

# THE ECONOMIC IMPACT OF CONNECTIONS TO CHINA

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A note prepared for Heathrow

January 2018





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## EXECUTIVE SUMMARY

Heathrow Airport serves as a vital link between China and the UK. Currently offering over 100 direct flights to China each week, Heathrow connects businesses in the UK and China and facilitates trade and FDI. Not only do current direct connections to China generate large GDP and employment benefits, but also in the future, with Heathrow expansion, further benefits are likely to be realised.

Figure 1 below describes the direct connections between Heathrow and China in operation in 2018. With an expanded Heathrow, these connections could increase in frequency generating additional economic impacts.

**Figure 1 Current Heathrow China connections**

City	Airlines	Weekly Frequency	Average Seats
Hong Kong	BA, Cathay Pacific, Virgin Atlantic	55	316
Beijing	Air China, BA	20	295
Shanghai	BA, China Eastern, Virgin Atlantic	22	260
Guangzhou	China Southern	10	228
Qingdao	Beijing Capital	2	213

Source: OAG 2018 Schedules Data.

To quantify the current and future benefits delivered by Heathrow's connection to China, we have estimated the economic impact in two scenarios:

- The current impact generated by existing direct connections; and
- The potential impact from adding one additional weekly connection to existing routes.

For each scenario, we have carried out the following analysis to highlight the positive impacts generated from direct connections:

- **Catalytic impacts:** Direct connections stimulate extra demand from business passengers. The availability of a direct flight makes connections quicker and more convenient than flying indirectly. In the short run business passengers – for whom time is money – may only choose to fly more regularly if a direct option is available. In the longer run, a direct service may support businesses seeking out business partners in new markets, leading to more new journeys being made in support of this business. By stimulating extra business demand, which in turn helps to improve business relationships, new direct connections can help to facilitate extra trade and FDI between China and the UK, and consequently extra GDP and jobs. We have estimated these potential impacts for each scenario.
- **Direct-indirect-induced (DII) employment impacts:** Direct connections stimulate extra O/D demand and attract transfer passengers, and therefore lead to an overall increase in activity at Heathrow. For example, a 4-times weekly connection would imply more than 400 additional movements per year, and could result in an extra 75,000 passengers passing through Heathrow per year (factoring in that transfer passengers would also fly on feeder routes). The

bigger the airport, the bigger the DII employment effects tend to be. Therefore, the new connections would lead to extra employment at and around Heathrow. We have estimated these effects for each scenario.<sup>1</sup>

- **Case studies:** To help bring to life the catalytic and DII analysis described above we also have identified a series of case studies to highlight in more real terms how these connections can be expected to bring benefits to the UK.

The tables below summarise the results for the catalytic and DII impacts for each scenario. First, for impacts generated by existing connections, the impacts are broadly proportional to the number of passengers on each route. Therefore, Hong Kong generates the largest economic impact with £315 million per annum in GDP. For an additional weekly connection on existing routes, the estimates range from £5 million per annum in GDP generated for Hong Kong and Beijing to £2 million per annum in GDP for Qingdao and Shanghai.

**Figure 2 Summary of economic impact estimates: Current direct connections**

	Catalytic impact		DII jobs	Total jobs impact
	GDP (£m)	Jobs		
Hong Kong	315	6,100	2,700	8,800
Beijing	99	1,900	800	2,700
Shanghai	72	1,400	800	2,200
Guangzhou	18	400	300	700
Qingdao	6	100	50	150

**Figure 3 Summary of economic impact estimates: Additional frequency**

	Catalytic impact		DII jobs	Total jobs impact
	GDP (£m)	Jobs		
Hong Kong	5	90	50	140
Beijing	4	70	50	130
Guangzhou	3	60	40	100
Qingdao	2	50	40	80
Shanghai	2	40	40	80

In the rest of this note we describe the analysis in more detail. This is split out across the following points:

- In **Section 1**, we describe our catalytic impact analysis;
- In **Section 2**, we set out the details underlying the DII impact analysis;
- In **Section 3**, we summarise various case studies to add extra colour to the impact analysis; and
- In **Section 4**, we provide our overall conclusions.

<sup>1</sup> We note that Heathrow is constrained and therefore these new connections may only be possible if other flights are squeezed out. Therefore, while the new Chinese connections would lead to positive benefits, there could be lost benefits arising from the other reduced flights. Our estimates can therefore be considered the 'gross' benefit of introducing the new routes, rather than the 'net' benefit, which has not been estimated. However, this analysis highlights that if Heathrow were unconstrained, and new connections could be added without needing to squeeze out other flights, there would only be positive employment impacts.

# 1 CATALYTIC IMPACT ANALYSIS

In this section we provide a more detailed overview of our catalytic impact analysis:

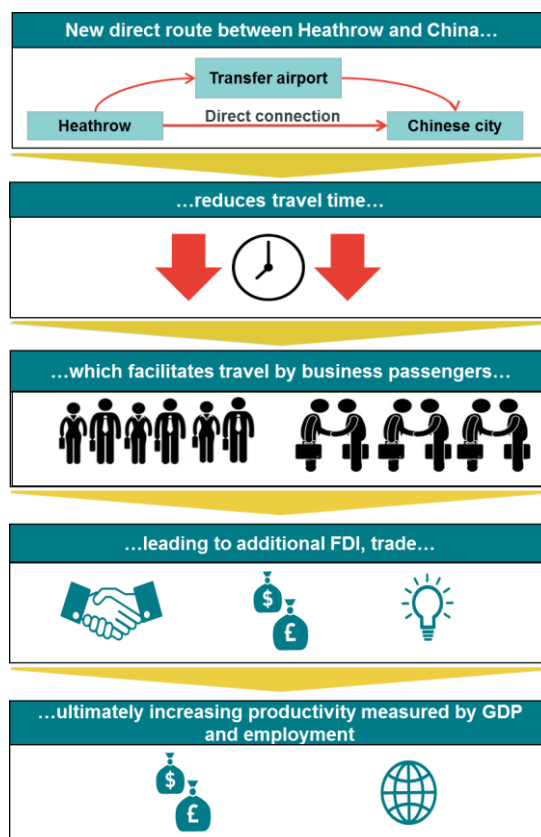
- First, we describe the logic underlying the approach;
- Second, we set out the calculations in more detail; and
- Third, we summarise our results.

## 1.1 Overview of approach

Figure 4 below provides a high level overview of our catalytic impact analysis. We have used this framework across multiple projects for Heathrow, as well as other clients – including other airports and airlines.

Direct flights between Heathrow and China are quicker and more convenient for passengers than flying indirectly, so direct flights attract extra demand. That is, because the overall time and journey costs are reduced, some passengers, who would not travel otherwise, will opt to take the direct flight and complete the journey. The economic activity related to the new passengers can therefore be said to be facilitated by there being a new direct connection.

**Figure 4 Catalytic impact of a new route to China**



By attracting business passengers who would not travel otherwise, direct China connections increase the ease of face-to-face meetings. These form an essential part of business relationships that promote trade and investment. Face-to-face meetings are important for building trust in business relationships, managing

increasingly globalised supply chains, maintaining current business partnerships, and overcoming cultural differences which may pose a barrier to doing business. The new face-to-face meetings occurring as a result of additional direct routes to China will increase the likelihood of closing business deals which has a positive impact on trade and FDI.

By increasing UK-China trade and FDI, direct China connections will also increase UK GDP and employment. An open economy that trades with the rest of the world – both importing and exporting – is likely to be more productive in the long term, and productivity drives GDP growth. Therefore, by attracting business passengers who would not otherwise travel, China connections serve to increase GDP and employment.

Similarly, to estimate the impact generated by existing connections, we can consider the impact of removing the existing direct connections between Heathrow and China. Without a direct connection option, overall time and journey costs increase causing some business passengers to no longer travel. This reduction in business travel lowers trade and FDI, thereby lowering GDP and employment. The total impact generated by these connections today is equal to the positive value of the lost economic impact should these connections be removed.

## 1.2 Catalytic impact calculations

To estimate the catalytic impact, we have carried out the following calculations:

- Step 1: We estimate the ‘induced’ or ‘lost’ O/D demand – i.e. those O/D passengers who fly because there is now a direct connection or stop flying once the direct connection is removed; and
- Step 2: We consider how this change in demand impacts trade and FDI.

These two steps are described in more detail below. As a worked example, we use an additional direct flight to Beijing to illustrate the overall approach.

### Step 1: Estimating the induced or lost demand

To estimate induced demand, we use the concept of ‘generalised journey cost’ (GJC). This argues that when passengers consider whether to fly and what option to take, they weigh up the ticket fares from the different options and their corresponding travel times – where the latter is implicitly monetised by considering their ‘value of time’. This helps to explain why more time-sensitive passengers, such as business passengers, may be inclined to choose quicker but more expensive options and why more price-sensitive passengers, such as leisure passengers or transfer passengers, tend to favour options with lower ticket fares despite longer travel times.

The table below first sets out our calculations to estimate the change in GJC associated with the additional direct flight to Beijing and then sets out our estimate of the associated increase in demand.

**Figure 5 Estimating the increase in demand: Additional Beijing connection**

	Direct	Indirect
Ticket fare*	£472	£363
Travel time (hours)**	9	13
Value of time per hour***	£54	£54
Generalised journey cost	£966	£1,061
<b>Change in GJC associated with the additional direct connection</b>		<b>9%</b>
<b>Elasticity of demand****</b>		<b>-0.7</b>
<b>Demand increase (route level)</b>		<b>6%</b>

Notes: \*Indirect ticket fares are based on 2016 data from OAG Traffic Analyser. The data does not include airport charges or taxes. Therefore, we have added the relevant Departing Passenger Charge and Air Passenger Duty. We have estimated the ticket fare for the direct option by considering the average relationship between direct ticket fares and indirect ticket fares for long haul connections at Heathrow based on data from OAG Traffic Analyser.

\*\*Travel times are estimated by taking the distance – based on Great Circle Mapper estimates – and converting them into journey times using standard flight time assumptions. For the indirect option, we identified the most common one-stop routing based on 2016 data, and assumed a transfer time of three hours at the hub along the way.

\*\*\*Value of time estimates are based on the Airport Commission's "Economy: Transport Economic Efficiency Impacts" 2014.

\*\*\*\*The elasticity of demand is based on a literature review, including Gillen D. et al, "Air Travel Demand Elasticities: Concepts, Issues and Measurement", 2008.

Next, we estimate the breakdown of passengers that could be expected to use the new flight between Heathrow and Beijing in order to estimate the number of induced passengers who now travel as a result of the direct flight. We use a bottom-up approach to calculate the number of passengers on a single flight by considering the following factors:

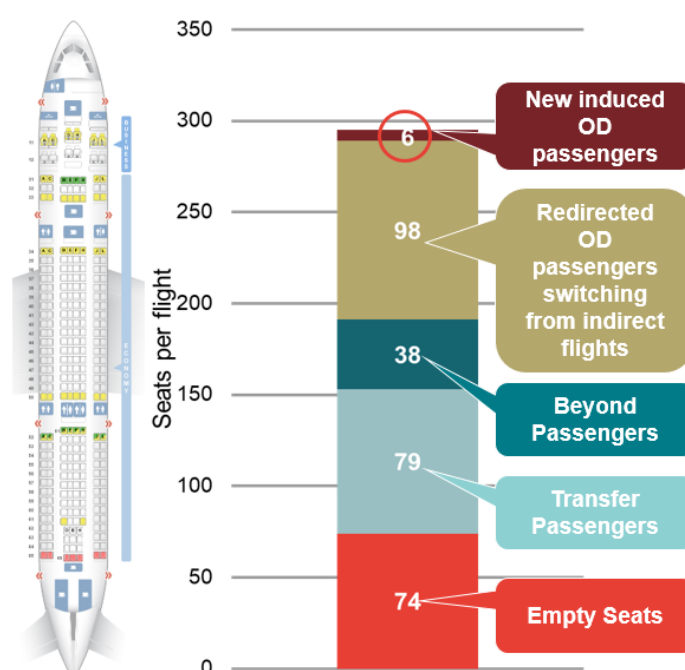
- The number of seats per flight – This is based on the average number of seats flown between Heathrow and China in 2018;
- Load factors – We assume a 75% load factor, which was the average on Chinese routes at Heathrow last year, and apply this to the total seats available to calculate the number of passengers on-board; and
- Passenger mix – We breakdown the total passengers into types to recognise that the flight would be used by different of passengers:
  - 'Beyond' passengers – These passengers fly from Heathrow to Beijing and then on to other destinations – i.e. transfer passengers from the perspective of Beijing airport. They are estimated by applying the average proportion of beyond passengers at Heathrow in 2016;
  - 'Transfer' passengers – These passengers connect at Heathrow and fly on to Beijing – e.g. Europe-Heathrow-Beijing. They are estimated by applying the average proportion of transfer passengers at Heathrow in 2016; and,
  - 'Local' passengers – The remaining passengers are assumed to be local, that is they fly point to point between Heathrow and Beijing. We use the estimated demand increase at the route level (as calculated in Figure 5) to split local passengers into the following two groups:



- ‘Switched’ demand – These are passengers who were previously flying indirectly between the two points who choose to switch to the new direct option. To be conservative, given that this demand would choose to fly anyway, even without the direct connection, we assume that any wider economic activity associated with these passengers does not add to catalytic impact.
- ‘Induced’ demand – This is the uplift in O/D demand that will allow us to calculate the additional catalytic impact, which is driven by these passengers.

As shown in Figure 6 below, we estimate that there would be about 6 induced O/D passengers per flight on average. These passengers would not travel if this new direct flight was not available. Over the course of a year, there would be a total of approximately 320 induced passengers, which represents a 0.04% demand increase at the UK-China level.<sup>2</sup>

**Figure 6 Assumed passenger breakdown on the additional Heathrow-Beijing connection**



Source: Seatguru.com, Air China Seat Maps.

Note: We assume 295 seats based on the average number of seats flown between Heathrow and Beijing in 2018. Based on historical data on Chinese routes at Heathrow, we assume an average load factor of 75%. We use 2016 data from OAG Traffic Analyser to estimate the number of passengers switching to the direct flight from indirect flights (as described in footnote 2). We also apply the induced demand uplift. We assume Heathrow’s average proportion of beyond passengers (17%) and transfer passengers (36%). In this particular example, because the size of the switched demand and induced demand is relatively high, we assume that it would squeeze out some of the transfer passengers – i.e. the transfer passengers are the balancing item to ensure that the flight remains 75% full.

We recognise that the ability to attract transfer passengers and beyond passengers may depend in part on the extent to which the airline can interline with other airlines

<sup>2</sup> We express the increase in demand at the route level as an increase in demand at the country level based on passenger data from OAG Traffic Analyser. This is because the macroeconomic indicators – such as trade and FDI – tend to be reported at the country-pair level.

and provide through-ticketing, both at Heathrow and at Beijing. In the analysis above, we make the simple assumption that the transfer passengers and beyond passengers would be attracted in line with the proportion attracted on other routes at Heathrow.

Finally, while the above description details the methodology for an additional direct connection on an existing route, the same approach applies to estimating the impact of a current direct connection. For this calculation we consider the counterfactual to be the scenario in which the connection no longer exists. While previously the GJC decreased, with the loss of a direct connection, the GJC increases so overall demand at the route level falls. The percentage decrease in demand can be applied to the current number of direct passengers to calculate the number of passengers who are no longer willing to fly without the direct connection.<sup>3</sup> This approach for Beijing is illustrated in Figure 7 and shows that over the course of a year 8,800 passengers would no longer travel. This corresponds to a decrease of 1.1% in overall UK-China demand.<sup>4</sup>

**Figure 7 Estimating the decrease in demand: Beijing**

	Direct	Indirect
Ticket fare*	£472	£363
Travel time (hours)**	9	13
Value of time per hour***	£54	£54
Generalised journey cost	£966	£1,061
<b><i>Change in GJC associated with the lost direct connection</i></b>		<b>10%</b>
<b><i>Elasticity of demand****</i></b>		<b>-0.7</b>
<b><i>Demand decrease (route level)</i></b>		<b>-7%</b>
<b><i>Total 2016 direct passengers</i></b>		<b>128,200</b>
<b><i>Lost passengers</i></b>		<b>8,800</b>

Notes: See the notes below Figure 7.

## Step 2: Calculating the economic impact

Having estimated the induced or lost demand and the change in demand at the country level, we then calculate the economic impact associated with this change. First, as shown in Figure 8 below, we calculate the impact on trade and FDI using the estimated 0.04% increase in total UK-China air travel demand from the additional direct connection to Beijing.

<sup>3</sup> Because the Qingdao connection was added in 2017, 2016 passenger figures are not available. Therefore, to estimate the lost annual demand for Qingdao we use the bottom-up approach described on pages 6 and 7.

<sup>4</sup> We express the increase in demand at the route level as an increase in demand at the country level based on passenger data from OAG Traffic Analyser. This is because the macroeconomic indicators – such as trade and FDI – tend to be reported at the country-pair level.

**Figure 8 Impact on trade and FDI: Additional Beijing connection**

	Trade		FDI	
	Imports	Exports	Inward	Outward
Current Level	£39 billion	£13 billion	£2 billion	£9 billion
Elasticity	0.3	0.3	0.3	0.3
Implied Increase	0.01%	0.01%	0.00002%	0.0001%
<b>Value</b>	<b>£5 million</b>	<b>£2 million</b>	<b>£0.2 million</b>	<b>£1 million</b>

Note: 2016 HMRC trade data and 2016 FDI data are used for the current level estimates. The 0.3 elasticities for trade and FDI are based on an extensive literature review. Further details can be found in our report "Employment impacts from growth at Heathrow", May 2014.

Finally, we convert the increase in trade and FDI into an impact on GDP and jobs. The overall logic is that a more open economy – i.e. one with a high proportion of trade and FDI – is more productive, which in turn boosts GDP. Figure 9 summarises the calculations. In total, the additional connection to Beijing could be expected to increase GDP by approximately £4 million per annum and create 70 jobs. The same approach can be applied to estimate the current impact of existing flights.

**Figure 9 Converting Trade and FDI to GDP and Jobs: Additional Beijing connection**

Value	Trade		FDI	
	Imports: £5 million	Exports: £2 million	Inward: £0.2 million	Outward: £1 million
Elasticity*	0.4		0.24	0.19
<b>GDP</b>	<b>£3.1 million</b>		<b>£0.1 million</b>	<b>£0.4 million</b>
GDP to jobs	£52,000			
<b>Jobs</b>	<b>70</b>			

Note: Further details on the trade- and FDI-to-GDP elasticities are set out in our report "Employment impacts from growth at Heathrow", May 2014. The GDP to jobs ratio is based on Eurostat data and considers the average output generated per worker.

### 1.3 Summary of catalytic impact results

We have repeated the calculations for the other routes under all scenarios. First, we have calculated the economic impact of current direct connections between Heathrow and China, which is reported in Figure 10. Hong Kong with the most passengers and flights results in the highest increase in GDP and jobs while Qingdao with the fewest passengers and flights leads to the smallest increase. In other words, direct flights to Hong Kong generate the largest economic impact while flights to Qingdao generate the smallest.

**Figure 10 Catalytic impact summary: Current direct connections**

Route	Induced annual demand	Increase in UK-China demand	Increase in trade (£m p.a.)	Increase in FDI (£m p.a.)	Total increase in GDP (£m p.a.)	Total increase in jobs
Hong Kong*	25,000	4.4%	220	611	315	6,100
Beijing	9,000	1.1%	180	36	99	1,900
Shanghai	6,000	0.82%	130	26	72	1,400
Guangzhou	2,000	0.21%	33	7	18	400
Qingdao	500	0.06%	10	2	6	100

Note: \*We have used separate values of trade and FDI between Hong Kong and the UK as China's figures do not include Hong Kong. Similarly, we use total UK-Hong Kong demand as Hong Kong is generally not included in statistics for Mainland China.

Finally, we have calculated the impacts of increasing the existing Heathrow-China connections by one additional flight per week. The results of this analysis are reported in Figure 11. Hong Kong realises the largest induced demand for two reasons: First, larger aircraft are used on the route, and second it has a high reduction in GJC from the direct connection. However, the differences in trade between the UK and China versus Hong Kong mean that the total economic impact from the additional Hong Kong flight is similar to the impact from an additional Beijing flight, despite the greater induced demand in Hong Kong.

**Figure 11 Catalytic impact summary: Additional frequency**

Route	Induced annual demand	Increase in UK-China demand	Increase in trade (£m p.a.)	Increase in FDI (£m p.a.)	Total increase in GDP (£m p.a.)	Total increase in jobs
Hong Kong*	350	0.06%	3	9	5	90
Beijing	320	0.04%	7	1	4	70
Guangzhou	290	0.04%	6	1	3	60
Qingdao	213	0.03%	4	1	2	50
Shanghai	180	0.02%	4	1	2	40

Note: \*We have used separate values of trade and FDI between Hong Kong and the UK as China's figures do not include Hong Kong. Similarly, we use total UK-Hong Kong demand as Hong Kong is generally not included in statistics for Mainland China.

## 2 DII ANALYSIS

In addition to the catalytic impact, the Chinese routes would also generate further DII employment effects in and around Heathrow, resulting from the operation of these services. DII impacts are made up from the following:

- Direct: Heathrow employs workers *directly*;
- Indirect: Heathrow employs workers *indirectly* through its supply chain; and
- Induced: The direct and indirect workers spend money in the wider economy and *induce* further employment.

The remainder of this section sets out the DII calculations using the additional Beijing connection as an example, before summarising the results for all routes.

### 2.1 Estimation

Heathrow's current DII impact is around 175,000 jobs.<sup>5</sup> Based on previous analysis, we assume that the growth in DII jobs is based on the growth in passengers and the growth in movements, weighted in the ratio 70-30 respectively. Therefore, we estimate the increase in the number of passengers and movements brought about by the new route – recognising that (i) passengers switching to the new direct flight from the indirect options should not be counted because without the direct flight they would still be at the airport and fly indirectly; and (ii) transfer passengers at Heathrow need to double-counted – e.g. a passenger travelling from Europe to Heathrow and then on to Beijing would be counted as an arriving passenger from the European flight and as a departing passenger on the China flight. Figure 12, below, shows that the additional flight to Beijing would be responsible for a further 50 jobs through DII impacts.

**Figure 12 Employment Impact**

	Status Quo	New Flight	Increase
Passengers	76 million	+21,000	0.03%
ATMs	475,000	+104	0.02%
<b>Total LHR Employment</b>	<b>175,000</b>	<b>50</b>	<b>0.03%</b>

Note: Heathrow passenger and ATM figures are taken from 2016 CAA Airport Data.

As set out earlier, we recognise that Heathrow is constrained and therefore new connections may only be possible if other flights are squeezed out. If this is the case, then the total number of movements at the airport level may remain unchanged. The total number of passengers could still increase – e.g. a short haul connection operated with a smaller narrow-bodied aircraft could be cut and replaced by a larger aircraft on a long haul route. Therefore our results can be considered the 'gross' benefit of introducing the new routes, rather than the 'net' benefit which would involve also analysing the routes which have been cut.

<sup>5</sup> In a 2014 report for Heathrow, "Employment impacts from growth at Heathrow", it was estimated that Heathrow is responsible for around 175,000 DII jobs today. For the purposes of this analysis, we assume that this number has remained broadly constant.

However, if Heathrow were unconstrained and new connections could be added without squeezing out other flights, only positive benefits would occur.

## 2.2 Results

Figure 13 reports the DII employment impacts of current direct connections. Here, results are primarily driven by passenger numbers on the routes in 2016. Hong Kong has the most passengers and subsequently the largest impact on employment while Qingdao with the fewest passengers has the smallest impact.

**Figure 13 Summary of Employment Impacts: Current direct connections**

	Hong Kong	Shanghai	Beijing	Guangzhou	Qingdao
Passengers	1,270,000	333,000	340,000	117,000	16,000
ATMs	5720	2,288	2,080	1,040	208
Total Jobs	2,700	800	800	300	50

*Note:* Passenger figures for all routes but Qingdao are taken from 2016 OAG Passenger Data. Because the Qingdao route did not operate in 2016, for Qingdao we use the bottom-up approach to estimate passengers.

Figure 14 reports the DII employment results for an additional connection on existing China routes. Here, results are driven by average size of aircraft used on the route. Hong Kong, with the highest average seats per flight has the highest DII impact while Qingdao with the lowest seats per flight has the lowest impact.

**Figure 14 Summary of Employment Impacts: Additional frequency**

	Hong Kong	Beijing	Shanghai	Guangzhou	Qingdao
Passengers	22,500	21,000	18,300	16,300	15,000
ATMs	104	104	104	104	104
Total Jobs	50	50	40	40	40

### 3 CASE STUDIES

This part of the report presents case studies that demonstrate the economic benefits of connectivity between the UK and China, in terms of fostering trade in goods, services and investment between businesses in the two countries that may be facilitated by Heathrow. The case studies highlight existing UK sectors and businesses that connect to Chinese consumers for trade in goods and services, and FDI, via Heathrow.

#### 3.1 Trade, Investment & Sector-specific links

China was the UK's 6th largest trading partner for **exports** in the 12 months to November 2017 – behind only the US, Germany, France, the Netherlands, and Ireland. Exports to China over this period were worth £15.3 billion.

UK **imports** from China in the 12 months to November 2017 were worth £38.4 billion. The value of UK imports from China was second largest, behind only Germany.

The top 10 commodities exported to and imported from China in the 12 months to November 2017 (by value) are set out in the following table:

**Figure 15 Top 10 Commodities / Sectors trading between UK and China in 2017**

UK Imports from China	UK Exports to China
Electricals (£9.3bn)	Vehicles other than rail (£4.5bn – of which £4.2bn road vehicles)
Nuclear reactors and machinery (£6.6bn)	Mineral fuels (£3.1bn – of which £2.9bn petroleum)
Furniture (£3.3bn)	Nuclear reactors and machinery (£1.5bn)
Toys, games and sports (£2.7bn)	Pharmaceutical products (£1.1bn)
Clothing (knitted) (£1.9bn)	Electricals (£1.0bn)
Clothing (not knitted) (£1.9bn)	Optical, photographic, cinematographic instruments and apparatus (£0.8bn)
Plastics (£1.3bn)	Pearls, precious or semi-precious stones (£0.5bn)
Footwear (£1.3bn)	Copper (£0.4bn)
Iron or steel (£1.2bn)	Pulp of wood (£0.4bn)
Vehicles other than rail (£1.0bn)	Aircraft and spacecraft (£0.3bn)

While many of these commodities are bulky goods that physically export by sea or rail, there are significant implications for deals and investments brokered and services traded that would be facilitated by face-to-face meetings via Heathrow.

Many of the higher value, higher-tech commodities such as aircraft and space craft, optical and photographic instruments, electricals, and pharmaceuticals are traded by air – and with Heathrow’s dominance in the market over other airports in the UK, it is highly likely that these are traded via Heathrow.

The following table shows The top 10 commodities exported to and imported from China in the 12 months to November 2017 **using aviation** (by value):

**Figure 16 Top 10 Commodities / Sectors trading between UK and China in 2017 by Air**

UK Imports from China (By Air)	UK Exports to China (By Air)
Electricals (£3.2bn)	Pharmaceutical products (£1.0bn)
Nuclear reactors and machinery (£1.2bn)	Nuclear reactors and machinery (£0.7bn)
Optical, photographic, cinematographic instruments and apparatus (£0.4bn)	Electricals (£0.7bn)
Clothing (not knitted) (£0.3bn)	Optical, photographic, cinematographic instruments and apparatus (£0.6bn)
Clothing (knitted) (£0.2bn)	Pearls, precious or semi-precious stones (£0.5bn)
Aircraft and spacecraft (£0.1bn)	Aircraft and spacecraft (£0.1bn)
Organic chemicals (£0.1bn)	Organic Chemicals (£0.1bn)
Furniture (£0.1bn)	Miscellaneous Chemicals (£0.1bn)
Toys, games and sports (£0.09bn)	Fish products (£0.1bn)
Plastics (£0.07bn)	Dairy products, eggs and honey (£0.8bn)

### Recent Progress in Trade and Investment

In December 2017 the UK Government announced that Chinese banks will have direct access to foreign exchange markets in London – intended to open a new channel for trading the renminbi in London, supporting the internationalisation of renminbi, and bringing new business to London’s financial markets. The deal is informally known as currency connect, flowing the Stock Connect and Bond Connect deals made in 2014. Heathrow will be critical in catalysing this investment plan through its connectivity.

The UK Government has also established a \$1 billion investment fund with China to back China’s Belt and Road Initiative (BRI) – an infrastructure project for high-speed rail, roads, internet and port facilities that will more closely integrate the Eurasian land mass and build closer ties between Europe and China.

Chinese investment in the UK reached \$20.8bn in 2017, up from \$9.2bn in 2016.



## The Energy Sector

**Chinese General Nuclear (CGN)** is a key partner in a £19.6 billion project to build a nuclear power station at **Hinkley Point**, Somerset, with a one-third stake, and agreement for joint work on a planned power station, **Sizewell C** in Suffolk, and a majority stake in a third power station at **Bradwell** in Essex.

This agreement promotes mutual benefit – the UK benefits from significant inward investment, while China benefits from the experience and best practice of developing new technology in a highly regulated environment.

China is not only investing in the UK Nuclear industry – it also owns roughly 12% of North Sea offshore oil and gas assets. China's State Development Investment Corporation (SDIC) acquired a £185 million stake in UK offshore wind assets including a 25% stake in the Beatrice Project and 100% ownership of the Inch Cape project, both in Scottish waters.

## The R&D Sector

Chinese company **TusPark**, which runs a number of science parks in China, Hong Kong, the US, South Korea and Russia, is in the process of setting up the company's first innovation centre in the **North East** (Maybrook House, Newcastle) – with a focus on strengthening links between UK and Chinese companies.

TusPark is also considering acquiring a second site at **Newcastle's Science Central**.

TusPark operates an international network of science parks, incubator projects and business enterprises from over 160 locations. The company, which originally started as the science park for **Tsinghua University**, spends more than £570m on R&D annually.

The new innovation centre is designed to provide funding and collaboration for firms working in **subsea technology, life sciences, healthcare and creative industries**.

TusPark will not only operate its own fund but will also promote joint ventures with Chinese businesses. Businesses who become part of the TusPark network will be able to visit the company's 40 other parks across China.

The centre will also help promote the North East by providing facilities in the UK that can be used by Chinese businesses.

## The Real Estate & Development Sector

Chinese investment in the UK property and development sector includes a number of London-based developments such as Chinese developer **ABP's Royal Albert Dock re-development in east London**.

## The Food, Drink and Entertainment Sectors

Essex jam-maker **Wilkin & Son** exports products to China including hand-made scones.

**Costa Coffee (Whitbread)** first entered the Chinese market in 2003, and now has 408 stores across the country. It is the second biggest coffee chain in China behind Starbucks (2,800 China stores).

Whitbread / Costa Coffee engaged in a decade long joint venture with South China based business **Yueda**, opening 252 stores. It also has a joint venture with **BHG**, North China. The company has ambitions to grow to 700 stores over the next 5 years based on projections that coffee consumption is set to grow significantly.

**British beer** exports increased by 6% in 2016, according to figures released by HMRC, buoyed by a **500% increase in exports to China**, according to the British Beer and Pub Association (BBPA).

**CRATE Brewery**, founded in 2012 in London's Hackney Wick, currently supplies bars in London, Budapest, Berlin and Sweden. It was recently contacted by **Drinking Buddies**, a China-based business that supplies craft beers to select bars, restaurants and hotels around China, as well as offering a straight to consumer Brew Club.

A 2017 deal between Edinburgh-based online drinks platform **Flavourly** and Beijing brewer **Panda Brew** will see Panda Brew made available to British drinkers.

Scottish craft brewer **Innis & Gunn** has announced a deal with Chinese beer importer **Dxcel** International to distribute its beer brands in the Chinese mainland, Taiwan, Hong Kong, and Macau.

### The Artificial Intelligence (AI) / Robotics Sector

China has set a goal of creating a \$150 billion AI industry by 2030 – as part of which it has been investing in promising UK start-ups in the field.

A joint UK-China AI summit took place in September 2017, bringing together key players in AI from China and the UK to build global partnerships and catalyse commercial business and investment opportunities.

China-UK cooperation in the field is well developed, for example **China DMTG Group** is working with a UK company called **600 Group** on frequency conversions to adjust the lathe speed of DMTG's products, and using Edgecam CAM software to improve its digital design capability.

The UK's **Giamite** has set up a precision manufacturing company in **Hangzhou**.

Chinese private equity firm **CSC Group** is helping to fund UK AI incubator **Founders Factory**, based in London.

### The Automotive Sector

A 2015 collaboration between **Scottish bus manufacturer Alexander Dennis Limited (ADL)** and **Chinese firm BYD** facilitated cooperation on the production of 50 zero-emission zero emission electric buses for London.

The deal, worth £19 million, was a strategic alliance whereby BYD produced the chassis and powertrain system and Alexander Dennis produced the body of the bus. BYD has strong capabilities in battery technology, battery management systems and powertrain systems.

Since 2012 **Chery**, an automotive firm headquartered in **Wuhu**, Anhui Province, has partnered with **Jaguar Land Rover** on the Chinese production of new models. Chery has a strong focus on developing sustainable technology, and is an active player in charging-point technology and infrastructure investments.

**LeEco** is a business venture of LeTV, a successful Chinese media company, and is expanding to areas such as NEVs, e-commerce and sports. LeEco and **Aston Martin** recently announced plans for the development and production of the RapidE electric concept vehicle, and also using internet capabilities developed by LeCo to build the next-generation connected electric vehicles by 2020.

Chinese company **Geely** acquired London Taxi and Emerald and is investing £300 million in the UK to take electric taxis into production.

### The Manufacturing Sector

In 2010, **China South Rail Group**, through UK company **Dynex**, invested in a semiconductor R&D centre in Lincoln. Dynex designs and manufactures high power semiconductor components and high power electronic assemblies.

The company's products are used worldwide in power electronic applications including electric power transmission and distribution, renewable and distributed energy, marine and rail traction motor drives, aerospace, electric vehicles, and industrial power controllers.

Based on direct investment from China, a **joint China – UK R&D and Design Centre was established in Lincoln** in October 2010, and a new R&D building was opened in 2012.

UK Company **JCB** has been in China since 2004, producing high-speed tractors and excavating machinery and has established R&D and training centres there.

### The Biopharmaceuticals Sector

In 2013 **Shanghai Fosun Pharmaceutical** invested US \$5 million in UK Oxford **Immunotec**. The company owns units in both life sciences and healthcare, and has its own R&D, manufacturing and distribution channels.

During a state visit to the UK by President XI Jinping in October 2015 it was announced that **CCBI** (a wholly-owned subsidiary of China Construction Bank) would partner with **China Regenerative Medicine International (CRMI)** and the **University of Oxford** – to provide £1.5 million funding to the centre to accelerate research and translation and improve operating and training capability.

### The Education and Childcare Sector

The overall size of China's education industry was £193bn in 2015, and this figure is expected to grow to £370bn by 2020.

**Westminster School, London** has signed an agreement with **HKMETG** (a Hong Kong education group) (December 2017) to set up six new schools in Chinese cities over the next 10 years, starting with **Chengdu** in 2020.

British education is a fast growing market in China – other UK schools that have entered the market include:

- **Eton College** (partnerships with Chinese schools delivering online teaching through Eton Online Ventures – launched September 2015);
- **Harrow** (Harrow International Schools in **Beijing**, and **Shanghai**); and
- **Dulwich College** (five campuses across China – **Beijing**, **Shanghai**, **Suzhou**, **Zhuhai**, and **Yangon**);
- **Malvern College** (satellite schools in **Qingdao** and **Chengdu**).

British private schools currently operate 59 campuses abroad, teaching 31,773 pupils, a sharp rise from the 29 schools reported four years earlier, according to the Independent Schools Council.

Hong Kong and mainland China make up the largest group of overseas students attending these schools, contributing £713 million (US\$912 million) to Britain's gross domestic product every year.

There has also been a surge in Chinese investment in **nursery level education** – with demand driven by Chinese parents seeking early years bilingual education.

A UK Department for International Trade early-education trade mission visited China in 2017, sharing expertise with 700 Chinese day-care providers.

In 2017, UK company **British Early Education** partnered with Chinese investors **Largreen Education** to open an international kindergarten in **Yixing**. It can serve 300 children. **Happy Tree Nursery Group**, operators of three nurseries in London, opened a new childcare facility in **Shenzhen**. And Staffordshire-based **Busy Bees Nurseries** has now opened its first nursery in China.

## The University & Education Sector

13% of students enrolled in UK universities are from outside the EU.

The number of students in the UK from China is much higher than the number from any other non-UK country – **95,090 student enrolments or almost one third of all non-EU students**.

The number of Chinese students studying in the UK has grown over recent years – by **14% between 2012/13 and 2016/17**, bucking the trend that shows an overall decrease in the number of non-EU students studying in the UK.

Data by institution for Chinese students studying in the UK is available for 2015 (58,810 total enrolments). The most popular institution was the **University of Liverpool** (3,200 Chinese student enrolments); the **University of Manchester** (3,100); the **University of Nottingham** (2,800); the **University of Birmingham** (2,500); and **University of Sheffield** (2,500).

The **University of Nottingham** aims to be a pioneer in international education, and has campuses in Malaysia (founded in 2000) and Ningbo China – a port city to the south of Shanghai (2004). The Ningbo Government and the University have collaborated on research in sectors including marine technology and advanced materials.

A £25 million International Academy for Marine Economy and Technology leverages research connections and supports a thriving innovation and research community of academics and students (announced 2014). A £6m deal between the University of Nottingham and the Ningbo Government in China led to the establishment of the Nottingham-Ningbo New Materials Research Institute in 2015. The Institute looks at composite materials and engineering, including soil mechanics, particle materials and technologies, sustainable materials and advanced manufacturing technology, new energy materials, and advanced materials and technology.

**Liverpool University** established a new university in partnership with Xi'an Jiaotong, one of China's top ten universities in 2006. The campus Xi'an Jiaotong-Liverpool University (XJTLU) is based in Suzhou – two hours' drive from Shanghai. It is the largest joint venture university in China. The Suzhou Campus is based at Suzhou Industrial Park (SIP), one of China's most successful business parks, with a focus on AI.

The **University of Manchester** has benefitted from funding from Chinese company Huawei, supporting research in use of graphene technologies and work at the National Graphene Institute (NGI) that opened in 2015, supported by UK government funding for graphene research and development. The funding allows the translation of research into development of consumer products.

In December 2017, Manchester University announced the establishment of a new major centre for China studies. The centre will be funded by a £5m donation from retired Hong Kong businessman Dr Lee Kai Hung. The centre is expected to place Manchester at the forefront of China studies in the UK. As well as research, the Centre will have a particular emphasis on working with the local Chinese community and the thousands of Chinese students in the city.

Manchester has more academics engaged in China and China-related studies than almost any other UK university – working on everything from the arts and humanities to health and science. It also has a Confucius Institute which focuses on teaching Chinese – a partnership between the University of Manchester, the Office of Chinese Language Council International (Hanban) and Beijing Normal University.

## 4 CONCLUSION

In this report, we have shown that Heathrow's current direct connections to China generate significant economic impact in the UK both in terms of GDP and jobs. While Figure 17 summaries the benefits for each route, overall, connections to China contribute £510 million per annum in GDP which translates to 14,550 jobs.

**Figure 17 Summary of economic impact estimates: Current direct connections**

	Catalytic impact		DII jobs	Total jobs impact
	GDP (£m)	Jobs		
Hong Kong	315	6,100	2,700	8,800
Beijing	99	1,900	800	2,700
Shanghai	72	1,400	800	2,200
Guangzhou	18	400	300	700
Qingdao	6	100	50	150

Furthermore, should Heathrow expand to a third runway, additional economic benefits can be realised. As shown in Figure 18, if current connections increase by one additional frequency per week, an additional £16 million of GDP and 530 jobs will be generated.

**Figure 18 Summary of economic impact estimates: Additional frequency**

	Catalytic impact		DII jobs	Total jobs impact
	GDP (£m)	Jobs		
Hong Kong	5	90	50	140
Beijing	4	70	50	130
Guangzhou	3	60	40	100
Qingdao	2	50	40	80
Shanghai	2	40	40	80

Case studies also demonstrate the vital link that Heathrow plays in connecting China and the UK. Connectivity between the UK and China fosters trade in goods, services and investment between businesses in the two countries. Given Heathrow's dominance in the market over other airports in the UK, many of the higher value, higher-tech commodities such as aircraft and space craft, optical and photographic instruments, electricals, and pharmaceuticals that are traded by air are also likely traded via Heathrow. Thus, Heathrow facilitates trade in sectors ranging from Manufacturing to AI / Robotics.

