Is Brexit Really Supported? A View of Optimal Currency Area

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The Optimal Currency Area (OCA) theory is utilized to evaluate if Brexit is supported in the context of economic integration. In brief, the greater the conformity to the criteria motivated by the OCA model, the greater the feasibility of a monetary integration between the UK and the EU. Logically, if conditions are conducive for a monetary integration, Brexit – which is a disintegration – is thus unsupported. On the other hand, if circumstances are unfavourable for monetary integration, further economic integration with the current customs union of the EU is not indicated, hence Brexit is not contradicted.

Introduction

The decision of the UK to abandon EU membership was primarily driven by protectionism, nationalism, fear of globalization and free markets, and scepticism regarding supranational government that does not emphasize domestic interests (Taylor-Gooby 2017). As a matter of fact, the EU is a customs union that erects unified trade barriers, concentrated on agriculture and manufacturing, at the expense of end users and business consumers that must endure higher prices than otherwise (Minford 2016). Whilst the incentive to join or not to join the EU is fundamentally protectionist, membership of the EU entails compromising domestic interests and subsidizing others in return for less unfavourable conditions for trade in the European continent. Discontent hence arose when Britons believed they are at the losing end of the deal.

While recent studies have concluded that disturbances in trade are detrimental to both sides of the Channel, the UK is estimated to suffer excessively since its economy is five times smaller than the EU's and since its multinationals exert less market power in the region (Belke and Gros 2017). Specifically, as high as 45% of Britain's exports are directed toward the EU (Hrebenciuc 2017). Consequently, losses of static income from trade could reach as high as 2.6% per household per year (Dhingra *et al.* 2016b) and, in the long run, overall impact can decrease income per household per year by as much as 9.5% (Dhingra *et al.* 2016a).

Barring other compensating factors, disintegration with the EU hurts the UK's production through tighter capital supply, greater trade barriers, smaller pool of skills, and lower technology transfer (Kierzenkowski *et al.* 2016). As far as the European market is concerned, greater trade barriers imply smaller markets, and hence lesser economies of scale and scope for UK-based MNCs. Meanwhile, FDI inflows to the UK are estimated to diminish by 22%, cutting UK productivity, and lowering real income by as much as 2.4% (Dhingra *et al.* 2016b). This is despite the short-run gain in the exports of goods and services due to the depreciation of the pound following the Brexit announcement (Hrebenciuc 2017).

In the financial sector, great challenges are looming ahead. The imminent problems to London include dual regulations, heightened uncertainty, increased transaction costs and frictions, and mounting rivalry from Frankfurt and Paris to be the financial centres of the impending Capital Markets Union of the 28 EU members (Gourinchas and Hale 2017). UK-based financial institutions servicing their customers in the EU may have to face tighter regulations and this will lead to relocation of operations from London to parts of the EU (Sapir *et al.* 2017). As the City of London loses its predominant role, capital flows into pound-denominated assets will decrease, reversing part of the accumulated real appreciation of the pound in recent decades (Sinn 2016). A long-run lower price of the pound should help boost exports of goods and services from, and FDI into, the UK.

In spite of the threats, Brexit also offers opportunities to Britain. Regulations in business and in areas such as water and waste can thus be better tailored to meet domestic technological and market changes (Rosewell 2017). In finance and banking, greater fragmentation as a result of decentralization from London may reduce systemic risk (Hrebenciuc 2017).

The above-mentioned pros and cons of Brexit, however, can be dubious. Whilst in every scientific study evidence is key in ascertaining validity of premises, the problem with Brexit is that evidence, if available, is at best tentative, and hence, judged on existing theories, the desirability of Brexit ultimately depends on circumstances and policies that follow after it (Harvey and Hubbard 2016).

Different from recent studies that revolve around the pros and cons of Brexit, this article evaluates Brexit from the viewpoint of optimal currency area (OCA) theory. To be brief, the OCA theory is essentially a cost–benefit analysis that demarcates the boundary of a currency area. It is often used in the literature to assess if two or more countries should unify their monetary policies or to form a monetary union. In general, the higher the conformity to the OCA criteria, the larger the degree of

integration between the economies, the greater the benefits and the less the costs of adopting the same monetary policy.

Along with this reasoning, the OCA theory is used here to check whether Brexit is supported by fundamentals in the scope of economic integration of the UK with the EU. In brief, the greater the conformity to the criteria prescribed by the OCA model, the greater the feasibility of a monetary integration between UK and the EU. Thus, progressing from the current customs union to a closer integration, such as monetary union, might instead be appropriate. Logically, if conditions are conducive for a monetary integration, Brexit – which is a disintegration – is unsupported. On the contrary, if circumstances are unfavourable for monetary integration, further integration with the current customs union of the EU is not suggested, and then Brexit is not contradicted, and hence can be regarded as supported.

Methodology

The foundations of the Optimal Currency Area theory are laid out by Mundell (1961), McKinnon (1963), and Kenen (1969). In essence, the OCA theory outlines the criteria under which an economic area can reap the most benefits and minimize the costs of participating in a currency area. It can be used to delimit the boundary of a monetary union. In this article, this analytical tool is used to gauge the appropriateness of the UK leaving the EU. Should the criteria stipulated by the OCA theory and related conditions be met by the UK, signalling economic convergence with the EU, the exit of UK will be uncorroborated. Indeed, further integration might be warranted. On the other hand, if the OCA-related criteria are not satisfied, indicating economic divergence with the EU, then the withdrawal of the UK is not in conflict, and hence can be regarded as supported. If the OCA conditions are neither met nor unmet, the decision of the UK to leave the EU will be neither supported nor unsupported.

Since the analysis evaluates the relationship between the UK and the EU, the point of reference is the EU as it is the larger economy, because, as the OCA framework suggests, the larger economy should always be the designated monetary anchor given its larger currency area. Unquestionably, multiple times more goods and services and hence transactions worldwide are denominated in the EU currencies, including the euro and Swiss franc, than that in the British pound. To give a sense of relativity, comparisons with the US and other important countries in the region are carried out in the analysis. A total of six dimensions are explored, of which most are measured with reference to the EU whilst the other facets are measured in absolute terms pertaining to the British economy.

The remainder of this article consists of three sections. The next, third, section introduces the OCA-related criteria and simultaneously evaluates these variables with respect to the relationship between the UK and the EU or with regard to just the UK economy. The fourth section discusses key findings, and the fifth section concludes.

Different approaches are employed accordingly in the respective criteria evaluations. Business cycle symmetry is assessed using the Hodrick–Prescott (HP) filter to analyse business cycle synchronicity, complemented by the correlation coefficient and standard deviation. Trade openness is assessed through bilateral trade intensity, while exchange rate variability is measured using the standard deviation of percentage changes in the GBP exchange rate against the euro and the US dollar. Convergence in price inflation is assessed using averages and standard deviations of inflation differentials. Interest rate synchronicity is analysed using the correlation coefficient and standard deviation of the interest rate cycle. Lastly, the fiscal stance of the government is examined by observing the synchronicity in the movement of the general government budget balance as a percentage of GDP and the general government gross debt as a percentage of GDP.

The more technical computational methods, such as the Hodrick–Prescott (HP) filter, the calculation of bilateral trade intensity, and the expression of the average of absolute differentials, are detailed within the respective subsections of the criteria and evaluation. However, common statistical measures, such as the correlation coefficient and standard deviation, are not explicitly presented in the axiom.

Criteria and Evaluation

Following Quah (2012a, 2012b, 2013a, 2013b, 2014a, 2014b, 2015, 2016b, 2016c, 2017), and Quah and Crowley (2010, 2012a, 2012b), the six OCA-related criteria selected for investigation are business cycle symmetry, trade openness, exchange rate variability, convergence in price inflation, synchronicity in interest rate, and fiscal stance of the government. The efficacy of the OCA model was clearly demonstrated when Artis and Zhang (2002) accurately singled out the troubled Portugal, Italy, Greece, and Spain as the euro members with the least conforming OCA features.

The characteristics examined span from 1999 to 2023, the period since the inception of euro until the most recent year with available data, including the period of the 2008–2009 global financial crisis. The degree of conformity of the UK is generally measured with reference to the EU (28 nations, in general, depending on data availability and 27 nations after Brexit), the Euro area (EA) (19 member states, in general, depending on data availability and 18 nations after Brexit), Germany, and the US whenever necessary and possible. Comparison with the US is made to offer a sense of relativity.

Business Cycle Symmetry

When business cycles of two currency areas are highly synchronous, the role of exchange rate flexibility as a temporal external shock absorber becomes unimportant. In fact, changes in exchange rate may even bring about unnecessary disturbances and shocks when business cycles are parallel. Moreover, when business cycles are synchronous, there is little reason for different policy responses to boom

and bust for the two currency areas. Thus, a single monetary policy or even fiscal policy is warranted when business cycles are symmetrical. For the case of the UK–EU, when their business cycles are parallel, there is little reason for them to pursue divergent economic policies. Hence, one can argue that the greater the degree of symmetry in the business cycle of the UK with the EU, the stronger the case for economic and monetary integration with the EU. In other words, the weaker the case for separation of the UK from the EU.

In terms of operationalization, this criterion is measured using the synchronicity of business cycles by looking at the cyclical component of real production (see Gerlach 1988; Baxter and Stockman 1989), of which the cyclical component is extracted by detrending the quarterly real production index using the Hodrick–Prescott (HP) filter (see, for example, Quah 2015; Artis and Zhang 2002).

The operationalization of the HP filter is expressed in the following (Hodrick and Prescott 1997):

$$Y_t = T_t + C_t \tag{1}$$

where the original time series (Y_t) is decomposed into a trend component (T_t) and a cyclical component (C_t).

$$\text{MIN}_T\left\{\sum_{t=1}^{T}(Y_t - T_t)^2 + \lambda\sum_{t=2}^{T-1}[(T_{t+1} - T_t) - (T_t - T_{t-1})]^2\right\} \tag{2}$$

where λ is the smoothing parameter, and $\lambda = 100$, 1600, and 14,400 are commonly used for yearly, quarterly, and monthly data, respectively.

Figure 1 compares the real business cycle of the UK with the cycles of Germany, the eurozone, the EU, and the US, respectively, for 1999 to 2023. Periods of recession are also highlighted: the first shaded area from the left represents the dot-com bust of 2001–2002, the second area marks the Great Recession of 2008–2009, the third shaded area corresponds to the 2011–2012 European sovereign debt crisis, and the fourth shaded area illustrates the Covid-19 pandemic 2020–2021.

The correlation coefficient of the UK business cycle with each of the reference economies for the pre-crisis 1999–2008, the post-crisis 2009–2023 (Q3), and the entire period of 1999–2023 (Q3) is provided in Table 1. Period segmentation allows for comparison before and after the great financial crisis. As an indication of relative variation in national output, the standard deviation (SD) of the detrended output series is also furnished in the table.

First and foremost, as the charts reveal, the UK business cycle is the most stable through the entire period. This is confirmed by the smallest standard deviation of the detrended series. Prior to the run-up to the 2008 crisis, the UK business cycle is closest with the EU cycle. Nevertheless, when the housing boom begins in 2006, the EU economic cycle experienced a sharp expansion, diverging remarkably from the UK's growth trajectory.

During this boom period, the fairly moderate UK expansion is instead closer to the US boom. In the trough of 2009, deviations of the now steadier UK with the EU and US are almost the same. After the Great Recession, the UK path again converges tightly with the EU path.
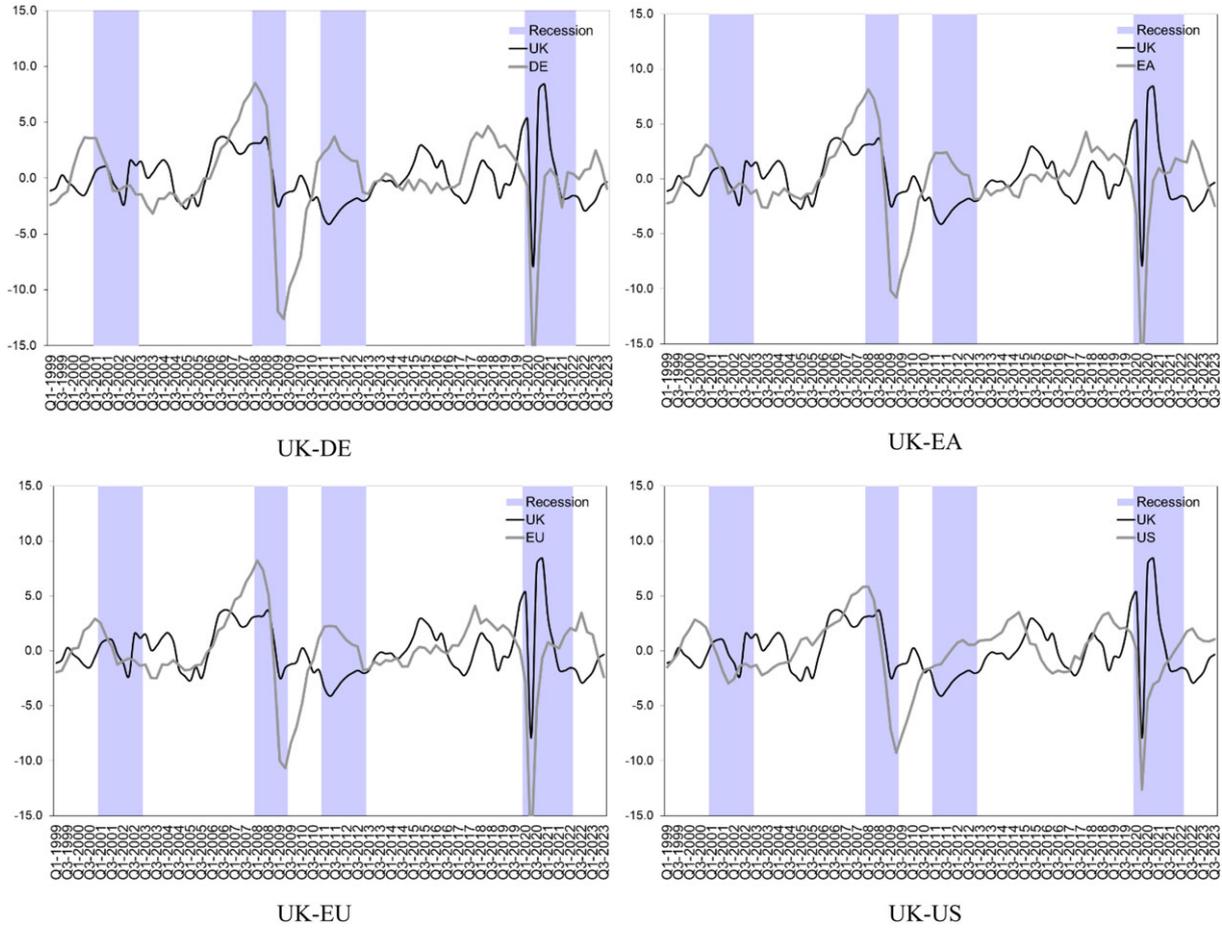
Figure 1. Business cycle using industrial production index, 1999Q1–2023Q3.
Source: Computed using OECD data.

Table 1. Correlation coefficient and standard deviation, business cycle.

			UK–DE	UK–EA19	UK–EU28	UK–US
Corr.	1999–2008		0.62	0.65	0.65	0.46
	2009–2023		0.15	0.14	0.14	0.15
	1999–2023		0.30	0.31	0.31	0.26
		UK	DE	EA19	EU28	US
SD.	1999–2008	1.89	3.28	3.00	2.96	2.47
	2009–2023	2.65	4.23	3.87	3.85	3.16
	1999–2023	2.41	3.94	3.60	3.58	2.95

Source: Computed using OECD data.*EA19 and EU28 (1999Q1–2020Q1); EA18 and EU27 (2020Q2 onwards)

To conclude, the UK business cycle, which is the most stable, is synchronous with the EU cycle even during the dot-com crash and the sovereign debt fiasco. Only in the boom period leading to the Great Recession is the UK more parallel with the US. Incidentally, the UK is most divergent with Germany owing to the huge changes in German output. During the crisis period, the divergence in business cycles between the UK and the US was most likely attributable to differences in stimulus policies. Regional economic trajectories and policies often align during times of crisis (Quah and Ho 2020). However, the divergence in the business cycle trajectories of the UK and the EU began in the lead-up to the 2008 crisis, became more pronounced during the crisis itself, and has continued since then. Prior to the 2008 crisis, the business cycle correlation between the UK–EU, and likewise between the UK–EA was 0.65, a fairly robust figure statistically, compared with the UK–US business cycle correlation of 0.46. However, following the crisis, the business cycle correlation between the UK–EU, and between the UK–EA significantly declined to 0.14, in contrast to the UK–US correlation, which also dropped to 0.15.

Trade Openness

The OCA theory suggests that countries which trade a great deal with each other are good candidates for monetary integration (McKinnon 1963; Frankel and Rose 1998). The benefits in transaction cost savings, exchange rate certainty, and price signalling from unified exchange rate can be enjoyed most fully. In addition, the more open the countries are to each other, the less asynchronous will be their output fluctuations arising from demand and supply shocks.

Hence, when trade between two countries is extensive, the price mechanism can work well in allocating scarce resources and resolving unemployment just as it always does within a country. Consequently, independent national policies are less needed, and it will be much easier for a member state of the EU, such as the UK in our context, to agree to centralized supranational policies.
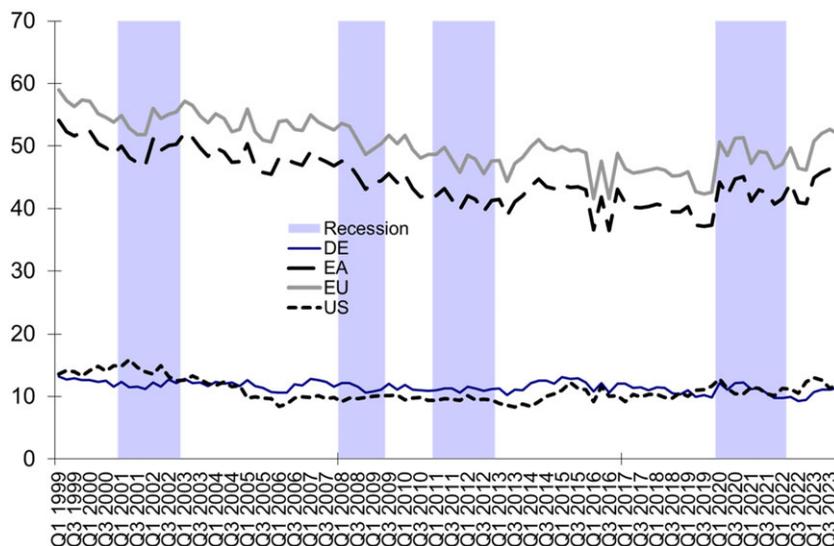
Figure 2. Trade openness (%), 1999Q1–2023Q4.
Source: Computed from IMF: DOTS data.

A bilateral trade measure is used here to quantify trade openness (see for example Quah 2017; Artis and Zhang 2002). For a country denoted by i, trade openness is measured by bilateral trade intensity, $(x_{i,r} + m_{i,r})/(x_i + m_i)$ where x_i and m_i are the dollar values of exports and imports of goods of that country and subscript r indicates the partner country. Figure 2 puts together four lines, depicting, respectively, the UK's bilateral trade intensities with Germany, the euro area, EU, and the US from 1999Q1 to 2023Q4.

As Figure 2 shows, it is apparent that trade linkages with the EU and the euro area parallel each other, each making up around half of UK's total trade in goods. The markup of the EU over the euro area is just due to the greater number of member states in the EU than in the eurozone. Otherwise, their trajectories do not appear to be disrupted by the four major recessions. They fall during the dot-com boom, rise in the corresponding recession, slide gradually until after the end of the European sovereign debt crisis, then level off slightly for a period before improving during the COVID-19 recession through the end of the observation period in 2023. From end to end, whilst the EU still takes up the majority of UK goods trade, its share has dropped by slightly more than 7 percentage points.

Incidentally, trade linkages with Germany and the US hover around 13% over the entire period. Trade intensity with the US stays consistently lower than that with Germany after the dot-com recession until the Covid-19 recession.

Exchange Rate Variability

Exchange rate movement is one indicator of the synchronicity of economic forces between currency zones. Exchange rate changes are clearly measurable and give the

Table 2. Standard deviation, percentage change of exchange rate against the euro and the US dollar, 1999:2–2016:12.

		Against EUR	Against USD
SD.	1999-08	2.37	2.51
	2009-23	2.44	2.52
	1999-23	2.24	2.50

Source: Computed from Investing.com

appropriate weights to the economic forces of which the changes are the result (Vaubel 1978). Such economic forces include monetary inflation, openness, economy size and structure, price flexibility, factor mobility, market integration, fiscal restraint, political stability, and so on (see, for example, Tavlas 1993). Short-run fluctuations in exchange rate are frequently the consequence of changes in market confidence in the above-mentioned forces. Since short-run exchange rate movement is a factor of market confidence, stability in the nominal exchange rate can hence indicate a lack of economic shocks that shake market confidence. With this reasoning, it will be much easier for the UK government to adhere to EU policies if the exchange rate between the UK and EU is more stable.

In this section, the euro is used as the proxy currency for the EU and, to evaluate the extent of variability of the pound–euro rate, the pound–dollar rate is used as a reference. Figure 3 shows the percentage change in nominal exchange rate of the pound sterling against the euro and the dollar for 1999:2–2023:12. Respective standard deviations for 1999–1908, 2009–2023, and 1999–2023 are collected in Table 2. It is apparent that the price of the pound is consistently steadier against the euro than against the dollar, except for only in the global financial turmoil when the pound rate against the euro is as volatile as the pound rate against the dollar. In spite of that, in recent years, the pound–euro rate has been as variable as that during the global crisis period. The major factor for this fluctuation might well be the uncertainty that arose from the European Union Referendum Act 2015 which allowed for an in–out referendum to take place by the end of 2017.

Convergence in Price Inflation

It has been generally accepted that, in the long run, price inflation is a product of monetary inflation (Quah 2016a) whereas short run price inflation is caused by a confluence of demand-pull, inflation expectations, and cost-push factors such as fluctuations in oil prices (Ho, Tew and Mansur 2013). Monetary inflation in turn reflects the fiscal and monetary stance of a government. Given the limitations of other public finance methods, the greater the fiscal deficit and public debt, the larger the monetary expansion by the central bank through debt monetization. On the other hand, low-price inflation indicates monetary discipline that restrains
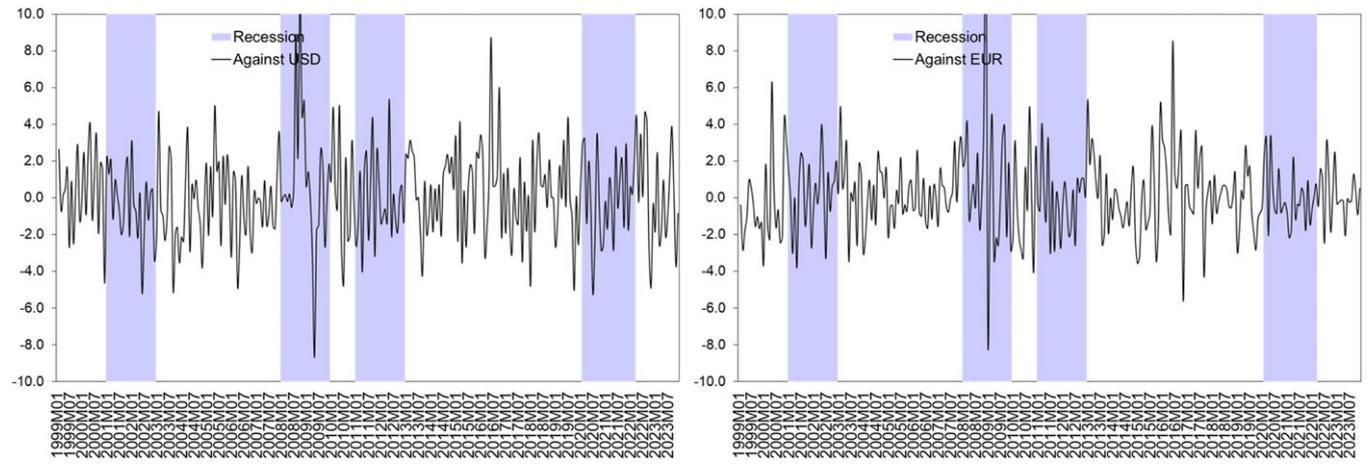
Figure 3. Percent change of exchange rate against euro and the US dollar, 1999:2–2016:12.
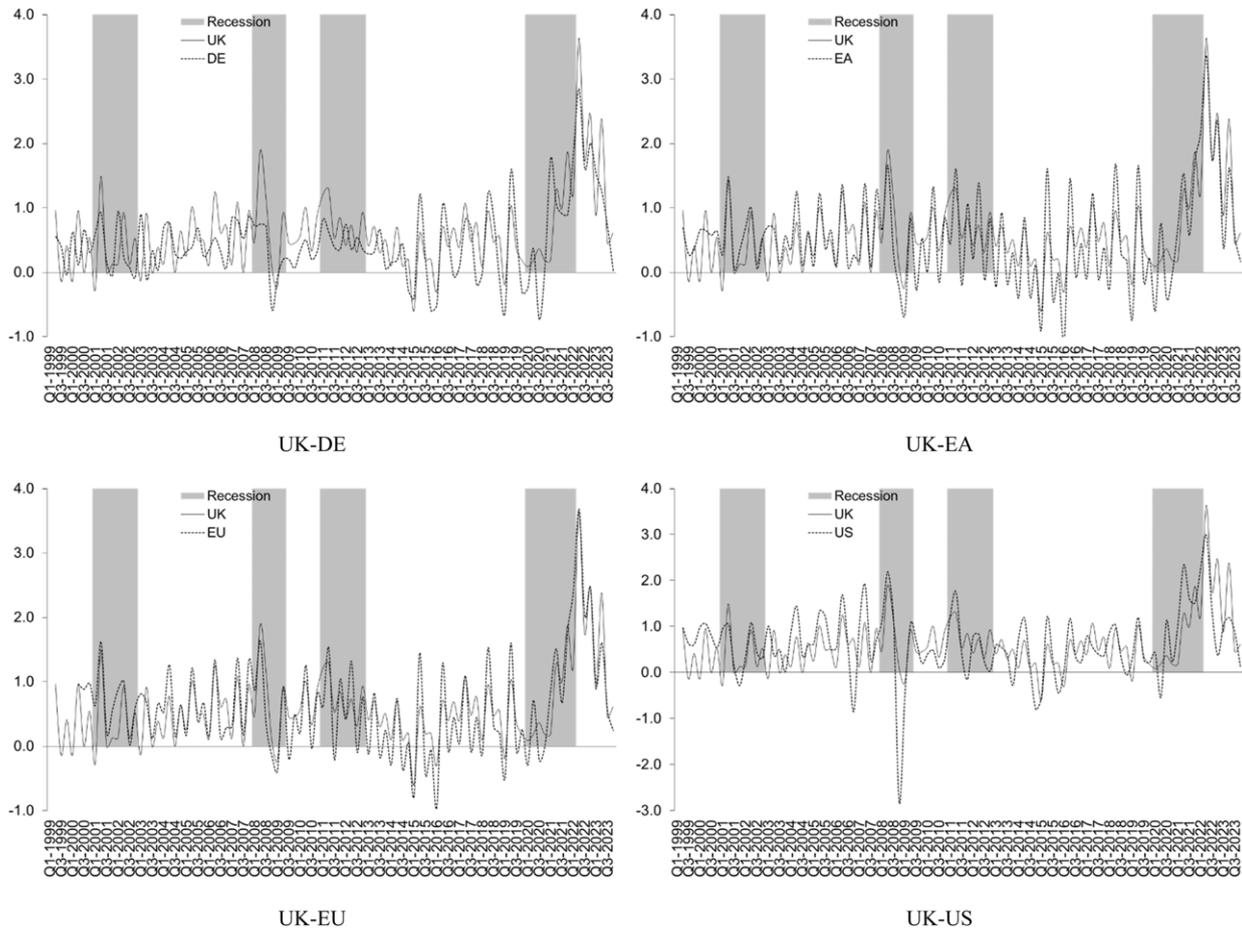*Source*: Computed from Investing.com.

Figure 4. Q-to-Q Inflation (%), 1999Q1–2023Q4.
Source: Computed from OECD data.

Table 3. Average and standard deviation, inflation differential, 1999Q1–2023Q4.

		UK–DE	UK–EA	UK–EU*	UK–US
Avg.	1999-08	0.49	0.53	0.27	0.31
	2009-23	0.43	0.45	0.42	0.35
	1999-23	0.46	0.48	0.36	0.34
SD	1999-08	0.29	0.55	0.23	0.27
	2009-23	0.30	0.38	0.25	0.25
	1999-23	0.30	0.45	0.25	0.26

Source: Computed from OECD data.*EU data for inflation begins from 2000Q1.

public spending. Hence, convergence in price inflation can signify a convergence in fiscal and monetary stance that is critical in the decision of the UK to stay within or to leave the EU. The more convergent the price inflation of the UK and the EU, the more conducive the environment for the UK to stay in the EU. In addition, convergence in inflation also reflects a similarity in trade union aggressiveness and labour costs (Fleming 1971), implying less need for divergent trade and labour migration policies in correcting current account imbalances between the UK and the EU.

Figure 4 plots the 1999–2023 quarterly CPI inflation rates by contrasting the rate of UK inflation against that of Germany, the euro area, the EU, and the US, respectively. Period averages of absolute differential, $|x_i - x_{UK}|$ where x_i and x_{UK} are the respective rates of inflation in country i and the UK, are given in Table 3. Standard deviation, indicating the variability of the differential, is also provided in the table.

Interestingly, before the global crisis, the UK inflation rate was most convergent with the German rate, and then the eurozone rate, but ever since the onset of the crisis through to the end of 2014, the UK inflation rate is closest with the EU inflation rate. From 2015 onwards, the UK, eurozone, and the EU inflations virtually unify. By and large, the UK is relatively divergent with the US. In short, the UK is increasingly convergent with the EU in consumer price inflation, which is especially evident since the global contraction.

Synchronicity in Interest Rate Movement

Although not formally listed as one of the criteria based on the classical OCA theory (Tavlas 1993), this facet is indicated by a 'revealed preference' argument (Quah 2015, 2017; Artis and Zhang 2002). If the monetary policy of a candidate country has historically differed little from that of a partner country, the cost of relinquishing monetary independence should hence be accordingly small. Thus, synchronicity in interest rates can be interpreted as a measure of coordination in monetary policy.

In the current context, coordination in monetary stance is, of course, an essential ingredient to a harmonious relationship with any international
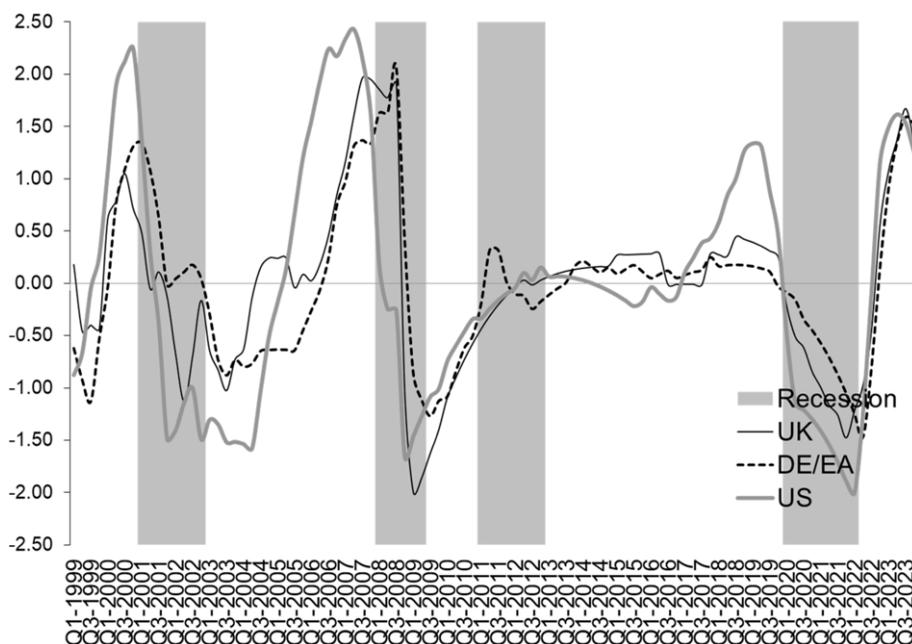
Figure 5. Detrended interest rates, 1999Q1–2023Q4.
Source: Computed from OECD data.

cooperation effort, including sustainable membership in the EU. Stark differences in monetary policy can result in huge changes in relative price, exchange rate, and external competitiveness that can undermine mutual agreement to open trade, financial flows, and labour movement.

In short, the more synchronous the interest rate paths between the UK and the EU, the more convergent the monetary policies, the greater the likelihood of conformity to free trade agreements in the EU. On the contrary, the less synchronous the interest rate trajectories, the less convergent the monetary policies, the smaller the likelihood of conformity to free trade agreements. Here, short-term interest rates of three-month maturity are observed, and detrending is accomplished by the H-P filter.

Figure 5 compares the detrended interest rates of the UK, Germany/eurozone, and the US for 1999Q1–2023Q4. Since aggregated interest rate data for the EU are not available, the eurozone interest rate is used as a proxy for the EU-wide interest rate. Correlations with the UK and standard deviations of the detrended series are provided in Table 4.

As the plots and the correlations reveal, the UK interest rate is more aligned with the eurozone rate until the middle of the global recession. Ever since, however, the UK, eurozone, and the US interest rates are highly convergent. This can be explained by convergence of price inflation and exchange rate expectations and further integration of the financial markets after the severe downturn.

Table 4. Correlation coefficient and standard deviation, interest rate cycle, 1999Q1–2023Q4.

			UK–DE/EA	UK–US
Corr.	1999–2008		0.76	0.66
	2009–2023		0.93	0.89
	1999–2023		0.84	0.76
		UK	DE/EA	US
SD.	1999–2008	0.89	0.89	1.42
	2009–2023	0.66	0.62	0.89
	1999–2023	0.83	0.75	1.13

Source: Computed from OECD data.

All three interest rates clearly move in tandem during the first two boom–bust cycles, but in the European sovereign debt crisis only the UK and eurozone rates noticeably rise and fall together. Since this debt crisis, all three rates are not only convergent but are also highly stable. To conclude, the monetary policies of the UK, eurozone, and the US have become increasingly convergent in recent times.

Fiscal Restraint

In light of the 2011 fiscal and government debt fiasco that stirred the European continent, it is instructive to evaluate this Maastricht criterion of fiscal restraint. Within a monetary union where monetary action is surrendered to a central authority such as the European Central Bank, in times of asymmetric shocks fiscal policy is the remaining tool for federal governments, for instance, in ameliorating recession. That being said, countries with a history of relatively low spending and budget surplus will be in a better position to borrow from internal or external sources to finance expanded expenditure. Hence, with the capacity to borrow more to finance a greater deficit, it will be easier for these countries to subscribe to supranational policies that may be unfavourable to certain sectors of the domestic economy. Thus, it is easier for the UK to comply with supranational EU prescriptions when it has a strong fiscal position than when it has a weak fiscal position.

Figure 6 displays the general government budget balance as a percentage of GDP for 1999–2023 for the UK, Germany, the US, eurozone, and the EU, where a positive value indicates a budget surplus while a negative value represents a deficit. Clearly, for all countries, downward swings can be seen in the dot-com bust, the great recession and the Covid-19 recession, while upward shifts can be observed during the respective recoveries. Notably, over the entire period, the UK has deteriorated from the least deficit nation to the second most deficit one after the US since the great contraction.

In respect of liability, Figure 7 exhibits the general government gross debt as a percentage of GDP for 1999–2023. Clearly, the UK stands out by enjoying a debt-to-
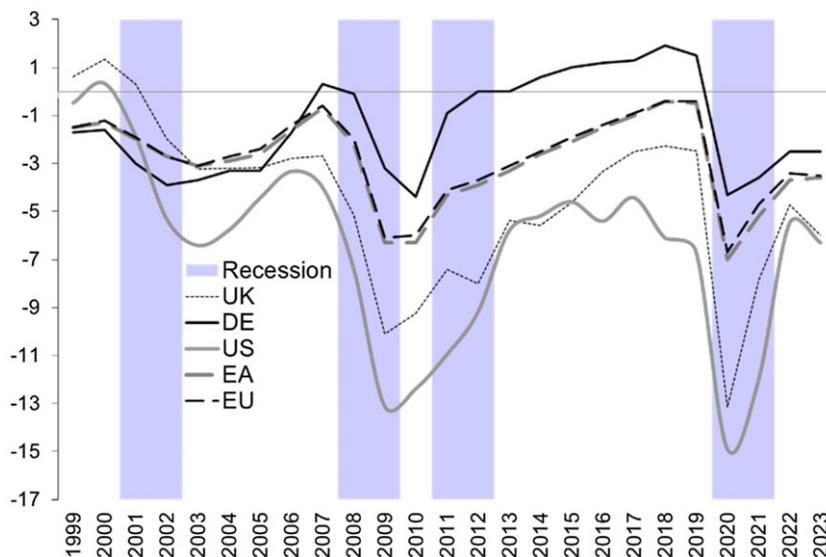
Figure 6. General government budget balance (% of GDP), 1999–2023.
Source: Computed from Eurostat, OECD, Congressional Budget Office and Office for National Statistics (UK).
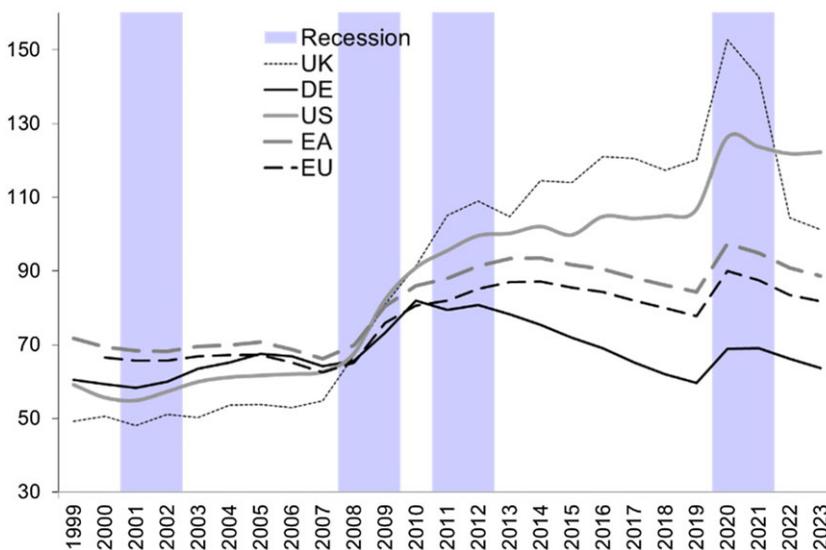

Figure 7. General government gross debt (% of GDP), 1999–2023.
Source: Computed from Eurostat, OECD, Trading Economics and Office for National Statistics (UK).

Table 5. Summary of findings

	Dimensions	Key Findings
1	Business cycle synchronization	The UK business cycle is generally most synchronous with the EU one.
2	Trade openness	Bilateral trade intensity in goods of the UK with the EU has declined gradually.
3	Exchange rate variability	The pound is generally steadier with the euro than with the dollar.
4	Inflation convergence	The UK is increasingly convergent with the EU in CPI inflation.
5	Interest rate symmetry	The interest rate paths of the UK, eurozone, and the US have become increasingly convergent.
6	Fiscal Restraint	Fiscal position of UK has declined considerably.

Source: Author's findings.

GDP ratio of around 40%, which is the lowest, since the beginning of that period through to the global financial crisis. However, ever since that crisis, its indebtedness has risen, reaching 152% at the peak of the Covid-19 recession, diverging significantly from that of the Euro Area and the EU. Remarkably, the debt ratio of Germany has fallen substantively from 80% since the end of the global recession to about 60% by the end of the observation period in 2023, whilst that of the US has increased from about 80% to above 120%.

To summarize, since the great recession, the fiscal position of the UK has declined significantly and this implies increased difficulty in exploiting fiscal spending or additional borrowing as a remedy to alleviate any unfavourable outcomes to domestic interests which can result from adherence to EU terms.

Summary of Findings

Hitherto, this article has inspected the OCA-related criteria evaluating the appropriateness of the UK exiting the EU. In this exercise, the EU, which is the larger economy, is designated as the anchor economy for the UK, considered a subsidiary. It is hypothesized that the greater the conformity to the OCA criteria, the greater the desirability of further integration with the EU. If this is the case, a Brexit decision is conflicted. The first five dimensions observed are dependent on the reference country, the EU, whilst the remaining facet of fiscal restraint is not dependent on a reference. A summary of the observations is listed in Table 5.

Findings are mixed but, by and large, consistent with retention or deeper integration of the UK with the EU. All six dimensions are found to be supportive of the UK remaining in the EU. The UK business cycle is generally most synchronous with the EU cycle and the pound–euro rate is generally less volatile than the pound–dollar rate. In addition, the rate of price inflation and interest rate movements of the

UK have been increasingly convergent with EU ones, while trade openness in goods of the UK with the EU and the fiscal position of UK have declined.

Discussion and Conclusion

Although no comparable study has specifically examined the synchronization of key indicators' movements before and after Brexit, as this article attempts, several studies align with its main findings, concluding that Brexit has had adverse effects on both the UK and the EU. Geiger and Güntner (2024) observed that an adverse Brexit shock had moderately negative effects on economic output and caused delayed upward pressure on consumer price inflation, while the impacts on monetary policy stance and consumer confidence were more pronounced. Graziono *et al.* (2024) found that Brexit-induced uncertainty increased import prices from the EU, particularly in sectors vulnerable to potential MFN tariff hikes, leading to welfare reductions, with the strongest effects observed in highly exposed industries. Kren and Lawless (2024), analysing product-level trade flows, identified a sharp decline in UK exports to the EU and smaller, yet significant, reductions in EU exports to the UK. Similarly, de Lucio *et al.* (2024) highlighted Brexit's negative effects on trade disintegration at the country level, particularly between the UK and Spain.

Despite the above, it must be noted that the analysis is limited in the sense that aggregation in the statistics used does not necessarily reflect the sectoral differences in the economy of each country in question. The OCA approach circumvents the issues of over-aggregation inherent in econometric or stochastic modelling approaches that may conceal individual differences of indicators over time. Recognizing the economy as a complex system, examining its constituent parts rather than its aggregated whole allows for a detailed analysis of each indicator's trajectory, providing a nuanced view of economic dynamics across different periods (Ho, Yasao and Ooi 2013; Ho *et al.* 2016). This disaggregated analysis enables a more precise and policy-relevant discussion. For instance, the industrial production index is used as a proxy to gauge business cycles but this measure may not indicate vibrancy of the stock market and the housing sector.

In conclusion, despite the limitations, the findings are generally in line with those found in recent works. As the findings suggest, Brexit is not corroborated by the dimensions motivated by the OCA theory as far as the economies of the UK and the EU are concerned. The analysis, structured around six dimensions of economic interaction between the UK and the EU, yields nuanced yet broadly supportive evidence for deeper integration. Notably, the synchronization of business cycles and the relative stability of the pound–euro exchange rate highlight a significant level of economic interdependence, suggesting that continued alignment with the EU would have been economically advantageous. Furthermore, while the findings temper extreme forecasts of substantial trade losses post-Brexit, they also reveal a persistent decline in the EU's share of the UK goods trade over the past decade, indicating shifting trade dynamics. Overall, the study contributes to the ongoing discourse on

Brexit by critically examining its economic underpinnings and implications through the lens of OCA theory. To the global community though, Brexit creates a more competitive environment in the region as multinational corporations based in the UK and EU will be less protected than before. Also, multinationals from the rest of the world can gain greater bargaining power as the monopsony of the European fortress will be weakened after Brexit.

References

Artis M and Zhang W (2002) Membership of EMU: a fuzzy clustering analysis of alternative criteria. *Journal of Economic Integration* **17**(1), 54–79.

Baxter M and Stockman AC (1989) Business cycles and the exchange-rate regime. *Journal of Monetary Economics* **27**(1), 377–400.

Belke A and Gros D (2017) The economic impact of Brexit: evidence from modelling free trade agreements. *Atlantic Economic Journal* **45**(3), 317–331.

de Lucio J, Mínguez R, Minondo A and Requena F (2024) The negative impact of disintegration on trade: the case of Brexit. *European Economic Review* **163**. https://doi.org/10.1016/j.euroecorev.2024.104698

Dhingra S, Ottaviano G, Sampson T and Van Reenen J (2016a) The consequences of Brexit for UK trade and living standards. CEP Brexit Analysis Papers 02, Centre for Economic Performance, London School of Economics and Political Science (LSE). https://cep.lse.ac.uk/pubs/download/brexit02.pdf

Dhingra S, Ottaviano G, Sampson T and Van Reenen J (2016b) The Impact of Brexit on Foreign Investment in the UK. CEP Brexit Analysis Papers 03, Centre for Economic Performance, London School of Economics and Political Science (LSE). http://cep.lse.ac.uk/pubs/download/brexit03.pdf

Fleming JM (1971) On exchange rate unification. *Economic Journal* **81**(1), 467–488.

Frankel J and Rose A (1998) The endogeneity of the optimum currency area criteria. *Economic Journal* **108**, 1009–1025.

Geiger M and Güntner J (2024) The chronology of Brexit and UK monetary policy. *Journal of Monetary Economics* **142**. https://doi.org/10.1016/j.jmoneco.2023.09.003

Gerlach S (1988) World business cycles under fixed and flexible exchange rates. *Journal of Money, Credit and Banking* **20**(1), 621–632.

Gourinchas P-O and Hale G (2017) Brexit: Whither the Pound? FRBSF Economic Letter, Federal Reserve Bank of San Francisco. https://www.frbsf.org/wp-content/uploads/el2017-11.pdf

Graziono AG, Handley K and Limão N (2024) An import(ant) price of Brexit uncertainty. *Journal of International Economics* **152**. https://doi.org/10.1016/j.jinteco.2024.104012

Harvey D and Hubbard C (2016) *Why Brexit?* Centre for Rural Economy Discussion Paper Series No. 35, Newcastle University.

Ho YJ, Ruiz Estrada MA and Yap SF (2016) The evolution of complex systems theory and the advancement of econophysics methods in the study of stock market crashes. *Labuan Bulletin of International Business & Finance* **14**, 68–83.

Ho YJ, Tew TH and Mansur K (2013) Income elasticity of demand in Malaysia during the period of fuel induced inflation. *Actual Problems of Economics* **140**(2), 404–416.

Ho YJ, Yasao MR and Ooi AY (2013) Complex systems in financial economics: a historical guide for the uninitiated. *Proceeding of the Second Applied International Business Conference 2013, Emerging Mega-trends in Asian Market*, pp. 1013–1019.

Hodrick RJ and Prescott EC (1997) Postwar U.S. business cycles: an empirical investigation. *Journal of Money, Credit and Banking* **29**(1), 1–16.

Hrebenciuc A (2017) The costs of Brexit for UK economy. *Theoretical and Applied Economics* **2**(611), 319–327.

Kenen P (1969) A theory of optimum currency areas: an eclectic view. In RA Mundell and AK Swoboda (eds), *Monetary Problems of the International Economy*. Chicago: University of Chicago Press.

Kierzenkowski R, Pain N, Rusticelli E and Zwart S (2016) The economic consequences of Brexit: a taxing decision. OECD Economic Policy Paper, April 2016, No. 16.

Kren J and Lawless M (2024) How has Brexit changed EU–UK trade flows? *European Economic Review* **161**. https://doi.org/10.1016/j.euroecorev.2023.104634

McKinnon R (1963) Optimum currency areas. *American Economic Review* **53**, 717–725.

Minford P (2016) Brexit and trade: what are the options. *The Economy after Brexit* **13**.

Mundell R (1961) A theory of optimum currency areas. *American Economic Review* **51**, 657–664.

Quah C-H (2012a) Is East Asia as prepared as Eurozone for monetary union? *Journal of Business, Economics, and Management* **13**(3), 471–488.

Quah C-H (2012b) Can Japan or China replace the US as the monetary anchor for Hong Kong and Macau? *Asia Pacific Business Review* **18**(3), 335–354.

Quah C-H (2013a) Clustering eurozone cycles. *Quality & Quantity* 1–16.

Quah C-H (2013b) Potential currency areas in East Asia using United States, Japan, or China as the monetary anchor. *Economia Mexicana Nueva Epoca* **3**(I), 247–279.

Quah C-H (2014a) A diagnosis of Greece. *Investigacion Economica* **73**(287), 3–35.

Quah C-H (2014b) Revisiting business cycles in the Eurozone: a fuzzy clustering and discriminant approach. *Acta Oeconomica* **64**(2), 161–180.

Quah C-H (2015) A diagnostic on the West African Monetary Union. *South African Journal of Economics* **84**, 129–148.

Quah C-H (2016a) *Eccentric Views on Money and Banking*. Kuala Lumpur, Malaysia: University of Malaya Press.

Quah C-H (2016b) Germany versus the United States: monetary dominance in the eurozone. *Economies* **2**(4), 8.

Quah C-H (2016c) Economic feasibility of a BRICS monetary union. *Global & Local Economic Review* **20**(2), 1–29.

Quah C-H (2017) Exchange rate fixation between US, China, Japan and Eurozone. *Margin: The Journal of Applied Economic Research* 0973801016689206.

Quah C-H and Crowley PM (2010) Monetary integration in East Asia: a hierarchical clustering approach. *International Finance* **13**(2), 283–309.

Quah C-H and Crowley PM (2012a) Which country should be the monetary anchor for East Asia: the US, Japan or China? *Journal of the Asia Pacific Economy* **17**(1), 94–112.

Quah C-H and Crowley PM (2012b) China and the dollar: an optimum currency area view. *Prague Economic Papers* **4**, 391–411.

Quah C-H and Ho YJ (2020) Economic feasibility of Malaysia and Singapore-Brunei monetary reunion: a scrutiny during major financial crises. *Applied Economics Journal* **27** (1), 23–51.

Rosewell B (2017) Infrastructure, policy, and Brexit. *Oxford Review of Economic Policy* **33**(suppl. 1), S113–S123.

Sapir A, Schoenmaker D and Véron N (2017) Making the best of Brexit for the EU27 financial system. Policy Brief 2017/01, Bruegel.

Sinn HW (2016) A Brexit lesson: is a single currency not worth the gamble? *The International Economy* **30**(3), 42.

Tavlas G (1993) The 'new' theory of optimum currency areas. *The World Economy* **16**, 663–685.

Taylor-Gooby P (2017) Re-doubling the crises of the welfare state: the impact of Brexit on UK welfare politics. *Journal of Social Policy* **46**(4), Brexit Special Issue, 815–835. https://doi.org/10.1017/S0047279417000538.

Vaubel R (1978) *Strategies for Currency Unification*. Tubingen: J.C.B. Mohr.

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