WP/21/93

IMF Working Paper

What's in the (R)-Stars for Korea?

By Sohrab Rafiq

INTERNATIONAL MONETARY FUND

 WP/21/93

IMF Working Paper

Asia and Pacific & Research Department

What's in the (R)-Stars for Korea?

Prepared by Sohrab Rafiq[1]

Authorized for distribution by Andreas Bauer

March 2021

Abstract

Korea's stars tell of an economy saddled with a real neutral rate (*r*-star) that has declined significantly in recent decades and is currently below zero. This reflects a significant decline in trend growth, and two large financial crises that triggered significant shifts in the saving-investment balance. Larger fiscal deficits and frothy financial conditions since 2012 have helped offset rising demand for safer assets, preventing the neutral rate from falling further. Nonetheless, the fall in the neutral rate, coupled with its effects on asset returns, has complicated the task of monetary policy stabilization. Korea's neutral rate is likely to remain low over the medium-term and could fall further, reflecting a structural savings-investment imbalance owing to declining productivity and a rotation in demographics increasing the demand for precautionary saving and convenience yield, and widening the capital risk premia. The COVID pandemic risks magnifying these trends.

JEL Classification Numbers: E4, E5

Keywords: Neutral Rate, Risk Premia, Covenience, Demographics, Savings

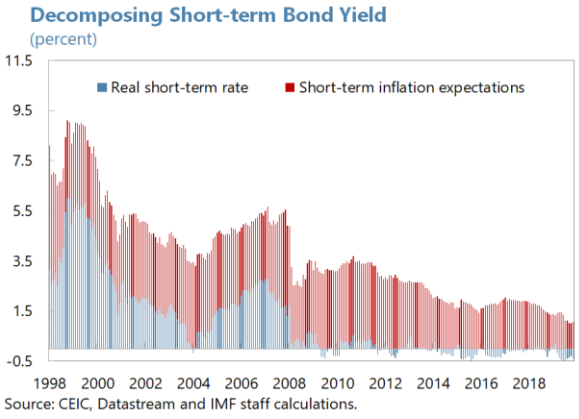
Author's Email Addresses: srafiq@imf.org

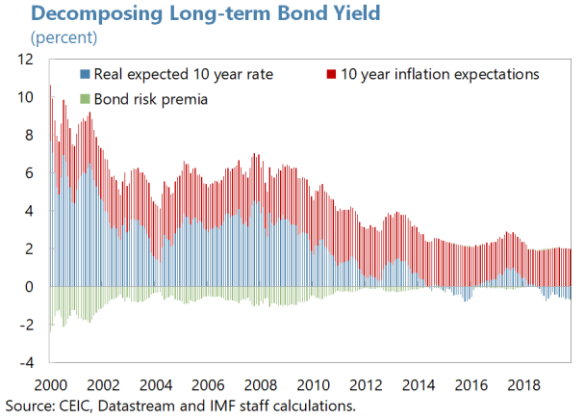
[1] Thanks goes to colleagues at the Bank of Korea, Signe Krogstrup, Andreas Bauer, Kenneth Kang, Davide Furceri, Roland Meeks, Domenico Giannone, Mikael Juselius, Peter Williams, Smith Lee, Sungjin Kim, Jinhyuk Lee, Paola Castillo, Andrew Swiston, Wenjie Li, Livia Tolentino, Angelia Grant and Tarhan Feyzioglu for helpful comments.

INTRODUCTION

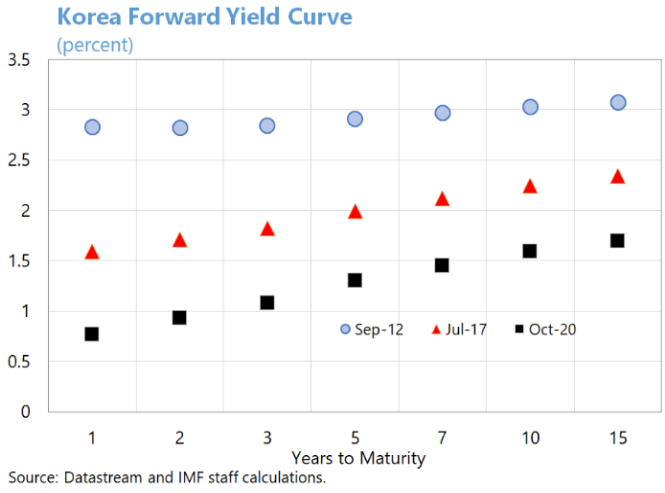
Real interest rates have declined globally, including in Korea, in past decades. Korean short-term real interest rates declined from an average rate of 7.5 percent in the 1980s and 1990s to an average rate of just below 1 percent since 2000. During the same period, inflation fell from an average 7 to 2.5 percent. Inflation has fallen further in recent years, averaging 1.25 percent since 2013, undershooting the Bank of Korea's inflation target for much of that time.[2] Korean markets are pricing in low rates for the foreseeable future, with an anticipated risk-free interest rate of 1.6 percent in 15 years' time, which is around half the expected level priced in mid-2012.

Figure 1. Korean Short- and Long Rates Decomposition





One hypothesis for the decline in the risk-free rate is the fall in the neutral real interest rate. The neutral rate (*r*-star) is defined as the rate of interest that sustains full employment (equivalently, output at potential) and stable inflation in the medium run when all transitory shocks dissipate. According to this view, higher desired saving and/or lower desired investment has pushed down the neutral rate in Korea, requiring the Bank of Korea to steer interest rates lower to sustain output close to potential and ensure stable inflation.



The level of the neutral rate and its likely future direction is key for assessing Korea's monetary policy stance, future policy space and the risk of hitting the effective lower bound. Partly reflecting below trend growth, inflation has been persistently lower than the Bank of Korea's inflation target of 2 percent. Financial conditions in contrast have remained loose. With the nominal policy rate already low and assuming the

[2] In 2016, the Bank of Korea's inflation target was lowered from 3.5 percent to 2 percent.

nominal interest rate is subject to an effective lower bound, and the inflation target is a small positive number, has limited the scope for monetary easing. Beyond monetary policy issues, a decline in the neutral rate would lower all economic and social discount rates. This would, for instance, boost the present value of future climate damages (social cost of carbon), providing an even stronger rationale for Korea's efforts to green its economy.

The drivers of the neutral rate in Korea are not well understood. As in most advanced economies, real risk-free rates in Korea have trended down over the past 30 years. Puzzlingly, considering this decline, the return on private capital has remained stable or even increased, creating a wedge with safe interest rates; Korea stock market valuation ratios have increased only moderately, and investment has been relatively lackluster. At the same time, except for a short period in the 1990s, economic and productivity growth has slowed, and aggregate precautionary savings, particularly for corporates, has risen.

This paper finds:

- The neutral rate in Korea has declined over the last 30 years, and by a greater magnitude than in other advanced economies. The neutral rate in Korea is highly sensitive to trend growth. There is uncertainty around the exact level at any given point in time, but all neutral rate estimates have fallen below zero in recent years.
- Shifts in Korean saving-investment factors have pushed down the neutral rate. Since the Asian crisis, net savings has risen, and the capital risk premia has risen as demographic rotation has accelerated. These private sector forces appear significant on interest rates and could accelerate post-COVID. On average across the business cycle, equilibration of private sector saving, and investment may require a low real rate of interest in future.
- When accounting for financial factors, the neutral real rate is more cyclical than standard estimates neutral rate measures based solely on inflation and the output gap. The natural rate fell sharply during the Asian and Global Financial Crisis when bond risk premia spiked but recovered subsequently in line with financial normalization and economic recovery. While Korea's rate of potential growth has steadily declined for several decades, time variation in financial market conditions has at times outweighed the impact of the long-term decline in trend growth on the neutral rate.
- Monetary policy has potentially persistent effects on the neutral real rate by offsetting the widening or compression of financial market risk premia. In a stress scenario, quantitative easing measures that help compress bond risk premia are likely to help support real neutral rates, all else equal. This, in turn, raises questions about the notion of a neutral rate that is independent of policy.
- Korea's neutral rate is likely to remain low over the medium-term and could fall further. With a backdrop characterized by a rotation in demographics and higher corporate and household leverage, the COVID pandemic risks triggering a further rise in precautionary savings, reducing domestic economic activity and accelerating demand for convenience yield assets. These factors risk acting as a drag on trend productivity and marginal product of capital, exercising downward pressure on the neutral rate. This will be reflected in a wider savings-investment

imbalance. These factors could be somewhat balanced against the more market orientated view that the pandemic will accelerate digitalization, helping sustain productivity in the short- to medium-term.

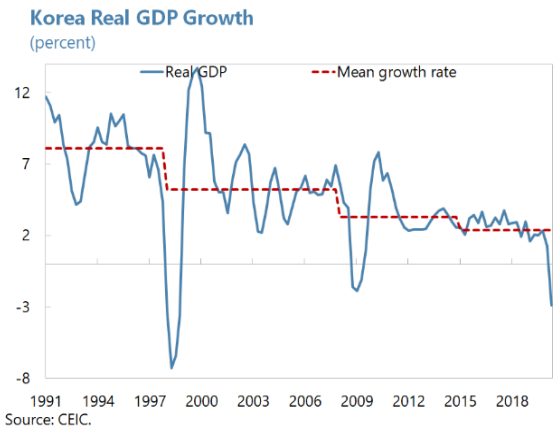
Korea's high savings rate coupled with the safety attributes of domestic government debt imply that fiscal and structural policies could push up the neutral rate. Strong demand for Korean government paper, driven in part by aging demographic dynamics and a wider capital risk premium, are in line with the savings glut hypothesis. A way to stimulate economic activity and raise the neutral rate would be to issue more positive yielding long-term safe assets to invest and fill the savings-investment gap. This suggests a more prominent role for fiscal policy for stabilization vis-à-vis monetary policy. Regulatory policies that encourage investment and reduce precautionary saving without sacrificing vital social objectives would also be beneficial.

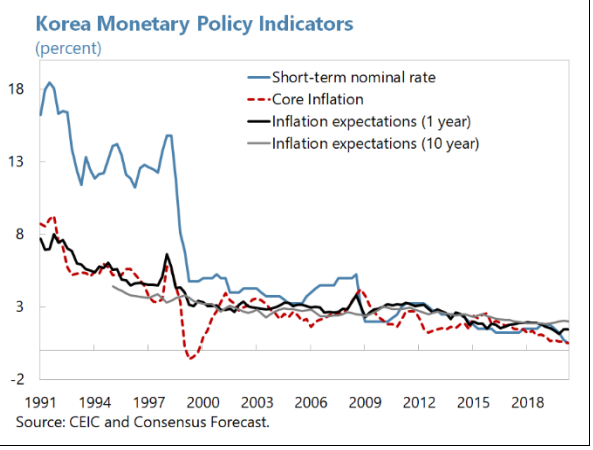
The interaction between a lower neutral rate, macroprudential policy and asset returns complicates the role of monetary policy in stabilizing the economy. The fall in the risk-free rate has stimulated asset price inflation, increasing their interest rate sensitivity and volatility. This raises the risk that monetary policy will be, on average, confronted with a lower nominal risk-free neutral rate going forward. If the risk-free short-term nominal rate is being used to counteract the higher probability of investment booms and busts associated with greater asset return volatility, the probability of the effective lower bound on the nominal rate becoming more binding rises. This suggests a greater role for macroprudential policies, particularly their fine-tuning over the economic and financial cycle. Prudential intervention may also put upward pressure on the neutral rate as a by-product of containing financial risk premia in financial markets.

KOREA BASELINE NEUTRAL RATE

The neutral real interest rate is unobserved and can only be inferred. Estimates rely on modeling and data choices, which means that neutral rates are estimated with a degree of uncertainty. It is therefore prudent to rely on as many different modeling approaches and estimates as possible to assess the likely level of the neutral rate and its uncertainty.

Figure 2. Korea Real Neutral Rate Coincident Indicators





The baseline estimate for Korea follows Laubach and Williams (2003) semi-structural approach. This framework approach allows enough structure to interpret estimates as neutral rates but is sufficiently standardized to allow for a consistent and comparable application across a set of widely different countries across time. It also has several drawbacks, notably when the Philips curves is flat. While Philips curves have been found to be close to or temporarily flat in many countries recently, evidence suggests the slope of the Philips curve is not flat in Korea.

The Laubach-Williams approach is based on a simple three-equation model of the economy. Laubach-Williams neutral rate is based on an IS equation linking the output gap ($y_t - y_t^*$) to the neutral rate gap $r_t - r_t^*$, a Philipps curve linking core inflation to the output gap and some relative prices, and an expression linking the neutral real interest rate to potential output growth (y_t^*) and an error term. The model is estimated using the short-term *ex ante* risk-free real interest rate (r_t), which allows an abstraction from modeling risk and term premia embedded in longer rates. Risk and term premiums are relevant for economic activity as well as saving and investment decisions and is examined in subsequent sections.

$$y_t - y_t^* = \beta_1(y_{t-1} - y_{t-1}^*) - \vartheta_1(r_t - r_t^*) + \varepsilon_{1t} \quad \text{(IS curve)}$$

$$(\pi_t - \pi_t^*) = \beta_2(\pi_{t-1} - \pi_t^*) - \vartheta_2\left(y_t - y_t^*\right) + \varepsilon_{2t} \quad \text{(Phillips curve)}$$

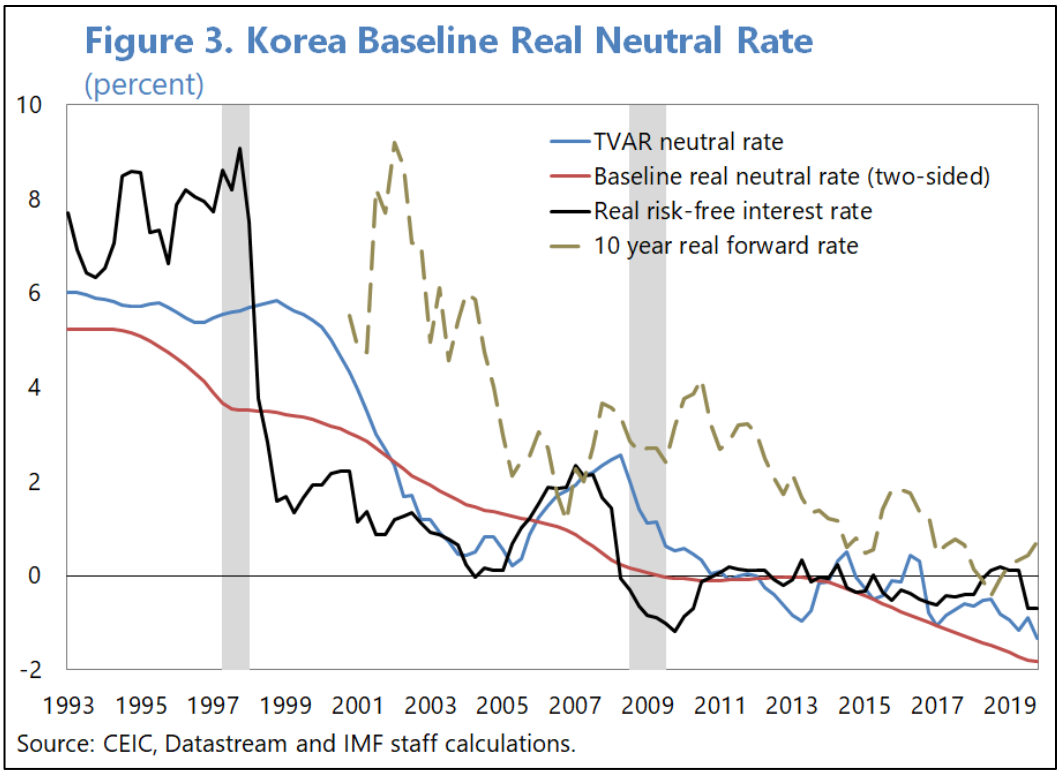
$$r_t^* = \beta_3 r_{t-1}^* + (1 - \beta_4)\left(z_t - \frac{1}{\rho}4\Delta y_t^*\right) + \varepsilon_{3t} \quad \text{(Neutral real rate)}$$

The IS equation relates the output gap to the real interest rate gap—the difference between the real short-term rate and the neutral real rate. The IS equation posits that an increase in the real interest rate above the neutral rate leads to a decline in real GDP below its potential level. If output falls persistently below its potential level, then the model would infer that the real interest rate has risen above the neutral rate, thereby turning the real interest gap positive. However, the output gap is unobservable. To infer whether GDP is above or below its potential level, Laubach-Williams model relies on an accelerationist Phillips curve, which implies that rising inflation is due to output exceeding its potential level. In this way, data on output and inflation can be used to measure potential output—which, in turn, can be used to infer the neutral real rate of interest. The model is estimated using data from 1991Q1 to 2020Q2.

Time series and survey evidence suggest that Korean real GDP growth, labor productivity growth, and real interest rates are subject to highly persistent changes masked by volatile transitory shocks. Maximum likelihood estimates of the standard deviations of the innovations to trend growth and other macro factors are therefore likely to be biased towards zero owing to the so-called 'pile-up problem'. To overcome the issue Stock and Watson's (1998) median unbiased estimator is used to obtain estimates of the ratio signal-to-noise ratios. These ratios are imposed when estimating the remaining model parameters by maximum likelihood.

For comparison, an alternative reduced-form neutral rate time series model is estimated. A time-varying parameter model (TVAR), which differs from Laubach-Williams in imposing less economic structure, is also estimated (see Lubik and Matthes 2015). Whereas Laubach-Williams estimates rely on stable economic relationships between the key macroeconomic variables, the time-varying model is agnostic about the structural relationships and instead captures the

nonlinear comovement between the variables in a flexible manner. The TVAR allows the parameters of the model, namely the lag coefficients and the variances of the economic shocks, to vary over time. It is therefore consistent with the idea that the neutral rate can be affected by real economic disturbances.



Three stylized facts stand out from the estimates of the real Korean neutral rate.

- *Stylized fact 1: The Korean neutral real interest and trend growth rates have declined substantially since the 1990s.*[3] The decline in the Korean neutral rate mirrors a progressive decline in the trend growth rate, which accelerated in the years following the Asian Financial Crisis in 1997/98. The unrestricted coefficient on trend growth is 7.9, positive and statistically significant at the 1 percent level. This magnitude implies that annualized trend growth affects the natural rate (expressed in annualized percentage points) almost 2 to 1. This compares to an almost 1-to-1 estimate for the U.S (see Hakkio and Smith, 2017). The neutral rate has declined from around 5.2 percent in the early 1990s, reaching 1 percent on the eve of the Global Financial Crisis. During the Global Financial Crisis, the *exante* real rate was negative, and the neutral rate hit zero, and remained at zero till 2014. Until the Global Financial Crisis there is quite a significant discrepancy between the real-time and *ex post* real neutral rate estimate. In the early 1990s, the discrepancy was at times as large as 2 percent, highlighting the difficultly in measuring the real neutral rate in real-time during periods of rapid structural change.

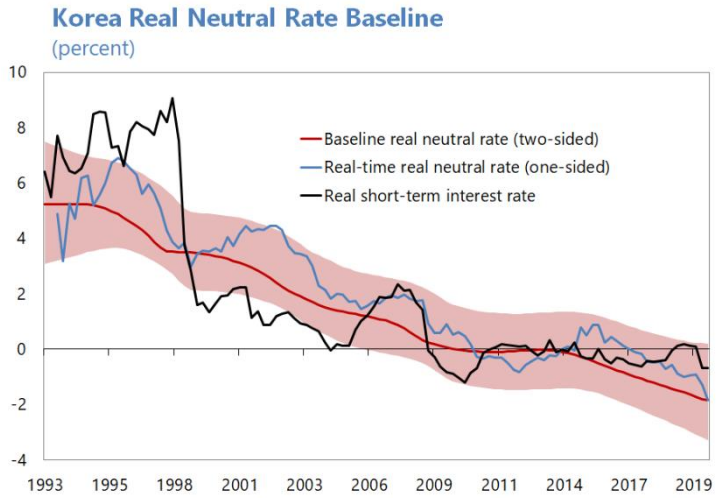
[3] The robustness of the estimates is also tested to account for COVID disruptions. This is done following Holton, Laubach and Williams (2020). The results are little changed. This is because the size of the recent economic downturn due to COVID in Korea is not a tail-event, and therefore is less likely to violate Gaussian assumptions.

Table 1. Korea Laubach-Williams Model Parameter Estimates			
Parameter		**Unrestricted model**	**Restricted model**
β_1	(hysteresis trend growth)	1.24***	1.26***
ϑ_1	(interest rate in IS curve)	-0.17***	-0.20***
ϑ_2	(slope of Philips curve)	0.21***	0.19**
β_4	(trend growth and neutral rate link)	7.79***	4.00
Adding risk premia in neutral rate			
Bond risk premia		-1.85***	-1.90***
Term premia		-1.51	-1.68
***(**) Denotes significance at 1(5) percent level.			

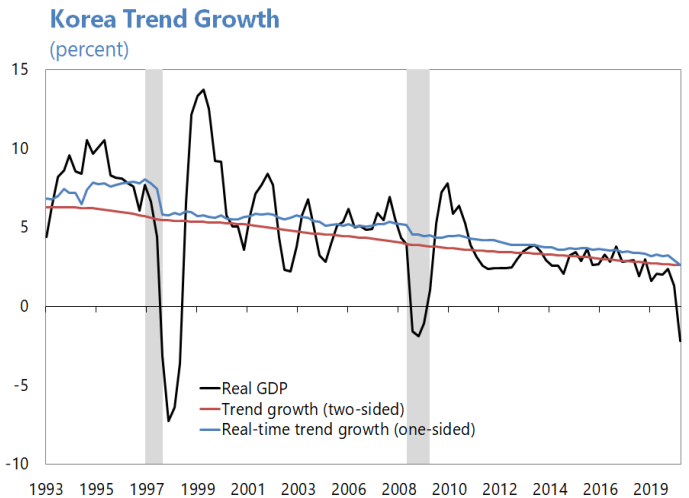
- *Stylized fact 2. Recent estimates show the real neutral rate is below zero*. However, there is some degree of uncertainty around the estimate. This reflects the close association of inflation with the output gap and the interest rate gap in the IS curve in the Laubach-Williams framework. In the early part of the sample and the years leading up to the Asian Financial Crisis, the downward trend in inflation leads to a persistently negative output gap and thus to an estimate of the natural rate that is generally below the real interest rate. Following the Asian Crisis, the Laubach-Williams output gap estimates was positive. And given the IS curve, which depends only on the interest rate gap, the estimated natural rate is above the observed real rate. Following the Global Crisis, the real *ex ante* real rate fell sharply and has fluctuated around zero ever since. As a persistently negative output gap morphed into subdued inflation below the Bank of Korea's 2 percent inflation target, at some point between 2014 and 2016 the real neutral rate turned negative. This has two implications: the negative rate limits (i) the ability of the central bank to do its job using conventional policy instruments and (*ii*) the use of new monetary (quantitative easing) tools to add monetary policy space (see Bernanke, 2019).
- *Stylized fact 3. The decline and low level of the Korean neutral rate mirrors global trends.* Figure 5 compares the baseline neutral rate estimate for Korea with four advanced economies. Theory predicts that, in a world of reducing financial frictions, a small open economy takes the neutral rate of interest as exogenous, which will converge to the global neutral rate of interest in the long run.[4] Korea had a significant higher neutral and trend growth rate compared to other advanced economies during the early 1990s. For this reason, the decline in the neutral rate since the 1990s has been more acute in Korea, with only the U.S. showing a somewhat similar decline. Compared to other advanced countries, Korea has also experienced the largest trend growth decline, falling from around 6 percent pre-Asian Crisis to just above 2.5 percent as of 2020Q2. The trend growth rates in the other advanced economies has remained relatively stable, despite the Global Financial Crisis. Rates converged in the mid-2000s following the Korean credit card crisis. During the Global Financial Crisis, the Korean neutral rate fell sharply (by around 1 percent), in line with similar magnitudes estimated for the Euro Zone and U.S. Since 2011 Korea's neutral rate has, in general, been below other advanced economy equilibrium rates. One view is that low levels of neutral rates globally are exceptional but not

4 See Miranda-Agrippino and Rey (2020).

Figure 4. Korea Equilibrium Real Rate and Real GDP Growth

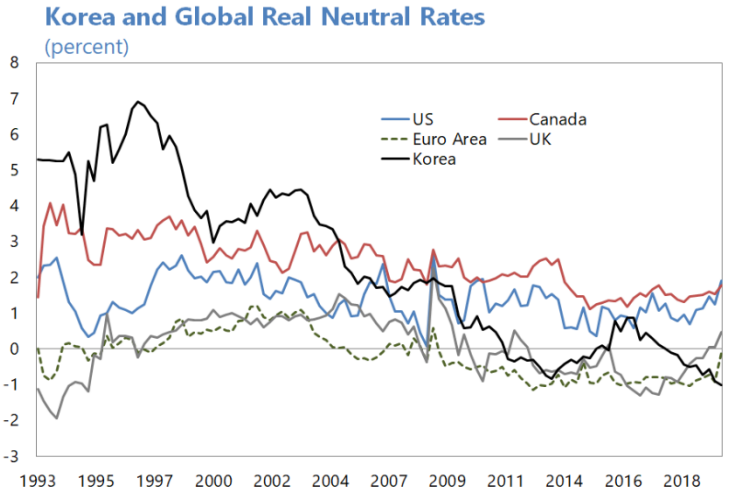


Source: CEIC, Datastream and IMF staff calculations.

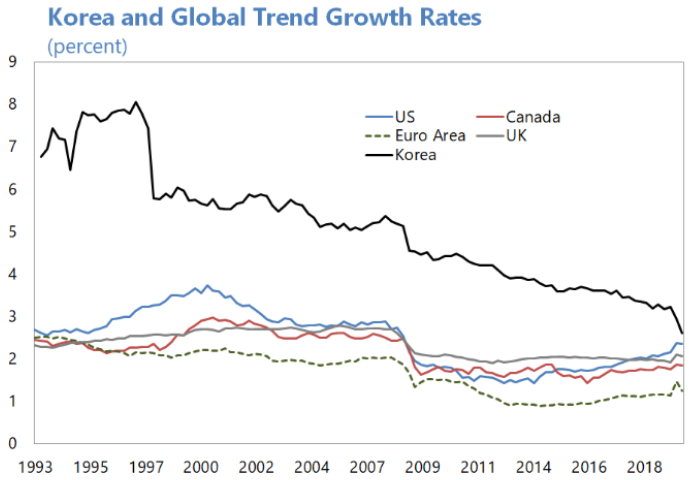


Source: CEIC, Datastream and IMF staff calculations.

Figure 5. Korea and Real Global Equilibrium Rates and Real GDP Growth



Source: Federal Reserve Bank of New York and IMF staff calculations.



Source: Federal Reserve Bank of New York and IMF staff calculations.

unprecedented in longer historical comparison. Rather, it may be viewed that the high levels of the 1980s and early 1990s are unprecedented (see Jorda et al 2016 and Del Negro et al 2018).

The fact that all these indicators point downward may give a false impression of robustness. In inferring the neutral rate, the realized path of the real policy interest rate is a key observed variable, which has fallen over the sample period and has in the Korea case fluctuated around zero since 2011. As noted in Rungcharoenkitkul (2020) this could make the inference prone to a circularity problem: is a neutral rate estimate tracking monetary policy actions or the other way around? This reinforces the need to look at other factors that drive real risk-free rate trends.

READING KOREA'S R-STARS

There are potentially many factors that drive the neutral rate beyond trend growth. These comprise (*i*) financial conditions and fluctuations in risk premia, including the role of financial crises, and (*ii*) the savings-investment balance, which in turn reflects demographics, productivity issues and the role of safety in the pricing of securities.

I. Korea Neutral Rate, Financial Cycle, Safety and Risk Aversion

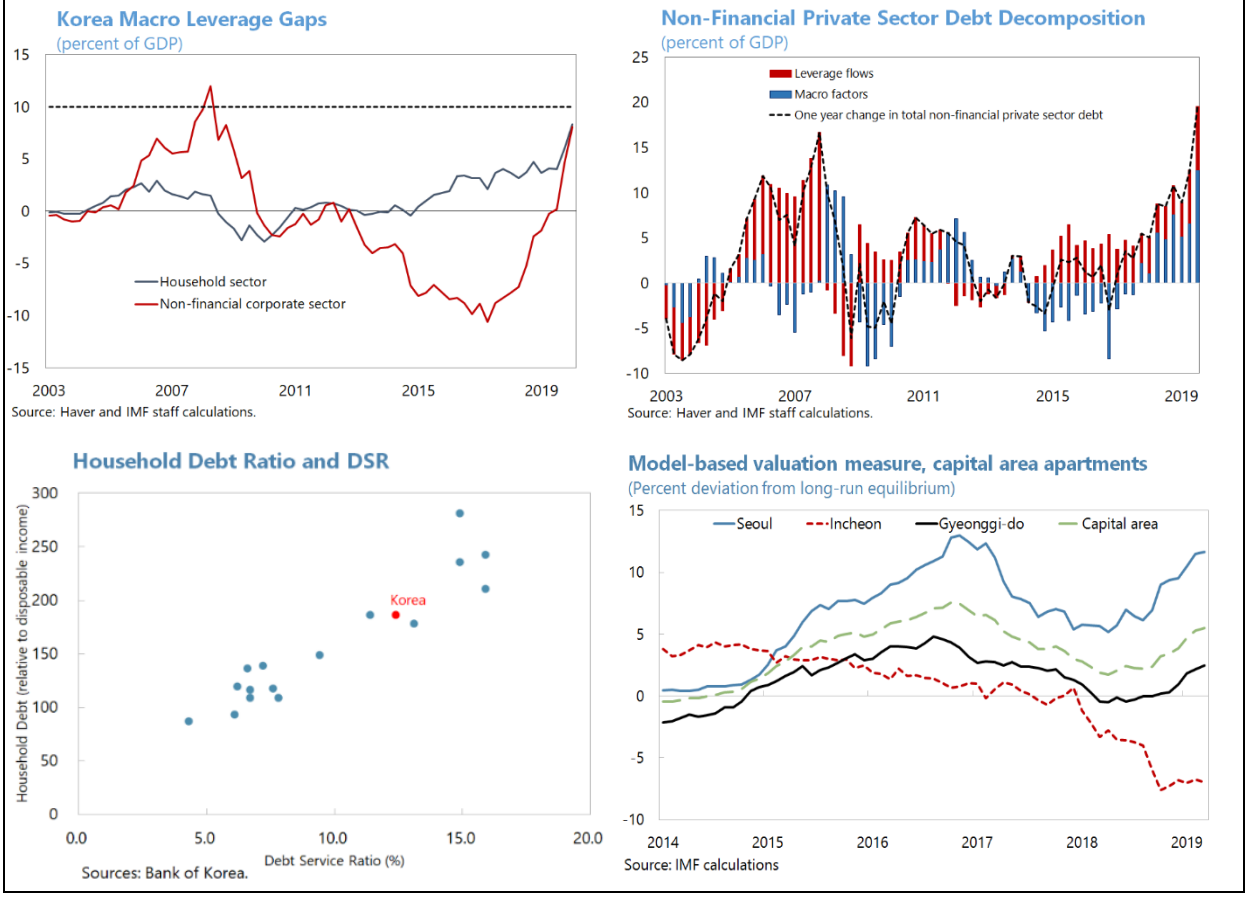
Financial factors can have persistent effects on the real neutral interest rate. Korea has undergone two large financial crises, which data shows led to dramatic shifts in domestic savings and investment behavior. Asset prices can be common source of financial instability, and therefore reference to an economic equilibrium real interest rate needs some locus on the financial sector. These factors are now explored.

Finance Neutral Real Interest Rate

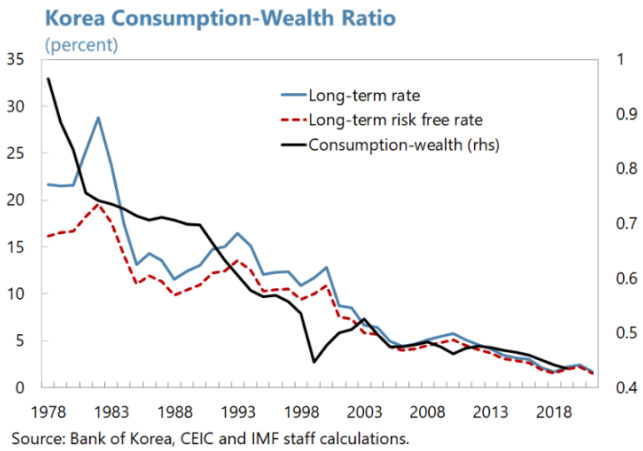
The natural rate in the standard framework fails to consider the role of financial factors as a symptom of unsustainability. Hamilton, Harris, Hatzius and West (2015) focus on long historical averages of interest rates and find that real interest rates may be affected persistently over time by a host of factors, including financial regulation, inflation trends and bubbles. The thesis being that one cannot derive an equilibrium real interest rate for the economy when the financial sector is in imbalance.

Financial imbalances in Korea have widened in recent years creating tension for monetary policy. The credit cycle has grown quickly owing to an upswing in the household leverage cycle. In recent years household credit from banks has been above historical trend, growing from around 85 to 100 percent of GDP. House prices, particularly in the metropolitan area around Seoul, have also risen. While output has grown close to trend, inflation has remained below the Bank of Korea's target of 2 percent, which has in turn constrained monetary policy. Data for Korea shows that while the relationship was never strong in the first instance, the link between inflation and the credit gap has weakened over the last few decades. This implies that if monetary policy has a material impact on financial booms and inflation is a poor indicator of deviations of output from potential, then ignoring financial cycles may lead policy astray (Figure 6). Monetary policy in Korea is currently caught between the financial cycle, on the one hand, and an inflation process that has become quite insensitive to financial slack, on the other.

Figure 6 Korea Leverage Cycle and Financial Imbalances



Financial crises triggered large shifts in risk aversion in Korea and put downward pressure on the neutral rate in Korea. Korea's neutral rate decline and widening capital risk premia accelerated in the years following the Asian and Global Financial Crises. A stylized fact across advanced economies, including Korea, is that the consumption-wealth ratio tends to decline in years preceding a period of high credit and then rises afterwards (see Gourinchas and Rey (2019)). Exuberance drives up asset prices and wealth during boom times. Saving propensities increase in the aftermath of financial crises, as agents attempt to repair their balance sheets (see e.g. Mian et al. (2013)). In equilibrium this needs to be offset by a decline in the real rate. This is because during crisis periods in which financial constraints may be binding shocks hitting the economy are amplified and lead to deleveraging and depressed aggregate demand (Eggertsson and Krugman (2012)). Mian, Straub and Sufi (2020) propose a theory of indebted demand, capturing the idea that large debt burdens by households (and in some instances the public sector) lowers aggregate demand, and thus the neutral interest rate. As a result,



recessions which coincide with financial dislocation tend to have permanent effects on output. Finally, Kozlowski, Veldkamp and Venkateswaran (2018) show that the materialization of large tail-risk events results in perceived tail-risks remaining high, generating demand for riskless liquid assets, and depressing the risk-free rate.

The neutral rate is adjusted to allow for the possibility that leverage contains information about the output gap. Following a variation of the model in Borio, Juselius and Rungcharoenkitkul (2017), the Laubach-Williams model is augmented to capture the leverage and debt service ratios and their effects on output. These ratios are known together as the 'double-trigger' of loan default and offer a good signal of risk-taking in the Korean economy.[5] The IS equation is augmented to include a measure of the leverage cycle, which here reflects fluctuations in the non-financial private sector debt-to-GDP ratio. Theoretically, it enters with a negative sign ($\vartheta_2 < 0$) because a positive leverage gap is associated with low asset prices, and hence low credit growth and correspondingly lower output. Since the debt service effect is quite sluggish in the data, the model allows it to enter with a one-quarter lag. Since the leverage gap drives a wedge between actual and potential output, the model relates deviations between the actual and neutral real interest rates. Rates above the neutral rate should decrease asset prices and/or output, which in turn increases the leverage gap. The model is therefore also consistent with the *r*** concept in Akinci, Benigno, Del Negro and Quaralto (2020), defined as the threshold interest rate that triggers financial constraints binding. In addition, the debt service gap feeds negatively into asset price growth and, hence, boosts the leverage gap. Thus, the model allows for the fact that (*i*) financial cycles have very persistent impact on output and (*ii*) that monetary policy may not be neutral.

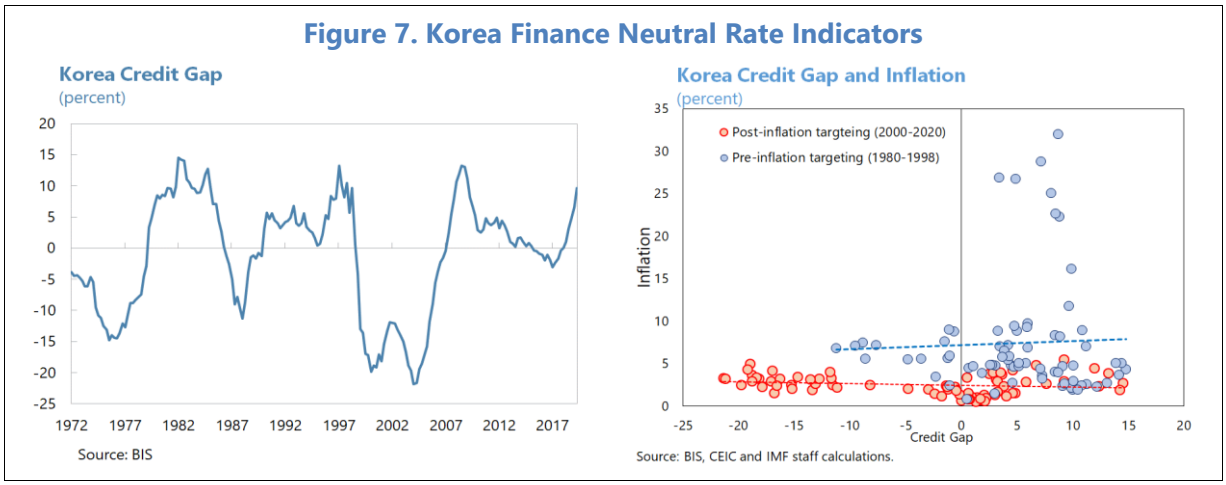
$$y_t - y_t^* = \beta_1(y_{t-1} - y_{t-1}^*) - \vartheta_1(r_t - r_t^*) - \vartheta_2 lev_t + \varepsilon_{1t} \quad \text{(IS curve)}$$

$$lev_t = \beta_2 lev_{t-1} + \beta_3(r - r_t^*) + \beta_4 dsr_{t-1} + \varepsilon_{2t} \quad \text{(Leverage cycle)}$$

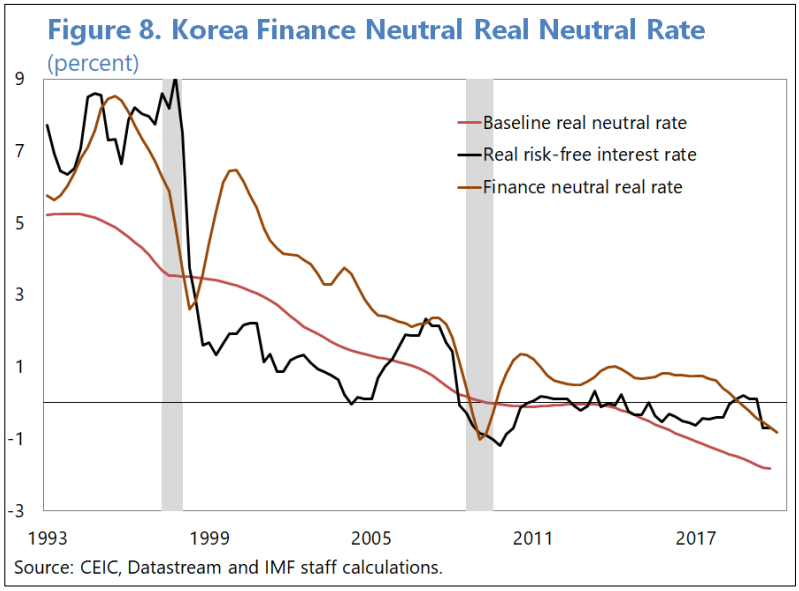
$$dsr_t = \beta_5 dsr_{t-1} + \varepsilon_{3t} \quad \text{(Debt service ratio)}$$

The leverage and debt service ratio interact as $lev_t < 0$ implies higher credit growth which supports output but also implies higher debt-service. Analogously $dsr_t > 0$ drags on growth as well as credit leading to endogenous cycles. The neutral interest rate estimated here is the one associated with full long-run equilibrium: output, inflation and financial gaps are all closed. When the economy is not in long-run equilibrium, the interest rate must deviate from the natural rate to bring the system back into balance. The neutral rate estimated is a benchmark with which to judge policy but not a target for policy to track. That is, unless the economy is in steady-state, the market interest rate must differ from the natural rate to compensate for the key gaps—output, inflation, and financial.

[5] See *Republic of Korea: Financial Sector Assessment Program-Technical Note-Non-Financial Balance Sheet Vulnerabilities and Risks to Financial Stability*: https://www.imf.org/en/Publications/CR/Issues/2020/09/18/Republic-of-Korea-Financial-Sector-Assessment-Program-Technical-Note-Non-Financial-Balance-49750

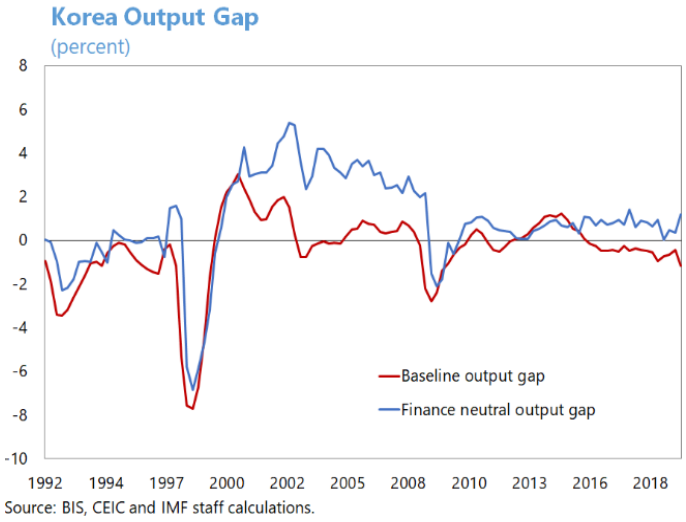


Including financial factors results in a less negative output gap. First, from the early 1990s till early 2000 the non-financial and finance neutral output gaps comove (Figure 8). Recognizing the financial tailwinds, the finance-neutral output gap measure indicates that the economy was running above sustainable levels in the years leading up to the Global Financial Crisis. Conversely, output was below potential in the aftermath of the crisis on account of the substantial financial headwinds. Second, until the past few years and periods during the Asian and Global Financial Crisis the neutral rate estimated by Laubach-Williams model has been consistently below the finance-neutral estimate. This reflects the close association of inflation with the output gap and the interest rate gap in the IS curve in the Laubach-Williams framework. The finance-neutral estimates are less sensitive to these factors, as the Phillips curve and the interest rate gap in the IS curve do not play such prominent roles. Actual interest rates have remained below the estimated finance-neutral rate since the Asian Financial Crisis. The real short-term rate has been persistently below the finance-neutral rate from 2010 to mid-2017, during which credit grew rapidly. Since 2018 the finance-neutral rate has fallen and tuned negative as credit slowed due to a tightening in prudential policies. The most recent estimate suggests the finance-neutral rate is broadly in line with the real short-term rate, but higher than the Laubach-Williams estimate. This implies that without the above trend credit growth since 2012 the neutral rate would have been lower than was the case.



The results imply that policy actions today can affect the policy environment and narrow policy options tomorrow. Sharp interest cuts in response to financial crises in the 1997 and 2008/9 were not taken back in the ensuing normalization phase, suggestive of policy asymmetry with

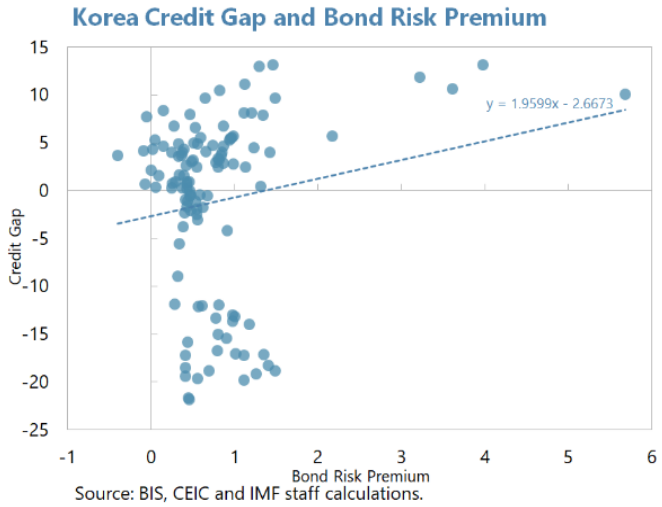
respect to the financial cycle. With low inflation, the Bank of Korea by leaning relatively modestly against the build-up of financial imbalances but easing aggressively during financial crises has, historically at least, imparted a downward bias to nominal and real interest rates. Going forward, if Korea's private debt continues to rise in relation to GDP it may become harder to raise interest rates without impacting growth, particularly given the high share of household debt linked to floating rates (also see Borio and Disyatat (2014) and Mian and Sufi (2020)). This implies (*i*) that monetary policy can have long-run effects on the economy (see Jorda, Singh and Taylor, 2020) and (*ii*) a greater role for prudential policies in providing space for monetary policy to pursue its primary inflation targeting objective.



Source: BIS, CEIC and IMF staff calculations.

Bond Risk Premia and Neutral Interest Rate

Economic theory predicts that an increase in risk aversion lowers the natural real rate. Smets and Wouters (2007) show that increases in bond premiums raise the return on bonds relative to the interest rate controlled by the central bank. This predicts a one-to-one reduction in the neutral rate: higher bond premiums cause consumers to save more in the present and delay consumption for the future. Since postponed consumption decreases current demand, policymakers must lower real policy rates to prevent a slowdown in the economy. Curdia and Woodford (2015) show that in the presence of credit frictions monetary policy should offset shifts in risk spreads, but not necessarily one for one. A stronger monetary policy aversion to short-term market volatility may make the market even more sensitive to future policy surprises, entrenching the need to move gradually (see Stein and Sunderam (2018)).



Source: BIS, CEIC and IMF staff calculations.

The term premium in Korea has been historically low and rarely spiked during economic downturns. This is consistent with a persistently low inflation and expectations of continued cuts in the monetary policy rate in Korea; the term premium arises, in part, from the risk that realized short-term interest rates could differ from their expected future values. Therefore, holding longer-term bonds may reduce the overall risk of investors' portfolios. Negative news about the economic outlook hurts stocks but tends to be good for bond prices (which are inversely related to yields), as a weaker outlook implies that the Bank of Korea will have to hold rates lower for longer.

Government bonds can also provide a hedge against the risk of deflation, since falling consumer prices increase the real value of the fixed payments that bondholders receive. If longer-term bonds are a hedge against risk, then investors would be more willing to accept low or even negative compensation for holding bonds rather than short-term securities.

Bond risk premia tend to spike during periods of heightened economic stress. Bond risk premia arise from the risk of default investors face in corporate debt markets and their tolerance for bearing such risks. Both factors tend to make bond risk premia strongly procyclical. Slowing economic growth can weigh on firms' balance sheets, increasing their risk of defaulting on corporate bonds and thereby increasing risk premiums. In contrast, due to the safety and liquidity characteristics of Korean government debt, the term premia have historically been countercyclical. Together this suggests that periods of economic stress are associated with a wider capital risk premium. This further implies a greater role for liquidity and convenience in the pricing of risk for securities during economic downturns, impacting savings behavior.

Risk aversion and premia, and credit cycles sometimes diverge. The recent COVID pandemic resulted in a spike in risk premia, but bank credit accelerated. Historical data shows that periods of higher bond risk premia are associated with a larger positive credit gap. This is consistent with the buffer stock role played by banks, who are more likely to have long-term lending relationships. During periods of stress credit lines are drawn down. The credit cycle therefore contains a countercyclical component that results in credit growth and risk aversion sometimes giving conflicting signals on the state of financial conditions and, hence, the neutral rate.

There is little understanding of the link between financial risk premia and the neutral rate, particularly bond premiums. The Bank of Korea's recent asset purchase program necessitates understanding the link between the equilibrium rate and bond risk premia. Changes to the central bank balance sheet that influence financial risk premia may influence the natural rate through their effects on bond premiums. If for financial stability purposes the Bank of Korea has adjusted short-term policy rates to counteract shifts in bond risk premiums' then this would impact the neutral rate.

The standard Laubach-Williams model is modified to include the term and bond risk premia. Specifically, the natural real rate equation is now expressed as:

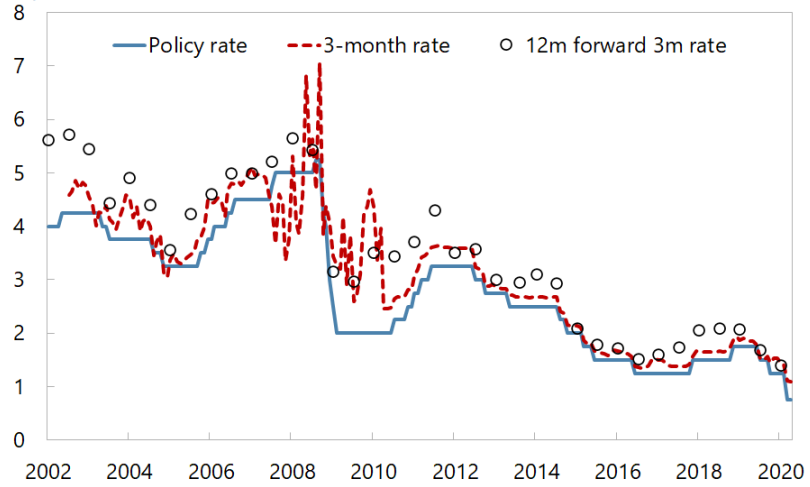
$$r_t^* = \beta_3 r_{t-1}^* + (1-\beta_3)\left(z_t - \frac{1}{\rho}4\Delta y_t^*\right) + \beta_4 tp_t + \beta_5 rp_t + \varepsilon_{4t} \qquad \text{(Neutral rate with financial risk premia)}$$

Neither the term premium nor the risk premium is perfectly observable. Instead, as in Hakkio and Smith (2017), common risk premia estimates are used. A Korea term premium (tp_t) measure is calculated using the Kim and Wright (2005) model, which is a three-factor arbitrage-free term structure model on the zero-coupon yield curve. The bond risk premium is based on the difference between BAA corporate bonds and the 10-year constant-maturity Korea government bond. The sum of the term and risk premium is therefore equal to the spread between corporate bond rates and the average of the expected future path of short-term interest rates. The coefficients β_4 and β_5, which theory predict to be negative, measures the potential influence that term and risk premiums have on the neutral rate. Higher bond risk premium would push down the neutral rate; higher bond returns encourage agents to save more now and consume less. Higher savings coupled with slower growth pushes down the risk-adjusted real neutral rate of interest.

Figure 9 Korea Rate Expectations Decomposition and Term Premia

Korea Short-term Rate Expectations

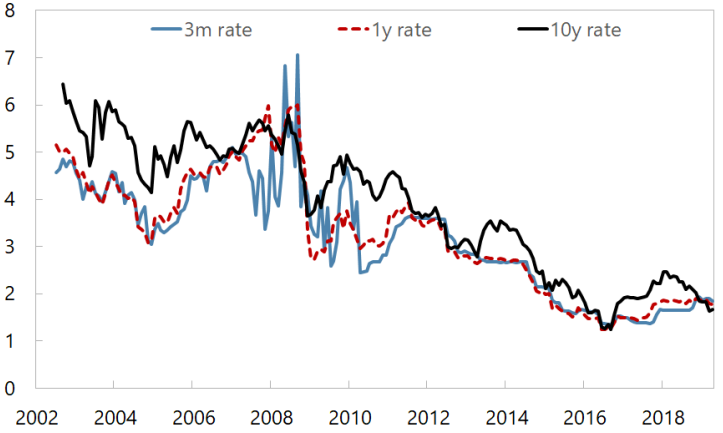
(percent)



Source: Bank of Korea, Consensus Economics, Thomsen Reuters

Yield Curve Shape in Korea

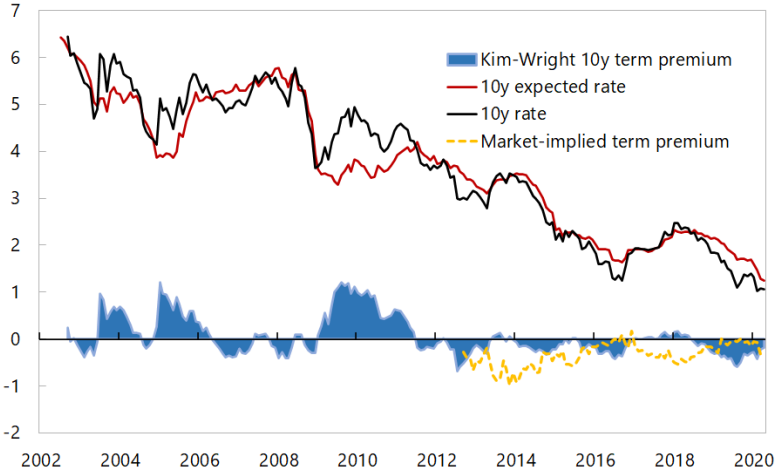
(percent)



Source: Bank of Korea, Consensus Economics, Thomsen Reuters

Korea 10-year Yield Decomposition and Term Premium

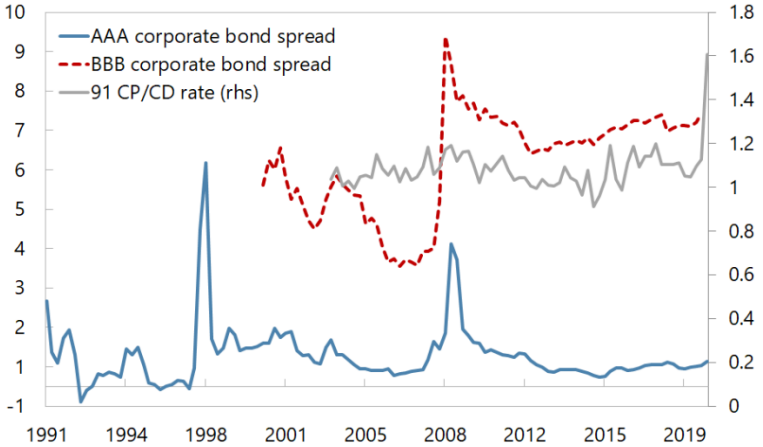
(percent)



Source: Bank of Korea, Consensus Economics, Reuters and IMF staff calculations.

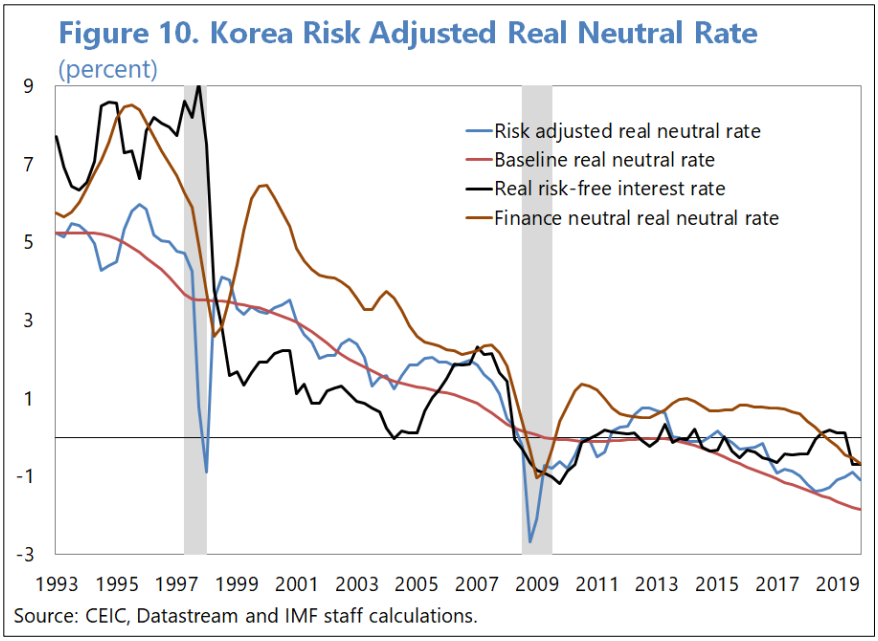
Korea Bond Risk Premia and Marginal Funding Cost

(percent)



Source: CEIC and IMF staff calculations.

The neutral rate is more countercyclical when accounting for shifts in risk premia. The neutral rate declines during recessionary episodes and rises during periods of output above potential (Figure 10). The coefficient on the risk premium, $\beta_5 = -1.9$, is negative suggesting a lower risk premium yields a higher neutral real rate when compared with trend growth (see Table 1). A likelihood ratio test comparing how the model with bond risk premia compares with a model without, suggests that bond premiums have an economically significant influence on the natural real; the null of the no bond premium in the model cannot be rejected with a *p*-value of 0.24.



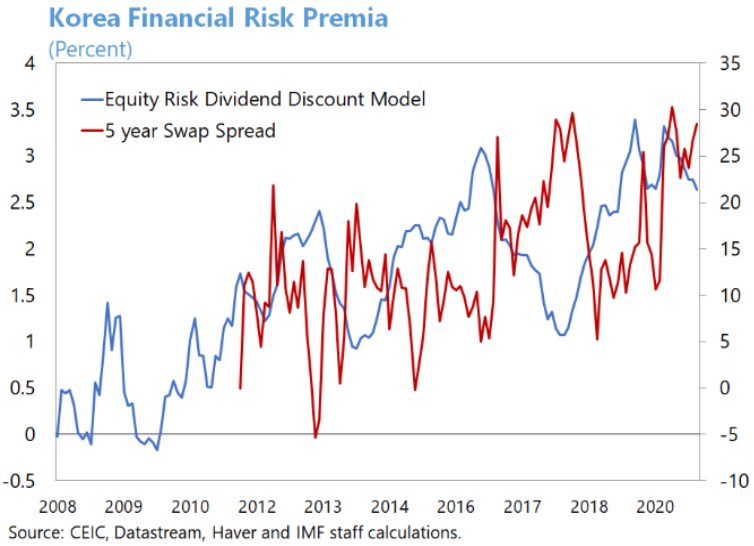
The risk adjusted neutral rate has, on average, been higher than the baseline Laubach-Williams estimate, especially during periods of faster growth. In the years preceding the Asian and Global Financial crises the risk adjusted neutral rate was higher than the baseline estimate. This perspective argues that, all else being equal, monetary policy should be less accommodative when estimates of credit risk premiums in the bond market are low. During the downturn, the risk adjusted neutral rate suggests a real short-term rate much lower than the baseline Laubach-Williams model and actual real short-term rate. This is consistent with a view that advocates adjusting short-term policy rates to offset increases in risk spreads during a financial crisis. The unusually large neutral rate declines during the two crises episodes in the sample suggest that negative real policy rates would have been needed to fully stabilize the economy. Therefore, through the lens of the model, unconventional monetary policy can be viewed as an attempt to reduce the output gap by narrowing the real rate gap when the natural real rate is negative and nominal interest rates have reached their effective lower bound. Rates therefore reflect the interplay between the central bank's reaction function and private-sector beliefs. Finally, the results also suggest that, given the link between risk premia and the neutral rate in Korea, macro prudential intervention could put upward pressure on risk free rates as a by-product of containing systemic risk in financial markets (see Van der Ghote, 2020).

Convenience Yield, Capital Risk Premia and Neutral Rate

The recent macro-finance literature emphasizes the role of safety and liquidity in the pricing of securities. In a Korean context, the real risk-free interest rates have trended down over the past 30 years and the term premia has been overall compressed. The Korea 5-year/5-year forward rate, which is less likely to be driven by time-varying liquidity and safety premia, is close to zero in real terms. More broadly, a large share of the decline in risk-free rates has been mirrored in risky asset

returns, such as rates of return on corporate bonds and on equites. Puzzlingly, in light of the decline in the risk-free rate, (1) the return on private capital has remained stable or even increased, creating a wedge with safe interest rates; (2) stock market valuation ratios have increased, albeit moderately; (3) corporate earnings yields have risen; (4) the share of labor income has declined and; (5) the savings-investment gap has widened.

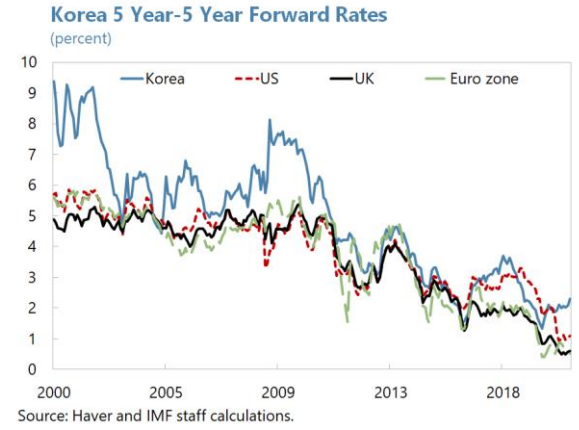
The importance of safety in the pricing of Korean assets is reflected by a compressed term premium and widening wedge between the risk-free rate and the required return on risky assets. While there has been the steady decline of safe real interest rates, less noticed is the fact that the real return on capital has remained stable over the same period, also reflected in a relatively stable price of capital in Korea. The result is a growing gap between the safe interest rate and the rate of return on productive capital (Figures 11 and 12). The implication is that Korea's equilibrium (risk-free) interest rate has fallen not only because there has been an increase in Korea's propensity to save relative to the propensity to invest, but also because a rise in the risk premium has increased the wedge between risk-free rates and the real required return on risky investments. The continued fall in the safe interest rate relative to the earnings (or rental) yield suggests a cheaper equity (housing) market given that the only way to justify upward momentum in equity prices is through expectations of higher growth or perceptions of falling and/or unusually low risk. The widening has been mirrored by a rise in the share of real estate investment in total investment.



The widening in the capital risk premia has been mirrored by a rise in the savings rate. Figure 12 depicts saving and investment rates across time in Korea. Much of the increase in savings has been driven by the non-financial corporates, while investment rates have remained flat or fallen in 1997/98. The non-financial corporate savings-investment deficit has narrowed and has turned a surplus since 2015. The rise in corporate savings has, in part, been driven by a decline in profits to labor income. Farhi and Gourio (2018) suggest the decline in the labor share may be attributable to an increase in market power, which in turn has widened the capital risk premia and pushed down the neutral real rate. Microdata for non-financial Korean firms suggests that larger firms have benefitted more from the low for long interest rate environment, increasing their market power (see Box 1). Rising risk premia should be reflected in relatively lower prices of risky assets such as equities; while the Korean equity prices has generally trended upward, they have tended to be priced at a 'discount'. A key question also is why investment has not picked up, given the low safe interest rate and relatively higher return on capital.

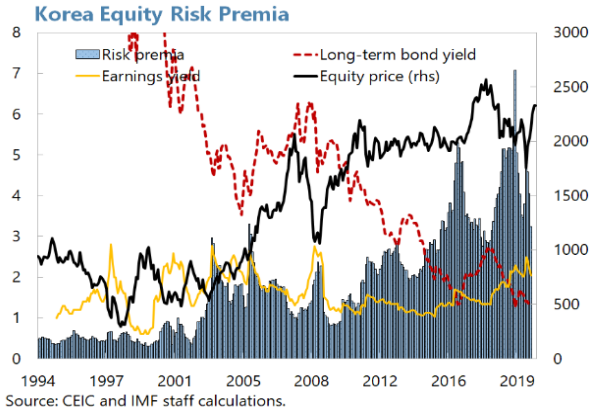
Figure 11. Korea Asset Returns, Risk Premia, and Interest Rates

Markets are pricing in low risk free rates over the medium-term.



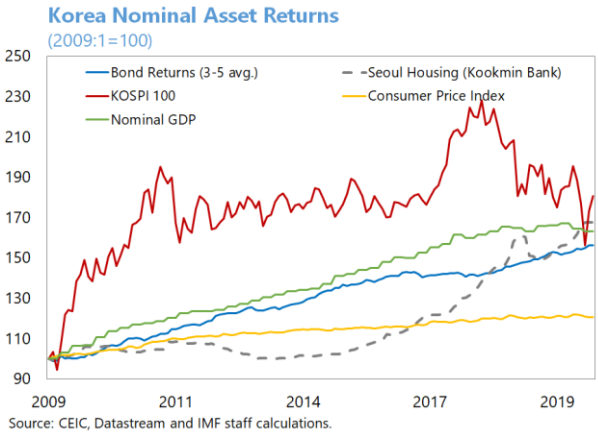
Source: Haver and IMF staff calculations.

The earnings yield has been stable, resulting in a widening equity risk premia....



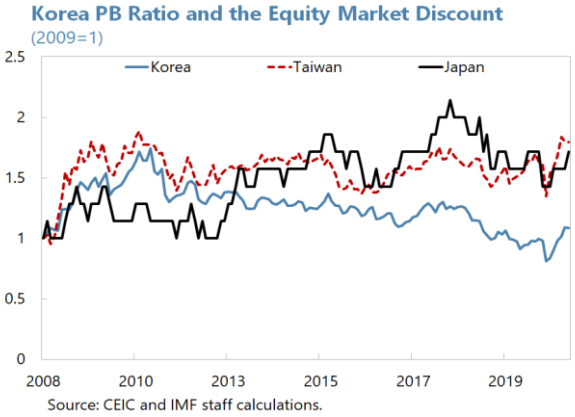
Source: CEIC and IMF staff calculations.

...helping sustain Korean equity returns, while the progressive fall in rates has sustained bond returns.



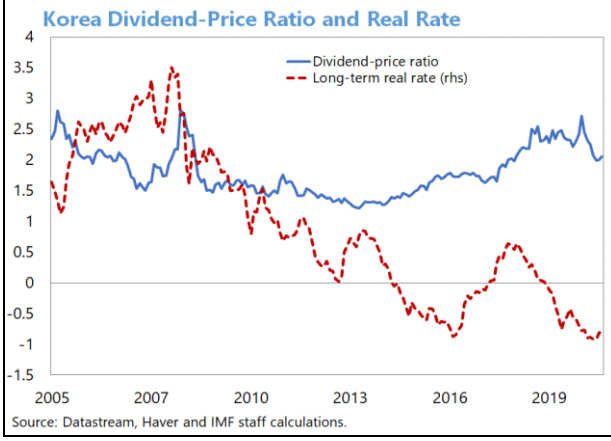
Source: CEIC, Datastream and IMF staff calculations.

Nonetheless, rising risk premia means the Korean equity market trades at a discount compared to peers...



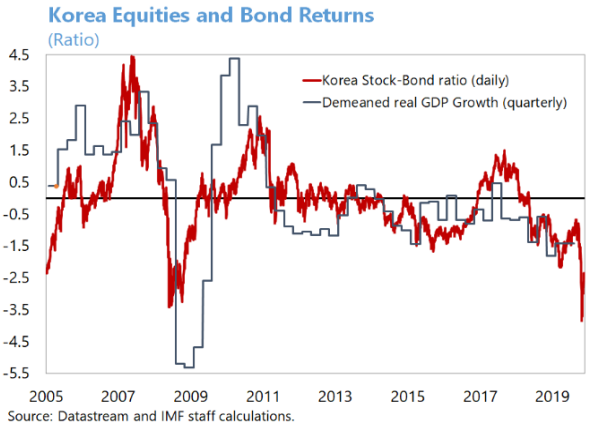
Source: CEIC and IMF staff calculations.

...and reflected by a rising dividend-price ratio despite falling long-term real rates since the financial crisis



Source: Datastream, Haver and IMF staff calculations.

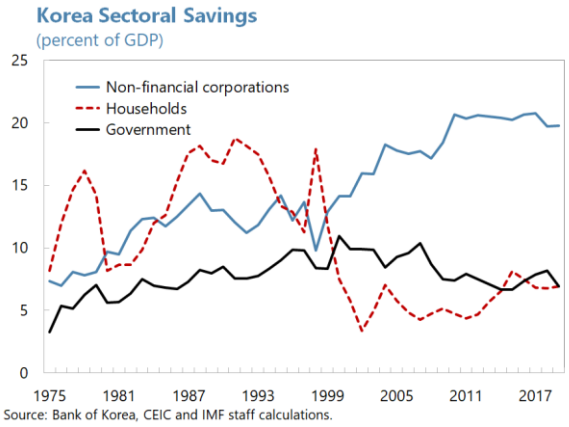
The negative correlation between equities/bonds returns suggests compressed risk premia and flight-to-quality.



Source: Datastream and IMF staff calculations.

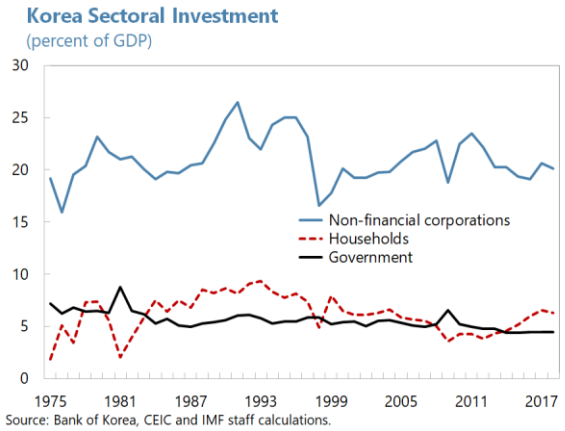
Figure 12. Korea Saving-Investment Dynamics

The rise in the Korean savings rate has been driven by NFCs.



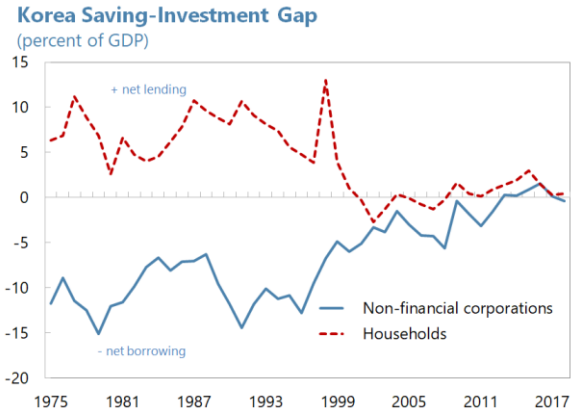
Source: Bank of Korea, CEIC and IMF staff calculations.

However, there has been no corresponding increase in private investment spending.



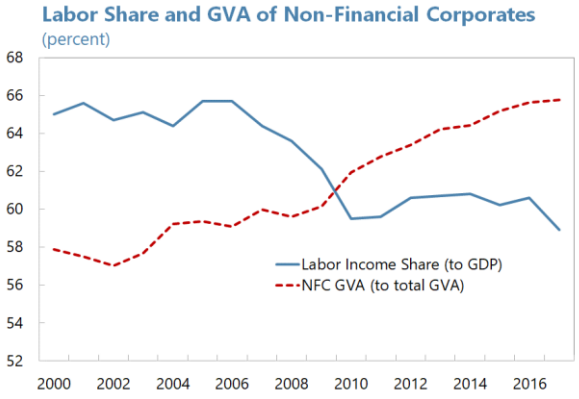
Source: Bank of Korea, CEIC and IMF staff calculations.

As a result, the S-I gap for the HH and NFC corporate sector has steadily moved in positive balance



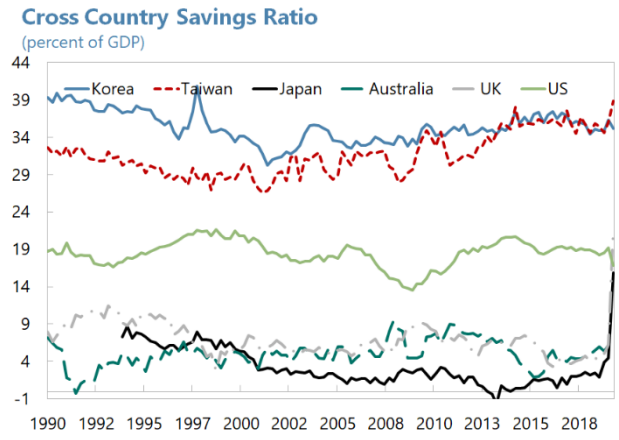
Source: Bank of Korea, CEIC and IMF staff calculations.

During this time income going to labor has fallen, despite growing GVA from NFCs.



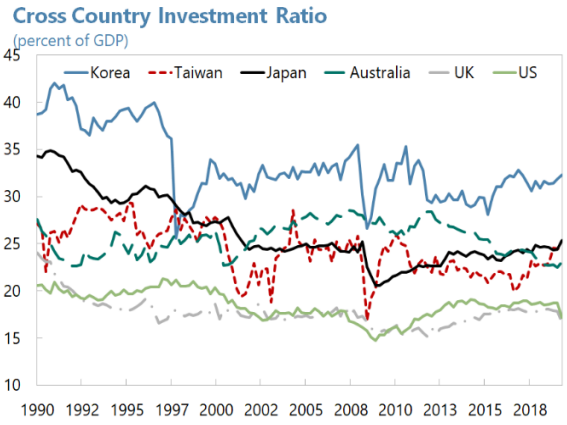
Source: Bank of Korea, CEIC and IMF staff calculations.

However, Korea's savings…



Sources: Haver Analytics and IMF staff calculations.

…and investment ratios remain higher than peers.



Sources: Haver Analytics and IMF staff calculations.

Box 1. Low for Long Interest Rates, Korean Firm Performance and Market Power

The traditional view holds that when long-term rates fall the net present value of future cash flows increases, making it more attractive for firms to invest in productivity-enhancing technologies. Low interest rates therefore have an expansionary effect on the economy through stronger firm productivity growth. However, this view is now being reconsidered. An alternate view suggests that

- Low rates encourage greater concentration in market power of large firms. This is because larger firms are better able to take advantage of low rates than their smaller (and lagging) rivals, since the payoff to borrowing to larger firms is greater.

- Dominance of large corporations impacts aggregate corporate performance via lower productivity. Even if these companies' operations are more productive, they can choke off markets to increase their profits. Together, these factors imply that persistent low rates may act as a drag on overall corporate performance and economic growth.

These issues are particularly relevant in Korea where there is significant firm market concentration and low productivity for smaller firms. Korean micro firm data shows that non-chaebol firms have deleveraged (as measured by the firm debt-to-asset ratio) while much larger chaebol-affiliated firms have taken advantage of the lower borrowing costs to maintain or leverage up. The market capitalization of the largest chaebols has grown; Samsung's market capitalization is now around 30 percent of the KOSPI, up from around 20 percent a decade ago. Firm performance (as measured by ROA) between chaebol and non-chaebol affiliated firms has widened, which in part reflects growing market concentration and rising corporate profits. Using micro balance sheet data from 2008 to 2018 for over 3000 Korean firms the following panel regression is estimated:

$$ROA_{it} = \alpha \cdot ROA_{it-1} + A \cdot firm_{char_{it-1}} + \beta \cdot macro_{financial_{t-1}} + (\beta_7 Firm\ Size * \beta_8 interest\ rate) + \upsilon_{it}$$

The equation relates firm characteristics, including firm size and interest rates, to their performance (ROA). Following Liu, Mian and Sufi (2019) an interaction term is included that interacts changes in interest rates with firm size. A positive value for the interaction term would imply the larger the firm, the greater (more positive) the effect of interest rates on firm ROA. Said differently, the greater the resources available, the stronger the effect of interest rates on firm performance. All coefficients are statistically significant and imply:

$$ROA_{it} = 5.22 + 1.5 \cdot\ operating\ revenue + 0.14 \cdot\ profit\ margin - 3.61 \cdot \frac{net\ debt}{asset} + 0.82 \cdot firm\ size - 0.42 \cdot financial\ conditions + 0.91 \cdot (Firm\ Size * interest\ rate) + \upsilon_{it}$$

- *Firm balance sheet characteristics important*: Profitability is negatively associated with a firm capital structure that carries more debt, and positively with size, turnover and profit margins.
- *Firm size, interest rates and firm performance interact*: The positive coefficient value for the effect of the interaction term implies that the bigger the firm, the greater (more positive) the effect of interest rates on firm performance. This implies that the lower rates are more likely to have benefitted larger firms.

The analysis suggests that persistent low interest have been more beneficial to larger firms, potentially increasing their market power. While falling rates have helped contain corporate debt-at-risk, low interest rates could further weaken small corporate performance, eroding their debt servicing capacities. Smaller corporates and, in particularly SMEs, have seen declining performance while a large share of SME debt is estimated at-risk. Larger corporates have maintained their leverage ratios and seen their performance rise. Moreover, due to smaller firms being the largest source of employment in Korea, further small firm balance sheet weakness would also pose significant indirect risks to household balance sheets.

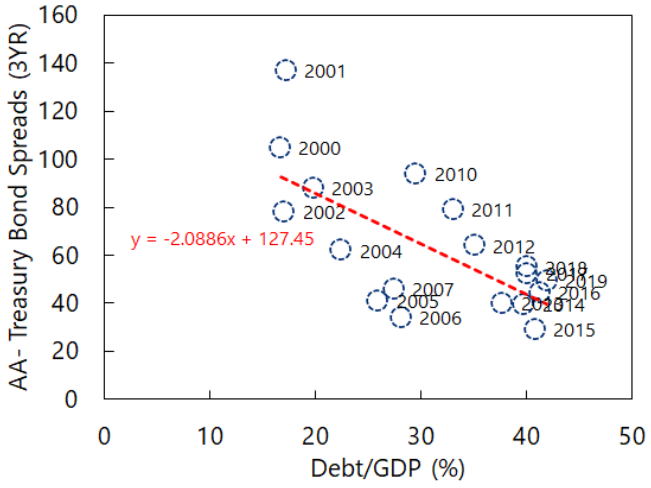
Economic volatility in Korea has declined while aggrgeate savings have risen. With risk-averse agents, the volatility and not just the level of consumption growth matters for precautionary savings decisions and the demand for safe assets, and hence, for equilibrium risk-free real interest rates. The decline in the volatility of GDP and consumption growth after the Asian crisis should in isolation have reduced precautionary savings and demand for safe assets and hence raised real interest rates. Instead, the data suggests that the strongly negative income growth shocks that Korea experienced during the Asian Crisis, which did not permanently impact macro volatility as much as higher moments (i.e. kurtosis), which may have increased Korean's perceived tail risks or level of risk aversion, and therefore their desired savings rate. Kozlowski, Veldkamp and Venkateswaran (2018) and Gourinchas and Rey's (2019) emphasize the relative demand for safe assets in the aftermath of a tail-risk event and/or deleveraging shock.

The negative correlation between Korea bond and equity returns reflects 'flight-to-quality' during periods of slower growth and heightened uncertainty. Negative correlations of equity and bond returns have tended to coincide with sharp increases in implied volatility of assets, which sometimes have overlapped with recessionary periods, representing a hybrid case where both recessionary and financial factors seem to have been at play (Figure 11). The negative correlation also exists in periods of high equity market volatility unrelated to economic recessions, that tend to coincide with heightened perception of risk by market participants in response to increases in global financial instability.

Box 2. Korea Government Bonds and Safety and Liquidity

Private agents value the attributes of government debt and drive down the yield on government bonds relative to other assets when their supply is scarce. The value that investors assign to the liquidity and safety attributes offered by Korea Treasury Bonds (KTBs) (sometimes referred to as the Treasury convenience yield) is high. As a result, the yield on KTBs is low relative to the yield on Korean AA- corporate bonds, which offer less liquidity and safety. The opposite applies when the supply of Treasuries is high (see Krishnamurthy and Vissing-Jorgensen, 2012).

Korea KTB Demand Function



The data for Korea shows that, historically at least, a 1 percent rise in the public debt-to-GDP raised the 3-year KTB rate relative to the riskier corporate bond yield by 2.1 basis points. The small increase in KTB yields relative to riskier assets implies that investors continue to view Korean government bonds as offering safety and liquidity even when their supply increases.

The risk-free rate is low because the neutral rate is low, and the neutral rate is low because of the increasing premium for safety and/or liquidity. Following Krishnamurthy and Vissing-Jorgensen (2012), the convenience yield $(1 + CY_t)$ of the risk-free rate can be decomposed into two parts: one due to liquidity $\left(1 + CY_t^l\right)$ and one to safety $(1 + CY_t^s)$.

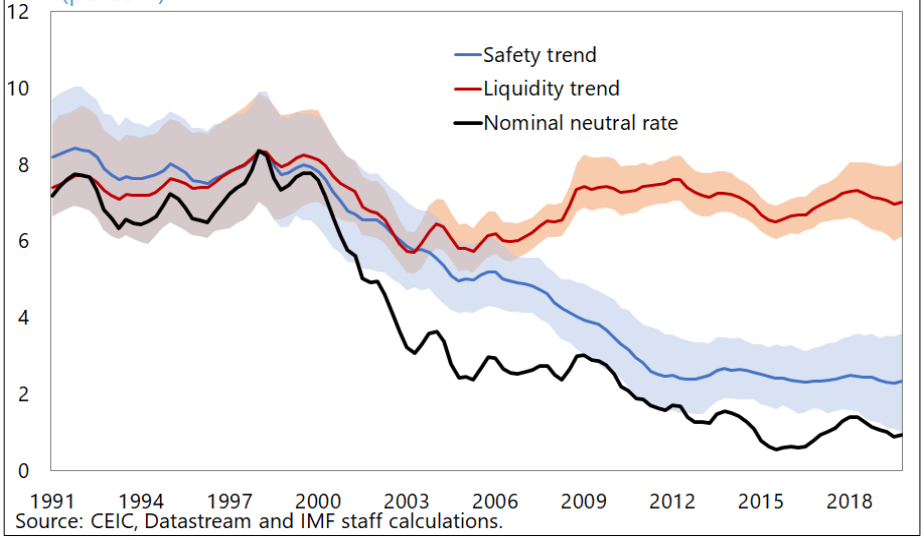
$$E_t[(1 + r_t)(1 + CY_{t+1})M_{t+1}] = 1$$

where M_{t+1} is the stochastic discount factor, $(1 + r_t)$ is the pecuniary return, and $(1 + CY_{t+1})$ is the convenience yield (the liquidity and safety attributes offered by Korean government paper). Therefore, an increase in the convenience yield depresses the safe real rate of return, for a given stochastic discount factor, because investors will be willing to accept a lower pecuniary return in exchange for the higher convenience. In the long run, this implies that trends in the convenience yield may drive trends in neutral rate.

The neutral rate can be decomposed into trends that characterize the convenience and liquidity yields. Del Negro, Giannone, Giannoni and Tambalotti (2017) show how to use a reduced-form common stochastic trends model to decompose the short-term real rate into trends for the components of the convenience yield (safety (*c*) and liquidity (*m*)). The trends are imposed using long-run priors (see Domenico, Lenza and Primiceri 2019).

Safety characteristics are significant in the pricing of Korean securities. Figure 13 shows the neutral rate and its decomposition between trends in the convenience yield for safety and liquidity. The focus is on the secular changes in the convenience yield, as opposed to its level. The estimates for the neutral rate and the levels of both safety and liquidity trends are normalized, so that during the Asian crisis the three series coincide, making the source of the post-1998 decline in the neutral rate more apparent. In interpreting these results, it is the change that matters not the level. The estimates show the nominal neutral rate fell by almost 7 percentage points between 1998 and 2020. Approximately 5.7 percentage point of this decline is attributable to an increase in the convenience yield and is precisely estimated. The implication is a shortage of safe assets, relative to assets that are less safe, has resulted in a decline in

Figure 13. Korea Neutral Rate Decomposition: Safety and Liquidity Trends
(percent)



Source: CEIC, Datastream and IMF staff calculations.

the risk-free rate. Pierre-Gourinchas and Hélène (2019) reached similar conclusions for the U.S. based on the determinants of the consumption–wealth ratio.

These findings are consistent with the liquidity and safety attributes of Korean government debt. Korea's high savings rate coupled with strong demand for Korean government paper appear to have influenced the neutral rate. These findings are also in line with the savings glut hypothesis that emphasizes the shortage of safe assets as a possible source of secular stagnation (see Summers, 2014). A way to stimulate economic activity would be to issue more positive yielding long-term safe assets to fill the savings-investment gap. The determinants of the savings-investment balance for the Korean neutral rate are examined next.

II. Korea Savings-Investment Determinants and Neutral Interest Rate

A second class of explanations for the low interest rate, linked to the convenience yield hypothesis, has focused on factors that can be expected to shift desired saving and investment. Saving-investment imbalances do not directly influence market rates. Their impact on the market interest rate is indirect, through the interaction between central bank and private sector agents' decisions. By identifying the evolution of real interest rates with saving and investment determinants, the implicit assumption is that the central bank and financial market participants can roughly track the evolution of the natural real rate over time.

The neutral rate reflects the price of loanable funds resulting from equilibrium, or structural, savings and investment decisions. As a well as financial factors, the savings-investment balance is affected by several structural factors. The Ramsay growth model can be used to illustrate the importance of these factors for the equilibrium interest rate. The optimal intertemporal choice of a consumer by the Euler equation is expressed as

$$c_t^{-1/\sigma} = E_t\left[\frac{1+r_{t+1}}{1+\rho}\right] c_{t+1}^{-1/\sigma}$$

where consumption c is a decreasing function of the real interest rate r adjusted by the elasticity of intertemporal substitution σ and the household's discount rate, ρ. A negative relationship between consumption and real interest rates underpins the Ramsey growth model. In steady state with population growth n and no uncertainty the equilibrium rate can be expressed as

$$r^* = {}^1\!/_\sigma \cdot g_c + \eta + \rho$$

Equation (9) shows that equilibrium interest rate, which also corresponds to the neutral rate, moves (*i*) one-for-one with the discount rate (ρ) and (*ii*) population growth (n) and (*iii*) also depends on the growth rate in per capita consumption g_c. This modified golden rule pins down return on capital in line with trend growth, demographics, and discount rate. In a risk-neutral world $\sigma = 1$ and $\rho = 0$.

- Demographics and aging (n). Conceptually, the link from working age population share to the neutral rate is ambiguous. According to the life cycle hypothesis, consumption remains relatively stable across individuals' lives, but income is earned during working age, leading to higher individual saving rates during that phase of life. Under the assumption of a well-functioning

financial system that allows individuals to save, this leads to a link from the share of working age population and life expectancy, to desired saving, and in turn, the neutral rate.[6]

Demographic developments in Korea stand out in comparison to the other sample countries. The share of Korea's working age population has been high, in contrast to most other advanced economies. The increase reflects high population growth and fertility in the 1970s and 1980s. Korea's demographics are projected to turn in the coming years, with UN projections suggesting that the working age population will decline, as fertility has fallen below Japan levels. However, life expectancy in Korea has also risen in comparison with other advanced economies. The link from life expectancy to the neutral rate is conceptually negative; an increase in life expectancy leads an individual to save more during working age, hence pushing up desired saving of a given working age population, all else equal.

While it is predicted that an aging population leads to a higher savings supply, which should increase capital accumulation—that is, investment, and hence reduced profitability—the returns on investment in Korea have remained stable as the risk-free rate has fallen resulting in a wider capital risk premia.

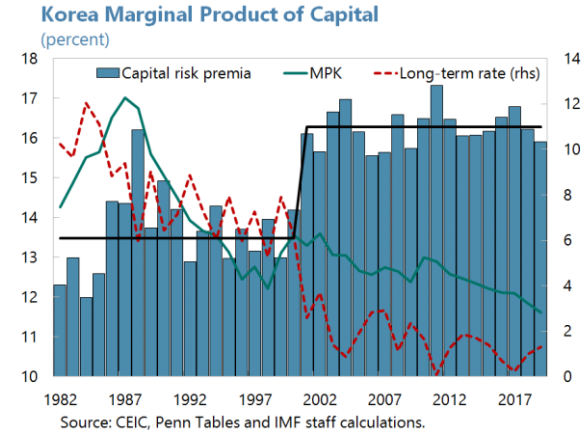
- Real GDP and productivity growth (g_c). Theory proposes a link between real interest rates and growth, either in income, consumption, or productivity. The Euler equation suggests the neutral rate depends on the intertemporal elasticity of substitution and consumption growth, and, by extension, GDP or productivity growth. High growth suggests a higher return to investment, hence bidding up the interest rate given available savings. Korean real growth rates were significantly higher compared to other advanced economies in the pre-Asian crisis, but the differences have since narrowed, reflecting the trend toward economic convergence at a higher income level that Korea has experienced. Following the Asian crisis there has been a downward shift in trend growth. Two hysteresis mechanisms can have led to protracted declines in potential output growth and neutral rates following the crisis. First, deleveraging in the wake of the Asian crisis reduced post-crisis investment demand and hence growth and real interest rates. Second, the sharp rise in unemployment and fall in labor market participation may have imbued hysteresis into the labor market.

The real rate and savings-investment determinants appear to have trended together since the early 1980s. Figure 14 plots the hypothesized associations between real interest rates and saving-investment determinants. The sample covers the last 40 years, which enables an examination of multiple historical trends in real interest rates. Korea's structural excess saving is reflected in the trend-decline in real interest rates and the current account. The Ramsay model predicts that in the presence of demographic aging and a shrinking labor supply force ($n < 0$), that (i) capital per worker rises, which eventually (ii) results in downward pressure on the marginal product of capital that (iii) in turn lowers capital demand and productivity, (iv) putting downward pressure on the real neutral rate. Korea data shows that since the early 1980s the old age

[6] The increase in life expectancy can have temporarily opposite effects, as unexpectedly living longer will require more consumption and hence less savings.

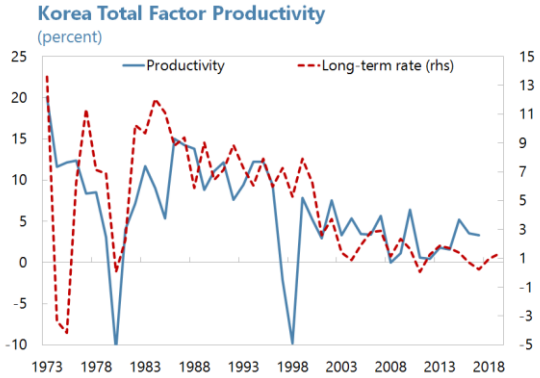
Figure 14. Korea Saving-Investment Determinants for Real Interest Rates

Since the early 1980s Korea's MPK has fallen, albeit proportionally less than the real rate...



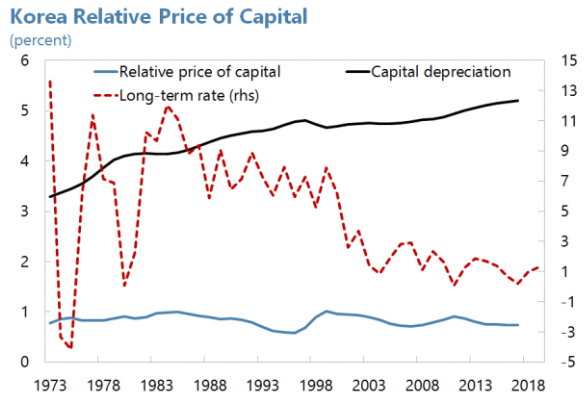
Source: CEIC, Penn Tables and IMF staff calculations.

...which is also reflected in a declining productivity growth.



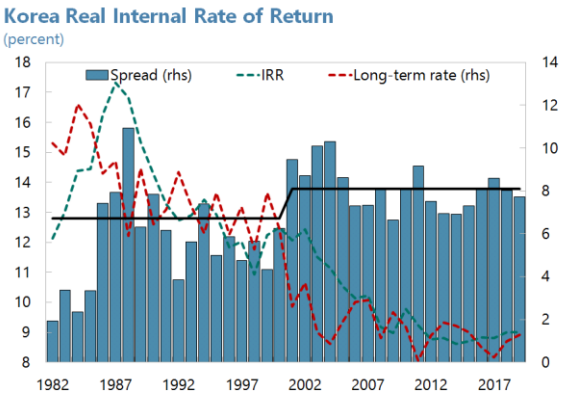
Source: CEIC, Penn Tables and IMF staff calculations.

However, the relative price of capital has remained stable...



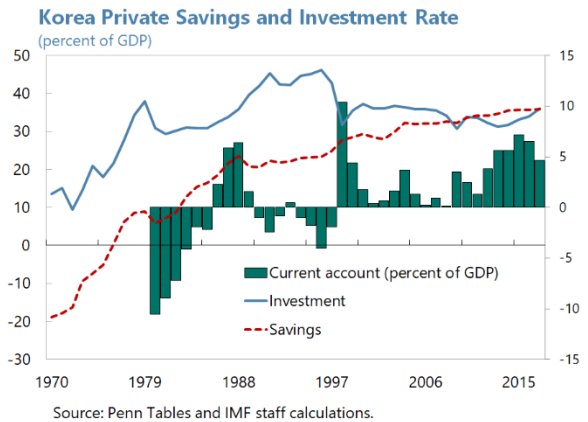
Source: CEIC, Penn Tables and IMF staff calculations.

...and the returns on investment relative to the risk-free real rate have remained stable since the early 1990s



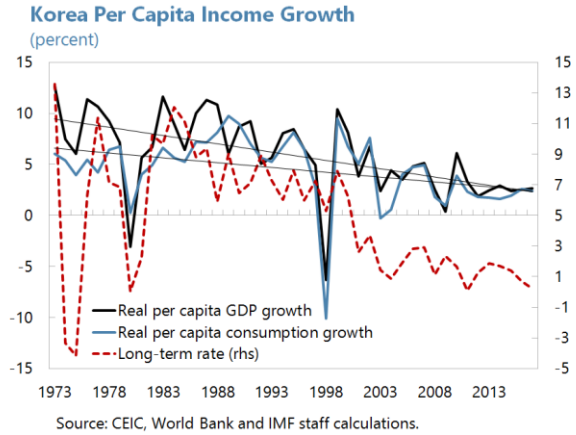
Source: CEIC, World Bank and IMF staff calculations.

The savings-investment balance has tilted toward the former since the Asian crisis in 1997/98.



Source: Penn Tables and IMF staff calculations.

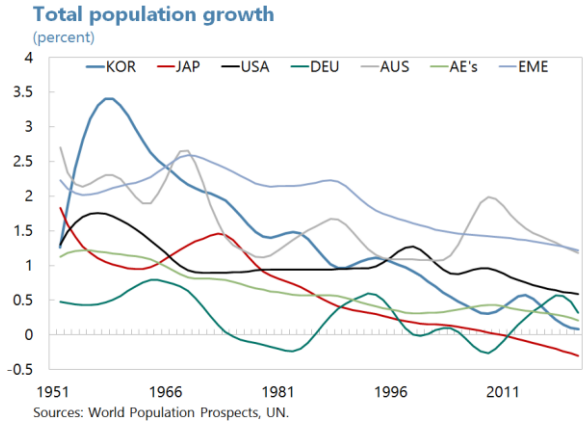
Per capital GDP and consumption growth has fallen and become less volatile.



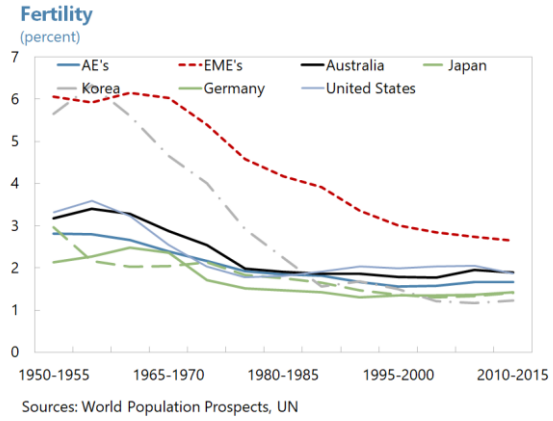
Source: CEIC, World Bank and IMF staff calculations.

Figure 15. Korea Demographics and Real Interest Rates

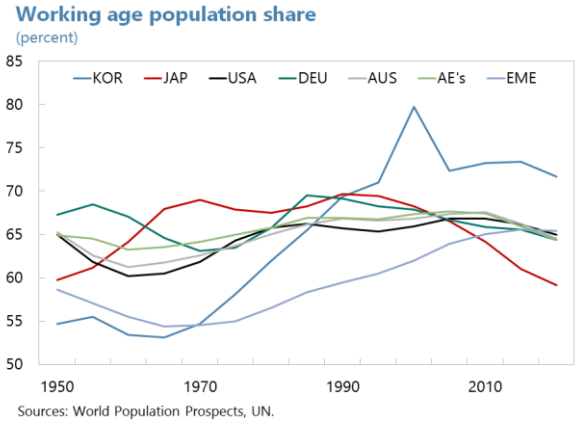
Since the early 1980s Korea's MPK has fallen alongisde the real rate…



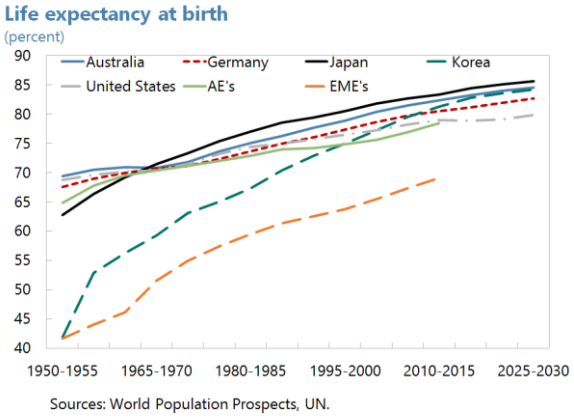
…which is also reflected in a declining productivity growth.



However, the relative price of capital has remained stable…

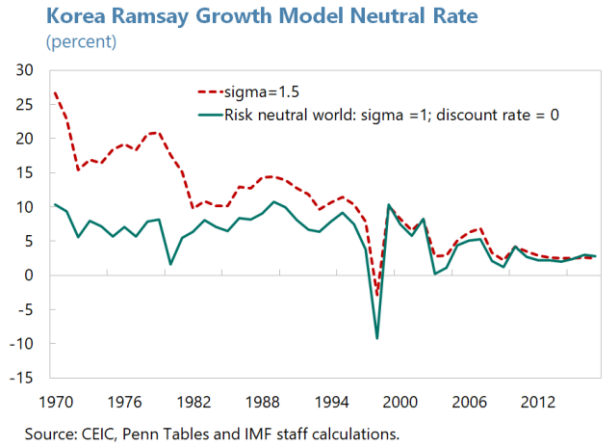


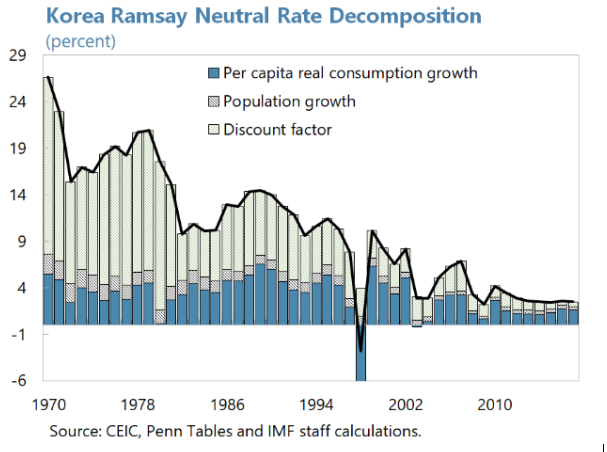
…and the returns on investment relative to the risk-free real rate have remained stable since the early 1990s.



dependency ratio, marginal product of capital, and real rate have trended down. The spread between the real interest rate and marginal product of capital, a proxy for the capital risk premium, has widened, particularly since the Asian crisis, while productivity has declined. Together, these patterns are consistent with the predictions from the Ramsay growth model. The marginal product of capital should, in principle, be identical to the neutral rate, as it incorporates all saving-investment factors' influences. Its widening has been attributed to increased risk aversion (Farhi and Gourio, 2019). Unlike other advanced countries, the price of capital has remained relatively stable in Korea and can therefore be ruled out as an explanation for the rise in the non-financial corporate savings rate. Finally, as Korean income has converged to advanced economy levels, real GDP and consumption per capita growth has trended down and become less volatile, which has not necessarily led to a decline in macro-wide precautionary saving.

Figure 16. Korea Demographics and Real Interest Rates





The Ramsay growth model suggests that demographics and fluctuations in per capita growth have become increasingly important drivers of Korea's neutral rate. The modified Ramsay golden rule (equation 2) pins down return on capital (neutral rate) in line with trend growth, demographics, and discount rate, and is measured beyond typical business cycle frequencies. The estimates show that there has been a secular decline in the neutral rate, which accelerated following the Asian crisis. Second, capital consumption and population growth have become increasingly important determinants of the Korean neutral rate over the last four decades. Again, these trends accelerated following the Asian crisis in 1997/98. The convergence in the neutral rate to an equilibrium rate implied by a risk-neutral world has been driven by a progressively declining discount rate, implying agents placing greater weight on what happen in the future. This is consistent with agents placing a greater emphasis on safety considerations in their economic decision making.

The Korea neutral rate is re-estimated to allow for a broader dataset to account for these various Ramsay growth model structural forces on the real neutral rate. The model accounts for (i) productivity via earnings growth and output per worker; (ii) labor market and demographics by including a measure of the working age-population ratio and unemployment and; (iii) explicitly model domestic savings by accounting for non-oil current account dynamics. The model is based on a modified version of the framework in Williams, Abdih and Kopp (2020), adjusted to account for Korea's economic characteristics. The following equations are added to the baseline Laubach-Williams model:

$$(\pi_t - \pi_t^*) = \beta_2(\pi_{t-1} - \pi_t^*) - \vartheta_2(y_t - y_t^*) - \vartheta_3 lpg_t^* + \varepsilon_{2t} \quad \text{(Phillips curve)}$$

$$y_t^* = lfg_t^* + lpg_t^* \quad \text{(Trend GDP growth)}$$

$$U_t - U_t^* = \beta_1(y_t - y_t^*) - \beta_2(y_{t-1} - y_{t-1}^*) + \varepsilon_{4t} \quad \text{(Labor market)}$$

$$w_t - (\pi_t^* + lpg_t^*) = \vartheta_1(y_t - y_t^*) + \varepsilon_{5t} \quad \text{(Wage dynamics)}$$

$$(cab_t - cab_t^*) = \beta_1(y_t - y_t^*) + \beta_1(y_t^{ROW} - y_t^{*\,ROW}) + \varepsilon_{2t} \quad \text{(Current account dynamics)}$$

where U_t is the unemployment rate, w_t manufacturing wages, lfg_t^* is trend force labor growth, lpg_t^* trend labor productivity, cab_t the non-oil current account balance and π_t^* the Bank of Korea's inflation target. The model also includes corporate bond spreads to account for shifts in risk aversion. Due to data limitations the model is estimated from 1999Q1 to 2020Q2.

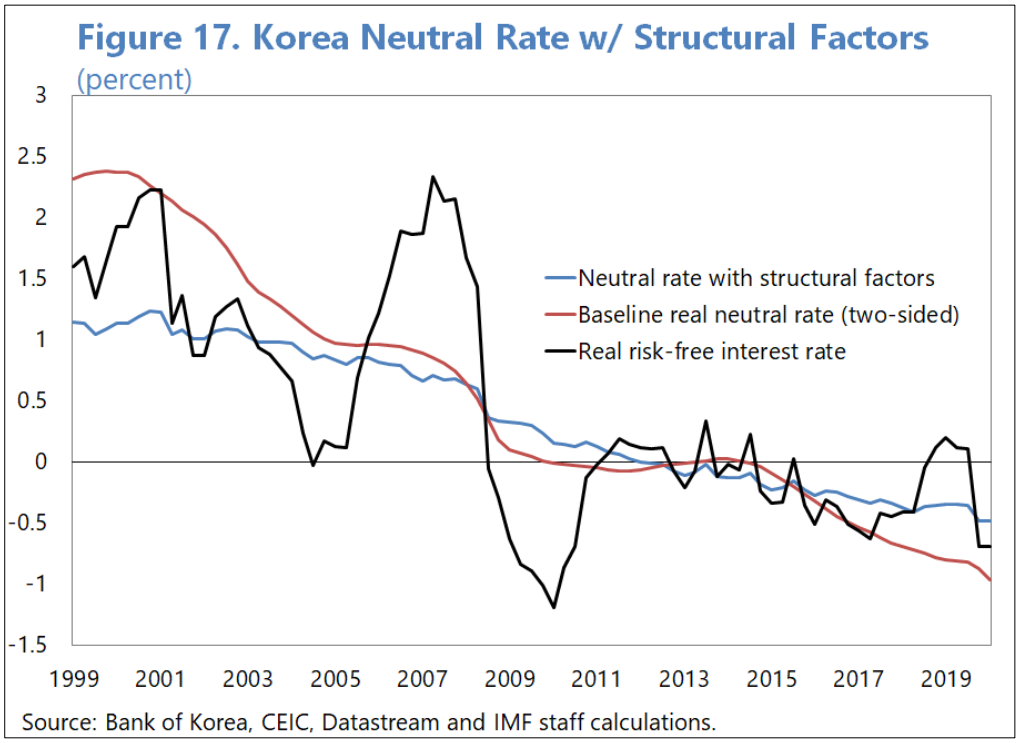
- Trend growth rate equation: This potential growth rate is determined by trend labor force growth (lfg_t^*) and trend labor productivity (lpg_t^*). The equation should help capture the effect of Korea's aging demographics on potential growth, and eventually the real neutral rate.

- Labor market equation: Labor market hysteresis may have contributed to the particularly sharp declines in growth and productivity following the Asian Crisis. The inclusion of wages also allows a direct measure of trend productivity.

- Nominal wage equation: Over the long-run wages are assumed to be a function of trend inflation and trend labor productivity growth. The equation should help pin down fluctuations in productivity growth.

- Current account equation: The model incorporates a relationship between the business cycle and the non-oil current account position (relative to its trend position). Where domestic demand outstrips supply there will be downward pressure on the current account relative to its trend value. Similarly, the stronger the cyclical position of trading partners the more positive will be the current account. This encompasses the view that the non-oil current account surplus in countries like Korea grew from the late 1990s to just before the Great Recession, and the globally low rates that accompanied them, were the result of a massive shift in desired saving in Asian countries following. This glut did not translate into a generic demand for assets, but into a specific one for safe (and liquid) assets. This shortage of safe assets is related to the saving glut hypothesis first proposed by Bernanke (2005). By including the current account and global growth the model also implicitly incorporates any cross-border effects (à la global saving glut) to the extent that the shifts in saving and investment can be traced back to changes in the current account.

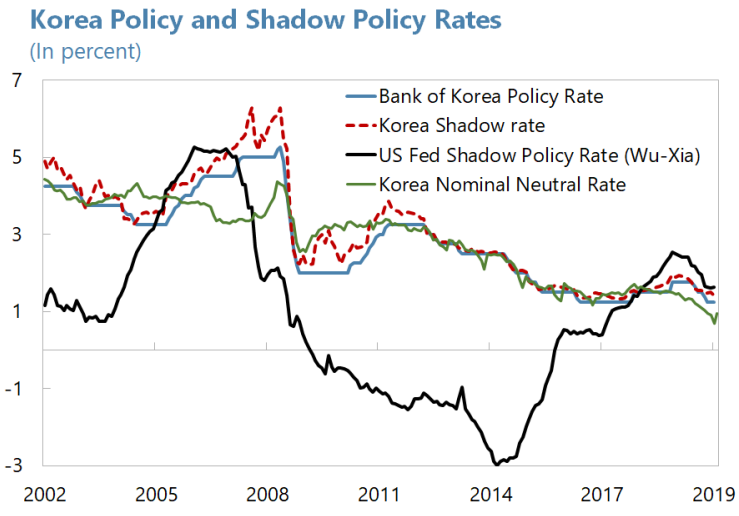
Encompassing a broader set of savings-investment determinants suggests Korea's neutral rate may be currently somewhat less negative than indicated by an equilibrium determined purely by inflation and the output gap. Since the Asian crisis, the neutral rate with structural factors was below the Laubach-Williams estimate (Figure 17). They closely tracked each other in the years following the Global Crisis but diverged from 2017. Based on the most recent estimates, the neutral rates differ by around 0.5 percent. This suggests that from 2017 onward, the downward pressure on the neutral rate from subdued inflation and a persistent output gap was partly offset by structural factors, namely a narrowing current account surplus and a small pickup in productivity). The narrowing current account surplus implied a smaller shortfall in domestic demand, thus pushing up the neutral rate.



NEUTRAL RATE AND IMPLICATIONS FOR MONETARY POLICY

The low and declining neutral rate of interest in Korea has important implications for the conduct and effectiveness of monetary policy. All else equal, a low neutral rate suggests that episodes of monetary policy being constrained at the effective lower bound are likely to be more frequent and longer lasting than in the past. Under these circumstances, more frequent use of unconventional policy measures, such as quantitative easing, may be warranted.

Wu (2017) suggests that a negative neutral rate could be reflecting a shadow policy rate. Nominal interest rates are subject to a physical lower bound. Although real interest rates can be arbitrarily negative in theory, the lower bound on nominal rates also constrains real rates, given inflation expectations. Unlike the U.S, however, the Korean shadow policy rate has closely followed the actual policy rate. This reflects lesser use of quantiative easing tools by the Bank of Korea compared to the Federal Reserve.

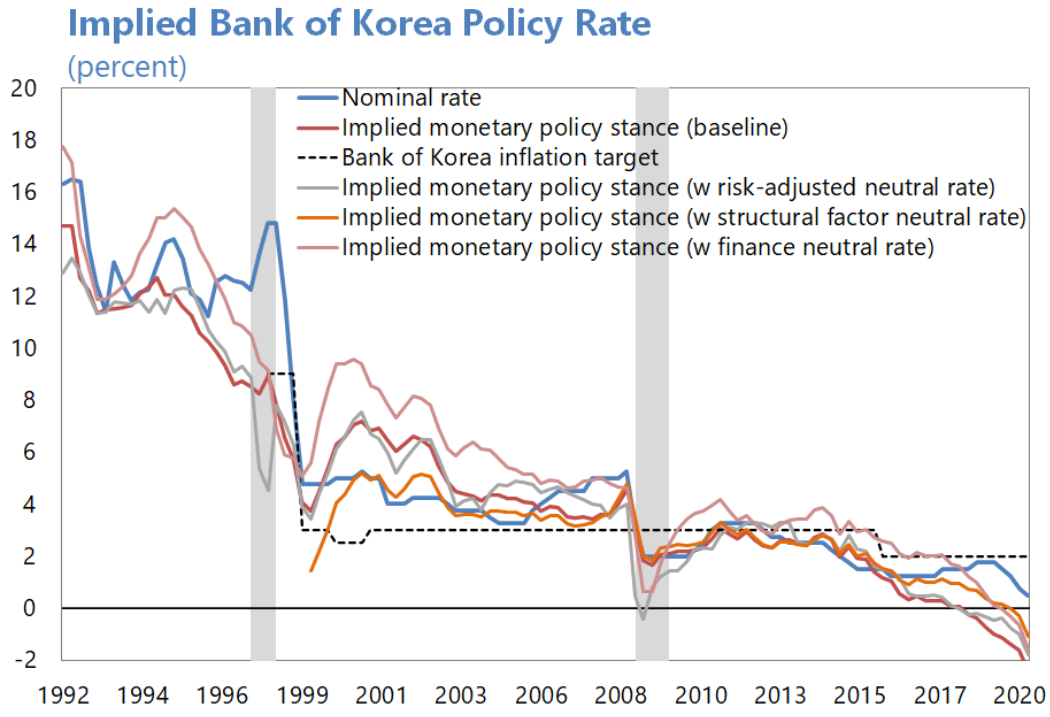


The neutral rate has influenced the Bank of Korea's monetary policy stance. As an approximate guide to the stance of Bank of Korea monetary policy, the Balanced Approach Taylor rule approximation is set as a function of the natural interest rate, expected inflation, and deviations from inflation gap and the output gap. The equation sets the neutral rate (r_t^*) to be an anchor for monetary policy, while the coefficients are reverse engineered to give a series that most closely approximates the actual Bank of Korea policy stance.

$$i_t = r_t^* + \pi_{t+1}^e + 0.75(\pi_t - \pi_t^*) + 0.25(y_t - y_t^*)$$

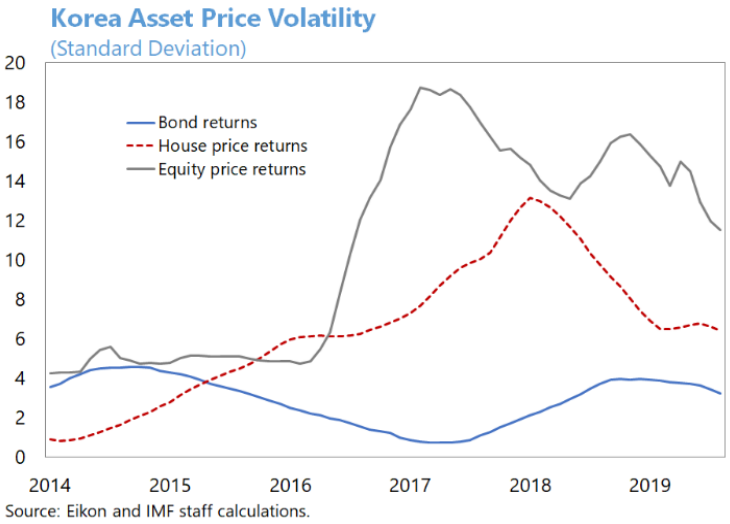
Korea data over the last 20 years implies that the nominal short-term rate has not, on average, fully offset inflation. A Taylor rule coefficient on inflation less than one raises the risk the economy can get stuck in a negative (sometimes unstable) equilibrium, in the sense that a surprise increase (fall) in the rate of inflation results in insufficient tightening (loosening). In many economic models, especially those with a limited role for rational expectations, an insufficiently aggressive monetary policy can result in a more unstable (some explosive) root in the difference equation describing the model's dynamics. This results in time paths for output and inflation that can depart arbitrarily (sometimes far) from its target value, and output can deviate (arbitrarily) far from potential. Korean data since 2012 shows a persistent output gap and inflation (on average) persistently below target.

Following the Global Financial Crisis Bank of Korea monetary policy rate moved in phase with an implied Taylor rule closely anchored on Laubach-Williams neutral rate. From early-2017, reflecting a slowing real sector and credit growth, the policy rates implied under all types of neutral rates progressively decline and begin to converge. Based on the most recent data, a Taylor rule based on historical values and the current level of the neutral rate suggests that monetary policy is restricted by the zero-lower bound.



Source: CEIC, Haver and IMF staff calculations.

Increased asset price volatility in recent years, partly due to a compression in the neutral rate, also further complicates the monetary stabilization task. Adam, Pfaeuti and Reinelt (2020) show that asset price volatility has risen across advanced economies, in part due to the fall in neutral rates. In Korea the significant fall in the neutral rate since 2015 has coincided with a rise in asset return volatility. Together this implies that, if sustained going forward, collateral constraints may become more easily binding, periodically increasing the risk of corporate and private defaults caused by investment booms and busts triggered by excessive optimism/pessimism in asset prices. To the extent that the observed volatility increase in asset returns fails to be justified by fundamental factors, it will exacerbate the lower bound problem for the Bank of Korea's monetary policy. Monetary policy is then not only confronted with a lower nominal risk-free rate on average but must also vary the risk-free short-term nominal rate more to counteract the adverse effects of increased asset price volatility, e.g., the investment booms associated with asset price booms. The effective lower bound on nominal rates will thus become a more stringent constraint. This would emphasize a greater role for macroprudential policies. Moreover, given the link between risk premia and the neutral rate in Korea, prudential intervention will also put upward pressure on risk free rates simply as a by-product of containing systemic risk in financial markets.



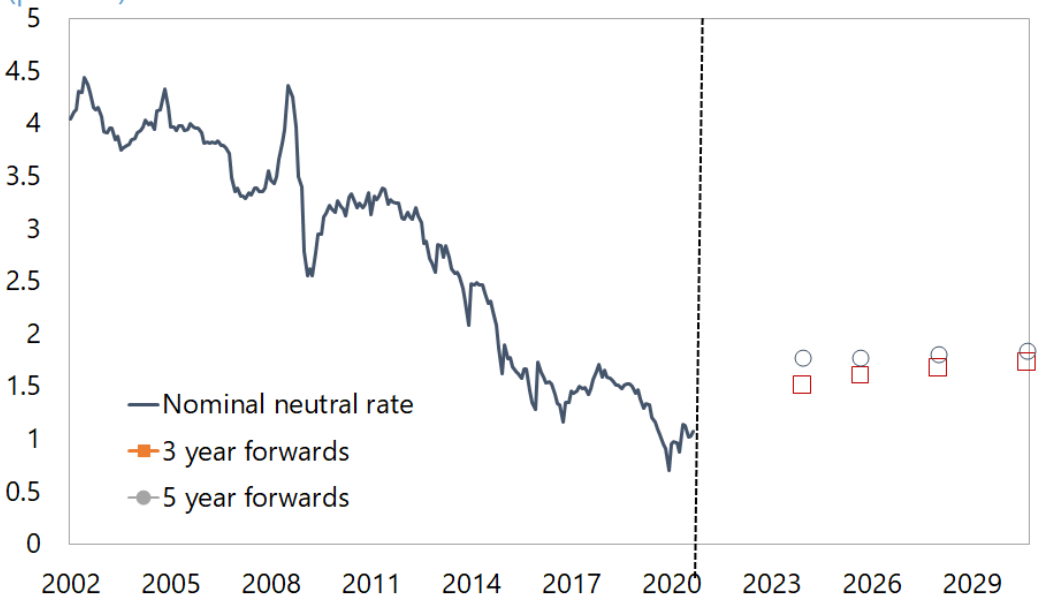
Source: Eikon and IMF staff calculations.

SUMMARY AND POLICY IMPLICATIONS

The Korean neutral rate has fallen over the last several decades and is currently in negative territory. A rotation in demographics, declining productivity and slower trend growth have all played some role in determining the neutral rate of interest. The rise in savings partly reflects a wider capital risk premium and a demand for convenience yield driven by liquidity and safety concerns and a demographic rotation. This implies that, on average across the business cycle, equilibration of private-sector saving, and private-sector investment may require a very low real rate of interest over the medium-term. In the years following the Asian or Global Financial Crises there were few signs of a quick return to post-crisis neutral rate trends; recent evidence from the Jorda, Singh and Taylor (2020) show that, historically at least, real interest rates also stay depressed years following a pandemic. Korea data also shows that the dynamics outlined may not only be a safe asset story, with expected riskier (equity) returns also having fallen.

Korea Nominal Neutral Rate and Implied Market Projection

(percent)



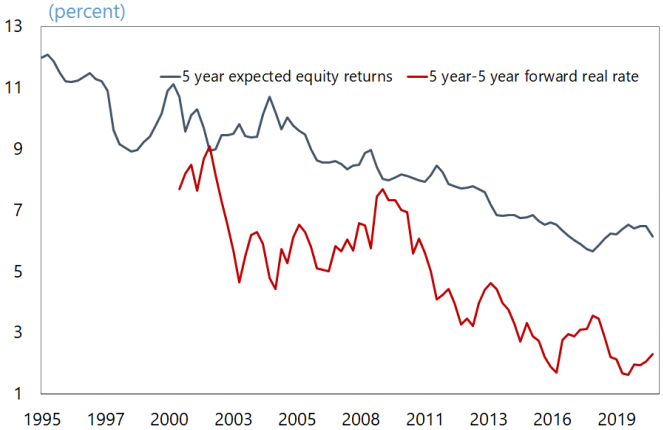
Source: Datastream and IMF staff calculations.

Note: Nominal neutral rate is based on the real neutral rate with structural factors in Figure 17.

Markets are pricing low rates over the long-term, however, this need not be a foregone conclusion. The conduct of monetary policy and the role of financial factors plays a role. The above trend credit growth and/or significant compression in bond risk premia in the post Global Crisis years before COVID, have put upward pressure on the neutral rate. Second, policy actions today can potentially narrow policy options tomorrow. This occurs through two ways. In a low inflation environment, the Bank of Korea, by leaning relatively modestly against the build-up of financial imbalances but easing aggressively during financial crises, has imparted a downward bias to nominal and real interest rates. In addition, quantitative easing measures that compress bond risk premia are likely to exert upward pressure on neutral rates, all else equal. Together, they raise questions about the notion of a neutral rate that is independent of policy.

Korea Expected Equity Returns

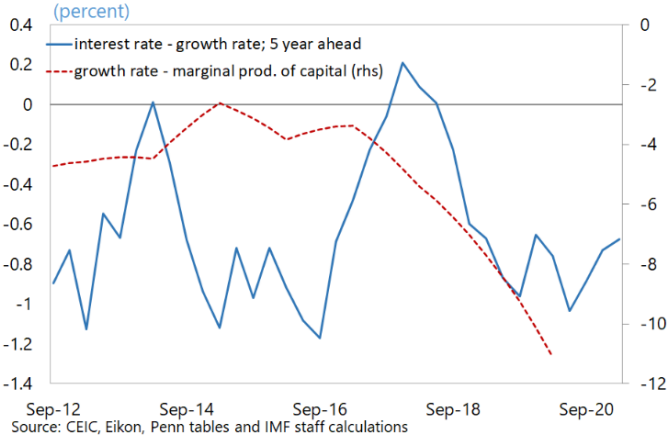
(percent)



Source: Datastream and IMF staff calculations.

Korea 5-Year Expected Interest-Growth Gap (r-g)

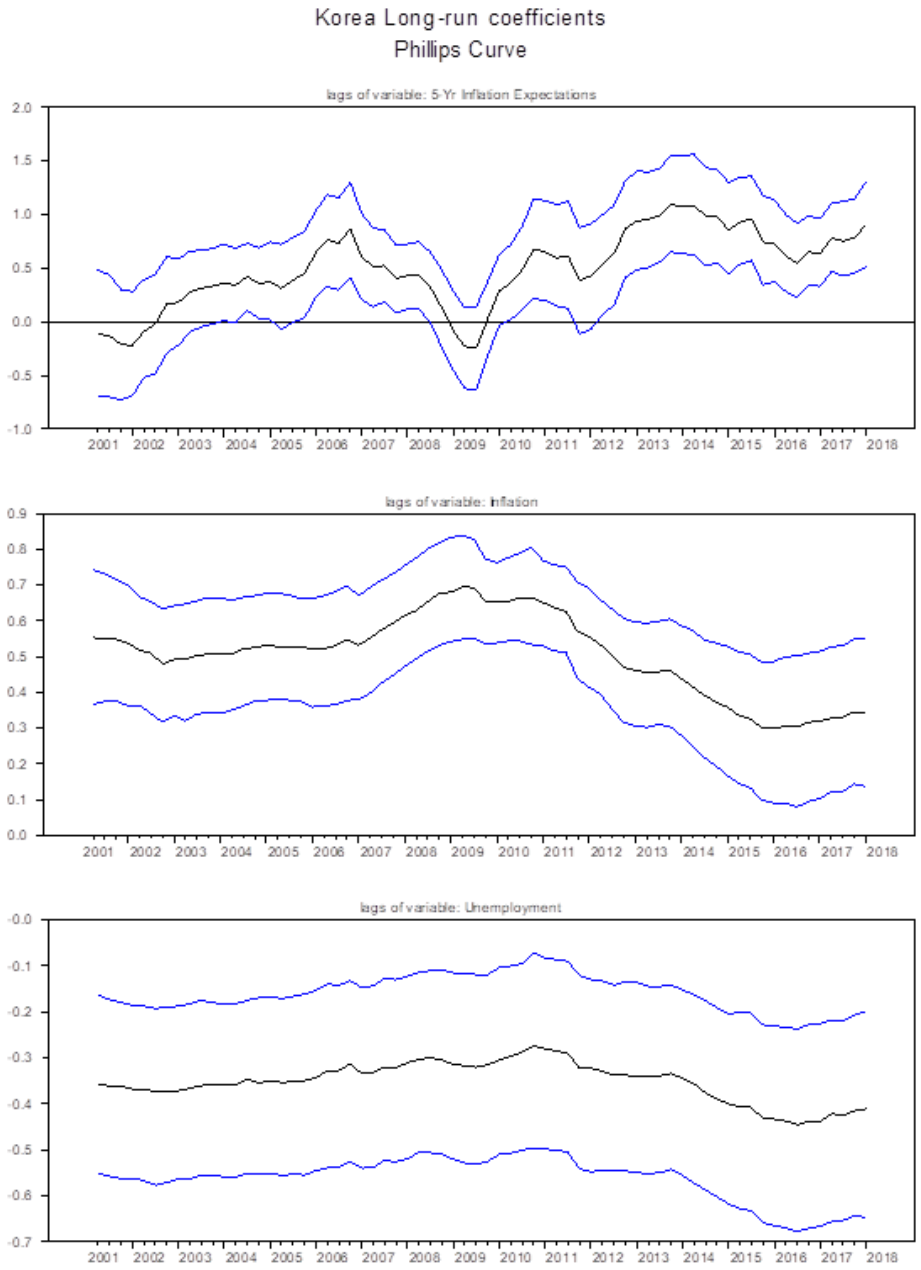
(percent)



Source: CEIC, Eikon, Penn tables and IMF staff calculations

Structural measures that reduce saving or promote investment are desirable to regain more monetary policy space and fiscal policy will likely have to play a more prominent stabilization role than monetary policy going forward. Clearly regulatory policies that encourage investment without sacrificing vital social objectives could be beneficial. Korea's high savings rate coupled with strong demand for Korean government paper, driven in part by aging demographic dynamics, are in line with the savings glut hypothesis that emphasizes the shortage of safe assets as a possible source of secular stagnation. A way to stimulate economic activity and raise the neutral rate would be to issue more positive yielding long-term safe assets for productive investment, such as in climate change mitigation, digitalization, or deepening the social safety net to fill the savings-investment gap. Markets projects long-term rates risk-free will remain below projected growth rates over the medium-term, while the marginal product of capital currently remains above growth rates, together providing an incentive for investment spending.

Figure A. Philipps Curve Coefficients



References

Akinci, O., G. Benigno, M. Del Negro, and A. Queralto, 2020, 'The Financial (In)Stability Real Interest Rate, R**', Federal Reserve Bank of New York Staff Reports, No. 946

Adam, K., O. Pfaeuti and T. Reinelt, 2020, 'Falling Natural Rates, Rising Housing Volatility and the Optimal Inflation Target', mimeo.

Bernanke, B. S., 2005, 'The Global Saving Glut and the U.S. Current Account Deficit', Remarks at Sandridge Lecture, Virginia Association of Economists, Richmond, Virginia.

Borio, C. & P. Disyatat & P Rungcharoenkitkul, 2019, 'What anchors for the natural rate of interest?' BIS Working Papers 777, Bank for International Settlements.

Caballero, R. J., Farhi, E., and Gourinchas, P.-O., 2017, The Safe Assets Shortage Conundrum. Journal of Economic Perspectives, 31(3):29-46

Curdia, V., and M. Woodford, 2016, 'Credit Frictions and Optimal Monetary Policy', Journal of Monetary Economics, vol. 84, pp. 30–65.

Del Negro, M., D. Giannone, M. P. Giannoni, and A. Tambalotti, 2017, Safety, Liquidity, and the Natural Rate of Interest. Brookings Papers on Economic Activity, 48 (1(Spring)): 235–316.

Eggertsson, G.. B. and P. R. Krugman, 2012, 'Debt, Deleveraging, and the Liquidity Trap: A Fisher-Minsky-Koo Approach', Quarterly Journal of Economics, 127(3): 1469–1513.

Giannone, D., M. Lenza and G. E. Primiceri, 2019, 'Priors for the Long Run', Journal of the American Statistical Association, Taylor & Francis Journals, vol. 114(526), pages 565–580, April.

Farhi, E. and F. Gourio, 2018, 'Accounting for Macro-Finance Trends: Market Power, Intangibles and Risk Premia', Brookings Papers on Economic Activity Fall: 147–250

Hakkio, C. S. and L. Smith, 2017, 'Bond Premiums and the Natural Real Rate of Interest', Economic Review, Federal Reserve Bank of Kansas City, issue Q I, pages 5–39.

Hamilton, J. D., E. S. Harris, J. Hatzius and K. D. West, 2015, The Equilibrium Real Funds Rate: Past, Present and Future, NBER Working Paper No. 21476.

Gourinchas, O. and R. Hélène, 2019, 'Global Real Rates: A Secular Approach', BIS Working Paper No. 793.

Holston, Laubach, and Williams, 2017, "Measuring the Natural Rate of Interest: International Trends and Determinants," *Journal of International Economics* 108, supplement 1 (May): S39–S75.

Juselius, M. & C. Borio & P. Disyatat & M. Drehmann, 2017, 'Monetary Policy, the Financial Cycle, and Ultra-Low Interest Rates', International Journal of Central Banking, International Journal of Central Banking, vol. 13(3), pages 55–89, September.

Kim, D. H and J. H. Wright, 2005, 'An Arbitrage-Free Three-Factor Term Structure Model and the Recent Behavior of Long-Term Yields and Distant-Horizon Forward Rates', Finance and Discussion Papers, Federal Reserve Board, 2005-33.

Kozlowski, J., L. Veldkamp and V. Venkateswaran, 2018, 'The Tail that Keeps the Riskless Rate Low', NBER Working Paper No. 24362.

Laubach, Thomas and John C. Williams, 2003, Measuring the Natural Rate of Interest. The Review of Economics and Statistics, 85(4).

Lubik, Thomas A. And Christian Matthes, 2015, Calculating the Natural Rate of Interest: A Comparison of Two Alternative Approaches. Economic Brief EB15-10, Federal Reserve Bank of Richmond.

Mian, A. & L. Straub & A. Sufi, 2020, 'Indebted Demand', NBER Working Papers 26940.

Jorda, Oscar., Schularick, Maurice., and Taylor, Alan. M., 2016, Macro Financial History and the New Business Cycle Facts. In NBER Macroeconomics Annual 2016, Volume 31, NBER Chapters, pages 213{263. National Bureau of Economic Research, Inc.

Jorda, Oscar., Knoll, K., Kuvshinov, D., Schularick, Maurice., and Taylor, A. M., 2017, The Rate of Return on Everything, 1870{2015. Working Paper Series 2017-25, Federal Reserve Bank of San Francisco.

Jorda, Oscar Taylor, Sanjay R. Singh and Alan. M., 2020, 'The Long-Run Effects of Monetary Policy', Federal Reserve Bank of San Francisco, Working Paper 2020–01.

Krishnamurthy, Arvind and A. Vissing-Jorgensen, 2012,'The Aggregate Demand for Treasury Debt', Journal of Political Economy, 120(2):, 233–267

Liu, E., A. Mian, A. Sufi, 2019, 'Low Interest Rates, Market Power, and Productivity Growth', NBER Working Paper No. 25505.

Miranda-Agrippino, S. and R. Hélène Rey, 2020, 'The Global Financial Cycle after Lehman', AEA Papers and Proceedings, 110: 523–28.

Rungcharoenkitkul, R. & C. Borio & P. Disyatat, 2019, 'Monetary policy hysteresis and the financial cycle," BIS Working Papers 817, Bank for International Settlements.

Rungcharoenkitkul, R., 2020, 'R-star Decline and Monetary Hysteresis', SUERF Policy Note, Issue No. 137.

Smets, F., and R. Wouters, 2007, 'Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach', The American Economic Review, vol. 97, no. 3, pp. 586–606.

Stein, J. C. and A. Sunderam, 2018, 'The Fed, the Bond Market, and Gradualism in Monetary Policy', Journal of Finance, 73(3): 1015–1060.

Summers, L., 2014, 'U.S. Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound', Business Economics, Vol. 49(2).

Williams, P.D., Y. Abdih and and E. Kopp, 2020, 'Reading the Stars', IMF Working Paper No. 20/136.

Wu, J. C. and F. D. Xia, 2016, 'Measuring the Macroeconomic Impact of Monetary Policy at the Zero Lower Bound', Journal of Money, Credit, and Banking, 48(2-3), 253–291.

Van der Ghote, 2020, 'Benefits of Macro-Prudential Policy in Low Interest Rate Environments', ECB Working Paper No. 2498.