Box 2.1
The neutral interest rate in the US: Estimations and implications

The neutral interest rate is one of the economic factors which the Federal Reserve (the Fed) considers in making policy decision. After the FOMC meeting in March 2019, Fed Chair Powell stated that the federal funds rate was within the broad range of estimated neutral interest rate, and reasserted that the Fed would be patient in adjusting interest rate[1]. This article examines the estimation of the US neutral interest rate and its relations with major economic trends, in the hope of shedding more light on the future path of the US interest rate policy.

The neutral interest rate, also known as "the natural rate of interest" in economics literature, refers to the level of interest rate at which economic growth is on par with its potential and inflation is stable. In other words, it is the level of interest rate which would neither speed up nor slow down economic growth[2]. Yet, the neutral interest rate is only a theoretical construct. It cannot be observed directly and it has to be estimated by econometric methods.

Economics literature suggests that there are quite a number of econometric methods for estimating the neutral interest rate (e.g. Neiss and Nelson, 2003[3]; and Edge, Kiley and Laforte, 2008[4]). This article will focus on the methodology in the seminal paper by Laubach and Williams (2003)[5] as an example for illustration[6]. In gist, this article made use of Kalman filter[7] to jointly estimate three time-varying and unobserved variables (namely, real neutral interest rate, real potential GDP and its trend growth rate) by employing five observable data series (including federal funds rate, real GDP, core inflation, and the relative prices of oil and non-energy imports).

The econometric model involves two core equations, namely the IS curve and the Phillips curve. The IS curve relates output gap[8] to its own lags and the lagged "real rate gap" (i.e. the gap between the actual and neutral interest rates in real terms). The Phillips curve links the core inflation to its own lags, the lagged output gap, and the relative prices of oil and non-energy imports. Together with assumptions on transition equations, a joint estimation of the whole model is performed by Kalman filter. From the estimation, the neutral real interest rate (r*) can then be decomposed into two parts, namely potential GDP growth (g*) and other determinants (z) which captures factors such as shifts in fiscal policy and changes in global supply of savings. The equation is shown as follows:

$$r_t^* = cg_t^* + z_t, \text{ where c is estimated as a positive coefficient.}$$

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(1) Federal Open Market Committee (FOMC) (2019) "Transcript of Chairman Powell's Press Conference, March 20, 2019", Washington, 20 March 2019.
(2) Powell, J.H., (2018) "Federal Reserve's Framework for Monitoring Financial Stability", a speech at the Economic Club of New York, New York, 28 November 2018.
(3) Neiss, K.S., Nelson, E., (2003) "The Real-Interest-Rate Gap as an Inflation Indicator" *Macroeconomic Dynamics*, 7(2), 239-262.
(4) Edge, R., Kiley, M., Laforte, J-P., (2008) "Natural Rate Measures in an Estimated DSGE Model of the U.S. Economy", *Journal of Economic Dynamics and Control*, 32(8), 2512-2535.
(5) Laubach, T. and Williams J.C., (2003) "Measuring the Natural Rate of Interest," *Review of Economics and Statistics,* 85(4), 1063-70.
(6) The authors of this paper are currently senior Fed officials. Thomas Laubach is the Director of the Division of Monetary Affairs. John Williams is the President of the Federal Reserve Bank of New York and currently serves as Vice Chairman of the FOMC. This paper has also been frequently cited by top Fed officials, as in former Fed Chair Yellen's speech "The Economic Outlook and Monetary Policy" in December 2015 and the then-Governor (current Chair) Powell's speech "A View from the Fed" in November 2016.
(7) Kalman filter enables researchers to obtain estimates of the unobserved variables through "filtering" the noise in observed variables given the model specification.
(8) Output gap refers to the difference between the actual GDP and the potential GDP in real terms.

Box 2.1 (Cont'd)

Based on the model above, the Federal Reserve Bank of New York (New York Fed) regularly updates its estimates of the real neutral interest rate in the US.   The corresponding nominal neutral interest rate can be derived by summing up the estimated real neutral interest rate and the expected inflation as proxied by the four-quarter moving average of the core PCE inflation[9].

The latest estimate of real neutral interest rate by the New York Fed was at around 0.8% in the fourth quarter of 2018.   With the expected inflation at 2.0%, the nominal neutral interest rate was estimated at 2.8%, which was the same as the median projection of the federal funds rate over the longer run by the FOMC participants in their meeting in March 2019.   With the current target range of the federal funds rate at 2.25-2.5%, this largely matches Powell's view that the current policy rate is in the broad range of the estimated neutral interest rate.

Taking a historical perspective, the estimates of both real and nominal neutral interest rates have been on a general downtrend in the past three decades, with particularly sharp declines after the Global Financial Crisis in 2007-08 (***Chart 1***).   In specific, the annual average of estimated real neutral interest rate eased from 3.5% in 1988 to 2.4% in 2007, and fell further to 0.8% in 2018.   Likewise, the annual average of estimated nominal neutral interest rate fell from 7.4% in 1988 to 4.6% in 2007, and declined further to 2.6% in 2018.

Chart 1:   The estimates of both real and nominal neutral interest rates have been on a general downtrend in the past three decades
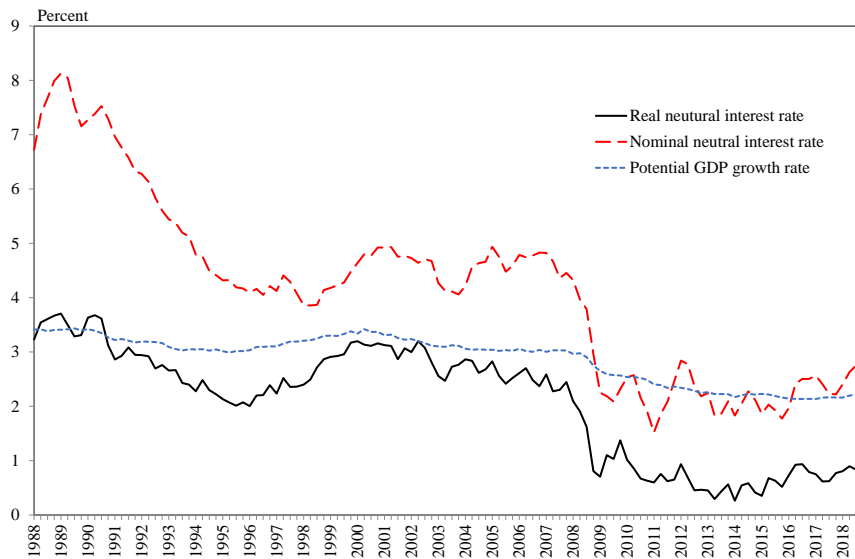

Table 1: Contributions of the change in real neutral interest rate (r*) from the two components

Period	Change in r*	Contributed from	
		Potential GDP growth (g*)	Other determinants (z)
2007 annual as compared to 1988 annual	**-1.1**	-0.5	-0.6
2018 annual as compared to 2007 annual	**-1.6**	-1.1	-0.5

Source: New York Fed's estimates of r*, g*, z and c as published in February 2019.
Note: The estimated value of c is 1.290.

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(9) This refers to the annualised quarter-to-quarter rate of change in the implicit price deflator of personal consumption expenditure (PCE) excluding food and energy items.   This follows the treatment in a recent paper by Holston, Laubach and Williams (2017) in conversion between interest rates in real terms and in nominal terms.
Holston, K., Laubach, T. and Williams J.C., (2017) "Measuring the Natural Rate of Interest: International Trends and Determinants," *Journal of International Economics*, 108, 59-75.

Box 2.1 (Cont'd)

To analyse the factors behind its general downtrend, *Table 1* shows the contributions to the decline in the real neutral interest rate by potential GDP growth (g*) and other determinants (z) in the past three decades. Specifically, the real neutral interest rate fell by 1.1 percentage points from 1988 to 2007, of which around 0.5 percentage point was due to moderation in potential GDP growth. More recently, the real neutral interest rate dropped sharply by 1.6 percentage points from 2007 to 2018, of which around 1.1 percentage points was due to slowdown in potential GDP growth. In gist, the slower potential economic growth contributed nearly 60% of the decline in the real neutral interest rate in the past three decades.

While the model as in Laubach and Williams (2003) did not offer more explanations behind the general downtrend in the neutral interest rate, other economics literature generally attributed its decline to the following factors:-

- *Lower growth in labour force*: As manpower is a major factor input for economic output, a slower growth in labour force would inevitably contain the potential GDP growth, and thus, the neutral interest rate of an economy. In the US, the general downtrend in population growth, coupled with the gradual retirement of the baby-boomer generation, led to slower labour force growth in the past three decades. In specific, growth in the US labour force decelerated from 1.2% p.a. in 1989-2007 to 0.5% p.a. in 2008-2018.

- *Moderated growth in labour productivity*[10]: As measured by output produced per hour worked, labour productivity growth moderated from 2.3% p.a. in 1989-2007 to 1.3% p.a. in 2008-2018. Given that labour productivity is another key propellant of economic growth, its growth moderation in recent decades inevitably contained the potential growth of the US economy, and hence, the neutral interest rate.

- *"Global savings glut"*: Former Fed Chair Bernanke posited in a lecture[11] in 2005 that the accumulation of foreign exchange reserves in emerging Asian market economies since mid-1990s, especially after the Asian Financial Crisis in late 1990s, helped increase the supply of funds in advanced economies, thus driving down the US neutral interest rate. Yet, he acknowledged in an article[12] in 2015 that the trend had reverted somewhat after the Global Financial Crisis, as reflected in the general shrinkage in the US current account deficit and the current account surplus in emerging Asian market economies[13]. This implies that the downward pressure on the US neutral interest rate from "global saving glut" eased somewhat in the more recent period.

Looking ahead, potential GDP growth in the US is likely to stay at the current low level. The median projection of the FOMC meeting in March 2019 suggested that real GDP growth in the US would be at 1.9% p.a. in the longer run, which is even slightly slower than the growth of 2.2% p.a. in the past two decades[14]. Hence, the US neutral interest rate should stay at a relatively low level in the period ahead. Given that the prevailing policy rate is in the broad range of the estimated neutral rate, the Fed should have no hurry to adjust its interest rate in the near term, though their decision would still hinge on future economic data.

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(10) For more details on the deceleration in productivity growth in the US, please refer to "Box 2.1 Productivity growth slowdown in the US and its economic implications" in *Third Quarter Economic Report 2016*.

(11) Bernanke B.S., (2005) "The Global Saving Glut and the US Current Account Deficit" Speech at the Sandridge Lecture, Richmond, 10 March 2005.

(12) Bernanke B.S., (2015) "Why Are Interest Rates So Low, Part 3: The Global Savings Glut" *Brookings Blog*, 1 April 2015.

(13) Based on the IMF's World Economic Outlook database in April 2019, the US current account deficit shrank from US$806 billion in 2006 to US$469 billion in 2018. Likewise, the current account balance of emerging and developing Asia also turned from a surplus of US$273 billion in 2006 to a deficit of US$25 billion in 2018.

(14) The US Congressional Budget Office also projected in January 2019 that potential GDP growth would slow to 1.9% p.a. in 2019-2028.