Matthias Burgert
Matthias.Burgert@bis.org

Michael Chui
Michael.Chui@bis.org

Denis Gorea
Denis.Gorea@bis.org

Fabrizio Zampolli
Fabrizio.Zampolli@bis.org

Online annex for BIS Bulletin no 103: "Investment in an increasingly uncertain global landscape"

Cyclical drivers of non-residential private investment

Our analysis employs country-specific Bayesian-VAR models to examine the cyclical drivers of non-residential private investment and provide near-term forecasts across three major regions. We estimate the Bayesian-VAR models for three regions separately: the United States, the euro area and Japan. Our quarterly data set starts in 1987 for the United States and Japan and in 1995 for the euro area and ends in the first quarter of 2025. Specifically, we run the following country-specific regressions at quarter *t*:

$$\boldsymbol{y}_t = \boldsymbol{\alpha}_0 + \boldsymbol{A}_1\boldsymbol{y}_{t-1} + \cdots + \boldsymbol{A}_p\boldsymbol{y}_{t-p} + \boldsymbol{\epsilon}_t$$

where $\boldsymbol{y}_t$ is an $M \times 1$ vector of endogenous variables, $\boldsymbol{\alpha}_0$ is an $M \times 1$ intercept vector, $\boldsymbol{A}_j$ $(j = 1, \ldots, p)$ are $M \times M$ coefficient matrices, and $\boldsymbol{\epsilon}_t$ is an $M \times 1$ vector of Gaussian exogenous shocks with zero mean and variance-covariance matrix $\boldsymbol{\Sigma}$. $\boldsymbol{y}_t$ encompasses a range of key economic indicators, including non-residential private investment, labour productivity (measured as real GDP per hour worked), public investment, real GDP, the consumer price index (CPI), the term premium (ie 10-year minus three-month yield), a shadow rate, and the economic policy uncertainty index by Baker et al (2016). The model includes four lags and is estimated using the Minnesota prior with a hierarchical approach to prior selection (Giannone et al (2015)).

Conditional forecasts (Graphs 3.B and 3.C) are computed based on a range of structural shocks identified through the following sign and zero restrictions:

- A *monetary policy shock* is assumed to contemporaneously lower (non-residential) private investment, GDP and the CPI, to raise the term premium and shadow interest rate and to leave public investment unchanged.
- An *uncertainty shock* is assumed to lower private investment and GDP, to increase uncertainty and the term premium and to leave public investment unaffected.
- A *fiscal policy shock* increases private and public investment as well as GDP, CPI, the term premium and the interest rate.
- A *supply shock* is the sum of a labour productivity shock – lifting private investment, GDP and labour productivity, lowering CPI and leaving public investment unaffected – and a more general supply shock – lifting private investment and GDP, lowering CPI and leaving public investment unaffected.
- A *demand shock* raises private investment, GDP, CPI and the interest rate and does not affect public investment.
- The remaining restrictions, captured within *other shocks*, include one that raises uncertainty and the term premium while reducing GDP and the interest rate, and another that exclusively raises the term premium.

Estimating the effects of monetary policy on investment conditional on uncertainty

We use local projections to examine how economic uncertainty influences the transmission of monetary policy to private investment across advanced and emerging market economies. We employ the local projections (LP) estimation methodology of Jordà (2005) for an unbalanced quarterly panel of countries. The data set comprises 10 AEs and eight EMEs, spanning the years 1985 to 2024. Specifically, the following regressions for country *c* at quarter *t* up to horizon *h* = 0, …, 20 are estimated:

$$y_{c,t+h} - y_{c,t-1} = \alpha_c^h + \boldsymbol{\beta_1^h} \cdot \boldsymbol{I_{c,t}} \cdot MP_{c,t} + \sum_{l=1}^{4} \beta_2^h X_{c,t-l} + \varepsilon_{c,t+h}$$

where $y_{c,t+h} - y_{c,t-1}$ is the cumulative change in the logarithm of seasonally adjusted real private gross fixed capital formation (GFCF); α_c^h is a country fixed effect which controls for time-invariant country characteristics. $X_{c,t-l}$ is a set of country-specific controls dated *t* – 1 and earlier which includes log changes of the dependent variable, of GDP, of the seasonally adjusted real government GFCF and of the three-month government bond yields. For most EMEs in the sample, linearly interpolated quarterly values for private and government real GFCF are used in the regressions due to a lack of quartely data on these variables. The regression results for the EME sample are robust to including log changes in the real exchange rate of the national currency relative to the US dollar.

To measure the effect of monetary policy on investment, we focus on changes in policy rates that are independent of economic conditions. Specifically, we use monetary policy surprises, $MP_{c,t}$, from Choi et al (2024). We extend their series until end-2024 using data from Acosta (2023) and Braun et al (2023) for the United States and United Kingdom, respectively. For other countries for the period after 2019, the proxy is the deviation of the actual policy rate from the expected one based on Bloomberg's survey of financial market participants' expectations for each monetary policy decision.

The objects of interest are the coefficients $\boldsymbol{\beta_1^h}$, which vary across low and high groups for uncertainty. Specifically, we construct variable $\boldsymbol{I_{c,t}}$ which is a vector of indicator variables that sort the countries in the panel regression based on whether the country-specific level of the index of economic policy uncertainty in a given quarter is above or below the median in the cross-section of countries in that quarter. The economic uncertainty measures are country-time specific, in the spirit of Baker et al (2016). The regression coefficients are plotted (Graphs 4.A and 4.B) as impulse response functions with 90% confidence bands based on standard errors clustered by country within the groups of AEs and EMEs.

Annex references

Acosta, M (2023): "The perceived causes of monetary policy surprises", mimeo.

Baker, S, N Bloom and S Davis (2016): "Measuring economic policy uncertainty", *Quarterly Journal of Economics*, vol 131, no 4, pp 1593–636.

Braun, R, S Miranda-Agrippino and S Saha (2023): "Measuring monetary policy in the UK: the UK Monetary Policy Event-Study Database", *Bank of England Staff Working Papers*, no 1050, November.

Choi, S, T Willems and S Y Yoo (2024): "Revisiting the monetary transmission mechanism through an industry-level differential approach", *Journal of Monetary Economics*, vol 145, July, 103556.

Giannone, D, M Lenza, G Primiceri (2015): "Prior selection for vector autoregressions", *Review of Economics and Statistics*, vol 97, no 2, 436–51.

Jordà, Ò (2005): "Estimation and inference of impulse responses by local projections", *American Economic Review*, vol 95, no 1, pp 161–82.