BANK OF ENGLAND

Speech

Inflation Now and Then

Remarks given by

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1. Introduction

Good morning everyone and thank you for having me here today. It's my first in person speech since the start of the pandemic and it's a pleasure to come back up to Glasgow following my last visit two years ago.

Inflation, as measured by the annual rise in the consumer price index (CPI), was 4.2% in October. Our latest MPC forecast projects inflation to peak at around 5 percent in the second quarter of 2022. Since the Bank of England is asked to hit an inflation target of 2%, we have some explaining to do. So, in light of that I'd like to step back and think about inflation more broadly, consider some theory that seeks to explain the determinants of inflation and place the current episode of above-target inflation in context. I have five main messages:

1. To those of you who are studying economics, the skills you are acquiring and models you are studying here in Glasgow have direct applications to modern policy-making.
2. The Bank of England was made independent in 1997. Since then, average inflation has been… 2%, the current target.
3. There has been variation around that 2% since then. On average, of every deviation of inflation from target,
    a. 24% has been due to food and energy,
    b. 13% due to taxes like VAT and
    c. 25% due to sharp exchange rate movements and imported prices.

Thus around 62% of inflation deviations from target is due to outside forces that are difficult for a central bank to control in the short run: echoing what the Governor has said, central banks cannot grow more food, supply more gas or make the wind blow stronger. Whether the central bank should take offsetting action today is a separate point that I'll come back to below, but I expect much of the recent variation to be transitory as it has been in the past.

4. The inflation problems of the 1970s were in part due to changes in commodity prices but also the long drawn-out response of wages to such changes. So then, as now, commodity prices and the labour market will be crucial to understanding the inflation process. Even though much of the current inflation is due to outside forces such as energy prices, but the labour market is tight and we have to be vigilant. *In my view, if the labour market stays tight, Bank Rate will have to rise.*
5. We should maintain a long term perspective. The pandemic was the worst shock to hit the UK economy in 100 years.[1] We have managed to recover largely from this shock, with, on current data, almost no rise in unemployment and the likely reabsorption of nearly all workers who were furloughed, who at one point accounted for almost one third of the workforce. *In my view the prospective rise in Bank Rate from its emergency level – when that comes - is not a bug, but a feature. It reflects the success of the policies, mostly fiscal, health and science that have supported the economy over the pandemic.*

[1] In terms of its impact on GDP.

In what follows, I'll try give some insights into how inflation is modelled, what went wrong in the 1970s and what policy might do now.

2. How to think about inflation

Trying to guess what a central banker will do is a cottage industry. In a constructive effort to help with that endeavour let me set out a description of inflation that I claim is in the head of many policy-makers including myself. I also hope this will be of interest to anyone concerned with the future of the economy. In what follows I'll be cautious to not oversell this framework because (like any model) it is necessarily simplified and stylised relative to the real world, and has some critics, for example see an interesting critique by Jeremy Rudd (2021).

2a. Broad outline

Before getting into the details, let me sketch a broad outline. Firms are setting prices based on the (marginal) costs they are facing and expect to be facing in the future. If they face, or expect to face, more taxes, higher energy prices, and escalating labour costs, they will be contemplating raising prices. A potentially important element of costs in the current situation is "adjustment costs". The costs of re-opening, say, a restaurant, after the pandemic are not only the staff and the building, but the costs of hiring new staff, finding a new building etc. So firms are heading towards a target level of prices based on these costs. But they don't get there immediately. Firms are rightly cautious about adjusting too fast: maybe large changes might deter customers for example. And maybe expectations change: an energy cost rise might be reversed. So firms adjust slowly towards their target price level. In this account, inflation, general price rises, depends on what firms expect inflation to be in the future (since that determines how much they will have to adjust their prices now) and the target price to which they are heading. In turn, that target price depends on the costs they face now and in the future.

At least part of those expectations of inflation will be determined by the central bank's inflation target. So what can the central bank do to keep inflation on target? It is often said that Central banks need to be "credible". Equally, they have to "take the punch bowl away at the party". What do these statements mean in the context of the framework above? First, by maintaining credibility, Central Banks will hope that long-run expectations are "anchored" to the target. Second, at least some cost pressures are likely determined by how "hot" the economy is running: wages for example, might be bid up if the economy is running "hot" such that demand for workers is running ahead of supply. Thus central banks can raise interest rates to "cool down" the path of the economy and relieve these cost pressures.

After a more formal outline of this model, we shall trace out how this framework helps understand inflation then and inflation now.

2b. Formal analysis

For those preferring a more formal analysis, we start by thinking about the economic decisions of a representative firm selling goods to a representative consumer in the United Kingdom. This firms seeks to maximise its expected discounted profits today and in the future subject to constraints on production and the sensitivity of consumers demand D to prices. In equations, that problem is as follows:

$$Max_{\{Y,p,N,K,M,E\}} \sum_{t=0:\infty} \beta^t \, \boldsymbol{E_t}[p_t Y_t - C(Y_t) - \Gamma\,(\Delta P_t, \Delta N_t, \Delta K_t, \Delta M_t, \Delta E_t)]$$

Such that: $Y_t = F(K_t, N_t, M_t, E_t)$, $Y_t = D(p_t)$, $C(Y_t) = p_{k,t}K_t + p_{w,t}N_t + p_{m,t}M_t + p_{e,t}E_t + p_{tax,t}Y_t$

This says that firm i decides price (p_i) and the level of its inputs (labour (N), capital (K), imports (M), energy (E)). These decisions are contingent on the production function of the firm (F), the cost of each input (p_x), taxes, and the sensitivity of demand to prices. We further assume there exist adjustment costs Γ associated with large changes in prices or inputs in short periods of time. For example, it is costly to rapidly increase or decrease staffing levels, contracts or reputational constraints may prevent or dissuade firms from large and frequent price changes and so on. Absent these adjustment costs, profit-maximising firms would choose to set prices as a markup (μ) over marginal costs (MC):

$$P^* = \mu^* MC^*$$

Which says firms will ideally charge consumers a price proportional to the cost of producing one extra unit of the good or service they provide. Why is there a markup?[2] In a competitive environment with no other costs or risks associated with production, firms would be constrained to set prices equal to marginal cost [$\mu = 1$] as any deviation from that price would be punished by consumers rapidly switching to other providers. Markups arise when firms have overheads to cover (fixed costs) like management, human resources and advertising costs. Firms may also enjoy some level of price insensitivity due to brand loyalty or a lack of a perfect substitute for the good or service they provide (although the higher markup afforded to firms who benefit from any price insensitivity should be better thought of as payments for risky intangible investments in e.g. branding or product development that underpin the firm's market position).

If the level of prices is primarily a function of marginal costs and desired/required markups, then changes to marginal costs or desired/required markups are our key drivers of changes in prices, i.e. inflation, disinflation or deflation. So what determines marginal costs? In order to produce an extra unit we need more inputs, which we assume include imported goods and materials, energy, labour and capital. Therefore marginal costs are a function of input prices. In the interest of time I will refer you to good economics papers or textbooks e.g. Walsh (2010) or Battini et al (2005) for details of the derivation but today let it suffice to say that one can derive the following equation from the maximisation problem outlined above:

[2] For simplicity, I assume it's constant.

$$\pi_t = (1-\beta)\pi^* + \beta E[\pi_{t+1}] + \kappa(\, mc - mc^*) + \gamma(\Delta x_t, \Delta x_{t+1}) + \phi\left(\Delta p_{tax,t}, \Delta p_{tax,t+1}\right)$$

Which says that price changes π_t are a function of some constant rate of inflation π^*, the expected rate of inflation tomorrow, temporary log deviations of real marginal costs from their expected longer run equilibrium, relative real input adjustments Δx_t and tax changes. Firstly let us think about π^*. This term is determined outside the model, but one hopes it is equal to the Bank of England's two percent target given to us by the government. Absent any unexpected deviations or adjustments, current and expected inflation should be π^*. When inflation drifts away from the target, central banks are expected to act to bring inflation back in line with the target. They do so by seeking to influence aggregate demand via a loosening or tightening of monetary conditions i.e. interest-rate changes or bond purchases. Once households and institutions understand this, inflation expectations anchor themselves around the target and become embeded in routine price re-setting. That's why central bankers look closely at measures of longer run inflation expectations.

But inflation is not always constant at π^*, even if peoples' longer run inflation expectations remain anchored. The reason for that is the economy is constantly buffetted by shocks. We've had a few huge ones recently with the economic impact of Covid-19, and the related global supply shortages and swings in energy prices. These shocks often move faster than firms and households are willing or able to adjust and lead to short-term inflationary pressures represented by gaps between actual marginal costs and an unobserved theoretical marginal cost mc^* consistent with what we expect marginal costs to be absent these shocks. When these gaps open up firms are moved away from their desired/required markup and will adjust prices accordingly. Note that we are now talking about real marginal costs expressed relative to the price firms sell their product, i.e. $\ln(\frac{MC}{p})$. We do this because firms care about unit costs relative to their unit prices. If input prices increase relative to output prices, markups decrease and firms need to increase prices to restore the markup. Finally the coeffcient κ arises because we expect the adjustment of prices to close the marginal cost gap over time and not instantaneously.

To proceed let's make a further simplifying assumption[3] that the log of real marginal costs can be expressed as an input-share-weighted linear combination of real input prices $\overline{p_i}$ minus the level of total factor productivity a. Note that higher productivity allows us to produce more for the same given level of inputs and thus lowers marignal costs:

$$mc = c + \sum a_i \overline{p_i} - a, \qquad mc - mc^* = \sum_i \alpha_i\left(\overline{p_{i,t}} - \overline{p^*_{i,t}}\right) - (a - a^*)$$

Putting this into the Phillips Curve gives

$$\pi_t = (1-\beta)\pi^* + \beta E[\pi_{t+1}] + \kappa \sum_i \alpha_i\left(\overline{p_{i,t}} - \overline{p^*_{i,t}}\right) - \kappa\,(a - a^*) + \gamma(\Delta x_t, \Delta x_{t+1}) + \phi\left(\Delta p_{tax,t}, \Delta p_{tax,t+1}\right)$$

[3] The keen economists amongst us might note this akin to an assumption of a Cobb-Douglas production function assumption where $F = A\prod_i {x_i}^{\alpha_x}$.

So inflation today is driven by long run expected inflation plus all current and expected future deviations in real marginal costs plus adjustment costs. Under this view, inflation-targeting central banks must look at expectations, and the costs incurred, and expected to be incurred by firms, if they want to understand how firms are likely to be setting their prices. That means it's important to understand and communicate not just recent input price moves but also how those input prices might be expected to move in the future. It's also important that businesses and households expect these gaps to close in the long run, and the central bank has a part to play in that.

2c. Implementing the model

I want to show how this model can be practically implemented. To do so, let me take a number of steps. First, one can replace the current prices terms and expected inflation term in the above equation with a forecast for each of the individual terms. A way to do that is by conducting a forecast based on the past history of deviations from trend of each of the inputs. This alters the equations above to the following form:

$$\pi_t - \pi^* = \sum_k \sum_i \lambda_{i,t-k} \left(\overline{p_{l,t-k}} - \overline{p^*_{l,t-k}}\right) - \lambda_{a,t-k}(\mathrm{a_{t-k}} - \mathrm{a^*_{t-k}}) + \lambda_{\gamma,t-k}\Delta \mathrm{x_{t-k}} + \lambda_{\phi,t-k}\Delta x_{t-k}$$

Where the λ coefficients on the lags of the deviations require estimation.

Second, for an open economy like the United Kingdom it's useful to further divide cost drivers into external and internal ones. The equation below makes that distinction clear by expanding the input price terms with the external terms for energy and import prices in blue:

$$\pi_t - \pi^* = \sum_k \lambda_{l,t-k} \left(\overline{p_{l,t-k}} - \overline{p^*_{l,t-k}}\right) + \lambda_{k,t-k} \left(\overline{p_{k,t-k}} - \overline{p^*_{k,t-k}}\right) + \lambda_{e,t-k} \left(\overline{p_{e,t-k}} - \overline{p^*_{e,t-k}}\right)$$
$$+ \lambda_{m,t-k} \left(\overline{p_{m,t-k}} - \overline{p^*_{m,t-k}}\right) - \lambda_{a,t-k}(\mathrm{a_{t+k}} - \mathrm{a^*_{t+k}}) + \lambda_{\gamma,t-k}\Delta \mathrm{x_{t-k}} + \lambda_{\phi,t-k}\Delta x_{t-k}$$

Third, central bankers tend to refer to the "output gap" when talking about inflation. How does this enter this framework? The assumption is that if demand moves ahead of what the domestic economy is able to supply that will tend to put pressure on wages as workers are asked to work harder and are able to move more easily between competing firms seeking to expand. Similarly higher utilisation rates of the capital stock [CAPU] leads to higher returns in the short run (higher p_k) but eventually creates costs pressures as the capital stock strains under demand.

$$\overline{p_l} - \overline{p^*_{l,}} \propto y - y^*$$
$$\overline{p_k} - \overline{p^*_k} \propto CAPU \propto y - y^*$$

The proportional relationships between these demand-induced marginal cost gaps and real quantities are folded together in the summary statistic that is the output gap $[y - y^*]$. Substituting the output gap for the p_l and p_k terms leaves us with our final expression for the determinants of price inflation:

$$\pi_t - \pi^* = \sum_k \lambda_{y,t-k}\,(y - y^*) + \lambda_{e,t-k}\left(\overline{p_{e,t-k}} - \overline{p^*_{e,t-k}}\right) + \lambda_{m,t-k}\left(\overline{p_{m,t-k}} - \overline{p^*_{m,t-k}}\right) - \lambda_{a,t-k}(a_{t+k} - a^*_{t+k})$$
$$+ \lambda_{\gamma,t-k}\Delta x_{t-k} + \lambda_{\phi,t-k}\Delta x_{t-k}$$

2d. Some lessons

What do we learn from this framework? First, inflation will be determined in part by shocks to energy and import prices. But these are often independent of domestic economic conditions (e.g. they might be determined by socio-political or natural (e.g. weather) events in raw-material exporting countries). Now, monetary policy could try to offset these effects.. For example, sharply raising interest rates in response to a significant increase in oil prices may provide a modest cushion against a jump in the inflation rate through a stronger[4] pound. But any real reduction in UK activity stemming from the rise in interest rates will have little to no impact on the fundamental global supply imbalance underlying the energy price change.

Second, the effects on inflation of, say, energy prices, depend on what other prices do. If a rise in energy prices is met by a fall in other prices, say wages, then inflation is muted. We shall return to the topic of the domestic economy's absorption of external cost shocks in the next section as this necessary adjustment is not something that can be taken for granted.

Third, current rises in imports prices are often described as "supply side" problems. Shortages of, for example, sea containers due to ports being closed due to Covid would be an example. But some of the price rises are due to the inability to supply, perhaps due to adjustment costs, following with very strong rises in demand: bicycle price rises for example. So at least some "supply side" problems might be due to the strong demand side.

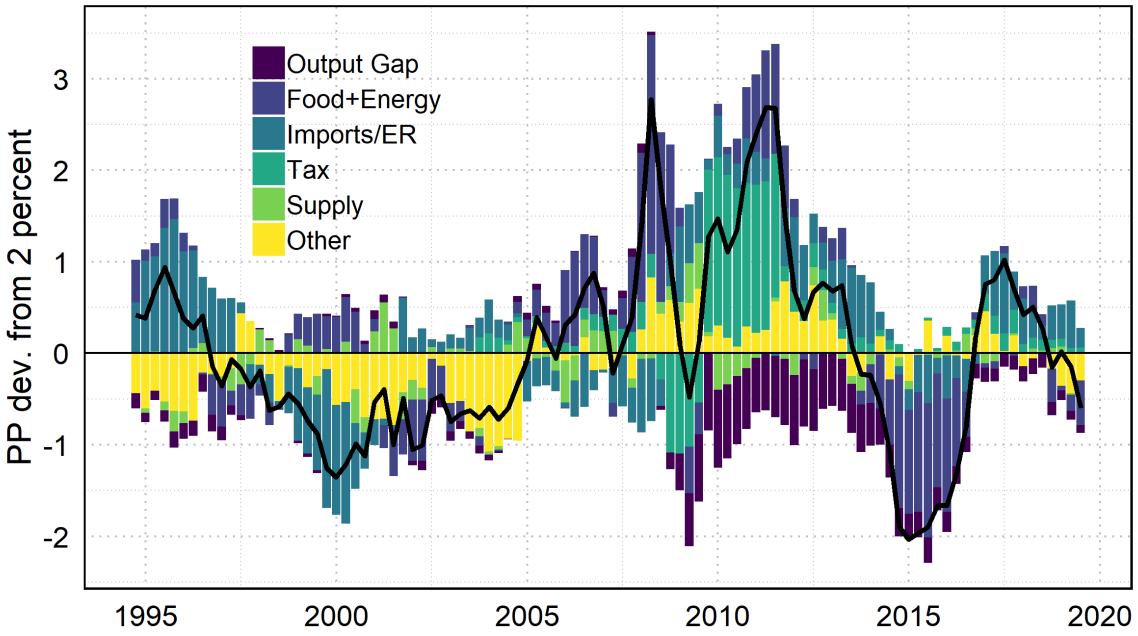
Fourth, it will be apparent that the output gap is a catch-all term for the underlying domestically- focused input costs. It can therefore be misleading if other factors mediate the difference between input costs and the output gap. Further, we don't observe y*, which is unsatisfactory, and there are many and often offsetting supply and demand factors that determine y^*. But we do at least measure y and this can be easier than measuring marginal costs, markups or CAPU of which we have no official timely measures. In light of this, the MPC conducts regular data-intensive forecast rounds in an attempt to pin down the output gap today and its likely evolution over the coming months and years. These forecast rounds focus on a myriad of economic indicators, domestic and international, which taken together feed into a collective view on the stance of the domestic economy.

[4] When domestic interest rates rise the exchange rate should adjust and strengthen to rule out arbitrage opportunities that would become available to investors willing to move their savings to UK bank accounts. An exchange rate strengthening in turn lowers the price of imports invoiced in other currencies.

2e. Inflation now.

Let us now apply this formula. To do so we need data on the output gaps, the energy, import and tax rates and the coefficients in the formula. With these data and assumptions we get **Chart 1**, a decomposition constructed[5] for this talk for the period 1995-2019. The black line is the percentage point deviation of actual inflation from 2%[6]. Notice first that despite some persistent departures from target, the area of the curve up until 2019 Q4 sums to zero and tells us on average the target has been hit.

Chart 1: Inflation deviations from target in the inflation targeting era



Source: ONS, Bank of England and author calculations.
Note: The chart decomposes deviations of year over year CPI inflation from 2 percent shown by the black line. The food and energy contributions are calculated directly from their CPI weights. The output gap contribution is based on a reduced form Philips curve embedded in an output gap filter (see Melolinna & Toth, 2016) and the Bank of England's estimate of the output gap. The tax contributions use ONS calculations of the effect of indirect tax changes on CPI. Other import and exchange rate contributions are determined by a regression of the CPI residual deviation on 8 lags of de-trended non-fuel import prices, de-trended imported fuel prices, Bank of England measure of the multi-lateral effective exchange rate and changes to trend supply growth. The yellow bars are determined as a residual and assumed to constitute other supply effects, adjustment costs and misspecification.

What does this decomposition tell us? First, when there have been significant departures, internationally determined prices such as energy prices, commodity prices and other import prices have played a big role. Food and energy prices (the dark blue bars) account for 24% of the gross integral of deviations from target.[7]

Second, changes to taxes like VAT (dark green bars) account for a further 13 percent of variation, with these changes assumed to be passed through by firms to consumer prices as one-off price changes. Third, import and exchange rate effects (light blue bars) not accounted for by the output gap or productivity changes, account for a further 25 percent of the integral. These other import-price and exchange-rate movements stem from other

[5] See note to chart and appendix for more details.
[6] Between 1997-2003 the target was 2.5% for RPIX, and has been 2% since then for CPI.
[7] Core inflation excludes these items with largely internationally determined prices and are perhaps a clearer read of domestic economic conditions.

global supply factors, financial market volatility and domestic factors. For example, they contributed to the departure from target following the substantial depreciation of the pound after the Brexit referendum in 2016. Some of this change could be attributed to excessive financial market volatility and it's hard to argue that Britain's ability to supply and demand goods was hugely impaired in the weeks and months following the depreciation. In that sense the depreciation felt like an external shock. But underlying the depreciation would have been deeper concerns about domestic supply in the longer run and transition risk.

In sum, an important key message is that food and energy price changes, tax changes and import price movements have been the proximate causes of 24+13+25=62% of the gross deviations from target.

It is instructive to consider some particular years. The largest departure from target in **Chart 1** occurred in 2011 when, as the black line shows, year-on-year CPI inflation reached 5 percent. This was largely explained by the green bars showing the effect of increases of the VAT rate from 15% to 17.5% in 2010 and then to 20% in 2011 alongside other indirect tax increases over that period. At the same time internationally determined food and energy prices also rose significantly. Against this, the output gap (dark purple bars) were pulling down on inflation (disinflation), and is estimated to have been a significant drag for much of the decade following the Global Financial Crisis (GFC) of 2008-2009. And indeed, inflation fell below target between 2014 and 2017 as the temporary effects pushing up on inflation fell dissipated and then reversed. This example illustrates the trade-offs that policy-makers faced at the time: high inflation and a negative output gap (i.e. low activity). In this case "looking through" that temporary period of high inflation was the right policy.

Finally a point about equilibrium. Decompositions like that in **Chart 1** work well when the economy is in a relatively stable equilibrium. That includes stable long term inflation expectations, stable institutions, and stable growth rates. Without this stability the means by which the economy processes shocks becomes unpredictable and the assumption that inflation and the domestic economy react to lagged deviations of, for example, energy or import prices in a consistent manner, becomes invalid. That is to say the ability to explain and forecast inflation rests on the assumption that everyone understands the equilibrium we are in and the ability of our institutions to deliver that equilibrium. We will now study a period that was not so stable.

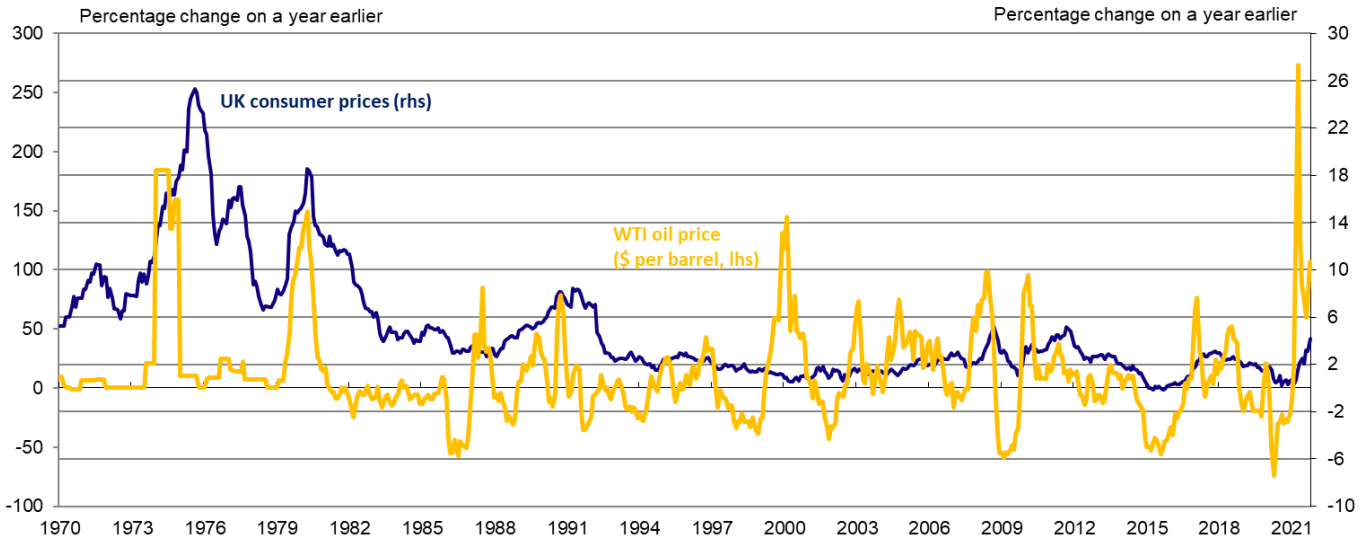
3. Inflation then

3a. The 1970s

Chart 1 started in 1995 and showed the importance of energy prices. But what about inflation and energy prices before then? **Chart 2** shows inflation and energy prices back to 1970. As the chart shows, inflation ran away in the 1970s which was also when oil prices rose. Consumer price inflation was more than 25% in August 1975, and more than 18% in May 1980 – orders of magnitude greater than the 4.2% in October 2021.

So the puzzle is: why did inflation run away then, but not now? Are we somehow better insulated from these and other shocks to the economy or are we destined for a repeat of the 1970s?

Chart 2: UK consumer prices and WTI oil price



Source: ONS for UK CPI and Federal Reserve Bank of St. Louis for the West Texas Intermediate spot crude oil price.

3b. Inflation and energy prices

As we have seen, inflation can be boosted by rising energy prices as firms react to the prices of their inputs. But it can be affected by the prices of other inputs too, such as those of labour and capital. So to understand inflation better, we need to understand the relation between all these prices.

How are these prices linked? The formal link between factor prices and productivity is the "factor price frontier", which gives the maximum combinations of input prices consistent with a certain cost per unit of output. Thus for example, for a given output price and productivity, a firm paying very high material costs and very high wages would have little room for capital payments. Thus we may think of firms in the following way. Firms buy in intermediate inputs to which, using capital and labour, they add value (a supermarket for example buys in food and uses labour and capital to fill the shelves and deliver the food thus providing retailing services). The value of gross output of these firms is therefore defined as the value of the bought in food plus the value of services provided. The net output, or value added, is the gross output less the food. The gross output is available to pay for the food, capital and labour inputs, and the value added to pay for the capital and labour inputs. In considering payments to labour and capital therefore, what matters to firms is those payments in terms of the value added. So when considering unit costs of workers and capital, the costs that firms care about are wage and capital payments in terms of value added, which we write $(p_l * L)/(p_v * V)$ and $(p_k * K)/(p_v * V)$.[8]

Now if firms care about the real product wage (p_l/p_v), what do workers care about? They consume not value added, but consumption goods. So they care about (p_l/p_c). Consider then a rise in imported material costs (food costs in the above example). We may think of two rounds of effects. The first-round effect is this: if a firm

[8] For labour, another way of expressing this is $(p_l/p_v)/(V/H)$, the real product wage divided by labour productivity, the latter being value added ("real product") per hour worked.

just passes on that rise in costs to its selling price in proportion to the share of material costs in final selling costs, then value added is unaffected and the firm has the same value added to distribute to labour and capital. Under these circumstances, nothing more would occur; the economy would have adjusted via some consumption price inflation and (p_l/p_v) remains the same.

The second-round effect comes from the point that workers will now find themselves worse off: their purchasing power (p_l/p_c) has fallen. If they push for a rise in p_l to restore purchasing power, then productivity must rise for payments to capital to stay the same, or payments to capital fall. So a diagnostic for this second-round effect is (p_l/p_v) relative to value added per hour (V/H): if these are out of line, capital payments will fall. Now, there is of course no reason that capital payments have to be defended. But in an open economy with capital mobility, we would expect capital to eventually leave economies with persistently low capital returns: factories setting up in low-cost countries for example. So taking (p_l/p_v) relative to (V/H) as a benchmark seems like a reasonable rough diagnostic.

Turning to the data, the real product wage is designed to measure the cost of hiring incurred by firms. It is defined as hourly labour compensation less employment subsidies, deflated by the GVA deflator at basic prices (basic prices means a consistent treatment of taxes and subsidies).[9] Employment subsidies are therefore subtracted from pre-tax and subsidy labour payments since they defray labour costs of firms.

The charts below set out the data. They show the real product wage (p_l/p_v), productivity (V/H) and the real consumption wage (p_l/p_c) in the 1970s in the left chart and during the late 2000s in the right chart.

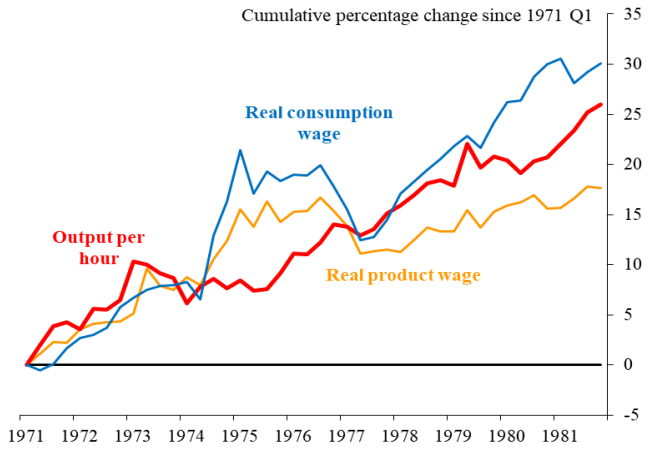
Chart 3 (Panel A) shows how during the first oil shock in the mid-1970s, workers' resistance to cuts in their real consumption wage brought on by surging oil prices translated into a rise in the real product wage, to a level above that commensurate with their productivity. Such "real wage resistance" to energy prices was first analysed by Michael Bruno and Jeffery Sachs in their 1985 book *The Economics of Worldwide Stagflation*. It was relatively short-lived however, and the real product wage rose by less than productivity over the subsequent decade from 1977.

Chart 3 (Panel B) shows the behaviour of real wages relative to output per hour starting in the first quarter of 2008. In the aftermath of the GFC, inflation peaked at 5.2% in September 2011, following one-off cost shocks from rising energy prices, there was a 25% depreciation of sterling during the crisis, and the VAT increase to 20%. The fall in the real consumption wage is striking – pointing to much greater real-wage flexibility than during the 1973/4 oil shock – while over that period the real product wage evolved broadly in line with hourly productivity until 2013/14, and started to fall behind thereafter.

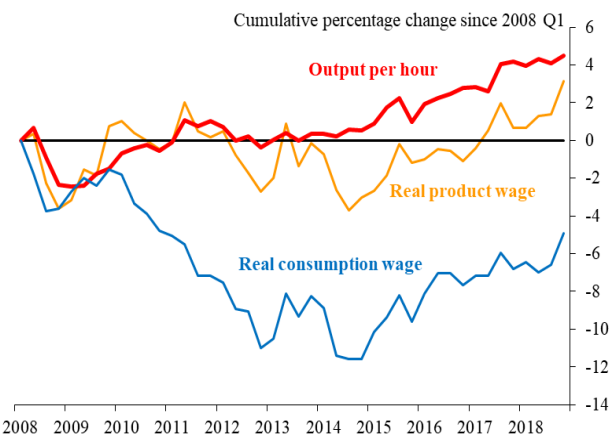
[9] Compensation is defined as wages and salaries plus firms' social insurance contributions.

Chart 3: Real wage resistance

Panel A: 1970s



Panel B: 2010s



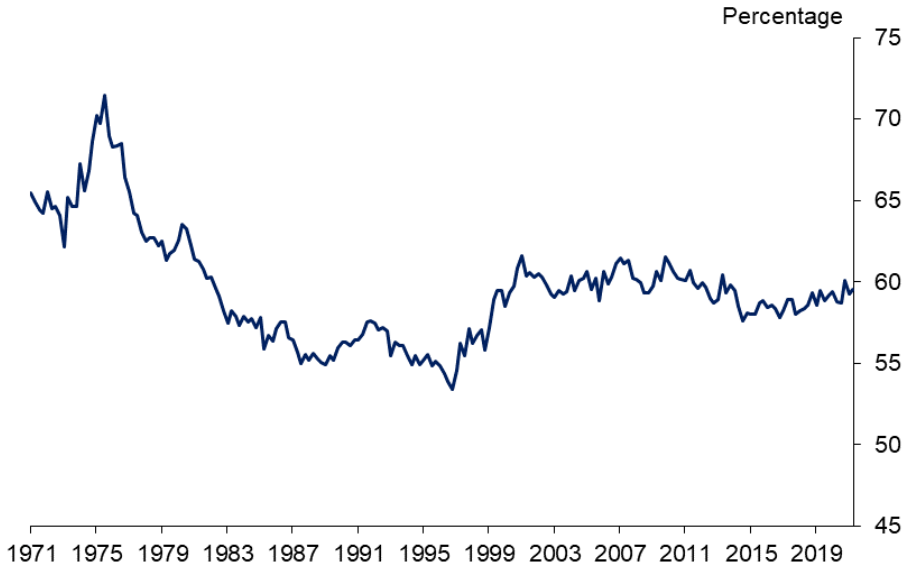
Source: ONS and author's calculations. The real product and consumption wages are calculated as hourly labour compensation less employment subsidies, deflated by the GVA deflator at basic prices and the consumer price index respectively. Productivity is calculated as GVA at basic prices divided by total hours worked.

We can construct a measure of the share of labour costs in value added that is conceptually similar to the real product wage, in that it captures labour costs incurred by firms.[10]

Chart 4 shows how the "labour cost share" has evolved over the past 50 years. Looking at the chart, it's immediately apparent that workers' share of income rose rapidly in the mid-1970s, when the real product wage was running ahead of productivity, only to fall more or less continuously until the mid-1990s and recover after that. Notice how the labour share is stable when the real product wage grows in line with labour productivity, as in the 2000s until the immediate aftermath of the GFC.

[10] The labour cost share measure used here is defined as labour compensation less employment subsidies, divided by GVA at basic prices. It differs conceptually from that officially published by the ONS. The published measure is the share of nominal labour compensation in GVA at factor costs. The numerator does not deduct employment subsidies because it focuses on the total labour income disbursed to workers.

Chart 4: Labour costs share

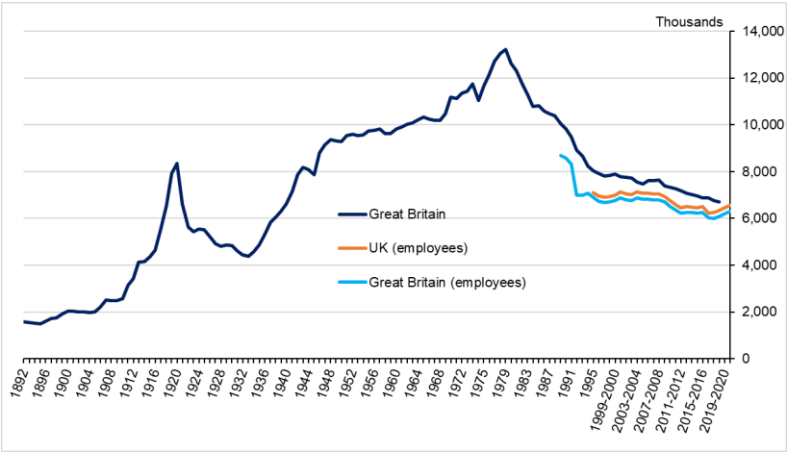


Source: ONS and author's calculations. The labour cost share is calculated as the real product wage divided by output per hour, as defined in the source to Chart 3. It is indexed to the published ONS labour share measure in 2019 Q1. The published ONS measure can be found in the ONS's Labour costs and labour income, UK: 2021.

3c. Why the difference?

So what can explain the drastically different evolution of the rewards to labour and capital in the mid-1970s and 2000s? Two obvious candidates are labour and product market reform upon which much has been written, see e.g. Layard, Nickell, Jackman (2005).

Chart 5: Trade union membership in Great Britain

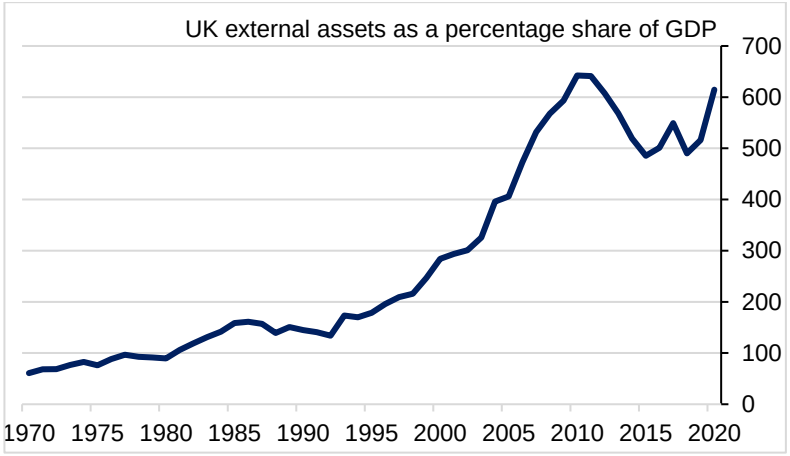


Source: Trade union statistics 2020, GOV.UK

Starting with the labour market, one contributing factor Bruno and Sachs pointed to in their book was labour-market institutions, in particular the degree of employment protection and unionisation and the extent to which real wages adjusted in the face of external shocks. **Chart 5** shows that trade-union membership was rising rapidly throughout the 1970s, to peak in 1979. Union membership then continued to fall to reach pre-WWII levels in 2020.

Turning to capital market reform, one development has been increasing international capital mobility. I've illustrated that from a UK perspective in **Chart 6**. It shows the evolution of the UK's external assets as a share of GDP since 1970. These are the total financial claims of UK residents on non-residents – how much capital we've invested abroad. The six-fold increase in the ratio over the past 50 years, starting at 100% in the 1970s to reach 600% in 2020, is a testament to how much more open capital markets have become.

Chart 6: UK international capital mobility



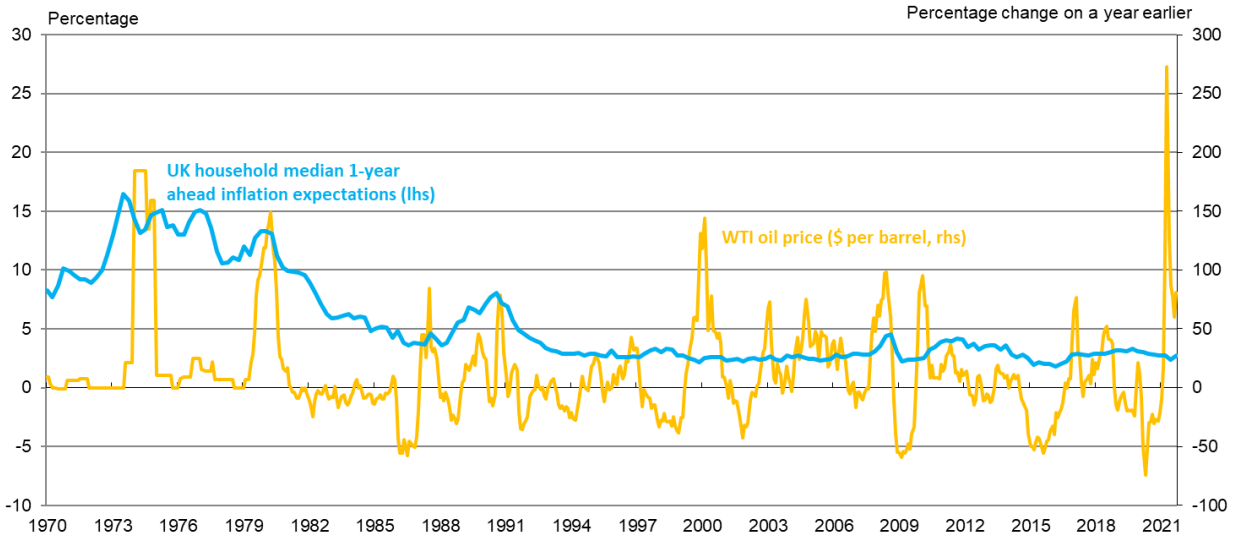
Source: Lane Milessi-Ferretti (2021) External Wealth of Nations dataset.
Lane, Philip R. and Gian Maria Milesi-Ferretti, External Wealth of Nations database (based on Lane, Philip R. and Gian Maria Milesi-Ferretti, 2018, "The External Wealth of Nations Revisited: International Financial Integration in the Aftermath of the Global Financial Crisis," IMF Economic Review 66, 189-222).
Note: External assets are the sum of portfolio equity, foreign direct investment, debt assets, financial derivatives and foreign-exchange reserves less gold.

3d. Credibility

In the theoretical framework I set out at the beginning, I said inflation today is a weighted average of some constant rate of inflation π^*, and current and expected future deviations in real marginal costs plus adjustment costs. In an era of inflation targeting, as long as the MPC is expected to set policy in a way that will bring inflation back to the target when it deviates from it, π^* embodies the central bank's target. So, much hangs on the credibility of central banks.

One gauge of that credibility is the substantial decline of households' expected inflation in response to oil-price shocks over the past forty years. You can see in **Chart 7** that during the 1970s oil price shocks, when oil-price inflation was peaking at more than 180%, UK households expected inflation one year hence to range between 10 and 15%. That figure was 2.7% last September, following an oil inflation rate of more than 270% in April.

Chart 7: UK households' median one-year ahead inflation expectations and WTI oil price



Source: Federal Reserve Bank of St. Louis for the West Texas Intermediate spot crude oil price; for households' inflation expectations, from 1970 Q1 to 1986 Q4, Gallup and EC surveys based on Batchelor and Orr (1988); from 1987 Q1 to 1996 Q2, average of Barclays Basix median one-year ahead and extended Batchelor and Orr measure; from 1996 Q3 to 1999 Q3, Barclays Basix adjusted for average difference with the 50:50 measure over the 2001-5 period; from 1999 Q4 to 2009 Q4, average of Barclays Basix median one-year ahead and Bank/GFK median one-year ahead; from 2010 Q1, Bank/Kantar median one-year ahead.

Where does that credibility come from? It is often argued credibility is limited if, as in the 1970s, politicians are responsible for both the target and operation of monetary policy. For example, it has been argued that in the face of adverse shocks politicians inflated demand relying on "Verdoon's law", namely the belief that increases in demand would lead to economies of scale in industry and boost productivity.[11]

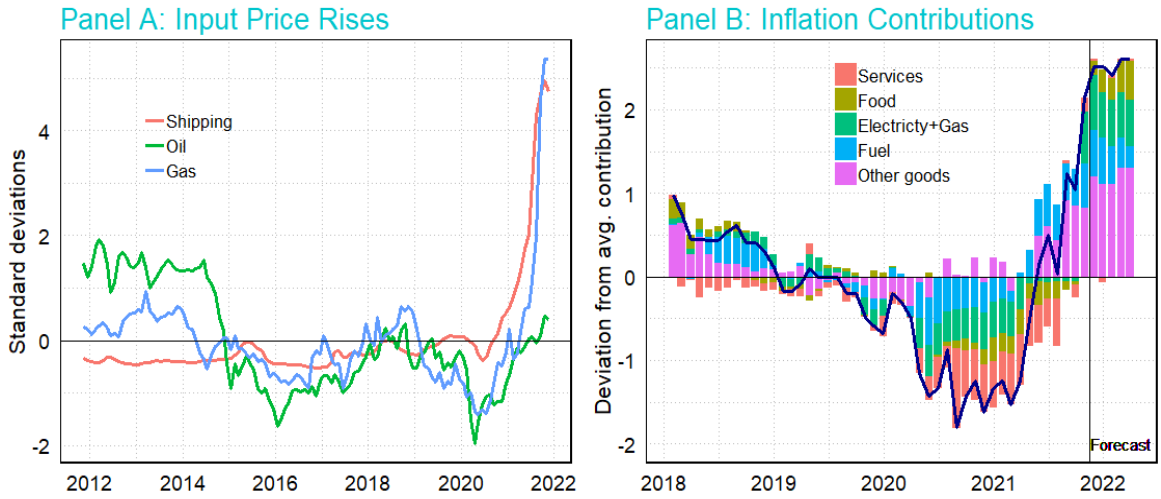
On the monetary policy side, there was no inflation targeting and no independent central bank in charge of achieving a target. The government relied on wage and price controls to moderate input costs.
Since then, much has changed in the design and conduct of monetary policy. In 1992, the UK adopted a form of inflation targeting and in 1997, the Bank of England was granted operational independence to achieve the inflation target. The motivation was two-fold. Firstly, an explicit target for inflation reduces the degree of uncertainty about future prices, making monetary policy more predictable (this is known as providing a "nominal anchor"). Secondly, the idea was that a central bank that sets policy independently, free from political interference and the electoral cycle, would build credibility.[12]

[11] See Dimsdale and Thomas (2020).
[12] The view was also taken that to affect expectations, policymakers should explain their understanding of economic developments and how that understanding affects their policy decisions to achieve the inflation target. This was the goal of the publication of the *Inflation Report* in 1993, now called the *Monetary Policy Report*, and of MPC members' regular appearances before the Treasury Select Committee.

4. Policy

4a. Energy and other contributions

Chart 8: Inflation outlook



Source: ONS, Eikon by Refinitiv, Bank of England & Author calculations
Note: Panel A shows three series normalised by their mean and standard deviation for the period 2011-2021. Shipping is the HARPEX shipping price index. Oil is the spot price for Brent crude oil. Gas is the UK national balancing point price for next day delivery. All series plotted as monthly averages with the last data point in November 2021. Panel B shows the contributions and forecasted contributions from the Bank of England November 2021 MPR of different components of the CPI basked to CPI inflation. Each contribution is expressed as deviations from its average contributions from 2010-2021. The forecast ends in March 2022.

What does this all mean for policy? Let us turn to the very recent period and the latest *MPR* forecast.

CPI inflation rose to 4.2% in October and the MPC expects inflation to continue to rise towards 5 percent in 2022. **Chart 8** shows some of the proximate factors behind this rise. **Panel A** shows the extraordinary recent spikes in container shipping rates, gas prices and oil prices. As we documented earlier, such changes have historically accounted for large shares of inflation changes. What of the future? There are two-sided risks. As set out in the November *MPR* due to the operation of the price cap, future prices will stay high, nudging up overall inflation. But, if these prices fall back substantially, then future price caps may well lower inflation. Indeed, in the *MPR* we calculated that such a fall could lead inflation to be 1 percent lower at its peak in 2022. An interesting side-note here[13] is that while oil prices and shipping rates can be quite clearly linked to the pandemic and global supply issues, the recent volatility in gas prices could be linked to recent efforts to decarbonise the economy. Ongoing efforts may therefore induce more volatility in the medium term from energy prices as we continue along this transition.

Panel B of **Chart 8** sets out the contributions to past and future inflation in terms of their deviation from the 1996-2021 average. Interestingly, over the pandemic, fuel prices had a below-average effect on lowering inflation. In the forecast however, all categories, except services, are pushing up on inflation to a greater extent than normal and thus taking us above target. In particular, goods prices have an above-average effect of raising

[13] See What we know about climate change and inflation | VOX, CEPR Policy Portal (voxeu.org) for more on this.

inflation. These goods prices are likely globally determined and hence their rising prices are a likely a combination of global supply disruptions related to Covid-19 and other idiosyncratic factors, alongside heightened demand for goods relative to services. As I've argued there is little UK monetary policy on its own can do to rectify these global imbalances. But my central expectation is that these inflationary pressures will moderate as the level of these energy prices is expected to fall back, demand for goods relative to services moderates and global supply chains catch up. That said, there is of course substantial uncertainty about how long this will take.

Finally, the contribution to inflation of services is in line with its average contribution. Since domestic services are in large part due to domestic wages, I turn to the labour market next.

4b. The labour market

One of the elements driving wage inflation is the "tightness" of the labour market. So how might one judge tightness? One very useful tool is the relation between unemployment (U) and vacancies (V) summarised in the Beveridge or UV curve.

Beveridge[14] was interested in understanding the simultaneous co-existence of unemployed workers and vacancies. He reasoned they must coexist if workers and firms had difficulty finding each other. There could not simultaneously be many vacancies and many unemployed (or else they would find each other and so both vacancies and unemployment would fall), so the relationship, shown in **Chart 9** must be negative: for a given "finding technology" more vacancies would mean fewer unemployed and vice versa. In a recession, u rises and v falls and so one moves down the curve: in a recovery back upwards. But if the unemployed are ill-suited to the vacancies the curve moves out (from black to red). So the VU curve is a diagnostic tool: movements up and down the curve are the ups and downs of the business cycle. Movements in and out are "mismatch" between available unemployed and vacancies getting better and worse. The modern analytics of the curve are due to the 2010 Nobel Prize winners, Peter Diamond, Dale Mortenson and Christopher Pissarides.

[14] See Yashiv (2000). The Beveridge Report, 'Social Insurance and Allied Services' (1942) is credited with the proposal that effectively founded the modern UK welfare state.

Chart 9: A theoretical Beveridge (VU) curve

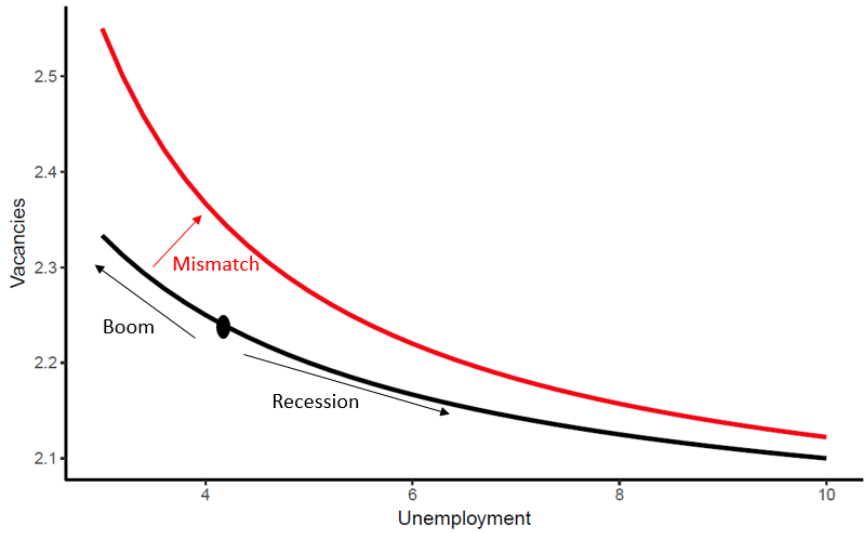
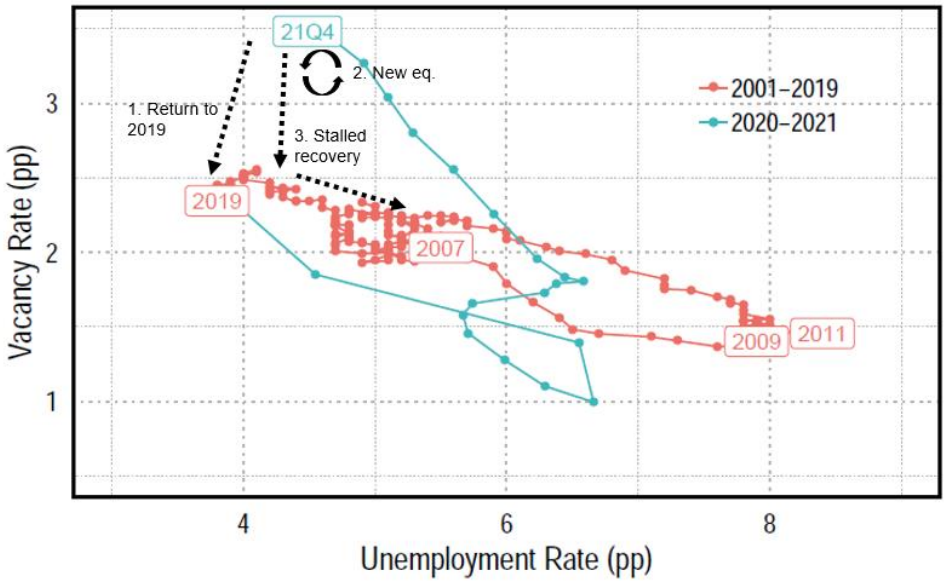


Chart 10 sets out what we see in the UK data. Starting in 2007, we can see that the financial crisis moved the economy down the curve to the south-east, with falling vacancies and rising unemployment. In 2011 we were at the most south-easterly point on the curve and the economy slowed recovered, moving up the curve in subsequent years. Recall from **Chart 1** that in 2011 for the next few years the output gap pulled down on inflation. That is, the relatively high unemployment and low vacancies meant a slack labour market (a relatively low V/U ratio), which in turn, served to lower inflation.

At the start of the pandemic, 2019, the economy was north-west of 2007, with high vacancies and low unemployment, and the green line plots out the economy in VU space since the onset of the pandemic. At the start of the pandemic vacancies fell. However, the fall in vacancies was not followed by a commensurate and sustained increase in unemployment. The main reason for this was the furlough scheme, which shielded millions from unemployment. The line partially adjust for the furlough scheme by assuming that 10 percent of furloughed workers were in effect unemployed (see note to chart) and makes the economy's path in VU space look more like a shift along the curve as had been the case after 2007.[15]

[15] The appendix shows changes in other countries. The United States, which did not have a furlough scheme experienced an unemployment rate as high as 14.8 percent in April 2020 but today find themselves in a similar position to the UK with slightly elevated unemployment and significantly elevated vacancies.

Chart 10 : The Beveridge (VU) curve



Source: ONS, Bank and author calculations.
Note: The 2020-2021 period has been adjusted by assuming that 10 percent of furloughed workers were in effect unemployed. This was calibrated using the Labour Force Survey microdata and is based on an estimate of the proportion of workers who report to be on furlough and state that they are searching for an additional or different job. The estimate comes from the LFS microdata. 21Q4 is a forecast based on the Bank of England MPR and extrapolation of the latest Adzuna vacancy data made available through ONS. Rates are expressed relative to the active labour force.

After the depths of the pandemic, the economy moved up to the north-west. The 2021Q4 data show a forecast point with higher vacancies and relatively low unemployment relative to what we have seen before.

I find it helpful to think of three possible cases all of which are indicated in the diagram.

Case 1. Recovery: Less V, less U.

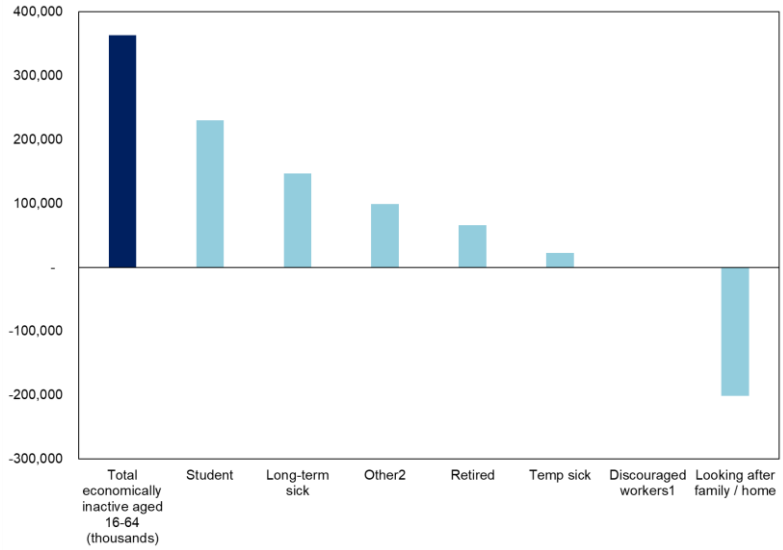
In this case, the current (21Q4) position on the VU diagram describes an imbalance between labour demand and labour supply relative to the previous equilibrium that reflects temporary adjustment costs due to the pace of recovery and the fact that the composition of demand has not returned to its pre-pandemic distribution. A temporary overshoot in vacancies is therefore not that surprising, and consistent with historical evidence that such temporary shifts in the Beveridge curve are fairly common.[16] This imbalance resolves itself as the composition of demand normalises further, hiring catches up, and fiscal and monetary support is gently withdrawn. That is a story of a smooth transition back to the 2019 equilibrium which would be consistent with a general path of rising rates embedded in the MPC forecast. Notice that in this case, rising rates should be seen as a successful transition back to a normal economy which has been supported over the pandemic.

This successful transition will also depend upon bringing some of the 360,000 16-64 year olds that became economically active between February 2020 and today back into the labour force. This margin of the labour market has proved to be quite elastic in the past. **Chart 11** decomposes the reasons for this change over the

[16] See Diamond and Sahin (2015).

pandemic. It indicates a rise in students, the long-term sick, and retirement. An obvious question is to extent to which the rise is due to long Covid. We don't know the answer this, since the data don't ask the long-term sick why they have this status. That said, there is no rise in the growth of those reporting disability in the LFS (which is defined as having a long-term health condition that limits your day to day activities).[17] If this wider group of inactive people proves difficult to bring back into the labour market then the likelihood of significant mismatch persisting is higher.

Chart 11: Changes in levels of economic inactivity by reason, 2019Q4-2021Q3



Source: ONS, Labour Force Survey.
Note: this chart is based on Figure 11 of the the Institute for Employment Studies November Labour Market Statistics, 16th November 2021. My thanks to Tony Wilson for kindly providing the data.

Case 2. Mismatch: more V, more U.

In this case, these current imbalances are more entrenched and/lead to a new equilibrium of lower labour supply. The current stock of unemployed workers alone will not be enough to restore balance in the labour market: perhaps such workers are unsuited to the new economic make up, or have permanently withdrawn from the workforce. This would also be consistent with the normalisation of policy, perhaps more vigorously than in case 1.

Case 3. The recovery stalls: less V and more U.

A final case is that temporary adjustment costs and imbalances give way to a stalled recovery. Worries about the pandemic, stalling consumer confidence in the face of falling living standards due to energy price rises, means that firms reverse hiring, stopping posting vacancies leading to rising unemployment. Indeed, GDP growth has moderated and come in below previous forecasts. GDP grew by 1.3 percent in 2021 Q3 versus an expectation of 2.9 percent in August. The November *MPR* forecast for the level of GDP in 2021Q4 also lies

[17] I thank Tony Wilson for his help in understanding these data.

3.5% below our pre-pandemic forecast and below the level recorded in 2019Q4. In this case therefore, one might want to wait before normalizing policy such that normalisation begins only once we are more confident that the recovery is entrenched.

In my view, adjudicating between these outcomes is crucial. In the November *MPR* we said would wait for more data following the end of furlough scheme. In terms of the diagram above, we would want more data to see if cases 1, 2 or 3 were more likely. So what has happened? We have at least two additional data points, both of which suggest that the labour market is buoyant. First, the Resolution Foundation survey[18] from last week suggests 88% of workers who were still furloughed immediately prior to the end of the scheme have been rehired. Second, the labour market data for this month shows that indicators of redundancies remain muted, the number of payrolled employees continues to grow beyond 2019Q4 levels and there has been no recorded rise in claims for unemployment since the scheme ended. This is consistent with the forecast we have in the MPR and puts more likelihood on case 1 or case 2 for now. The next labour market report is released on December, 14th, and provides data through to November that should give an even clearer steer of the post furlough labour market.

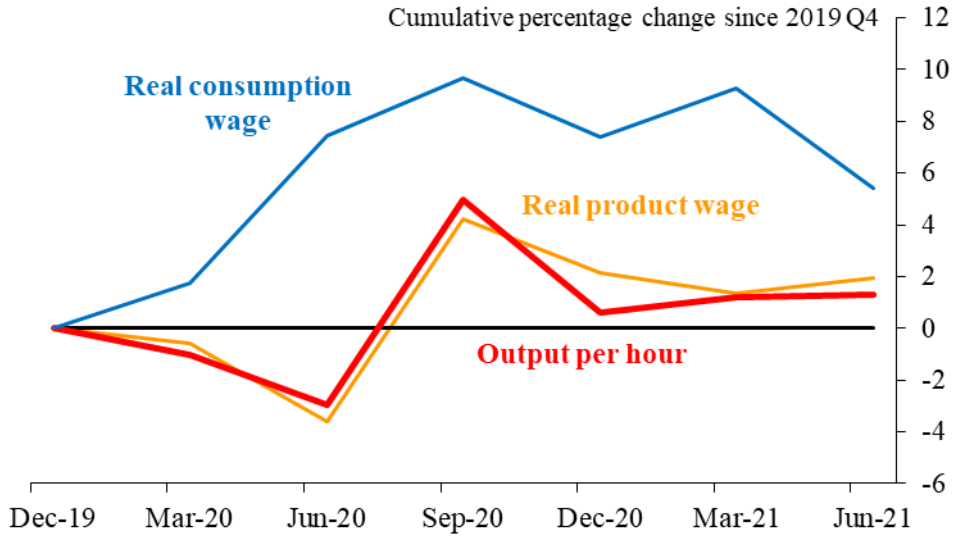
I now come to look at wage developments. Current wage inflation (AWE) is measured at 5.8 percent. As the *MPR* has set out, it is hard to take a clean read from these data due to changes in composition and the like. A key question for me, as set out above, is the correspondence between real product wages, productivity and real consumption wages. **Chart 12**[19] repeats **Chart 3** for the recent period. It shows that workers' consumption wage has risen significantly over the pandemic but product wages have continued to track output per hour.

For the moment, the implication of the chart is twofold. First, productivity will have to keep pace with product wages to avoid more persistent domestic inflationary pressures. Second, without those productivity increases the real consumption wage will have to fall if imported prices keep rising. Third, the tightness of the labour market will be critical in understanding the likely evolution of wages. If the labour market remains buoyant then this puts upward pressure on wages that, from an inflation point of view, will need to be matched by increased productivity.

[18] See Post-furlough blues • Resolution Foundation

[19] I should say that the construction of this chart involves a number of difficult conceptual issues since there have been large subsidies and tax breaks over the pandemic period: the chart shows whole-economy labour compensation of those engaged less subsidies plus a share of mixed income divided by the GVA deflator at basic prices, which is not the same as the usual measures of private-sector wages and productivity.

Chart 12: Compensation and productivity over the pandemic



Source: ONS and author's calculations. The real product and consumption wages are calculated as hourly labour compensation less employment subsidies, deflated by the GVA deflator at basic prices and the consumer price index respectively. Productivity is calculated as GVA at basic prices divided by total hours worked.

5. Conclusion: the big picture

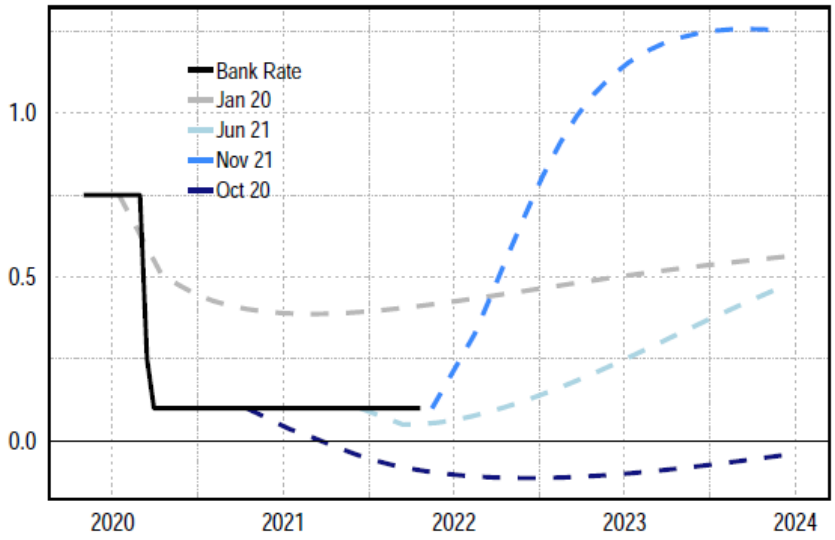
I have tried to make a number of points.

First, much of the variation in inflation is due to global factors such as imported goods and energy prices. I expect much of that variation to be transitory.

Second, as we have seen much of the inflation problems of the 1970s were due to changes in commodity prices and the long drawn-out response of wages relative to productivity to such changes. The latest data continues to indicate a tight labour market, putting upward pressure on wages. From a living standards point of view, this is of course excellent news, but from an inflation point of view this has to be matched by increased productivity and so we have to be vigilant.

Finally, you will know that the November *MPR* suggested that if the economy proceeds to recover rates will rise. It is worth having some perspective on that rise. The solid line in **Chart 13** shows Bank Rate since the start of the pandemic, falling from 0.75% to the current level of 0.1%. The dotted lines show the market-implied path of Bank Rate at intervals over the pandemic (measured by a snapshot of the expected market curve of future rates at the indicated times). In January 2020, before the pandemic, rates were expected to fall and then rise back gently. In October 2020, in the depth of the pandemic, with no vaccine in prospect and successive lockdowns, the market expected negative rates. By June 2021, with the vaccine rolled out and the prospect of much fewer restrictions, the curve had moved up. The message of this chart future rises in Bank Rate are largely indicative of the recovery. In my view, the prospective rise in Bank Rate from its emergency level – whenever that comes - is not a bug, but a feature. It reflects the success of fiscal, health and science policy in dealing with worst economic shock in 100 years.

Chart 13: The evolution of Bank Rate



Source: Bank of England (Yield curves | Bank of England)
Note: Bank Rate forecasts are based on sterling overnight index swap (OIS) rates.

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Appendix

A1. Real product wage and labour share definitions

This section lays out the definitions that go into the real product wage and various labour share measures featuring in section 3.b.

The employed are defined as employees plus the self-employed.

As defined here, the real product wage measures the cost of hiring incurred by firms. It is defined as hourly labour compensation less employment subsidies, deflated by the GVA deflator at basic prices. Using basic prices ensures a consistent treatment of taxes and subsidies across the numerator and denominator. Employment subsidies are therefore subtracted from pre-tax and subsidy labour payments since they defray labour costs of firms.

Labour compensation is pre-tax wages plus non-wage labour costs such as pensions and employer national insurance contributions. As defined here, it includes the compensation of employees and that of the self-employed.

The author's measure of the share of labour costs in value added is conceptually similar to the real product wage, in that it captures labour costs incurred by firms.

The labour costs share measure is thus defined as labour compensation less employment subsidies, divided by GVA at basic prices. It differs conceptually from that officially published by the ONS. The ONS's published measure is the share of nominal labour compensation in GVA at factor costs. The numerator does not deduct employment subsidies because it focuses on the total labour income disbursed to workers.

Below is a glossary table.

Compensation of employees (CoE)	= wages and salaries + employers' social contributions
Employment subsidies	Subsidies paid to businesses by the government directly based on how many employees they employ or how much they pay employees. The furlough schemes implemented during the coronavirus (COVID-19) pandemic are considered employment subsidies. Subsidies to the self-employed are included.
GDP at market prices	= GVA at basic prices + taxes on products (inc VAT) - subsidies on products

Gross operating surplus (GOS)	= consumption of fixed capital + net operating surplus
GVA at factor prices	= total output - intermediate consumption or = compensation of employees + mixed income + gross operating surplus
GVA at basic prices	= GVA at factor prices + taxes on production - subsidies on production
Hours	Hours worked by employees and the self-employed
Labour compensation	= CoE + MI* MI* is the sum across industries of share a of Mixed Income (MI), where a = CoE / (GOS + CoE) in each industry
Labour share of income (published by the ONS)	= (CoE + MI*) / (CoE + MI + GOS) = (CoE + MI*) / GVA at factor prices MI* is the sum across industries of share a of Mixed Income (MI), where a = CoE / (GOS + CoE) in each industry
Labour-cost share of income (author's calculations)	= (CoE + MI* - employment subsidies) / GVA deflator at basic prices MI* is the sum across industries of share a of Mixed Income (MI), where a = CoE / (GOS + CoE) in each industry

Mixed income	The operating profit of unincorporated businesses owned by households. Household members often provide unpaid labour inputs to the business. The profit is therefore a mixture of labour remuneration and return to the owner as entrepreneur. It captures the remuneration of the self-employed
Real Product Wage (author's calculations)	= (CoE + MI* – employment subsidies) / Hours) / GVA deflator at basic prices MI* is the sum across industries of share a of Mixed Income (MI), where a = CoE / (GOS + CoE) in each industry
Output per hour worked	GVA at basic prices / Hours

See Labour costs and labour income, UK - Office for National Statistics (ons.gov.uk) and the ONS glossary for the main terms used in the national accounts.

A2. Inflation Accounting Decomposition

Chart 1 decomposes CPI inflation deviations from 2 percent at the quarterly frequency into several semi-structural factors for the period 1995-2019.

1) Food and energy is the direct contribution of from food (COICOP 01), alcohol and tobacco (COICOP 02) and energy (COICOP 04.5).
2) Tax uses the calculated direct effects of changes in indirect taxes from ONS (link).
3) The output gap is calculated using a reduced form Philips curve from an output gap filter based on appendix 1 of Melolinna & Toth (2016) but estimated without the financial conditions index. The filter uses data from 1986-2019 including real GDP, CPI core inflation, the unemployment rate and the
4) long-term unemployment rate.

$$\hat{\pi_t} = 0.28\hat{\pi_{t-1}} + 0.19\,\hat{y_{t-1}} + \epsilon_t.$$

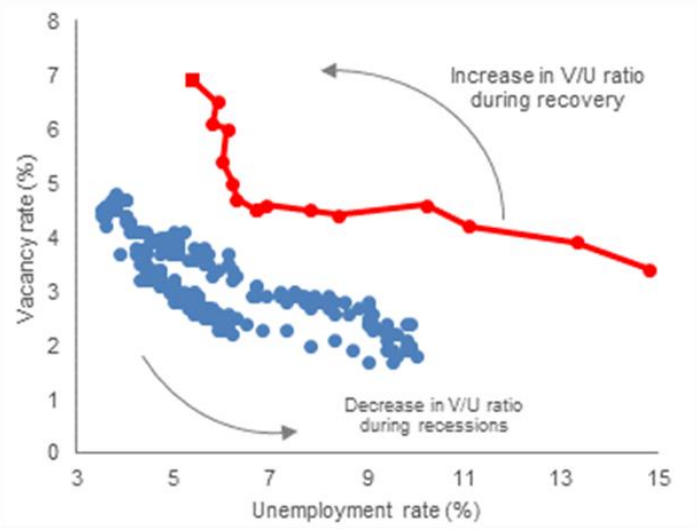
$\hat{\pi_t}$ is the cyclical component of quarterly inflation (annualized) and $\hat{y_{t-1}}$ is the lagged output gap. This formula is then applied to the MPC's estimate of the output gap and converted to its effect on quarter on year inflation. This implies a coefficient of about 0.30 between a constant output gap and 12 month CPI inflation.

5) The residual deviation from 2 percent minus the average contribution of non-core items is then regressed on 8 lags of the following variables that aim to capture other import price effects, the indirect effect of food and energy prices and other supply effects:
   a) HP filtered imported fuel prices published by ONS
   b) HP filtered non-fuel import prices published by ONS.

c) The change in the effective exchange rate. The effective exchange rate is first regressed on the current and lagged output gap. Changes to the residuals from the first stage regression enter the second stage.
d) The residuals from the output gap filter estimate of the random walk trend growth rate $g_t = g_{t-1} + \epsilon_{g,t}$.

6) The contributions from (1) are then labeled the food and energy category. Contributions (4 a-c) are the import/ER category. (4d) is the supply category.
7) Any residual unexplained deviations are the other category and due to factors like state contingency and misspecification from the reduced form semi-structural nature of the decomposition.

A3. US Beveridge Curve



Source: Bureau of Labor Stastistics and Bank calculations

Note: pre-COVID data in blue; data since COVID in red.