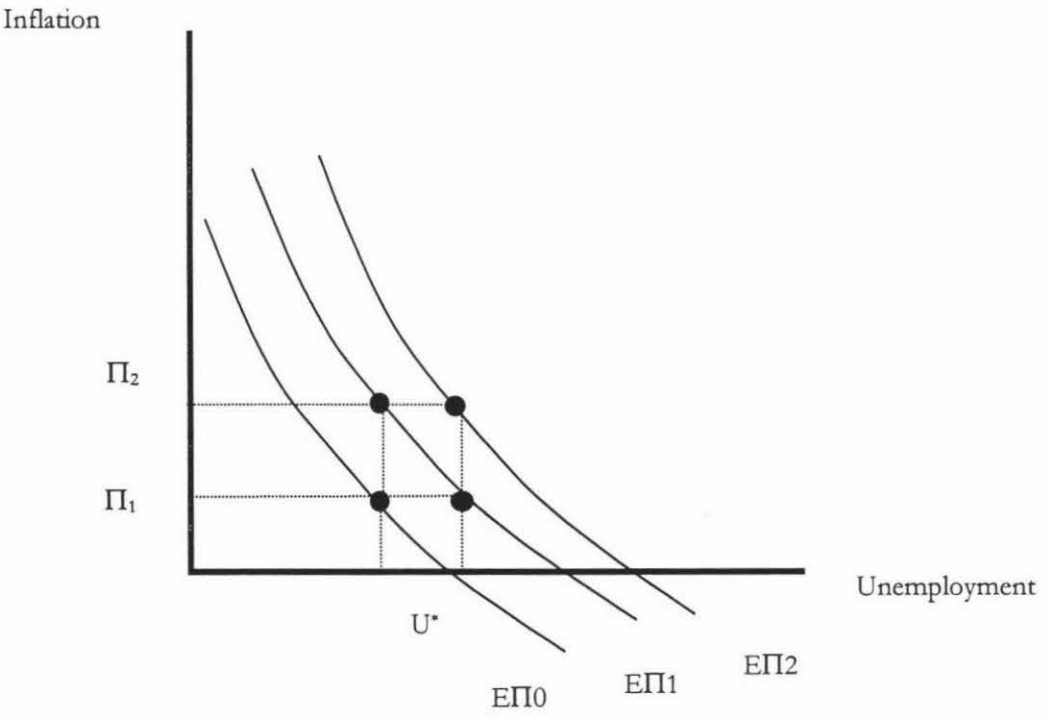
After the price shocks of the 1970's, the Phillips curve relationship was said to be dead. The NAIRU was said to be of little substance, and of no use for policy decisions. However a revival occurred. Friedman came to the defence of the relationship, and his defence was to cement himself a place in history. This

revival subsequently filled economics textbooks. Leeson (1997:49) noted this change "according to the textbook story, Friedman corrected Phillips mistake and ...introduced adaptive inflationary expectations to predict that the simple trade-off would break down."

Mankiw in an introductory article, talked of the contribution to the development of the NAIRU and the Phillips curve by Friedman. He noted the work that both Friedman and Phelps had done with the NAIRU theory. There was a "chasm between microeconomic principles and macroeconomic practice" (Mankiw 1990:1647). Friedman and Phelps filled this gap in the theory, after the seventies price shocks. They argued that the NAIRU was dependent on labour supply, labour demand, search times and other microeconomic considerations.

The concept of adaptive expectations saved the theory from being relegated to economic obscurity. Friedman, as the 'originator' of the theory of Adaptive Expectations, was hailed a hero. This solved the problems of stagflation, and enabled a policy tool to be able to be used again. Figure Two shows the Expectations-Augmented Phillips curve (EAPC). Where the Phillips curve rests on the graph depends on inflationary expectations. If expectations of inflation increase the Phillips curve shifts up, where U* is the NAIRU. If unemployment is high, and inflation less than expected, the Phillips curve would then shift down. Policy and economic decisions as well as recent experience affect expectations about inflation. If prices were stable for a period of time then people would expect this. At this time if the government decided to reduce unemployment below the NAIRU this will lead to inflation, and continued inflation for as long as the policy lasts.

Figure Two



EΠ0: Expected $\Pi = 0$

EΠ1: Expected $\Pi = \Pi_1$

EΠ2: Expected $\Pi = \Pi_2$

Further advances were to be made. It was an economist by the name of Lipsey who Leeson (1997:95) credited as creating "the first labour-market based theoretical analysis of the Phillips curve." The theory was being developed, and the empirical techniques that were employed to establish the theory were also further developed and debated.

On a question of policy related issues, Robert Gordon was noted by Leeson. Gordon was an economist who looked into the effects on inflation if the Phillips curve is shifted. Leeson (1997:96) stated "Gordon explained how policy-induced recessions can shift the short-run Phillips curve and 'reduce inflation by any desired amount, to zero or even to a negative number."

The Natural Rate Hypothesis (NAIRU in the early stages of its development as a concept) was now starting to make its prominence felt in work published. Friedman again took centre stage as a key figure in the new developments. Friedman was noted by Chapple (1996:22) as the one who led the way to the Natural Rate of Unemployment hypothesis. This natural rate was where the unemployed was solely made up of those temporarily between jobs, or those choosing not to work. "Wage inflation depended only on the difference between actual unemployment and...the natural rate of unemployment" Chapple (1996:21).

The definition of an EAPC was, as said before, a monumental turning point in the relationships' history. This work was based on Phillips work and yet took on a life of its own. This process led to a more rapid theoretical development of the NAIRU concept as it enabled the theory and empirical work to merge, making the theory seem more concrete.

The theory of an expectations-augmented Phillips curve was developed. Stiglitz (1997:362) noted that as the EAPC increases over time with workers using higher expectations of inflation to bargain for wages "their expectations are assumed to adapt to what they actually experience; when expectations are formed in that way, they are said to be adaptive." This then formed the theory of adaptive-expectations.

Another theory emerged a few years later. This was the theory of rational expectations. This theory held credence for a short while but has now all but gone from respectable economic vernacular. This theory suggested that people behaved rationally, and their expectations were rational as well. Lucas defined this method. He suggested that any increase, in the EAPC would occur more rapidly (Stiglitz 1997:364). This implied that, the government could decrease inflation without too much impact on unemployment by convincing the public that inflation can and will decrease (Stiglitz 1997:364).

The NAIRU became a theory capable of being verified through statistical techniques. The economist who took this leap was none other than Phelps. Phelps looked at the Philip's curve assumed one that adjusted to inflation gradually over time, being negatively sloped and intersecting the horizontal axis at the NAIRU rate (Phelps 1967:254-257). He found that inflation would increase if unemployment was less than the NAIRU (Phelps 1967:258). Conversely if unemployment is above this level there were inefficiencies.

The NAIRU (still known as the natural rate of unemployment) was then more carefully examined. The question as to what would cause this concept to shift was prevalent in the minds of many of the top economists. Hall was one such economist.

In determining what caused the NAIRU to shift, Hall noted that the Natural Rate was independent of the supply or demand for labour (Hall 1979:153). The labour market structures that will affect the natural rate strongly are "costs of recruiting, the costs of turnover to employers, the efficiency of matching jobs and workers, and the cost of unemployment to workers" (Hall 1979:153). This would suggest that "fluctuations in the natural unemployment rate are unlikely to contribute much to fluctuations in the observed unemployment rate" (Hall 1979:153).

The definition of the NAIRU was under question and the implications for policy analysis were also. Brosnan and Hicks gave another definition of the NAIRU. They defined the NAIRU as a rate that "could not be reduced in the long run through an expansion of demand without accelerating inflation" (Brosnan and Hicks 1986:186). They noted that any increase in the duration of unemployment, for the unemployed, had the effect of increasing the unemployment rate. Policy decisions needed to be targeted at the duration people are unemployed. This would have the effect of lowering the future unemployment rate.

In the countries of Europe the traditional Phillips curve relationship and the NAIRU did not seem to fit with the economic conditions of the time. Europe was analysed with interest by several notable economists, who were actively trying to discredit the NAIRU and Phillips curve concepts. Europe had a different history with regard to unemployment and unemployment policy, say Blanchard and Summers. They found that even with policies that should have restored the economy to the NAIRU, the economy did not move back to the

NAIRU (Blanchard and Summers 1988:182). In Britain's case, there may have been structural changes moving the NAIRU above what it was before the employment policies took hold (Blanchard and Summers 1988:183). At one stage unemployment had got so bad in Britain that

> "the Thatcher government stopped requiring unemployment insurance recipients to regularly appear at job centres because there was not enough room" (Blanchard and Summers 1988:185).

The problems of Europe did not sink the chances of the NAIRU becoming a valuable policy tool. Two leading economists empirically used the natural rate hypothesis with a disaggregated labour force to see if the market would indeed clear at the natural rate of unemployment (NAIRU). Coen and Hickman defined a model of the labour force[2] and the unemployment rate. Defining the labour force as:

$$L = \Sigma \, Ni \, LPi \, [(1-r)(W/Pc), (E/N), AH, t, Z]$$

This gives room to develop an estimate for the aggregate natural unemployment rate (Coen and Hickman 1988:189). This formula is UF= S UFi (LFi/LF). Where LFi/LF is a fraction of the full employment labour force, in a specific age- sex section. Coen and Hickman (1988:190) say that the labour force at full employment is considered wage inelastic, and the full employment wage (WRF) would clear the market at the NAIRU: (LF-EF)/LF

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[2] Where: Ni is the population, Lpi is the labour force participation rate, r is the personal tax rate, W is the nominal hourly wage, PC is the consumption deflator, E is the aggregate employment, N is aggregate population, AH is the annual hours, t is the time trend and Z is the vector of exogenous variables (1988:189).

Hall, and then Barro, deviated from the Phillips curve relationship. They did, however, retain the concept of a NAIRU. Hall developed a working model for use in empirical work. Barro put it to use defining a NAIRU. Barro used the 1979 Hall model.

This model gave every unemployed person a job finding rate (f) and a job separation rate (s) (Barro 1988:32). Hence he described the change in unemployment over time as a formula:

$$Ut/L - u_{t-1} = s\,(1 - u_{t-1}) - fu_{t-1}$$

Where $ut = Ut/L$

The NAIRU he then defined as (Barro 1988:32): $U = s / (s+f)$.

Hence the NAIRU increases at the ratio of s to f. The unemployment rate moves towards the NAIRU subject to the turnover rate (s+f) (Barro 1988:32). A recession is when the job finding rate is smaller than the natural job finding rate consistently, and the same is said for the job separation rate.

The term NAIRU was now officially being used. Its definition was still under a cloud of controversy, as were the empirical techniques that were used to define it. The advances in computing and statistics were such that new methods for compiling and arranging data were being discovered almost daily. This created controversy as to which of the new techniques were valid, which were more accurate and which variables should be included. Of distinguished organisations of academic research, the OECD has a formidable reputation for producing high quality and challenging work. It was to this end that Elmeskov was working when he defined his NAIRU in a different way. Elmeskov looked at the non-accelerating wage rate of unemployment or NAWRU (Elmeskov 1993:9). The model he used to help explain this NAWRU, was a first order

ARMA model (Elmeskov 1993:11). The model looked at unemployment over the time frame of 1969-1991. Elmeskov when defining the types of unemployment that he would be looking at said, "frictional unemployment...is affected by a whole range of factors, many of them policy determined" (Elmeskov 1993:15).

When analysing the labour market Elmeskov noted, "long duration and generous levels of unemployment are likely to entail slow adjustment of reservation wages...In principle, all structural policies are likely to affect behaviour on the labour market" (Elmeskov 1993:21). He said that policies relating to the structure of the labour market, if changed, will have effects on the levels of unemployment. Elmeskov went even further when discussing the effects of income support. He said "income support during periods of unemployment would, like any other non-work related income or transfer, be expected to weaken the effort to search for work and the willingness to accept job offers...this affect should unambiguously tend to raise equilibrium unemployment" (Elmeskov 1993:24)[3]. The definition of the NAWRU that Elmeskov (1993:94) gave was the unemployment rate above which wages accelerate[4]. The formula for his NAWRU is included in a footnote below.[5]

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[3] Elmeskov (1993:90) used in his model a generosity indicator. He defined this as the total spending on unemployment / average wage, where the average wage is equal to the business sector wage bill / number of business sector employees.

[4] He uses a Hodrick-Prescott filter with a smoothing factor of 25^2.

[5] $DlogW = -a*(U - NAWRU)$, where $a>0$. W is the nominal wage, U is the actual unemployment rate and D is the first difference. Then the equation can be manipulated, $a = -D^2LogW / DU$. This can be further manipulated to solve for NAWRU, $NAWRU = U - (DU / D^2LogW) * DlogW$.

There were also serious policy implications involved in Elmeskov's work. He seemed to be suggesting a reduction of unemployment benefits. This was the opposite of what the original thinkers in the Keynesian days would have thought. Such a shift in thinking was spreading around the world. Friedman, still very much at the forefront of economic controversy, was leading the charge to control monetary spending, and reduce government involvement in the economy. This economic methodology was to become known as the new economic 'right'. A merging of the political debate, and strict economic policy decisions was occurring in the thinking of the general population.

Tootell, another more recent economist was to create a simple model for finding an empirical value of the NAIRU. This was the formula that is included in the opening section. It is interesting to note, however the statistical technique that Tootell used to carry out his economic research. He looked to the inter-connections of the global economy and then added variables that would take into account inflation that passes from country to country. This variable was an import price deflator that Tootell included in his model (Tootell 1994:34). This was inserted to catch any foreign price instability. When commenting on possible explanatory variables, that others had excluded from their models, Tootell (1994:39) noted that "including the two largest shift factors in the labour force composition, teens and women, has little if any, affect on any of the Phillips curves...The results indicate that using the simple unemployment rate should not produce any problems for this analysis." This helps to justify using only a simple model of unemployment for analysis.

Tootell questioned whether inter-industry mismatch, geographical or inter-sectoral mismatch affected the NAIRU. The results that Tootell found were surprising. Tootell (1994:40-41) said that

> "there is no evidence that inter-industry mismatch has raised the NAIRU...there is no evidence that a rise in the geographical or inter-sectoral mismatch between the unemployed and the vacant jobs has increased the natural rate of unemployment."

Layard et al further clarified the factors that would influence the NAIRU. They looked at the social institutions that could change, affecting the labour market and thereby affecting both the Phillips curve and the NAIRU. Layard et al also examined possible explanations for the different results that were found in Europe. "The main social institutions that affect unemployment are the unemployment benefit system and the system of wage determination. In Europe unemployment benefit systems generally became more generous financially and more readily available up to around 1980. This did not happen in the United States. In addition, the position of the unions became increasingly strong in Europe up to around 1980" (Layard et al 1994:4).

Further developments in the NAIRU concept looked at the time frame analysis of unemployment. Layard et al documented this development. They noted another separation of the theoretical and empirical side to the NAIRU debate. They also looked at whether the theory was at the long run or the short run. "In the long-run, unemployment is determined entirely by long-run supply factors and equals the NAIRU (U*). But in the short-run, unemployment is determined by the interaction of aggregate demand and short-run aggregate supply. Short-run aggregate supply is given by:

$$\Delta P - \Delta P_{-1} = -\theta_1 (U - U^*)$$

Aggregate demand is...given by:

$$U = -\frac{1}{\lambda}(M - P)$$

Where M is the log of nominal GDP...this aggregate demand relation implies that:

$$\Delta P = \Delta M + \lambda(U - U_{-1})$$

Where P is the price level, U is the unemployment rate, U* is the NAIRU, M is the Money supply and θ and λ are multiplying factors. A "demand shock, associated with a rise in ΔM, will shift demand outwards and thus raise both inflation and employment. By contrast a 'supply shock' associated with a rise in U*, will also raise inflation but will reduce employment." (Layard et al 1994:24)

Combining both gives a general formula for the level of unemployment:

$$U = \frac{1}{\theta + \lambda}[\theta_1 U^* + \lambda U_{-1} - (\Delta M - \Delta P_{-1})]$$

Where Layard et al (1994:24) said "if ΔM is constant for long enough and U* is constant, ΔP_{-1} converges on ΔM and employment converges on U*." This is their basic model, it is suggesting that when the money supply is constant (changing at a constant rate), the change in prices will converge on the change in the money supply rate. The employment level will also converge on the NAIRU. They then included hysteresis into the model[6]

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[6] if price and wage behaviour depends upon the change in unemployment as well as on its level, the aggregate supply curve becomes:

(Footnote continued)

> "In terms of policy, hysteresis means, that once unemployment has risen, it cannot be brought back at once to the long-run NAIRU without a permanent increase in inflation. But it can be reduced gradually without inflation rising." (Layard et al 1994:26)

If the labour force was segregated then this would be, it was suggested, one method for decreasing the NAIRU. This would shift the burden of unemployment on to those who should easily gain employment. Layard et al (1994:70) discussed this method.

> "Even if age differences in unemployment reflect an equilibrium, it is still true that, by shifting labour demand from middle aged to younger people we could reduce the NAIRU" (Layard et al 1994:70).

Certain policies on employment could therefore be directed at a segregated labour force. These policies would then be more effective in reducing the NAIRU. For example, the labour force could be split along age lines. The resources would then be directed towards those who typically find gaining employment harder in those age groups. The labour force could be split along gender or race lines. This segregation technique they suggested could make policies that use the NAIRU as a guide more efficient.

$$\Delta P = \Delta P_{-1} - \theta_1 (U - U^*) - \theta_{11} (U - U_{-1})$$

The short run NAIRU (U^*_s) is given by:

$$U^*_s = \frac{\theta_1}{\theta_1 + \theta_{11}} U^* + \frac{\theta_{11}}{\theta_1 + \theta_{11}} U_{-1}$$

Further debate over the NAIRU stemmed from policy implications. The problem of high European unemployment led many to the conclusion that some drastic measures were needed. These measures would be aimed at lowering the NAIRU and the unemployment rate.

> "Unemployment is not determined by an optimal process of allocation...it does perform a vital role in the re-direction of labour, its level is subject to a host of distorting influences, tending to make it higher than is economically efficient. The most obvious of these distortions are:
>
> 1. The benefit system...and
>
> 2. The system of wage determination" (Layard et al 1994:91).

The policies that Layard et al recommend are that of reducing the welfare system for the unemployed and changing the system by which wages are determined. They went further noting a cause of the high levels of unemployment in Europe, and further pressed the case for reform of the welfare system. "The unconditional payment of benefits for an indefinite period is clearly a major cause of high European unemployment" (Layard et al 1994:92).

The debate over the policy implications of the NAIRU then changed tack. The debate now only analysed how long it would take for the NAIRU to return to a 'near full employment' level. This was the most desirable outcome and the most politically advantageous and as such was a concern for economist and policy maker alike. Dawkins noted the length of time to bring down the level of unemployment would be longer than most would wish. "The institutional and other constraints that determine the NAIRU...mean that it will take time to drive down the level of unemployment (and the NAIRU) to a level which approaches full employment" (Dawkins 1994:19).

There was still debate over the definition of the NAIRU in theory and empirically. Mitchell attempted to more clearly define the NAIRU. He saw the theory lending itself to some shaky conclusions due to an ill-defined concept. "The NAIRU must be distinguished from the notion of a steady state unemployment rate which is cyclically sensitive or hysteretic...the steady state unemployment rate is not only sensitive to microeconomic changes, but also to the business cycle" (Mitchell 1994:51).

Keynon argued that the effects of high unemployment were quite dramatic on the NAIRU. He argued that there was a drop out rate of the longer-term unemployed, from the labour force. This drop out rate would then affect the NAIRU in a negative way. "The NAIRU shifts adversely because the long term unemployed drop out of effective labour supply" (Keynon 1994:40).

Chapple agreed with Keynon. He further developed the argument that the NAIRU was affected by the payment of benefits. In discussing the effects of an unemployment benefit policy Chapple discovered changing the level and administration of benefits, and the attitudes to receiving benefits, could change the NAIRU (Chapple 1996:32). "A rise in the benefits relative to wages means that some of the unemployed will stop actively looking for a job" (Chapple 1996:32). The attitude towards living on benefits and the administration of benefits if changed, would affect the NAIRU. This would occur through those who cease looking for work as a result of the benefit increase. Chapple is closer to Friedman than Keynes in his views on unemployment and the NAIRU. His view (Chapple 1996:32) was that humans are only near rational and the belief of rationality for consumers was unreal. This meant that the NAIRU could be affected by the actual rate of unemployment.

Chapple also argued the case that the Phillips curve itself would be able to be shifted. To make this point he reexamined Phillips original work and decided that Phillips knew that the curve could be shifted.

> "While Phillips believed the inflation unemployment curve was stable and offered the government an ongoing exploitable policy trade off, it would under certain circumstances shift its position. Factors mentioned by Phillips...include...cost of living adjustments to retail prices, inflation...changes in trade union pushfulness, changes in the degree of centralisation of wage bargaining" (Chapple 1996:221).

Stigliz looked at the policy implications of a NAIRU that could be affected by various microeconomic changes. Stiglitz noted (Stiglitz 1996:10) that the natural rate can move over time, so that the rate that was NAIRU one year may be above or below the actual NAIRU rate the next year. This meant that policy makers would need to be careful in their policy decisions to make policy using a precise measure of the NAIRU.

With the desire for an accurate measure of the NAIRU in mind, newer techniques were created to improve the accuracy of the empirical nature of the NAIRU. One economist keen to break new ground with empirical work and theoretical work on the NAIRU was Gordon. He too, looked at the microeconomic structures of the economy. Gordon agreed that the NAIRU could change because the microeconomic relations that exist within an economy affect it (Gordon 1997:12). As an example of these relations Gordon noted the structures and institutions involved with both the product and labour market (Gordon 1997:12). These relations are able to change, and in doing so, will affect the level of the NAIRU. Other macroeconomic variables could also have affected the current state of unemployment. Several global trends emerged from the previous ten years. A weakening of the labour unions, an increase in foreign competition, a sluggish global recovery and price decreases in the consumer electronics and automotive industries (Gordon 1997:12).

The effects of government policies on the labour market and hence the NAIRU was further commented on by Stiglitz. When analysing what would shift the NAIRU, Stiglitz looked at forces that impacted on the workings of the labour market. "Government policies to help workers move quickly from one job to another may lower the NAIRU. Similarly, competitive pressures have increased, and unionisation has decreased, so that wages more frequently fall, and are slower to rise. This too has helped lower the NAIRU" (Stiglitz 1997:360).

The debate called for even more accurate estimates of the NAIRU. Gordon rose to this challenge. Gordon built his triangle model of inflation, which he claimed, summarised its dependence on inertia, demand and supply (Gordon 1997:14). His model is further explained in Chapter Four. Gordon modified his triangular model to become a 'time varying' model of the Phillips curve. He used this model to estimate the NAIRU over time. The time varying model is explained in more detail in Chapter Four.

The time varying approach was a novel one but not one that everyone agreed with. Staiger, Stock and Watson were cautious about Gordon's time varying approach to calculate the NAIRU. They suggested (Staiger et al 1997:41-42) that using time variation as a stochastic function of time, as opposed to their deterministic approach, would lead to uncertainty as to the values for the NAIRU. In order for such macroeconomic relations to change over time they suggested (Staiger et al 1997:42) using recursive least squares while forecasting out of the sample as a real-time methodology. This only fuelled the debate over whose econometric technique was the most accurate. More often the debate was centred on why one regression was poorer than another was.

Blanchard and Katz went back to the theory of the NAIRU and looked at the labour market effects. They were concerned with the implications of unemployment on this reservation wage and corresponding affects on the NAIRU. The bargaining power of both workers and employers cannot, in today's marketplace be costlessly and/or instantly replaced (Blanchard et al 1997:53). This meant that, workers who bargain in a depressed labour market will settle for lower wages. If workers were in a tight labour market they would be able to gain wages that were much higher than their reservation wage. Due to this Blanchard et al (1997:53) looked at the exit rate from unemployment.

With workers at the low end of the skill level able to be replaced easily they would have few job opportunities. This led Blanchard and Katz to define the NAIRU as the point where the supply wage and demand wage are equal. The NAIRU would not be affected by an increase in productivity if the reservation wage increases in line with real wages. This meant that the NAIRU would change, only if the reservation wage increased to the same level as the demand wage. For this to happen one of the determinants would have to increase, i.e. unemployment benefits.

Blanchard and Katz also noted that labour market rigidities would lead to a decrease in average productivity, with less flow of workers and greater duration's of unemployment. This did not mean that such rigidities will lead to larger unemployment (Blanchard et al 1997:59) "Higher prolonged unemployment creates pressure for government policies to offer more generous programs aimed at helping the unemployed. These changes decrease the pain but they are likely to increase the natural rate in the process" (Blanchard et al 1997:69).

The debate over the validity of the Phillips curve continued. Many arguments over the policy implications and the NAIRU were published. Leeson (1997:95) made an interesting comment about the slope of the Phillips curve "If a Phillips curve becomes horizontal at higher levels of unemployment-as it did in the curves derived from a century of data by Phillips and Lipsey-then policy-induced increases in unemployment can reduce neither inflation nor inflationary expectations."

New Zealand economists were following this debate with interest. Prominent economist at the Reserve Bank, Razzak was interested in debating the shape of the Phillips curve. This would have interesting implications for the NAIRU. The methods that Razzak used to derive his Phillips curve were the latest statistical techniques. Razzak used New Zealand economic data to see if the Phillips curve was symmetric and (Razzak 1997:1) used quarterly data from 1982Q3 to 1996Q1. He looked at a single equation expectation augmented Phillips curve, and used the statistical technique known as the Generalised Method of Moments (GMM). The hypothesis that Razzak used was that the relationship between inflation and output was asymmetric. Inflation, Razzak says, is increased by positive demand shocks (Razzak 1997:1). The increase in inflation in the short run is dependent on the duration and size of the shock, and the slopes of the aggregate demand and aggregate supply curve. If the relationship is not symmetric then it is asymmetric which Razzak defined as where "positive demand shocks tend to increase inflation by more than negative demand shocks of similar magnitudes decrease it", (Razzak 1997:1).

More recently (1998) an economist at the Federal Reserve Bank in Kansas remodelled the Phillips curve for his data set in order to obtain a NAIRU estimate. The statistical techniques, that Laubach used involved using moving average regressions, and was looking across countries. He also critiqued other methods of obtaining estimates of the NAIRU, and found some interesting results. Laubach's results suggested that sustained changes in unemployment were reflected by shifts of the NAIRU (Laubach 1998:12-13). In commenting on the approach others have taken in studying the NAIRU, Laubach (1998:13) found that there is not a lot of time variation in the NAIRU. He suggested that adding a drift term to the model added more to the complexity of the model than any additional benefits that could be gained from adding that drift element.

This brings the debate to the present. The statistical techniques used to obtain estimates for the NAIRU are very advanced and highly technical. Research is still going on in this area, and in the future more advanced techniques, and even higher degrees of accuracy will be claimed in the quest for an accurate estimate of the NAIRU. The debate over the validity of all the statistical techniques has arisen of late and this is the subject of a later chapter.

2.4 SUMMARY CHAPTER TWO

Chapter Two focused on, what the NAIRU is, the policy implications of the NAIRU, and its origins and development as a concept. The NAIRU was defined as the special rate of unemployment where inflation had no tendency to accelerate. This rate was normally viewed in the long run, using the Phillips curve relationship between inflation and unemployment as a method to estimate the NAIRU.

The estimated value for the NAIRU as defined by Tootell was the absolute value of the constant term, divided by the sum of the coefficients in a Phillips curve (Tootell 1994:33). The constant was usually the rate of change of inflation. The coefficients varied but usually included two lags of unemployment rates, some measure of expected inflation, import inflation, and proxies for significant events and policy changes. The main implications of the NAIRU were shown to be the elimination of demand effects in the long run, and the focusing of monetary policy on the goal of price stability.

The NAIRU was developed and analysed from the Phillips curve. The Phillips curve was a theoretical, then empirical construct designed to explain the relation between inflation and unemployment. This model was then further worked on. Flaws were found first in the theory and then in reality, as the 1970's oil price shocks eventuated. Friedman, Phelps and Lucas revived the concept adding a distinction between the long and short run, and also adding inflationary expectations. This lead to the development of the NAIRU.

The Keynesians began to debate the long-run part of the Phillips curve, where no demand side effects were theorised. The, model continued to develop, with each economist adding their own approach. Many added to the variables included in the Phillips curve regressions. Some regions had difficulty fitting the model to their local economic reality. Europeans particularly, had difficulty accepting the validity of the Phillips curve and the NAIRU, given their economic situation of high unemployment. The British and American economists worked on the model. Many accepted it as 'fact' and then taught the NAIRU to students through Friedman's textbooks.

The empirical testing developed new technique after new technique refining the estimates of the NAIRU and answering the critics of the concept. Filters were an important development in the techniques used to estimate the NAIRU, as were the development of the concepts of hysteresis, time varying and moving average techniques.

New concepts were created during the debate, such as the generosity indicator, non-linear and job separation techniques. Policies were recommended using the NAIRU and Phillips curve as a guide. These policies were to reduce state welfare, decrease the length of time welfare was available, and increase the difficulty of obtaining welfare. Other recommendations were to free up the labour market, and control the rate of growth of the money supply. All of these policies had their supporters and detractors. The NAIRU and Phillips curve have become a political issue as well as an economic one.

CHAPTER THREE

NAIRU IN NEW ZEALAND

Looking at the history of employment policies in New Zealand, evidence of the NAIRU concept can be found. The underlying relationship behind the NAIRU, i.e. the Phillips curve, is often quoted in New Zealand policy. The late eighties and early nineties saw some policy changes that were motivated by the Phillips curve relationship. The policy changes involved, implicitly contained the NAIRU concept as a leading motive.

The macroeconomic policy of New Zealand until the late 1980's had a dual motivation. This was to engineer both full employment and price stability. Both policy directives were thought possible to achieve. This dual focus was changed in 1989 by legislation. The Reserve Bank Act (RBA), set up by a Labour government in conjunction with leading economic thinkers in New Zealand, established price stability as the sole objective of macroeconomic policy. This RBA was a dramatic change and it implied a reliance on the Phillips curve relationship, and the NAIRU that is derived from it. The RBA implied that monetary policy was not relevant in the long run. This was a dramatic shift in policy from previous years.

Brash in an address to the Auckland Chamber of Commerce in 1998 spoke of the focus of all monetary policy in New Zealand. The focus of monetary policy he said was aimed at the maintaining low levels of inflation. This is what the government defined as price stability. "Monetary policy has to be excessively

focused on delivering low inflation in accordance with the target agreed with government" (Brash 1998:2). The motivation behind this price stability agenda was also explained by Brash. He said, there was evidence that price stability was the most effective method of aiding the development of a nation. Monetary policy, he said, should be focused on the objective of stable prices. "By the late eighties it had become increasingly recognised here and abroad that the best contribution which monetary policy could make to...social justice, growth in employment, growth in output was to deliver predictably stable prices" (Brash 1998:2).

Brash (1998:23) in a publication designed to explain the Reserve Bank Act (RBA), and the role of the Reserve Bank defines the role of the Reserve Bank as being threefold. Firstly he feels it should operate "monetary policy to maintain price stability." The Reserve Bank secondly, should maintain a "sound and efficient financial system" (Brash 1998:23). Finally, Brash said that the Reserve Bank should control the currency of the nation. There was no mention of full employment, this was a radical change from the macroeconomic policies prior to the RBA. The RBA itself required the Reserve Bank, under the leadership of Don Brash, to "independently manage monetary policy (management of the supply of money and credit) to maintain overall price stability." (Brash 1998:23) The definition of price stability was inflation of between zero and two percent originally, and later increased to between zero and three percent annually.

The Reserve Bank of New Zealand would use its monetary policy to control the business cycle Brash said. There should not be the big depressions and big booms that typify the business cycle if monetary policy is used effectively (Brash 1998:3). He also outlined the determinants, as he saw it, of inflationary pressures in an economy.

> "Situations where inflationary pressures are increasing are by their nature usually situations where demand in the economy is running ahead of the economy's long term capacity to supply, so that monetary policy aimed at restraining those...pressures...tends to dampen down booms" (Brash 1998:3).

The goal of price stability was to "contribute to New Zealand's overall economic success by protecting the value of people's income and savings, and encouraging investment in the nation's productive capacity, thereby contributing to employment, growth, export competitiveness and a more just society" (Brash 1998:23). Brash then went on to define the 'evils' of inflation, and noted how effective monetary policy would ensure that the New Zealand economy remained at an equilibrium level of unemployment. "In the ideal world, monetary policy would allow New Zealand to continuously enjoy growth at the highest possible rate. This is because, if the economy under-performs, that creates a risk of deflation...The inverse applies if the economy overheats" (Brash 1998:5).

In 1996 in a statement of monetary policy that Brash outlined the successes of monetary policy. This policy was successful in that it was able to control the inflationary pressures that sent distortions to the market price mechanism. He then defined how monetary policies should be managed. "For the first time in a generation, New Zealand has managed to have a sustained period of economic expansion without a major acceleration of inflation...[monetary] policy works best if it is run in a forward looking manner" (Brash 1996:1-2).

In the Policy Targets Agreement, Brash and Birch defined what the government would accept as a delineation of price stability. This definition was made public so that there was full information for the market, and the public could have confidence in the determination of the Reserve Bank to control inflation. Inflationary expectations of the public are very important to the government

and the Reserve Bank as they determine wage negotiations. "12 monthly increases in the CPI of between 0 and 3 percent will be considered consistent with price stability" (Brash et al 1996:1).

Brash (1997:1-2) then defined, in a speech to the Canterbury Employers Chamber of Commerce, what the link was between inflation and unemployment. He said that there was not a way that the Reserve Bank could maintain a sustainable smaller level of unemployment. Brash said that the pressure of inflation would make lower levels of unemployment unsustainable. "There is in fact no evidence that monetary policy can, by tolerating a little more inflation, engineer...a sustainably higher level of employment...there is not much doubt that growth and employment would be a little higher...Within a very short time, inflation would be rising."

Conway an economist in the Economic Department at the Reserve Bank wrote a letter that described a model built for forecasting purposes. This model included the NAIRU but was never used for policy or forecasting (Conway, 1998:1). An important feature of the model was "that the model's...NAIRU is endogenous...the NAIRU in equilibrium is driven (like output, investment, etc) by all the exogenous variables in the model" (Conway et al 1995:193). This model that Conway and Hunt built was different to the Hysteresis model.

Temporary shocks in this model would change the NAIRU temporarily, whereas a hysteresis model would show that temporary shocks would permanently change the NAIRU (Conway et al 1995:193). This model used as explanatory variables the nominal exchange rate, and a variable linking the five year and ninety day interest rates (Conway et al 1995:193). The policy of the Reserve Bank of New Zealand, Conway said, was to not specifically use the

NAIRU. The concept of an output gap was instead favoured in order to find capacity constraints (Conway 1998:1). The output gap method used was the deviation to actual output from potential output (Conway 1998:1). The concept of potential output, however, was assumed to have a stable rate of inflation (Conway 1998:1). This output gap concept implicitly contained a NAIRU inside it in the form of a stable rate of inflation at potential output.

To estimate potential output Conway and Hunt used a Phillips curve. This Phillips curve contained the potential output variable in it:

$$\pi_t = \pi_t^e + A(L)(Y_t - \gamma_{Y,t}) + \varepsilon_{\pi,T}$$

Where Π was inflation, Π^e expected inflation, Y was actual output, γ potential output, and ε was the residual error (Conway 1998:1).

3.2 COMMENTATORS ON NEW ZEALAND'S ECONOMIC POLICY AND THE NAIRU

Philpott (1981) looked at the unemployment situation in New Zealand, in particular he analysed the discouraged worker with regard to benefit payments. He found that searching for employment was related to the benefit scheme. The unemployed person would keep up their search as long as it was beneficial to do so. Philpott reasoned that should the benefit levels change the unemployed person may decide that they are indifferent about working or not working. Any further changes, increasing the availability or level of benefits, will cause the unemployed person to stop searching altogether. This he said is an argument for increasing the difficulty in obtaining benefits, and or generally decreasing the level of benefit payments. This means policies that the

government has undertaken since 1989 to change the benefit regulations, i.e. increased the restrictions for receiving a benefit and decreasing the level of benefits over all, should have lowered the NAIRU in New Zealand.

The approach Godfrey takes to unemployment benefits is similar to Philpott's. He decided that in order to decrease unemployment and the NAIRU the government should "cut unemployment benefits and make them proportional to wages...to tighten up procedures for allowing benefits; to raise the tax thresholds to improve incentives to work and to reduce substantially the power of the trade unions" (Godfrey 1986:77).

In New Zealand the Prime Minister, Rt. Hon. Jim Bolger, commissioned a taskforce to look into employment and in their reports they mentioned the NAIRU (equilibrium unemployment) and what it meant. They also commented on what work had been done analysing the NAIRU in New Zealand. The taskforce was taking the NAIRU concept into account when they were recommending policy to the Prime Minister. "The equilibrium rate of unemployment is the rate of unemployment which remains when the economic forces leading to a higher or lower rate of unemployment are balanced...There is little empirical work regarding what percentage of unemployment represents the current equilibrium rate in New Zealand...however evidence from overseas suggests that it may lie in the range of five to seven percent" (Taskforce 1994:44). The taskforce also had recommendations regarding what policies the government should prescribe given the existence of the NAIRU. They noted the length of time that it takes unemployment to reach the NAIRU as an important guide when prescribing policy. The taskforce suggested a growing economy would aid the movement of the unemployment to the NAIRU. "It

will take some time for New Zealand's unemployment rate to fall to something like its equilibrium level, but if the forecast stronger growth materialises, this will inevitably happen" (Taskforce 1994:44).

The Taskforce (1994:44) defined the role of policy in New Zealand in terms of the equilibrium rate of unemployment. "The urgent policy task is to use that time to find ways of reducing the equilibrium rate itself...this will be easier to do during a period of growth than during economic recession. It involves devising policies which increase the overall effectiveness of New Zealand's labour force by tackling, for example, the problems and causes of skills mismatch...and the self-reinforcing effects of long-term unemployment."

The benefit system's administration was changed progressively from the 1990's. Such that now "benefit eligibility criteria have been tightened" (Chapple 1996:82). There was, he noted (Chapple 1996:83) a big increase in unemployment in New Zealand between 1990-1992. This can be explained by the structural changes in the economy that added to the frictional component of unemployment (Chapple 1996:83). Then Chapple pointed to the rate in 1996 as being only 6%. The 1996 figure points to a substantial decrease in unemployment from the height of 11% in 1992. This he said is possible evidence to support the claims that the benefit regulation changes had a positive effect on the New Zealand economy and may have lowered the NAIRU.

The changes that were made to the welfare programs in 1990 are noted as a decrease in the basic benefit, and changes to the eligibility criteria (Maloney 1997:1). Using his utility function model, Maloney found that increasing benefits led to an increase in the wage rate, unemployment, and the NAIRU. To conclude his research Maloney commented on evidence to support his claim that the reforms to the benefit system affected the labour market, and thereby

the NAIRU. There was Maloney said "extensive empirical evidence to support the conclusion that the 1990-1991 benefit reforms substantially influenced labour market behaviour in New Zealand" (Maloney 1997:64). This implies that the recent reforms in New Zealand have lowered the NAIRU as such policies were assumed to do.

New Zealand is noted for its price stability legislation. The Reserve Bank Act attempts to hold inflation at a rate between zero and three percent. Models built for other countries did not always fit New Zealand data well. Razzak (as mentioned in Chapter Two) built a New Zealand model that he hoped would express the relationship between inflation and unemployment, and enable policymakers to use the NAIRU concept in their decision making. The New Zealand model was different from the overseas models with different assumptions, and different variables. Razzak included in his model, assumptions about the nature of New Zealand's economy i.e. small and open. Other assumptions that Razzak made in his New Zealand model are that "information is symmetric and expectations are model consistent; the Phillips curve is asymmetric in the short run and vertical in the long run; inflation is assumed to be persistent, but not a unit root process. The policy instrument is a short term nominal interest rate; and the monetary policy reaction function, known by the public, is based on the deviations of expected annual inflation from a one percent target rate" (Razzak 1997:2).

It is interesting to note the variables that Razzak used for his model and what the policy implications would be if it were found that the Phillips curve for New Zealand was indeed symmetric. Asymmetry would result in Razzak's model when "slower policy...lead to greater variations in output and inflation than prompt policy reactions", (Razzak 1997:2). To test for symmetry Razzak used a

kinked Phillips curve with two linear segments. The equation is included in the footnote below[7], (Razzak 1997:3). With a variable explaining output gap and the test being a two-sided centre moving average of actual real GDP. Razzak tested the hypothesis that $\gamma = 0$, if it was zero then the Phillips curve would be symmetric (Razzak 1997:3).

Razzak developed a proxy for supply shocks. This variable was to account for the various supply shocks that had affected inflation. This variable dealt with the difference between actual inflation and median inflation (Razzak 1997:5). The conclusion Razzak reached after analysing the New Zealand economy through this model, was that the relationship between inflation and output for New Zealand was not symmetric. The relationship in New Zealand between inflation and unemployment was asymmetric. An asymmetric relationship suggested that slowly delivered monetary policy, reacting to a positive demand shock, will lead to higher inflation, and a larger decrease in output (increase in unemployment) than with a regular linear Phillips curve. This implied that for policies in New Zealand to be effective in reducing unemployment and the NAIRU they would have to be enacted quickly.

Maloney analysed the New Zealand economy to see if the labour market reforms had a beneficial effect on the economy. Maloney looked at the major reform of the wage setting system, the Employment Contracts Act. This Act should in theory have led to a reduction in unemployment and the NAIRU. "The Employment Contracts Act (ECA) in May 1991...abolished the remnants

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$$Pt - Pt_{-1} = \alpha Et(Pt_{+1} - Pt) + \sum_{i=0}^{j} \beta(Yt_{-i} - Y_{t-1}^{p}) + \sum_{i=0}^{j} \gamma \frac{[(Yt_{-i} - Y_{t-i}^{P}) + (Yt_{-i} - Y_{t-i}^{p})]}{2} + et$$

Where $\alpha = 1$, $\beta > 0$, $Y \geq 0$, Pt is the price level, Yt is the real GDP value, and et is white noise.

of a centralised wage-setting system...It made compulsory unionism illegal...[the] post ECA period coincides with a recovery in the New Zealand economy" (Maloney 1997:243-244). Maloney found that the New Zealand economy had benefited from the ECA reform. The ECA led to a decrease in unemployment and possibly the NAIRU.

3.3 SUMMARY CHAPTER THREE

Chapter Three, analysed policy in New Zealand, and work that was done on the Phillips curve and the NAIRU by New Zealand economists. New Zealand policies such as the ECA, RBA, and the welfare reforms of the late eighties and early nineties all implicitly used as a motivation, the long-run Phillips curve and the NAIRU with price stability as an aim.

The Reserve Bank built models containing estimates of the NAIRU. These models were intended for forecasting, but the models were superseded more recently, as the debate over the validity of the NAIRU grew, by the development of a new model. This new model analysed output gap and the level of excess capacity. It used a Phillips curve (the NAIRU is implicit now instead of explicitly being stated). New Zealand economists Philpott and Godfrey agreed with the restructuring of the economy with a price stability focus. These policies they said would lower the NAIRU.

The asymmetry of the New Zealand data is a recent discovery that has important implications. These implications suggest that policies should be made promptly in the event of a shock to the economy. This given, the recent Asian crisis is indeed an important point. For New Zealand this has significant

implications. Given the size of our economy and the open nature of our trading status, New Zealand is vulnerable to imported inflation and external price shocks. An understanding of how price effects will impact on unemployment is vital for New Zealand. So is an understanding of the need for considered haste to implement policy to ensure that desired results are obtained.

CHAPTER FOUR

METHODOLOGICAL CRITIQUE AND GENERAL CRITICISIMS

In the literature surrounding the debate over the NAIRU there are two main types of criticisms of the NAIRU. The first group criticise the concept of the NAIRU through its methodology and the manner in which estimates of the NAIRU are obtained. This critique stands by the validity of the NAIRU, but questions the techniques used in formulating an estimate of it. The first group of economists contains such names as Godfrey, the Prime Ministerial Taskforce on employment, Lindbreck and Snower, Gordon, Blanchard and Katz, Leeson and Crosby et al. The second group, wish to debunk the NAIRU concept in its entirety. They have serious issues with the validity of the NAIRU. These economists generally are classified as having a 'leaning' towards Keynesian thinking. The second group, who disagree entirely with the NAIRU, contains such names as Davidson, Galbraith, Rogerson, Issac, Eisner, Cornwall and Cornwall, and Sawyer.

4.1 PRO-NAIRU CRITICISMS OF METHODOLOGY

Godfrey (1986) examined the determinants of the NAIRU. He noted that the principle behind the NAIRU concept undermined the Keynesian demand management practice. The size of the NAIRU he said depends on the method used in calculation. "In general models based on adaptive expectations generate

lower natural rates than those based on rational expectations" (Godfrey 1986:74). This meant, that the value of the NAIRU would change depending on the technique used to estimate it. This result called into question the reliability of the techniques used to estimate the NAIRU.

Lindbreck and Snower are also critical of the methodology used to formulate the NAIRU. They used an insider-outsider theory for the labour market. At equilibrium in their model wage price expectations are correct, is at this equilibrium that Lindbreck and Snower find if "expectations are correct, unemployment is not necessarily at a unique rate" (Lindbreck et al 1988:40).

The Taskforce on Employment in New Zealand when examining the New Zealand economic situation were also critical of the NAIRU and Phillips curve concepts. They felt that the techniques used to calculate the estimates of the NAIRU were not universally agreed upon. This meant that estimates of the NAIRU were not reliable. There were also issues to do with the data collection that the taskforce mentioned as bringing the concept of the NAIRU into disrepute. "There is little empirical work regarding what percentage of unemployment represents the current equilibrium rate in New Zealand (with both methodological and data problems making such work highly speculative)" (Taskforce 1994:44).

Gordon (1997) also questioned the estimates of the NAIRU. Much of the empirical work done on the NAIRU and the Phillips curve was done within countries. This empirical work meant that results from one country were not comparable with results from another, without assuming similar economic structures, data collection and statistical techniques. He noted (Gordon

1997:14) that as different countries have different structures to their economies, unemployment may be affected in different ways, given the same time period and the same global trends. This questioned the use of these estimates of the NAIRU as a policy tool.

Despite the empirical and theoretical work done on the NAIRU Blanchard and Katz have doubted the efficacy of the NAIRU. Blanchard and Katz said that the level of knowledge that existed about the NAIRU was far removed from a good quantitative understanding of the concept (Blanchard et al 1997:52).

Estimating the NAIRU is risky, said Crosby et al (1998), as the techniques used, and the structures involved in the economy make comparisons of techniques and validation of results difficult. The implication is that policy makers should not accept the results of an international study. The estimations might be very different if similar techniques were used in their native country. The validity of the NAIRU as a policy aid was questioned. "If it is only changes in unemployment, that forecast changes in inflation, rather than the level of unemployment, then the NAIRU will be difficult to pin down with any precision. Indeed, if it is only changes in unemployment that are related to inflation, then the NAIRU today is simply yesterdays unemployment rate" (Crosby et al 1998:125). The structural changes that occur in countries can have dramatic effects on the NAIRU. Crosby and Olekalns analysed the OECD countries for their estimates of the NAIRU. They also looked also at the structural changes that had been undertaken in those countries, and tried to see if that would affect the NAIRU in any way. The results suggested that policies aimed at the NAIRU and trying to control inflation may not be necessary if the economy has the right structural changes. "Structural changes in

the Australian and in other economies seem to be leading to low inflation regardless of the unemployment rate" (Crosby et al 1998:126). This implies that the NAIRU may be irrelevant in policy decisions.

4.2 ANTI-NAIRU CRITICISMS: ROGERSON

Rogerson quoted Solow saying, "it is not clear what we are talking about when we talk about the natural rate" (Rogerson 1997:74). As the NAIRU concept is a section of economics used by policy makers, Rogerson said, we must be clearer on the definition of the theory before we prescribe policy remedies. Rogerson quoted, the famous speech by Friedman, in his presidential address: "The natural rate of unemployment...is the level that would be ground out by the Walrasian system of general equilibrium equations provided there is imbedded in them the characteristics of the labor and commodity markets, including market imperfections, stochastic variability in demands and supplies, the cost of gathering information about job vacancies and labor availability's, the cost of mobility and so on" (Rogerson 1997:76-77). After presenting this extensive definition Rogerson took it to pieces, quoting Hall, "this definition is hardly more than a list of things to think about" (Rogerson 1997:76-77). Rogerson went on in his criticism of the language of the speech, pointing out that this speech "ends with the catchall phrase, and so on" (Rogerson 1997:76-77).

Rogerson (1997) is further critical of Friedman's speech that helped to develop the NAIRU concept. He said that the speech talked about the Walrasian general equilibrium equations, built on perfect competition, and then included market imperfections. The basic definitions to the NAIRU theory are not in place Rogerson complains. The NAIRU concept had no foundation he said. The concept of a Non Accelerating Inflation Rate of Unemployment was a 'fantasy' Rogerson implied. He questioned the validity of the NAIRU as a concept

stating that "the idea of the natural rate is often used not as an explanation of unemployment but rather as an explanation of inflation or a guide to monetary policy" (Rogerson 1997: 84).

The relevance of an economic model, Rogerson explained, was how well it predicted real life systems. For the NAIRU to be relevant it had to be dynamic, like real life. Many economists still think of the NAIRU as a static concept, where its real use would have been a dynamic guideline to the workings of the relationship between inflation and unemployment. An empirical trend line would, according to Rogerson, explain the relationship better, instead of the ambiguous NAIRU (Rogerson 1997:86). The NAIRU therefore is irrelevant.

Rogerson noted that many NAIRU models were built from Friedman's assumptions. Friedman, Rogerson believed, did not build his models using real life assumptions. There was no monetary causation in his models; all effects were due to real variables. This was an obvious problem for a modern economy that had money as a principal cause or motive. The NAIRU concept was based on a theory excluding money as a causal factor, thus reducing its validity (Rogerson 1997:75).

Rogerson (1997) then turned his analysis on the NAIRU itself. He analysed the empirical estimations of the NAIRU. Monetary policy would not, he said, be necessarily more effective if we could more precisely estimate a value for the NAIRU. This would mean all the estimations of the NAIRU that had occurred were just further refining a superfluous concept. Although these estimations were helpful for statistical accuracy, they would not give more credence to effective monetary policy. The empirical results of the NAIRU were not proven

either, Rogerson noted (Rogerson 1997:86). Inflation prediction, the 'foundation' of the Phillips curve, and the NAIRU was not reliable and as such the NAIRU should not be used as a policy device.

4.3 ANTI-NAIRU CRITICISMS: GALBRAITH

Another prominent economist, James K. Galbraith, was against the use of the NAIRU as a guide for policy. His position was to question the validity of using a long-run equilibrium as a guide to macroeconomic policy. The future said Galbraith (1997:95) "may be inherently unpredictable." A famously scathing quote from Galbraith described the idea of following a policy based around the NAIRU as "running from the phantom of accelerating inflation...the result: a self-inflicted wound, a socio-psychological disability, of colossal proportions" (Galbraith 1997:99).

Galbraith critically examined the Phillips curve theory, and the NAIRU, suggesting that "if professional economists want to be taken seriously on the NAIRU they have to come to agreement" (Galbraith 1997:99). Galbraith was implying that the theory of the NAIRU was fractured. The concept rebounds around different definitions and applications. The results are varied and then arguments develop about how to interpret the results. He says this disunity created a lack of credibility at the macroeconomic policy level. There are questions as to the reliability of any estimate of the NAIRU.

The empirics behind the NAIRU are not accurate enough for the concept to gain validity (Galbraith 1997:94). The Phillips curve, at the time of a classical crisis during the 1970's price shock, was adjusted to fit the new way of thinking promoted by Keynes. The fit that occurred between the Phillips curve and the Keynesian IS-LM model was misaligned; it was an ill fit according to Galbraith in his critique of the concept.

The theory behind the NAIRU, derived by the famous address of Friedman's to the American Economic Association, was incomplete Galbraith (1977) said. There was no theory behind the concept of the short run Phillips curve that Friedman proclaimed. The only evidence, Galbraith noted that Friedman expressed, was his own personal assurance that such a short run Phillips curve existed. This lack of theory suggested an improvised solution to the classical crisis in faith, which was due to a stagnating economy and rising prices.

The validity of the NAIRU was heavily weighted on the empirical results of the Phillips curve. The empirics of the Phillips curve have failed, Galbraith (1997) noted when he writes of the oil shocks of the 1970's. Galbraith suggested this failure meant that inflation could not be predicted by unemployment. The failure of the empirical results of the Phillips curve meant that the concept of the NAIRU was meaningless.

The classical approach to the NAIRU concept is through the labour market. Keynes, Galbraith (1997:94) said, refuted this approach. The use of demand and supply cannot be used with real wages Galbraith claimed. There was also no such thing as an aggregate labour market, suggesting that any attempt by neo-classical economists to link the NAIRU to the classical labour market model would also be fundamentally flawed.

Reality is very different from that prescribed by economists using the NAIRU as a policy guide said Galbraith (1997:95). There was the possibility of information asymmetry, monopolistic competition, non-linearity and even chaos. The long run would then just be a sequence of short runs. All of these real life possibilities would, he suggested, make it easier to base policy around the short run. In this case there would be no need for the NAIRU. The unemployment-inflation trade-off that the NAIRU and the Phillips curve was

based on was more complex than the theory allowed. The long-run Phillips curve was noticeably missing when the empirical results of the 1970's were analysed. All that Galbraith noted was a moving set of short run Phillips curves, there was no discernible long run curve from which to base estimations of the NAIRU (Galbraith 1997:97). Unemployment then explained only part of the changes in inflation. He recommended the removal of the NAIRU as an economic guidepost.

Galbraith called into question the responsiveness of inflation to changes in unemployment. This questioned the background to the Phillips curve theory and the NAIRU concept. If the elasticity of inflation was greater than the theory suggests, then this would imply that the threat of increasing inflation from decreasing unemployment rates would be reduced. This reduced threat made the NAIRU either a minor figure in the study of macroeconomics, or one that should disappear from textbooks altogether. "The empirical evidence is in almost uniform agreement that inflation is highly inertial and that whatever limits may exist are at worst highly elastic" (Galbraith 1997:98).

Galbraith (1997) disputed the validity of the NAIRU theory due to the lack of even a consensual definition. This definition is lacking despite the NAIRU concept being worked on by the leading economists of the last twenty years. The usefulness of a concept, if not commonly agreed upon, to policy makers is diminished Galbraith claimed. There has been

> "20 years of unexplained variation and failure of the profession to coalesce on procedural issues...we as a scientific profession have not advanced this concept to the point where it is suitable for practical use, almost 30 years after Friedman's (1968) address, it is a fair question whether we will ever do so" (Galbraith 1997:101-102).

Galbraith (1997) berated the policy makers for a lack of zeal in their policy making. When courage and ardour were required, the policy makers were bound by their fears of increasing inflation. This was the legacy Galbraith believed, of the NAIRU, an in-built conservatism that stifled economic progress and welfare. Galbraith said that there are no clear guidelines for policy makers other than conservatism. Potential economic gains were being lost as economists argue, and policy makers were afraid of the NAIRU (Galbraith 1997:102).

4.4 ANTI-NAIRU CRITICISMS: ISSAC

Issac, a prominent post-Keynesian economist said that the NAIRU was a concept that has outlived its usefulness. Policy decisions made using the NAIRU were a mistake he argued. Such policies were, Issac said, ruinous for the economy. "By encouraging...a fatalistic acceptance of high unemployment, the natural rate reasoning of mainstream economics may be their single most destructive macroeconomic policy legacy" (Issac 1993:458-459).

The theory behind the NAIRU has not obtained enough evidence that proves the validity of the concept, Issac said. The price shocks of the nineteen seventies and eighties as well as the international variation has not been explained well enough to give credibility to the NAIRU. This was despite the attempt to explain the NAIRU as having labour force composition effects.

> "No convincing natural rate explanation has been offered for the sustained domestic unemployment shifts in the 1970's and 1980's, despite the common rationalisations based on the changing age and sex composition of the labour force" (Issac 1993:459).

The concept of the NAIRU should be dismissed as a valid policy tool. The evidence tends to be against the concept, and not for it he further noted. Policy makers should not be tied to the concept of the NAIRU as it inhibits "the conduct of sensible macroeconomic policy" (Issac 1993:453).

4.5 ANTI-NAIRU CRITICISMS: EISNER

Eisner, another prominent post-Keynesian economist, also disagreed with the validity of the NAIRU concept. He used strong language to express how the NAIRU causes a fear of inflation. This fear of inflation binds policy makers to a conservative action despite the need for positive policy to promote employment.

> "If unemployment equals the natural rate, the rate of inflation will keep constant...God forbid, unemployment is below the natural rate, inflation, like that battery in current advertisements will keep rising, and rising, and rising-...until we run into hyperinflation...Correction can only come then...by sending it [unemployment] above the natural rate" (Eisner 1994:160).

Eisner said that the NAIRU does not have a 'strong' enough theoretical base for it to be used in policy making decisions and the data is not easy to use specifically to estimate a NAIRU. The results gained from such an estimation of the NAIRU are too debatable for them to be of any use to policy makers. "The NAIRU has never had any sound base in theory and has not found support in the historical data" (Eisner 1997:197).

The issue of unemployment is an emotive one. The thought that adherence to a NAIRU based monetary policy would actually decrease employment is a distasteful thought. The implications of the concept suggests that this decrease in employment is a possibility, and it is this thought that Eisner picked up on

when he analysed the American economy. "Mr Greenspan put the natural rate at 6.5 to 7 percent...with the actual rate of 6.5 percent, Mr Greenspan and his colleagues set to work-to drive others out of work" (Eisner 1994: 160).

The assumptions of the NAIRU are erroneous Eisner claimed. There are two assumptions that are behind the NAIRU concept that he saw as essential to the concept but erroneous. The assumptions have to do with the nature of the model, and the relationship between inflation and unemployment. "One [assumption] is that, left to itself, any given rate of inflation is somehow self-perpetuating...The second crucial assumption is that unemployment lowers inflation and that lower unemployment raises the rate of inflation" (Eisner 1997:198). His essential assumptions that Eisner noted would make the model invalid if violated in anyway. Eisner also noted another assumption that was crucial to the functioning of the NAIRU concept. This assumption was that of voluntary unemployment. This would mean that "workers are always on their supply curves, so that what unemployment exists is voluntary" (Eisner 1997:198).

Eisner pointed out the growing level of distrust in the validity of the NAIRU concept. There were, he said too many policies still made that follow the guidelines of the NAIRU concept. Policy makers were still caught out by the fear of inflation. "Professional economists have been challenging more and more the theoretical foundations and the empirical support for the natural rate doctrine...but too many policy makers...apparently still follow it slavishly" (Eisner 1994:161).

Eisner tested the NAIRU concept. He ran several models based on the typical Phillips curve with all the assumptions built into it. In this model Eisner discovered that the coefficient on the first lag of inflation was normally assumed to equal one. Eisner said, "if the value...is less than one we are faced with the proposition that inflation is not self-sustaining. Left to itself any given rate of inflation would then decay, a devastating blow to the NAIRU and the vertical long-run Phillips curve" (Eisner 1997:199).

Eisner critiqued the American use of the NAIRU as a monetary policy tool. He said that it was an irrational fear that held back policy makers from acting on the unemployment problem. For Eisner, unemployment was a bigger problem than inflation. "Greenspan, by his action...introduced a new policy regime. He made it clear that, far from accommodating continuing economic growth and reduction in unemployment, as had seemed to be the case until then, he would keep rates high in the future to fight that imagined inflation; we would otherwise be defying God by getting below his natural rate of unemployment" (Eisner 1994-95:223).

In his regressions Eisner looked at the effect on inflation if unemployment was lowered. The results he got were contrary to the assumptions that were behind the NAIRU concept. This he believed is 'shattering' to the NAIRU concept. "At the NAIRU...lowering unemployment a percentage point would make little difference. At the worst, with a permanent reduction in unemployment of one percent, inflation would have increased only two percentage points more" (Eisner 1997:213).

The concept of the NAIRU is not accurate enough for it to be anything more than a theoretical 'curiosity'. The NAIRU should Eisner thinks, be an econometric problem and not used to define or control policy. The NAIRU is "poorly based to begin with - its breakdown when we distinguish between responses to high and low unemployment may not easily be dismissed" (Eisner 1997:221). The evidence against the NAIRU seems copious to Eisner as he analysed the NAIRU. Eisner said that it has "no robust empirical support" (Eisner 1997:221) in the area of policy decisions. This had, for Eisner, serious implications for the American economy as it used the NAIRU for policy-making decisions.

4.6 ANTI-NAIRU CRITICISMS: CORNWALL AND CORNWALL

Cornwall and Cornwall are other post-Keynesian economists that question the validity of the NAIRU concept. They looked at the origin of the concept and said that it was founded on misconceptions. These misconceptions are the classical way of thinking about economic issues. The concept is "as wrong today on the key issues as it was when Keynes was writing" (Cornwall et al 1997:525). The NAIRU is no less than a "reincarnation" of the classical economic thought (Cornwall et al 1997: 525).

The assumptions of the mainstream NAIRU concept were at fault, Cornwall et al claimed. The deviations from equilibrium were analysed and the speed as to which they were corrected was examined. The usefulness of the NAIRU was then called into question by Cornwall et al.

> "The...assumption is that when, for example, a negative aggregate demand shock pushes an economy off its full employment growth path, there will be only a temporary deviation from equilibrium as Keynes and Pigou effects automatically restore to the full-employment growth path and to the natural rate of unemployment...There is little empirical or theoretical evidence to support the view that Keynes and Pigou effects work so quickly and forcefully in the real world that they dominate movements on the demand side of the market either in the short or long run" (Cornwall et al 1997:530).

Cornwall et al then questioned the validity of the NAIRU by analysing the lack of an adjustment mechanism. This lack of a mechanism to return to the NAIRU equilibrium is a problem for the NAIRU concept. Its validity as a policy tool they say depends on this mechanism. "Without a plausible adjustment mechanism the unique equilibrium unemployment rate cannot be considered a useful analytical concept" (Cornwall et al 1997:530).

Cornwall and Cornwall questioned the fundamental assumptions of the NAIRU. They argued that the NAIRU was an irrelevant concept as a model for unemployment. The distinction that Friedman made, between the short and

long run Phillips curves, voluntary and involuntary unemployment, and the NAIRU is what makes the concept fail a validity test Cornwall et al said. "NAIRU analysis suffers from an additional weakness...it relies on contradictory assumptions" (Cornwall et al 1997:532).

4.7 ANTI-NAIRU CRITICISMS: SAWYER

Sawyer a prominent guest economist at the Levy institute also said that he thought the NAIRU was invalid as a policy tool. It was fear that drove policy makers, he said, and not economic common sense. Sawyer questioned the reliance on the NAIRU with its various estimated values. "Fear of inflation has led to a reluctance to allow the unemployment rate to fall below the estimated NAIRU...If so much weight is...placed on an estimate of a theoretical variable, it is extremely important to know how valid that theory is and how valid the estimates of that variable are" (Sawyer 1997:1).

The role of aggregate demand has been ignored in the formulation of the NAIRU Sawyer said. He argued that it was not wise to use the NAIRU as a policy tool as it had not got a strong theoretical or empirical base (Sawyer 1997:1). He also questioned the specification of the NAIRU. The estimation methods for the NAIRU have been "inadequately specified and...have ignored the role of aggregate demand" (Sawyer 1997:1).

Sawyer further questioned the validity of the NAIRU. Debating the assumptions he denounced the NAIRU because of its incorrect assumptions about equilibrium, capacity, a correction mechanism, and price indexes. The NAIRU was invalid in that it relied on these assumptions. The NAIRU assumes "the unemployment-capacity utilisation relationship must be stable, changes in unemployment or capacity utilisation must have no effect on wage

and price inflation, there can be no error correction mechanism and the same price index must be relevant for both wage settlements and price determination...casting doubt on the validity of any model relying on them" (Sawyer 1997:1-2).

Sawyer concludes his argument with one last warning about the NAIRU. He said that the NAIRU could not be accurately estimated. The NAIRU should not then be used for policy making. The NAIRU he said has no connection with the aggregate demand side of the economy. "No convincing mechanism by which aggregate demand would adjust to the NAIRU...The difficulty of estimating the NAIRU adds further uncertainty to policies based on the NAIRU...We should not base policy on the NAIRU" (Sawyer 1997:2).

4.8 OTHER ANTI-NAIRU CRITICISMS

The implications of the Phillips curve and the NAIRU as a concept are criticised by Guy Routh. The criticism by Routh, as cited by Leeson, highlighted the point that although the raw data suggested a relationship between inflation and unemployment, there are adverse political implications. A government not concerned with unemployment can accept a higher level of unemployment to reduce inflation.

> "Guy Routh concluded that 'you may see [in Phillips data] dimly represented, the silhouette of an 'ostrich'...yet the curve imposed upon this data came to be seen as a reversible 'Keynesian' safety net...above which governments could print money and spend, in accordance with the requirements of the political landscape" (Leeson 1997:119).

The chance that economists will even agree on estimates of the NAIRU and policy recommendations from that estimate are slim says Leeson. The microeconomic structures of countries are very different and the way data is

collected can vary considerably between countries. This suggests that the techniques that worked for one country with its structures and data set will probably not work in the same way for another country, and indeed would have different implications from the results. "The statistical existence (or otherwise) of a Phillips curve tends to be specific to particular data sets, and to different econometric specifications" (Leeson 1997:144). This questions the validity of the NAIRU concept.

The results from Laubach's bivariate model suggested that (Laubach 1998:20-21) the estimation process for the NAIRU was flawed. The results suggested that other than for extreme circumstances it was impossible to tell whether the actual unemployment rate was above, or below NAIRU (Laubach 1998:21). This casts doubt on the validity of using the NAIRU concept in policy decisions.

4.9 ANTI-NAIRU CRITICISMS: DAVIDSON

Davidson is sceptical of any policy decision based on the NAIRU concept. The results from such policies will not be good for the economy he believes. The argument against the NAIRU concept has to do with the foundations of the theory. The concept of the NAIRU is irrelevant in that it is not in step with reality.

> "By adopting the same axiomatic foundation as the classical system, natural unemployment rate analysis suffers the same short coming, namely that the 'characteristics' of these models happen 'not to be those of the economic society in which we actually live, with the result that...[their] teaching is misleading and disastrous" (Davidson 1998:818).

The theory behind the NAIRU, Davidson argues, is inconsistent with the fundamentals of the science of economics. The principles developed by Marshall in his equilibrium analysis are not included in the theory of the NAIRU. This leads to several 'real life' problems being assumed away. "Natural rate theorists substitute a different meaning for the concept of equilibrium from the one introduced by Marshall...In so doing...[they] define away the problem of involuntary unemployment equilibrium and are left with the same explanations of observed unemployment that pre-Keynesian classical theorists invoked" (Davidson 1998:818).

Davidson went on to quote Keynes in his rebuttal of the NAIRU theory. He believes that the theory ignores real life and should be excluded from policy-making decisions because of this. Davidson uses strong language in an attempt to create a 'nonsense' out of the NAIRU.

> "The Natural Rate explanations of unemployment involve what Keynes...called an ignoratio elechi i.e., the fallacy of offering proof irrelevant to the proposition in question" (Davidson 1998:818).

The use of money in an economy highlights another fault with the NAIRU concept. When money is not neutral i.e. it has an effect, then the concept of the NAIRU is an irrelevancy and should be ignored Davidson says. "A money-using economy will never be automatically self adjusting to any full employment rate (or natural unemployment rate) and without purposive direction it is incapable of translating...involuntary unemployment into...full employment...The label of a (dynamic) 'natural rate of unemployment' theory may be different from the (static) old classical 'full employment' model, but the alcoholic content is the same" (Davidson 1998:827-829).

Economists who believe in similar philosophies to John Maynard Keynes promote demand management. This ignores the supply side of the economy and fails to explain the issue of capacity in the economy. The amount of excess capacity in an economy would render either side of the debate correct or incorrect. Where excess capacity exists when the capital being used in the economy is not reaching its full potential. There is a larger amount of capital (capacity) in the economy than is currently being used. With no excess capacity the Keynesians have a case against the pro-NAIRU economists. Their argument would be to increase the level of capacity in the economy, to stimulate growth and decrease unemployment, with little or no effect on the rate of inflation. With excess capacity the post-Keynesian argument falls over. Demand management will not be effective if there is excess capacity in an economy. Adding more capacity (capital) to the economy through increased government spending will only distort the price of goods and not affect the level of unemployment, assuming a situation of excess capacity.

4.10 SUMMARY CHAPTER FOUR

Chapter Four outlined the arguments against the NAIRU. The principal argument was that demand effects were assumed away in the long run as the long run Phillips curve was vertical. It was also pointed out, that the many different specifications of the NAIRU and the Phillips curve gave many different estimation results. Policies built on a range implied a different effect, than a policy aimed at one clear number.

Cross-country comparisons were found not to be relevant and the definition of the NAIRU contained conflicting or incorrect assumptions. The definition of the NAIRU contains reference to perfect competition while also including imperfections. Effective monetary policy is not, the post-Keynesian's noted, conditional on an accurate estimate of the NAIRU.

The empirical estimates of the NAIRU tended to be unclear and there was no consensus among economists as to the value of the NAIRU. Inflation they say is not self-perpetuating, as is assumed by NAIRU advocates. Unemployment does not necessarily lead to a decrease in the inflation rate, as the theory of the NAIRU would suggest. Indeed they seemed to find that you could decrease unemployment with only a moderate increase in inflation, and not experience the accelerating inflation that was theorised.

Several other criticisms were made about the NAIRU. One of these was that it was impossible to tell, outside of any extreme cases, if the economy was above or below the NAIRU. Structural changes, it was also claimed, can actually bring about a decrease in inflation despite the level of the unemployment rate. Finally, it is said that if money is not neutral then the NAIRU is irrelevant.

The post-Keynesians in their argument did not address the issue of capacity in the economy. The amount of excess capacity in the economy then would make either side of the debate correct or incorrect. With no excess capacity the Keynesians have a case against the NAIRU. With excess capacity the post-Keynesian argument falls over. This is a big obstacle for the post-Keynesian argument.

CHAPTER FIVE

5.1 EMPIRICAL DEVELOPMENTS OF THE NAIRU

Another group of economists decided to create a new model of the Phillips curve in order to estimate a NAIRU. Their NAIRU would have discrete jumps at certain points in time. Staiger, Stock and Watson (1997) used regression with two lags of unemployment in order to model their NAIRU to include discrete jumps at certain points in time. Their model (Staiger et al 1997:35-36) is as follows:

$$\Delta\pi_t = \beta_1(U_{t-1} - U^*) + \beta_2(U_{t-2} - U^*) + \gamma X_t + V_t$$

Where π_t is price inflation, U_t is unemployment, X_t is an additional control variable, U^* is NAIRU (an unknown parameter), and V_t is a statistical error term. They then rewrote this equation as:

$$\Delta\pi_t = \mu + \beta_1 U_{t-1} + \beta_2 U_{t-2} + \gamma X_t + V_t$$

Where $\mu = -(\beta_1 + \beta_2)U^*$

Solving for U* gives

$$U^* = -\mu / (\beta_1 + \beta_2)$$

The NAIRU that Staiger, Stock and Watson got from their study is modelled off a flexible polynomial called a 'Spline'. They took a different route to analysing unemployment by concentrating on one group in the economy. The group in question was married men as they are usually, it was claimed, less affected by changing demographics (Staiger et al 1997:40).

Gordon's 1997 triangle model of inflation is expressed as

$$\pi_t = a(L)\pi_{t-1} + b(L)D_t + c(L)Z_t + e_t$$

Here inertia is conveyed by the lagged inflation variable π_{t-1} where D_t is an index of excess demand ($D_t = 0$ indicates no excess demand). The Z_t variable captures supply shocks, e_t is the variable accounting for serially uncorrelated error, and L is a polynomial in the lag operator. As a proxy for the Dt variable, unemployment gap was used i.e. the difference between the NAIRU and actual unemployment. This model did not seem accurate enough for Gordon and so he modified it. Changing this model slightly, gave Gordon a time varying model for the NAIRU (Gordon 1997:20). This model is as follows:

$$\pi_t = a(L)\pi_{t-1} + b(L)(U_t - U_t^n) + c(L)Z_t + e_t$$

Where $U_t^n = U_{t-1}^n + e_t$

Using this model with 165 observations from 1955 to 1996 Gordon worked out his time varying NAIRU for the United States. This new NAIRU was higher than any other estimates from previous models of the natural rate (Gordon 1997:22). He thought this was attributable to economists being too optimistic about the ability of the economy to maintain a given level of unemployment without suffering the consequence of accelerating inflation.

Razzak, in his model, (explained in chapters Two and Three), used variables such as, the first difference of the natural log of the trade weighted real GDP lagged three-quarters, in his Phillips curve model (Razzak 1997:4). Another variable used by Razzak was the "contemporaneous trade weighted foreign CPI inflation rate with three lagged values, and the trade weighted foreign interest rates as measured by the 90 day lending rates" (Razzak 1997:4). He also used three different rates of inflation, the "CPI excluding interest and GST, the CPI excluding interest, GST fresh food and fuel prices and the median CPI excluding interest and GST" (Razzak 1997:5). GST was 10% at 1986 Q4 and rose to 12.5% in 1989Q3.

Laubach (1998) in his model estimates the NAIRU using a cross section of seven countries with quarterly data from 1970, his regression began in 1971. His work used a two-sided and two-quarter moving average series. As Laubach was looking across countries he excluded dummies to gain symmetry. He also included a vector designed to capture the terms of trade and supply shocks. The model Laubach used[8] contained four lags for unemployment, two lags for the nominal exchange rate and two for the commodity price.

Laubach modified his model to a bivariate model[9], adding a term that explained the observed rate of unemployment tending to the NAIRU over time, (Laubach 1998:15). This term was added to see if hysteresis had an impact on the estimates of the NAIRU, and what that would mean for the actual rate of unemployment.

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[8] $\Delta\pi_t = \varepsilon^3_{I=1}\beta_i\Delta\pi_{t-1} + \varepsilon^4_{I=1}\gamma_I(U_{t-I} - U^n_{t-I}) + \varepsilon^2_{I=1}\alpha\delta_{1i}\Delta^2S_{t-1} + \varepsilon^2_{I=1}\delta_{2i}\Delta^2CP_{t-I} + e_t$

Where U^n_t is the NAIRU at time t and S and CP are the commodity price variables.

[9] Bivariate model: $\Delta\pi_t = \beta(L)\Delta H_{t-1} + \gamma(L)\Delta U_{t-1} + \delta(L)X_{t-1} + E_t - \gamma(L)v_{t-1}$ (Laubach 1998:19). This model has hysteresis replacing the drift element.

Phelps and Zoega used a time varying augmented Phillips curve. Their equation contained changes in the rate of wage inflation as a function of a log of the unemployment rate. They also included a variable that reflected the curve moving twice, and another reflecting the proportional change in employment.

$$\Delta^2 W_t = \alpha_0 + \alpha_1 \text{Log}(U_t) + \alpha_2 \Delta \text{Log}(100 - U_t + \alpha_3(\Delta^2 W_t - \Delta^2 P_t)) + \alpha_4 X_t + e_t$$

(Phelps et al 1998:793).

Where W is the log of the nominal wage, P is the log of prices and X is a vector of variables that would affect the position of the NAIRU. In the vector X they include "the world rate of interest...the real price of oil...two measures of the extent of the welfare state. One is...the ratio of public spending on welfare...to GDP, and the other...is the sum of workers and firms contribution to national insurance...[they] include...measures of personal wealth...as a ratio to GDP...Finally [they] include the rate of growth of the labour force" (Phelps et al 1998:793-794).

The results Phelps and Zoega found were interesting. They found that unemployment was significantly different from zero. This was not surprising; of the other variables, the real oil price was significant, and the welfare variable was significant. When they added the wealth variable it made the social welfare coefficient insignificant. The variable for welfare was, however, significant in itself. The growth of the labour force variable was insignificant (Phelps et al 1998:794).

Phelps and Zoega also tested hysteresis. They used the complicated technique of the Markov Switching model (MSR) in order to detect the timing of the changes in the NAIRU. A bootstrap test was then used, to see if unemployment was persistent, once the NAIRU shifts had been accounted for. The NAIRU they estimated for was time varying relating to different 'states of the world' (Phelps et al 1998:796). Their equation that included hysteresis is:

$$U_t = U^*_t(S_i) + \beta[U_{t-1} - U^*_t(S_i)] + \eta_t$$

Where S_i is the differing states of the world. Phelps and Zoega found that the NAIRU shifted infrequently for most OECD countries (Phelps et al 1998:796).

5.2 ECONOMETRIC ANALYSIS OF THE NAIRU IN NEW ZEALAND

INITIAL MODEL

The initial model that I used was designed to explain changes in the price level. I used simple linear regression. The simple Phillips curve relationship was used and other variables were added in order to improve the accuracy of the estimations of the NAIRU. These explanatory variables would make the model more complete in its explanation of the changes that occurred in the overall price level. The NAIRU[10] could be estimated from this model, and then the distance of our actual level of unemployment from the level associated with non-accelerating inflation (NAIRU) discerned. The estimation was based on forty-five observations from June 1986 until December 1996. The model's dependent variable was the rate of inflation (changes in the price level), and the explanatory variables were the rate of unemployment lagged over two time periods.

I regressed the natural log differences in quarterly inflation via the Consumers Price Index (CPI) from quarter two to quarter one, as the dependant variable. This was regressed against the dependant variable of the unemployment rate in New Zealand. The unemployment rate was also expressed in quarterly form. The unemployment rate was then lagged by two quarters.

This model hypothesises that the changes in the price level, as measured by the change in the CPI over two quarters, could be fully explained by the differing levels of unemployment over two quarters. I used this initial model as a base for my regression analysis. Further analysis was then conducted. New variables were added with the aim of increasing the explanatory power of the model. This analysis is an attempt to match the data as closely as possible to the relationship defined by the Phillips curve, and to obtain a NAIRU for New Zealand and test its statistical significance.

TABLE ONE

INITIAL MODEL RESULTS (4DP)

R^2:	0.4332	LL[a]= -52.8950
Adjusted R^2:	0.4074	Regression standard error: 0.7706
Variables	**Coefficients**	**t-Statistic [p-value]**
INT	3.9628	10.0061 [0.000]
URt-1	-0.5977	-2.8603 [0.006]
URt-2	0.3035	1.4885 [0.114]
Diagnostic Tests	**LM Test [p-value]**	**F-Tests [p-value]**
Serial Correlation	6.8485 [0.009]	7.3344 [0.010]
Functional Form	0.01815 [0.893]	0.0166 [0.898]
Normality	5.2948 [0.071]	N/A
Heteroskedasticity	0.0098 [0.921]	0.0094 [0.923]
NAIRU:	13.4697	Observations: 47 Parameters: 3

[A] Value of the log-likelihood function.

If all of the observations lay exactly on the regression line then the model would fit the relationship perfectly. This perfect fit would be indicated by an R^2 equal to 1. The R^2 values gained from the Initial Model were below 0.5 but greater than zero. The R^2 of this model is low, it explains less than fifty percent of the relationship. This result is a relatively poor fit especially as it refers to time series data.

The coefficient for the first lag of unemployment (UR_{t-1}) had a high t-statistic, with a very low p-value thus this parameter estimate is significantly different from zero at almost any level of probability. This parameter is significant in explaining the relationship between the changing price level and unemployment. The second lag of unemployment (UR_{t-2}) had a lower t-statistic, despite this we retain it as an explanatory variable for future regressions, as its presence is essential to the model's economic logic. The intercept term was significantly different from zero at the one-percent level.

The large estimate of the NAIRU is not necessarily an indication of a total failure of the model, rather it may well be an indication that some elements (variables) that were needed to properly explain the relationship between the changing price level and unemployment are missing from the model. The NAIRU estimate is larger than what some other models had estimated (Taskforce 1994:44). The actual value for the NAIRU, given in overseas studies, had been found to be between five and seven percent (Taskforce 1994:44).

The diagnostic tests attempt to highlight any statistical problems with the data or the estimates. It was assumed, when estimating this model, that the error terms were not related. The error terms are the difference between what we observe and what the estimated model predicts the observations would be. In the Initial Model the relationship was assumed to be an inverse linear function. This serial correlation problem occurs when using time series data. Correlation in the error term is often caused by some systematic effect on the dependant variable not included among the explanatory variables. Serial correlation could also be caused by "an incorrect functional form, such as applying a linear estimation to a curvilinear relationship" (Eastman 1984:91).

We tested for serial correlation by a Lagrange Multiplier test, or LM test, and an F test. These tests enable one to judge whether or not the model rejects the null hypothesis, in this case whether there is serial correlation. If the computed statistics are greater than their table value at a chosen level of probability (5 percent), this indicates that there is evidence of serial correlation. Alternatively, if the test p-value is less than the chosen level of probability then we cannot reject the hypothesis that serial correlation exists. Both the LM and F-statistics obtained for this model had very low p-values (0.009 and 0.01 respectively), indicating that some evidence for serial correlation exists. This evidence might indicate that the initial model is inadequate, and the explanatory variable used so far does not properly explain changes in the dependent variable.

The assumption of a linear relationship between inflation and unemployment can also be tested. When we assume that a function (relationship) has a particular form i.e. a straight line, we can test the model for linearity. A LM and an F test again tested functional form, where the null hypothesis was the assumption of a straight-line relationship between inflation and unemployment. Both tests' p-values were less than five percent therefore we did not reject the hypothesis that the relationship is linear.

Another assumption about this model is that the error term follows the normal distribution. This is a statistical assumption made to allow statistical testing. We test this assumption with the LM test, where the null hypothesis was error term normality. The computed value of the LM statistic indicates that the normality assumption cannot be rejected, as the p-value is greater than the chosen level of probability.

Another assumption made was that the error term variances are equal, i.e. that the spread of the data is even. This is known as the assumption of homoskedasticity. If this assumption is violated then the problem is known as heteroskedasticity. The effects of heteroskedasticity would be to cause the variability of the sample to be overstated or understated.

This overstating or understating has the effect of causing the confidence intervals to be too wide or too narrow. The test results gained from a sample that has heteroskedasticity present can also be inaccurate, as they may lead to the rejection of a correct hypothesis less often or more often than the significance level would suggest. We tested heteroskedasticity both with a LM test and an F-test. The tests were designed to find evidence to reject or accept the null hypothesis of homoskedasticity. Both tests had very high p-values this lead to the null hypothesis not being rejected. This indicates that there is no evidence that the simple model has problems with heteroskedasticity. The stage was set to introduce some new explanatory variables.

MODEL TWO

As well as the initial model variables, I included three dummy variables. These dummy variables were designed to capture any seasonal changes in the relationship. For New Zealand with our climatic variation and a large seasonal workforce this is likely to be an important variable in explaining unemployment. As the data are collected in quarterly form, we only used three dummy variables to represent seasonal variations, the fourth quarter being subsumed in the equation's intercept.

TABLE TWO

MODEL TWO RESULTS (4DP)

R^2:	0.4503	LL^A= -52.1737
Adjusted R^2:	0.3833	Regression standard error: 0.7862
Variables	**Coefficients**	**t-Statistic [p-value]**
INT	4.0210	9.0742 [0.000]
URt-1	-0.6415	-2.4962 [0.017]
URt-2	0.3460	1.3792 [0.175]
D1	-0.2625	-0.7967 [0.432]
D2	0.1054	0.3025 [0.764]
D3	-0.0511	-0.1547 [0.878]

Diagnostic Tests	**LM Test [p-value]**	**F-Tests [p-value]**
Serial Correlation	7.9721 [0.005]	8.1707 [0.007]
Functional Form	0.0018 [0.967]	0.0015 [0.969]
Normality	3.8337 [0.147]	N/A
Heteroskedasticity	0.1184 [0.731]	0.1136 [0.738]
NAIRU:	13.607	Observations: 47 Parameters: 6

[A] Value of Log-likelihood function

The results from Model Two, which includes the dummy variables D1, D2 and D3, are interesting. In Model Two R^2 has increased slightly and adjusted R^2 has decreased slightly. This suggests that the model's explanatory power has worsened as a result of adding the dummy variables.

The coefficient for the first lag of unemployment still has a high t-statistic and a small p-value thus it is still significantly different from zero at almost any level of probability. All dummy variables have low t-statistics and high p-values, which suggests that they are not significantly different from zero.

The NAIRU calculation has increased in size slightly. This indicates that increasing the number of variables has not helped to explain the relationship between the price level changes and unemployment.

The LM and F tests still show the existence of serial correlation, as the computed values of the statistics are greater than their table values and the p-values are lower than the five percent level chosen. The second model is still

inadequate, and the explanatory variables used do not properly explain the changes in the dependant variable.

The LM and F tests for linearity of the functional form do not reject the null hypothesis that the relationship was linear, as their p-values were much greater than five percent. The assumption that the error is normally distributed holds, for Model Two, as the p-value for the LM test is greater than the chosen level of probability.

The LM and F tests' do not reject the null hypothesis of homoskedasticity, as the large p-values clearly show (0.731 and 0.738 respectively). The p-values have decreased from the Initial model.

MODEL THREE

An import price index is added to Model Two with the aim of determining import effects on inflation changes as seen in Gordon's (1997) paper. This is important as New Zealand has a very open economy, and is also import dependent on resources such as oil. The results of Model three are as follows.

TABLE THREE

MODEL THREE RESULTS (4DP)

R^2:	0.4517	LL^A= -52.1135
Adjusted R^2:	0.3695	Regression standard error: 0.7949
Variable	**Coefficients**	**t-Statistic [p-value]**
INT	-6.1636	-0.1940 [0.847]
URt-1	-0.6162	-2.2684 [0.029]
URt-2	0.2921	0.9597 [0.343]
D1	-0.2643	-0.7900 [0.434]
D2	0.1066	0.3027 [0.764]
D3	-0.0202	-0.0580 [0.954]
LNIMP	1.4935	0.32052 [0.750]

Diagnostic Tests	LM Test [p-value]	F-Tests [p-value]
Serial Correlation	8.3611 [0.004]	8.4393 [0.006]
Functional Form	0.0017 [0.967]	0.0014 [0.969]
Normality	4.4085 [0.110]	N/A
Heteroskedasticity	0.0529 [0.818]	0.0507 [0.823]
NAIRU:	19.02	Observations: 47 Parameters: 7

[A] Value of the Log-likelihood function.

The results from Model Three, which include the log value of the import price index (LNIMP), prove to be quite surprising. The R^2 has increased slightly and the adjusted R^2 has decreased slightly. This indicates that the model has lost more explanatory power as the import price index was added. The regression standard error has also increased slightly.

The coefficient of the first lag of unemployment still has a high t-statistic and low p-value, which indicated that it is still significantly different from zero. The t-statistic for the first lag on unemployment in model three has decreased from the previous two models and the p-value has begun to increase. This indicates that the coefficient is losing some of its significance as more parameters are added. The low t-statistic and high p-value for the coefficient on the second lag of unemployment indicate that it is not significantly different from zero.

The NAIRU value is high at 19.02 this indicates that there are still some variables that are missing that would properly explain the relationship between inflation and unemployment. Adding the import price index variable has not

helped to explain the relationship. Model three still seems to be inadequate to properly explain the changes in the dependant variable.

The computed statistics' from the LM and F test for serial correlation indicate that serial correlation still exists. The computed statistics have actually increased from Model two to Model three which suggests that the problem of serial correlation is worsening with the addition of new variables. The LM and F tests do not reject the null hypothesis that the relationship was linear, as their p-values were much greater than the chosen level of probability.

The assumption that the error is normally distributed holds, for Model three, as the p-value for the LM test was still greater than the chosen level of probability. We tested heteroskedasticity again with both a LM test and an F test. The LM and F tests do not reject the null hypothesis of homoskedasticity, as both the p-values are large.

Another two models were attempted. The Model four lagged quarterly inflation to help explain the relationship between inflation and unemployment by creating a variable representing anticipated inflation. The results, however, from the regression on Model four gave a nonsensical estimation for the NAIRU. The estimated value did not make any economic sense. I decided to not include the results from Model four because of this result.

Model five attempted, to correct Model four's nonsensical result for the NAIRU. Model four was rerun as Model five with the anticipated inflation variable corrected as a log difference. The NAIRU estimate, however from Model five was also nonsensical. This result too did not make economic sense. I decided not to include this model's results either.

5.3 SUMMARY CHAPTER FIVE

Chapter Five further analysed the empirical development of the NAIRU. It was also to estimate a NAIRU value for New Zealand. This chapter discussed the newer techniques used in estimation. Techniques such as, flexible polynomials, triangle models, time varying models, cross sectional inter-country analyses, and various moving average models were examined in more detail.

Most models found unemployment significant in explaining changes in the price level. Other significant variables were a measure of import inflation and welfare spending, as well as locally significant proxies. Variables such as the growth of the labour force, and segregating the labour force were found to be insignificant in the process of explaining the rate of change in inflation.

For New Zealand the initial model confirmed a relationship between inflation and unemployment. There were, however, serial correlation problems with the New Zealand data. The quarterly dummies were not significantly different from zero. There were large problems with adequacy of the model for New Zealand.

It has become apparent that it is very difficult to get an accurate estimate of the NAIRU for New Zealand. The empirical work done in this chapter shows that, more advanced techniques are needed to fit the New Zealand data to the relationship between inflation and unemployment, and to gain an economically logical estimate of the NAIRU. The amount of data for New Zealand is small compared to other countries that have done similar studies. In the future with more advanced techniques and more data an economically logical estimate of the NAIRU for New Zealand should be possible.

CHAPTER SIX

CONCLUSION

The debate over the validity of the NAIRU raises more questions than answers. The issue between the pro-NAIRU thought and the post-Keynesians, or anti-NAIRU thought, is the debate over the long run trade off between inflation and unemployment. The post-Keynesians' in general tend to see a long-run trade off between inflation and unemployment. This implies that the long run Phillips curve is not vertical for the post-Keynesians. The NAIRU then is not valid as a policy tool, and there is debate from the post-Keynesians as to whether it even exists.

The post-Keynesians did not address the issue of capacity in the economy. The amount of excess capacity in the economy would cause either side of the debate to be rendered valid or invalid. With excess capacity the post-Keynesian argument is invalid. However, even with excess capacity the pro-NAIRU criticisms of the estimation procedures are still valid.

Other issues were also debated. These were about the shape of the short run Phillips curve, the assumptions behind the model, the focus of the model on either the demand or supply side, the legitimacy of international comparisons, and the application of the concept to real life policy questions. These issues all relate to the validity of the NAIRU. The debate centres on econometric issues that do not have as much relevance to the validity debate. Many economists who agree with the NAIRU as a concept, and as a policy tool, still debate the econometrics used to formulate estimates of the NAIRU and Phillips curve.

The econometric debate over techniques used in the estimation procedure has brought some new and exciting techniques to the fore. These new techniques offer promise for future work in the area of inflation and unemployment (and also other areas of economics such as economic growth). Their estimates of the NAIRU with the new techniques, help to gain a greater understanding of the complex relationship involved between inflation and unemployment.

The data source from which New Zealand economists can draw to derive their models is somewhat light compared to other countries, such as Britain. This issue is one that should resolve itself over time as more data is added, and new ways of processing the data becomes available. There should be in the future, more work done in New Zealand on the issue of inflation and its relationship with unemployment. The approach that Layard et al (1994) took to the relationship between inflation and unemployment seems to equate well with the New Zealand experience. In agreement with New Zealand's Reserve Bank, Layard et al saw no long run trade off between inflation and unemployment. This approach points to a vertical Phillips curve in the long run. Supply is the dominant influence in the long run, with supply and demand as influences in the short run. Price stability and the reductions of the benefit system are the policies they advocated as the best method to ensure that the economy would converge at the NAIRU in the long run (Layard et al 1994:24). This is similar to the philosophy behind the RBA and ECA legislation in New Zealand.

The post-Keynesians such as Galbraith said that the NAIRU was incorrect and invalid. These differing perceptions of the relationship prevent the development of a unified theory on the NAIRU. The weight of evidence, however, seems to support the NAIRU, and the Phillips curve that it is derived from. Each economist adds to the body of knowledge surrounding the NAIRU with every

new paper they release on the subject. Many economists agree that there are changes needing to be made in order to make the NAIRU a more acceptable concept. Economists critique each other's work, aiming to improve understanding of the model that looks at the NAIRU. They agree on a basic relationship between inflation and unemployment, but disagree on how to define it, and what this means for the policy makers wishing to exploit any trade off to gain economic growth.

New Zealand is on the right track according to many economists, such as Layard et al, Chapple, Maloney and Razzak. The monetary policy that was put into place, and guided by Reserve Bank (Governor Brash), has the aim of price stability through control of the money supply. The economy needs a forward-looking team of policy makers aimed at sustained economic growth through stability. Economic shocks aside, the growth that has been achieved in New Zealand is certainly a positive testament to the work that the Reserve Bank does. The policies, as Razzak noted, need to be enacted quickly and without impediment due to the asymmetric nature of the New Zealand economy.

Opposition to the NAIRU has grown in later years. Evidence against the theory is based more on ideological grounds than economic history. Despite price fluctuations that shocked the global economy, the relationship between inflation and unemployment has proven itself to be valid, although it has been hard to define in terms of the NAIRU.

Further work has to be done on the definition of the NAIRU, and the relationship between inflation and unemployment. It would aid the use of the NAIRU as a policy tool if a clearer understanding were agreed upon. With a better understanding of the NAIRU, policy tools could be localised and made more responsive to shocks to the system.

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