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The Brexit Vote, Inflation and UK Living Standards

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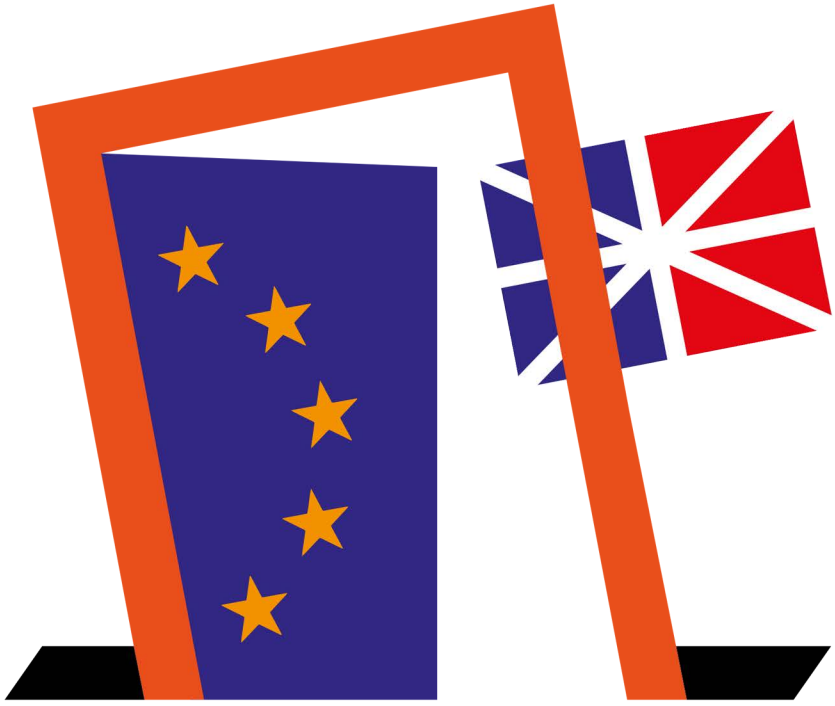

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CENTRE for ECONOMIC PERFORMANCE

CEP BREXIT ANALYSIS No. 11

The Brexit Vote, Inflation and UK Living Standards

- The vote to leave the European Union (EU) was an unanticipated shock to the UK economy that increased uncertainty and reduced the country's expected future openness to trade, investment and immigration with the EU.

- Our research examines the observed effect of the Brexit vote on UK living standards since the referendum, focusing on inflation and real wage effects.

- The pound depreciated by approximately 10% immediately after the referendum. We analyse whether products that are more exposed to changes in the value of sterling experienced higher inflation following the vote. Sterling exposure is measured by the share of consumer expenditure that is spent on imports, including both direct expenditure on imported final goods and indirect expenditure on imported inputs used by UK firms.

- The depreciation raised inflation by increasing the import cost of both final goods and intermediate inputs. We find that for each 10 percentage point rise in a product group's import share, inflation increased by 0.71 percentage points in the year after the vote.

- Accounting for both the depreciation and other 'general equilibrium' effects of the referendum, we estimate that the Brexit vote increased aggregate inflation by 1.7 percentage points in the year following the referendum. There is uncertainty about the exact size of this effect, but our analysis unambiguously shows that the referendum led to a substantial rise in inflation.

- The 1.7 percentage point increase in inflation implies that by June 2017, the Brexit vote was costing the average household £7.74 per week through higher prices. That is equivalent to £404 per year.

- Higher inflation has also reduced the growth of real wages. The impact of the referendum is equivalent to a £448 cut in annual pay for the average worker. Put another way, the Brexit vote has cost the average worker almost one week's wages due to higher prices.

- Pass-through from the exchange rate depreciation to higher import costs peaked in the first quarter of 2017, but it is continuing in the third quarter of 2017.

- Households at all income levels and in all UK regions have experienced higher inflation because of the referendum. The costs have been evenly shared across the income distribution, but not across regions.

- The rise in inflation due to the referendum has been lowest for households in London, while Scotland, Wales and especially Northern Ireland have been worst hit.

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Introduction

On 23 June 2016, the UK voted to leave the European Union (EU). The Leave vote did not lead to any immediate changes in the UK's economic relations with the EU or the rest of the world. The UK did not officially notify the EU of its intention to leave until 29 March 2017 and withdrawal is unlikely to occur before March 2019. Until the withdrawal date, the UK will remain a member of the EU and, consequently, the Single Market, and will continue to be subject to EU regulations and to participate in the EU's trade agreements with non-EU countries.

But the referendum vote did lead to an immediate change in expectations about the future of the UK's economic relationships with other countries. And since economic behaviour depends on both the current state of the world and expectations about the future, the referendum had immediate consequences for the UK economy. Most obviously, between 23 and 27 June 2016, sterling depreciated by 11% against the US dollar and 8% against the euro, and in August 2016, the Bank of England loosened monetary policy through a 25 basis point interest rate cut and renewed quantitative easing. The depreciation of sterling has increased the cost of imports into the UK and made UK exports to other countries cheaper.

This briefing reports new research on how the referendum vote has affected living standards in the UK. We focus on its impact on consumer price index (CPI) inflation and the effect of changes in inflation on real wages. Inflation has risen sharply since the referendum: from 0.4% in June 2016 to 3.0% in October 2017. We study to what extent this increase is due to the Brexit vote compared to other factors, such as changes in oil prices and inflationary pressures resulting from faster growth in the euro area and the United States.

After accounting for other determinants of inflation, we find that *products with a larger import share in consumer expenditure experienced higher inflation following the referendum.* This shows that the exchange rate depreciation caused by the Brexit vote has put upward pressure on inflation. We find evidence that higher import prices for both final goods and intermediate inputs used by UK producers have contributed to the rise in inflation.

Pinning down the precise effect of the referendum on inflation is a difficult challenge with many uncertainties. But we find *robust evidence that the Brexit vote has reduced household living standards by increasing the cost of living.* Our baseline estimates imply that the vote led to a 1.7 percentage point increase in inflation in the year following the referendum. This means that by June 2017, the Brexit vote was costing the average household £7.74 per week, or £404 per year, through higher prices.

We find no evidence that the Brexit vote has affected nominal wage growth. This means that the increase in inflation has also led to lower real wage growth. Our estimates imply that higher inflation due to the referendum has cost the average worker close to one week's wages.

Households that spend more on products with larger import shares will be worse affected by rising import costs. Using data on how different households allocate their expenditure across 84 product groups in the CPI, we also analyse the distributional consequences of the Brexit vote.

We find that the costs are quite evenly shared across the income distribution, but not across regions. The least affected region is London where the rise in inflation due to the referendum is 0.35 percentage points below the UK average. By contrast, Scotland, Wales and Northern Ireland are worst affected. Compared with the UK average, the increase in inflation due to the vote is 0.18 percentage points higher in Scotland, 0.21 percentage points higher in Wales and 0.47 percentage points higher in Northern Ireland.

Previous work has used assumptions about future changes in trade costs to obtain ex ante forecasts of how Brexit will affect prices (Breinlich et al, 2016; Clarke et al, 2017). Clarke et al (2017) also discuss the pattern of price changes since the referendum. By contrast, we undertake the first statistical analysis of how the referendum has affected consumer prices, thereby providing evidence on the realised effects of the Brexit vote on living standards.

There is a large body of research forecasting the long-run economic consequences of Brexit (Aichele and Felbermayr, 2015; Booth et al, 2015; Ciuriak et al, 2015; HM Treasury, 2016; Dhingra et al, 2017). Most of this work concludes that Brexit will reduce UK living standards in the long run, although the size of the losses will depend on the form taken by the UK's relationship with the EU following Brexit (Sampson, 2017).

At this stage, it is too soon to attempt a complete evaluation of all the channels through which the referendum may affect the UK economy. But our findings show that even before Brexit occurs, the increase in inflation caused by the Leave vote has already hurt UK households.

The referendum shock

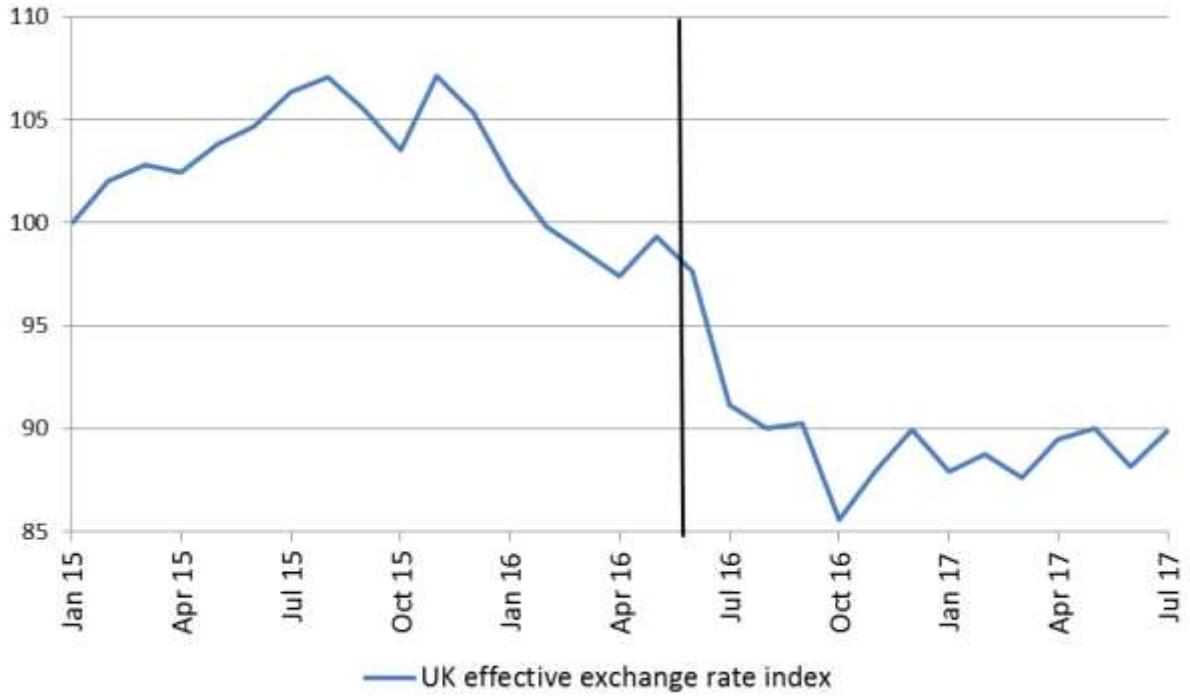
In the days prior to the referendum, opinion polls predicted a close vote. By contrast, betting markets implied around an 85% probability that the UK would choose to remain in the EU (*The Economist*, 2016), reflecting the conventional wisdom that undecided voters would opt for the status quo.

But in the early hours of 24 June 2016, it became clear that the UK had voted to leave. This led to an immediate shift in expectations about the UK's economic future. When financial markets opened on 24 June, the pound depreciated and the FTSE 100 stock market index fell by 3.8%. Companies with greater exposure to the UK and EU markets suffered larger share price falls (Davies and Studnicka, 2017).

The shift in expectations triggered by the Leave vote has two components. First, there was an increase in uncertainty. Would the UK actually leave the EU? When would the UK leave the EU? What relationship with the EU would the UK have following Brexit? How would Brexit change policy-making in the UK? The answers to these and related questions were unknown following the referendum and, in most cases, they remain uncertain at the end of 2017.

Second, the referendum led to a decline in the expected future openness of the UK to trade, investment and immigration with the EU. Reduced openness is expected to lower UK living standards by increasing trade costs and making the UK a less attractive destination for foreign investment (Dhingra et al, 2017). Consequently, the decrease in expected openness is a negative shock to the level of the UK's future economic performance. The observed depreciation of sterling shown in Figure 1 is consistent with market participants downgrading their expectations of the UK economy.

Figure 1: Value of sterling, 2015-17



Source: CEP calculations.
Notes: Import weighted effective exchange rate calculated using 2013 UK import shares and monthly average exchange rates. Normalised to 100 in January 2015.

This briefing studies the effect of the referendum vote on the UK economy, focusing primarily on the impact on CPI inflation of the exchange rate depreciation triggered by the vote. We do not attempt to separate the effects of changes in uncertainty and changes in expected future openness. Instead, we treat the referendum outcome as an unanticipated shock to the UK economy and evaluate the combined impact of the two effects.

Although exchange rate movements are the main channel linking the referendum to inflation, our results should be interpreted as the effect of the Brexit vote on inflation, not the effect of a generic exchange rate depreciation. As Forbes et al (2015) highlight, the pass-through from exchange rate movements to inflation depends on why the exchange rate changes. Moreover, Brexit may have affected inflation through channels other than the exchange rate depreciation, such as changes in monetary policy or investment decisions.

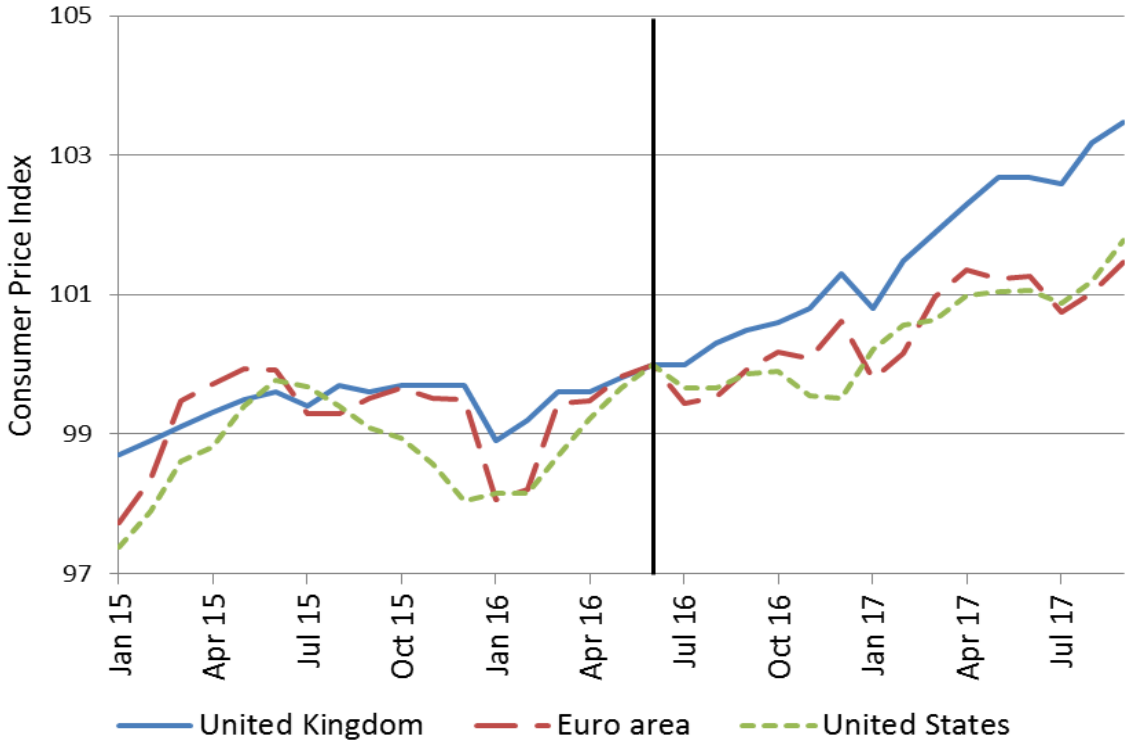
It is also important to bear in mind that our analysis captures the impact of the referendum on inflation given how UK policy-makers responded to the vote. This means, for example, that our estimates incorporate the consequences of the Bank of England's decision to ease monetary policy following the vote and the government's decision not to trigger Article 50 immediately. If these decisions had not been made, the effect of the Brexit vote on inflation may have been different, but that is not the world in which we live.

Import exposure and inflation

Following the referendum, UK inflation rose sharply. Annual CPI inflation increased from 0.4% in June 2016 to 3.0% in September 2017.[1] Other major economies also experienced an increase in inflation over this period, but the rise was much smaller. In the euro area, inflation increased from 0.1% in June 2016 to 1.5% in September 2017, while US inflation rose from 0.2% to 1.9%.

Figure 2 shows the evolution of price levels in the UK, the euro area and the United States before and after the referendum. Prior to the referendum, there are no obvious differences in the inflation rates in the three areas, but after June 2016, a gap emerges as prices in the UK increase more quickly than those in the euro area and the United States.

Figure 2: Consumer prices for the UK, the euro area and the United States, 2015-17



Source: Eurostat Harmonised Indices of Consumer Prices.
Notes: All indices normalised to 100 in June 2016.

A lower exchange rate raises the cost of importing both consumption goods and intermediate inputs. Consequently, it is natural to hypothesise that the Brexit vote and subsequent exchange rate depreciation caused the rise in inflation in the UK. But higher inflation may also be driven by other trends in the UK economy or by global economic events that are unrelated to Brexit, such as changes in the price of oil and inflationary pressures resulting from faster growth in the euro area and the United States.

To isolate the effect of the Brexit vote on inflation, we study whether products that are more exposed to changes in the value of sterling experienced higher inflation following the

[1] Throughout this briefing we use data on the CPI not the CPIH. Annual inflation for a given month is the percentage increase in prices over the previous 12 months.

referendum. For the 84 product groups that compose the CPI, we calculate the share of consumer expenditure that is spent on imports. We expect that products with a higher import expenditure share will experience larger price rises when the cost of imported goods increases. Our calculations take into account both direct consumer expenditure on imported final goods and indirect expenditure on imports used as intermediate inputs in domestic production.[2]

Table 1 summarises our import exposure measures. We divide the 84 product groups into the 12 divisions that make up the CPI. Column (1) shows direct exposure defined as the share of consumer expenditure on imported final goods. Column (2) shows indirect exposure to imports of intermediate inputs. Column (3) gives the total import expenditure share, which is the sum of columns (1) and (2).

Table 1: Import shares in consumer expenditure by COICOP division

	Import share in consumer expenditure		
	(1)	(2)	(3)
COICOP division	Direct	Indirect	Total
Food and non-alcoholic beverages	50%	14%	63%
Alcoholic beverages and tobacco	50%	11%	60%
Clothing and footwear	88%	2%	90%
Housing, water, electricity, gas and other fuels	1%	17%	18%
Furniture, household equipment and maintenance	66%	6%	72%
Health	42%	4%	47%
Transport	31%	20%	51%
Communication	43%	14%	57%
Recreation and culture	34%	10%	44%
Education	1%	4%	5%
Restaurants and hotels	0%	17%	17%
Miscellaneous goods and services	36%	9%	45%
Average	39%	12%	51%
Standard deviation	0.35	0.09	0.32

Source: CEP calculations.
Notes: Average and standard deviation are unweighted and computed at the product group level. Column (3) is the sum of columns (1) and (2), but the numbers may not match the exact total due to rounding.

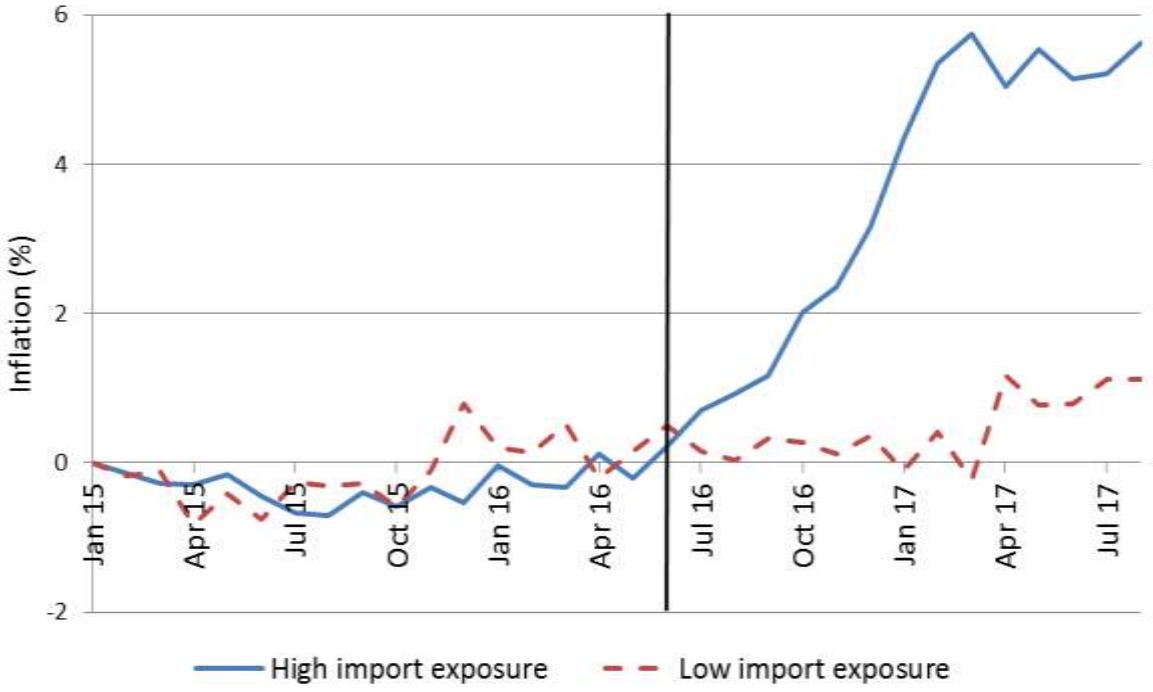
The average total import share across all product groups is 51%, but there is substantial variation both across and within divisions. At the division level, total import shares range from 5% in Education to 90% in Clothing and footwear. Unsurprisingly, tradable goods, such as food and drinks, have higher import exposure than services, such as restaurants and

[2] We calculate import exposure using the UK Input-Output Analytical Tables for 2013 from the Office for National Statistics. Our measure of indirect expenditure on imported intermediate inputs embodied in domestic production takes into account the input-output linkages across sectors in the UK economy. Our 84 product groups are chosen to match the level of disaggregation available in the Input-Output tables and correspond to COICOP classes. Full details of all the calculations and estimation results reported in this briefing are in our technical paper, Breinlich et al (2017). Levell et al (2017) discuss the direct and indirect components of UK households' food expenditure.

utilities. But even services have positive import shares because service production uses imported intermediate inputs. For example, Restaurants and hotels has a direct import share of 0%, but an indirect import share of 17%.

Do changes in inflation after June 2016 differ depending on the product's import expenditure share? We divide our 84 product groups into a high import exposure set containing the top half of product groups ranked by total import share and a low import exposure set including product groups in the bottom half by total import share. Figure 3 shows the average inflation rates for these two sets, where inflation is expressed as the difference from the average inflation rate in the set in January 2015. We see that following the referendum there is a rapid increase in inflation for the high exposure set, while the rise in inflation is slower and much more muted for the low exposure set. This suggests that the Brexit vote led to higher inflation by increasing the cost of imports.

Figure 3: Import exposure and inflation, 2015-17



Source: CEP calculations.
Notes: High import exposure set includes product groups with import shares above the sample median. Low import exposure set includes product groups with import shares below the sample median. Figure shows the unweighted average inflation rate for each set expressed as the difference from the set average for January 2015.

Statistical analysis confirms the pattern shown in Figure 3. Accounting for differences in product-specific inflation rates that are unrelated to Brexit, oil price movements and global inflationary pressures that led to changes in euro area inflation, we find that product groups with higher import shares experienced significantly higher inflation following the referendum. We interpret this finding as evidence that the referendum outcome caused an increase in inflation.

Our analysis implies that for each 10 percentage point rise in a product group's total import share, inflation in the year following the referendum increased by 0.71 percentage points.[3] To understand this estimate, consider the example of two product groups with different total import shares: Meat, which has an import share of 61%, and Accommodation services (for example, hotels), which has an import share of 18%. Our results mean that because Meat has a higher import share, the Brexit vote caused inflation to increase by 3.1 percentage points more for Meat than for Accommodation services.[4]

Since import shares vary substantially across product groups, our results imply there are large cross-product differences in how the Brexit vote affected inflation. At the upper end, we find large inflationary effects for product groups with high import shares, such as Bread and cereals, Milk, cheese and eggs, Coffee, tea and cocoa, Beer, Wine, Furniture and furnishings, and Jewellery, clocks and watches. At the lower end, the referendum had smaller effects on the prices of products with low import shares, such as Dental services, Passenger transport by air, Recreational and sporting services, and Restaurants and cafes.

We also study whether the direct and indirect import exposure measures have different effects on inflation. We find that both direct and indirect import exposure raised inflation following the referendum and, while the evidence is somewhat mixed, there is no compelling reason to conclude that the two variables have different effects on inflation. This means that the Brexit vote led to higher inflation by increasing the import prices of both final goods and intermediate inputs.

Aggregate inflation

We have shown that the Brexit vote increased the cost of imports. But to determine the overall effect of the referendum on inflation, we also need to consider whether the vote affected inflation through any other channels. For example, if the vote led to an increase in wages or other domestic costs of production, then we would expect prices to rise in all sectors of the economy. Alternatively, if producers expect Brexit to lead to slower future growth, then they may choose smaller price increases leading to lower inflation.

Pinning down such 'general equilibrium' effects of the referendum on inflation is more challenging than estimating the import exposure effect. But our statistical analysis shows that after controlling for other determinants of inflation (including the import share), the general equilibrium effect was negative in the year to June 2017.[5]

It is uncertain exactly how much of this negative effect was caused by the referendum. For our baseline results, we choose to attribute the entire negative effect to the Brexit vote, since this is likely to give a more *conservative* estimate of the impact of the referendum on

[3] This estimate is the regression coefficient on the interaction between a post-referendum dummy and total import share taken from Table 2, column (3) in Breinlich et al (2017), which is our preferred estimation specification. We use data at an annual frequency covering the three years up to June 2017 for 84 product groups. The regression also controls for period fixed effects, product group fixed effects, oil price changes interacted with the product group's oil consumption (both direct and indirect) and Euro area product group inflation rates. The estimated size of the import share effect varies little across different specifications.

[4] The calculation is: 3.1 = (61-18)*0.71/10.

[5] See Table 2, column (3) in Breinlich et al (2017). The estimated coefficient on the post-referendum dummy variable for the year after the vote is -0.015 and is significant at the 5% level. We find a negative post-referendum effect across a range of alternative specifications.

aggregate inflation. But given the uncertainty inherent in this stage of the analysis, it is important to treat our aggregate results with appropriate caution. Our results will underestimate the impact of the referendum on inflation if the negative general equilibrium effect is picking up downward price pressures that are unrelated to the Brexit vote. By contrast, we will overestimate the impact to the extent that there were changes to the UK economy after June 2016 that had a positive effect on inflation and were not caused by the referendum.

Combining the negative general equilibrium effect with the positive import exposure effect, and using the CPI weights to aggregate across product groups, gives the aggregate inflation effect. We find that the Brexit vote increased CPI inflation by 1.7 percentage points in the year following the referendum. This is our baseline estimate of the impact of the referendum on inflation. As a check on this finding, note that between June 2016 and June 2017, UK inflation increased by 1.1 percentage points more than euro area inflation.[6] Our estimates suggest that this naïve comparison probably understates the magnitude of the referendum effect.

The baseline estimate implies that by June 2017, the Brexit vote was costing the average household £7.74 per week through higher prices.[7] This is equivalent to £404 per year. Even acknowledging the uncertainty attached to this estimate, it is clear that the inflationary effects of the Brexit vote have already imposed a substantial cost on UK households.

Is it possible that our estimates are partially capturing the delayed effects of the sterling depreciation, shown in Figure 1, which occurred between November 2015 and April 2016? We have investigated this hypothesis and think it is unlikely for two reasons.

First, any impact of the earlier depreciation on inflation should start to emerge before July 2016. But Figure 3 (and also Figure 5 below) shows that the inflation rates for low and high import exposure products moved in parallel until the vote, after which they quickly diverged. This finding illustrates how exchange rate pass-through depends on the causes of exchange rate movements (Forbes et al, 2015) and why our results should be interpreted as the effect of the Brexit vote on inflation, not the effect of a generic exchange rate depreciation.

Second, we repeat our statistical analysis taking explicit account of the impact of exchange rate movements on inflation both before and after the referendum. The impact of the post-referendum exchange rate depreciation on inflation estimated using this approach is similar to our baseline estimate.[8] This reinforces our conclusion that the November 2015-April 2016 depreciation is not generating upward bias in our estimates of the effect of the Brexit vote on inflation.

[6] UK inflation increased from 0.4% in June 2016 to 2.7% in June 2017 while Euro area inflation increased from 0.1% to 1.3% (Source: Eurostat).

[7] Based on the Office for National Statistics Family Spending data for the financial year ending 2016, average household expenditure was £455.30 per week (see Table A1, all expenditure on groups 1-12). 1.7% of £455.30 is £7.74.

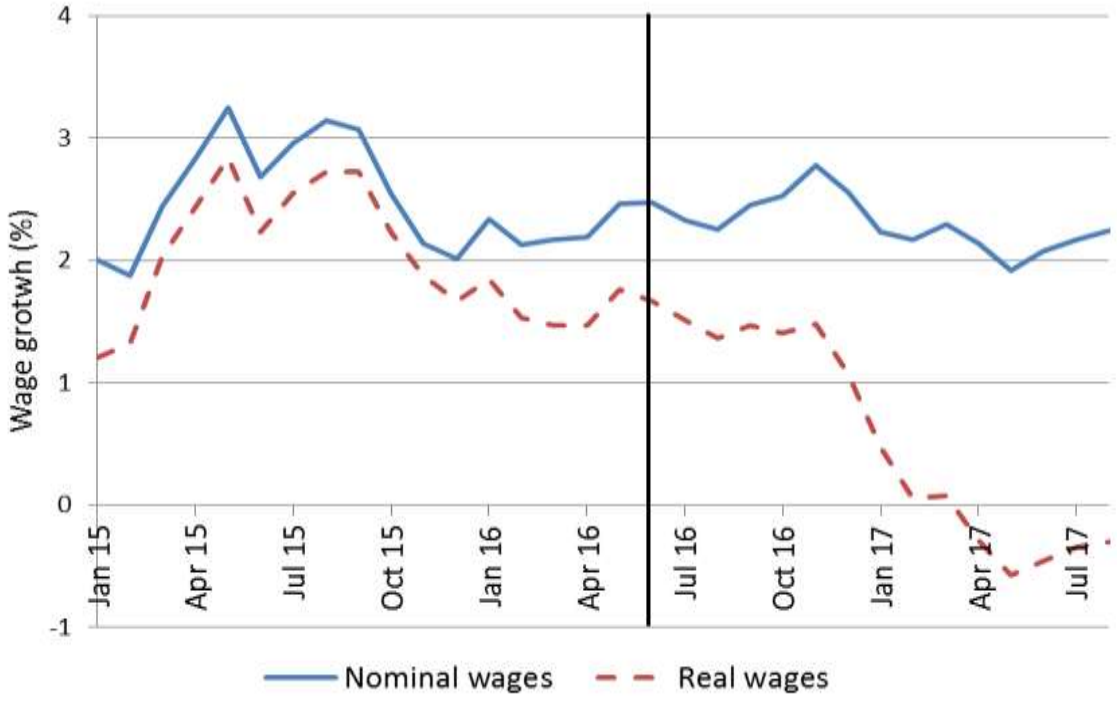
[8] See Section 6 of Breinlich et al. (2017) for details.

Real wages

Voting for Brexit led to an increase in inflation. Higher inflation will lead to a decline in living standards if it causes a reduction in real incomes – that is, a reduction in the ratio of nominal incomes to the price level. By contrast, if the referendum caused incomes to grow by the same amount as prices, living standards would be unaffected. Therefore, to determine the impact of the Brexit vote on living standards we need to know whether the referendum affected nominal income growth. We focus on wage income, which makes up 71% of gross income for the average household.[9]

Figure 4 shows growth in nominal and real wages before and after the referendum. For each month, we plot nominal and real wage growth over the preceding year. Nominal wages have grown at around 2-2.5% throughout 2016 and 2017 and we do not observe any change in the rate of nominal wage growth after the Brexit vote. By contrast, real wage growth fell sharply following the referendum: from 1.7% in June 2016 to -0.3% in August 2017. This decline is consistent with the hypothesis that the increase in inflation caused by the referendum has reduced living standards.

Figure 4: Nominal and real wage growth, 2015-17



Source: EARN01 October 2017, Office for National Statistics.
Notes: Wage growth is the percentage change year on year in the three month average of Average Weekly Earnings - Total Pay. Series KAC3 for nominal wages, A3WW for real wages.

Based on Figure 4, we conclude that the Brexit vote did not affect nominal wages. Likewise, Blanchflower et al (2017) argue that the vote has not changed the norm of 2% nominal wage growth that is firmly established in the UK labour market. Consequently, our baseline

[9] 71% is the ratio of Wages and salaries plus Self-employment income to Gross income for all households (Source: The Effects of Taxes and Benefits on Household Income 2015/16, Office for National Statistics).

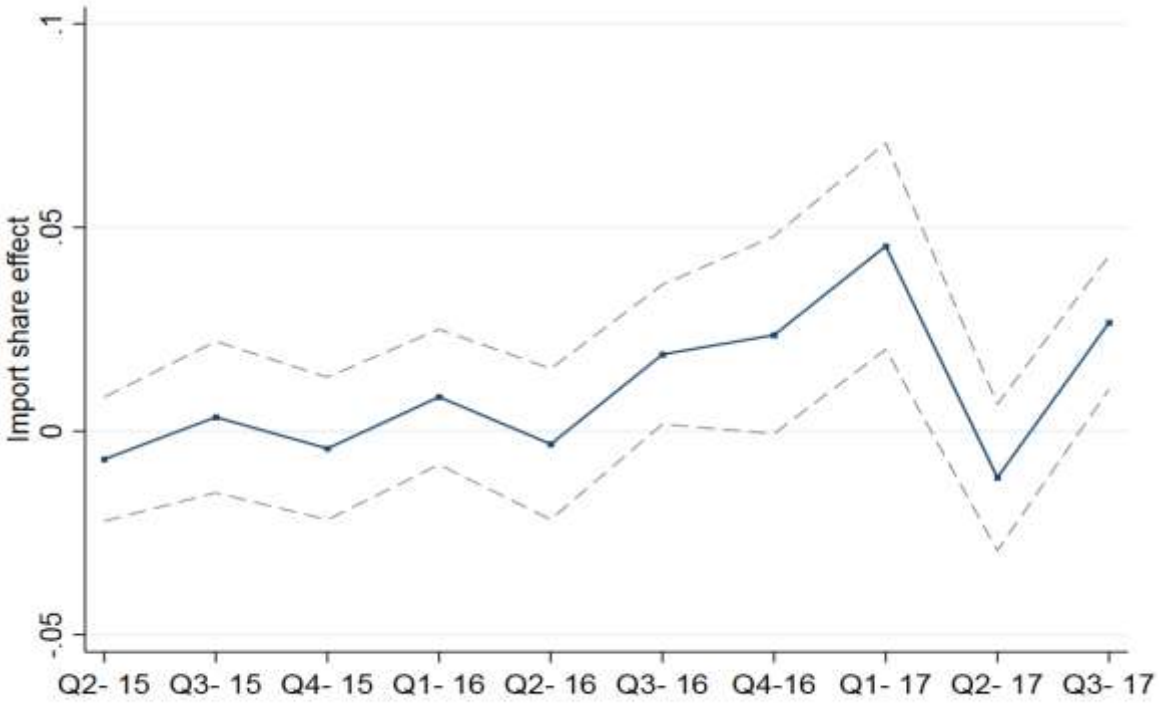
estimate that the referendum outcome increased prices by 1.7% also implies that real wages in June 2017 were 1.7% lower than they otherwise would have been. This decline is equivalent to a £448 cut in annual pay for the average worker.[10] Put another way, this means the increase in inflation due to the Brexit vote has cost the average worker almost one week's wages (4.4 working days' wages, to be precise). Unless Brexit increases real wages in future years, this pay cut will be permanent.

Speed of exchange rate pass-through

To shed further light on inflation dynamics following the referendum, we study the speed of pass-through from the exchange rate depreciation to import prices. For each quarter, we analyse whether there is a relationship between import shares and price increases across product groups. As before, our analysis takes account of other factors that may lead to differences in inflation, but are unrelated to Brexit, such as oil price movements and global inflationary pressures.

The results are shown in Figure 5. The squares (joined by the solid line) show the estimated effect of the total import share measure on inflation in each quarter. The upper and lower dashed lines show the 95% confidence interval for our estimates. This means that we estimate that there is a 95% chance that the true effect in each quarter lies between the two dashed lines. We see that prior to the referendum, the estimates are close to zero and there is no evidence of a relationship between import shares and inflation.

Figure 5: Estimated effect of the import share on quarterly inflation, 2015-17



Source: CEP calculations.
Notes: For each quarter the solid line shows the estimated effect of a product group's total import share on its quarterly inflation rate. The dashed lines bound the 95% confidence interval for the import share effect. See Breinlich et al (2017) for technical details. Estimates are from Table 5, column 1.

[10] Average earnings in June 2017 were £506 per week (Source: EARN01 October 2017, series KAB9, Office for National Statistics) or £26,366 per year. 1.7% of this is £448.

After the vote, a positive relationship emerges and product groups with greater import shares have higher inflation. The positive effect is visible immediately following the referendum in the third quarter of 2016 and then increases in size, reaching a peak in the first quarter of 2017. In the second quarter of 2017, the effect is not significantly different from zero, but in the third quarter of 2017, we once again find a positive effect.

These results show that pass-through from the exchange rate depreciation to higher import prices mostly occurred during the first nine months after the vote, but there is also evidence that pass-through was continuing to occur during the third quarter of 2017. Recall that our baseline results refer to the impact of the referendum on inflation between June 2016 and June 2017. To the extent that the Brexit vote has a positive effect on inflation after June 2017, our baseline results will underestimate the increase in inflation resulting from the referendum.

Distributional consequences

We have shown that the Brexit vote led to bigger increases in inflation for product groups with higher import shares. These cross-product differences mean the effect of Brexit on living standards will vary across households with different expenditure patterns (Cravino and Levchenko, 2017). In particular, households that mainly consume products with high import shares will face larger price rises than households that mainly consume domestically produced goods and services.

To explore the distributional consequences of the Brexit referendum resulting from variation in household expenditure patterns, we use data on expenditure by households in different deciles of the disposable income distribution.[11] For each income decile, we calculate the share of household expenditure allocated to each of our 84 product groups. We then calculate a decile-specific inflation rate by using these shares to compute a weighted average of the product group inflation increases in the year after the vote from our baseline estimate. The resulting inflation rates vary by income decile only because of differences in household expenditure shares across product groups.[12]

Figure 6 shows how the inflation rate for each income decile differs from the effect for the average household. Inflation varies little across deciles, which implies that the costs of voting for Brexit are evenly shared throughout the income distribution. We conclude that the referendum increased inflation by approximately the same amount for poor, middle income and rich households.

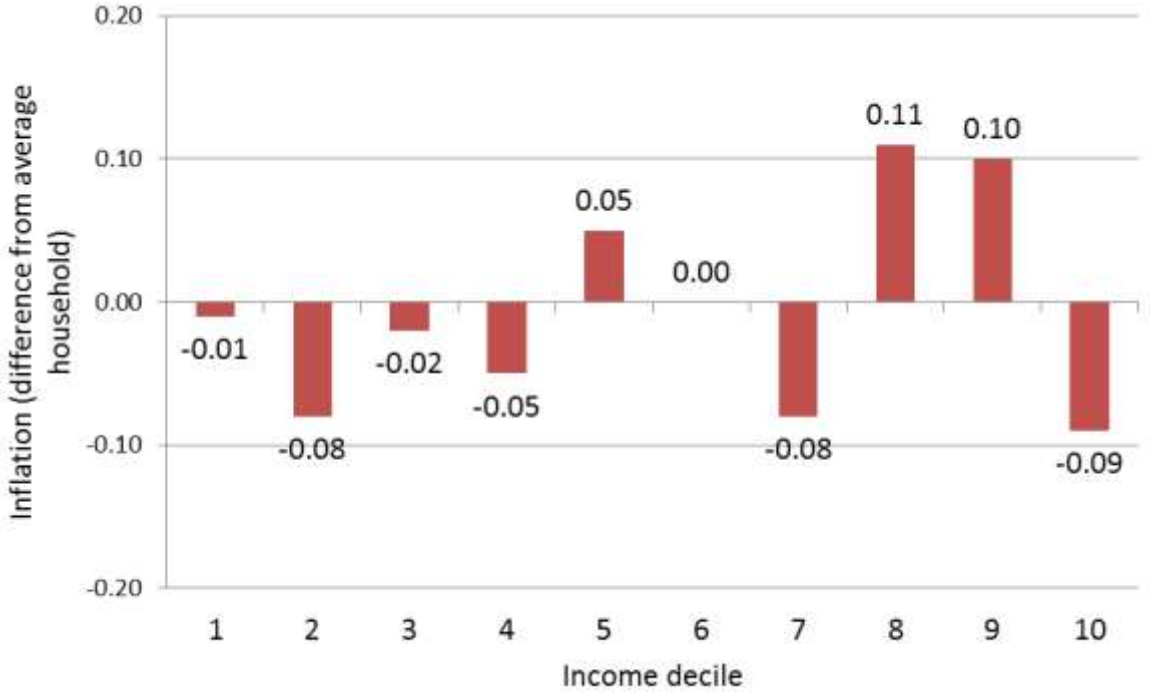
To understand this finding, note that the negative general equilibrium effect in our baseline estimate has the same effect on inflation for all deciles. Consequently, the differences between deciles are independent of the magnitude of the general equilibrium effect and hinge entirely on cross-decile differences in import consumption. Although there are large differences in consumption patterns across the income distribution, we find that these differences are not systematically related to import shares.

[11] Expenditure by household type is from the Office for National Statistics Family Spending data for the financial year ending 2016.

[12] Household expenditure on imports may also vary within product groups. Unfortunately, we do not have the data needed to analyse this dimension of variation. Levell et al (2017) do not find a systematic relationship between import consumption shares and socio-economic class within four groups of food products.

For example, poorer households spend relatively more on food and drinks, which have high import shares, but also on rent, which has a very low import share. Likewise, richer households spend relatively more on some high import share products such as fuels, but also spend a higher proportion of their budget on domestically produced services such as hotels and restaurant meals. Households' overall import exposure is similar throughout the income distribution.

Figure 6: Inflation differences across income deciles due to the Brexit vote



Source: CEP calculations.
Notes: For each decile we show the estimated inflation increase due to the Brexit vote minus the increase for the average UK household. Deciles are based on disposable household income. Decile 1 is the poorest households, decile 10 the richest. See Breinlich et al (2017) for technical details.

Although the inflation effect differs little across income deciles, there are stark differences across regions. We perform the same exercise described for income deciles above, but using data on household expenditure patterns by region. Figure 7 shows the difference between the inflation rate for each region and the UK average. We find that all regions experience a rise in inflation because of the referendum (remember our baseline estimate for the UK as a whole is a 1.7 percentage point increase), but some regions lose more than others.

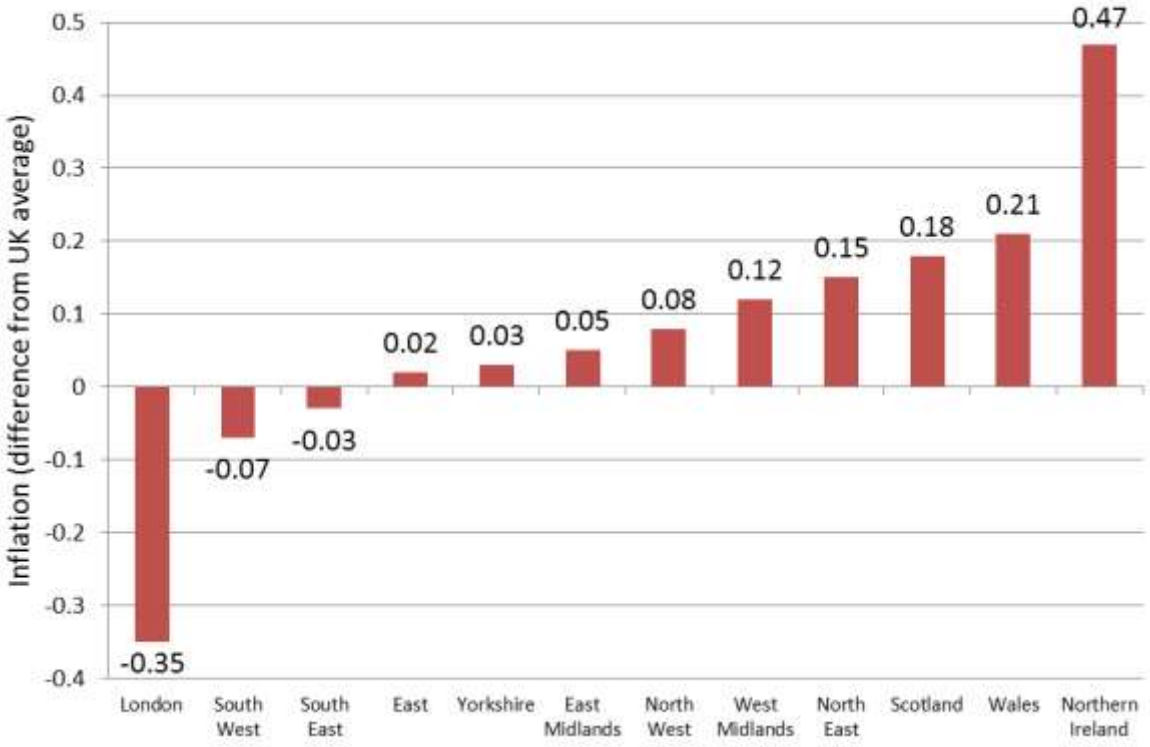
London is the least affected region with a rise in inflation 0.35 percentage points below the UK average. The increase is smaller for London primarily because Londoners spend relatively more on rent than the average household and rent has a very low import share.[13]

In general, the north of England is harder hit than the south. Scotland, Wales, and Northern Ireland are the worst affected areas. Our estimates imply that inflation in Northern Ireland increased by 0.47 percentage points more than the UK average because of the Brexit vote.

[13] The average London household spends 12.9% of its budget on rent, compared to a UK average of 7.1%. Housing rental has a direct import share of 0% and an indirect import share of 8%.

This is because households in Northern Ireland spend relatively more on food and drink, clothing and fuel, which are high import share product groups, and relatively less on rent and sewerage, which have low import shares.

Figure 7: Inflation differences across regions due to the Brexit vote



Source: CEP calculations.
Notes: For each region we show the estimated inflation increase due to the Brexit vote minus the average increase for the UK. See Breinlich et al (2017) for technical details.

Conclusions

Brexit is yet to take place, but the Brexit vote caused a negative shock to the UK's expected future economic performance leading to an immediate depreciation in the value of the pound. Our research provides the first detailed analysis of how the referendum outcome has affected inflation, real wages and living standards in the UK.

We find that following the referendum, prices increased more in product groups where imports account for a higher proportion of consumer expenditure. Our baseline estimate is that the Brexit vote increased inflation and decreased real wage growth by 1.7 percentage points during the year to June 2017. There is uncertainty about the exact magnitude of this estimate. But our results provide compelling evidence that UK households are already paying an economic price for voting to leave the EU.

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