Expecting Brexit*

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Abstract

The Brexit vote precipitated the unravelling of the UK's membership of the world's deepest economic integration agreement. This paper reviews evidence on the realized economic effects of Brexit. The 2016 Brexit referendum changed expectations about future UK-EU relations. Studying its consequences provides new insights regarding the economic impacts of news and uncertainty shocks. Voting for Brexit had large negative effects on the UK economy between 2016 and 2019, leading to higher import and consumer prices, lower investment, and slower real wage and GDP growth. However, at the aggregate level, there was little or no trade diversion away from the EU, implying that many of the anticipated long-run effects of Brexit did not materialize before the new UK-EU trade relationship came into force in 2021.

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1 Introduction

On 23rd June 2016 the United Kingdom (UK) unexpectedly voted to leave the European Union (EU). The Leave vote provided a popular mandate for Brexit, but left uncertain the date and terms of the UK's departure and what the UK's future relationship with the EU would be. Attempts to resolve this uncertainty in a way acceptable to both the UK and the EU dominated UK politics and society for the next four years leading to acrimonious debates both inside and outside of parliament, fractious negotiations with the EU and bitter divisions between Leave and Remain supporters.

Brexit finally took place on 31st January 2020. However, the economic relationship between the UK and the EU did not change until the start of 2021, when a new UK-EU free trade agreement entered into force. The Trade and Cooperation Agreement (TCA) provides for tariff-free and quota-free trade between the UK and the EU in all products. But under the TCA the UK is no longer a member of the EU's Single Market or Customs Union.[1] Consequently, Brexit has resulted in a reversal of the deep integration fostered by EU membership and the re-introduction of a customs and regulatory border between the UK and the EU.

This paper reviews the literature studying the economic consequences of the Brexit referendum before the UK's new economic relationship with the EU came into effect. During this waiting period, which lasted until the end of 2020, Brexit can be conceptualized as a shock to expectations about future economic policy. In particular, the Leave vote raised the probability of economic disintegration, leading to a decline in the expected future openness of the UK to trade, investment and migration with the EU. In addition, it increased uncertainty over future UK and EU economic policy, creating a higher risk environment for decision makers.

Studying Brexit is important because it is the biggest reversal of deep international economic integration in the modern era. There is no precedent for an industrialized economy leaving an economic area like the EU's common market. Trade agreements generally seek to strengthen economic integration and lower barriers to trade. Brexit does the reverse.

[1]The Single Market aims to guarantee the free movement of goods, services, people and capital throughout the EU. The Customs Union requires that EU countries have a common external trade policy and ensures that there are no tariffs or other customs barriers between member states.

The unusual nature of Brexit provides novel evidence on the channels through which shocks to deep integration and changes in expectations affect economic behaviour. We document how Brexit has contributed to understanding the mechanisms through which forward-looking economic decisions respond to changes in expectations and to studying the relative importance of first versus second moment shifts in expectations. We also describe how the large depreciation of sterling following the Leave vote has been used to provide new estimates of exchange rate pass-through, the nature of price setting and the labour market effects of international trade.

Brexit is a macroeconomic shock that affects not only the manufacturing sector, which constitutes a small share of the aggregate economy, but also services, investment flows, the exchange rate and international policy coordination. Brexit studies have improved our understanding of how these aspects of openness affect both microeconomic and macroeconomic outcomes. In the process, they have also revealed where future research is needed to fill gaps in our knowledge.

The fact that Brexit has consequences for almost all parts of the UK's economy has allowed researchers to use a wide variety of data sources and empirical methods to measure exposure to Brexit and estimate the impacts of the Leave vote – from differences-in-differences analysis with microdata to synthetic control studies of aggregate output. We discuss the strengths and weaknesses of alternative approaches and highlight the consistency (or lack thereof) between findings using different data, methodologies and levels of aggregation. A recurrent theme that will be important for future theoretical and empirical modelling is the importance of reconciling micro-level estimates with aggregate outcomes when quantifying the effects of Brexit.

Existing research constitutes the first draft of an economic history of Brexit. What does it tell us? We conclude that the Leave vote had a sizable negative effect on the UK economy even before the UK left the EU. The fall in sterling following the referendum raised consumer prices and imported input costs leading to a decline in real wages. Uncertainty and the prospect of higher future barriers to trade and migration led to lower capital investment, reduced demand and slower GDP growth. Based on the available evidence, our judgment is that the UK economy was around 2 to 3 percent smaller at the end of 2019 than it would have been if voters had opted to remain

in the EU. This fall is an order of magnitude larger than US losses from the trade war with China initiated by President Trump and equates to a GDP decline of between 650 and 1000 pounds per person per year at 2019 prices.

An important determinant of the long-run effects of Brexit will be how trade and investment flows respond to the rise in barriers caused by the TCA. Interestingly, despite evidence that firm and product level trade was affected by the threat of higher trade costs, there is little sign of aggregate trade diversion away from the EU prior to the implementation of the TCA. The EU's share of UK imports and exports remained roughly stable between 2016 and 2020, suggesting aggregate trade is relatively unresponsive to news of future increases in trade barriers. However, there is already evidence that the TCA has reduced UK-EU trade in 2021, particularly UK imports from the EU. Tracing how the UK and EU economies respond to this trade shock is an important agenda for future research, especially given wider concerns about the effects of the Covid-19 pandemic on international openness.

The remainder of the paper is organised as follows. We start in Section 2 with a short history of Brexit, before briefly summarizing the expected economic effects of Brexit in Section 3. Sections 4-8 review the literature on the observed consequences of the Leave vote, considering its impact on financial markets, prices, labour markets, investment and output, and finally trade. Section 8 also discusses early evidence on the trade effects of the TCA in 2021. Finally, Section 9 concludes with an agenda for future trade policy research. For want of space, we do not consider the political economy literature on why the UK voted for Brexit. Becker, Fetzer and Novy (2017) and Sobolewska and Ford (2020) are good introductions to this literature that illustrate the differing approaches economists and political scientists have taken to understanding why voters supported Brexit.

2 Brexit: A brief history

The political movement that eventually led to Brexit began in the 1990s as opposition to the deepening of European integration that accompanied the creation of the Single Market and establishment of the European Union. Initially a fringe right-wing campaign with little support even in the Conservative Party, it grew in popularity after EU expansion in the 2000s led to a wave of immigration to the UK from eastern Europe (Sobolewska and Ford 2020). In an attempt to stave off competition from the United Kingdom Independence Party (UKIP) – a single issue party established to advocate for Brexit, which drew much of its support from traditional Conservative voters – Prime Minister David Cameron pledged to hold a referendum on EU membership if his Conservative Party won the 2015 election. The appendix provides a timeline of key events in the Brexit process.

After the Conservatives unexpectedly won a majority in 2015, the referendum was held on 23rd June 2016. The vote took place against a backdrop of long-run economic decline in many regions outside the prosperous south-east of England, which was exacerbated by real wage stagnation following the global financial crisis (Dorling 2018, Elliot Major and Machin 2018). Under Cameron, the UK government had also embraced fiscal austerity. Welfare payments, such as housing and child benefits, were reduced by up to 23 percent per person between 2010 and 2015. The intensity of the cuts differed substantially across regions, with poorer areas facing larger reductions on average (Beatty and Fothergill 2014, Dhingra 2016). Austerity alienated voters from the main political parties and increased support for UKIP, whose vote share rose by between 3.5 and 11.9 percentage points in areas more exposed to benefit cuts (Fetzer 2019). Since the referendum was decided by a margin of only 3.8 percentage points, this suggests the UK may not have voted to leave the EU in the absence of austerity.

The referendum campaign reflected and reinforced social and cultural divisions between more educated and cosmopolitan Remain supporters, and Leave voters, who tended to be older and have more authoritarian worldviews and a stronger sense of national identity (Sampson 2017). Opinion polls predicted a close vote. But with Cameron and the opposition Labour Party opposed to Brexit,

the conventional wisdom was that voters would opt for the status quo. Betting markets implied around an 85 percent probability the UK would choose to remain in the EU (The Economist 2016). However, a narrow majority of voters disagreed and 51.9 percent voted in favour of Brexit.

The Leave vote was a major, unanticipated, political and economic shock. Cameron announced his resignation as Prime Minster the next day and both the stock market and sterling fell sharply, as discussed further in Sections 4 and 5. There is even evidence the referendum affected the happiness of the UK population and led to an increase in hate crime.[2]

The referendum outcome did not lead to any immediate change in the UK's relationship with the EU or the rest of the world. Instead, it shifted expectations. Expected future openness declined and policy uncertainty increased. Although the referendum gave a popular mandate for leaving the EU, it provided no guidance over when Brexit should occur or what form future UK-EU relations should take – a question on which the Leave campaign had maintained a strategic ambiguity.

Some Leave supporters advocated cutting all ties and dealing with the EU simply as another member of the World Trade Organization (WTO). Under this option not only would the UK lose access to the EU's Single Market, but UK-EU trade would face the most-favored nation (MFN) tariffs that EU countries apply to WTO members with which they do not have a preferential trade agreement. Others hoped Brexit would be a political rather than an economic act and that the UK would remain in the EU's Single Market and Customs Union. Debates over Brexit dominated UK politics for the next four years, with politicians and society split over the meaning of the Leave vote and what should come after Brexit. O'Rourke (2019) traces how this split echoes a long history of ambivalence in UK relations with continental Europe.

For its part, the EU stressed that the nature of the future relationship would depend upon the UK's willingness to commit to constraints on its sovereignty over economic policy. For example, Single Market membership would require accepting free movement of labour and remaining subject to EU regulatory policy and the jurisdiction of European courts. Customs Union membership would require relinquishing an independent trade policy for goods. And a deep free trade agree-

[2]See Powdthavee et al. (2019) and Kavetsos et al. (2021) on happiness and Albornoz, Bradley and Sonderegger (2021) on hate crime.

ment would require committing not to undercut EU labour, state aid and environmental standards. A full account of the Brexit negotiations and the UK's debate over the integration-sovereignty trade-off lies far beyond the scope of this paper.[3] But driven by the demands of Leave supporters on the right of the Conservative Party, the government edged towards prioritising domestic control over economic integration.

Theresa May, who succeeded Cameron as Prime Minister and Conservative leader, pledged to take the UK out of the Single Market in order to end free movement of labour. She also sought a deal that would maintain close trade relations with the EU and avoid regulatory barriers to goods trade, while allowing the UK to pursue an independent trade policy. However, May lost her parliamentary majority after calling an election in 2017 and subsequently failed to consolidate support for her approach from either side of the Leave-Remain divide. A draft Withdrawal Agreement setting out the terms of the UK's departure and shared aspirations for the future UK-EU relationship was reached in late 2018, but it was thrice voted down by parliament.[4] Consequently, it was May's turn to resign and the Brexit date, which had been scheduled for March 2019, was postponed.

When Boris Johnson replaced May as Prime Minister in July 2019 it remained uncertain whether Brexit would ever take place and, if it did, what form it would take. Unlike May, Johnson supported Brexit in the referendum and he led Conservative opposition to May's deal on the grounds that it would not give the UK sufficient control over economic and trade policy. To general surprise, Johnson quickly proved to have the political skills needed to cut the gordian knot and make Brexit happen. He renegotiated the Withdrawal Agreement to promise a more distant future relationship based on a free trade agreement, and to ensure that Britain would not be required to remain in a customs partnership with the EU in order to maintain an open border between Northern and southern Ireland. In December 2019 Johnson won public support for his deal in yet another election. This allowed the UK to finally leave the EU on 31st January 2020, after which it entered a 'transition' period, scheduled to last until the end of 2020, during which trade and economic

[3] Informative accounts of how the negotiations unfolded can be found in O'Rourke (2019) and Grey (2021).

[4] Under EU rules, negotiations over the future UK-EU relationship could not start until after the UK left the EU. However, the Withdrawal Agreement was accompanied by a non-binding joint declaration setting out an intended framework for future relations.

relations with the EU did not change.

The Covid-19 pandemic began in early 2020, but the UK government would not countenance a delay in the future relationship talks. Despite fears that talks would breakdown and trade would revert to WTO terms, a deal was eventually struck on 24th December, coming into provisional effect just eight days later at the start of 2021. The Trade and Cooperation Agreement (TCA) is a free trade agreement that provides for zero tariffs and zero quotas on UK-EU trade for all goods, but does little to promote deeper integration by reducing non-tariff barriers or guaranteeing market access for services. Under the TCA, the UK is no longer a member of the EU's Single Market or Customs Union.[5] Consequently, free movement of labour has ceased and there is now a customs and regulatory border with the EU. In Section 8 we present early evidence on how the TCA has affected UK-EU trade.

The agreement also includes level playing field provisions designed to ensure that neither side uses subsidies or changes in labour or environmental standards to obtain an 'unfair' competitive advantage. These provisions include commitments not to weaken current labour and environmental standards, as well as a novel rebalancing mechanism that allows for retaliatory tariffs or suspension of parts of the TCA if future divergence in standards affects trade and investment between the two sides (Lydgate et al. 2021). However, the dispute resolution mechanisms established to enforce these commitments are yet to be tested.[6]

[5] An important caveat to this statement is the status of Northern Ireland, which was one of the most controversial aspects of the Brexit negotiations. The Withdrawal Agreement gives Northern Ireland an unusual (and extremely complex) hybrid status, whereby it is effectively part of the customs territories of both the UK and the EU and remains part of the EU's Single Market for goods. This arrangement was designed to support the peace process by avoiding the introduction of a physical border between Northern Ireland and the Republic of Ireland, but has created a border in the Irish Sea between Britain and Northern Ireland. See Hayward (2021) for an overview. Since the introduction of the TCA, there has been an ongoing UK-EU dispute over how the Irish Sea border should be implemented.

[6] A useful summary of the TCA is available at: `https://www.instituteforgovernment.org.uk/publication/future-relationship-trade-deal/level-playing-field`.

3 Expected effects of Brexit

This paper primarily focuses on the window before the TCA came into force in 2021. In policy terms, economic integration between the UK and the EU did not change during this period. Nevertheless, the Brexit referendum immediately impacted the economy by changing expectations. The shift in expectations affected both the first and second moments of beliefs about economic policy. The expected future openness of the UK to the economic exchanges with the EU declined (first moment news shock). At the same time, uncertainty over both the future of UK-EU relations and the UK's domestic economic policy increased (second moment uncertainty shock). To better understand the shock to expectations, this section discusses the anticipated economic consequences of Brexit and how the Leave vote affected uncertainty.

The consensus, shared by most researchers, policy institutions and businesses, is that Brexit will have a negative long-run effect on the UK economy by raising barriers to trade, migration and investment between the UK and EU. EU countries are also expected to face costs, though these are usually forecast to be much smaller than UK losses because the EU is less dependent on UK-EU trade. This consensus is based on historical evidence of how joining the European Communities in 1973 affected the UK economy (Griffith, Harrison and Macartney 2007, Crafts 2010, Campos, Coricelli and Moretti 2014), simulations of Brexit using general equilibrium trade and investment models (Dhingra et al. 2017; Steinberg 2019; McGrattan and Waddle 2020), empirical gravity analysis of the effects of EU membership on trade and income (Dhingra et al. 2017) and surveys of businesses' expectations (Bloom et al. 2018). The Leave campaign dismissed this consensus as 'project fear', but made little effort to engage with the substance of the economic arguments.[7]

There is less agreement over how large the costs of Brexit will be. Office for Budget Responsibility (2020, p.27) lists thirteen estimates of the long-run effect of Brexit on UK productivity based on the assumption that UK-EU trade is governed by a free trade agreement. The estimates vary from negative 1.8 percent to negative 6.4 percent, apart from one outlier that predicts a 10 percent fall. These declines are expected to take around a decade to materialize. The range of expected

[7] A partial exception is Economists for Brexit (2016). See Sampson et al. (2016) for a critique of their analysis.

outcomes reflects both uncertainty over the magnitude of trade costs generated by the non-tariff barriers that exist under a free trade agreement, and differences in modelling strategies. Studies that allow for dynamic effects of trade on production technologies often find losses that are two to three times larger than static trade models. Van Reenen (2016), Sampson (2017) and Campos (2019) review the literature on the long-run economic consequences of Brexit.

Looking at shorter horizons, most forecasters predicted that a Leave vote would reduce UK growth even before the UK left the EU. These forecasts were driven by the expectation that higher uncertainty and forward-looking adjustments to expected future disintegration would reduce investment and final demand. For example, Baker et al. (2016) forecasted that a Leave vote would cause an immediate 20 percent depreciation of sterling and would reduce UK GDP by around 1 percent in 2017 and a little over 2 percent in 2018. They also predicted double digit declines in investment in 2017 and 2018. Qualitatively at least, these predictions are consistent with the observed effects of the Leave vote documented in Sections 5 and 7.[8]

The UK's high levels of spatial inequality have motivated interest in forecasting the regional effects of Brexit (McCann 2018). However, studies using different theoretically motivated measures of Brexit exposure give conflicting answers about which regions are likely to be hardest hit. Dhingra, Machin and Overman (2017) estimate the impact of Brexit on local gross value added by interacting sectoral estimates of the impact of future trade barriers at the national level from Dhingra et al. (2017) with sectoral employment shares by local authority and metropolitan areas. They find that areas with larger services sectors, such as London and the south east, would be worse hit. Interestingly, these areas also had lower Leave vote shares on average. By contrast, using regionalized input-output tables to measure the share of domestic value-added embodied in UK-EU trade, Chen et al. (2018) find that poorer regions in the midlands and north of England are more exposed to Brexit.

Valuable information on private sector attitudes to Brexit is provided by surveys of firms' ex-

[8]Financial Times' (2018, 2019) analysis of short-run Brexit forecasts concludes that, although the slowdown in UK growth took longer to materialize than predicted, independent forecasts performed well from 2017 onwards. But politically motivated forecasts by HM Treasury (too pessimistic) and Economists for Brexit (too optimistic) performed poorly.

pectations of future policy and economic outcomes. Confederation of British Industry surveys covering before and after the referendum reveal a large spike in businesses with negative expectations of future output changes following the Brexit vote (Costa, Dhingra and Machin 2019). After the referendum, the Bank of England also established the Decision Maker Panel (DMP), which provides monthly data on businesses' expectations obtained from a survey of financial officers at a representative sample of UK firms.[9] DMP data shows that firms perceive Brexit as a major source of uncertainty and, on average, expect Brexit to reduce future sales and investment. Faccini and Palombo (2021) use DMP data on sales expectations to calibrate how firms expect Brexit to affect the productivity distribution. Their calibration implies that, if Brexit resulted in the UK and EU trading on WTO terms, it would reduce UK GDP by 7.6 percent in the long-run.

The DMP also enables construction of a Brexit Uncertainty Index, calculated as the share of respondents that say the referendum outcome is either the largest, or among the top two or three, sources of uncertainty affecting their business. The index increased sharply to above 50 percent in late 2018 and early 2019 when parliament debated and rejected the Withdrawal Agreement negotiated by Theresa May's government, during the second half of 2019 when Boris Johnson's government flirted with the possibility of leaving the EU without an exit deal, and in September 2020 after the UK threatened to breach commitments made in the Withdrawal Agreement.

While researchers and the business community expect Brexit to have negative economic consequences, voters' expectations are more mixed. Prior to the referendum, the British Election Study asked how leaving the EU would affect the UK's 'general economic situation'. Curtice (2017) reports that 23 percent of respondents thought that leaving would have a positive economic impact, whereas 35 percent thought it would be negative and 32 percent thought the economic situation would be about the same post-Brexit. Interestingly, 90 percent of respondents who thought Brexit would make the economy better voted Leave, while 93 percent of those who expected negative economic effects voted Remain. This data cannot tell us the direction of causality between economic expectations and support for Brexit, but it illustrates how views regarding the economic

[9]Decision Maker Panel data can be downloaded from: `https://decisionmakerpanel.co.uk/`. See Bloom et al. (2018) for an overview.

implications of Brexit differed starkly between Leave and Remain voters.

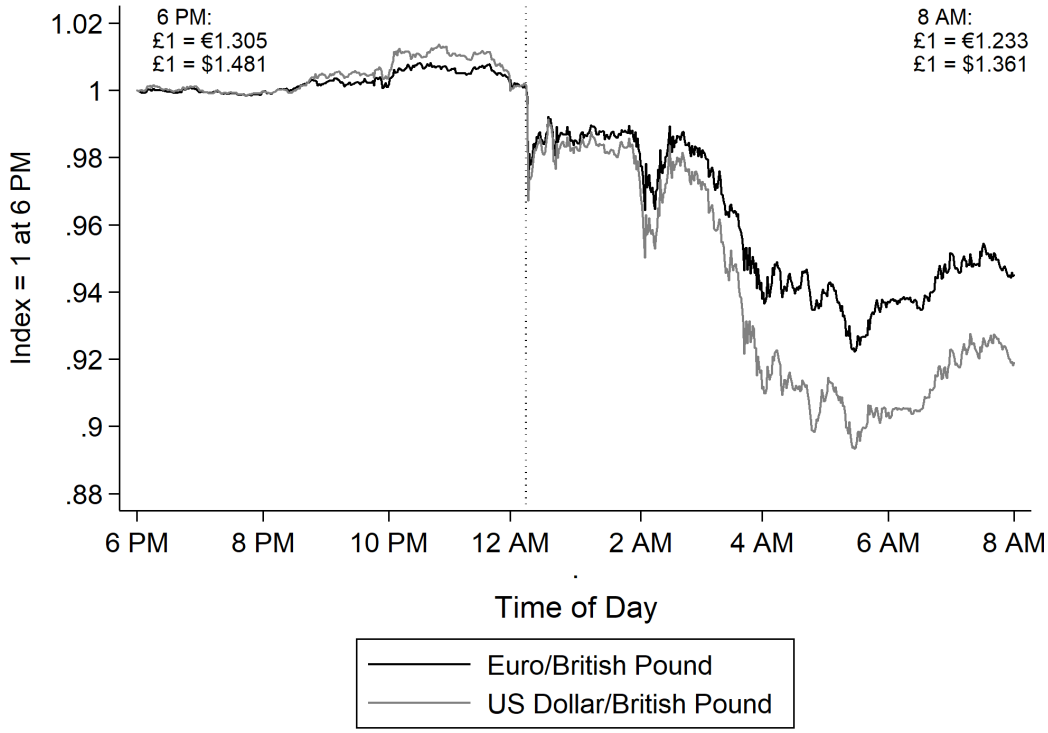
Moving from forecasts to observed impacts, we now proceed to review research studying how the change in expectations triggered by the Brexit vote affected the economy. For ease of reference, Table 1 lists a selection of the empirical papers that we review. For each paper, the table reports the outcomes studied, the channels analyzed, the main data source, and whether the estimated results are consistent with observed changes at the aggregate level. We start by considering financial markets.

4 Financial markets

The economic consequences of the Leave vote first materialized in financial markets. As Figure 1 shows, the pound started to fall on the night of the referendum within moments of early results from Sunderland (an industrial town in the north of England) showing an unexpectedly large win for the Leave campaign. And as the outcome became clear, sterling experienced the biggest overnight fall in any of the world's four major currencies since floating exchange rates were introduced in the early 1970s (Costa, Dhingra and Machin 2019).

The day after the referendum, the FTSE 100 stock market index fell by 3.8 percent and the pound depreciated by 8.1 percent against the US dollar and 5.8 percent against the euro (Breinlich et al. 2022). With support from an easing of monetary policy, stock prices quickly recovered from their initial falls, although in dollar terms UK stock indices grew less quickly than US and German indices in the year following the referendum (Gourinchas and Hale 2017). By contrast, the pound declined further, particularly after Theresa May announced in a speech to the Conservative party conference in October 2016 that the UK would seek to leave the Single Market. Moreover, the fall in sterling proved to be persistent. In the two years following the vote the pound fluctuated around 10 percent below its pre-referendum value. Gourinchas and Hale (2017) argue that the depreciation resulted from market participants' expectations that Brexit would reduce future UK economic growth. We discuss how the depreciation affected consumers, firms and workers in

Figure 1: Sterling depreciation on referendum night



Source: Costa, Dhingra and Machin (2019).
Notes: Vertical line indicates announcement of referendum result in Sunderland.

Sections 5 and 6.

Event studies of stock returns in the days around the referendum shed additional light on market expectations regarding Brexit. The main conclusion of this work is that the Leave vote had a negative short-run effect on the share prices of firms with greater exposure to the UK market and to the depreciation of sterling. Ramiah et al. (2017) find that the banking, and travel and leisure sectors suffered the largest negative effects. Davies and Studnicka (2018) show that FTSE 350 firms with a greater share of affiliates in the UK and, to a lesser extent the EU, had lower than expected returns. By contrast, when studying the German HDAX index, which also fell sharply after the referendum, they find that returns are not correlated with the share of EU affiliates. This result is consistent with predictions that Brexit will have a larger negative effect on the UK than on other EU countries (Dhingra et al. 2017).

Breinlich et al. (2018) find that UK-listed stocks in sectors that are less sensitive to the business

cycle had higher than expected returns, suggesting investors were concerned about a slowdown in growth. They also show that firms that report earnings in sterling had lower than expected returns. Interestingly, Breinlich et al. do not find evidence that variation in expected trade barrier increases affected returns in the days following the referendum. Returns are uncorrelated with sector-level measures of the EU's MFN tariffs and of the EU's restrictions on services trade with non-members. However, there is some evidence that the MFN tariff variable is associated with lower returns after May's Conservative Party conference speech in October 2016. May's speech marked the first official announcement that the UK would seek to leave the EU's Single Market and Customs Union, a decision that made it more likely future UK-EU trade would be subject to tariffs.

Fisman and Zitzewitz (2019) construct a 'long-short' index of stocks that outperformed versus underperformed the market on the day after the referendum and then track the evolution of index returns to gauge whether initial market expectations are realized. They show that during July 2016 returns increase following events that raise the probability a Leave supporter wins the race to succeed Cameron as Prime Minister. However, they also find that the index reverts towards its pre-referendum value by the end of 2016, suggesting that over time Brexit became a less important determinant of investors' profit expectations.

5 Consumer and border prices

The depreciation of sterling following the Leave vote has been used in several papers as a quasi-experimental shock to estimate the price effects of exchange rate movements. A consistent finding that emerges from this work is that pass-through from the depreciation to UK border and consumer prices was very high. Consequently, the medium-to-long-run price effects of the Brexit depreciation are well approximated by treating the UK as a small, neoclassical economy.

Breinlich et al. (2022) consider the impact of the depreciation on the cost of living. Their identification strategy exploits variation across product groups in the import share of consumer

expenditure, accounting for both directly consumed imports and imported inputs used in domestic production. The import share measure they construct from UK input-output tables is, unsurprisingly, higher for tradable goods such as food or clothing, than for services like restaurants or education. But even services groups have positive import shares because they are produced with inputs from sectors that use imported intermediates.

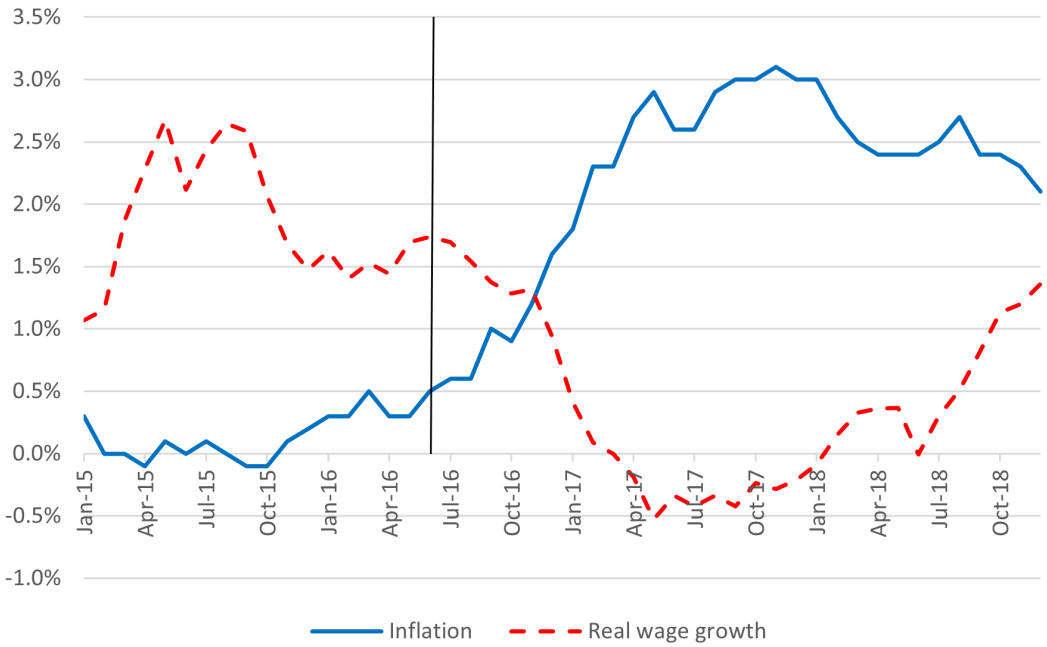
UK consumer price index (CPI) inflation rose rapidly after the referendum from 0.5 percent in June 2016 to peak at 3.1 percent in November 2017 as depicted in Figure 2. Breinlich et al. show, using an event study specification, that the rise in inflation is greater for product groups with higher import shares and that producer prices for goods sectors increased more in industries where the share of imported inputs in domestic production costs is larger. These results support the hypothesis that the rise in inflation was caused by the fall in sterling. The paper also estimates pass-through from the exchange rate to consumer prices, allowing pass-through to vary across product groups with different import shares. The results are consistent with complete long-run pass-through conditional on the import share, meaning that a 1 percent depreciation causes a 0.1 percent greater price increase for a product group with a 10 percent higher import share.

These findings imply that the Brexit depreciation led to a substantial increase in UK consumer prices. Assuming that prices for a product group with zero import share are unaffected by the exchange rate, the estimates mean that aggregate pass-through to consumer prices equals the import share of overall consumer expenditure, which is 29 percent in the UK. It follows that the approximately 10 percent decline in sterling following the referendum raised consumer prices by 2.9 percent, with the full impact taking around two years to materialize. This sizable increase in the cost of living was the first channel through which the economic consequences of voting for Brexit were widely felt and contributed to a sharp decline in real wage growth from 1.7 percent in the year to June 2016 to 0.1 percent per year between June 2016 and June 2018 (see Figure 2).[10]

Breinlich et al.'s (2022) estimates are consistent with evidence on border price movements from transaction-level customs data. Chen, Chung and Novy (2021) study how pass-through to

[10]Hobijn, Nechio and Shapiro (2019) study the roles of state-dependent and time-dependent price setting in explaining the dynamics of consumer price adjustment following the depreciation.

Figure 2: UK inflation and real wage growth, monthly 2015-18



Source: Office for National Statistics. Inflation: Annual CPI inflation (series D7G7). Real wage growth: EARN01 3 month average percentage change year on year in Total pay, seasonally adjusted (series A3WW).
Notes: Vertical line indicates date of Brexit referendum (June 2016).

UK import prices depends upon the currency in which transactions are invoiced. They argue that accounting for vehicle currency invoicing is important in explaining the magnitude of the short-run rise in import prices following the referendum. Relatedly, Corsetti, Crowley and Han (2020) find that sterling-invoiced import prices were slower to adjust to the depreciation than producer or vehicle currency transactions. However, after around 36 weeks, sterling prices had fully adjusted to the weaker pound regardless of the currency of invoicing and, overall, there was rapid and complete pass-through of the depreciation into higher import costs.

Strikingly, Corsetti, Crowley and Han also find near complete pass-through of the depreciation to export prices. They estimate that the sterling price of exports invoiced in local and vehicle currencies rose quickly and roughly one-to-one with the depreciation, such that after around six weeks local prices in destination markets showed no effect of the depreciation. Export prices invoiced in sterling responded more slowly to the depreciation. However, the potential competitive

advantage this created for UK exporters did not lead to a rise in export volumes and the price of sterling-invoiced exports fully reflected the depreciation after around 18 months (Ayele and Winters 2020, Corsetti, Crowley and Han 2020). The implication of these findings is that the border price response to the Brexit depreciation raised import costs without giving UK exporters any long-run gain in price competitiveness.

Working with Portuguese customs data, Fernandes and Winters (2021) estimate how the depreciation affected the price of Portuguese exports to the UK. They identify price effects within firm-product-destination triples by comparing growth in unit values before and after the referendum. Their estimates imply that the average euro-dominated export price to the UK decreased by between 2 and 2.5 percent in the year following the referendum and that price declines were greater for more productive exporters. This evidence of pricing-to-market by Portuguese exporters is consistent with the literature showing that larger firms face less elastic demand and adjust mark-ups by more following exchange rate shocks (Berman, Martin and Mayer 2012). But as the authors note, since sterling depreciated by roughly 10 percent, their findings imply high short-run exchange rate pass-through into sterling-denominated UK import prices. In addition, their event study estimates show that the fall in Portuguese export prices only persisted for around six months. At longer horizons, euro-denominated prices are unaffected by the Brexit referendum implying complete pass-through of the depreciation into UK import prices.

An important question regarding these papers concerns their external validity. The Brexit depreciation was an unusually large and salient exchange rate shock and was caused by news about future policy rather than a change in current conditions, such as an economic crisis, which often drives big depreciations. Burstein, Eichenbaum and Rebelo (2005) provide evidence that tradable goods prices are more responsive to exchange rate movements following large devaluations than after smaller exchange rate fluctuations. Future work could address whether smaller and less salient exchange rate shocks generate consumer price pass-through similar to that observed after the Brexit depreciation.

6 Labor markets

The impact of leaving the EU on jobs was a key battleground in the Brexit campaign and was closely tied to the debate over the labor market effects of immigration from the EU. Prominent Leave supporters claimed new trade deals with countries outside the EU could create 400,000 jobs (Daily Mail 2017), while short-term government forecasts put job losses from a Brexit vote at around half a million (HM Treasury 2016). It is too soon to disentangle the long run effects of Brexit and Covid-19 on workers, but researchers have already started to explore how the Leave vote affected short-run outcomes.

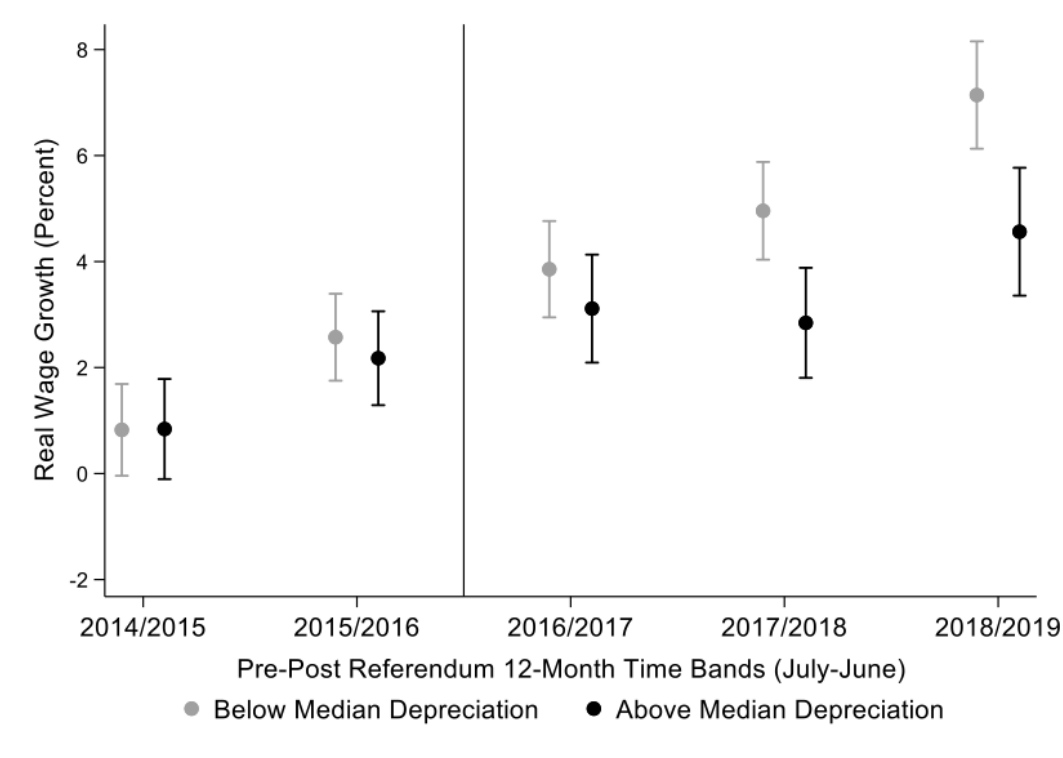
Although some evidence suggests that exposure to Brexit may have led to slower employment growth (Javorcik et al. 2020, Hassan et al. 2021), studies using representative samples of firms and workers have not found significant effects (Bloom et al. 2019, Costa, Dhingra and Machin 2019). Aggregate statistics show no discernible effect of the referendum outcome on employment growth and the UK unemployment rate stood at record lows of around 4 percent prior to the Covid-19 pandemic. However, labor market outcomes other than employment do appear to have been affected by the referendum.

The depreciation of sterling in the 24 hours around the Leave vote varied by currency, with smaller falls on average against European than non-European currencies. Costa, Dhingra and Machin (2019) exploit this observation to estimate the impacts of the depreciation on UK labor market outcomes. Sectors and regions differ in their exposure to the fall in sterling because of differences in their pre-referendum trade partners. Using this variation, they find that the depreciation caused a return to real wage stagnation, largely in services sectors, which were more exposed to the shock.

Sectors and regions that rely on imports from countries outside the EU were most affected because of the larger depreciation against non-European currencies. Interestingly, the real wage stagnation is driven by imports of intermediate goods, rather than exports or final good imports. Figure 3 illustrates this by dividing sector-region pairs into groups with above and below median intermediate import weighted exchange rate shocks. Prior to the referendum, real wage growth is

similar for both groups. However, after the Leave vote, real wage growth stagnated in the above median sector-regions and did not catch up until 2019.

Figure 3: Brexit depreciation and real wage growth



Source: Costa, Dhingra and Machin (2022)
Notes: Average real wage growth for sector-region pairs that experienced above and below median intermediate import-weighted exchange rate shocks in the 24 hours around the referendum. Real wage growth is cumulative relative to 2013/14. Vertical line indicates date of Brexit referendum (June 2016).

Costa, Dhingra and Machin's results imply that the increase in imported intermediate costs caused by sterling's depreciation was not offset by revenue gains from higher exports. Consequently, real wage growth declined due to both a reduction in nominal wages and higher consumer prices. Calibrating the estimated wage elasticity to textbook theory, Costa, Dhingra and Machin uncover evidence of a production complementarity between imported intermediates and domestic workers. This complementarity is also evident in other flexible margins of labor market adjustment, such as job-related education and training, and overtime work, which were negatively impacted by the sterling depreciation.

A notable feature of the analysis is that it covers service sector workers. Although services account for the majority of employment in most countries, there are relatively few studies on trade and labour market impacts in services. Measurement challenges and the difficulty of finding plausibly exogenous variation in services trade has meant previous studies have often needed to focus on small subsets of workers (such as those in manufacturing sectors or those affected by trade in goods only) to obtain causal identification (Hummels et al. 2016). The large sterling depreciation caused by the Brexit vote is a rare unanticipated shock that is applicable to both goods and services and provides a unique window into understanding the impact of trade on all workers.

An alternative strategy for using Brexit to shed light on the labor market and regional effects of services trade is developed by Javorcik et al. (2020). They study the impact of expected increases in services trade barriers due to Brexit on online job postings using data for 2015 to 2019 from Burning Glass Technologies. Their measure of expected trade barriers uses the OECD's Services Trade Restrictiveness Index (STRI) for professional services exports to 24 EU countries. Following the influential literature on trade policy uncertainty, Javorcik et al. calculate the gap between the pre-referendum STRIs that prevailed with countries outside the EU and with members of the EU's Single Market. This STRI gap is a destination-specific proxy for the increase in trade barriers UK exporters would face outside the Single Market. It is combined with sectoral data on UK exports per worker to obtain a sector-level measure of trade policy uncertainty and finally interacted with pre-referendum employment shares to yield a shift-share measure of regional exposure to Brexit. Their main finding is that regions that were more exposed to potential trade barriers in professional service exports experienced a larger decline in online job adverts in the period after the referendum, particularly for higher skilled jobs.

Despite its salience in the referendum campaign, there has so far been little work on how the Leave vote affected immigration. Wadsworth et al. (2016) and Wadsworth (2018) summarize the key issues debated in the run-up to the referendum, concluding that immigration from the EU had negligible impact on native labour market outcomes and limited, if any, effect on access to public

services. Moreover, immigrants from the EU made a positive net contribution to UK government finances.

There is evidence of a sharp reduction in net migration to the UK from EU countries after the referendum (Wadsworth 2018, Portes 2021) – although patchy data collection and confounding Covid-19 effects cloud the picture and make it difficult to assess the size of the fall (Manning 2021). The UK has also loosened immigration restrictions for countries outside the EU (Portes 2021), which may have contributed to a rise in skilled migration from non-EU countries. We expect immigration to receive much greater attention in future research, particularly given the labour shortages reported by UK firms during real-time surveys in 2021 (De Lyon and Dhingra 2021a).

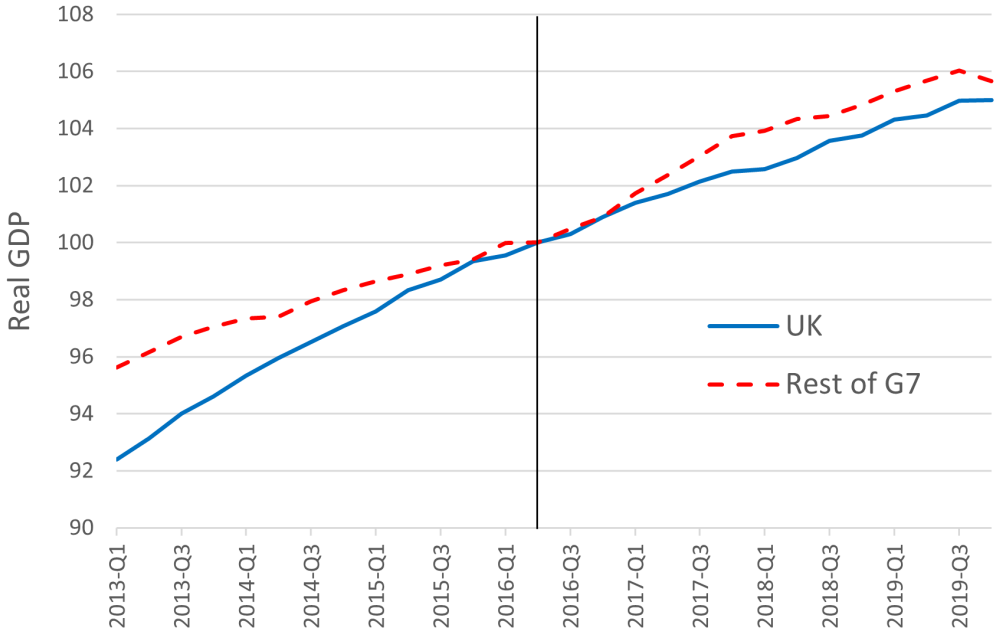
7 Output and investment

GDP growth in the UK was not immediately affected by the referendum, but slowed during 2017 and 2018 as shown in Figure 4. The UK dropped from having the highest growth rate in the G7 in 2015 to the lowest two years later (De Lyon and Dhingra 2019). Identifying the determinants of aggregate growth is challenging, but both micro and macro evidence suggest that voting to leave the EU contributed to the UK's growth slowdown.

Applying the synthetic control method, Born et al. (2019) estimate that the Leave vote reduced UK GDP at the end of 2018 by between 1.7 and 2.5 percent.[11] Their synthetic control gives the largest weight of 51 percent to the United States, with Italy, New Zealand and Hungary also receiving weights above 10 percent. Decomposing GDP into its components, Born et al. find that reductions in private consumption and investment both make important contributions to the gap between UK GDP and the synthetic control. The consumption slowdown starts soon after the vote, while the investment effect is not visible until the second half of 2017.

[11] We note that, though not a direct welfare measure, these costs are large relative to the estimated effects of many trade policy changes. For example, Caliendo and Parro (2015) find NAFTA increased US welfare by 0.08 percent, while Fajgelbaum et al. (2020) estimate that the US-China trade war initiated by President Trump reduced US real income by 0.04 percent.

Figure 4: UK and G7 GDP, quarterly 2013-19



Source: OECD. National currency, chained volume, seasonally adjusted, expenditure approach (series LNBQRSA).
Notes: Quarterly GDP normalized to 100 in 2016-Q2. Rest of G7 simple average of normalized GDP in Candada, France, Germany, Italy, Japan and US. Vertical line indicates date of Brexit referendum (2016-Q2).

Fetzer and Wang (2020) also use the synthetic control method to study the referendum effect, but at the regional level. Their results are consistent with the aggregate findings of Born et al. (2019) and show that two-thirds of 382 UK local authorities had lower gross value added than their synthetic control by the end of 2018. The estimates imply average lost output is greater in regions with higher Leave vote shares, bigger manufacturing sectors and more low skilled workers.

Working with more disaggregated data, Bloom et al. (2019) use DMP data up to June 2019 to study the effects of Brexit on a representative sample of UK firms. They show that firms that have stronger trade, workforce, regulatory and ownership links with the EU report facing higher levels of Brexit-related uncertainty. In addition firms reporting higher Brexit uncertainty experienced lower stock price growth in the 30 days after the referendum compared to the previous 30 days and a bigger increase in stock price volatility over the same period. Importantly, these firms also report spending more managerial time and financial resources on Brexit preparations.

Bloom et al. use their data to estimate the within firm effects of the Leave vote by interacting firm-level Brexit uncertainty with a post-referendum dummy. They find that higher uncertainty is associated with lower growth in investment, value-added and productivity, but has an insignificant effect on employment. Their estimates imply that the Leave vote reduced total investment by 11 percent and value-added by 2 to 5 percent over the three years after the referendum. These declines arise mostly from within firm changes. However, since Brexit uncertainty is positively correlated with firm productivity, there is also a small reduction in aggregate productivity due to cross-firm reallocation.

Based on the analysis by Born et al. (2019), Fetzer and Wang (2020) and Bloom et al. (2019), together with the other studies reviewed in this article, our judgment is that by the end of 2019 the Brexit vote had reduced UK GDP by around 2 to 3 percent. Although this estimate is inevitably subject to uncertainty, it gives a useful sense of the magnitude of the economic impact of the referendum on the UK economy.

What were the channels through which the Brexit vote affected output and investment? Bloom et al. (2019) point to the shift in expectations caused by the vote leading to higher economic uncertainty, which resulted in firms reducing capital investment and consumers cutting expenditure. Their uncertainty measure derived from the DMP survey incorporates both first and second moment changes in expectations. Other studies have attempted to disentangle the relative importance of the first and second moment shocks in explaining the firm-level and aggregate effects of the referendum.

Broadbent et al. (2020) analyze macroeconomic dynamics in the UK following the referendum using a small open economy model without nominal rigidities. They argue that conceptualizing the Leave vote as news of a future productivity growth slowdown in the tradable sector can explain observed short-run changes. In the window before the slowdown occurs, the news shock leads to a real exchange rate depreciation, lower investment and GDP growth, an expansion of the tradable sector relative to the non-tradable sector and a decline in interest rates, but has little effect on labor supply – all patterns that are present in the data. However, once the shock materializes, the model

predicts that the tradable sector will contract relative to the non-tradable sector leading to falling trade and further declines in GDP. Since Broadbent et al. do not allow Brexit to affect uncertainty, their analysis suggests that the short-run effects of the referendum were driven by the first moment, not the second moment, of the shift in expectations.

Born et al. (2019) and Faccini and Palombo (2021) reach similar conclusions. Born et al. estimate a structural expectations-augmented vector autoregression model incorporating measures of economic policy uncertainty and revisions to future output growth forecasts. Their results imply that second moment uncertainty played a limited role in the UK's post-referendum growth slowdown and that downgrades of future output growth expectations can account for most of the gap between UK GDP and their synthetic control.

Faccini and Palombo use DMP data on firms' expectations to calibrate both uncertainty over the outcome of the Brexit negotiations and how different outcomes are expected to affect the first and second moments of the firm-level productivity distribution. Their calibrated partial equilibrium model implies the Leave vote led to gradual falls in output and employment, as firms cut investment in expectation of future productivity declines. Most interestingly, they show that the impact of the referendum is primarily driven by the shift in the level of expectations rather than by higher uncertainty. Given the calibrated first moment shock to productivity, changes in the second moment have a negligible effect on the economy's response to the Brexit vote.

While structural methods suggest that the first moment news shock explains the macroeconomic effects of the Brexit vote, firm-level analysis by Hassan et al. (2021) points in the opposite direction. Using the transcripts of English language quarterly earnings calls from a global sample of publicly listed firms, Hassan et al. construct separate firm-level measures of Brexit sentiment and Brexit risk. Brexit sentiment proxies first moment exposure and is coded based on the prevalence of positive versus negative tone words used when discussing Brexit in the transcripts. Brexit risk is calculated using a count of synonyms for risk and uncertainty appearing close to Brexit and is a proxy for firms' second moment Brexit exposure.

Negative Brexit sentiment is evident in all sample countries, especially Ireland, the UK and

Germany. It stems mainly from concerns about regulatory divergence, reduced labor mobility, higher trade barriers, and adjustment costs. Brexit sentiment falls and Brexit risk rises immediately after the referendum. Sentiment and risk then quickly revert towards their pre-referendum levels, before spiking again in the second half of 2018 and throughout 2019. These patterns are similar to those seen in the Brexit uncertainty measures discussed in Section 3 and illustrate the progress that has been made in constructing novel measures of expectations and uncertainty.

Studying firm-level outcomes, Hassan et al. first show that stock returns in a 4-day window around the referendum are positively correlated with sentiment and negatively correlated with risk. However, while higher Brexit risk is associated with lower capital investment and employment growth up until 2019, these outcomes are not related to Brexit sentiment. Sales growth is not significantly correlated with either variable. These findings are consistent with second moment policy uncertainty causing delays to investment and hiring, but differ from other work which finds a larger role for first moment exposure to Brexit.

Further understanding the relative importance of news versus uncertainty shocks in explaining the impact of the Leave vote is an important avenue for future research. Developing pre-determined measures of first versus second moment Brexit exposure would help in achieving this objective. If uncertainty is the main culprit, the UK may experience catch-up growth as implementation of the TCA reduces uncertainty. But if the expectation of higher future trade costs drove the slowdown, or businesses did not internalise the expected changes, then the introduction of trade barriers under the TCA is likely to cause further reductions in growth.

Foreign investment

Leaving the EU's Single Market and Customs Union is expected to make the UK a less attractive destination for foreign direct investment (FDI), particularly for export platform FDI intended to serve European markets (Dhingra et al. 2016). To date, there has been little research on how Brexit has affected FDI and existing studies have used data on announcements of new FDI projects rather than actual flows. Breinlich et al. (2020) use data on the announcement of new cross-border

greenfield investments and mergers and acquisitions. Using the synthetic control method, they find that the Leave vote led to a 9 percent reduction in announced EU investment projects in the UK by March 2019. Serwicka and Tamberi (2018) also provide evidence of a decline in inward investment from the EU. And Tamberi (2021) argues that the referendum led to fewer announcements of new greenfield investments in the UK by non-EU investors in sectors facing greater expected rises in trade costs (as measured by the EU's MFN tariffs).

Looking at outward investment, Breinlich et al. (2020) find that the Leave vote led to a 17 percent increase in announced FDI projects by UK firms in the EU, but did not affect investment in OECD countries outside the EU. The increase in announced UK outward investment is entirely driven by the services sector, particularly business, financial and real estate services. This is consistent with UK services firms responding to the referendum by setting up subsidiaries within the EU to guarantee continued access to the Single Market after Brexit. The asymmetry between higher outward investment and lower inward investment highlights how the smaller UK economy is more exposed to the costs of Brexit than the EU. As more data becomes available, future research should be able to paint a richer picture of how changes in trade barriers affect foreign investment, a question which has often been difficult to answer because of policy endogeneity.

8 Trade

In the long run Brexit is expected to substantially reduce the EU's share of UK trade. For example, Bevington et al.'s (2019) analysis using the trade model developed by Dhingra et al. (2017) predicts that a free trade agreement similar to the TCA would lead to a roughly one-third decline in UK-EU trade and a 13 percent fall in total UK trade. However, trade barriers were unchanged before the TCA came into force at the start of 2021. Until then the Leave vote affected trade through two channels: the shift in expectations about future trade policy, and the depreciation of sterling following the referendum. Studying UK trade prior to agreement of the TCA therefore provides evidence on both the trade effects of exchange rate shocks and, more unusually, on how trade

responds to an anticipated, but uncertain, unravelling of deep economic integration.

All else equal, the sterling depreciation would be expected to boost UK exports and cut imports by reducing the relative cost of domestically produced output. Indeed, Broadbent et al. (2020) argue that the Leave vote created a temporary sweet spot for the UK tradable sector during which producers benefited from the depreciation but did not yet face higher trade barriers. In support of this argument, they show that the aggregate value of UK exports relative to GDP rose immediately following the referendum and that the tradable sector of the UK economy expanded relative to the non-tradable sector between the referendum and the end of 2018. However, they do not decompose changes in the value of trade into price versus volume effects.

Analysis by Fernandes and Winters (2021) on Portuguese data finds that the Leave vote reduced UK imports on both the intensive and extensive margins. Their estimates imply that the referendum outcome reduced imports from Portugal by around 5-7 percent in the year following the vote, with around two-third of the decline coming from lower import quantities. Their analysis does not speak to the cause of the decline, which may have been the appreciation of the euro relative to sterling or the shock to expectations about future trade barriers between the UK and Portugal. Similarly, Martin, Martinez and Mejean (2019) estimate that the Leave vote led to a 1.2 percent decline in the number of new buyer-seller relationships between French exporters and UK importers. However, they do not find evidence of a post-referendum fall in the value of French exports to the UK.

Looking at UK exports, there is no evidence that the fall in sterling boosted the volume of exports (Ayele and Winters 2020). Studies using synthetic control methods suggest that, if anything, the referendum reduced aggregate UK import and export growth relative to other countries when trade is measured in a common currency (Du and Shepotylo 2021; Springford 2021), although this decline could partially reflect short-run price stickiness in sterling-denominated prices together with the slowdown in UK output growth. The absence of an export boom is consistent with the evidence discussed in Section 5 showing that the depreciation raised average import and export prices, thereby increasing the cost of imported intermediate inputs without generating a persistent gain in price competitiveness for UK exporters. However, there is undoubtedly scope for more

work examining how UK firms responded to the depreciation.

Another strand of the literature has sought to identify how anticipation of Brexit has affected trade. This research has produced contrasting results at different levels of aggregation and for different trade margins. Several studies find that the referendum had a negative impact on trade for products more exposed to the risk of Brexit-induced increases in trade barriers (Crowley, Exton and Han 2019, Ahmad et al. 2020, Graziano, Handley and Limao 2021). At the same time, the EU's share of total UK trade has remained stable and it is hard to find evidence that growth in UK-EU trade since the referendum has been lower for products more exposed to Brexit risk (Freeman et al. 2021).

Graziano, Handley and Limao (2021) show that Brexit-related uncertainty affected UK goods trade even before the referendum. Using prediction market contract prices as a time-varying measure of the probability of a Leave vote, the paper tests whether changes in the probability of a Brexit vote affected relative trade levels of products with different exposure to Brexit risk. To measure variation in Brexit exposure across products, the authors use the EU's MFN tariffs, which provide an observable proxy for the effect of Brexit on both the first and second moments of expected future UK-EU trade costs. A higher EU MFN tariff implies a greater expected tariff increase on UK-EU trade after Brexit in the event that the UK and EU trade under WTO terms (first moment trade policy exposure) and greater uncertainty over future tariff levels (second moment exposure).

Using monthly trade data for HS 6 digit products from August 2015 to June 2016, Graziano, Handley and Limao find that an increase in the probability of a Leave vote reduced UK-EU trade in products with higher EU MFN tariffs.[12] This effect holds for both exports and imports, for product-level entry and exit, and when comparing changes in UK-EU trade to trade with third countries. In related work, Douch and Edwards (2021) use the synthetic control method to analyse bilateral UK trade flows. They argue that anticipation of Brexit reduced UK exports to the EU (and to a lesser extent non-EU countries) in the year prior to the referendum.

[12]Graziano, Handley and Limao (2020) provide evidence that a higher Leave vote probability also reduced UK exports to five countries that have a free trade agreement with the EU. The Leave vote increased the probability the UK would have to renegotiate preferential access to these markets leading to lower exports of products that would face higher non-preferential tariffs.

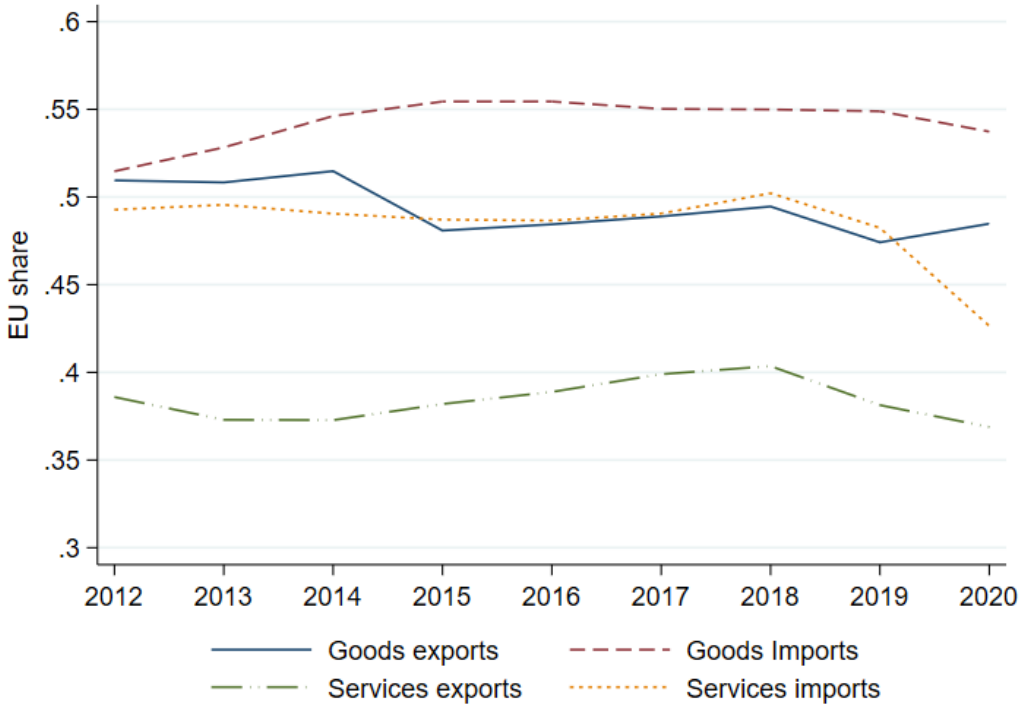
Crowley, Exton and Han (2020) also use the EU's MFN tariffs as a product-level measure of Brexit exposure. But they study changes in goods trade immediately after the referendum using UK customs data at the firm-CN 8 digit product level. Focusing on the extensive margin, they find that the referendum reduced entry and increased exit for EU exports in products with higher MFN tariffs and products where the EU applies import quotas. Under the assumption that the referendum did not affect entry or exit for products facing a zero tariff threat, the estimates imply that the Leave vote reduced entry by 5.0 percent and increased exit by 6.1 percent in 2016. However, the authors caution that the aggregate statistics do not show a decline in aggregate export value or the number of exporters to the EU in 2016, which could be due to strong entry growth for zero tariff threat products.

While most work has focused on goods trade, Ahmad et al. (2020) adapt Graziano, Handley and Limao's (2021) identification strategy to study trade in services, which account for close to half of UK exports. Ahmad et al. use quarterly data on 12 services industries from 2016-18 and measure Brexit exposure by industry using variation in "restrictions to foreign entry" from the OECD's Services Trade Restrictiveness Index. By their measure, Brexit risk exposure is highest in the air and sea transportation, finance and insurance industries. It is lowest for architectural, engineering, scientific, audiovisual and computer services. Like Graziano, Handley and Limao (2021), they find that increases in the probability of Brexit are associated with lower UK-EU trade in industries with higher Brexit exposure.

Together these studies provide compelling evidence that trade flows responded to Brexit-related changes in expectations of future trade barriers. However, the magnitude of these responses was insufficient to cause a noticeable shift in the geography of aggregate UK trade. As Figure 5 shows, the EU's share of UK trade changed little between the referendum and the beginning of the Covid-19 pandemic. For goods trade, it was 52.4 percent in 2015 and 51.7 percent in 2019, while for services trade it was 42.3 percent in 2015 and 42.2 percent in 2019.

A more sophisticated version of this comparison is performed by Freeman et al. (2022), who analyze UK goods trade from 2013 onwards. They compare EU and non-EU trade to control for

Figure 5: EU share of UK trade, 2012-20



Source: Office for National Statistics. Goods: UK trade: May 2021. Services: UK total trade: all countries, non-seasonally adjusted, July 2021.
Notes: Goods trade excludes precious metals.

UK-specific supply and demand shocks that have the same effect on trade with all partners and use US trade flows to control for export supply and import demand shocks in partner countries. Freeman et al. find that the referendum did not affect bilateral UK-EU trade between 2016 and 2020. They also find no evidence of differential changes in the value of EU trade for products with higher EU MFN tariffs or products where the EU applies more non-tariff measures according to the UNCTAD TRAINS database.

This aggregate stability is consistent with the predictions of Steinberg (2019), who calibrates a dynamic trade model featuring uncertainty over whether the UK will remain in the Single Market after Brexit or end up trading with the EU on WTO terms. An appealing feature of his model is that it can be used to simulate both the short and long run effects of Brexit in a unified framework. In Steinberg's simulations, the Leave vote has a very small effect on trade until Brexit takes place,

but UK-EU trade falls sharply once trade barriers increase. Steinberg also finds that the second moment uncertainty shock accounts for a negligible fraction of the total welfare costs of Brexit.

Trade under the TCA

The implementation of the TCA starting in 2021 has created many new non-tariff barriers between the UK and the EU. These barriers include customs checks, rules of origin requirements, sanitary and phytosanitary restrictions on trade in animal and plant products, the need to prove regulatory compliance separately in the UK and EU, reduced market access for service providers, the end of passporting rights for financial services, and restrictions on short-term business visits. Additional barriers will come into effect in 2022 when the UK introduces customs checks on imports from the EU. And trade costs will increase further over time if policy divergence results in firms facing different regulations in the UK versus the EU.

Although the Leave vote did not shift aggregate UK trade away from the EU, the eventual introduction of new trade barriers had a more dramatic impact. Research on UK-EU trade under the TCA is still in its infancy, but the raw data shows that UK-EU goods trade experienced a major shock at the start of 2021. Figure 6 plots monthly UK goods trade with the EU and with non-EU countries. Exports are in panel A and imports in panel B with all series normalized such that the monthly average in the final quarter of 2020 equals 100. Comparing EU to non-EU trade is a simple way to control for the common components of Covid-19 effects.[13] Note that Covid-19 led to large declines in trade in the first half of 2020, but that both exports and imports of goods had recovered to pre-pandemic levels by the end of 2020.

Exports to the EU fell 45 percent in January 2021 compared to December 2020, a bigger drop than occurred at the beginning of the Covid-19 pandemic in the first quarter of 2020. But exports

[13]To date, Brexit has not had a significant effect on trade costs between the UK and the rest of the world. The UK succeeded in rolling over the EU's existing trade deals with non-EU countries (with some minor modifications) and is yet to secure any major new deals. However, it has reached a free trade agreement with Australia and a preliminary deal with New Zealand, and has opened negotiations to join the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP). The UK government's impact assessment puts the benefits of the Australia deal at round 0.08 percent of GDP (Department for International Trade 2021).

subsequently recovered strongly and Figure 6 shows no evidence of a persistent drop in EU exports relative to non-EU exports. By contrast, imports from the EU fell around 20 percent more than imports from non-EU countries in the first nine months of 2021, suggesting that the TCA has sharply reduced UK imports.[14]

Business surveys provide additional evidence that the TCA has created new barriers for UK firms trading with the EU. In April 2021, 24 percent of exporters reported that Brexit had caused a decline in exports to the EU, while 33 percent of importers reported negative effects on EU imports. Over 60 percent of firms had experienced at least one Brexit-related issue with the most prevalent issues relating to the border: 37 percent of firms reported delays, 36 percent reported additional customs and administration costs and 22 percent reported regulatory checks (De Lyon and Dhingra 2021b).

It is not yet possible to draw any conclusions about the long-run effects of Brexit on UK-EU trade. But we expect future studies of trade under the TCA to play an important role in better understanding the consequences of non-tariff barriers and in evaluating the wisdom of the pre-referendum consensus that Brexit would reduce UK-EU trade and leave the UK worse off economically in the long run.

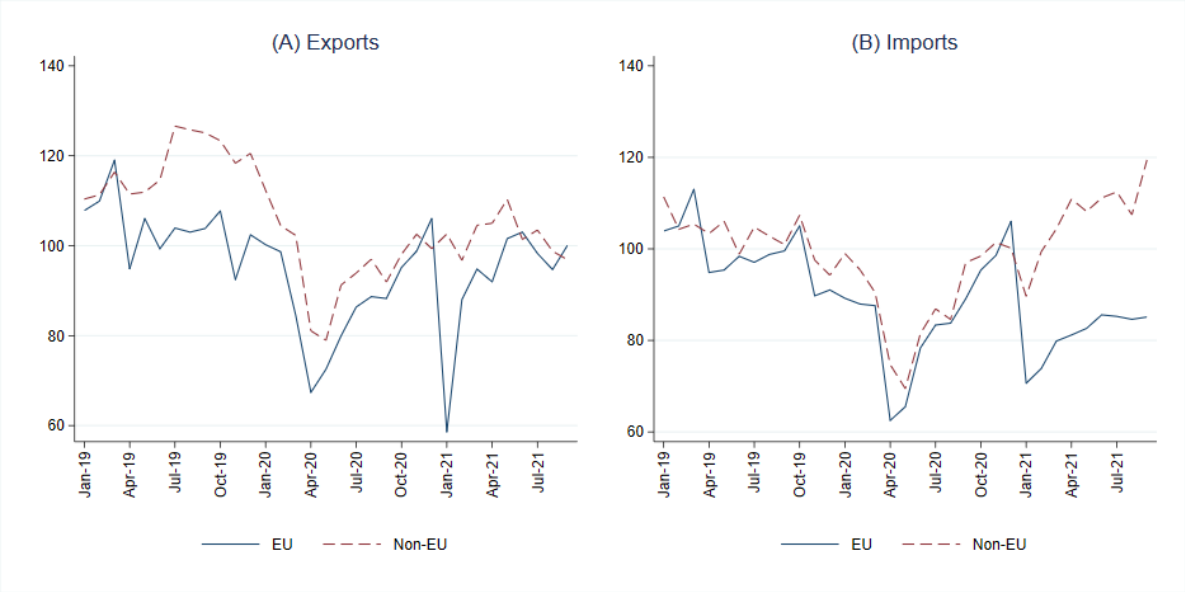
9 Future research

The Brexit vote led to the UK leaving the world's deepest economic integration agreement. Studying the resulting economic shock provides new evidence on the impact of trade policy changes. In this review we have summarized research analyzing the short run effects of the referendum. But the UK's eventual departure from the EU has now opened up a new set of research questions.

Although it may take a decade or more for the long-run effects of Brexit to materialize, we hope that future work will inform important questions such as: the quantitative impacts of deep economic integration; the importance of market access for services trade, investment flows and the

[14]Early research on the trade effects of the TCA reaches conclusions consistent with the descriptive evidence in Figure 6. See Ayele, Larbalestier and Tamberi (2021) and Freeman et al. (2022).

Figure 6: UK goods trade, monthly 2019-21



Source: Office for National Statistics, UK trade: September 2021.
Notes: Monthly average of each series normalized to 100 in 2020-Q4. Data is seasonally adjusted and excludes trade in precious metals.

geography of supply chains; the speed and margins of microeconomic adjustment to higher trade barriers; the impact of disintegration on innovation and productivity, and; the costs, benefits and political economy of regulatory sovereignty.

Better understanding the short and long run impacts of Brexit on pre-existing regional inequalities in the UK is also likely to be important, particularly given the regional divides in support for Brexit and the ambition of successive UK governments to 'level-up' poorer regions. At the same time, the uncertainty Brexit has created over the future relationships of Scotland and Northern Ireland with the rest of the United Kingdom raises new questions about the links between domestic and international integration, while the Irish Sea border between Britain and Northern Ireland provides a rare opportunity to study the impact of customs checks on domestic trade.

There is also scope for insightful sector-specific studies of how industries adapt to higher trade costs and which non-tariff barriers are the most costly. Systematic analysis of how leaving the single market has affected sectors such as financial services, research and development, and transportation would start to open up the black box of non-tariff barriers.

Finally, future research should devote more attention to a topic that is conspicuous by its near-total absence from this article: immigration. Despite the fact that migration seems to have responded to the Leave vote more quickly than trade flows, the economics literature is yet to probe the causes or consequences of post-referendum changes in migration, or to analyze the extent to which Brexit and Covid-19 have contributed to widespread reports of UK labor shortages during 2021. In this and other areas the policy changes Brexit has generated will provide fertile ground for research for years to come.

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Table 1: Selected studies of observed economic effects of expecting Brexit

Topic	Paper	Outcomes studied	Main channels considered	Main data sources	Results discernible at aggregate level?
Financial markets	Costa, Dhingra & Machin 2019	Sterling depreciation	Brexit vote	Reuters real-time exchange rate data	Yes
	Davies & Studnicka 2018	Stock prices	Firm-level exposure to Brexit & sterling depreciation	FTSE 350 stock prices & ORBIS	Yes, but only in short-run
Prices	Breinlich et al. 2022	Consumer & producer prices	Product group exposure to sterling depreciation	Consumer prices & input-output tables	Yes
	Fernandes & Winters 2021	Border prices & trade	Brexit vote	Portugese customs transactions	Yes, for border prices
Labor markets	Costa, Dhingra & Machin 2019	Wages, employment & training	Sector-region exposure to sterling depreciation	Labor force surveys, sector-region trade	Yes
	Wadsworth 2018	Immigration, wages & employment	EU immigration & Brexit vote	Labor force surveys	Yes
Output	Born et al. 2019	GDP	Brexit vote	OECD quarterly national accounts	Yes
	Fetzer & Wang 2020	Regional output	Brexit vote	Quarterly regional GDP, annual local authority GVA	Yes
Investment	Bloom et al. 2019	Investment, employment, value-added & productivity	Brexit uncertainty	Decision Maker Panel firm survey	Yes
	Hassan et al. 2021	Investment, employment & sales	Brexit uncertainty & sentiment	Earnings call transcripts of publicly listed firms	Yes, except for employment
Trade	Crowley, Exton & Han 2020	Extensive margin of UK exports to EU	Product exposure to tariff increases on UK-EU trade	UK customs data & EU MFN tariffs	No, small aggregate changes if any
	Graziano, Handley & Limao 2021	UK-EU trade	Product exposure to tariff increases on UK-EU trade	Monthly bilateral trade, EU MFN tariffs & prediction market prices	No, small aggregate changes if any

Brexit timeline

Key Political Events in the Brexit Process.

- 23 January 2014: In a speech at Bloomberg, Prime Minister David Cameron declares support for an in or out referendum on EU membership.
- 23 June 2016: UK holds referendum on its membership of the EU, with the majority (51.9 percent) of voters choosing to leave the EU.
- 24 June 2016: Cameron, who campaigned to remain in the EU, announces his intention to resign as Prime Minister.
- 2 October 2016: In her Conservative Party Conference speech, new Prime Minister Theresa May confirms the exit process (Article 50) will be triggered before the end of March 2017.
- 17 January 2017: May delivers her Lancaster House speech and hardens her red lines for Brexit, including an end to the jurisdiction of the European Court of Justice, exit from the Single Market and control over immigration from the EU.
- 29 March 2017: The UK triggers Article 50 of the Treaty on European Union starting a two year process for negotiating the terms of the UK's exit.
- 8 June 2017: May's gamble on holding a general election backfires. She loses her parliamentary majority and forms a minority government with the support of the Northern Irish Democratic Unionist Party.
- 15 January 2019: May's attempt to pass her Withdrawal Agreement with the EU suffers the biggest parliamentary defeat since 1924. Parliament rejects the Withdrawal Agreement two further times in March, leading to an extension of the Article 50 negotiations and May's resignation.
- 24 July 2019: Boris Johnson replaces May as Prime Minister.

- October 2019: Johnson negotiates a revised Withdrawal Agreement, but lacks parliamentary support to pass his deal.
- 12 December 2019: Johnson holds a general election and wins a large majority on the pledge to ‘get Brexit done’. The revised Withdrawal Agreement subsequently passes easily through parliament.
- 31 January 2020: The UK leaves the EU at 11pm UK time and enters a standstill transition period.
- 24 December 2020: The UK and EU reach a deal on the Trade and Cooperation Agreement (TCA) setting the terms of their future relationship.
- 1 January 2021: UK leaves the EU’s Single Market and Customs Union as the TCA comes into effect.