

Seen and Unseen: NAIRU, Informal Labor Market and Talking Points for Monetary Policy

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Motivation

Policymakers face different types of challenges in identifying the factors and events that lead to unfavorable outcomes, such as high inflation or a prolonged recession.

The non-accelerating inflation rate of unemployment (NAIRU) is an unobservable measure that underpins the long-term relationship between inflation and the level of unemployment.

In this paper

We examine how informal labor markets affect estimates of the Non-Accelerating Inflation Rate of Unemployment (NAIRU) and the effectiveness of monetary policy in Peru.

We argue that standard NAIRU estimates typically rely on formal unemployment data, ignoring the informal workforce, which represents a large share of employment in developing economies.

Then, this omission leads to biased assessments of inflationary pressures and misinterpretation of the Phillips curve slope, which guides monetary policy decisions.

Including informal workers provides a more realistic view of labor market slack and the transmission of monetary shocks.

Extended unemployment rate

As in Aguilar-Argaez et al. (BIS WP, 2022), we extend unemployment with informal workers.

Unemployment rate

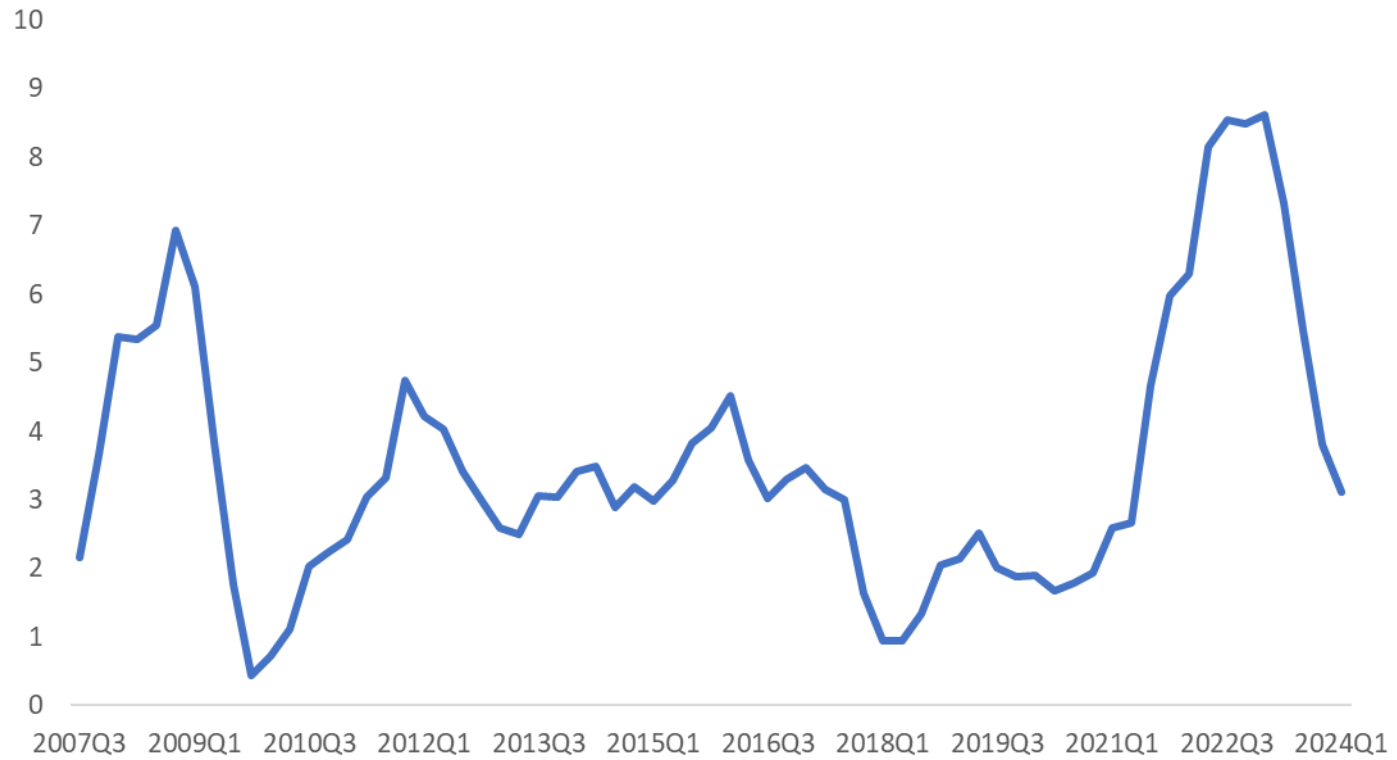
$$\frac{\text{Working population} - \text{Employed working population}}{\text{Working Population}}$$

Extended Unemployment rate

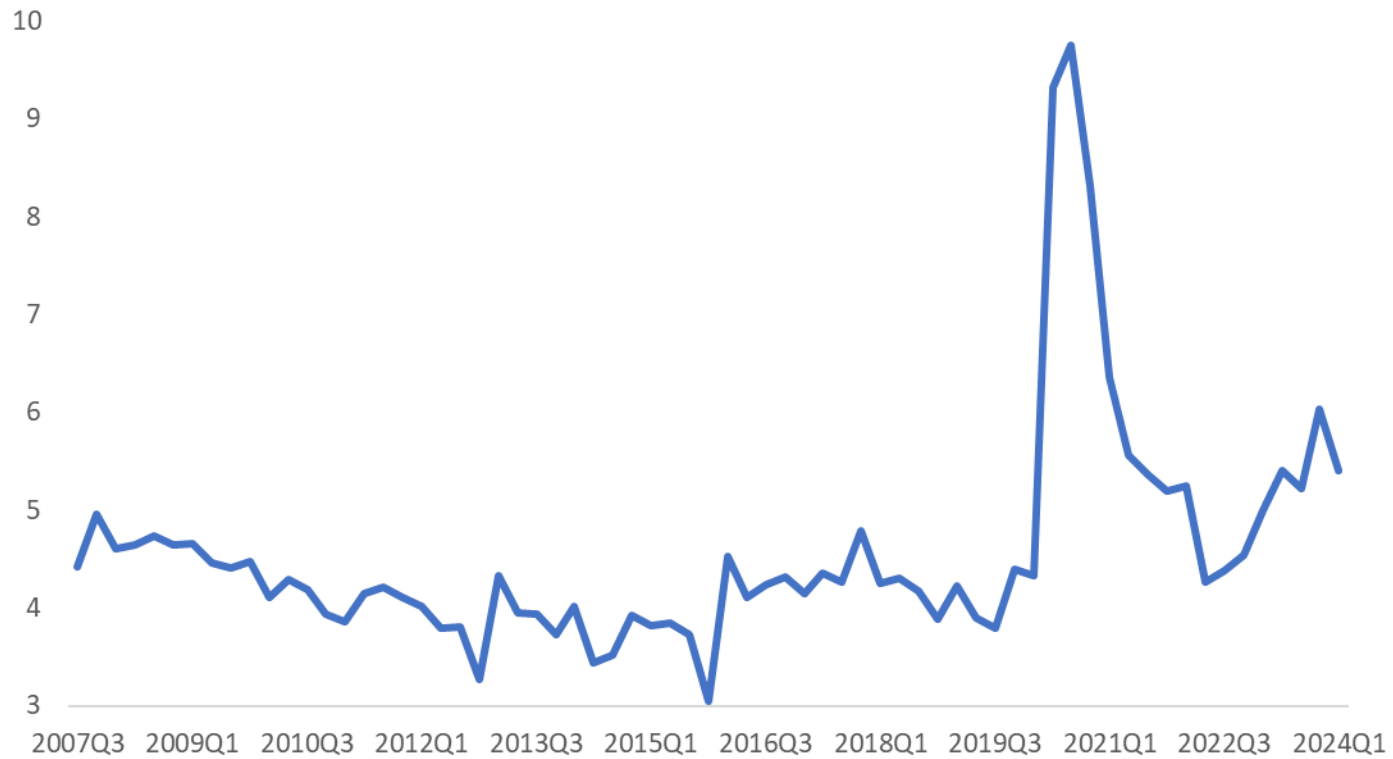
$$\frac{\text{Working population} - \text{Employed working population} + \text{Informal workers}}{\text{Working Population}}$$

Armas et al. (2023): workers who cannot find jobs in the formal sector accept jobs in the informal sector. We may expect that, whenever there is an opportunity to join the formal sector, an informal worker will take it.

Inflation



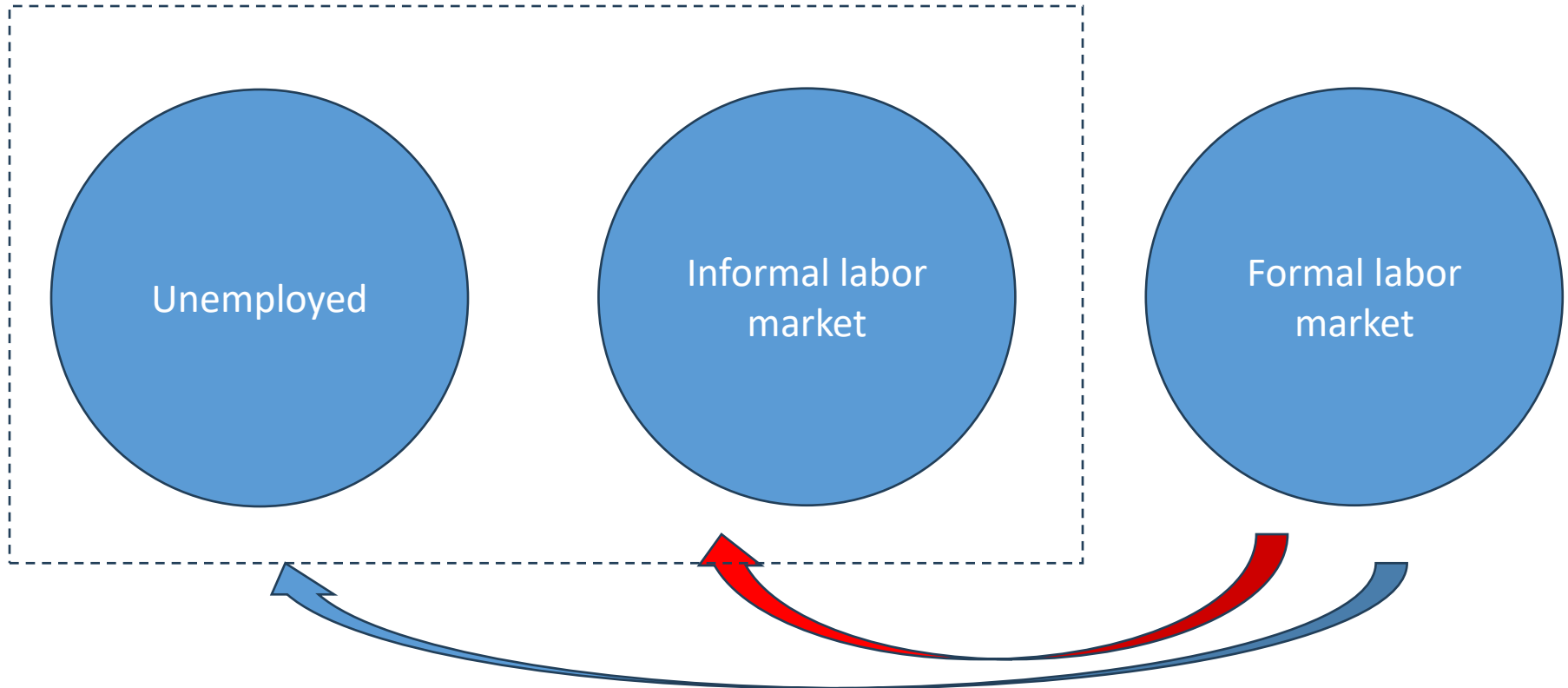
Unemployment rate



Extended unemployment rate



Labor market dynamics



Covid-19

The COVID-19 pandemic: labor market was directly hit.

Inflation in Peru was around 2 percent between 2020 and 2021, while the unemployment rate peaked around 10 percent at the same time.

If the unemployment data are extended with informal workers, a different pattern emerges.

The transition from formal to informal labor market was a direct effect of regulations that limited the number of people in the same place and the need for those unemployed to generate income in order to cope with pandemic-related expenditures.

In this context, the informal market absorbed a significant portion of the labor force when the COVID-19 pandemic struck the economy, buffering the real effects of the shock, and limiting the final effect on prices.

Informal labor markets

It is usually less productive i.e. represents around one third of the GDP.

It is larger than the formal labor market i.e. it is around two thirds of the working force.

Here we consider those dependent workers in the informal sector.

Methodology

We follow Chan, Koop, and Potter (2016): estimate a bivariate unobserved components model for inflation and unemployment within a state-space framework (SS).

The model treats trend inflation and the NAIRU as latent (unobserved) variables that evolve over time, incorporating bounds.

Two specifications are compared:

- ✓ Standard unemployment rate (NAIRU).
- ✓ Extended unemployment rate (NAIRU-E) – includes underemployed workers in informal markets.

The estimation uses Bayesian inference and Markov Chain Monte Carlo (MCMC) methods, covering data from 2007 to 2024.

SS – NAIRU

Chan, Koop and Potter (2016)

$$(\pi_t - \tau_t^\pi) = \rho_t^\pi (\pi_{t-1} - \tau_{t-1}^\pi) + \lambda_t (u_t - \tau_t^u) + \varepsilon_t^\pi \exp\left(\frac{h_t}{2}\right) \quad (1)$$

$$(u_t - \tau_t^u) = \rho_1^u (u_{t-1} - \tau_{t-1}^u) + \rho_2^u (u_{t-2} - \tau_{t-2}^u) + \varepsilon_t^u \quad (2)$$

$$\tau_t^\pi = \tau_{t-1}^\pi + \varepsilon_t^{\tau\pi} \quad (3)$$

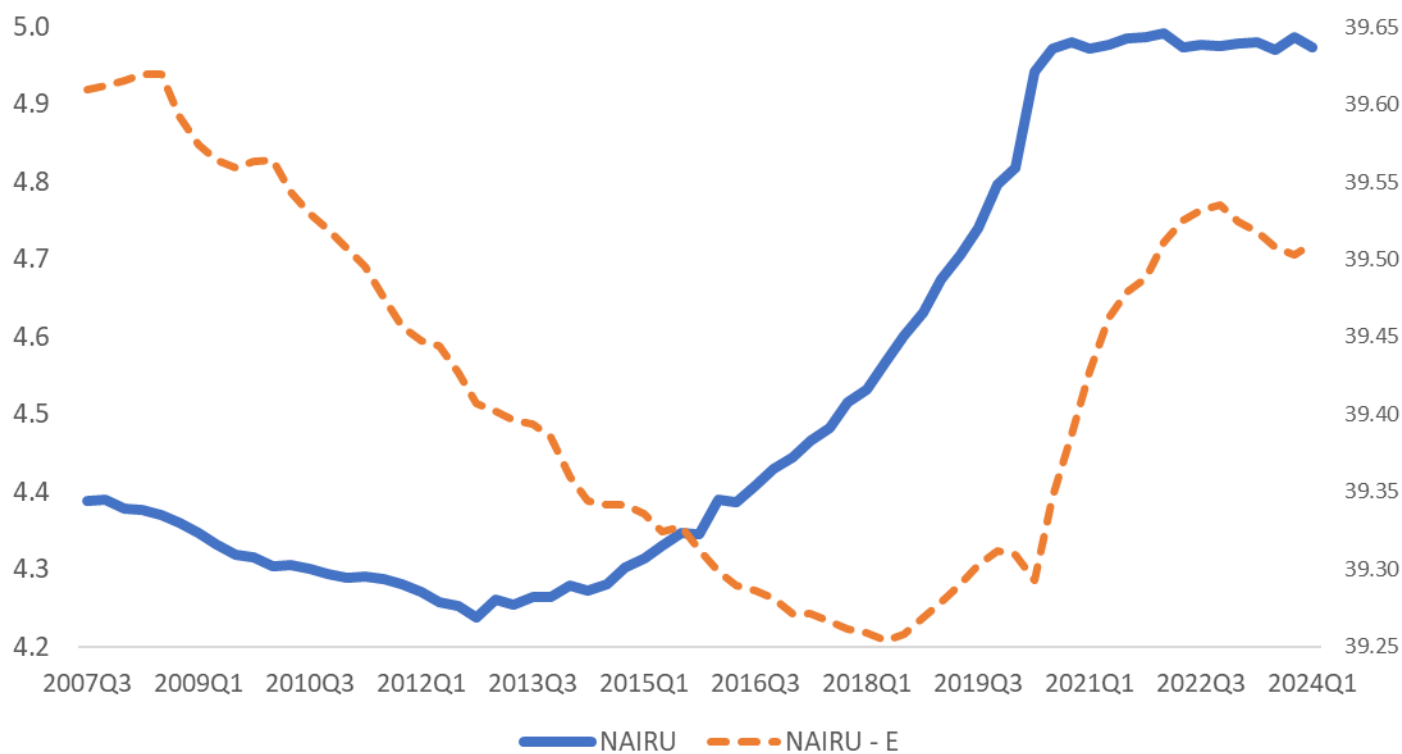
$$\tau_t^u = \tau_{t-1}^u + \varepsilon_t^{\tau u} \quad (4)$$

$$\rho_t^\pi = \rho_{t-1}^\pi + \varepsilon_t^{\rho\pi} \quad (5)$$

$$\lambda_t = \lambda_{t-1} + \varepsilon_t^\lambda \quad (6)$$

$$h_t = h_{t-1} + \varepsilon_t^h \quad (7)$$

NON-ACCELERATING INFLATION RATE OF UNEMPLOYMENT, NAIRU (τ_t^u)



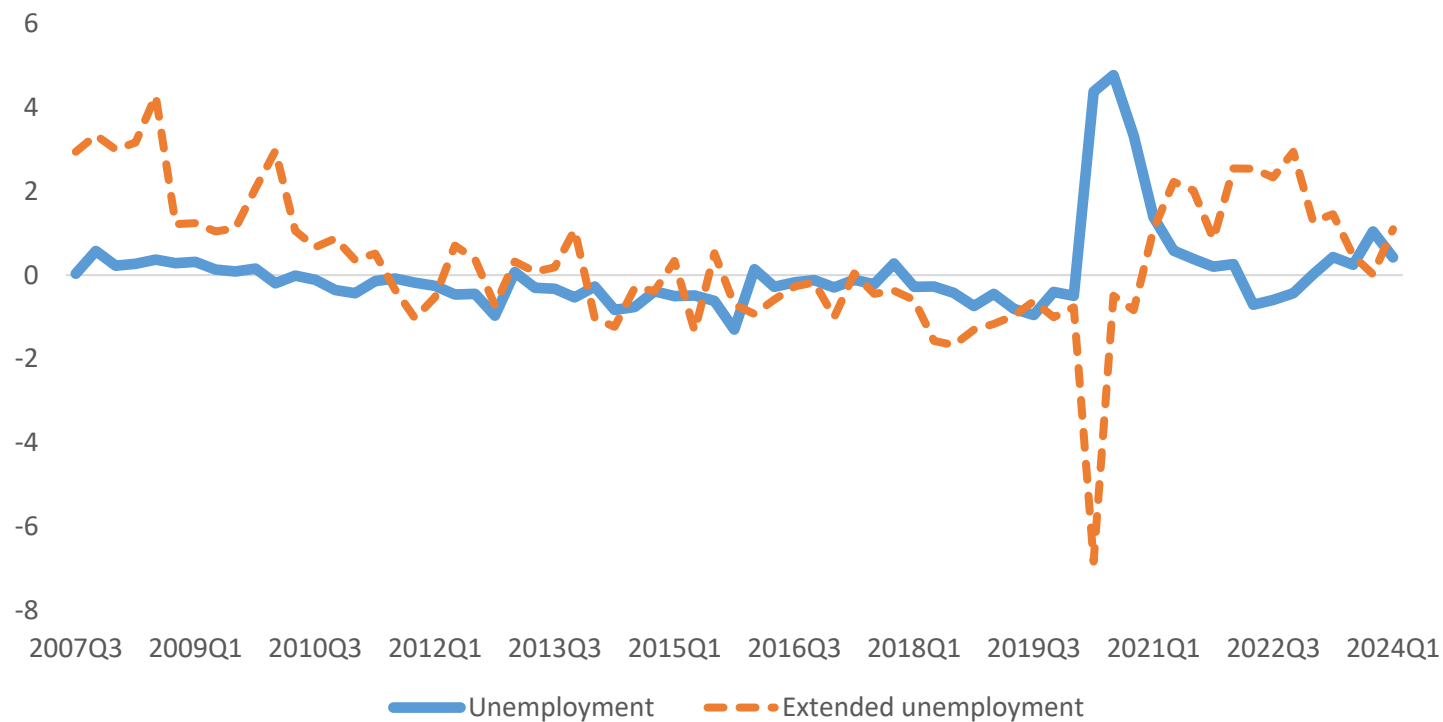
Two-tails implications

The standard NAIRU rises over time, implying a need for higher unemployment to control inflation.

The extended NAIRU (NAIRU-E) decreases when informality is included, indicating that the labor market can absorb shocks through informal employment rather than higher unemployment.

This result suggests that monetary policy transmission weakens in economies with large informal sectors: inflation responds less to unemployment changes.

UNEMPLOYMENT GAP ($u_t - \tau_t^u$)



SS – Trend inflation

Chan, Koop and Potter (2016)

$$(\pi_t - \tau_t^\pi) = \rho_t^\pi (\pi_{t-1} - \tau_{t-1}^\pi) + \lambda_t (u_t - \tau_t^u) + \varepsilon_t^\pi \exp\left(\frac{h_t}{2}\right) \quad (1)$$

$$(u_t - \tau_t^u) = \rho_1^u (u_{t-1} - \tau_{t-1}^u) + \rho_2^u (u_{t-2} - \tau_{t-2}^u) + \varepsilon_t^u \quad (2)$$

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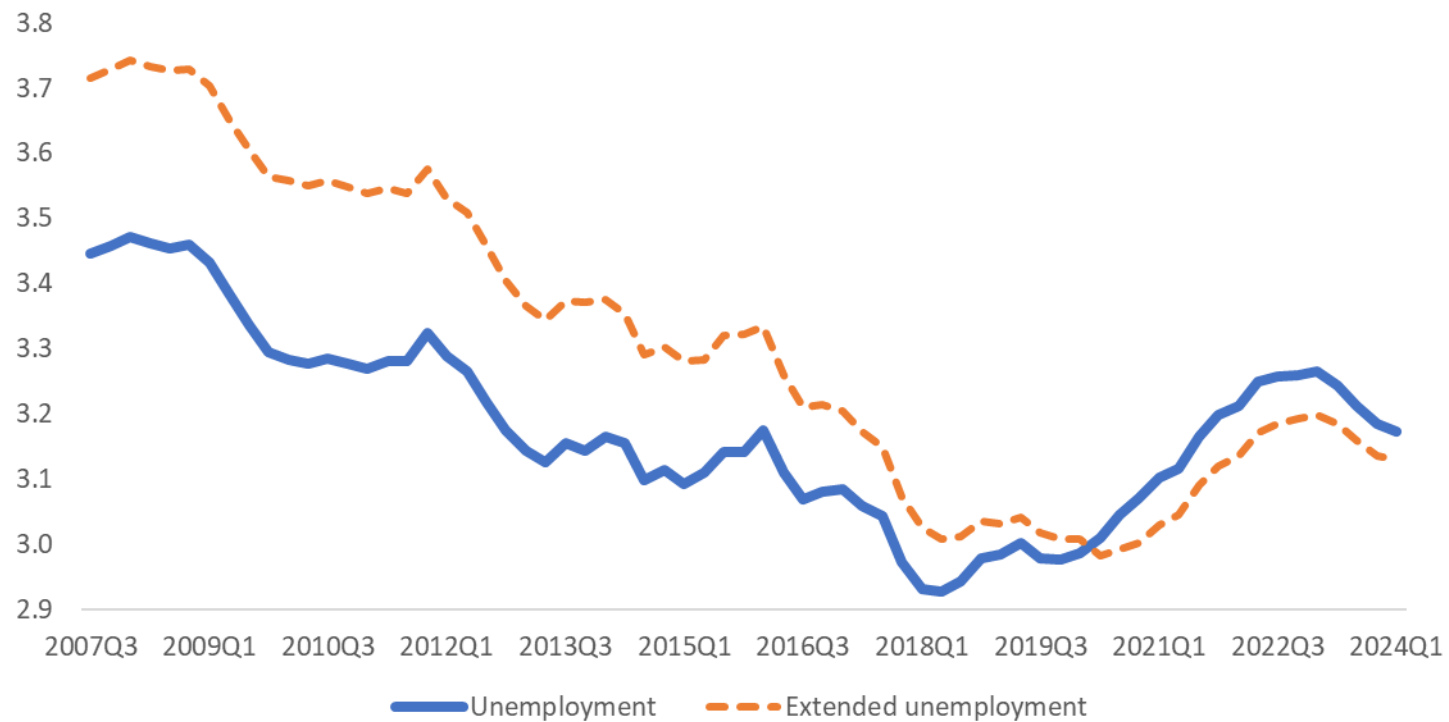
$$\tau_t^u = \tau_{t-1}^u + \varepsilon_t^{\tau u} \quad (4)$$

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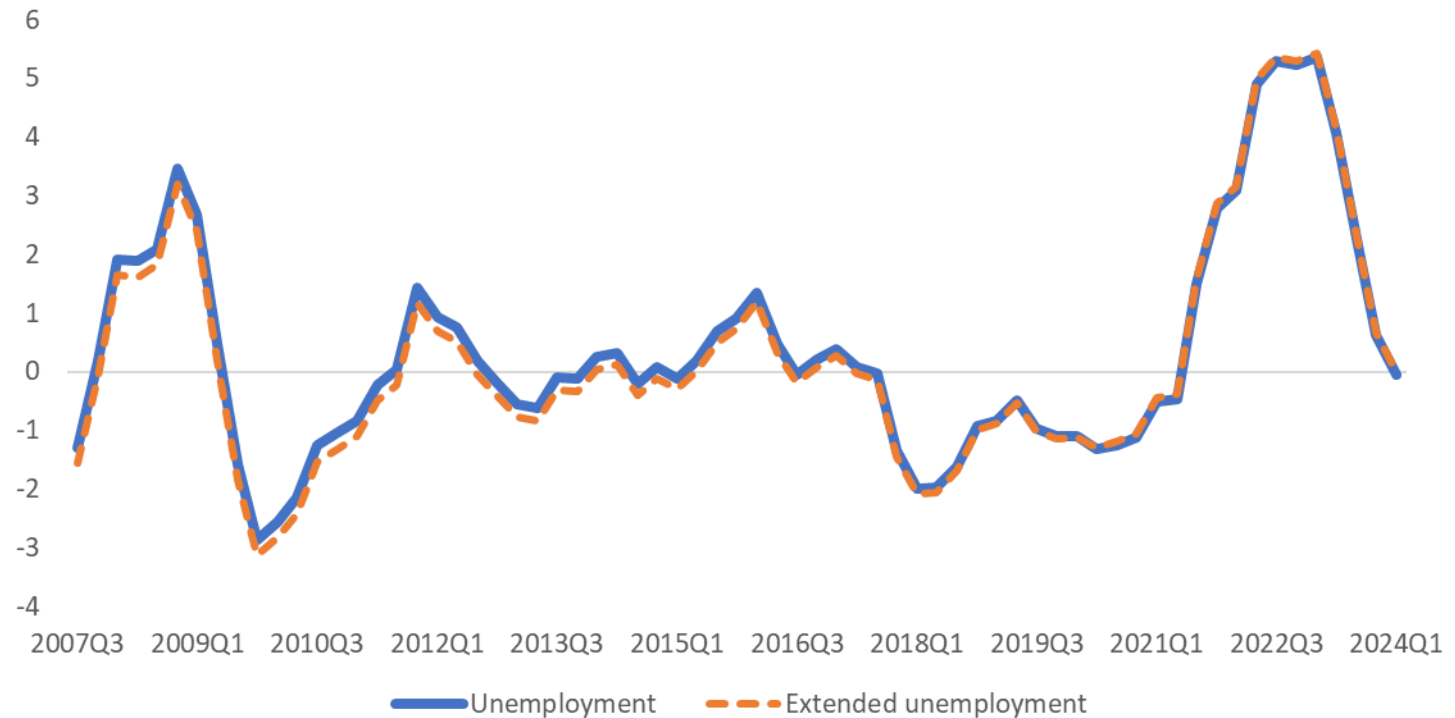
TREND INFLATION τ_t^π



Implication for inflation

The trend inflation is initially higher under the extended measure of unemployment but exhibits lower inflationary pressures in recent years, particularly after COVID-19.

INFLATIONARY PRESSURE ($\pi_t - \tau_t^\pi$)



Implications for Monetary Policy

Talking points

For Castillo and Montoro (2012), the key distinction is the composition of households. Some of them have no decision-making on how much to consume while the remaining group makes decisions for consumption. Those hand-to-mouth are either unemployed or part of the informal labor market.

Alberola and Urrutia (2020) and Castillo and Montoro (2012) argue that the informal labor market works as a buffer for monetary policy: when a monetary policy shock impacts the economy, one part of the labor force affected by this shock moves into informality rather than becoming unemployed.

Since this market has a lower productivity, the presence of this large group diminishes the intended final effect on output as well as on inflation, which also implies a greater effort by the central bank to achieve its targets.

SS – Slope of the Philips curve

Chan, Koop and Potter (2016)

$$(\pi_t - \tau_t^\pi) = \rho_t^\pi(\pi_{t-1} - \tau_{t-1}^\pi) + \lambda_t(u_t - \tau_t^u) + \varepsilon_t^\pi \exp\left(\frac{h_t}{2}\right) \quad (1)$$

$$(u_t - \tau_t^u) = \rho_1^u(u_{t-1} - \tau_{t-1}^u) + \rho_2^u(u_{t-2} - \tau_{t-2}^u) + \varepsilon_t^u \quad (2)$$

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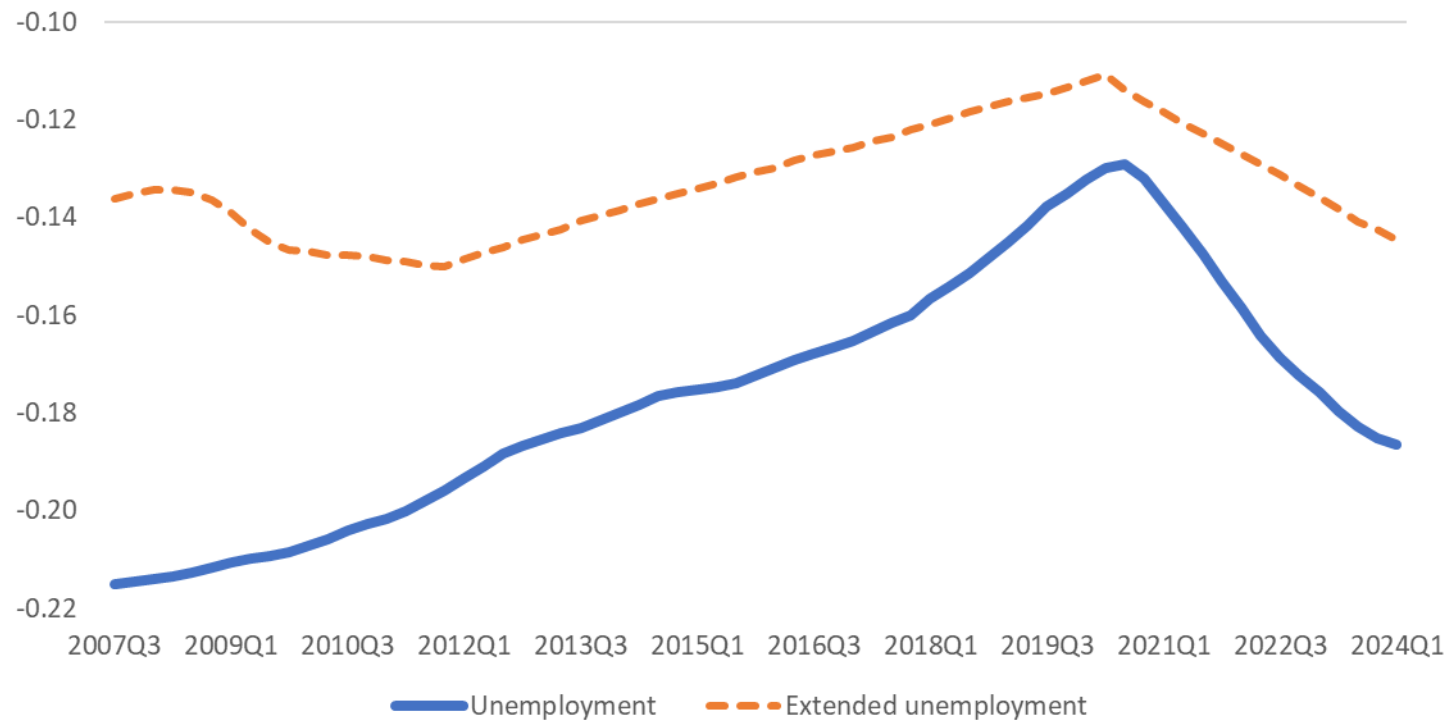
$$h_t = h_{t-1} + \varepsilon_t^h \quad (7)$$

The slope of the Philips curve

Eq (1) is a Phillips curve describing the relationship between inflation and unemployment by λ . Positive unemployment deviations from its trend lead to negative deviations in inflation relative to its trend as well.

λ is a measure of how strongly higher unemployment exerts downward pressure on inflation, which is akin to the definition of the slope of the Phillips curve.

SLOPE OF THE PHILLIPS CURVE (λ_t)



When the standard unemployment rate is used, the slope of the Philips curve suggests a higher impact on inflation from unemployment deviations from trend.

The impact on inflation clearly decreases if the extended measure of unemployment is used.

Our result is consistent with a weaker monetary policy transmission channel when more informal workers are part of the labor market (Alberola and Urrutia, 2020; Castillo and Montoro, 2012).

Conclusions

Incorporating informality changes the interpretation of labor market slack

Including informal (underemployed) workers in the estimation of the NAIRU fundamentally changes how we interpret labor market conditions in Peru.

When the analysis relies solely on the formal unemployment rate, the estimated NAIRU follows a rising trend, suggesting that inflation control requires maintaining relatively high unemployment.

However, once the extended unemployment rate (NAIRU-E) is used the trend flattens or even declines in recent years.

This indicates that part of the adjustment previously attributed to rising unemployment is **actually absorbed** through transitions between formal and informal employment.

Informality thus serves as a **buffer** mechanism, allowing the economy to absorb shocks without creating excessive formal job loss or inflationary pressure.

A flatter Phillips curve reflects weaker monetary transmission

The estimated time-varying Phillips curve slope becomes notably **flatter** when informality is included in the model.

This flattening implies that the responsiveness of inflation to unemployment is diminishing—**monetary policy shocks have smaller real effects**.

When a central bank tightens policy to reduce inflation, the adjustment in prices occurs more slowly and with smaller changes in unemployment because part of the adjustment happens in the informal sector.

For policymakers, this suggests that the **traditional Phillips curve framework may overstate the power of interest rate adjustments** to influence inflation in economies with pervasive informality.

Informality acts as a structural shock absorber—but at a cost

Our analysis highlights the **dual role** of informality.

On the one hand, it provides flexibility to firms and workers by facilitating rapid labor reallocation during downturns or policy tightening. This reduces the amplitude of unemployment cycles and helps maintain output stability.

On the other hand, it **weakens the transmission of stabilization policies** and perpetuates a segmented labor market, where a large share of workers remains outside social protection systems.

Hence, informality can be interpreted as a **stabilizer with structural costs**: it cushions the economy against short-term shocks but hinders long-term efficiency, productivity growth, and the credibility of monetary policy.

Lessons from Post-2017 dynamics and the COVID-19 episode

The evolution of the extended NAIRU reveals important structural changes after 2017 and especially following the COVID-19 pandemic.

While formal employment contracted sharply in 2020, informality expanded, keeping overall labor participation relatively stable.

The estimated NAIRU-E declined during this period, indicating that **informal employment absorbed the shock**, preventing inflation from accelerating despite the economic contraction.

This reinforces our main argument: **ignoring informality can lead to misinterpreting cyclical adjustments as structural unemployment** and thus to an incorrect reading of inflation pressures.

Agenda

While the state-space model provides valuable insights, it remains a reduced-form statistical approach.

Future work could extend this framework by:

- ✓ Incorporating wage inflation and productivity data to strengthen identification of the Phillips curve
- ✓ Estimating sector-specific NAIRUs (formal vs. informal) to capture differential price-setting behavior
- ✓ Testing for nonlinearities or regime changes to better model crises like COVID-19 or sharp disinflation episodes

Those extensions would refine the understanding of how informality interacts with monetary policy transmission and long-term inflation stability.

Thanks!