About a rate of (general) interest: how monetary policy transmits

How monetary policy affects the economy

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The monetary policy transmission mechanism (MTM) describes how monetary policy – conducted through changes in the policy interest rate – affects financial conditions, expectations, economic activity and, ultimately, inflation.

Understanding how the MTM operates is essential for monetary policy makers, such as the Bank of England's Monetary Policy Committee (MPC), to assess and predict the impact of their policies on the economy – and hence for their ability to deliver on their price stability mandate. This article outlines the Bank of England's staff view on the impact that conventional monetary policy (ie, changes in the policy rate, or expectations of its future path) is believed to have on key UK variables, which has informed MPC discussions.

The MTM can be explored through both a 'bottom-up' and a 'top-down' approach, together providing a picture of the overall strength and speed of transmission, and the 'channels' through which that works. The bottom-up approach examines the channels, which detail the sequence of steps through which an (expected) change in the policy rate transmits to key macroeconomic variables. The 'top-down' approach instead directly estimates the average effects of interest rate changes on these key variables. While such estimates are widely available, the precise impact of changes in the stance of monetary policy is inherently uncertain, as are the relative contributions stemming from the various channels. In part, because the impact of monetary policy is likely to vary over time, for example with the strength of the economy or due to changes in its structure. This underscores the importance of continued assessment of the MTM's functioning for effective policymaking.

1: Introduction

By drawing on Bank staff work in the context of the broader literature, this article seeks to explain how monetary policy is able to affect the level of economic activity and inflation – a process known as 'the monetary policy transmission mechanism' (MTM).[1] This article outlines the Bank of England's staff view on the MTM, and the analysis covered in this article has informed MPC discussions in the past and present.

Understanding the MTM is essential for monetary policy makers to assess and predict the impact of their policies on the economy, and hence for their ability to deliver on their mandate. For the Bank of England ('the Bank'), that remit is set by the UK Government and tasks the monetary policy maker (in case of the UK, the Monetary Policy Committee or 'MPC') with achieving price stability (defined as 2% annual consumer price inflation) over the medium term and, subject to that, support the government's economic objectives – including those on growth and employment.

This article focuses on conventional monetary policy, ie, changes in the Bank's 'policy rate' (the very short-term rate of interest that the MPC controls) or changes in expectations of its future path.[2] In the case of the Bank, the policy rate is referred to as 'Bank Rate', which is the rate that eligible financial institutions earn on any deposits they hold at the Bank. This rate is the MPC's main tool to conduct monetary policy. As the remainder of this article will set out, this very short-term rate of interest – and expectations of its future path – affects the longer-term interest rates that UK households and firms face, as well as the prices of other UK assets alongside the level of economic activity. Those developments will ultimately affect inflation (in part also through 'direct' effects, via inflation expectations and the exchange rate), helping the MPC to achieve its remit of price stability. Bank Rate can thereby be said to be a rate that is of general interest to the UK public, and the remainder of this article aims to set out why that is the case.

2: The importance of nominal rigidities to the monetary policy transmission mechanism

Before turning to the inner workings of the MTM, this section starts by explaining a core concept from which monetary policy ultimately derives some of its powers: the concept of 'nominal rigidities', which governs how quickly prices (including wages) adjust to changes in aggregate demand. Without such rigidities, monetary policy would have no impact on real activity, making this a key ingredient to the MTM.

To see why the degree of 'stickiness' in the aggregate price level matters, first imagine an economy in which all prices – including wages – are perfectly flexible, continuously being adjusted in response to demand. Furthermore, suppose that the economy is in equilibrium, ie, that the level of goods and services demanded is equal to what the economy can supply.

As will be explained in greater detail in Section 3, the stance of monetary policy is able to affect the ability and willingness of households, firms and the government to spend – mostly by affecting the real rate of interest (see Box A).

Consider a monetary easing (ie, an interest rate reduction) which increases the overall ability and willingness to spend – boosting aggregate demand. However, since the economy is not producing more, the additional demand cannot be met.[3] This gives rise to 'excess demand' (consumers queueing to obtain a good or service that is now short in supply), a state of dis-equilibrium that typically does not last in market economies. Instead, prices adjust to restore equilibrium. This implies that prices will rise in response to the increase in nominal demand, so that consumers' purchasing power is brought back to the level that prevailed before the monetary stimulus (when the economy was in equilibrium). Crucially, under flexible prices, monetary policy has no impact on 'real' variables like production quantities and employment. In contrast, monetary policy is everything to nominal variables, ie, to the aggregate price level and hence inflation.

From this, it follows that monetary policy is unable to affect the real economy in the long run (defined as a period long enough to allow prices to adjust to nominal demand); over such time spans, output growth is instead largely driven by increases in labour productivity alongside population growth.[4]

But in the short run, prices aren't fully flexible, for example because changing prices is costly to firms. One reason for this is that contracts are costly to write, making parties do so only infrequently – often fixing price-related terms for one or more years at once. In addition, managerial costs incurred when deciding price changes may play a role too, as is the notion that frequent price changes are seen as upsetting by customers (**Blinder et al (1998)**).

Estimates suggest that only around 20% of UK prices changed in any given month pre-Covid (implying that the average price lasted for about six months; **Bunn and Ellis (2012)**); during the pandemic, this share rose to 25% (**Brandt et al (2024)**). Along similar lines, UK wages are typically reset only once per year (**Olivei and Tenreyro (2010)**).[5]

A consequence of nominal rigidities is that changes in the stance of monetary policy are not immediately offset by changes in the price level – leading to persistent (but not permanent) variations in consumers' purchasing power. This gives businesses the opportunity to adjust production quantities in response to demand conditions, meaning that monetary policy obtains some leverage over real variables, such as the levels of production and employment.

Box A: Real interest rates

Bank Rate is a nominal interest rate. However, real interest rates, defined as nominal interest rates minus expected inflation,[6] are more important when assessing the stance of monetary policy. Theory tells us that this is so because firms and households should factor in their expectations about future inflation when making investment and saving decisions – the reason being that they ultimately derive well-being from the quantity of goods and services they purchase. Taking this perspective, a 2% nominal rate of interest over the next year is not a strong incentive to save when inflation is expected to equal (say) 5%: savings grow at 2%, but inflation is expected to reduce purchasing power by 3%. That prospect might induce someone to spend their money today, rather than saving it.

Monetary policy can influence real interest rates in two ways: directly, by adjusting nominal interest rates, and more indirectly, by affecting inflation expectations. When inflationary pressures build, the MPC would typically raise Bank Rate which may, at the same time, reduce inflation expectations (as agents believe inflation to fall because of this policy action; see Section 3.3). Both elements work to raise the real interest rate, which normally lowers aggregate demand.

Since the MTM is mainly driven by changes in real rates of interest (although there are exceptions, detailed in Section 3.2.1), inflation expectations need to be ‘well-anchored’ for the MTM to operate in full force: absent that precondition, expected rates of inflation could move in tandem with changes in Bank Rate – implying that a move in Bank Rate would not bring about the desired change in real rates.

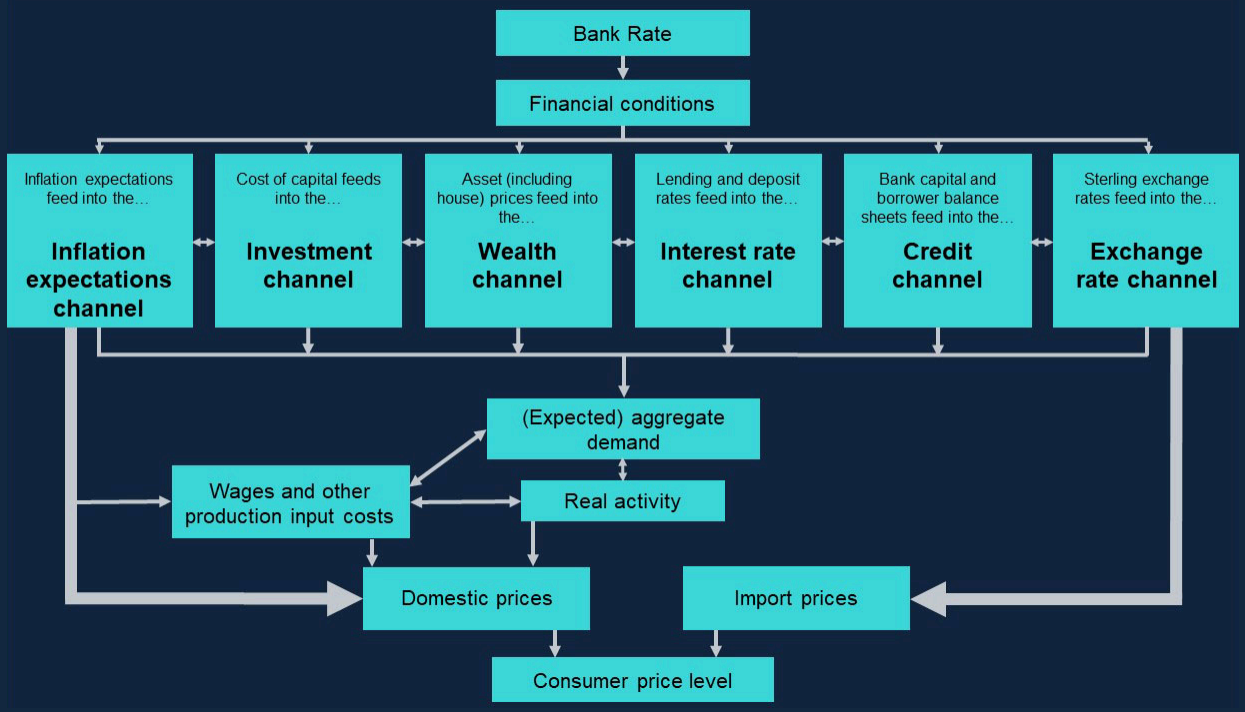
3: The channels of monetary policy transmission

Armed with an understanding of how monetary policy can affect the level of real activity in the presence of nominal rigidities, this section discusses the MTM in a 'bottom-up' way, zooming in on the various 'channels' of the MTM – the precise way in which monetary policy transmits. These channels are present in models the MPC uses as inputs to its forecasts (eg, **Burgess et al (2013)** and **Cloyne et al (2015)**). Figure 1 offers a stylised visualisation of the MTM.

Within channels, one can distinguish between a 'first stage' and a 'second stage' of transmission. The first stage (to be discussed in Section 3.1 and depicted in the top part of Figure 1) covers the transmission of Bank Rate to asset prices (like the exchange rate, and prices of stocks and bonds) and other interest rates (eg, mortgage rates) – collectively referred to as 'financial conditions'.[7] Because of the forward-looking nature of financial markets, this stage typically occurs relatively quickly – provided that the broader environment is characterised by financial stability (making this a pre-condition that needs to be in place for monetary policy to transmit effectively; see Box B). Second stage transmission (depicted in the bottom part of Figure 1) subsequently covers the transmission of financial conditions to the real economy (Section 3.2) and inflation (Section 3.3).

When thinking about the setting of monetary policy, it should be kept in mind that the MTM is of interest to policymakers as it constitutes the mechanism through which they can deliver price stability. The ability to achieve this mandate may, at times, be jeopardised by external, non-monetary shocks – like a sudden rise in energy prices. In such instances, the central bank can be expected to respond in a way to offset the force that is pushing inflation away from its 2% target (as explained in Box C). To calibrate the appropriate size and timing of the response, the monetary policy maker needs to understand the MTM's strength and functioning, as that determines how crucial variables like the level of real activity and inflation end up responding to a change in interest rates.

Figure 1: Stylised visualisation of the MTM (a)



(a) While arrows could be drawn between most boxes, this figure only captures the linkages that are deemed of major importance to the MTM. In addition, the fact that many firms and households are forward-looking implies that variables towards the bottom of the figure can respond prior to variables located higher up (more on this in Section 3.3). For instance, changes in expected aggregate demand should affect financial conditions in the present. Finally, while monetary policy transmits in part by affecting the level of real activity (which in turn has an impact on inflation; see Section 3.3.1), transmission directly to prices is possible via the inflation expectations channel to domestic prices (see Section 3.3.3) and via the exchange rate channel to import prices (see Section 3.2.3). This is denoted by the two bold outer arrows.

3.1: Transmission from Bank Rate to financial conditions

Bank Rate is the rate of remuneration for any overnight deposits (so-called ‘reserves’) that banks and other eligible financial institutions have placed with the Bank. Since this removes any incentive for these institutions to lend to other parties below this rate, Bank Rate establishes a minimum for overnight interest rates that they charge each other. Therefore, reserve remuneration forms an important element in the transmission process of monetary policy.

Bank Rate is short term in nature (overnight), while firms and households are unlikely to transact over such a short maturity. The ‘yield curve’ depicts how interest rates vary across maturities (see Chart 1) and makes clear why the (expected) policy rate matters beyond the overnight horizon.[8] The MPC is able to affect longer-term yields by affecting expectations regarding future levels of Bank Rate.[9]

Given that most firms, households and the government borrow and save at maturities longer than overnight, the entire yield curve matters for the MTM. By comparing the yield curve between December 2021 and June 2022, as shown in Chart 1, one can see how expectations of future policy (shaped by monetary policy makers responding predictably to macroeconomic developments; see Box C) can affect the level of interest rates beyond implemented changes in Bank Rate: while Bank Rate increased by just under 1 percentage point over those six months, longer-term yields went up by nearly 1.7 percentage points. Part of the reason is that, as inflation started rising, markets expected the Bank to continue tightening in response (given the Bank's past responses to previous inflationary pressures). This shows how monetary policy credibility can affect financial conditions to a degree that goes beyond realised actions by the central bank.

Chart 1: The UK yield curve – December 2021 versus June 2022 (a)

Sources: Bloomberg Finance L.P., Tradeweb and Bank calculations.

(a) This chart shows the UK nominal government bond spot yield curve (showing the UK Government's cost of borrowing at different maturities) on 1 June 2022 and 1 December 2021.

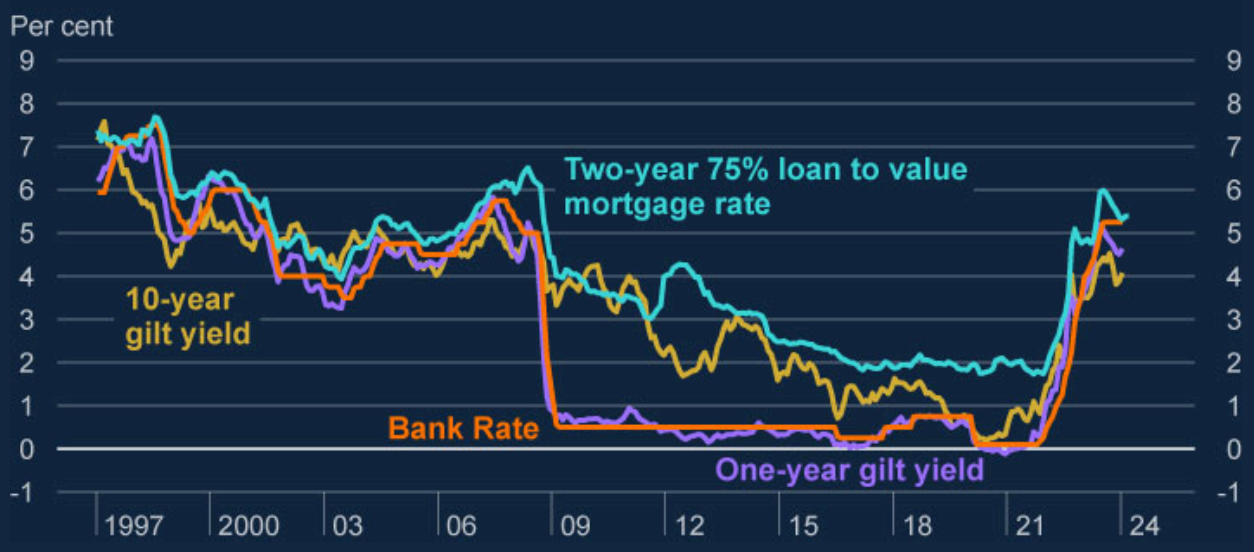
Management of expectations by the central bank, via both actions and communications about possible future actions, is therefore an important channel through which monetary policy affects the economy (at all times, not only when short-term interest rates are constrained by their effective lower bound (ELB); recall footnote 2).

The discussion thus far has focused on Bank Rate – and expectations of it. But households and firms do not encounter Bank Rate directly. Instead, they face deposit rates, mortgage rates and other borrowing rates (entailing greater risks to the lender, contrasting with Bank

Rate which is a risk-free rate), which are determined by transactions in financial markets, some intermediated by banks or other financial institutions. Starting on the borrowing side, consider mortgage rates. A two-year mortgage rate, for instance, will be priced off a two-year market interest rate (which is in turn affected by Bank Rate and expectations of its future path as set out above), with some wedge – the 'credit spread'. This spread is determined by various factors, including the borrower's default risk,[10] the degree of leverage, competition in the banking sector and broader credit conditions. Unsecured lending rates (where no collateral is required, implying a greater risk to the lender) feature a greater credit spread and are less closely related to Bank Rate (**Butt and Pugh (2014)**).

Chart 2 shows that Bank Rate is indeed related to various other interest rates, although the connection is looser for longer-term rates owing to a combination of term premia (recall footnote 8), other risk premia and expectations of interest rates further into the future.

Chart 2: Bank Rate, gilt yields and mortgage rates (a)



Sources: Bank of England, Bloomberg Finance L.P., Tradeweb and Bank calculations.

(a) Data is monthly. Latest observation: February 2024.

On the saving side, interest rates received on deposit accounts are linked to Bank Rate because commercial banks compete to attract deposits. When interest rates are higher, it becomes more attractive for banks to have a greater deposit base (as that enables them to invest more funds at those higher rates), which incentivises them to increase deposit rates.

Next to affecting other interest rates, Bank Rate also influences the prices of various assets (stocks, bonds, real estate, etc). This process is driven by a core result in asset pricing, namely that the price of an asset should equal the present value of its future cash flows. By setting the short-term interest rate, the central bank affects investors' discount rates. A higher discount rate makes the present value of a given cash-flow stream go down, implying that prices of securities tend to fall as interest rates rise (and vice versa).[11] Similar forces are at play with respect to the exchange rate (more on which in Section 3.2.4).

3.2: Transmission to economic activity

Once the first stage (from Bank Rate to broader financial conditions) of transmission has taken place, the process continues with its 'second stage' to the macroeconomy via the various individual channels – the remainder of this section discusses the channels that work through an impact on production levels, before subsequently affecting inflation. Section 3.3 discusses transmission through channels that impact inflation in a more direct fashion (without first having to affect the level of economic activity).

3.2.1: The interest rate channel

Armed with an understanding of how Bank Rate affects other rates of interest, one can discuss the relatively 'direct' effects of changes in interest rates, which occur via 'intertemporal substitution' and through 'cash-flow effects'.

The intertemporal substitution channel

By influencing real interest rates, monetary policy can affect the timing of consumption,[12] known as the 'intertemporal substitution channel'. Higher interest rates increase the cost of borrowing while also increasing the benefits of saving, encouraging households to save more and/or borrow less, reducing consumption as a result. This channel tends to have varying effects across the income distribution. Richer households typically have a greater ability to save and therefore a larger capacity to maintain their level of spending and smooth their consumption through a shock.

A major determinant of the strength of this channel is the 'elasticity of intertemporal substitution', which governs how willing and/or able households are to delay (or pull forward) consumption in response to a change in the real interest rate. Empirically, this elasticity is found to be rather small in the UK (**Havranek et al (2015)**; **Best et al (2020**)), which would render the intertemporal substitution channel a relatively weak force in the MTM.

The cash-flow channel

Changes in bank lending and deposit rates also affect the cash flows of households and firms, giving rise to the 'cash-flow channel' of monetary policy. Higher interest rates increase the interest payments received by depositors, while increasing the interest payments on debt for those who are net borrowers.

In a world where deposit and debt holdings are roughly balanced (which is the case for the UK) one would not expect changes in interest rates to have a big impact on net interest income – as the effects would cancel out between savers and borrowers. However, for a given change in income, borrowers tend to adjust their spending by more than savers: evidence from the NMG survey of UK households suggests that borrowers cut their spending by £50 for a £100 increase in mortgage payments (**Anjum and Herler (2023)**); in contrast, saving households are found to be less likely to spend any gains in interest income (**Panigrahi et al (2018)**). Consequently, an increase in interest rates, which redistributes income from borrowers to savers, reduces aggregate spending (**Auclert (2019)**; **Floden et al (2021)**). This perspective also suggests that monetary policy might be more potent when debt levels are high – a prediction that tends to find empirical support (**Jordà et al (2020)**; **Kim and Lim (2020)**). This is an example of a 'state-dependency' (more on which in Section 4.2), with 'the state' being the aggregate level of debt in the economy.

When thinking about this channel, it should be noted that it is not only realised cash-flow streams that are important: expected streams matter as well, although the effect tends to be less strong compared to realised streams. As a result, even households on a fixed-rate mortgage (not immediately responsive to changes in Bank Rate) might respond to a monetary tightening with relatively little delay – saving in anticipation of the negative cash-flow effect that they expect to be hit by when their mortgage needs to be refinanced (likely at a higher rate, due to the tighter stance of monetary policy); see **Anjum and Herler (2023)** for survey evidence that such forward-looking dynamics are at play in the UK.

The effect of interest rates on consumption through this channel is strongest for more liquidity-constrained households who simply consume all of their disposable income. Since the latter is affected by monetary policy via some of the parallel transmission channels, the cash-flow channel also involves transmission via indirect effects. In this case, monetary policy can affect the rate of unemployment alongside wages via the other channels, which in turn affects consumption of liquidity-constrained households (**Kaplan et al (2018)**; **Slacalek et al (2020)**). Such households might also be affected by the nominal rate of interest (as opposed to the real one, which is typically thought to drive the MTM; see Box A): when households are constrained to simply consume whatever is left of their earnings after taxes and due interest have been paid, a change in a nominal interest rate (eg, their mortgage rate) will affect their consumption even if a simultaneous change in expected inflation keeps the ex-ante real rate

unaffected – the reason being that the (future) impact of expected inflation (which erodes the real burden of the debt) cannot be brought forward to the present, due to the constraint (**Kearl (1979)**).

3.2.2: The investment channel

As discussed in Section 3.1, current and (expected) future levels of Bank Rate are tightly linked to interest rates that individuals, corporations, but also the government face when borrowing funds, eg to finance investment. For corporates, an investment project could be a machine that yields a return by producing valuable goods; for the government, a flood barrier to keep citizens dry; for households, a durable good that delivers a 'service flow' (eg, a dishwasher providing its owner with the service of not having to wash dishes manually). Empirically, spending on durable goods is found to be quite sensitive to the stance of monetary policy (**Sterk and Tenreyro (2018)**; **Choi et al (2024)**); the same holds for firm investment (**Cloyne et al (2018)**; **Bahaj et al (2020)**; **Shah et al (2024)**), making the 'investment channel' another route via which monetary policy is thought to transmit.[13]

In this context, monetary policy affects the 'user cost of capital', which measures the price of capital services (simply put: how expensive is it to rent a machine?).[14] Next to the interest rate (determining how expensive it is to borrow funds to finance the acquisition), the user cost of capital is also pushed up by the price of the capital good itself and its expected rate of depreciation over time.

As this user cost rises, for example in response to a monetary tightening that increases borrowing costs, it becomes less attractive to invest, which reduces economic activity (which, in turn, further reduces the incentive to invest). A key question for monetary policy makers however is: which maturity enters this user cost? The very short-term rate, or are longer-term rates more important? Conventional wisdom (eg, **Boivin et al (2010)**) states that, since investment decisions are long term in nature, households and businesses will mainly be influenced by the part of the yield curve that matches the expected duration of the capital good that is being acquired (that is: for a machine that is expected to last 10 years, they will mainly be influenced by the 10-year rate). **McKay and Wieland (2022)** however highlight that an important element of investment decisions is when to invest. Since such a timing decision can always be broken down into the question of making the investment now or waiting a short instant, the short-term rate takes on a special role in guiding the timing of investment decisions and cannot be ignored entirely when thinking about the investment channel (even for long-lived investment projects).

This perspective also illustrates how a monetary easing that accelerates the triggering of investment decisions has the by-product of taking demand away from the future. The investment channel may therefore be less powerful on the back of a prolonged period of loose

monetary policy (when households and firms are not close to making new investments, as they recently did this already). This is another example of the MTM possibly being state-dependent, 'the state' being the historical rate path in this case. Since loose monetary policy is more likely to arise when the economy is weak, this logic suggests that the investment channel is less potent in the aftermath of recessions – especially persistent slumps (**McKay and Wieland (2021)**).

Next to affecting the cost of external financing, monetary policy can also affect the cash-flow streams accruing to individuals and firms (in line with the discussion in Section 3.2.1) – influencing their ability to finance investment 'internally' (without borrowing). This mode of transmission runs via indirect effects (monetary policy first affecting aggregate demand through other channels, which then starts impacting cash flows) and is therefore thought to operate with significant delays. Consistent with this notion, UK firms that have greater access to cash ('internal financing') are found to be less sensitive to financial conditions (**Joseph et al (2019)**; **Shah et al (2024)**). Internal financing is found to be particularly important for small and medium-sized firms in the UK (**Bora et al (2024)**).

3.2.3: The wealth channel

The MTM is also shaped by the link between interest rates and asset prices, given their impact on the value of household wealth holdings. Those, in turn, affect consumption, giving rise to the 'wealth channel' of monetary policy.

When discussing the wealth channel, it is useful to distinguish between 'financial wealth' (totalling to about 370% of UK GDP, three-quarters of which being held in the form of pension entitlements; see **ONS (2022)**) and 'housing wealth' (at around 240%), as their effects are likely to differ in strength and nature. While the concept of 'willingness to spend' is crucial to the impact of financial wealth, 'ability to spend' also matters with respect to housing wealth (as that is much less liquid, but can serve as collateral in a mortgage loan arrangement).

Financial wealth

Since many households save during their working lives for retirement purposes, or with the aim of leaving a bequest to their children, they also carry financial wealth, held in forms like stocks, bonds or cash deposits – often in part via a pension fund. As a result, changes in the prices of such securities can affect aggregate demand.

When it comes to the first-stage of this channel (from Bank Rate to prices of securities), empirical studies (to be discussed in Section 4) find that a 1 percentage point surprise-hike in Bank Rate would cause the UK stock market to fall by an average 4%–10% (though there are times and circumstances under which stock markets are less responsive to fundamentals, including the stance of monetary policy).

The second stage of this transmission channel occurs in line with the 'life-cycle hypothesis of saving'. This theory recognises that households are richer as the value of their assets goes up, leading them to convert some of their wealth into consumption (from which they ultimately derive utility).[15] Empirical studies typically estimate that UK households tend to consume about 5 pence for every additional pound of wealth held (**Slacalek (2009)**).

A key determinant of the strength of this effect is a household's willingness to spend their wealth. That willingness could go up if a monetary easing boosts employment opportunities, thereby lowering fears of unemployment. In that case, there would be a reduced motive to hold precautionary savings ('saving for a rainy day'), increasing households' willingness to spend (**Benito et al (2006)**).

Monetary policy can however also affect a household's desire to accumulate assets. When households wish to save during their working lives to finance future retirement, persistently low rates may increase households' desire to accumulate assets (lowering their willingness to spend): when rates are low-for-long, each unit of wealth grows less rapidly over time, making it more difficult to reach a certain target level of wealth that suffices to support the household through retirement. Whether lower interest rates stimulate the economy, then depends on whether the resulting increase in wealth holdings (stemming from the standard channel described in footnote 11) outstrips the increase in desired wealth holdings (**Beaudry et al (2024)**). Empirically, **Di Maggio et al (2020)** and **Fagereng et al (2021)** find that households are less likely to spend capital gains if they are driven by lower rates (as opposed to gains stemming higher dividends). This suggests that generic estimates of the marginal propensity to consume out of wealth may be too high to apply to monetary policy (as changes in interest rates can have a countervailing impact on households' desire to hold assets).

Housing wealth

Many households also carry significant wealth via any houses that they own. And since both current and expected future levels of Bank Rate affect mortgage rates (which determine how much households are willing and able to borrow when purchasing a home), the stance of monetary policy affects house prices.[16] Empirical estimates (discussed in Section 4.1) suggest that a one percentage point hike in Bank Rate might lower house prices by some 4% on average.

The impact of fluctuations in housing wealth is however likely to differ from that of financial wealth, for two main reasons. First, housing wealth provides an essential service, namely shelter. This implies that changes in house prices come with a redistributive component (**Buiter (2010)**): higher house prices redistribute wealth from those who are moving to a more expensive (or their first owned) home next, to those who will be downsizing in the future. Second, housing wealth is relatively illiquid, meaning that gains/losses in wealth through a change in house prices cannot be easily spent (selling a house is a major operation).

In practice, however, the illiquidity of house price changes can be overcome via collateral effects, with some households and firms borrowing against any increases in the value of their home. Such 'home equity withdrawal' overcomes the hurdle that house price gains are not liquid, as it provides the homeowner with more cash on hand and can boost spending that way. **Reinold (2011)** shows how this process stimulated demand stemming from households prior to 2007 (the onset of the global financial crisis, 'GFC'), with this process going into reverse as house prices fell during the GFC. **Bahaj et al (2020)** instead focus on firm investment, documenting how housing wealth is an important determinant in this regard for smaller UK firms, for which the value of a director's home is relatively large relative to the firm's assets. The channel runs by the director being able to obtain a loan collateralised against the value of their personal home (making this also link to the 'balance sheet channel' of monetary policy, to be discussed in Section 3.2.5). In addition, there might be an additional effect via the cash-flow channel of Section 3.2.1, since a change in house prices can also bring changes to loan to value ratios on remortgaging – with mortgage rates typically increasing in such ratios (**Cumming and Walker (2023)**). As with changes in financial wealth, changes in house prices can also affect desires to accumulate precautionary savings – and therewith a household's willingness to spend.

3.2.4: The exchange rate channel

For a small open economy like the UK's, exchange rates (the price of foreign currencies in terms of domestic currency) play a pivotal role in the pricing of imported goods and services. Simultaneously, exchange rates also affect the price at which foreign buyers can purchase UK-produced goods and services – making the exchange rate affect international demand for UK exports (including financial assets).

Exchange rates are influenced by a multitude of factors, one of which is monetary policy. Thus, one way in which monetary policy can affect the domestic economy is by its impact on the value of sterling relative to foreign currencies.

Beginning with the first stage, an increase in Bank Rate (assuming interest rates in other countries remain the same) makes it more attractive for investors to shift funds into UK interest-bearing deposits – as UK interest rates are now higher. Consequently, a monetary tightening tends to increase demand for sterling, pushing up its price. The empirical studies cited in Section 4.1 suggest that an unanticipated 1 percentage point increase in Bank Rate typically causes the sterling **exchange rate index** to appreciate by 2%–7%, with the effect peaking after about one quarter.

The second stage of this channel starts from price rigidities. When prices are sticky in the currency in which they are quoted, the exchange rate affects demand for both exports and imports. To see this, suppose that prices are quoted in the currency of the producing country.

[17] As sterling appreciates, UK exports become more expensive to foreign buyers, making them demand less. At the same time, imports become cheaper for UK residents (because they can buy more foreign currency, per unit of sterling), leading domestic consumers to switch away from domestically produced goods, into imports – a process known as 'expenditure switching' (but note that this force will be weaker when the degree of substitutability between foreign and domestic goods is lower). As a result, spending becomes more import and less domestic-focused, slowing aggregate demand and thus output.

In addition to the above effects, the exchange rate channel not only affects domestic prices through its effect on economic activity, but also has a direct effect on inflation through its effect on import prices, as discussed in Section 3.3.3.

3.2.5: The credit channel

Another channel through which monetary policy is thought to transmit, is by affecting credit conditions – yielding an important role to banks and other financial institutions. This is often referred to as the 'credit channel' and is typically broken down into a 'bank lending channel' alongside a 'balance sheet channel' (**Bernanke and Gertler (1995)**).

The bank lending channel

The bank lending channel captures the view that monetary policy can affect the supply of bank loans. One way in which monetary policy can affect credit creation is through its impact on commercial banks' profitability (**Van den Heuvel (2007)**; **Disyatat (2011)**). If a monetary contraction reduces banks' profits (eg, because higher interest rates push up default risk, which worsens the quality of any loans extended), this deteriorates banks' capital positions (with bank capital being determined by profits made in the past, minus any dividends paid). The adequacy of banks' capital positions is typically assessed relative to a bank's total assets (think: their total amount of loans extended, adjusted for risk). While UK banks need to respect minimum regulatory standards on capital adequacy (stemming from the **Basel framework**), market forces may also push banks towards strengthening their capital position (or the bank may not be able to borrow new funds). When issuing additional equity is not an attractive option (eg, when equity prices are low, like they tend to be when monetary policy is tight), banks can improve their capital adequacy by cutting back on lending (eg, by approving fewer loan applications – especially those by riskier borrowers), which is how monetary policy can affect credit creation. **Jiménez et al (2012)** offer empirical evidence that such dynamics are indeed at play in the data, reporting stronger effects for banks with weaker capital positions.

There is evidence that this bank lending channel functions differently depending on the level of interest rates (**Abadi et al (2023)**; **Eggertsson et al (2019)**): when rates are low, the pass-through of changes in a central bank's policy rate to deposit rates may decline (due to

households being able to hold cash, which prevents deposit rates from going too negative). In a low-rate environment, further rate cuts may therefore eat into banks' profits: while lower rates reduce the flow income on banks' assets, their cost of funding (the interest they pay on their deposits) is relatively unresponsive. This may give rise to a 'reversal rate' below which rate cuts make the bank lending channel operate in a contractionary direction. Still, the overall effects of monetary easing could continue to be expansionary as long as (some of) the other channels continue to work in the conventional direction; it is just that the overall effect will likely be weaker due to a countervailing force.

The bank lending channel also links to the cash-flow channel of Section 3.2.1. There, a major role is often attributed to mortgages – with tighter monetary policy reducing households' disposable income via higher mortgage payments. Since more UK households have opted for fixed-rate mortgages over the last decade, which are not sensitive to Bank Rate during the fixation period, this is often seen to imply that the UK economy has become less quick to respond to changes in the stance of monetary policy.[18] At the same time, however, greater prevalence of fixed-rate mortgages could imply that the banks that have issued these mortgages are exposed to monetary policy: absent hedging, an increase in Bank Rate would raise banks' funding costs, while their revenues (the mortgage payments flowing to them) remain fixed. This erodes banks' capital, potentially leading to a contraction in lending. Consequently, it is too crude to state that transmission lags are longer when fixed-rate mortgages are prevalent.[19] It is more accurate to say that such a situation shifts the transmission process away from the cash-flow channel, towards the bank lending channel. Whether that increases or decreases the potency of monetary policy on balance, depends on the relative strength of the two channels involved. Given that UK banks typically hedge their interest-rate exposure (meaning they receive compensation from, or pay compensation to, a counterparty when rates move), the cash-flow channel likely ends up dominating (provided that the counterparty is not a source of broader transmission to the UK economy, for example because it is located abroad).

The balance sheet channel

In addition, monetary policy can affect the balance sheets of borrowers, which in turn affects their cost of borrowing by affecting the risk premium (**Bernanke et al (1999)**). Since it is riskier to lend to firms (or households) facing greater default risk, and given that tighter monetary policy tends to push default risk up (by slowing economic activity via the other transmission channels), monetary policy can affect the risky interest rates that households and firms get to face. That, in turn, affects spending and investment.

By influencing the pricing of assets, monetary policy can also affect the ability of households and firms to obtain collateralised loans (which pose lower risks to the lender, therefore typically occurring at lower interest rates). In this context, **Bahaj et al (2020)** document that homes of UK small/medium enterprise owners are often used as collateral to obtain business

loans. As a result, higher house prices tend to boost investment, particularly for firms whose other assets are 'intangible' in nature – making them ill-suited to serve as collateral (**Haskel (2020)**).

The balance sheet channel also gives reasons to suspect that the strength of the MTM is state-dependent, varying with the strength of the economy. Papers in this literature typically take the view that credit-constrained firms are more responsive to changes in the stance of monetary policy (**Kashyap et al (1994)**; **Bernanke et al (1999)**). Together with the notion that credit constraints are more likely to bind when the economy is weak, this perspective suggests that the balance sheet channel is stronger in recessions.

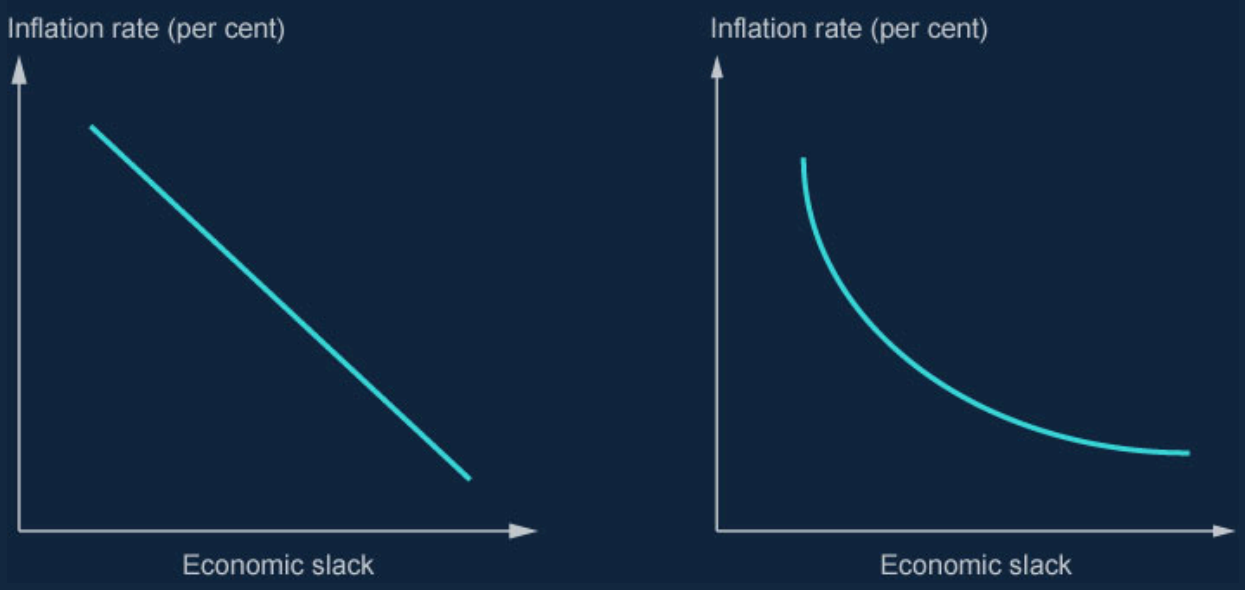
3.3: Transmission to prices

Section 3.2 has only covered how the presence of nominal rigidities gives monetary policy the ability to affect the level of real activity. But since the primary objective of most modern central banks is to target a certain rate of inflation, it is also important to understand how monetary policy can affect inflation. Here, there are three main channels at play. One channel works by first affecting the level of real activity, which then transmits to prices, whereas the other two channels work directly on inflation.

3.3.1: The Phillips curve channel

First of all, the level of real activity (affected by the channels discussed in Section 3.2) is thought to affect the rate of inflation, via a mechanism known as the 'Phillips curve' (after **Phillips (1958)**; see Chart 3). It captures the notion that economic slack (as for example proxied by the ratio of unemployment to vacancies) tends to have a disinflationary impact, because the presence of unemployed workers puts downward pressure on wages – reducing firms' production costs, enabling competitive forces to translate those into lower consumer prices. Symmetrically, a 'hot' economy (in which employees are working overtime and machines run at full capacity) puts upward pressure on wages and prices – bringing demand back down to a more attainable level.[20] The slope of the line in Chart 3 is referred to as the slope of the Phillips curve: when it is flat, the degree of economic slack only has a minor impact on inflation, while inflation is more sensitive to slack when the Phillips curve is steeper.

Chart 3: The Phillips curve



The left panel of Chart 3 depicts a Phillips curve that is linear in form, ie it assumes that the impact of slack on inflation is independent of the extent of economic slack. This may not be an accurate representation of reality. Instead, it may be state-dependent and non-linear. This is often envisioned as stemming from cost factors being relatively insensitive to production levels while there is slack left. However, as this residual slack disappears, with the level of production of approaching (or even rising above) its potential, the Phillips curve steepens – making inflation more sensitive to the level of slack. This can be visualised by a non-linear Phillips curve, one that is steeper when there is less slack in the economy – see Chart 3's right panel.

In the presence of such a non-linear Phillips curve, monetary policy may have greater leverage over inflation when the economy is a boom (which is associated with the steeper part of the curve). Several studies suggest that this non-linearity does indeed exist. For example, **Cesa-Bianchi et al (2023)** argue that there is a non-linear effect stemming from supply-chain bottlenecks, with inflation being more sensitive to slack when supply chains are disrupted (as they for example were when the Suez Canal was blocked by a container ship that had run aground back in 2021, pushing up shipping costs). Similarly, **Benigno and Eggertsson (2024)** provide evidence that the Phillips curve steepens when the ratio of vacancies to unemployment (a measure of labour market tightness) is higher. Such a non-linearity was already envisioned by **Phillips (1958)** who wrote that with 'very few unemployed we should expect employers to bid up wages quite rapidly', but since 'workers are reluctant to

offer their services at less than the prevailing rate (…) wage rates fall only very slowly. The relation between unemployment and the rate of change of wage rates is therefore likely to be highly non-linear.'

Generally speaking, a world in which monetary policy can affect the level of real activity, which in turn has an impact on prices, gives the central bank leverage over inflation. This only occurs after some delay though (especially when wages and prices are sticky), giving rise to the 'long and variable lags' of monetary policy transmission. These lags can however be shortened when prices are set in a forward-looking way, as captured by the next channel.

3.3.2: The inflation expectations channel

Since firms tend to change their prices only infrequently, they are thought to be forward-looking when setting prices – considering any price increases (especially in their cost factors) they expect to occur during the horizon over which prices are expected to remain fixed. That way, higher expected rates of inflation can be pulled forward in time and push up inflation in the present. That also implies that the prospect of a slowdown in real activity, which in turn gives rise to the prospect of lower inflation via the Phillips curve, can lower inflation in the present. As a result, inflation might respond to a change in the stance of monetary policy before output or employment do. A similar process applies to workers when they negotiate wages (typically for the next year, making their wage demands a function of their expectation regarding next year's cost of living), which feeds back into firms' production costs.

In this context, survey evidence from UK firms suggests that they lower their near-term inflation expectations following increases in Bank Rate (**Di Pace et al (2023)**), for example because they foresee how a future reduction in real activity will bring some moderation to wages (as those are set in a forward-looking way) and hence firms' production costs.

While this argument is forward-looking in nature, there is also work that is rooted in 'behavioural' arguments – suggesting that inflation expectations are significantly shaped by recent inflation outturns, with agents believing that yesterday's inflation rate will continue to apply tomorrow (**Rowe (2016)**). Then, given that tighter monetary policy lowers inflation outturns (albeit with a lag), this is another way in which monetary policy can tame inflation expectations. However, absent a sufficient contractionary response, an initial inflationary shock may acquire additional persistence through 'second-round effects', eg via workers or firms fearing that inflation will remain elevated for a while, which makes them demand higher wages and prices in anticipation (and thus validating their initial fear).

This inflation expectations channel reiterates the importance that monetary policy makers act to keep inflation expectations anchored at the 2% inflation target, as discussed in Box C.

3.3.3: The exchange rate channel

Finally, there is an effect via the exchange rate. Its value not only affects aggregate demand (as discussed in Section 3.2.4), but can also have a direct impact on consumer prices index (CPI) inflation by decreasing the sterling price of imports originally invoiced in another currency. Evidence suggests that pass through of exchange rate changes to import prices (converted into sterling) varies between 40%–100% (**Forbes et al (2018)**; **2020**). Since about 20% of final UK consumption is imported, the impact of import prices on CPI can be substantial – especially as the real importance of imports to CPI inflation is even greater, since many intermediate inputs into the production process are imported as well (**Dhingra and Page (2023)**).

There are however several factors that could mute the pass-through from import prices to CPI inflation somewhat. That includes the invoicing currency of imports and exports, with evidence reported by **Hjortsoe and Lewis (2020)** suggesting that US dollar-driven changes in the sterling exchange rate index pass through most strongly to inflation. They also find that the impact on inflation appears to be non-linear, with larger movements in the exchange rate being found to pass through faster than smaller ones. This is consistent with the notion that larger shocks are more likely to induce firms to change their prices, thus increasing the degree of price flexibility. Along similar lines, **Forbes et al (2017)** report that pass-through tends to be higher when inflation and its volatility are higher – again suggesting that the frequency at which prices are being reset is relevant. At the same time, this logic also implies that exchange rate pass-through is likely weaker in an environment of low and stable inflation, and when inflation expectations are anchored at the inflation target (**Taylor (2000)**).

Box B: The importance of financial stability

Financial stability plays a key role in the transmission of monetary policy, and a central bank's ability to deliver on its price stability objective (**Breeden (2023**)). The reason is threefold.

First, monetary policy makers should not feel constrained by financial stability considerations when making monetary policy decisions. This is because a situation of 'financial dominance' – where the central bank would for example refrain from tightening monetary policy due to concerns about bank failures – could tie the monetary policy maker's hands when it comes to controlling inflation and limit its ability to meet its monetary policy remit; similar considerations are at play with respect to 'fiscal dominance' (see footnote 13).

Second, history has demonstrated that financial crises tend to push inflation away from target – often in the downward direction and in a rather persistent way – which stands in direct conflict with the notion of price stability.

Finally, since monetary policy can only work effectively when the financial system transmits changes in the stance of monetary policy to the rest of the economy, an unstable financial system risks impairing the 'first stage' of the transmission process (more on which in Section 3.1).

Box C: Achieving price stability by responding predictably to macroeconomic developments

The MTM is the process which governs the causal impact that monetary policy has over broader macroeconomic and financial variables of interest. Given the Bank's mandate, the MPC ultimately aims to utilise the MTM to create an environment that is characterised by price- and broader macroeconomic stability.

In order to achieve such stabilisation, central banks are mostly responding to (forecasted) macroeconomic developments in a predictable way to offset any pressures that would take inflation away from target (**Pill (2024)**).[21] This gives rise to the so-called 'systematic' component of monetary policy. Since higher interest rates lower inflation (more on which in Section 3.3), a typical systematic response of central banks is to raise interest rates in response to inflationary pressures. By consistently doing so over time, a central bank can build up credibility and create an environment in which some notion of a 'monetary policy reaction function' emerges, eg: when inflationary pressures build (recede), the central bank can be expected to raise (lower) its policy rate. The desired size of the response will depend on the expected strength of the MTM, including the sensitivity of inflation to interest rates, as that determines how strong a reaction is needed to offset the original non-monetary force that is pushing inflation away from target.[22]

Absent such a response strategy, the economy can become prone to self-fulfilling dynamics (inflation being high because it is expected to be high, or vice versa),[23] which would introduce undesirable volatility in variables like output and inflation. That may ultimately harm economic prosperity – for example because a more volatile environment harms investment (**Beaudry et al (2001)**).

A volatile environment could moreover lead to a 'de-anchoring' of inflation expectations. The concept of anchoring refers to a situation in which long-term inflation expectations reside close to the 2% target and are relatively insensitive to short-run developments in inflation and other macroeconomic variables. Without the anchoring of expectations, a central bank will not be able to control the relevant real rate of interest – the nominal rate minus expected inflation – which is the rate that is mainly driving the MTM (recall Box A).

Starting from a situation in which a history of systematic conduct of monetary policy has created monetary policy credibility alongside anchored inflation expectations, the remainder of this article describes how, and to what extent, a central bank is able to

affect macroeconomic outcomes.

4: Empirical evidence on the transmission of monetary policy

4.1: Top-down estimates of the MTM

While Section 3's 'channel representation' lends itself well to describing how certain mechanisms affect the economy in isolation, it ignores interactions between channels. As a result, the overall MTM effect is not the simple sum of individual channels. Instead, the total impact also includes interactions and feedback between them, as represented by the horizontal arrows between channels in Figure 1.

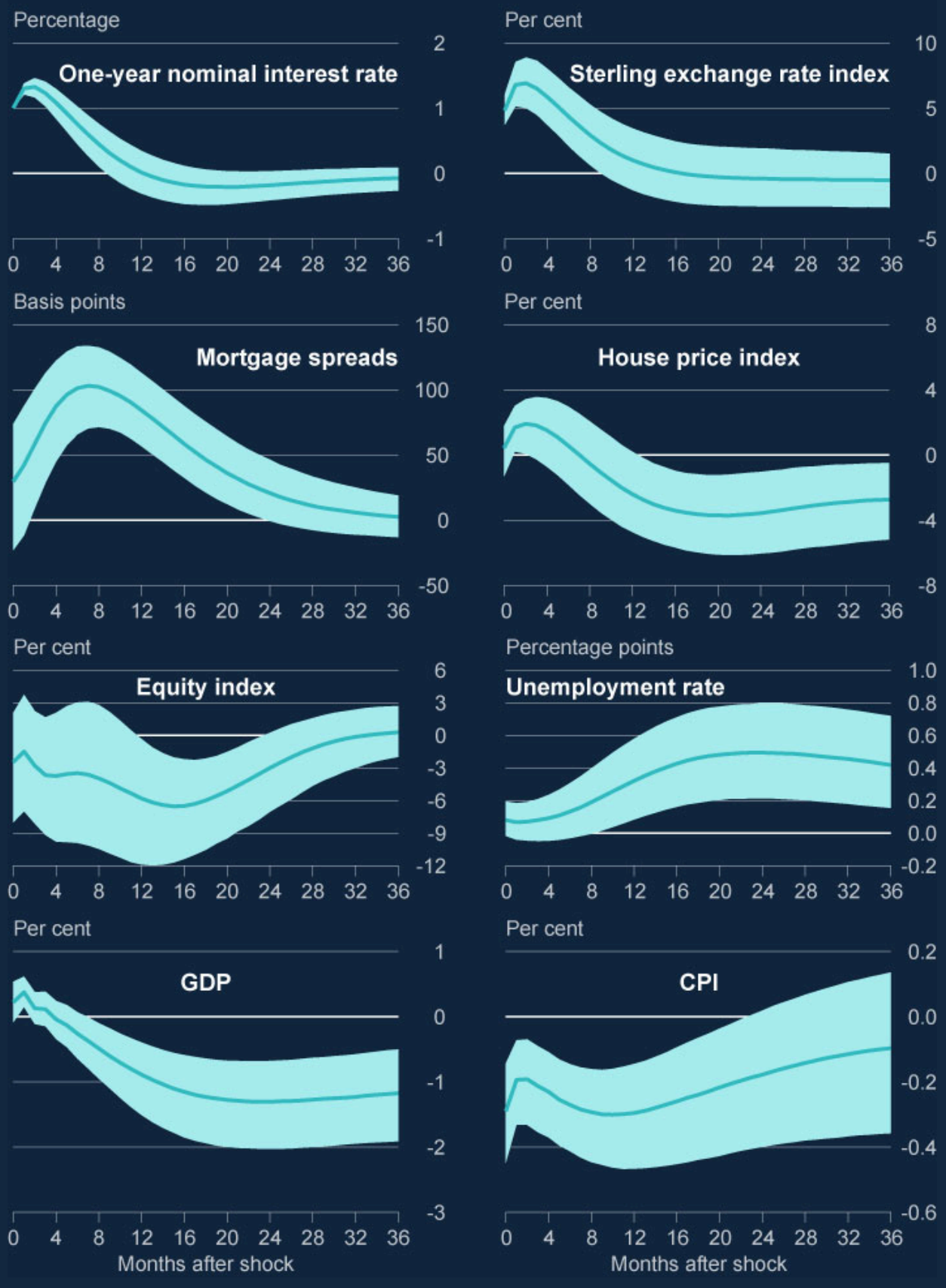
To take such 'general equilibrium effects' into account, one can take a top-down approach – using econometric techniques to quantify the impact from unanticipated changes in Bank Rate ('monetary policy shocks') on key macroeconomic variables like inflation, real GDP and unemployment.[24] It is however important to emphasise that there is no unique answer to the underlying question, as it is likely to vary with the persistence of the monetary shock, the state of the economy, and other factors (more on which in Section 4.2). Quantitative top-down evidence merely provides a sense of the MTM's average strength and speed over the past few decades.

Answers to questions of this type are often summarised via impulse response functions (IRFs) – graphical representations of the effect that changes in monetary policy are estimated to have on financial and macroeconomic variables of interest. Chart 4 shows an example of such a set of IRFs, adapted from the literature.

Note from the chart how the first-stage transmission to financial variables (one-year interest rate, mortgage spread, exchange rate) is relatively fast, whereas the second stage (from financial conditions to real activity and prices) takes longer to build. Results suggest that, on average over the sample period (1997–2019), an unanticipated 1 percentage point increase in Bank Rate has:

- lowered the price level by 0.3% (with this response peaking after one year);
- reduced real GDP by about 1.3% (with this response peaking after about two years); and
- increased the rate of unemployment by 0.5 percentage points (with this response peaking after about 1.5 years).

Chart 4: Impulse response functions for a 1 percentage point increase in Bank Rate (a)



Source: Authors' calculations based on **Cesa-Bianchi et al (2020)**, updated with data to 2019.

(a) IRFs are based on monthly data spanning 1997–2019. The mortgage spread is calculated relative to the five-year government bond yield. The monetary policy shocks are estimated by considering changes in (expected) interest rates that are observed in a narrow 30-minute window around MPC decisions. The underlying idea is that – provided the window is tight enough – it is unlikely that the observed movement is in response to news other than the monetary policy announcement (eg, the release of new unemployment numbers). Instead, any observed changes represent the unanticipated surprise-component of monetary policy.

Table A provides additional estimates, focusing solely on peak effects (which are typically obtained 1–3 years after the shock). These findings suggest that, on average over the past few decades, a 1 percentage point increase in Bank Rate has lowered the price level by 0.3%–1.0%, while reducing real GDP by 0.5%–1.4%. These numbers are not dissimilar to those found for other advanced economies: cross-country work by **Jordà et al (2020)** reports on -1.5% on CPI and -1.5% on real GDP, while **Willems (2020)** arrives at -0.7% and -1.1%, respectively (all for a 1 percentage point surprise-hike in a sample of advanced economies, including the UK).

Table A: Estimated peak effect of an unanticipated 1 percentage point hike in Bank Rate

Study:	Peak effect on:		
	Prices	Output	Unemployment rate
Ellis et al (2014) (a)	-1%	-0.5%	n.a.
Cloyne and Hürtgen (2016) (b)	-1 percentage point	-0.6%	n.a.
Cesa-Bianchi et al (2020)	-0.3%	-1.3%	+0.5 percentage points
Braun et al (2023)	-0.5%	-1.4%	n.a.
Jordà et al (2020) (c) (d)	-1.5%	-1.5%	n.a.
Willems (2020) (c)	-0.7%	-1.1%	n.a.

(a) Uses the GDP deflator rather than CPI.
(b) Uses inflation (rather than the price level) and industrial production (rather than real GDP).
(c) Uses a panel of advanced economies (including the UK) rather than relying exclusively on UK data.
(d) Results based on post-World War II data.

However, these estimates are all to be interpreted with some caution: they are based on historical relationships between variables (that may not apply to the future) and are surrounded by uncertainty. In addition, these estimates are symmetric and linear in nature –

abstracting from the state-dependencies and non-linearities central to Section 4.2. That said, these estimates provide useful guidance when gauging the effect of monetary policy.

4.2: Non-linearities and state-dependencies

The 'top-down' empirical evidence in Section 4.1 is unconditional in nature – implicitly suggesting that the functioning and strength of the MTM are always the same. This is however unlikely to be the case in reality: the MTM may for instance be affected by the size or sign of the monetary policy shock hitting the economy (a 'non-linearity' in shock size/sign). Certain characteristics of the economy when the shock hits (eg, whether the economy is in a boom or a recession) may play a role too – in which case the MTM is said to be 'state-dependent' (recall the discussion in the various subsections of Section 3).

The bottom-up perspective, however, doesn't provide a clear message as to the direction in which non-linearities are likely to affect the MTM: while the investment channel for example suggests that monetary policy is less powerful in recessions, the balance sheet channel predicts that the MTM is weaker in booms (when credit constraints are less likely to bind).

Faced with these conflicting messages from the 'bottom-up' perspective, one can proceed by taking the 'top-down' route – using IRFs as seen in Section 4.1. While those IRFs are averages for the sample period over which they are estimated, it is also possible to repeat the process while distinguishing between different states of the economy (such as booms versus recessions).

Empirical studies that allow the MTM to differ depending on the strength of the economy, typically find that monetary policy tends to be less powerful in recessions (**Tenreyro and Thwaites (2016)**; **Stenner (2022)**). These results may however be somewhat sensitive to the way in which one cleans the data from the systematic component of monetary policy (which is needed to uncover the causal effect; recall footnote 24), with different monetary policy shock series yielding results that are less clear-cut (**De Santis and Tornese (2024)**). Consequently, it seems premature to draw any firm conclusions regarding the cyclicality of the strength of the MTM.

Next to the strength of the economy, the rate of inflation may matter too: when inflation has been trending high, the frequency at which firms reset their prices typically goes up, which increases the degree of price flexibility in the economy (**Bunn et al (2023)**). As discussed in Section 2, theory predicts that more price flexibility should give monetary policy bigger leverage over inflation, and less over output and employment. Empirically, **Ascari and Haber (2022)** indeed find this to be the case in US data.

Finally, monetary policy may also be non-linear in either the sign or size of the shock. On the former, most empirical studies find that, for the US, surprise-hikes tend to be more powerful than interest-rate cuts (**Tenreyro and Thwaites (2016)**; **Angrist et al (2018)**), yet the opposite has been reported on UK data (**Stenner (2022)**). There seems to be greater unanimity when it comes to the size of the shock, with evidence for both the US (**Ascari and Haber (2022)**) and UK (**Stenner (2022)**) suggesting that larger shocks have a bigger per-unit effect on inflation and less impact on real activity compared to smaller shocks. This is again consistent with the notion that larger shocks are more likely to induce firms to change their prices, making the aggregate economy look more like a flexible-price one (in which monetary policy is not able to affect real variables, only affecting the price level instead; recall the discussion in Section 2).

5: The MTM during the post-Covid tightening cycle

The post-Covid tightening cycle formally began when the MPC first voted to raise Bank Rate on 16 December 2021, from 0.1% to 0.25%, although longer-term rates had already started rising earlier on (as financial markets anticipated future interest rate increases in response to the inflationary pressures that were building). Since then, the MPC increased Bank Rate to 5.25%, where it stands at the time of writing.

This process has been associated with a tightening in financial conditions. The increase in Bank Rate has fed through to higher deposit and lending rates, while house price growth has stalled. Equity prices have been resilient in aggregate, but they would likely have been higher in the absence of higher rates.

As mentioned throughout this article – and as becomes clear in this example – monitoring the impact of higher interest rates (relative to other influences) is challenging, particularly in real-time, but also ex-post. Acknowledging the uncertainty, there is evidence that tighter monetary policy weighed on aggregate demand.

First of all, it appears that higher interest rates have been weighing on consumption. Household consumption growth weakened throughout 2023 even as aggregate real incomes increased. The resulting increase in the saving ratio is consistent with the MTM operating through intertemporal substitution and wealth channels, which incentivise greater saving. While many UK mortgagors were on a fixed-rate mortgage when inflation started rising (see footnote 18), an increase in mortgage repayments for those on variable rates and expiring fixed-rate products will have reduced spending through the cash-flow channel. Anticipation effects (households foreseeing that their mortgage payments would likely rise beyond their fixation period) may have added to this, with survey results suggesting that the spending effect of such anticipated increases equals about 60% of the response to realised increases (**Anjum and Herler (2023)**).

Survey evidence from UK firms also suggests that higher interest rates have reduced business investment. Firms report an overall magnitude of around 8%, with an important role for general equilibrium effects (higher interest rates reducing demand via parallel channels, which lowers firms' incentive and capacity to invest); see **Shah et al (2024)**. Housing investment also weakened materially over the period, reflecting both a significant fall in housing market activity (transactions) and lower construction of new builds, consistent with the expected drag from higher interest rates.

For the exchange rate channel, it is the relative real rate (in particular, the UK's real rate relative to those in other countries) that matters. Since many central banks lifted policy rates in tandem, bringing only minor changes to relative real rates, the sterling exchange rate index has also moved relatively little. But, as with the wealth and collateral channels, a counterfactual featuring lower levels of Bank Rate would have likely led to a depreciation of sterling – with heightened inflationary pressures as a result. Moreover, in the realised case where various central banks (including the Bank of England) raised their policy rates in tandem, aggregate demand for UK output can still be expected to fall – but now due to the contractionary effect that rate hikes in other countries will have via their own transmission channels, which lowers demand for UK exports.

Finally, the increases in Bank Rate helped to keep inflation expectations anchored close to the 2% target (**Bahaj et al (2023)**), even as CPI inflation peaked at 11.1% in October of 2022. This limited the occurrence of second-round effects, which would have added to inflation outturns and their persistence.

Bank of England staff monitors the MTM on an ongoing basis, including for potential changes to its functioning over time, and in different states of the world. Such analyses can be found for instance in the **May 2023**, **November 2023** and **February 2024** Monetary Policy Reports.

6: In closing

Monetary policy affects the economy through a range of channels, whose exact functioning is not under the central bank's direct control and may change over time. Changes in the stance of monetary policy therefore come with an 'a priori' uncertain impact which is, in fact, even difficult to establish with the benefit of hindsight. But since the MTM links the monetary policy instrument to crucial outcome variables like the rate of inflation and unemployment, central banks must rise to the challenge. This calls for continuous research into the functioning of the MTM, including into structural changes influencing its strength and time profile. The agreement of empirical estimates presented in Section 3.1 does provide some degree of reassurance in the functioning, direction and speed of monetary policy transmission.

The MTM can be broken down into a first stage, the pass-through from Bank Rate to various asset prices and other interest rates, and a second stage – governing how financial conditions affect macroeconomic outcomes. First-stage transmission is typically rapid, thanks to the fast speed at which financial markets react to news, whereas the second stage takes more time – in part because they rely on general equilibrium effects (eg, a monetary tightening pushing up the unemployment rate, which in turn lowers wage income, thereby moderating firms' production costs alongside consumption demand). However, to the extent that households and firms are forward-looking in their behaviour, anticipated developments can be brought forward in time – shortening transmission lags.

Finally, when thinking about the role and powers of monetary policy, it should not be forgotten that monetary policy is not directly able to affect the long-run prosperity of a country. Indirectly, however, it can fulfil an important supporting role – by helping to create a stable macro-environment that is conducive to households and firms taking appropriate investment decisions that are beneficial to long-run economic outcomes. The co-creation of such a stable macro-environment occurs to a large extent via the central bank conducting monetary policy in a 'systematic way': it predictably and stably responding to (forecasted) macroeconomic developments. In this light, the message once conveyed by former Bank of England Governor Mervyn King (**King (2000)**) still holds: 'our ambition at the Bank of England is to be boring'.

Boring and predictable.

1. See **Mishkin (1995)**, **Bank of England (1999)** and **Boivin et al (2010)** for other accounts.
2. While monetary policy could also be conducted via quantities (the amount of money in circulation), most modern central banks – including the Bank of England – choose to set an interest rate and let the money supply adjust accordingly. The focus on conventional monetary policy is most relevant when the short-term interest rate sits above its effective lower

bound (ELB): once at this bound, it is not possible to implement any further nominal interest rate reductions. This is because households and firms may always hold cash, at 0% return. When a central bank's policy rate is at its ELB, additional, unconventional monetary policy tools are typically relied upon to further loosen monetary conditions should this be required, using tools such as forward guidance and quantitative easing, the latter as discussed in **Busetto et al (2022)**.

3. Monetary policy is thought to have no short-run impact on supply, as that is mainly determined by developments in the past (**Bailey (2023)**).

4. However, as discussed in Box C, there may be an important indirect effect – with higher macroeconomic volatility doing damage to an economy's potential to grow (eg, by structurally harming investment, which lowers productivity growth).

5. Both of these outcomes are however highly dependent on inflation realisations and expectations – with the frequency of price/wage-resetting likely going up as the economy moves into a higher inflation regime (**Bunn et al (2023)**).

6. Technically, this is the 'ex-ante real rate'. The 'ex-post real rate' is defined as the nominal interest rate minus realised inflation over the associated period. Since agents are thought to take many economic decisions in a forward-looking manner, central banks pay most attention to real rates from the ex-ante perspective.

7. See **Eguren-Martin and Sokol (2019)**, **Burr and Saha (2021)**, **Burr (2023)** and **Mann (2023)** for more details on this concept.

8. Other factors can influence long-term yields as well, including term premia, which one can think of as compensation offered to risk-averse investors for taking on duration risk through holding longer-term bonds (**Adrian et al (2013)**; **Kaminska et al (2015)**). Monetary policy could affect the term premium if it can affect investors' willingness to take on duration risk. One possible channel is that lower interest rates make investors 'search for yield' (ie, shift to holding longer-term bonds that typically offer higher interest rates), which would lower term premia. This is also known as the 'risk-taking channel' of monetary policy (**Borio and Zhu (2012)**; **Bauer et al (2023)**).

9. The reason lies in the equivalence between borrowing or depositing funds for one year, and renewing a one-day loan or deposit for 365 days in a row. Since these strategies are equivalent, they must also deliver the same return. As a result, a longer-term rate should equal the sequence of one-day rates that is expected to apply over the same period. This is known as the expectations hypothesis of the term structure of interest rates and establishes a link between short and long-term rates.

10. Default risk is another variable that is affected by the stance of monetary policy; see Section 3.2.5.

11. This inverse relationship is easiest to understand for bonds. They typically pay a fixed 'coupon' at pre-set dates, implying that (absent default risk) the future cash-flow stream is known and fixed in advance. For stocks, the future cash-flow stream is less certain (as dividend payments and share buybacks are optional and driven by firm profits, which are likely to be affected by the stance of monetary policy). To the extent that looser monetary policy boosts firm profits, stock prices therefore have an additional reason to rise as rates fall. See **Dison and Rattan (2017)** for a discussion on the impact of interest rates on equity prices.

12. Technically, this section is mostly about consumption of non-durables. Since it is more appropriate to think of durable purchases as an investment decision, it is mainly covered in Section 3.2.2.

13. There is less available evidence on the impact of monetary policy on government investment. It has been noted that a monetary expansion (contraction) is more likely to raise (lower) inflation if it is matched by a fiscal expansion (contraction); see **Kloosterman et al (2022)**. **Caramp and Silva (2023)** analyse this issue analytically, showing how monetary policy affects the timing of output, while the fiscal response determines its present value. More generally, for the MTM to work as described in this article, there should be no 'fiscal dominance': the central bank should be left free to focus on targeting inflation, without having to worry about rendering government debt sustainable (which is a task that should be left to the fiscal authority).

14. Occasionally, the investment channel is presented through the prism of 'Tobin's q': monetary stimulus pushes up firms' stock prices, which increases incentives for firms to invest (as they can now issue equity at a higher price and use the proceeds to purchase new capital goods). **Hayashi (1982)** establishes an equivalence between q-theory and the user-

cost approach, which is why this article exclusively focus on the latter in the main text.

15. See **Modigliani (1971**) for an overview. Next to the effect on consumption, there may also be an impact on investment: as discussed in footnote 14, lower rates tend to boost stock prices, which increases firms' ability to raise funding through the issuance of new equity.

16. More formally, one could also approach this issue via the 'present value'-concept: since a lower rate of interest increases the net present value of housing services (ie, the rental price of a given house), this tends to boost house prices (and vice versa for a higher rate).

17. This is a reasonable approximation for trade with the EU: UK exports to the EU are mostly invoiced in sterling, while imports from the EU are equally likely to be invoiced in euros and sterling (**ONS (2023)**). When trade is invoiced in the currency of the destination country, or in some third 'vehicle' currency (eg, the US dollar), the transmission mechanism is slightly different (**Gopinath et al (2020)**). Since the US dollar has recently gained ground as invoicing currency for UK exports, this has made the UK economy more sensitive to the US dollar over time (**Garofalo et al (2024)**).

18. Eg, the share of mortgage stock with a rate fixed for five years went up from around 20% in 2016, to over 50% in 2022.

19. In addition, Section 3.2.1 explained how expected cash-flow streams matter, which provides another reason for why the MTM is not necessarily more sluggish when more households have fixed-rate mortgages.

20. When discussing the link from the degree of overheating or slack to prices, the focus typically lies on a mechanism that runs via wages, as this is a significant cost factor to firms that is largely shaped domestically (as opposed to in world markets, on which UK monetary policy has little effect). It could however be the case that there are other production costs whose pricing is sensitive to the strength of the UK economy, though they are unlikely to be as important a cost factor as wages are to most firms.

21. Since monetary policy is thought to affect outcomes only after some lag, central banks are typically responding to forecasted movements in key outcome variables – otherwise they would end up reacting too late (**Batini and Haldane (1999)**; **Broadbent (2021)**).

22. While a full discussion of optimal policy considerations goes beyond the scope of this article, it should be noted that it is not always optimal to try and fully offset deviations in inflation from target (as that may for example come at too high a cost in terms of higher unemployment), especially in the presence of lags in the transmission process (**Bandera et al (2023**).

23. For example: if households and businesses believe that the central bank can be relied upon to use its tools to bring inflation back to 2% following shocks, they will worry less about inflation. That, in turn, may moderate firms' price-setting behaviour, which lowers the odds of inflation drifting up in the first place. To quote former Bank of England Governor Mervyn King (**King (2005)**): 'the real influence of monetary policy is less the effect of any individual monthly decision on interest rates and more the ability of the framework of policy to condition inflation expectations'. Also see **Clarida et al (1998)**; **2000**), who document the role played by systematic monetary policy in this regard.

24. Here, it is crucial to work with surprise changes since looking at observed changes (which include the systematic component of monetary policy as described in Box C) leaves the cause-effect relationship unclear: did the rate hike cause inflation to rise, or was the interest rate raised in response to inflationary pressures that were building up due to (say) a positive demand shock? In the latter case, the subsequent dynamics will not only reflect the impact from monetary policy; instead, the effect of the demand shock would be reflected – potentially leading observers to conclude that interest rate hikes increased inflation, giving them a wrong idea regarding the impact that monetary policy is having. It is important to note that the use of monetary policy surprises, as opposed to systematic monetary policy, is purely for the purpose of getting to the causal effect. Estimates of those can subsequently be used by policymakers to evaluate alternative future policies (**Hebden and Winkler (2021)**; **McKay and Wolf (2023)**).