



Gravity without weight

How does distance affect
the UK's trade in services?

Newton famously observed that if you were to drop an apple it would fall to the ground. An insurance product, on the other hand, would not. Unlike goods, services are weightless. When traded overseas, this means that goods are subject to large transportation and other distance-related costs, whereas services can be sold across borders at the click of a button. This begs the question, does distance even affect services trade? In fact, it does. Using a new dataset, we explore what gravity means for UK trade in services and show that distance matters – as much as it does for goods.

The attraction of gravity models

In the 1950s, as the postwar world was building international institutions like the UN, NATO and what would become the EU, economists began building models to help them understand the global trading system. The results confirmed much of what they expected: two countries will trade more with each other if there was a shared language, history and culture, and if tariffs are low. But one of the more surprising findings was that when you correct for all of these factors, trade is largely determined by the same two features that govern the physical world – mass and distance. This has given rise to what is now known as the gravity model of trade, which predicts that large economies that are close together will trade more.

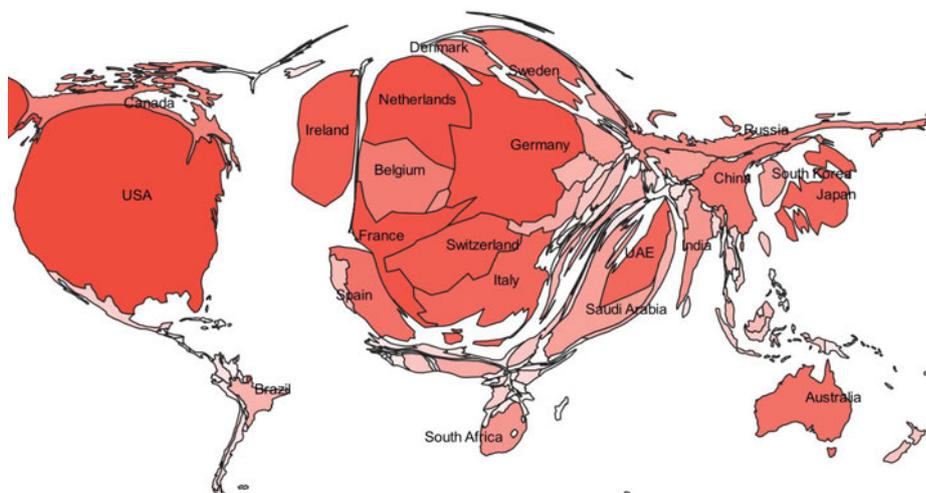
The importance of distance in the gravity equation was thought to be diminishing due to recent global trends such as reduced transport costs, liberalised markets and improved communication.² But a recent PwC study showed that in each of the past four decades distance has

actually become more important for goods trade, due to the proliferation of regional supply chains, onshoring of production and the hub production sites of multinational firms.³

A key feature that was omitted from this analysis was trade in services. Despite making up around a quarter of world trade, services have been relatively overlooked by the economic literature. When the original gravity models were designed, this made sense: most services consisted of activities like haircuts, taxis and eating out, which are non-tradable by nature.

The recent proliferation of tradable services, like offshore call centres, online accounting software and legal and consulting services, means that tradable services are more important to the world economy than ever before – but measuring them remains notoriously difficult. Whereas goods can be classified into one of several thousand distinct categories, services are – literally – harder to put in boxes.

Figure 1: Countries of the world scaled to the value of UK service exports in 2018



The map shows that the UK generally trades more with countries that are nearer. But how much of this is because of distance, and how much is due to other factors?

'Black holes' in the data

According to the UK Trade Policy Observatory, 'trade in services is the dark matter that... matters'.⁴

Trade economists categorise services by their 'mode of supply'. Your lawyer could provide legal advice on India law to you remotely from Bangalore (mode 1), or you could travel to Bangalore to be represented in a court case (mode 2), or your lawyer could travel to the UK for a face-to-face meeting (mode 4), or you could receive advice through her firm's foreign branch in London (mode 3).

But the ever-changing nature of services means that any fixed categorisation of services will at some point become outdated. Moreover, the 'servicification' of manufacturing is eroding the more basic distinction between a good and services, as modern manufactured goods increasingly contain embedded services; for example autonomous vehicles sold as a good will require updates which take the form of a service.⁵

E-commerce poses further problems. E-books such as Kindle involve a transaction that is marketed, bought, sold, delivered and consumed online. As Amazon has servers in many different countries, which ones should count these sales and imports and exports?

In spite of these difficulties, international trade bodies have developed a commonly-accepted approach to measure services trade, leading to significant data improvements.⁶ In this study, we use a new experimental dataset on UK services trade, released by the ONS, which has a particularly granular sectoral breakdown and broad country coverage.⁷

Zero gravity in services?

Since services do not have to be physically transported, it has been suggested that service trade would result in the 'death of distance'.⁸ Others point out that because many modern services, like accounting, require trust and face-to-face contact, distance will remain an important factor. The limited empirical evidence on this is very mixed: some studies suggest that services may indeed be less susceptible to the forces of gravity than goods, while others have concluded that distance effects are significantly stronger for services.⁹ Moreover, the literature rarely distinguishes between different service sectors, even though this is crucial for business and policy decisions.¹⁰

Our analysis suggests that gravity is an important factor in services trade for the UK. Distance and size together explain 50-60% of trade in the data set. In fact, the force of gravity is as strong for services as for goods.¹¹ As shown in Figure 2, our analysis implies that doubling the distance between the UK and a trading partner would decrease trade in services by just under half (41% decrease). For goods the average distance effect is 3 percentage points stronger for exports and 2 percentage points weaker for imports.

Newton's law of universal gravitation

$$F_{ij} = G \frac{M_i M_j}{D_{ij}^2}$$

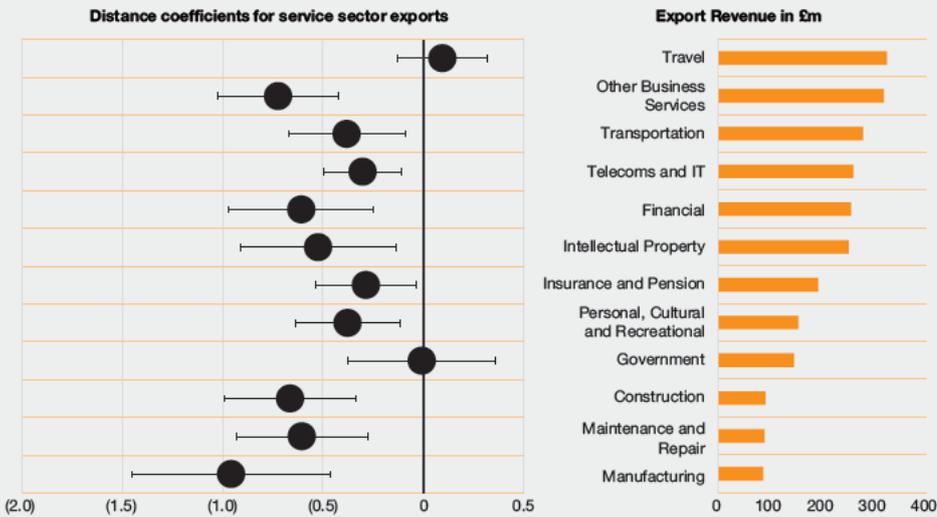
The gravitational force (F) acting between two objects (i and j) is proportional to the product of the two masses (M) and inversely proportional to the square of the distance (D) between them.

Gravity model of trade

$$F_{ij} = G \frac{M_i M_j}{D_{ij}}$$

The trade flow (F) between two countries (i and j) is proportional to the product of the two economic masses (M, e.g. measured by GDP) and inversely proportional to the distance (D) between them.

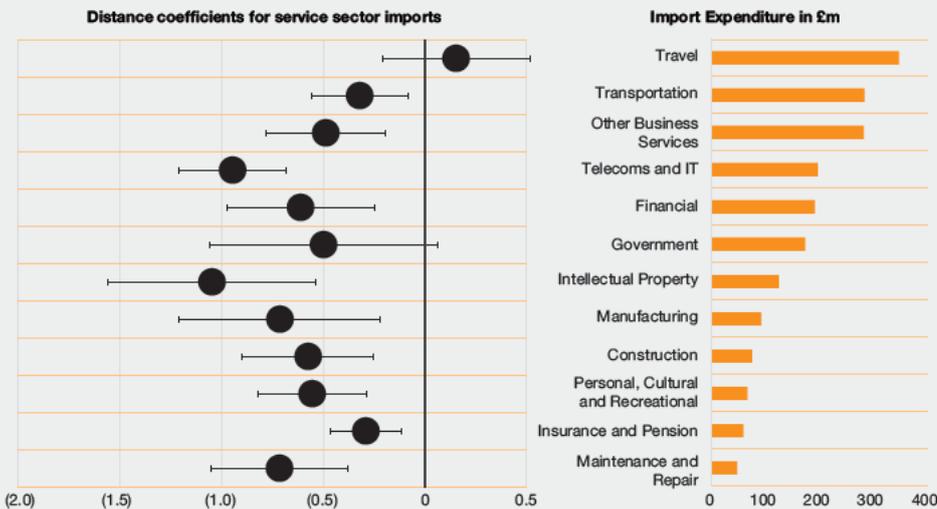
Figure 2a: Distance coefficients for UK service sectors and sub-sectors for exports, and value of trade in 2016



The figure on the left shows the importance of distance to trade for each UK export sector (closer to zero means less importance); the graph on the right shows the size of that sector in terms of UK export revenues.

These regression coefficients capture the relationship between distance and trade. Since we log both variables in our model the coefficients can be interpreted as elasticities. For example, an elasticity of -0.72 (e.g. maintenance imports in figure 2b) implies that a 10% increase in distance corresponds to a 7.2% decrease in trade, controlling for the other variables in the model. We have presented the coefficients alongside their confidence bands on individual service sectors, and the weighted average coefficients services and goods as a whole (the thick and thin vertical lines, respectively.) These figures are also being shown by the table below, in particular there are similar elasticities for both goods and services trade, which suggests that distance matters to services broadly to the same extent as it does for goods.

Figure 2b: Distance coefficients for UK service sectors and sub-sectors for imports, and value of trade



The figure on the left shows the importance of distance to trade for each UK import sector (closer to zero means less importance); the graph on the right shows the size of that sector in terms of UK import expenditures.

	Exports	Imports
Average coefficient for services	(0.41)	(0.44)
Average coefficient for goods	(0.44)	(0.42)

Methodology

Data

We used a new experimental dataset from the ONS on UK services imports and exports.¹² The data divides trade flows by 12 sectors and a further 22 sub-sectors and covers 66 partner countries. This sectoral granularity increases statistical confidence in the conclusions and allows for a comparative analysis of sectors and sub-sectors.

Model

With this data we ran a set of econometric gravity models. We used a cross-section of data for 2016 so as to be consistent with the available goods data.¹³ As is standard in the literature, we have estimated a log linear form of gravity model by using an Ordinary Least Squares method with sub-sector specific fixed effects, shown by the following form below:

$$\ln(\text{TradeFlow}_{jk}) = \beta_0 + \beta_{1k} \ln(\text{Distance}_j) + \beta_{2k} \ln(\text{GDP}_j) + \beta_{3k} \text{ControlVariables} + \beta_{4k} a_m + \beta_{jk}$$

where j represents different trading partners, k represents different sectors and m represents different sub-sectors under each sector. We ran separate regressions for each sector with dummies for sub-sectors to capture specific fixed effects.

Variables

We have considered a set of explanatory variables consistent with those in the gravity modelling literature. The 'distance' and 'GDP' variables follow from the gravity model and the other variables serve as control variables that allow us to isolate the effect of gravity. We note that distance may be correlated with variables such as cultural similarities that are not included in the model, so more analysis is needed to unpack this variable.

Dependent variable	$\ln \text{TradeFlow}_{jk}$	log of sector k's export/import between UK and country j
Gravity variables	$\ln \text{Distance}_j$	log of distance between UK and country j
	$\ln \text{GDP}_j$	log of country j's GDP
Control variable	$\ln \text{Population}_j$	log of country j's population
	$\ln \text{Area}_j$	log of country j's area
	EU_j	Dummy variable that has a value of 1 if country j is a member of the EU
	EEA_j	Dummy variable that has a value of 1 if country j is a member of the EEA
	FTA_j	Dummy variable that has a value of 1 if country j has a free trade agreement with the UK/EU
	CommonLanguage_j	Dummy variable that has a value of 1 if country j official language is English
	a_m	Sub-sector specific dummy variables.

Gravity without weight

The story becomes more interesting when we compare individual service sectors. We also separate the distance effect for imports and exports. The magnitude of the gravity effect should be considered in relation to the size of the sector, as shown on the right of figures 2a and 2b.

The value of trade decreases with distance in all service sectors except travel, which is the largest import and export sector. This is driven by a combination of personal and business travel. One reason for this is that the demand for long distance travel is more 'inelastic'¹⁴, i.e. airlines can charge more for long distance travel as there are no realistic alternatives.

Some of the strongest distance effects for exports are observed in the manufacturing, maintenance and repair, and construction service sector. These services are often sold in conjunction with or embedded in heavy goods which in effect weigh the service down.

Other businesses services, which make up a large proportion of UK GDP, are also highly affected by distance. Within this sector, research and development is by far the most constrained by distance. This highlights the importance of face-to-face contact for collaboration, but the distance effect may also be a proxy for factors such as a common business culture.

Distance also affects financial services. The UK is already the biggest exporter of financial services; its trade surplus of £68bn equal to that of the next three countries combined.¹⁵ The City has a highly educated, multilingual workforce, sits between US and Asian timezones, and is the European headquarters location of half the world's financial services firms. While the UK is likely to continue playing an important role in global financial markets¹⁶ Brexit is likely to add frictional costs to the cross-border provision of financial services as UK (and EU) financial services firms can no longer rely on 'passporting'.^{17, 18}

As well as there being large differences in the distance effect for different service sectors, there are also disparities between the coefficients for imports and exports.¹⁹ We might expect the import and export effects to be in line with each other, and

this is true for most sectors, but it is emphatically not the case for Intellectual Property (IP), Telecommunications, computer and information services.

This disparity may just be a result of comparing apples with oranges, as the composition of services within a given sector may be very different for exports and imports. On the other hand, it may reflect meaningful differences between the UK and foreign services. For example, UK cultural exports seem to be less affected

by distance than cultural imports into the UK. Similarly, UK IP exports (e.g. trademarks or patents) are less resistant to distance than imports. Does this suggest that UK culture has a higher global appeal? Do British innovators generate more globally competitive intellectual property than others? More generally, these disparities are worth exploring further so that we get a better understanding of the UK's comparative advantage in these areas and how they might be exploited in future trading arrangements.

Figure 3a: Hypothetical interpretation: change in UK export revenues if distance between the UK and trading partners were to halve

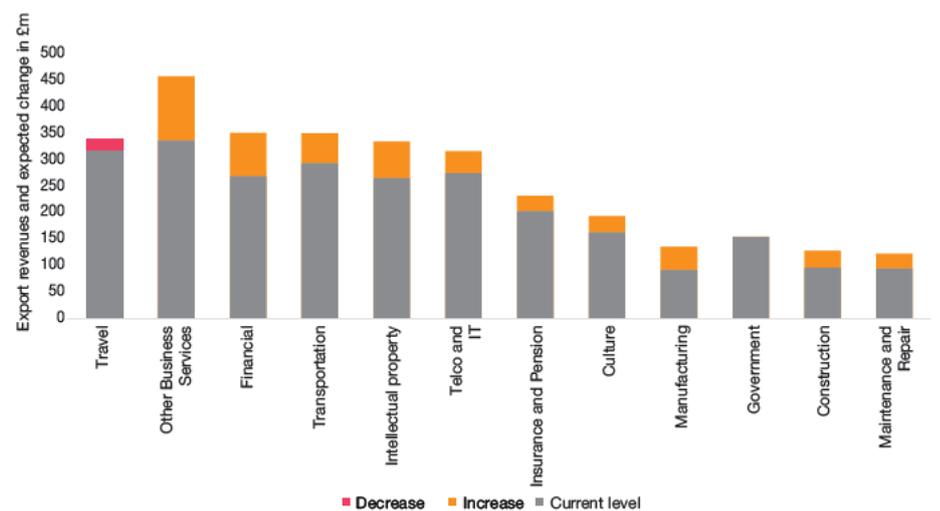
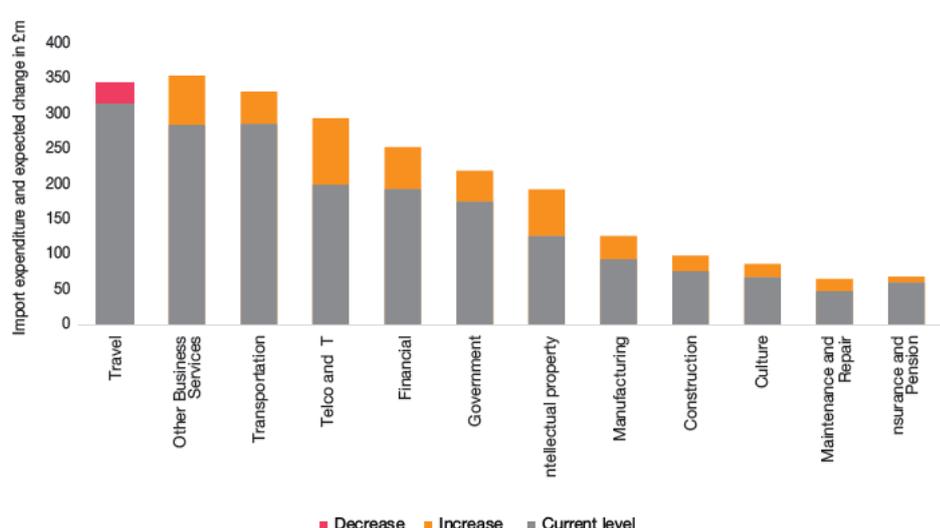


Figure 3b: Hypothetical interpretation: change in UK import expenditure if distance between the UK and trading partners were to halve



Service tips: what does this mean for the UK?

Although the UK is leaving the EU, the country's future trading arrangements with the EU and other countries are still unclear: some trade deals will need to be negotiated for the first time, but even those that could be replicated may need to be updated for services, as even the most advanced FTA agreed to date, EU-Canada CETA, has limited provisions for services. One thing remains certain, that is the distance between the UK and its trading partners. With that in mind, how can the effects of gravity on services be used to inform these negotiations?

1. Don't underestimate what you can't see

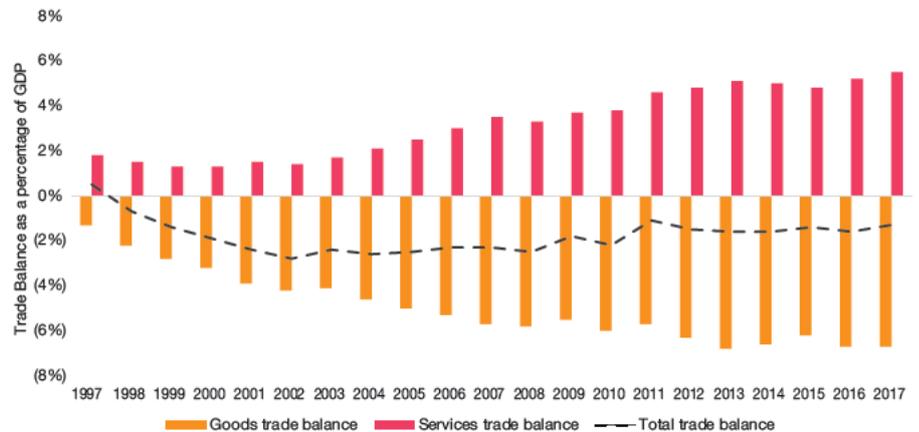
The historical focus of trade deals on goods sectors is no longer appropriate in the context of a modern advanced economy. Like most developed countries, the UK's economy is driven by services: activities like finance, engineering, hospitality and transport contribute 80% of GDP.²⁰ However, in a 2005 review, just 17% of free trade areas were found to include a commitment towards liberalising services.²¹ But the UK trades its services much more than any other advanced economy – they make up 47% of total exports, compared with 27% for the OECD and 35% for the US.^{22, 23} What's more, for the past two decades, the UK has consistently had service export surpluses and goods export deficits (see Fig 4).

This picture varies dramatically by sector (Figure 2), but the overall importance of services exports means that UK trade negotiators should place as much weight on them as on goods.

2. NTBs: Not The Best

As demonstrated by the recent dispute between the US and China, trade policy often focuses on tariffs. But this is only half the picture. Non-tariff barriers (NTBs) are, as the name suggests, factors other than tariffs and quotas that impede trade. Tariffs predominantly apply to goods, as it is relatively simple to add a tax to tangible items; services comprise a more diverse range of activities, creating scope for a more diverse, and complex range of trade restrictions, which are often hard to measure (see page 3). NTBs in services include regulatory requirements, restrictions on data flows and licensing laws (see box).²⁵

Figure 4: UK Trade Balance as a % of GDP: Goods, services and net²⁴



License to kill trade

One of the most common types of restrictions to services trade is licensing. Many professions are required to hold licenses in order to carry out their jobs, and those qualifications are often valid only for the country, or state, in which they are issued.

For instance, it may take a UK-qualified doctor more than a decade to pass the necessary conversions needed to practice in the US.²⁸ And while it is easy to understand why professions like medicine, childcare or nuclear engineering require extra regulatory scrutiny, 49 out of 50 US states also require manicurists to hold a license – and Louisiana licenses florists.²⁹ Such labour restrictions are, in effect, barriers to trade that protect workers in those industries from outside competition. As Milton Friedman pointed out, you can tell who benefits from licensing by observing who lobbies for it—and rarely is that consumers.³⁰

Recent academic work found that the effect of removing all NTBs creates six times as much welfare as removing all tariffs. One example is product market regulations (PMRs); the OECD measures hundreds of these for each OECD country, from ownership restrictions to state control of industry. Figure 5 (overleaf) demonstrates that for PMRs on professional services, there are large variations, even within advanced countries. Several gravity models have shown strong negative links between PMRs and trade in services.²⁶

Research by the UK Government found that removing **all** such barriers to trade within the EU would increase the bloc's GDP by 14%. Interestingly, the study found that UK income would only increase by 7% because UK markets are already much less restrictive, and have therefore already benefited from some of these gains.²⁷ It is not clear whether lower levels of service restrictions in the UK are a factor in the country's outsized services exports, but these findings make the case for encouraging other countries to liberalise.

3. Standardise standards

Common standards are one way to liberalise markets and increase trade – the problem is deciding whose standard should be commonly used.³¹ For example, electronics manufacturers have largely abandoned their own connectivity technologies, choosing instead to use the market leaders – Bluetooth and Wi-Fi. Many also use the same mini-USB charging socket – to the benefit of consumers.

For services, such convergence has been much less common. One example is accounting, where International Financial Reporting Standards (IFRS) is an internationally-recognised set of standards to enable company accounts to be understandable and comparable across international boundaries. But the licensing of local accountants remains fragmented – many countries require senior auditors to be locally qualified.

The scope of worldwide services means that there are undoubtedly industries where common standards can and should be pursued, in particular where there is a clear market leader.

4. Dismantle with care

One area of caution is that, unlike goods, most services involve interaction between people, which means they can be very emotionally charged, particularly when it comes to immigration. The EU's 2006 Services Directive attempted to remove service barriers but faced strong opposition from member states.³³ The trope of the Polish plumber became a widespread symbol of both the pros and cons of making it easier to provide services abroad.³⁴

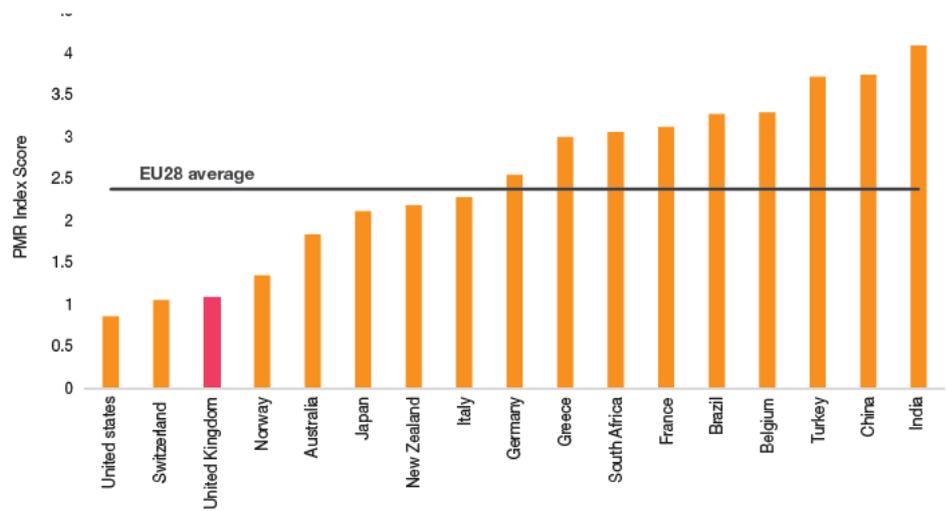
Such emotions are not limited to immigration. Service restrictions found in the UK include the proportion of local songs radio stations must play, or the number of homegrown players that must be included in a football team.³⁵ The proposed application of the Investor-State Dispute Settlement (ISDS) regime – a critical element of trade agreements – under the proposed EU-US Transatlantic Trade and Investment Partnership (TTIP) prompted angry protests that the UK's National Health Service would not receive special treatment in the deal.³⁶ The deal, in any case, now looks unlikely to go ahead. Other countries have affirmative action quotas to redress historic inequalities, such as South Africa's black economic empowerment rules. These measures can restrict trade but are popular with voters and unlikely to be sacrificed for the sake of trade policy.

Policymakers should instead focus on regulations that enjoy stronger public support and consensus, in particular those in the digital economy that lack the protectionist tendencies in other industries. For example, the recent GDPR rollout was a major step in the harmonisation of data regulation across EU member states. This 'fifth freedom' of the single market is estimated to increase EU GDP by 4% by 2020.³⁷

5. Size matters

Distance is only one half of the gravity equation – size matters too. As we mentioned in our previous study, it is important to have strong ties with economies of close geographic proximity,

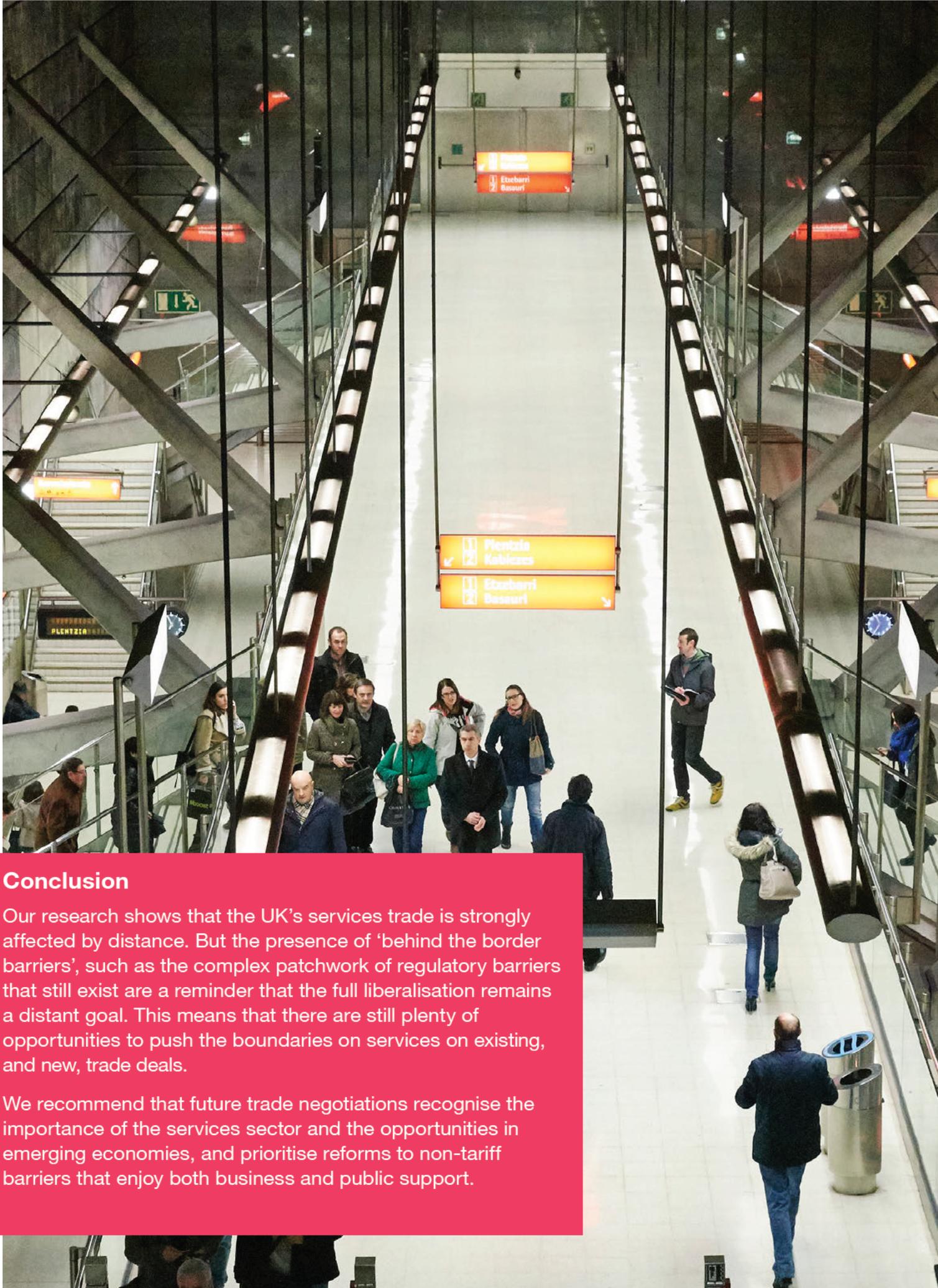
Figure 5: Product market regulation index for professional services, selected countries³²



Note a higher index score represents more restrictions.

but gravity modelling tells us that relationships with larger countries are also key for trade. The Secretary of State for International Trade recently noted that the seven largest emerging economies will increase from a share of 35% of global GDP to nearly 50% by 2050, overtaking the G7.³⁸ Our own research shows that the E7 countries could grow twice as fast as the G7.³⁹ At the same time, emerging economies are starting to realise the potential that services trade can hold for their overall economic development.⁴⁰ They are tapping into this at ever earlier stages of their economic development. In fact, some countries, for example India, have made the transition to services more quickly than has historically been the case, while largely bypassing the manufacturing stage.⁴¹ If the UK can showcase a globally competitive services sector, it may just be able to establish itself as a partner of choice for these countries, and bypass gravitational forces such as local trading hubs.⁴²

What holds for goods, again also holds for services: emerging markets are an opportunity not to be missed. The UK's strategy to target trade deals with these emerging economies is right, and services should be a key priority in any negotiations.



Conclusion

Our research shows that the UK's services trade is strongly affected by distance. But the presence of 'behind the border barriers', such as the complex patchwork of regulatory barriers that still exist are a reminder that the full liberalisation remains a distant goal. This means that there are still plenty of opportunities to push the boundaries on services on existing, and new, trade deals.

We recommend that future trade negotiations recognise the importance of the services sector and the opportunities in emerging economies, and prioritise reforms to non-tariff barriers that enjoy both business and public support.

Endnotes

1. As a result of explicit free trade policies or otherwise.
2. More specifically, mass containerisation, supply chain management, digitisation.
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19. Most studies do not separate the distance effect by exports and imports. This is because most studies have a 'many-to-many' dataset, i.e. trade flows between many countries. In this case the difference between an import and an export is one of perspective (one country's import is another country's export). Our dataset is 'one-to-many', i.e. trade flows between the UK and other countries. The analysis is therefore relative to the UK, and therefore it makes sense to distinguish between imports and exports.
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