Box C. The UK investment puzzle

There was a 20% fall in the real level of business investment following the global financial crisis – the largest in postwar history. This is almost 50% deeper than previous crashes in investment one year after the onset of recession, highlighting the scale of the 2007 downturn. This is to be expected, as changes in investment are closely related to changes in output in large fluctuations (Dow, 1998) and the 2007 crisis saw the largest fall in output since the Great Depression. Falls in investment tend to be more persistent for recessions caused by financial crises, partially due to restrictions in credit supply. This is indeed what we observe, in figure C1, where the recent post-crisis recovery in the level of investment spending has been one of the weakest postwar recoveries, with business investment taking five years to recover to its previous peak.

Standard economic theory says that firm investment decisions depend on the cost of capital and the availability of finance along with their predictions for current and future demand for their goods and services. Firms have an ideal capital stock which is determined based on the marginal product of capital, and firms have to invest to reach such a level and maintain this capital stock which naturally depreciates over time. To illustrate, the aggregate depreciation rate is around 5% which means that total investment – of which business investment accounts for more than half of the total – needs to be just under 10% of GDP merely to keep the capital–output ratio constant (Oulton and Wallis, 2016). Given that total investment is around 17% of GDP, over one half of investment goes towards offsetting depreciating capital with only the remainder going towards augmenting the capital stock.

To incorporate the forward-looking nature of firm investment decisions economists consider Tobin's Q, the ratio between the market value of installed capital and the replacement cost of installed capital; if greater than one then firms invest, because the benefit of owning capital exceeds the cost of installing it and vice versa if Q is less than one. Current and expected future firm demand are reflected in the equity price of a firm, and the neoclassical theory assumes that equity prices reflect fundamentals, ignoring bubbles or irrational exuberance which may be important in application.

The cost of capital does not only include the cost of borrowing, but also costs associated with installation and training the workforce to operate the capital, the sum of these total costs is known as the user cost of capital. We estimate this using long-term real interest rates, the investment premium, the corporation tax rate and the depreciation rate of capital stock.

The neoclassical theory suggests that if investment is low then it must be because either firm-level demand is low – or is expected to be in the future – or that the user cost of capital is high. However the user cost of capital averaged 5.5% over the period 2007–15, lower than the 6.9% cost between 2000 and 2007. Neither can low demand fully account for the weakness of investment, meaning we need to consider other factors.

One immediate explanation for this investment puzzle is uncertainty, with a recent Bank of England (2017) survey reporting the largest "major obstacle" to investment was uncertainty and so this plays a role in explaining some of the weak investment. However, uncertainty can often be a broad and vague concept, used as a catch-all to explain everything we do not understand about

Figure C1. Post-crises recoveries in the level of real UK business investment
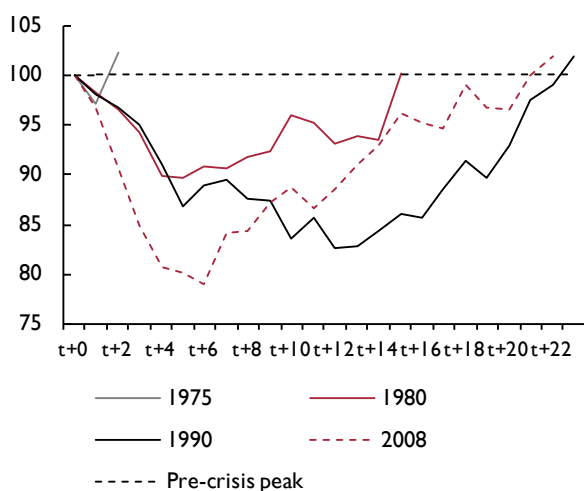
Source: ONS and NIESR.

Figure C2. Growth in net capital stock per employee, 1998–2015
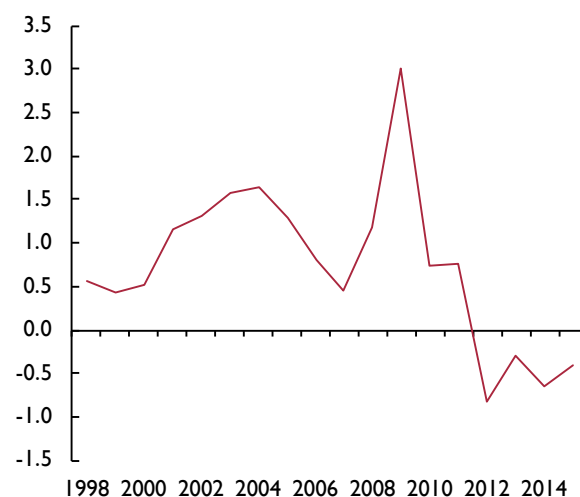
Source: ONS.

Box C. (continued)

investment. We therefore emphasise that our focus is on firm-level uncertainty, one measure of which is the volatility in earnings which tells us uncertainty about future demand conditions.

Uncertainty can then be incorporated into our model by considering that greater volatility in earnings will mean that firms delay investment until they know more about future revenue conditions (Dixit and Pindyck, 1994). Empirical evidence on the effects of uncertainty implies that a 10% increase in volatility of earnings forecasts would lead to a 4.4% reduction in short-run investment rates with an 8.6% reduction in the long run if the high levels of uncertainty persisted (Bond *et al.*, 2005).

Fundamentally, uncertainty arises because there are multiple states of the world, and we do not know if we will end up in a high or low realisation. Hence, we highlight that the resolution of uncertainty does not mean that investment will rise, if the economy ends up in the low realisation state.

The NiGEM model uses an aggregate business investment equation which conditions on previous business investment, aggregate output, the user cost of capital, capacity utilisation and uncertainty. Estimating this equation we find that since 2010 business investment is cumulatively £36bn less than forecast, meaning business investment is some 3% lower over the 2010–16 period than we anticipated given the state of the economy. The over-prediction in the level of investment, even when accounting for uncertainty, demonstrates that there must be other causes for weak investment. This compares to business investment being £2bn less than forecast for the period 2000–10, emphasising that our missing cause of under-investment has increased in prominence during the recovery phase of the 2007 recession.

We turn to three other potential explanations for this phenomenon: investment in intangibles, balance sheet repair and investment in labour.

In the past three decades investment has shifted away from fixed assets towards intangibles – investment in brands, software and R&D – which may have reduced the traditional accelerator mechanism whereby increases in investment, stimulated by high demand, increased firm profits, permit further investment which stimulates incomes and demand further in a virtuous cycle. This mechanism is diminished when investment is directed towards intangibles, as these assets are less suitable for use as collateral and thus limit the amounts a firm can borrow to invest. Additionally, investment in intangibles is notoriously difficult to estimate and so some of the investment puzzle will merely be measurement error which has increased in recent years as the importance of intangible investment has risen (Nakamura, 2010).

A second explanation is that high investment prior to the financial crisis was funded by a rise in corporate debt and following the crisis firms have been deleveraging which may have quashed investment spending (Koo, 2014). Furthermore, pension liabilities have increased, which again limits room for firms to spend limited internal funds on investment programmes. However, there is little evidence that limited funds or the cost of borrowing is acting to inhibit investment.

The final explanation we consider is that a fall in real wages has made it profitable for firms to substitute away from capital towards labour (Blundell *et al.*, 2014). This is supported by figure C2 showing growth in net capital stock per employee has turned negative in recent years. This would imply that if wage costs start to pick up as a result of strong employment results, or due to restrictions in labour supply post-Brexit, then we would see firms reverse their substitution away from capital, resulting in higher investment.

These factors will be considered further by the Institute in future research examining the investment puzzle.

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This box was prepared by Rhys Williams.