



Employment impacts from growth at Heathrow

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Executive Summary

Project context and objective

The Airports' Commission has confirmed a shortage of runway infrastructure in London, and forecasts that Heathrow, Gatwick, London City and Luton will be full by 2030. As Heathrow Airport is already at full capacity today, there is a particular shortage of hub airport capacity. In order to meet future demand for air travel, the Commission has shortlisted both Heathrow and Gatwick as potential options for expansion.

The Commission will assess these options based on their economic, social and environmental impact. In particular, expanding airport capacity has significant impacts on employment both in the local area but also more widely. As increased employment is one of the key positive contributors to economic growth, it is important to develop a robust estimate of the employment effects of expanding Heathrow.

At the same time, increases in employment, when concentrated in a small geographic area, can create local issues for public infrastructure such as housing, transport, etc.. An accurate estimate of the employment effects of Heathrow is therefore also required to inform the assessment of local infrastructure needs.

The purpose of this report is to estimate the likely employment effects from adding a third runway to Heathrow Airport. We estimate the employment effect in 2025, 2030 and 2040. To quantify the full range of employment effects, we also estimate the output effect from additional trade, FDI and tourism that is facilitated by the new runway.

Types of employment effects and summary of results

We have considered two types of employment effects. The starting point for the first effect is Heathrow Airport as a location of concentrated employment. An additional runway would lead to an increase in the volume of passengers, which requires a greater number of people to provide airport-related services. This employment effect includes three sub-categories:

- **Direct employment** at the airport and its immediate vicinity, such as security staff, check-in desks, ground handling, retail, parking, etc.;
- **Indirect employment** in airport-related services such as catering, air-crew, etc.
- **Induced employment** that is facilitated by the spending of the directly and indirectly employed.

We have estimated that a third runway at Heathrow will add **82,300 direct, indirect and induced jobs** by 2040. This has an impact of 0.65% on the GDP in 2040.

The second employment effect is based on the benefits of air connectivity provided by Heathrow Airport. Air connectivity is an important input for international business relationships, and face-to-face meetings still play an important role in facilitating business deals. Increased air connectivity as a result of a third runway at Heathrow would facilitate increased trade and foreign direct investment (FDI) which in turn has a positive impact on long-term productivity. We call these employment effects “**catalytic**”. We have also included additional employment based on tourism in this category. We have estimated that a third runway at Heathrow will add **41,200 catalytic jobs** by 2040, with an impact of 0.16% on GDP.

In total, we therefore estimate that a third runway at Heathrow would add 123,500 jobs to the UK economy, which would represent 0.81% of GDP in 2040.

Direct, indirect and induced employment effects

Our estimates of direct jobs are based on passenger and ATM forecasts and include assumptions on economies of scale and productivity improvements. We have estimated the indirect and induced employment based on multipliers from Input-Output tables.

Table 1 provides a summary of our results on the additional employment under a scenario with 3 runways (“3R scenario”) as compared to 2 runways (“2R scenario”). It shows that the employment effects grow over time as the incremental passenger volumes between two and three runways increases. It also shows that the direct employment effect is the largest. This is to be expected as it reflects the current situation at Heathrow.

Table 1. Summary of direct, indirect and induced employment effects – Increments from third runway

Year	Direct employment	Indirect employment	Induced employment	Total
2025	3,400	2,100	2,300	7,800
2030	17,900	11,300	12,100	41,300
2040	35,600	22,600	24,100	82,300

Source: Frontier Economics estimates

Catalytic employment effects

Our estimates of catalytic employment effects include additional employment based on increases in trade, FDI and tourism. We have undertaken an extensive literature review to develop appropriate parameters to quantify the role of air connectivity in facilitating trade and FDI. Our estimates are conservative as we have selected assumptions at the bottom end of each range.

Table 2 provides an overview of the catalytic employment effects. It shows that the effect grows over time as passenger volumes from the third runway grow. It also shows that the employment related to trade and FDI is significantly larger than the tourism impact, which reflects changes in both inbound and outbound tourism.

Table 2. Summary of catalytic employment effects – Increments from third runway

Year	Trade	FDI	Tourism	Total
2025	5,100	6,600	75	12,000
2030	14,500	17,800	400	32,700
2040	17,500	23,000	720	41,200

Source: Frontier Economics estimates

The catalytic employment effects are based on the increases in output associated with higher trade, FDI and tourism. **Table 3** below provides the volumes of trade, FDI and tourism spending and their impact on GDP that underpin the employment estimates. While tourism spending has a direct impact on GDP, the impact of trade and FDI is via a range of channels including fostering innovation, competition and economies of scale.

Table 3. Summary of catalytic macroeconomic effects - Increments from a third runway

Year	Trade		FDI		Tourism		GDP
	Imports	Exports	Inward	Outward	Inbound	Outbound	
2025	£501m	£330m	£453m	£850m	£16m	£11m	£765m
2030	£1.55bn	£1.03bn	£1.49bn	£2.72bn	£96m	£68m	£2.33bn
2040	£2.28bn	£1.53bn	£2.29bn	£4.1bn	£214m	£151m	£3.59bn

Source: Frontier Economics estimates

1 Introduction

1.1 Background and context

The Airports' Commission has confirmed a shortage of runway infrastructure in London, and forecasts that Heathrow, Gatwick, London City and Luton will be full by 2030. As Heathrow Airport is already at full capacity today, there is a particular shortage of hub airport capacity. In order to meet future demand for air travel, the Commission has shortlisted both Heathrow and Gatwick as potential options for expansion.

The Commission will assess these options based on their economic, social and environmental impact. In particular, expanding airport capacity has significant impacts on employment both in the local area but also more widely.

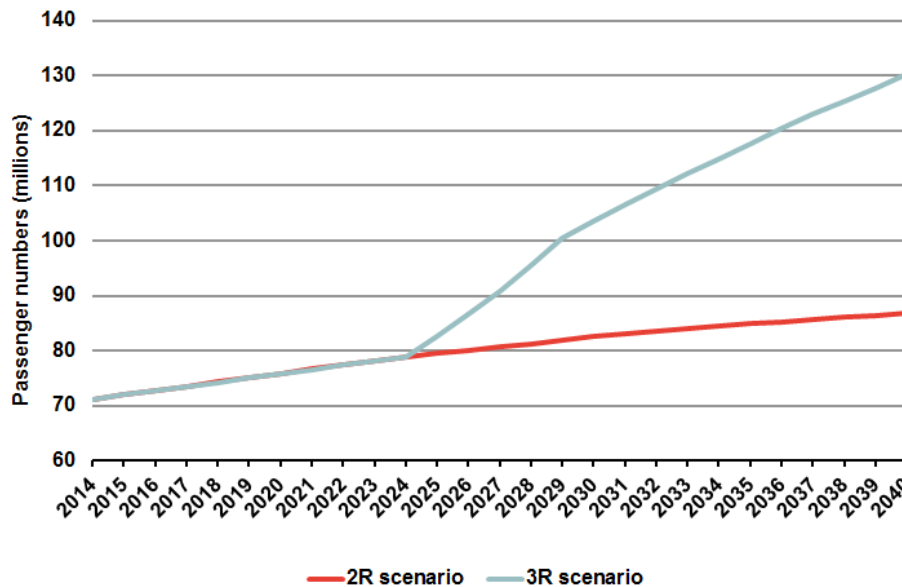
As increased employment is one of the key positive contributors to economic growth, it is important to develop a robust estimate of the employment effects of expanding Heathrow as these effects are clearly one of the key benefits.

At the same time, increases in employment, when concentrated in a small geographic area, can create local issues for public infrastructure such as housing, transport, etc.. An accurate estimate of the employment effects of Heathrow is therefore also required to inform the assessment of local infrastructure needs.

1.2 What is the project's objective?

The purpose of this project is to estimate the employment effects from adding a third runway to Heathrow Airport by comparing the employment in a two runway ("2R") scenario with a three runway ("3R") scenario. To quantify the overall employment effects, we also estimate the output effect from additional trade, FDI and tourism that is facilitated by the new runway.

We have undertaken the analysis for 2025, 2030, 2040. The analysis is based on considering the gap in traffic including passengers, ATMs and freight from moving from two to three runways. **Figure 1** provides the differences in passenger volumes in the 2R and 3R scenarios that underpin our results. It shows that the new runway is assumed to open in 2025.

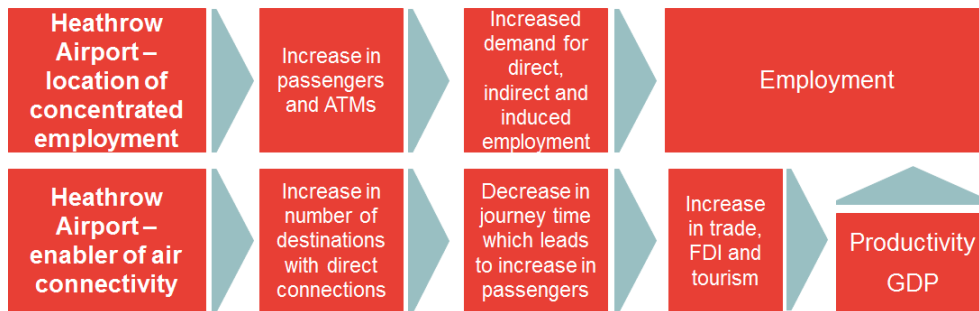
Figure 1. Passenger projections under 2R and 3R scenarios

Source: Heathrow projections

The additional runway at Heathrow has an impact on employment via two different channels illustrated in **Figure 2**.

The first channel is based on considering Heathrow Airport as a location of concentrated employment and its effect on direct, indirect and induced employment. Direct employment refers to employment generated at the airport itself. This would include security staff, check-in desks, ground handling, retail, parking, etc.. Indirect employees are those in airport-related services. For instance, catering companies that supply airlines are included in indirect employment. The wages earned by direct and indirect employees are then spent in the wider economy, and this in turn would generate more jobs. These jobs are categorised as induced employment.

The second channel is based on the benefits of air connectivity facilitated by the additional runway, as illustrated in **Figure 2** below. Additional direct connections shorten the journey time of passengers as they do not have to connect via a different hub airport now. As a result of the change in journey time, there is an incremental increase in the number of passengers, including business travel. The increase in business travel facilitates an increase in trade and FDI, which in turn has a positive impact on GDP as it improves productivity. The increase in GDP translates to an increase in employment in the UK economy. Similarly, the increase in leisure travel implies additional tourism spending which also affects GDP and therefore employment.

Figure 2. Drivers of economic value considered in analysis

In summary, our report estimates the employment resulting from the direct, indirect and induced as well as catalytic impact of an additional runway in 2025, 2030 and 2040.

1.3 How is the report structured?

The report is structured as follows:

- Section 3 provides an overall description of the types of employment effects we consider;
- Section 4 provides our methodology and results on the direct, indirect and induced employment effects;
- Section 5 provides our methodology and results for catalytic employment effects;
- Section 6 provides our conclusions.

Annexe 1 provides detailed assumptions on the estimation of direct, indirect and induced employment. Annexe 2 provides detailed assumptions on the estimation of catalytic employment effects.

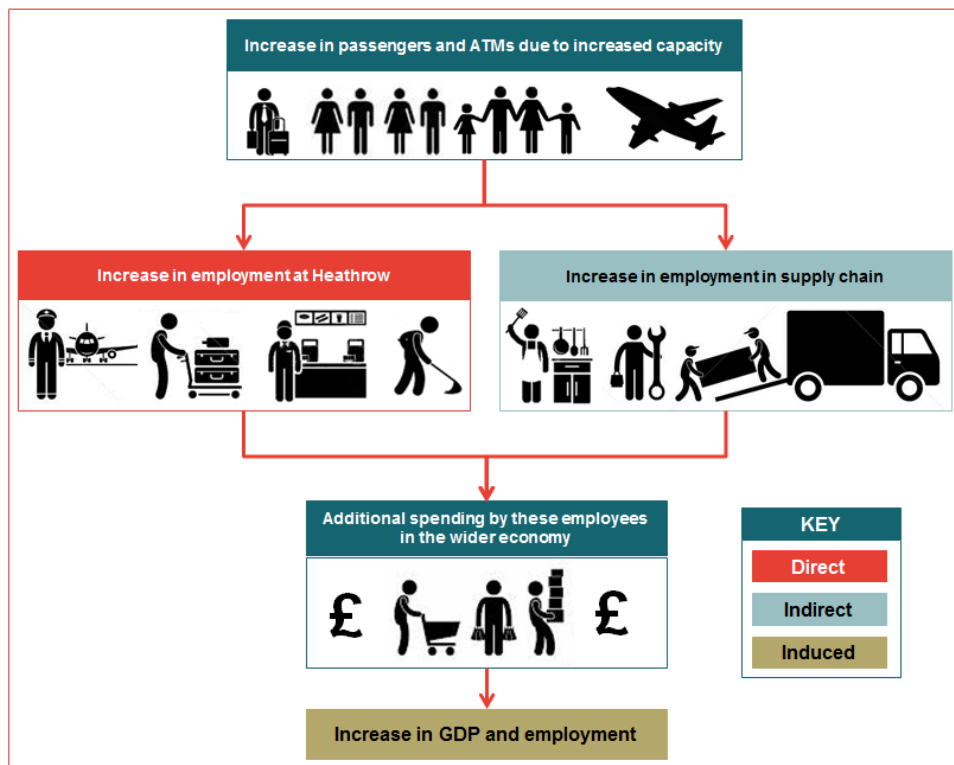
2 Direct, indirect and induced employment

This section discusses our approach and results for direct, indirect and induced (DII) employment. We first provide an overview of our approach and then discuss the methodology for each of the employment categories. We then discuss our results.

2.1 Overview of our approach

Figure 3 provides a simple illustration of the logic behind our methodology in estimating the DII impact of an additional runway at Heathrow.

Figure 3. DII impact of an additional runway at Heathrow



The additional runway permits an increase in passengers and air traffic movements (ATMs). This has a direct impact on employment at the airport and also increases indirect employment along the supply chain that supports activities at the airport (e.g. airline catering). The increase in direct and indirect employment leads to additional spending in the economy which has a positive (induced) impact on GDP and wider employment.

Direct, indirect and induced employment

The next sections describe in detail the methodology that underpins our estimates of the additional direct, indirect and induced employment at Heathrow under a 3R scenario compared to a 2R scenario.

2.2 How do we quantify direct employment?

Direct employment involves all employees whose jobs are directly related to producing the output of the airport and its immediate vicinity. As a result, we first consider what the “output” of Heathrow is, and then consider how this output drives employment in order to estimate direct jobs.

We identify two output measures of Heathrow Airport that drive changes in direct employment: passengers (PAX) and Air Traffic Movements (ATMs). Our calculations are therefore based on estimating a relationship between PAX, ATMs and direct employment. Historically, the relationship between ATMs and employment, and PAX and employment has developed in a similar way for Heathrow. Recent data for comparator airports, however, suggests different relationships for the two output measures. As a result, we use a weighted average of the growth in both ATMs and PAX as drivers of direct employment.

In addition to identifying the most appropriate drivers of direct employment, we recognise that the relationship between employment and PAX and ATMs is likely to evolve over time as Heathrow becomes more efficient. To capture this, we include an assumption on increasing labour productivity over time. In the 2R scenario, we apply productivity improvements of 0.6-0.8% p.a. which is consistent with employment either staying the same or falling slightly over time. In the 3R scenario, we assume an additional effect capturing economies of scale of 1.9-2.3% p.a. resulting from the substantial increase in PAX and ATMs. Both the productivity and economies of scale effects are based on analysis of historic data for Heathrow which, considers changes over a period both before and after the point Heathrow became capacity constrained.

The two sets of assumptions on productivity and economies of scale yield different estimates for DII employment. Our final results for each category of employment are a simple average of these estimates. Details on the employment estimates under both assumptions can be found in Annex 1.

Overall, the incremental increase in direct employment in the 3R scenario compared to 2R is therefore driven by the increase in PAX and ATMs and assumptions on economies of scale.

2.3 How do we quantify indirect employment?

Indirect employment is defined as employment along the supply chain that supports the airport. In order to estimate this type of employment we use a combination of Heathrow-specific data and national statistics.

First, we need to establish an appropriate multiplier that captures the relationships between direct and indirect jobs. The Office of National Statistics (ONS) publishes Input-Output tables which show flow of goods and services between different industries in the economy. One of the additional outputs related to these tables are multipliers. The Type I multiplier takes account of the direct and indirect effect of a one unit increase in demand for the output of an industry. While these multipliers are published at an industry level, consider the following simplified example. A Type I multiplier of 1.6 for a textbook implies that demanding the production of an additional textbook unit would lead to an increase of 0.6 units in the industries that produce inputs for the production of the textbook.

In terms of the ONS Input-Output tables, Heathrow produces several outputs. The primary output is air travel, with secondary outputs being retail and cargo. We estimate this total output using per-passenger values from Heathrow and IATA data (e.g. average ticket price and average spend per passenger at the terminal), and use passenger projections to estimate the direct output in 2025, 2030 and 2040.

Since the Input-Output tables involve classification into general industry categories, and because these outputs do not fall into a single industry, we produce a weighted average of the relevant multipliers according to the proportions of direct employment related to those categories. This gives us a single multiplier of 0.63 for the airport, which we apply to Heathrow's direct output in order to estimate its indirect output.

We assume that the multiplier remains unchanged over the time period of the estimation for two reasons. Firstly, the weighted average multiplier has not changed significantly between 1995 and 2005 (the last two years in which Input-Output tables were published). Thus, it is reasonable to assume that they will remain of a similar magnitude in the future. Secondly, our literature review has indicated that projections of multipliers are unlikely to be meaningful¹.

We therefore apply the Heathrow-specific multiplier of 0.63 to the increase in output produced directly at Heathrow as a result of the third runway. The final step involves translating the indirect output into employment figures by using an appropriate GVA-to-jobs ratio. As GVA excludes taxes² we remove a proportion of the output in each scenario to take account of taxes. This allows us to translate the output (or "GVA") into employment figures. We use a Heathrow-specific GVA-to-jobs ratio derived from the direct employment figures and the GVA

¹ Input-Output Analysis, Foundations and Extensions, Miller and Blair (2009)

² In theory, $GVA = GDP - Taxes + Subsidies$. We assume that Heathrow does not receive any subsidies and so, derive the GVA from its total output (or GDP) by removing taxes.

Direct, indirect and induced employment

figure for each scenario. Dividing output by the ratio in each scenario therefore gives us the number of induced jobs related to the activity at Heathrow.

Overall, indirect employment is therefore derived by developing Heathrow-specific multipliers that describe the effect an increase in output at Heathrow has on the wider economy and translating these effects into employment figures.

2.4 How do we quantify induced employment?

Induced employment captures the jobs created in the wider economy through additional spending by direct and indirect employees of the airport. Although Type II multipliers (another output of Input-Output tables) are suitable for calculating induced employment, these are not published by the ONS and therefore an alternative methodology is required. Our methodology for calculating induced employment in 2025, 2030 and 2040 is based on the methodology used in similar appraisals and loosely on the framework for calculating a Type II multiplier.

We consider the spending of direct employees as the average wage (post tax) at Heathrow, after removing the average proportion of income that is saved. The spending of indirect employees is estimated by using the national average wage after removing the average proportion of income that is saved. Aggregated spending by direct and indirect employees therefore provides induced GVA.

However, in order to ensure that the calculation is robust we also consider a counterfactual where these direct and indirect employees are unemployed. In this scenario, individuals that are directly or indirectly employed by Heathrow Airport as the result of the additional runway, would be spending approximately the value of Job Seekers Allowance in the base case (we assume that in this scenario they do not save any income). Therefore by subtracting GVA under the counterfactual from the GVA with direct and indirect jobs at Heathrow, we produce a conservative estimate of the additional induced GVA from the additional runway.

As for indirect employment, it is then necessary to convert the GVA values, which are produced for all scenarios based on the corresponding direct and indirect employment estimates, into employment terms to find the induced employment. We use a national GVA to jobs ratio as these jobs are likely to be spread across the whole economy.

Further details on the assumptions underpinning the direct, indirect and induced methodology can be found in Annex 1.

2.5 What are our results?

The table below shows the results for direct, indirect and induced employment. The table shows the additional employment from the third runway at Heathrow compared to the 2R scenario.

Table 4. Summary of additional direct, indirect and induced employment under the 3R compared to the 2R scenario

Year	Direct employment	Indirect employment	Induced employment	Total
2025	3,400	2,100	2,300	7,800
2030	17,900	11,300	12,100	41,300
2040	35,600	22,600	24,100	82,300

Source: Frontier Economics estimates

As we would expect, there is not a large difference in employment levels in the two runways (2R) and three runways (3R) case in 2025: we are assuming the third runway only commences operation in 2024, so in 2025 the differences in passengers and ATMs is relatively small. However, over time employment is expected to increase to a total of 82,300 additional jobs. Clearly, direct, indirect and induced employment is one of the major economic benefits from the additional runway. While direct employment will be based around Heathrow, indirect and particularly induced employment will be spread across the economy.

Table 5 below summarises the GDP impact of additional direct, indirect and induced jobs at Heathrow. We estimate that overall, there would be an addition of £7.16 billion to GDP in 2030 in the 3R scenario compared to the 2R scenario, which represents 0.37% of the GDP in 2030. In particular, additional direct employment would increase the GDP by approximately £3.9 billion in 2030. Indirect employment and induced employment would have a GDP impact of around £2.47 billion and £787 million respectively in 2030.

Direct, indirect and induced employment

Table 5. Summary of additional GDP impact under the 3R compared to the 2R scenario

Year	Direct employment	Indirect employment	Induced employment	Total
2025	£579m	367m	£148m	£1.10bn
2030	£3.90bn	£2.47bn	£787m	£7.16bn
2040	£8.05bn	£5.10bn	£1.57bn	£14.71bn

Source: Frontier Economics estimates

3 Catalytic employment

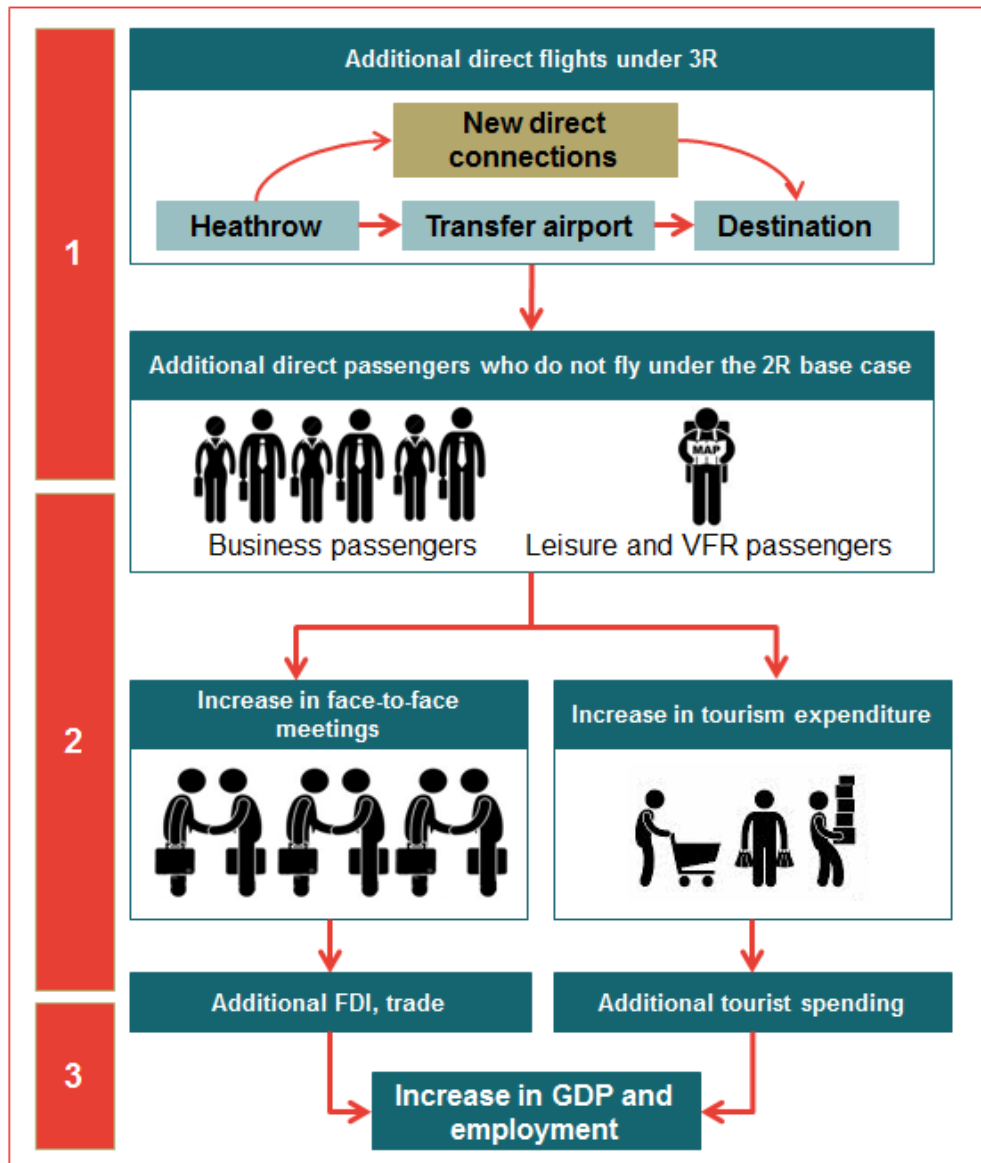
This section discusses our approach and results to estimating catalytic employment. We first discuss our methodology and then provide an interpretation of our results.

3.1 How do we quantify catalytic employment?

In contrast to the direct, indirect and induced employment, the starting point for estimating catalytic employment is the difference in air connectivity between two and three runways at various points in time. One of the key impacts from the additional runway is the ability of airlines to offer more direct connections to and from Heathrow. In order to estimate the catalytic employment impact of a third runway, we therefore focus on the routes that can be served with a direct flight under the 3R scenario but cannot be served directly in the 2R base case. Our methodology is based on three key relationships:

- Air connectivity (i.e. the number of direct routes) – passenger volumes;
- Passenger volumes – FDI, trade and tourism;
- Tourism, FDI, trade – productivity, GDP, employment. .

Figure 4 below gives a simplified outline of the logic underpinning our methodology to estimate the catalytic impact of an additional runway at Heathrow. Our methodology captures how air passenger travel affects the movements of goods and capital. As a result, it does not take into account the volume and value of increased belly hold air cargo connectivity. It also does not capture the impact of any reduced delays from the new runway.

Figure 4. Catalytic impact of an additional runway at Heathrow

In the following sections we describe each of the relationships and discuss the evidence that underpins our parameters.

Air connectivity and passenger volumes

An additional runway at Heathrow would facilitate an increase in the number of direct routes served. This implies that passengers who previously had to use an indirect flight can now access a wider range of destinations with a direct flight. The advantage of a direct connection is that it creates a saving in travel time as the in-flight time is lower and the transfer time is saved. The travel time saving

Catalytic employment

can be monetised by using a value of time. This is a common approach in land transport appraisals. The value of the time saving can then be expressed as a proportion of the generalised travel costs (the ticket price and time value). A change from an indirect to a direct connection leads to a reduction in the generalised travel costs. Applying a price elasticity to the change in generalised travel costs, we can estimate the marginal increase in passenger volumes as a result from a direct flight. Overall, an increase in the number of direct connections will therefore lead to an increase in the number of passengers as a result of reduced generalised travel costs.

Passenger volumes and FDI, trade and tourism

The additional passengers can be divided into leisure or VFR (visiting friends and relatives) and business travellers.

Additional leisure travellers lead to an increase in inbound and outbound tourism for the UK. Inbound tourists have a direct impact on the economy through the amount they spend while visiting the UK. Outbound tourists also affect the UK economy, albeit in a negative manner, via the amount they spend abroad while travelling. Tourism spending includes accommodation, food and beverages, entertainment and land transport. We apply ONS estimates for average spending by inbound and outbound tourists to the additional tourists under the 3R scenario. Because Heathrow has more inbound than outbound tourists, the net effect on GDP is positive, but being a net effect, the overall magnitude is small.

The benefit of additional business passengers is derived from the international connections they create. There is a range of literature that identifies the importance of face-to-face meetings for business in overcoming barriers to do business across countries. In particular, in cases where business partners do not share a common language or culture and where business regulations vary significantly, face-to-face meetings are essential for doing business as supported by the following examples of literature:

- A survey by the UK Institute of Directors (2008) asked about the impact on businesses if the amount of business travel by air was significantly curtailed. 30 per cent of respondents said that there would be significant adverse effect, while 44 per cent indicated small adverse effects.
- The World Travel and Tourism Council (WTTC) (2011) conducted a survey of business travellers and asked about the importance of personal contact which revealed that:
 - 28 per cent of existing business could be lost without face-to-face meetings; and

Catalytic employment

- Sales conversion rates are estimated to be 20-25 per cent higher with face-to-face meetings.
- Poole (2010) finds that business travel to the United States by non-residents, non-citizens has a positive impact on the extensive export margin.

Connectivity is also one of the factors that influence decisions on where to locate business headquarters. For example, Strauss-Kahn and Vives (2005) find that:

Headquarters relocate to metropolitan areas with good airport facilities, low corporate taxes, low average wages, high levels of business services, and agglomeration of headquarters in the same sector of activity. The effects are quantitatively significant (airport facilities in particular).

- Frankel (1997) illustrates the importance of face-to-face meetings as follows:

Consider a kind of export important to the United States: high-tech capital goods. To begin sales in a foreign country may involve many trips by engineers, marketing people, higher ranking executives to clinch a deal, and technical support staff to help install the equipment or to service it when it malfunctions.

Furthermore, the Airports Commission, in its Interim Report, conducted further research on the links between connectivity and FDI, trade and tourism. A literature review found that greater connectivity created better access to foreign markets. The Commission also made reference to the study by Poole (2010), highlighting that more easily available direct client contact plays an important role in increasing trade. Moreover, an econometric study conducted by the Commission found that a positive relationship exists between connectivity, trade and tourism and FDI in the UK. The Commission thus found that these relationships support the view that air connectivity may play an important role in enabling trade and tourism, and facilitating foreign investment in the UK.³

As face-to-face meetings are an important factor in establishing and consolidating business relationships, an increase in business passengers would lead to an increase in closing deals that support both trade and FDI. More detail on this relationship is provided in Annexe 2. Based on our literature review, we have developed business travel elasticities with respect to trade and FDI. As there is little research on the quantitative relationship between business travel and trade and FDI, we have made conservative assumptions. This is particularly relevant in two areas.

³ Section 3, Airports Commission: Interim Report, December 2013. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/271231/airports-commission-interim-report.pdf

First, for Europe we have assumed that the business travel elasticities of trade and FDI are zero. Our rationale is that, the trade links between the UK and Europe are well-established so face-to-face meetings to build mutual trust and understanding are likely to have a smaller effect. Further details on the methodology and evidence supporting are provided in Annexe 2.

Second, our key assumption when modelling the catalytic impact of a third runway is that direct and indirect passengers have the same impact on trade, tourism and FDI. This is because either the origin or destination for both sets of passengers is London. We therefore only value the impact of the additional passengers that start flying as a result of the direct connection being available. As we assume that indirect connections are available in the base case, our method only values the incremental benefit from the additional passengers (i.e. those that do not fly in the base case but start flying as a result of the direct connection). We do not place a value in terms of FDI or trade on those passengers that switch from an indirect to a direct flight.

Tourism, FDI, trade and employment

Changes in trade, foreign direct investment and tourism spending have an effect on GDP and employment, but by different routes.

The net change in tourism spending has a direct (positive but small) impact on GDP. We can convert the GDP impact into employment figures by applying an appropriate GDP to jobs ratio.

Business travel has a direct impact on trade and FDI but an indirect, long term dynamic impact on GDP. From a pure accounting perspective, exports have a positive impact on GDP and imports have a negative impact in the short run. The same holds true for inward and outward investment. An equal increase in exports and imports would therefore have no impact on GDP, as the positive impact of exports would cancel out the negative impact of imports.

However, this short-term view does not take account of the long-term dynamic effects of having an open economy. A high volume of trade (both imports and exports) is indicative of an open economy. A more open economy is likely to be more productive in the long term. Productivity is one of the key drivers of GDP growth as it describes the efficiency of production. For example, if the same output can be produced with fewer inputs, productivity increases. We have reviewed a large body of academic research that investigates the positive impact of imports and exports as well as inward and outward investment on long-term productivity. Most of the literature is focused on examining the impact of trade and FDI on productivity at the firm level. The literature suggests that not only do exports and inward investment have a positive impact on productivity growth but imports and outward investment also contribute to the level of “openness” of the economy, which has a positive impact on productivity.

Catalytic employment

There are three main channels by which imports, exports, inward and outward investment can increase long-term productivity.

- a) **Innovation** – Trade is one of the key “transmitters” of innovation as it exposes companies to a wider range of products and processes in other countries. FDI can provide access to new technologies and cheaper inputs, which has a positive impact on productivity. This is particularly true for imports and outward investment.
- b) **Competition** – Competition puts pressure on companies to be more efficient. Exporting companies are faced with more competition as they compete in a larger market. Imports also put more pressure on domestic firms as they compete with a greater number of competitors.
- c) **Economies of scale** – Larger market sizes imply that production processes can benefit from economies of scale. Both trade and FDI can provide access to markets outside Ontario so that firms can reduce costs by realizing economies of scale. This is particularly true for exporting firms who can access foreign markets and therefore increase their size.

For example, the OECD, (2012) finds that:

A main channel through which trade increases income is productivity growth. Importing creates competition that forces domestic firms to become more efficient and provides access to inputs of international calibre; exporting creates incentives for firms to invest in the most modern technologies, scales of production and worker training. The combined effect is to spawn a process of continual resource reallocation, shifting capital and labour into activities with higher productivity.

This illustrates the combined effect of exports and imports. More detail on this relationship is provided in Annexe 2.

As a result, our methodology focusses on the long-term benefit that trade and FDI generate by increasing “openness” of the economy. Therefore, our conclusion is that both exports and imports, alongside inward and outward investment, have positive long-term effects on an economy.

We use FDI and trade elasticities of GDP in order to estimate the impact of the increase in total FDI and trade on the GDP in the UK in 2025, 2030 and 2040. As with estimating the employment effects of tourist spending, we apply a national GDP to jobs ratio in order to translate the increase in GDP to an increase in jobs.

3.2 Catalytic effects and causality

Studies on the relationship between connectivity and economic value are often criticised as there are a range of other factors that influence economic value. This

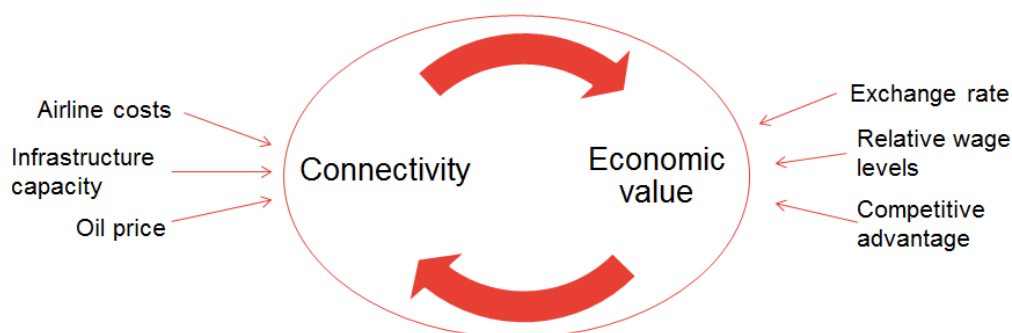
implies that connectivity should be viewed as one of the factors contributing to economic value.

While connectivity is an important factor that enables international business relationships to develop, by itself it is not sufficient to cause economic growth. Obviously, there are a range of other factors that also influence economic growth. The best way to describe this relationship is a virtuous circle (shown in **Figure 5** below). The relationship goes both ways: economic growth creates demand for connectivity, but connectivity enables growth. Both connectivity and economic value are also influenced by a range of other factors.

This reverse causality often gets ignored in studies on connectivity and economic value. We acknowledge that there is a two-way relationship between connectivity and economic value. In light of this, we interpret our results as the economic value *facilitated* by the airport rather than the economic value *generated* by the airport.

But the fact that causation works both ways does not diminish the contribution that Heathrow makes to the economy. Connectivity represents an element in a virtuous circle of economic activity and growth. While the connectivity enabled by Heathrow is not a sufficient condition for creating economic activity, the role the airport plays in the economy is a necessary condition in helping a well-functioning and open economy to achieve its full potential.

Figure 5. The virtuous circle between connectivity and economic value



3.3 What are our results?

Using the methodology described above, we estimate that a third runway at Heathrow would facilitate the addition of 12,000 jobs in the UK economy in 2025. This number is expected to increase to 41,200 by 2040.

Disaggregating the employment effect implies that additional imports and exports would be expected to add around 5,100 jobs in 2025, 14,500 jobs in 2030 and 17,500 jobs in 2040. As was described above, both imports and exports have

Catalytic employment

a positive impact on GDP and jobs as they improve the openness of the economy and thereby improve productivity.

Similarly, inward and outward FDI facilitated by improved connectivity would be expected to add 6,600 jobs in 2025 compared to the 2R scenario. This numbers would be expected to increase to 23,000 additional jobs in 2040.

Additional employment based on by tourist spending is much smaller by comparison, less than 100 in 2025, 400 in 2030 and around 720 in 2040. This is because the improved connectivity implies more inbound and outbound tourist travel. Spending by tourists to the UK is offset by tourist spending by UK residents abroad. The net effect on GDP is positive because Heathrow has more inbound than outbound tourists but the offsetting effect implies only a small level of additional employment from tourism in the 3R scenario.

Table 6. Summary of catalytic employment effects- Additional employment from adding a third runway

Year	Trade	FDI	Tourism	Total
2025	5,100	6,600	75	12,000
2030	14,500	17,800	400	32,700
2040	17,500	23,000	720	41,200

Source: Frontier Economics estimates

The employment figures are derived on the basis of the macroeconomic impact of the additional runway. We estimate that overall, there would be an addition of £2.4 billion to the GDP in 2030 in the 3R scenario compared to the 2R scenario, which represents 0.12% of the GDP in 2030. In particular, increased trade would add around £1 billion to the GDP. The impact from FDI has been estimated at £1.3 billion. As mentioned before, this takes a long term view on trade and FDI wherein both inward and outward FDI, and exports and imports have a positive impact on the economy. **Table 7** provides a breakdown of our results.

Table 7. Summary of macroeconomic effects- Increments from a third runway

Year	Trade		FDI		Tourism		GDP
	Imports	Exports	Inward	Outward	Inbound	Outbound	
2025	£501m	£330m	£453m	£850m	£16m	£11m	£765m
2030	£1.55b	£1.03b	£1.49b	£2.72b	£96m	£68m	£2.33b
2040	£2.28b	£1.53b	£2.29b	£4.1b	£214m	£151m	£3.59b

Source: Frontier Economics estimates

Our results are consistent under different scenarios

As an input for our results, we have estimated how many new direct connections a third runway at Heathrow could facilitate. In doing so, we have assumed a continuation of the current market structure – with Heathrow as a hub and Gatwick as a point-to-point airport.

It is important to check the robustness of our results with against the two additional potential market developments identified by the Airport Commission in their interim report:

- ▣ An increased adoption of lower-cost long-range aircrafts; and
- ▣ The development of Gatwick as a second hub for London.

In the first scenario, the catalytic employment effects we have estimated would be even higher. This is because an increased adoption of lower-cost long-range aircrafts would lower the passenger threshold used by airlines to assess the feasibility of a route. In turn, this would allow for a greater number of new direct connections, which would imply more additional direct passengers, increasing the catalytic impacts.

While we consider the second scenario unlikely, a new runway at Gatwick instead of Heathrow would result in much lower catalytic employment because a split hub system would be able to sustain fewer direct routes and less frequent direct connections, thus reducing the number of direct passengers.

Catalytic employment

4 Conclusion

Overall, we estimate that an additional runway at Heathrow will facilitate an additional 123,500 jobs by 2040 of which 82,300 are related to direct, indirect and induced (DII) employment and 41,200 are related to catalytic employment. **Table 8** provides the breakdown of our results.

Table 8. Estimates of additional employment at Heathrow under the 3R scenario

Type of Employment		2025	2030	2040
DII	Direct	3,400	17,900	35,600
	Indirect	2,100	11,300	22,600
	Induced	2,300	12,100	24,100
DII Total		7,800	41,300	82,300
Catalytic	Trade	5,100	14,500	17,500
	FDI	6,600	17,800	23,000
	Tourism	75	400	720
Catalytic Total		12,000	32,700	41,200
Grand Total		20,000	74,000	123,500

Source: Frontier Economics estimates

Considering the development of additional employment over time, it is in line with passenger growth. We see the biggest increase in total additional DII and catalytic employment between 2025 and 2030 as the airport starts to make use of the increased capacity available. Additional DII employment approximately doubles between 2030 and 2040. However, additional catalytic employment increases by only 26% over the same period. This is because of the drivers of the two types of employment are different as the DII employment is related to passenger volumes and ATMs whereas catalytic jobs are driven by new direct connections.

As discussed in Section 3, we have assumed that the additional direct flights to Europe from Heathrow would not have a catalytic impact. This implies that our results for catalytic jobs are conservative.

Annexe 1: Detailed assumptions for quantifying direct, indirect and induced employment

In Section 2 we discuss our approach to quantifying direct, indirect and induced employment. As we use a range of productivity improvements from 0.6-0.8% p.a. and also a range of economies of scale effects from 1.9-2.3% p.a., the ranges of results are presented in **Table 9** below. We have taken the midpoint of these results as our central results presented in the main body of the report.

Table 9. Detailed results

Direct Employment	2025	2030	2040
Totals under 2R	73,660-75,462	72,724-75,257	72,510-75,795
Totals under 3R	77,029-78,815	90,852-92,903	108,022-110,546

Indirect Employment	2025	2030	2040
Totals under 2R	46,659-47,801	46,066-47,671	45,931-48,012
Totals under 3R	48,793-49,925	57,549-58,849	69,059-70,025

Induced Employment	2025	2030	2040
Totals under 2R	49,733-50,950	49,101-50,812	48,957-51,175
Totals under 3R	52,008-53,214	61,341-62,726	73,609-74,638

Table 10 provides an overview of the key assumptions we use to estimate direct employment.

Table 10. Key assumptions in estimating direct employment

Input	Assumptions/Source
ATMs and PAX relationships with employment	Historical and comparator airport evidence suggested that both ATMs and PAX should be used to inform direct employment predictions. The weights allocated were based on a study which examines the drivers of growth in employment at hub airports.
ATMs projections	Heathrow provided projections for Air Traffic Movements under the 2R and 3R scenarios for 2025, 2030 and 2040.
PAX projections	Heathrow provided projections for Passenger numbers under the 2R and 3R scenarios for 2025, 2030 and 2040.
Labour Productivity	<p>Historical evidence from Heathrow suggests that employment is likely remain stable in constrained environment. We assume that there are no economies of scale in this scenario. Given PAX and ATM predictions a labour productivity improvement of 0.6% p.a. would keep employment stable in the 2R scenario.</p> <p>A CAA report on opex efficiency estimates a productivity benchmark for Heathrow based on adjusted TFP. The suggested range is 0.8-1.7% p.a. It is plausible that over a substantial period employment be at the lower end of this scale so a 0.8% productivity rate is also plausible. We therefore model both scenarios to produce a range.</p>
Economies of scale multiplier	<p>In the 3R scenario, due to increased capacity there are likely to be economies of scale in addition to labour productivity improvements. Our estimates are based on historic data for Heathrow over a period where capacity was not constrained. We remove pure productivity and use the PAX relationships with employment we extract the employment savings which can be associated with economies of scale.</p> <p>Using labour productivity of 0.6% p.a. results in economies of scale of 2.3% p.a. whilst using 0.8% productivity results in economies of scale value of 1.9% p.a. These economies of scale improvements are applied to the incremental growth in ATMs and PAX weighted for consistency with the 2R calculations.</p>

Table 11 provides our key assumptions for estimating indirect employment.

Annexe 1: Detailed assumptions for quantifying direct, indirect and induced employment

Table 11. Key assumptions in estimating indirect employment

Input	Assumptions/Source
Composite Type I multiplier	We construct a composite multiplier for Heathrow using the ONS 2005 Input Output tables Type I multipliers. We create a weighted average of the multipliers for the industries that apply to the output at Heathrow using proportions of employees in those categories from current Heathrow data. This provides us with a multiplier that approximately relates to the combination of outputs (and hence inputs) that Heathrow produces (uses).
Heathrow GVA/Jobs ratio	<p>To create a GVA to jobs ratio for each year, we use the estimates of direct jobs produced and combine this with estimates of Heathrow GVA. These estimates are based on considering Heathrow's outputs (based on data provided by Heathrow). Output is determined as per passenger spend (including average air fares and average retail spend) combined with PAX predictions. Average Tax is removed to convert output to a GVA figure.</p> <p>The GVA/jobs ratio in each scenario allows us to convert the indirect output found using the type I multiplier to a corresponding number of jobs.</p>

Table 12 provides an overview of the key assumptions in estimating induced employment.

Table 12. Key assumptions in estimating induced employment

Input	Assumptions/Source
Heathrow Employee Average wage	We use the figure published in the 2011 Optimal Economics report on the average wage of a Heathrow employee scaled by inflation to determine the approximate 2013 value.
National average wage	We use the most recent ONS national average wage figures and scale by inflation to find the approximate 2013 value.
Job Seekers Allowance	We use the basic 2013 value for Job Seekers Allowance published online by the government.
Savings rate	We use an average of historical savings rates produced by the ONS, to find the average proportion of income that is saved not spent. This allows us to estimate the value of employees' wages which are re-entering the economy as spending.
GVA/Jobs Ratio	We use the most recent national average GVA to jobs ratio which we scale by inflation to find the approximate 2013 value.

Annexe 2: Detailed assumptions for quantifying catalytic employment

This Annexe provides more detail on our methodology to estimate catalytic employment and the literature we reviewed to inform our assumptions. It is structured as follows:

- Overview of key steps in the methodology;
- Key relationship 1 – Air connectivity (i.e. the number of direct routes) and passenger volumes: detailed approach and evidence to underpin assumptions;
- Key relationship 2 – Passenger volumes and FDI, trade and tourism: detailed approach and evidence to underpin assumptions; and
- Key relationship 3 – Tourism, FDI, trade and productivity, GDP and employment: detailed approach and evidence to underpin assumptions

Overview of methodology

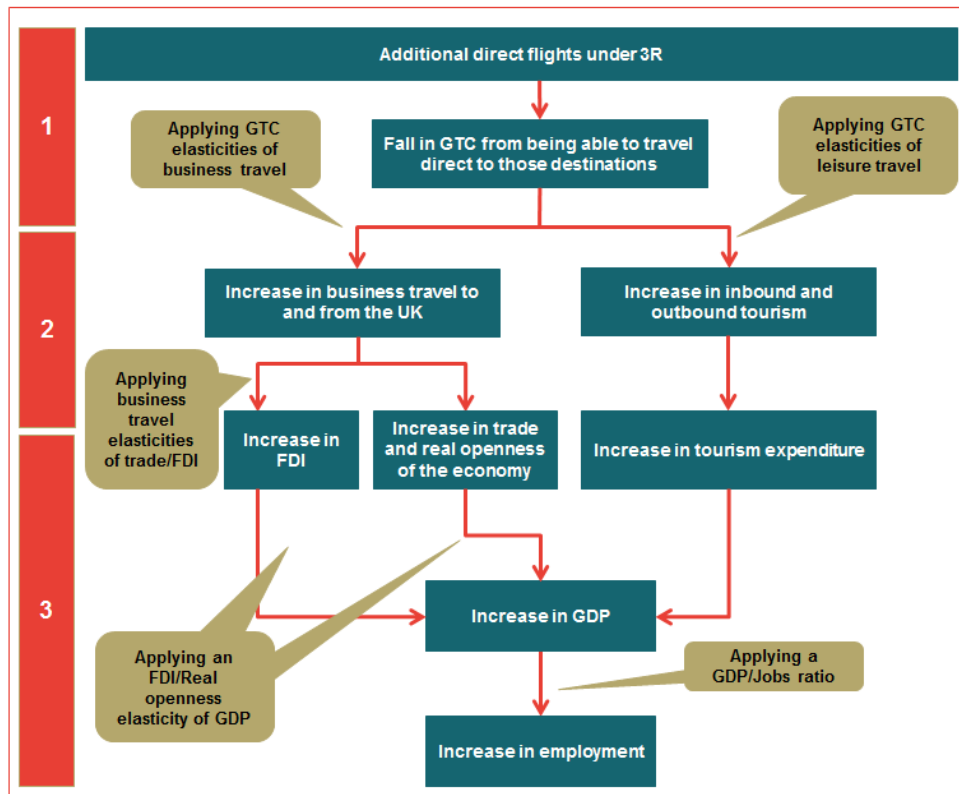
Our methodology follows the steps illustrated in **Figure 6**. Our starting point is the additional direct flights that could be added if there was a third runway in the years under consideration- 2025, 2030 and 2040. For FDI and trade, we undertake the analysis at a country level, rather than a city level, because trade and FDI data is provided at the country-level. For tourism, we carry out the analysis at a city-level.

We determine the additional travel time for the indirect connection by considering the additional distance flown and connecting time at the transfer airport. Distance is determined using a great circle route mapping tool. Switching from a direct to an indirect flight leads to a greater percentage increase in travel time for destinations that are closer to Heathrow. For example, adding 3 hours of travel time to a 5 hour journey represents a bigger percentage increase than adding 3 hours of travel time to a 12 hour journey. As a result, the impact of an indirect flight is greater for destinations that are closer.

We convert the additional travel time into a monetary value by applying the value of time derived from the Department for Transport's (DfT) analysis of values of time and hourly wage rates. The change in the travel cost is then related to the price of the original ticket to determine the percentage change in the travel cost. Using a price elasticity of demand, we can determine the change in total demand for travel to each destination. We then relate the percentage increase in passengers to a change in trade, FDI and tourism spending by using the

elasticities discussed in the sections that follow. Changes in trade, FDI and tourism spending can then be related to the impact on GDP and employment.

Figure 6. Overview of the three key relationships in calculating the employment facilitated by having a third runway



We use data on FDI flows by partner country (both inward and outward FDI) for the UK from the OECD. Data on exports and imports between the UK and the rest of the world is available from the HMRC. We used ONS data published in Overseas Travel and Tourism releases on tourist spending and purpose of visit in order to estimate the impact on tourism.

Key relationship 1: Air connectivity and passenger volumes

Additional direct connections imply that passengers will save time spent travelling by choosing to fly direct rather than indirect. By monetising the travel time saved, we can estimate the change in demand for direct travel, and hence the number of additional passengers that will fly direct. This then enables us to estimate their impact on trade, FDI and tourism.

Annexe 2: Detailed assumptions for quantifying catalytic employment

The methodology behind monetising the travel time and estimating the increase in direct passengers is outlined in the formula below:

$$\frac{((\text{Additional travel time} * \text{Value of time}) / \text{Ticket price}) * \text{Travel cost elasticity of demand}}{\text{Change in number of passengers}} =$$

The change in travel time is calculated on the basis of additional travel distance multiplied with average speed. We distinguish speed for take-off and landing from the speed during the flight and use the following assumptions:

- ▣ average speed during flight: 500 mph; and
- ▣ average speed for take-off and landing: 250mph.

Distance is calculated on the basis of great circle routes. We add additional connecting time at the airport. Our results are based on an assumption of an average of 1 hour of connecting time for a short-haul flight and an additional 3 hours on average of connecting time for a long-haul flight. This implies that passengers would need 1-3 hours between landing and take-off for their connecting flights. We consider this assumption to be conservative, as this is likely to be close to the minimum rather than the average connecting time. The total additional connecting time is therefore equal to the additional flight time plus the connecting time. Our results show that the additional travel time varies from 1.1 hours to 3.5 hours.

We monetise the value of time by using hourly wage rates from the ONS and the DfT's estimates of values of time. For business travellers our value of time is £50 which is informed by the DfT's estimate of Value of Working time per person for a rail passenger (Tag Unit 3.5.6, Values of Time and Vehicle Operating Costs, October 2012). We estimate that the value of working time of an air passenger would be as much, if not more, than a rail passenger. While recent estimates suggest a working time for a rail passenger closer to £30, this is likely to be based on increased use of mobile internet access. As this does not generally apply to air travel (even though wifi is available on some flights), we use the rail passenger value of time of £50. For non-business travel, we use the hourly wage rate to estimate the value of time saved by travelling direct. We use the ONS estimate of £16 for mean hourly earnings from their analysis of Patterns of Pay⁴. We adjust wage rates for other countries using Purchasing Power Parity.

Ticket prices are based on IATA data. We reviewed a number of studies on the price elasticity of demand. The most disaggregated values are available from IATA (2007). We have used these to estimate a travel cost elasticity of -0.70.

⁴ "Patterns of Pay: Estimates from the Annual Survey of Hours and Earnings, UK, 1997 to 2013", 27 February 2014, ONS

Key relationship 2: Passenger volumes and FDI, trade and tourism

In this section, we describe the link between passenger volumes and FDI, trade and tourism as follows:

- Relationship between face-to-face meetings and trade and FDI
- Relationship between leisure passengers and tourist spending

Relationship between face-to-face meetings and trade and FDI

Our analysis of the value of a third runway at Heathrow requires us to make an assumption on the relationship between face-to-face meetings, trade and FDI. Face-to-face meetings increase the likelihood of closing business deals which has a positive impact on trade and FDI. Face-to-face meetings are also important to manage increasingly globalized supply chains. This relationship is supported by qualitative literature, but it is difficult to quantify the relationship.

Concept

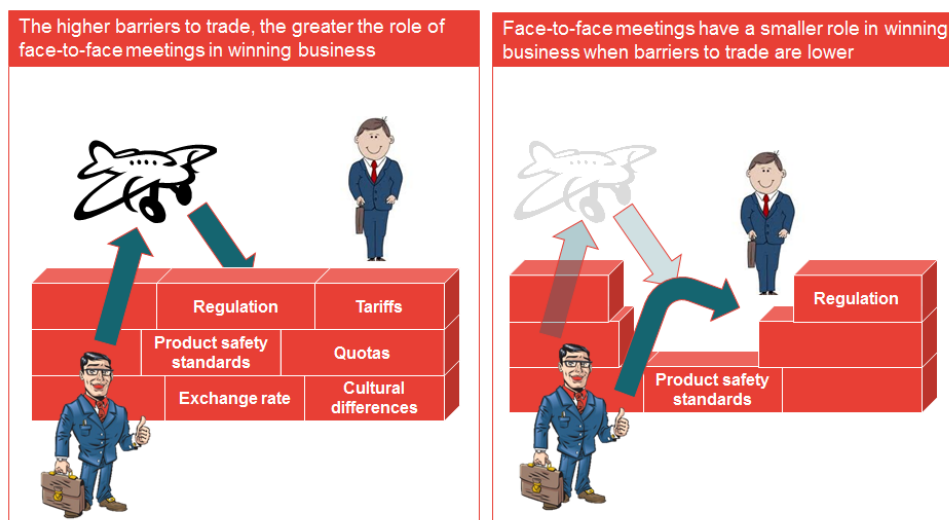
Despite the rise of technologies such as videoconferencing, face-to-face meetings still play an important role in developing and maintaining successful business relationships. Most relationships are built on trust between business partners and face-to-face meetings are still the most effective way to build and establish trust. In addition, in-person meetings can be used to inspect production sites and meet larger teams which cannot be done through videoconferencing.

This is because face-to-face meetings play role in overcoming trade and FDI barriers between economies. The most common barriers include:

- **Product market regulation** – a range of different types of regulation (product standards, safety regulation, etc.) can inhibit trade and FDI across borders;
- **Tariffs and quotas, local content requirements** – formal trade barriers such as tariffs also reduce the likelihood of trade;
- **Exchange rate** – the risk of changes in the exchange rate can pose a significant barrier to trade and FDI, as exchange rate volatility can increase the spread of potential returns; and
- **Cultural differences** – language differences and different business cultures can impede business relationships across cultures as it is more difficult to build trust.

Business travel can reduce or overcome some of these barriers, as face-to-face meetings enable a better understanding of local product market regulation and formal trade barriers. Face-to-face meetings are also one of the key ways to build trust across cultures. **Figure 7** illustrates this concept.

Figure 7. Illustration of differences in trade barriers



These barriers are much lower when considering trade and FDI between the UK and Europe compared to other international transactions. This is because cultural differences are much smaller (for example, common language), and the trade links between the UK and Europe are well-established. Therefore, face-to-face meetings to build mutual trust and understanding are likely to have a smaller effect. For this reason, we assume that additional direct travel to and from Europe has no impact on trade and FDI.

Review of evidence

There is a range of qualitative, survey-based evidence that suggests face-to-face meetings play an important role in business relationships. We discuss these below. The importance of in-person meetings for trade facilitation is also supported by the existence of trade missions. For example, UK Trade and Investment (UKTI) helps UK-based businesses in establishing links with overseas partners. Among other events, they organise trade missions for different sectors/industries involving workshops, fairs, speakers, etc. which facilitate networking and business opportunities.

The World Travel and Tourism Council (2012) finds that sales conversion rates with an in-person meeting are 50 per cent, compared to conversion rates of 31 per cent without an in-person meeting. The results are based on surveys in Brazil,

Annexe 2: Detailed assumptions for quantifying catalytic employment

China, Germany, the UK and the USA and are consistent across these countries. In 2011, the WTTC conducted another survey on the importance of business travel and found that 28 per cent of existing business could be lost without face-to-face meetings and sales conversion rates are estimated to be 20-25 per cent higher with face-to-face meetings. This is further supported by a range of qualitative studies.

- Frankel (1997) illustrates the importance of face-to-face meetings as follows:
Consider a kind of export important to the United States: high-tech capital goods. To begin sales in a foreign country may involve many trips by engineers, marketing people, higher ranking executives to clinch a deal, and technical support staff to help install the equipment or to service it when it malfunctions.
- A survey by the UK Institute of Directors (2008) asked about the impact on businesses if the amount of business travel by air was significantly curtailed. 30 per cent of respondents said that there would be significant adverse effects while 44 per cent indicated small adverse effects.
- Poole (2010) finds that business travel to the United States by non-resident, non-citizens has a positive impact on export margins. This report has also been cited by the Airports Commission.
- Aradhyula & Tronstad (2003) find that their results support the hypothesis that both formal business exploration and casual exposure to cross-border business opportunities have a positive impact on trade.
- Strauss-Kahn & Vives (2005) find that headquarters relocate to metropolitan areas with good airport facilities, low corporate taxes, low average wages, high levels of business services, and an agglomeration of headquarters in the same sector of activity. The effects are quantitatively significant (for airport facilities in particular).
- The City of London (2008) surveyed finance and insurance companies on the importance of air travel. They found that 69 per cent of firms consider air travel to be critical for business travel by their staff, with only 2 per cent viewing it as not important.
- Boeh & Beamish (2012) demonstrate that travel time between different locations has a significant predictive power in firm governance and location decisions, as travel time could otherwise be employed for productive purposes.

Annexe 2: Detailed assumptions for quantifying catalytic employment

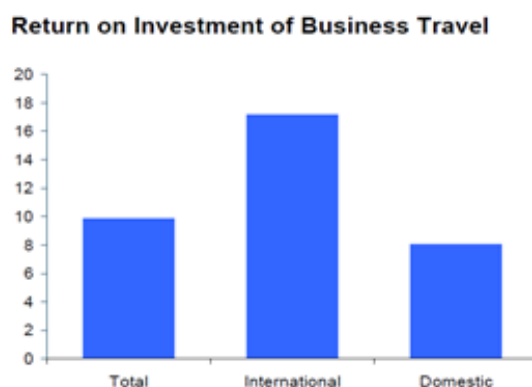
- Napier University (2004) finds that “[...] *air transport per se is not a necessary condition, but what is important are: the extent to which that area is plugged directly into other major international hubs - availability and efficiency of routes (direct, hubbed); costs and the level of competition in global transport market, and; perceived and actual interchange efficiencies. This is a key consideration in the level of foreign investment into an area and is most important for firms with international trading or contacts such as, high-tech firms, financial services and pharmaceutical firms*”.

Survey-based evidence also suggests that the importance of face-to-face meetings depends on differences between business partners. Evidence from the World Travel and Tourism Council (WTTC) and the Harvard Business Review indicates that international business travel plays a more important role in generating and sustaining business than domestic travel. The WTTC (2012) found that:

- One extra dollar invested in international business travel would generate on average US\$17 in trade; and
- One extra dollar invested in domestic US business travel by companies results in an increase in revenue of US\$9.50.

This implies that the return on investment for international travel is roughly half of domestic travel. **Figure 8** illustrates the difference in the return on investment.

Figure 8. Return on investment



Source: World Travel and Tourism Council, 2011

Similarly the Harvard Business Review (2009) confirms the role of face-to-face meetings in facilitating and sustaining business deals and also provides some evidence for the specific role of business travel to overcome barriers to trade across different cultures. For example, it found that:

Annexe 2: Detailed assumptions for quantifying catalytic employment

- 93 per cent of survey respondents agreed that in-person meetings are helpful in negotiating with people from different language and cultural backgrounds;
- One survey respondent said that “*Communicating with our Chinese partners is enough of a challenge without face-to-face, because it is very difficult to explain a difference in perspective without body language*”; and
- A number of respondents described the need to work with clients in their own environment to get a full picture of the challenges and opportunities they face.

There is a small amount of literature that supports this view.

- Cristea (2011) found robust evidence that the demand for business-class air travel is directly related to volume and composition of exports in differentiated products. The paper finds that trade in R&D intensive manufactures and goods facing contractual frictions is most dependent on face-to-face meetings. Contractual frictions are more likely to occur with higher trade barriers so this would support a conservative assumption of an elasticity of zero for trade between the UK and Europe compared to the rest of the world.
- Poole (2010) finds that business travel for the purpose of communication acts as an input to international trade. The effect is stronger for differentiated products and for higher-skilled travellers, reflecting the information intensive nature of differentiated products. The effect is driven by travel from non-English speaking countries, for which communication with the U.S. by other means may be less effective. The findings therefore also confirm our view that business travel plays a bigger role when connecting firms from different cultural backgrounds.

Selection of assumption values

Quantitative evidence on the relationship between face-to-face meetings and trade/FDI is difficult to obtain. This is because it is difficult to pick out the impact of face-to-face meetings from the other factors that influence trade and FDI.

The World Travel and Tourism Council (WTTC) performed an econometric analysis on the relationship between flights and trade/FDI for a range of countries as shown in **Figure 9**. The figure shows the correlation coefficient as well as the results of the Granger test for causality. The figure shows that the correlations vary between 0.17 for outbound business travel from Italy to 0.98 for outbound business travel from Brazil.

Annexe 2: Detailed assumptions for quantifying catalytic employment

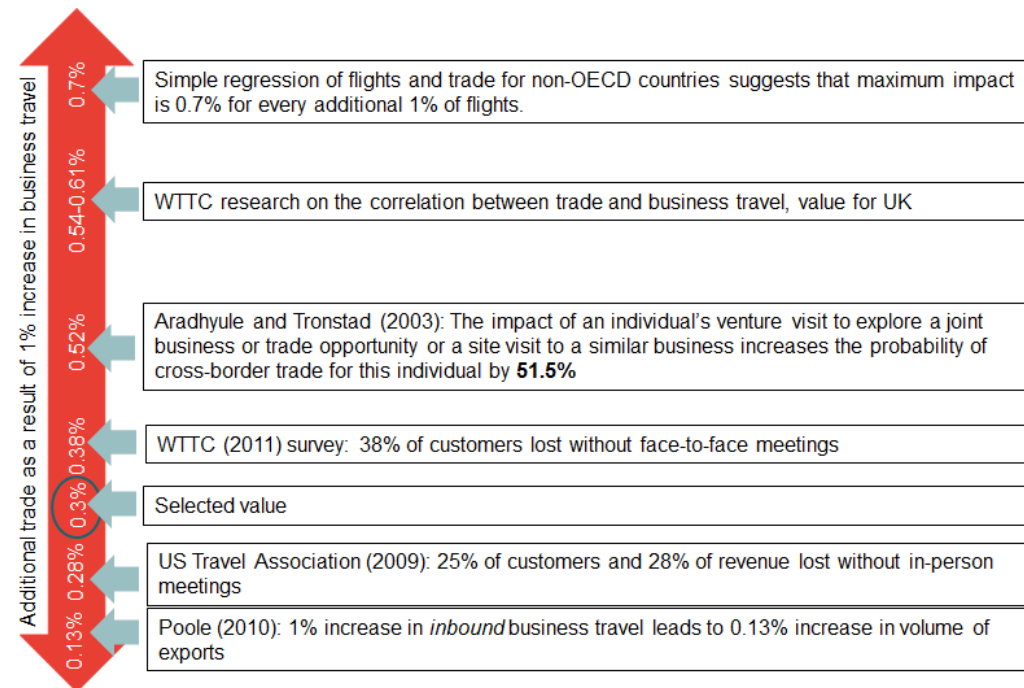
Figure 9. Trade and business travel by country

Trade & Business Travel by country						
	Inbound business travel vs imports			Outbound business travel vs exports		
	Causality (% confidence)			Causality (% confidence)		
		Travel causes	Trade causes		Travel causes	Trade causes
	Correlation	Trade	Travel	Correlation	Trade	Travel
US	0.87	95%	26%	0.65	82%	86%
Canada	0.92	100%	99%	0.85	98%	87%
UK	0.54	65%	85%	0.61	95%	80%
France	0.49	57%	85%	0.63	61%	92%
Germany	0.97	90%	81%	0.69	60%	98%
Italy	0.52	99%	100%	0.17	58%	99%
Spain	0.20	75%	99%	0.74	91%	80%
Japan	0.91	97%	53%	0.40	74%	92%
China	0.32	92%	95%	0.67	90%	99%
Russia	0.83	50%	90%	0.52	100%	95%
Brazil	0.57	100%	100%	0.98	88%	87%
India	0.72	84%	66%	0.46	99%	58%
UAE	0.42	83%	49%	0.82	95%	64%
Singapore	0.70	96%	94%	0.74	83%	53%
Hong Kong	0.67	95%	100%	0.43	86%	78%

Note: causality is shown as the probability that the identified casual relationship is true

Source: WTTC, 2012

We acknowledge that it is difficult to select an appropriate estimate for the relationship between trade and business travel. We have considered a range of evidence as illustrated in **Figure 10** and have selected 0.3% as the elasticity. In the context of the available evidence, this is a conservative estimate.

Figure 10. Evidence on relationship between face-to-face meetings and trade

It is even more difficult to select an appropriate estimate for the relationship between FDI and flights as little research has been done on this topic. For example, a survey of businesses in Munich indicated that 55% of foreign businesses would not be located in the region around the airport if air connectivity was not satisfactory. Regressions of inbound passengers and inward FDI for different country/airport combinations suggest that the elasticity may be as high as 0.67. As these regressions suffer from omitted variable bias and endogeneity issues, we consider this an upper bound only. In order to select a conservative estimate, we have selected 0.3 as the elasticity of business travel to FDI.

Relationship between leisure passengers and tourist spending

The additional direct connections and travel time savings imply more tourist visits to the UK as well as more UK tourists abroad. In order to estimate the impact of connectivity on tourism spending we have obtained data on spending by purpose of visit from the ONS Overseas Travel and Tourism Quarterly Release for Q3 2013. We estimate the average spend per passenger (for overseas visitors to the UK and for UK citizens abroad), and then multiply these values by our tourist passenger increase under the 3R scenario. This provides an estimate of the value of inbound and outbound tourism spending facilitated by Heathrow. The net gain to the UK economy is obtained by subtracting outbound spending from inbound spending, and this feeds straight into the GDP for the year under

consideration. Because Heathrow has more inbound than outbound tourists, the net effect is small but positive.

Key relationship 4: Tourism, FDI, trade and productivity, GDP and employment

We break this section into separate relationships:

- Trade, productivity and GDP;
- FDI, productivity and GDP;
- GDP and employment

Trade, productivity and GDP

A large body of academic research investigates the positive impact of trade on productivity at the firm level. At the economy-wide level, there are also some studies which suggest additional trade leads to higher productivity. The key mechanisms by which trade influences productivity can be characterized in three ways:

- **Innovation** – trade is one of the key “transmitters” of innovation as it exposes companies to a wider range of products and processes in other countries. This applies regardless of whether the partner country is a developed or developing economy.
- **Competition** – as trade increases the market size companies that export or import are faced with more intense competition. Competition puts pressure on companies to be more efficient. This applies to trade with any partner country.
- **Economies of scale** – larger market sizes imply that production processes can benefit from economies of scale. This also applies to trade any partner country.

For example, the OECD, (2012) found that: *“A main channel through which trade increases income is productivity growth. Importing creates competition that forces domestic firms to become more efficient and provides access to inputs of international calibre; exporting creates incentives for firms to invest in the most modern technologies, scales of production and worker training. The combined effect is to spawn a process of continual resource reallocation, shifting capital and labour into activities with higher productivity”.*

Importantly, the impact of trade on productivity holds for both exports and imports. This is because we are considering the long-term impact on trade on productivity instead of the short-term. In the short-term import substitution can

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lead to structural changes in the economy that require some adjustments. However, once resources are allocated to more productive uses, imports have a long-term positive impact on productivity. The study that underpins our main assumption uses a measure of “real openness” which is the sum of exports and imports over GDP.

The OECD has undertaken a study with data from 21 high-income countries over nearly 30 years controlling for other factors: every 10-percentage point increase in trade exposure (as measured by trade share of GDP) contributes a 4-percent increase in GDP per capita. Similarly, in 2007 the European Commission stated that *“For instance, empirical analysis indicates that, on average, a 1% increase in the openness of the economy, as measured by the ratio of imports to value added, results in an increase of 0.6% in labour productivity in the following year”*. To select a conservative assumption, we have used the lower figure of 0.4 as indicated by the OECD research.

FDI, productivity and GDP

Both inward and outward FDI have a positive impact on productivity and competitiveness. Our research suggests that access to new markets, cheaper inputs and new technology or know-how boosts the scale and efficiency of domestic production. The underlying theory is similar to that applied to free trade agreements. **Figure 11** summarizes how FDI can impact on productivity.

Figure 11. Impact of FDI on productivity

	Rationale	Long term impact of FDI
Horizontal FDI	Direct access of new markets	<ul style="list-style-type: none"> • In the long run firms gain competitiveness by accessing new markets or penetrating existing ones • Productivity and hence domestic production increases
Vertical FDI	Access to cheaper inputs	<ul style="list-style-type: none"> • Firms can import intermediate goods from foreign plants at lower costs • Firms can produce a greater volume of final goods at lower costs • This new production chain is more efficient • Competitive position improves and domestic output increases
Technology-sourcing FDI	Access to new technologies	<ul style="list-style-type: none"> • Firms acquire foreign firms or establish R&D facilities in “foreign centres of excellence” • Transfer of technological know-how, management techniques and other knowledge back to parent company • Productivity and hence domestic production increases

Evidence on the specific impact of FDI on productivity is limited. We have found the following studies:

- DIW (2009) studies the relationship between outward FDI and economic growth. They find that FDI enables firms to enter new markets, import intermediate goods from foreign affiliates at lower costs and access foreign technology. As a result the domestic economy benefits from outward FDI due to increased competitiveness of the investing companies and associated productivity spill-over to local firms. The analysis shows that for every 1 per cent increase in outward FDI stock, local GDP increases by 0.19 per cent.
- Korea Institute for International Economic Policy (2008) studies the relationship of inward FDI and productivity using Ireland as a case study. They find that FDI advances new foreign technology or import of new intermediary goods and enhances growth by accumulation of human capital by means of labour training or absorption of technology and new management techniques. Their analysis shows that for a 1 per cent increase in inward FDI stock, local GDP increases by 0.24 per cent.

Based on the quantitative analysis we reviewed, we make the following assumptions:

- a 1% increase in inward FDI increases productivity and thus, GDP by 0.24 %; and
- a 1% increase in outward FDI increases productivity and thus, GDP by 0.19 %.

GDP and employment

The relationships between trade, FDI and GDP give us a percentage change in GDP resulting from the change in trade and FDI. In order to estimate the value of this impact in money terms, we estimate GDP for the UK in 2025, 2030 and 2040 using projections of GDP growth from HSBC Bank (2012). We then convert the contribution of GDP into employment. For this, we have assumed that for every £50,000 of GDP, one full-time job is created. This is based on the average GDP per filled job from latest ONS figures. We assume that GDP per job increases by 2% per annum as labour productivity increases.

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