



The natural interest rate: Concept, measurement and monetary policy implications

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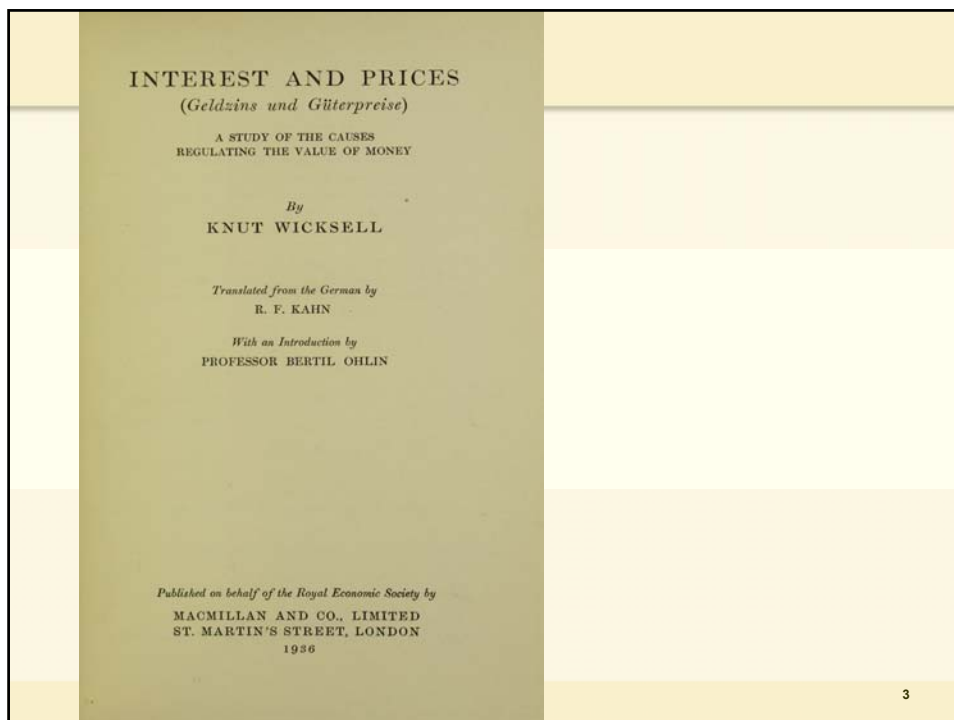


What is the natural (equilibrium, neutral) interest rate?

Concept introduced by Knut Wicksell in 1898 in *Geldzins und Güterpreise: Eine Studie über die den Tauschwert des Geldes Bestimmenden Ursachen*, Gustav Fischer Verlag, Jena

Remarkable book: "Modern monetary and macroeconomic theory starts *here*" (Axel Leijonhufvud)

At a time of the gold standard, Wicksell anticipated the use of interest rates as an instrument to maintain price stability



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The concept (cont'd)

Wicksell was dissatisfied with the Quantity Theory of Money
He noted that the evolution of “simple” (trade) and “organised” (bank-intermediated) credit practices reduced the role of metallic money in the economy
Small denomination banknotes had displaced gold coin from circulation and almost all business transactions were settled by check or by giro; the resulting transfers on the books of banks did not involve “money” at all
Wicksell developed a concept of “pure credit economy”: cash plays no role at all; banks create “money” by providing credit, ie deposits upon which borrowers can draw
He analysed the indirect effect of increases in credit on prices, which he called the “cumulative process” of inflation

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The concept (cont'd)

In elaborating the cumulative effect, Wicksell distinguished between the real rate of return on new capital (the “natural rate of interest”) and the actual or observed market rate of interest

If banks reduced the market rate through their commercial activity below the real rate of return on capital, the demand for bank loans would increase and generate excess demand, thus driving up prices

This “cumulative process” would stop only when the bank reserves had fallen to their legal or desired limit, whichever was higher, inducing banks to raise rates

In modern economies, which approximate pure credit economies, it is central banks that perform the role of banks in Wicksell’s model and are responsible for ensuring equilibrium



Three properties of the natural rate

1. It is consistent with *equilibrium*
2. The natural rate is
 - a *real* interest rate, because it measures the real rate of return on physical capital and
 - a *short-term* rate, because its market equivalent is the interest rate on short-term bank loans
3. The natural rate is characteristic of the *economy in the long run*: it is not fixed, but fluctuates in response to changes in its determinants (productivity, population growth, saving preferences etc)



Modern refinements of the natural rate

The natural interest rate equates desired saving and investment by rational optimising agents

Ensures that output is at its potential and inflation stable in the long run

The natural rate depends only on “deep fundamentals”:

- technology and endowments on the supply side (determine potential growth)
- time preferences and the intertemporal elasticity of substitution in consumption on the demand side (determine the saving rate)

In any given general equilibrium model it is possible to derive an exact formula for the natural rate by solving the various first-order conditions that must hold in equilibrium

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Examples in the current literature

Steady-state value of the short-term (policy) interest rate, to which the actual short-term rate is expected to converge over the long run

- interest rate predicted by the neoclassical growth model
- constant term in a simple Taylor rule, ie interest rate at which inflation is expected to be on target and the output gap is zero

Value of the short-term (policy) interest rate at any given point in time

- natural rate implicit in the New Keynesian (DSGE) models: fluctuates continuously, short-term real interest rate that would prevail in the economy in the absence of nominal rigidities.
- In this type of model, the actual policy rate should track this unobserved equilibrium rate in every period

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Extensions

Open economy

The natural rate is inherently global, related to the equilibrium in the international capital market, where the global supply and demand for funds are matched

An increase in global precautionary saving would depress the natural rate (Bernanke's "saving glut" hypothesis)

Note the tension between the interest rate as the rate of intertemporal allocation and a financial market price:

- "The" global rate may not be well defined unless there is some equalisation of interest rates across currencies and regions
- In practice, either the dollar or euro rate will be relevant for a given central bank



Extensions (2)

Financial sector frictions

Wicksell's original interpretation highlighted bank lending as a key mechanism influencing inflation, noting the possibility that the "cumulative process" might not be self-equilibrating in a pure credit economy. But he did not pursue the disequilibrium implications

Build-up of financial imbalances coinciding with low and stable inflation shows that financial flows and the structure of the financial sector could be additional determinants of the natural rate

- "finance-neutral" rate as the interest rate required to stabilise the financial markets and safeguard financial stability in the long run



Empirical assessments

By construction, the natural rate is unobservable and hence depends on views about how the economy works – ie it is model-dependent

Like other unobserved equilibrium concepts (potential output, natural rate of unemployment) it may be inferred only indirectly, through techniques that reveal the underlying assumptions more or less explicitly

Virtually all these approaches indicate that the natural rate, as defined above, has fallen in recent decades, although its current level may not be unprecedented



Statistical approach

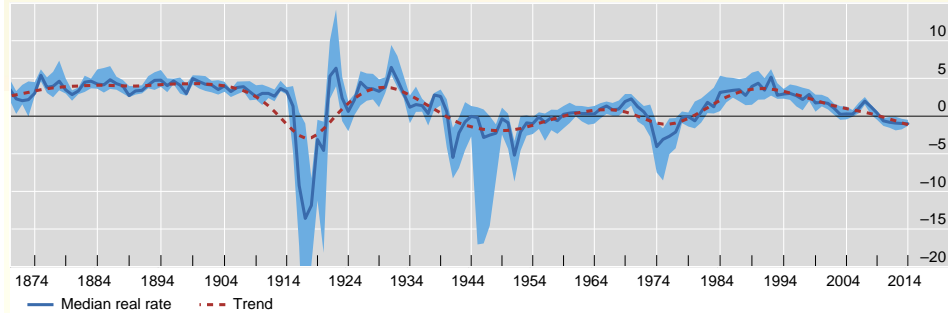
Simplest statistical approach: examine trends in short-term real policy rates over very long periods

This approach assumes that, over a sufficiently long window, the economy is on average in equilibrium

Example: median of ex-ante real interest rates, calculated from nominal policy rates and a simple measure of expected inflation for advanced economies since 1870 (temporary fluctuations of real rates due to business cycles removed)



Short-term real rates in advanced economies have declined several times in the past¹



¹ In per cent; median and interquartile range (shaded area) of the real interest rate across 17 advanced economies, including Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States. Real interest rates are nominal short-term interest rates less expected headline inflation. Nominal interest rates are policy interest rates, for some older observations spliced with short-term market rates. Expected inflation is calculated as next-year forecast of CPI inflation using the autoregressive model of order 1, for annual data over a 20-year rolling regression. Inflation rates greater than 100% are dropped from the estimation (hyperinflation is likely a poor guide for normal-time inflation dynamics), but are used as inputs to calculate expected inflation. Trend is an HP-filtered trend of the median series with the smoothing parameter $\lambda=100$. The result is robust to increasing the smoothness parameter; the large declines in the trend during the 1910s, 1940s and recent decades remain after setting $\lambda=1600$.

Sources: Schularick and Taylor (2012) data set; Global Financial Data; IMF; national authorities; BIS.



Statistical approach – findings

Short-term real policy rate followed a low-frequency cyclical pattern over the past 150 years; declined and turned negative over prolonged periods on several occasions

Most recent episode started in the early 1990s: the median real policy rate was around 5% in 1992 and declined to -1% by end-2014

Notable feature of this decline: it has taken place in an environment of low and comparatively stable inflation

Previously, real rates were negative largely because of high inflation, casting doubt on whether they were really at their equilibrium level



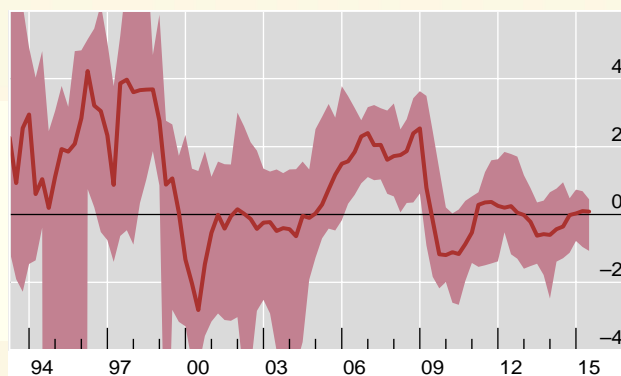
Simplest approach – findings (cont'd)

Strong international co-movement of real short-term rates, not just in advanced economies (blue-shaded area in graph above) but also in EMEs (graph below)

→ In a globally integrated economy, real interest rates co-move closely, and the natural rate may be related to the equilibrium rate in the international capital market



Real short-term policy rates have also declined in EMEs¹



¹ In percent; median and interquartile range (shaded area) of real policy rates in Brazil, Chile, China, the Czech Republic, Hungary, Indonesia, India, Korea, Mexico, Malaysia, Peru, the Philippines, Poland, Russia, Saudi Arabia, South Africa, Thailand and Turkey; quarterly data. Nominal interest rates are policy interest rates and expected inflation is calculated from a first-order autoregressive model of four-quarter-ahead annual CPI inflation, estimated in a 40-quarter rolling regression.

Source: IMF, national authorities, BIS.



Model-based approaches

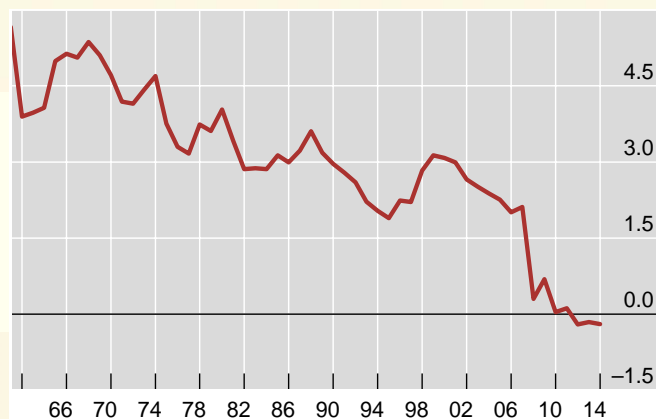
Calculating the natural interest rate from an estimated general equilibrium model

Best-known: Laubach and Williams (2003)

- Combines goods market equilibrium with a Phillips curve (which entails views about potential growth)
- Exploits insight that above-trend inflation and/or a positive output gap signal that the current interest rate is below the natural rate
- Estimates available online at www.frbsf.org/economic.../Laubach_Williams_updated_estimates.xlsx
- The natural rate has declined in recent decades and is currently slightly negative (-0.092% as of end-Sept 2015)



Natural rates estimated by Laubach and Williams¹



¹ The Laubach-Williams estimate is the updated one-sided filtered series.

Source: Laubach and Williams (2003).



Laubach-Williams estimates

Why is the natural interest rate negative?

- Current, relatively slow growth reflects a lower potential growth
- Stable inflation suggests that the economy is relatively close to equilibrium
 - current low (slightly negative) real interest rates are consistent with the low natural rate



Why has the natural interest rate declined? Will it stay low?

$$r^* = \frac{1}{\sigma}g + \lambda n + \theta$$

r^* = natural rate

g = growth rate of total factor productivity

n = growth rate of population

σ = intertemporal elasticity of substitution in consumption

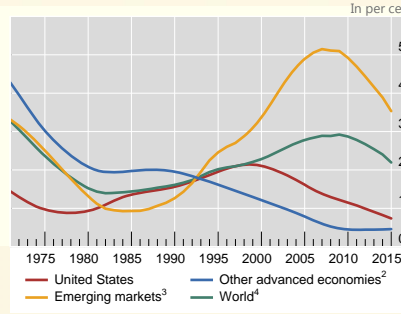
θ = rate of time preference



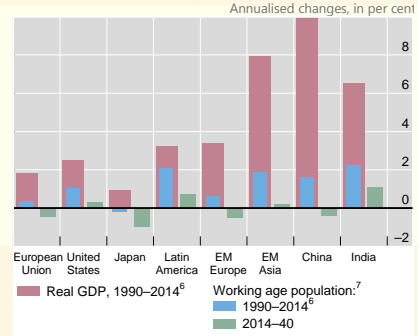
Why has the natural interest rate declined?

Productivity and population growth have declined

Trend growth of labour productivity¹



Working age population contribution to GDP growth⁵



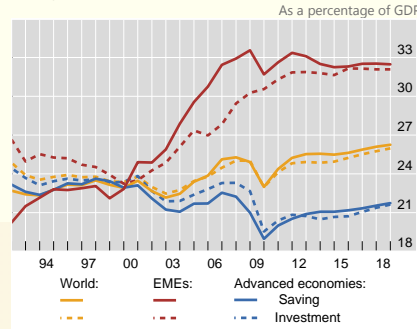
¹ Using HP filter. Labour productivity per person employed. Weighted averages based on rolling GDP and PPP exchange rates. ² Euro area (15 countries), Australia, Canada and Japan. ³ 23 major EMEs. ⁴ United States, other advanced economies and EMEs. ⁵ Weighted averages based on 2014 GDP and PPP exchange rates. ⁶ For emerging Europe, 1995-2014. ⁷ Aged 20 to 64 years.
Sources: Conference Board, *Total Economy Database*, May 2015; BIS, *85th Annual Report*; BIS calculations.



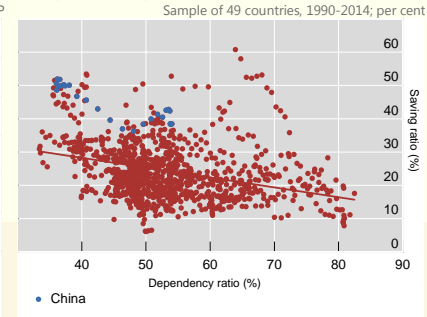
Why has the natural interest rate declined?

Saving rates have increased globally since the crisis

Saving and investment



Saving and demographics



Sources: IMF; World Bank, *World Development Indicators*.



Will the natural interest rate stay low?

Growth rates of working age population not likely to rebound in major economies

But recent increase in saving rates could be partly reversed

- Growing cohorts of elderly, greater preference for current consumption
- Global demand for safe assets to diminish as China adopts more flexible exchange rates
- Impact of these factors on saving rates could be offset to varying degrees by deleveraging, longer life expectancy, regulatory changes etc



Will the natural interest rate stay low? (2)

- The key issue is however productivity growth
- TFP growth unlikely to be permanently lower – depends on technological innovation
- Techno-pessimists vs techno-optimists
- Techno-pessimists (Robert Gordon)
 - Low-hanging fruits of innovation have been picked
 - Digital/future innovations will not have nearly as radical an impact as those in transportation, hygiene, electricity, medicine
 - Innovation therefore not likely to be strong enough to counter other economic headwinds to economic growth



Will the natural interest rate stay low? (3)

- Techno-optimists (Joel Mokyr)
 - Economic contribution of today's innovations is not captured well by existing statistics, which was created for a brick and mortar economy
 - Scientific progress in the past decades has been as exciting as ever. Major advances in many fields, from astronomy to material science to IT to biochemistry
 - If the patterns of the past hold, the rate of technological change can be expected to accelerate over the next decades



Will the natural interest rate stay low? (4)

- Techno-optimists (cont)
 - Competition ensures the spread of best-practice science and technology – and the world is more pluralistic and competitive than ever
 - Institutional and political factors could slow down or hinder advances that are technically possible
 - But if technical problems get solved somewhere, in a globally competitive economy they will also get solved everywhere



Implications for monetary policy

Normalisation of monetary policy of major central banks

- What could be the "new normal" level of the real policy rate?
- When/how fast will it be reached?

What are the policy trade-offs facing small open economies?

- How far can domestic policy rates deviate from the global real interest rate?
- How much protection from flexible exchange rates?
- What are the alternative policies?

Is the natural rate exogenous to monetary policy?

- Impact of monetary policy on financial cycles
- Monetary policy responses to financial and business cycles

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Implications for monetary policy (2)

Normalisation of monetary policy

- Central banks have discussed the possibility of a natural rate being lower in the long term than before the crisis
- Long-run projections of the Fed's policy rate less 2% inflation declined to around 1.3% (Dec 2015)
- The Fed has emphasised that the pace of interest rate normalisation is expected to be gradual and dependent on growth and inflation trajectories

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Implications for monetary policy (3)

Uncertainty about the natural rate and path of normalisation

- Volatility in financial markets could pick up if expectations about the "normal" level of policy rates are sharply revised
- Low global growth, high financial risks and weak inflationary pressures might encourage central banks to keep interest rates low for longer, to avoid the economy falling back into recession or having inflation persistently below the price stability target
 - Greater inertia in policy rules, later lift-off and a steeper path for rate rises
- But a higher-than-expected natural rate may prompt a sharper policy adjustment, raising the risk of overshooting, especially in economies approaching full employment, and creating a perception that policy makers are behind the curve

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Implications for monetary policy (4)

Trade-offs for small open economies

- Lowering policy rate could help moderate capital inflows and currency appreciation pressures, but at the risk of overheating domestic demand or increasing financial stability risks (SE, CH)
- Flexible exchange rate may provide only an imperfect protection amid lower global real interest rates – EMEs that have relied on foreign currency borrowing
- Can other policies (FX intervention, macroprudential) help maintain adequate degree of domestic macroeconomic and financial stability when the global natural rate is very low?

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Implications for monetary policy (5)

Is the natural rate defined too narrowly?

- Hard to regard a given interest rate as an equilibrium or natural rate if it generates financial instability even if inflation is low and stable
- Inferring the natural rate only from short-term output and inflation behaviour may be problematic
- Measures that include information about the financial cycle could provide useful complementary information



Implications for monetary policy (6)

Is the natural rate exogenous to monetary policy?

- Monetary policy may have long-lasting effects on output by influencing financial cycles
- Financial booms and busts can have a lasting impact on productivity growth, by shifting resources to sectors such as construction, financial services (Borio et al 2015)
- By failing to lean against unsustainable booms if inflation remains low and stable, but responding strongly to busts, monetary policy may impart a downward bias to interest rates and an upward bias to debt
- Relevant policy question may be more about designing a monetary policy regime that responds symmetrically to financial booms and busts



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