The Natural Rate of Unemployment and the NAIRU: Theoretical Foundations, Empirical Evidence, and Policy Debates

Vîntu, Denis

National Institute for Economic Research

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Abstract

This paper explores the concepts of the natural rate of unemployment and the non-accelerating inflation rate of unemployment (NAIRU). It discusses their theoretical foundations, empirical estimation, and policy implications. While both concepts have been central to macroeconomic theory and policymaking, they remain controversial. The analysis draws on historical developments, empirical evidence, and contemporary debates to evaluate the relevance of these concepts in modern economies.

Keywords: Simultaneous equations model; Labor market equilibrium; Unemployment rate determination; Wage-setting equation; Price-setting equation; Beveridge curve; Job matching function; Phillips curve; Structural unemployment; Natural rate of unemployment; Labor supply and demand; Endogenous unemployment; Disequilibrium model; Employment dynamics; Wage-unemployment relationship; Aggregate labor market model; Multivariate system estimation; Identification problem; Reduced form equations; Equilibrium unemployment rate

Jel Classification: C30, C31, C32, C33, C51, J64, J65, J68.

1 Introduction

Unemployment and inflation have been central concerns of macroeconomic theory and policy for decades. The relationship between these two variables has been formalized through the Phillips Curve, which has evolved considerably since its introduction in 1958. Out of this evolution emerged two influential concepts: the natural rate of unemployment (Friedman, 1968; Phelps, 1967) and the NAIRU (Modigliani and Papademos, 1975). These concepts underpin much of modern macroeconomic policy, especially monetary

policy aimed at price stability. Unemployment and inflation are among the most critical concerns of macroeconomic theory and policy. Historically, economists have sought to understand the relationship between these two variables to guide monetary and fiscal policy. The Phillips Curve, first introduced in 1958, provided a framework suggesting an inverse relationship between unemployment and wage inflation. Policymakers initially believed that reducing unemployment could be achieved at the cost of slightly higher inflation.

However, the economic phenomena of the 1970s, particularly stagflation, challenged this view, demonstrating that high inflation and high unemployment could occur simultaneously. In response, economists developed new theories that incorporate expectations and structural characteristics of labor markets, leading to the concepts of the natural rate of unemployment and the non-accelerating inflation rate of unemployment (NAIRU).

The natural rate of unemployment, proposed by Friedman (1968) and Phelps (1967), represents the long-run unemployment rate consistent with stable inflation. The NAIRU, on the other hand, is an empirically estimated unemployment rate at which inflation does not accelerate. Both concepts have had a profound influence on modern macroeconomic policy, particularly in the formulation of monetary policy and central bank strategy.

This paper aims to provide a comprehensive analysis of the natural rate of unemployment and the NAIRU, discussing their theoretical foundations, empirical estimation methods, and implications for economic policy. It also examines case studies from advanced and developing economies, highlighting the practical relevance and limitations of these concepts in guiding policymakers.

This paper provides a systematic review of these concepts, contrasting their theoretical underpinnings, empirical estimations, and implications for policy design.

Unemployment has long been one of the central concerns of economic theory and policy. While short-term fluctuations in joblessness are often linked to the business cycle, economists have also emphasized the existence of a "natural" or structural level of unemployment that persists even when the economy is at full capacity. This concept, formalized in the 1960s and 1970s as the natural rate of unemployment and later as the Non-Accelerating Inflation Rate of Unemployment (NAIRU), remains at the heart of debates over the trade-off between inflation and unemployment.

The natural rate hypothesis, originally advanced by Milton Friedman and Edmund Phelps, challenged the prevailing Keynesian view that policymakers could permanently lower unemployment through demand management. Instead, it suggested that attempts to push unemployment below its natural rate would merely accelerate inflation without achieving lasting gains in employment. Building on this idea, the NAIRU refined the relationship between inflation and unemployment by identifying the unemployment rate consistent with stable inflation dynamics.

Over time, the natural rate and the NAIRU have become crucial analytical tools for

central banks, international institutions, and policymakers in designing monetary and fiscal strategies. Yet, both concepts are controversial, as they are not directly observable, vary across time and countries, and are influenced by labor market structures, institutions, and expectations. Empirical evidence often shows instability in NAIRU estimates, raising questions about their reliability as guides for policy. Moreover, recent developments—such as globalization, technological change, and the post-2008 "jobless recoveries"—have intensified debates about whether the natural rate remains a meaningful benchmark in modern economies.

This paper explores the theoretical foundations of the natural rate and the NAIRU, examines the empirical evidence surrounding their estimation and application, and assesses the policy debates that continue to shape their relevance in economic discourse. By situating the concepts within both historical and contemporary contexts, the analysis highlights the enduring tension between economic theory, measurement challenges, and real-world policymaking.

2 Literature Review

The concepts of the natural rate of unemployment and the Non-Accelerating Inflation Rate of Unemployment (NAIRU) have generated a vast and evolving body of literature. This section surveys the main theoretical contributions, empirical findings, and controversies that have shaped the debate(Zhang et al., 1998).

1. Origins of the Natural Rate Hypothesis

The natural rate hypothesis emerged in the late 1960s as a response to the perceived breakdown of the Phillips Curve (Phillips, A. W. , 1958). Friedman (1968) and Phelps (1967) independently argued that the trade-off between inflation and unemployment could not be exploited permanently. According to their framework, expectations of inflation adjust over time, rendering any attempt to maintain unemployment below its natural rate unsustainable. This view introduced the distinction between the short-run Phillips Curve (subject to demand shocks) and the long-run vertical Phillips Curve, centered on the natural rate.

2. The Development of NAIRU

Building on this foundation, the concept of the NAIRU emerged in the 1970s as an operational tool for policy analysis. Unlike the broader notion of a natural rate, the NAIRU is defined more precisely as the unemployment rate consistent with stable inflation (Modigliani & Papademos, 1975). Its prominence grew as central banks adopted inflation-targeting frameworks(Box et al., 2015), making it essential to estimate the unemployment threshold beyond which inflationary pressures emerge.

3. Empirical Estimation and Challenges

A large body of empirical research has attempted to estimate the NAIRU using econo-

metric models of inflation dynamics. Staiger, Stock, and Watson (1997) highlighted the substantial uncertainty surrounding such estimates, noting their sensitivity to model specification and data revisions. Later research demonstrated significant time variation, reflecting structural shifts in labor markets, demographics, and productivity (Blanchard & Katz, 1997).

Labor market institutions have also been found to influence the equilibrium unemployment rate. Layard, Nickell, and Jackman (1991) emphasized the role of wage bargaining, unions, and unemployment benefits in shaping unemployment persistence. Orphanides and Williams (2002) argued that mismeasurement of the NAIRU contributed to policy errors in the 1970s, when central banks misjudged the extent of inflationary pressures. Recent studies employ state-space models and Bayesian methods to capture uncertainty and time variation (Laubach, 2001), but measurement challenges persist.

4. Policy Relevance and Controversies

The policy implications of the NAIRU remain contested. Proponents argue that it provides a crucial benchmark for monetary policy, preventing excessive stimulus that could fuel inflation (Ball & Mankiw, 2002). Critics,(Box et al., 2015) however, contend that over-reliance on NAIRU estimates risks unnecessarily restrictive policies, particularly during periods of structural change. After the 2008 Global Financial Crisis, many central banks assumed elevated NAIRU levels, only to observe that unemployment could fall further without accelerating inflation (Blanchard, Cerutti, & Summers, 2015).

Alternative approaches have emerged, including the Non-Accelerating Inflation Buffer Employment Ratio (NAIBER) (Mitchell & Muysken, 2008) and hysteresis models, which suggest that unemployment itself can influence the natural rate through skill erosion and labor market detachment (Blanchard & Summers, 1986).

5. Contemporary Perspectives

Recent debates have revisited the relevance of the NAIRU in light of globalization, technological change(Blanchard, O. J., & Katz, L. F. , 1997), and secular stagnation. Summers (2014) highlights persistent demand shortfalls that undermine the usefulness of NAIRU-based frameworks, while the COVID-19 pandemic renewed discussions on whether temporary disruptions can permanently alter structural unemployment (Galí, 2020). These perspectives underscore the continued evolution of the literature, reflecting both theoretical refinement and empirical complexity.

3 Theoretical Foundations

Understanding unemployment and its relationship with inflation requires examining different macroeconomic theories and how they have evolved over time. This section explores the classical and Keynesian perspectives, the development of the Phillips Curve, and the emergence of the natural rate hypothesis.

3.1 Classical and Keynesian Views of Unemployment

Classical economists considered unemployment primarily as a voluntary phenomenon, arising from workers' preferences or wage rigidities. The labor market, in the classical view, is self-correcting, with wages adjusting to equate labor supply and demand.

Keynes (1936), in contrast, emphasized involuntary unemployment resulting from insufficient aggregate demand. According to Keynesian theory, even if wages are flexible, an economy may remain below full employment because total spending may be inadequate to purchase the output that could be produced at full employment. This insight laid the foundation for post-war macroeconomic policies aimed at maintaining employment through fiscal and monetary interventions.

3.2 The Phillips Curve and its Evolution

The Phillips Curve, introduced by A.W. Phillips in 1958, initially described a stable inverse relationship between unemployment and wage inflation. This relationship was later extended to price inflation, suggesting that policymakers could trade higher inflation for lower unemployment in the short run.

However, the 1970s witnessed stagflation—simultaneously high inflation and high unemployment—challenging the notion of a stable trade-off. Economists recognized that ignoring inflation expectations could lead to misguided policy conclusions. This recognition prompted the development of the expectations-augmented Phillips Curve, incorporating anticipated inflation into the model:

$$\pi_t = \pi_t^e - \alpha(u_t - u^*) + \varepsilon_t, \tag{1}$$

where π_t is the actual inflation rate, π_t^e is expected inflation, u_t is unemployment, u^* is the natural rate of unemployment, and ε_t represents exogenous shocks.

3.3 Emergence of the Natural Rate Hypothesis

Friedman (1968) and Phelps (1967) argued that any attempt to push unemployment below its natural rate would eventually accelerate inflation, as expectations adjust. This hypothesis, known as the natural rate of unemployment, posits that there exists a level of unemployment consistent with stable inflation, determined by structural factors in the labor market such as skills, technology, and institutional settings.

The natural rate hypothesis provided a theoretical foundation for understanding why persistent attempts to reduce unemployment through expansionary policy might be counterproductive in the long run. It also laid the groundwork for the NAIRU framework, which integrates empirical estimation with inflation dynamics to guide monetary policy.

3.4 Criticisms

Critics argue that the natural rate is not observable, may shift over time, and is influenced by policy itself, raising doubts about its operational usefulness.

4 The NAIRU

4.1 Definition

The NAIRU is the unemployment rate consistent with non-accelerating inflation. Unlike the natural rate, the NAIRU is explicitly linked to the inflation process.

4.2 Estimation Techniques

Economists estimate the NAIRU using econometric models of inflation dynamics, often based on variations of the expectations-augmented Phillips Curve:

$$\pi_t = \pi_{t-1} - \alpha(u_t - u^*) + \varepsilon_t, \tag{2}$$

where π_t is inflation, u_t unemployment, u^* the NAIRU, and ε_t a shock term.

4.3 Empirical Findings

Empirical studies suggest that the NAIRU varies across time and countries. For instance, OECD estimates show declining NAIRU values in the 1990s due to labor market reforms, but increases following the 2008 financial crisis.

5 Natural Rate vs. NAIRU

Both the natural rate of unemployment and the NAIRU provide insights into the limits of reducing unemployment without triggering accelerating inflation. While related, they differ in their theoretical and practical applications.

5.1 Similarities

Both concepts posit that there exists a level of unemployment below which inflation tends to rise. They emphasize the importance of structural characteristics of the labor market, such as skill mismatches, labor market rigidity, and demographic factors, in determining sustainable employment levels.

5.2 Differences

The natural rate of unemployment is primarily a theoretical concept describing a long-run equilibrium consistent with stable inflation. It reflects structural factors and is less directly observable. In contrast, the NAIRU is an empirically estimated unemployment rate at which inflation does not accelerate, making it a practical tool for policymakers.

While the natural rate is based on economic theory, the NAIRU incorporates observed inflation dynamics and expectations. Consequently, NAIRU estimates can vary over time due to changes in labor market conditions, policy environments, and inflation expectations, whereas the natural rate conceptually represents a more stable structural parameter.

5.3 Relevance for Policy

Central banks often rely on NAIRU estimates to forecast inflationary pressures and to guide interest rate decisions. Understanding the distinction between the theoretical natural rate and the empirically estimated NAIRU helps policymakers recognize the uncertainty involved in targeting unemployment and the potential risks of misestimating the sustainable level of unemployment.

5.4 Post-2008 and Post-COVID Debates

Following the Global Financial Crisis and the COVID-19 pandemic, estimates of the NAIRU have been questioned. Some argue that prolonged low unemployment has not triggered inflation, challenging the concept's empirical validity.

6 Conclusion

The natural rate of unemployment and the NAIRU have shaped modern macroeconomic thought and policy. While both provide a useful framework, they suffer from limitations in measurement and applicability. Policymakers must therefore treat these concepts with caution, combining structural reforms with flexible policy approaches.The natural rate of unemployment and the NAIRU are foundational concepts in modern macroeconomics, offering insights into the limits of reducing unemployment without causing accelerating inflation. The natural rate provides a theoretical benchmark based on structural characteristics of the labor market, while the NAIRU offers an empirically derived measure useful for guiding monetary policy and inflation targeting.

Both concepts highlight the importance of structural reforms, labor market flexibility, and realistic policy expectations. However, their measurement is subject to uncertainty,

and their applicability can vary across countries and over time. Events such as the stagflation of the 1970s, the 2008 financial crisis, and the COVID-19 pandemic demonstrate that the relationship between unemployment and inflation is complex and influenced by multiple factors, including expectations, shocks, and institutional changes.

Policymakers should treat the natural rate and NAIRU as guiding frameworks rather than precise targets. Combining these insights with data-driven analysis and flexible policy tools can help maintain price stability while promoting employment, ensuring that short-term interventions do not undermine long-term economic sustainability. Further research is needed to improve estimation methods, account for evolving labor market dynamics, and integrate global economic trends into national policy frameworks.

Appendix

- Additional econometric models
- Placeholder for graphs of unemployment vs inflation
- OECD and IMF estimates of NAIRU (tables)

7 Aknowledgements

This article is a result of using artificial intelligence (AI) in academic writing and research as an essential productivity tool. Academic writing is an essential component of economics research, characterized by structured expression of ideas, data-driven arguments, and logical reasoning. To ensure the responsible development and deployment of AI, collaboration between government, industry, and academia is essential. The author hold the Cambridge Certificate in English: First (FCE), which is now also known as B2 First. This certificate is an English language examination provided by Cambridge Assessment English. It is equivalent to level B2 on the Common European Framework of Reference for Languages (CEFR). Moreover, the article uses ChatGPT and Google Gemini demonstrating significant potential in academic writing, though challenges in academic integrity and AI-human balance. Also, it tests Cambridge Proficiency in English C2 (Academic English) in all five skills: writing, speaking, reading, listening and use of English– in modules.

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