An assessment of the economic effects of IFC's airport investments

OXFORD ECONOMICS

December 2016

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Case study analysis of Montego Bay, Jamaica and Punta Cana, Dominican Republic

Commissioned by IFC to Oxford Economics and funded by the Let's Work Partnership.

Redacted Version

1. The Executive Summary and report of the Evaluation entitled '*An assessment of the economic effects of IFC's airport investments*. *Case study analysis of Montego Bay, Jamaica and Punta Cana, Dominican Republic'* has now been redacted for public disclosure in accordance with IFC's 2012 Access to Information Policy, following the Procedure for Development, Management and Disclosure of IFC Evaluations effective on January 20, 2016.

2. The attached redacted version reflects the following adjustments:
   - Redaction of sensitive or confidential information related to financial and proprietary information shared by and used with the consent of IFC clients (e.g. trends in revenues and profits, tax revenues paid, procurement bill, and size of infrastructure of IFC clients). This information was originally used in the estimations of economic effects, and also included in the report to show improved operational performance of both airports;
   - Minor typographical corrections.

3. The redacted version was reviewed by Oxford Economics to ensure that their views, estimations, and assessment are adequately reflected as originally intended.

4. The redacted version will be disclosed to the public on February, 2017. The document is available on www.ifc.org.

5. Questions on this document should be addressed to Enrique Lora (elora@ifc.org), Evgenia Shumilkina (eshumilkina@ifc.org), and Hayat Abdulahi Abdo (habdo@ifc.org).

OXFORD ECONOMICS

AN ASSESSMENT OF THE ECONOMIC EFFECTS OF IFC'S AIRPORT INVESTMENTS

CASE STUDY ANALYSIS OF MONTEGO BAY, JAMAICA AND PUNTA CANA, DOMINICAN REPUBLIC

DECEMBER 2016

IFC International Finance Corporation World Bank Group

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EXECUTIVE SUMMARY

The International Finance Corporation (IFC), a member of the World Bank Group (WBG), is the largest global development institution focused on providing financial support, knowledge and advisory services to the private sector in developing countries. Airports represent a vital asset class for IFC and understanding the economic impact that its airport investments have is, therefore, strategically important in the delivery of its mandate to further economic development by encouraging the growth of productive private enterprise in member countries, particularly in less developed regions, thus supplementing the activities of the World Bank.

To this end, IFC commissioned Oxford Economics (OE) to analyse the economic impact of airports. The report's purpose is to advise how best to accurately measure and track the economic impact of airports; and to evaluate the effect of IFC's investments in two case study airports in which it had previously invested: Montego Bay Airport (MBJ) in Jamaica and Punta Cana Airport (PUJ) in the Dominican Republic. The main focus of the project was on quantifying impacts via the airport's operational activity, the footprint of tourist arrivals and effects on the tradable sector.

To do this, we established a Theory of Change (ToC) framework that identified the various channels through which airports support economic activity. It sets out how economic effects stem from the operations of an airport itself, its supply chain and through the wages spent by its employees; and from wider catalytic effects—here most notably from the impact on tourism and trade.

It was necessary to adopt a mixed methods approach to explore all of IFC's questions of interest. Social Accounting Matrix (SAM) modelling was used to quantify the economic impact of the airport's operations and the impact of tourist's expenditure in the wider economy. On the other hand, a SAM model's framework is not suited to understanding wider effects on (non-tourist) international trade via connectivity. These were quantified via a gravity model equation which explains observed changes in bi-lateral trade based on a set of explanatory variables including GDP, population, shared language, distance and, in this instance, air connectivity.[1]

Finally an assessment of the role of IFC's investments was undertaken on the basis of a qualitative review of evidence collected as part of a desk-based review and during the field trip. This includes a commentary on how the investments have contributed to current operational performance and analysis of how the operational performance of the airports has evolved since the investments. In addition, an attribution rule was established, which related a fraction of the airport's current economic footprint to IFC's investment based on the extent to which the investment relieved a binding capacity constraint. In the

[1] Connectivity was measured by the level of non-visitor arrivals by country of origin (on a residency basis). Although it is also possible to measure connectivity on the basis of routes data this would have been problematic in the context of a gravity model as direct aviation routes do not exist between each host economy and a number of their trading partners. Further detail on the derivation of the gravity model is contained in Appendix 2.

case that an investment enhances the capacity of an airport, and passenger flow subsequently exceeds this capacity, the associated additional economic activity that results—via operations, tourism and trade—was enabled by the project.[2]

The next section of this chapter reports the findings from our case studies, and assesses the role of IFC's investments in each airport. GDP impacts are most typically expressed in terms of Gross Value Added (GVA). GVA is the statistical term used to measure the contribution of a sector or an organisation to the GDP of the domestic economy. It is most simply understood as the value of sales (turnover) less the cost of brought-in goods and services.

IFC'S INVESTMENTS IN MBJ AND PUJ

Between 2004 and 2008 IFC part-financed a number of investment projects in MBJ. These supported substantive improvements to landside and airside facilities and resulted in a trebling of passenger handling capacity. A new concourse was constructed, significantly expanding the airport's offer in terms of retail, and food and beverage amenities and modernised check-in and baggage handling facilities helped to improve customer experience.

IFC's investments have meant that MBJ has overcome a capacity constraint that would otherwise have become binding. During the fieldtrip, it was suggested that the infrastructure at MBJ prior to privatisation would have limited the airport's passenger-handling capacity to approximately three million. IFC's investments have helped to lift capacity at MBJ to around nine million. Therefore, without IFC's investments it is reasonable to assume that passenger flow in 2015 would have been limited to approximately three million—around 22 percent lower than the actual volume

At PUJ, IFC's investment financed on-site developments including a new runway, the expansion of an existing passenger terminal and new structures that have enhanced operational safety. IFC's investment also supported the installation of new safety equipment including a control tower, a new fire and rescue brigade building and instrument landing systems and repair work to the existing runway. This ensured that PUJ complied with regulations set out in the Runway End Safety Area (RESA) specified by the International Civil Aviation Organisation (ICAO).

THE ECONOMIC IMPACT OF MBJ IN 2015

Through its operations, MBJ made a total value added contribution of US $56.0 million to Jamaica's GDP in 2015 (0.45 percent of the economy total), sufficient to support over 1,000 jobs (0.10 percent of the economy total). Around three-quarters of the total GVA supported by MBJ in 2015 was retained by the airport, reflecting its very high profit margin.

Each US $1 million of revenue generated by MBJ in 2015 supported US $0.73 million in GVA, US $0.16 million in labour compensation and 14 jobs across the economy of Jamaica. A common method to assess the strength of an organisation or sector's linkages to the wider economy is multiplier

[2] Further detail on this approach is contained in Appendix 4.

analysis. In this report, we present output 'effects' which quantify how each US $1 million of output (or revenue) supports economic activity across the economy inclusive of direct, indirect and induced effects. Our analysis indicates that MBJ, in 2015, had a GVA effect of US $0.73 million and an employment effect of 14 jobs.

In total, the spending of the 1.7 million tourists that used MBJ as a gateway to Jamaica in 2015 sustained US $1.3 billion in GVA (10.4 percent of the economy total) and supported 133,000 jobs (12.2 percent of the economy total). Tourist expenditure supported activity across Jamaica, most notably in tourist-facing industries such as hotels and restaurants, personal, sporting and recreational service providers and land and water transport services.

Our modelling suggests that for each 10 percent increase in connectivity (as measured by non-resident arrivals) in Jamaica, goods exports rise by 2.1 percent and goods imports by 0.8 percent—this reflects how the international flow of people can help to foster business relationships between suppliers, customers etc. Applying this result to MBJ implies that the increase in connectivity at the airport since the completion of IFC's investments in 2008 has boosted international goods trade by US $118 million (2.1 percent of the economy total). Of the overall boost to trade, exports were found to have increased by US $49 million (3.9 percent of the economy total) and imports by US $69 million (1.6 percent of the economy total). Intuitively, leisure tourists are less likely to catalyse international trading relationships (compared to those travelling on business) although qualitative evidence gathered during the field trip did attest to known examples of leisure trips that had spurred subsequent trade and investment activity. Therefore, the fact that most non-resident arrivals at MBJ were travelling for leisure rather than business purposes implies that the values above are likely to overstate the airport's impact in this respect.[3]

Fig. 1. MBJ's total economic footprint in 2015[4]

	GVA	Employment	Tax
	US$ millions	Headcount jobs	US$ millions
Operations	56	1,054	13
Tourism spending	1,285	132,329	477
Trade	27	2,565	8
Total	**1,369**	**135,947**	**498**

Source: Oxford Economics

THE ECONOMIC IMPACT OF PUJ IN 2015

In 2015, PUJ made a total contribution to GDP of US $136.0 million (0.25 percent of the economy total) and over sustained 2,000 jobs (0.05 percent of the economy total). Over 80 percent of the GVA contribution was

[3] Further discussion on this point can be found in section 4.6.

[4] Figures may not sum due to rounding.

generated on-site at the airport, and so most of the impact was felt in the transport sector itself. However, the total employment impact was much more widely spread across the economy through supply chain and wage expenditure channels, with a significant number of jobs supported in sectors such as professional services, utilities and distribution (retail and wholesale trade).

Each US $1 million of revenue generated by PUJ in 2015 supported US $1.01 million in GVA, US $0.19 million in labour compensation and 15 jobs across the economy of the Dominican Republic. In this report, we present output 'effects' which quantify how each US $1 million of output (or revenue) supports economic activity across the economy inclusive of direct, indirect and induced effects. At PUJ in 2015, our analysis indicates a GVA effect of US $1.01 million and an employment effect of 15 jobs.

In 2015, the expenditure of 3.2 million tourists arriving at PUJ supported over US $2.6 billion in GVA, which sustained 188,000 jobs across the economy. A substantial amount of activity throughout the economy was supported by tourist expenditure, representing 4.9 percent of the Dominican Republic's economy-wide GVA and 4.6 percent of total employment.

Our modelling suggests that for each 10 percent increase in connectivity (as measured by non-resident arrivals) in the Dominican Republic, goods exports rise by 0.9 percent and goods imports by 0.1 percent—this reflects how the international flow of people can help to foster business relationships between suppliers, customers etc. Applying this result to PUJ implies that the increase in connectivity at airport since IFC's investments has led to international goods trade being 0.9 percent higher (US $248 million) than it would otherwise have been. Drilling down, the export impact was worth some US $196 million (2.1 percent of the economy total) and the import impact amounted to US $53 million (0.3 percent of the economy total). Intuitively, leisure tourists are less likely to catalyse international trading relationships (compared to those travelling on business) although qualitative evidence gathered during the field trip did attest to known examples of leisure trips that had spurred subsequent trade and investment activity. Therefore, the fact that most non-resident arrivals at PUJ were travelling for leisure rather than business purposes implies that the values above are likely to overstate the airport's impact in this respect.[5]

Fig. 2. PUJ's total economic footprint in 2015[6]

	GVA	Employment	Tax
	US$ millions	Headcount jobs	US$ millions
Operations	136	2,023	18
Tourism spending	2,647	187,609	284

[5] Further discussion on this point can be found in section 4.6.

[6] Figures may not sum due to rounding.

Trade	172	10,206	29
Total	**2,955**	**199,838**	**331**

Source: Oxford Economics

THE IMPACT OF IFC'S INVESTMENTS IN MBJ

The operational efficiency of MBJ has increased substantially since 2008—it is our view that this trend is strongly linked to IFC's investments. Operational efficiency at MBJ increased substantially in 2008 and has remained at an elevated level up to 2015. The investments enabled MBJ to substitute capital for labour.

Since the completion of IFC's investment programme, MBJ's operational contribution to GDP has grown strongly while total employment growth has been much more modest—we think these trends are linked to IFC's investments. Growth in total GVA has come predominantly from the airport's direct impact, and is related to it having much higher gross margins than before. Indirect supply chain GVA has also increased steadily while induced GVA, which results from the consumer spending of airport and supply chain employees, has fallen since 2008, a reflection of the real terms decline in wage expenditure during this period.

Since passenger handling capacity would have been limited to around three million without the investments, it can be concluded that approximately 21 percent of the airport's footprint in 2015 (US $288 million in GVA and close to 29,000 jobs) was enabled by IFC's intervention. Inbound passenger arrivals are the driving force of all three of the identified channels of impact. In the context of Jamaica, it seems unlikely that many of these additional passengers would have used an alternative route to enter the country given that travelling from the other international airport (Kingston Norman Manley) to the tourism locations around Montego Bay is very time-consuming.

IFC's investment can be regarded as a necessary but not a sufficient condition in supporting this additional level of economic activity. This impact cannot be fully attributed to IFC's investment but the increased capacity at MBJ is part of a wider ecosystem of infrastructure vital to ensuring that Jamaica can cater for the demands of tourists who come to enjoy holidays and do business.

THE IMPACT OF IFC'S INVESTMENTS AT PUJ

Prior to IFC's investment in PUJ, the airport was operating well below its passenger-handling capacity, a feature that remained the case in 2015. Despite the very strong growth in arrivals enjoyed by PUJ since 2011, there is no evidence that this level of passenger flow could not have been accommodated at PUJ without the investment supported by IFC. This finding was confirmed by representatives of PUJ and an IFC industry specialist. Given this, it has not been possible to establish a clear attribution rule that would link a fraction of the 2015 economic footprint to IFC's investment, as was the case for MBJ.

However, the investment has been important in supporting wider benefits by reducing the environmental footprint of PUJ in terms of noise pollution and enhancing safety standards. Virtually all passenger flights at PUJ in 2015 used the new runway. The new trajectory of take-off for the planes has substantially reduced the level of noise pollution inflicted on local residents. Therefore, IFC's investments have supported an environmental benefit in this context. In addition, the investments have ensured that PUJ is compliant with international safety guidelines as set out by ICAO—enhanced standards in this area is an important benefit that has not been monetised in this research.

It was suggested that the construction of the new runway has enabled PUJ to handle larger planes opening up a more diverse set of routes although this assertion has been questioned. Part of the rationale for the investment, as set out in the IFC Board Paper document, was that the new runway would enable the airport to handle larger aircraft. This finding was validated by representatives from PUJ during the fieldtrip and by information provided by an IFC former engineer. However, the assertion has been questioned on the basis that satellite imagery suggests that the dimensions of the new runway are identical to the old runway. We have been unable to reach a firm conclusion on this point. Should the assertion be valid then it is reasonable to conclude that IFC's investment in PUJ has the potential to help the airport to diversify its direct routes. During consultations with IFC industry specialists, an observation about the new orientation of the runway was made: the new runway might have reduced crosswind speed which represents a significant safety risk. However, we could not find information to validate this point.

Although whether the new runway has enabled PUJ to handle larger aircraft remains a moot point, our analysis indicates little evidence of route diversification up to this point. Much of the growth in arrivals since 2011 has come from short- and medium-haul origin markets. Time series analysis of flights operating out of PUJ indicates that growth in passenger numbers, since the completion of IFC's investments, has been driven by short- and medium-haul destinations, in particular from the US and Canada. This likely reflects demand side factors—we estimate that the growth of outbound air passengers from short- and medium-haul markets has been three times as strong as from long-haul markets between 2011 and 2015.

COMPARATIVE ANALYSIS

Growth in passenger arrivals, and hence the associated economic impact of tourism and trade, has been much stronger post-investment at one of the airports. This can be largely attributed to the differences in the rates of development of the tourist offer in the two locations. The number of hotel rooms in Punta Cana more than doubled between 2011 and 2015—while in the Montego Bay area it remained static during the same period.

In both case studies the vast majority of the total contribution to GDP was created on-site at each airport. At both PUJ and MBJ around four-fifths of the

airport's total operational impact was sustained on-site, a ratio that was substantially higher than the economy-wide average of approximately 50 percent. Therefore, in both cases, the airports had relatively weak linkages with the rest of the domestic economy via indirect and induced effects.

At both airports, the number of jobs sustained due to each airport's operations was relatively low, even including multiplier effects. At both MBJ and PUJ the level of employment supported by US $1 million of output in 2015, inclusive of indirect and induced effects, was virtually identical. More significantly, in both cases this employment effect was substantially lower than the economy-wide average. This reflected the fact that the vast majority of value sustained in each case was retained at the airport and both organisations have exceptionally high productivity in comparison to the wider economy.

At both MBJ and PUJ, the operational economic impact was dwarfed by the impact of the expenditure of tourists who used the airport as a gateway to the local economy. This is likely to be the case for most airports but in our view two factors contributed to the discrepancy being particularly large in these cases. Firstly, both airports are gateways to prime hubs for leisure tourists—in general, leisure tourists have a larger economic footprint than those arriving for business. Secondly, at both airports the vast majority of passengers who used the airport were non-residents.

In both cases, the impact on trade via connectivity was substantial and was likely considerably larger than the observed increase in cargo through each airport alone. This finding is interesting in that it suggests that documenting trends in cargo trade alone as a way to judge trade effects may significantly understate an airport's impact on the tradable sector. However, it is important to note that both airports have relatively limited cargo operations—as such, it may be that the relative importance of these connectivity effects has been exaggerated by this structural feature of the two airports in our case studies.

LESSONS LEARNED AND RECOMMENDATIONS

The findings from this study suggest a number of insights which can inform IFC's operations going forward—particularly in research and measurement:

- In both case studies, the number of jobs that the airports sustained via their operations was relatively low, reflecting very high labour productivity on-site and high profit margins. These operational characteristics are not optimally suited to achieving IFC's goals of reducing poverty and boosting shared prosperity;
- The analysis has highlighted that airports help to support economic activity across a wide range of industrial sectors. Therefore, adequately monitoring impact requires a methodology which is able to track these cross-sector linkages;
- In both cases, the value added that was supported by the airports was predominantly in the form of profits rather than labour earnings. Of the two, labour earnings are preferable from a developmental perspective. As such, it may be useful to quantify a breakdown of GVA in future impact assessments in this asset class;

- In both case studies the size of the operational impact was dwarfed by the associated footprint of tourists—this trend is likely to hold in most cases although we think the discrepancy was exaggerated by structural factors in the two case studies;
- Airports contribute to international goods trade directly via the transport of air freight. However, this research has demonstrated that the extent to which they facilitate international passenger movements can also indirectly support goods trade; and
- Benefits via the tradable and tourism sectors from airport investments result from the boost that they can provide to connectivity. An airport's connectivity will only be directly affected by an investment that lifts a binding passenger-handling capacity constraint. Therefore, an alternative methodological framework (to that used here) would be better suited to evaluate the impact of a non-capacity related investment.

A set of fully developed recommendations is provided in chapter 7 of this report. Here, we provided a summary of the major points:

- The current monitoring programme offered by the Development Outcome Tracking System (DOTS) should be enhanced to include a wider set of impact channels. This study has highlighted that airports contribute to economic activity via a wide range of channels, some of which are not included in the current monitoring framework. It is not realistic to expect that all these channels should be included in any expanded monitoring framework but it is our view that the existing system restricts itself to an unnecessarily narrow lens;
- The methodological framework adopted to assess the impact of an IFC airport investment should be tailored, based on the type of project that was financed and to account for the structure of the host economy and other contextual factors. For example, the methodology employed in this study is better suited to assessing the impact of a capacity enhancing investment (MBJ). Moreover, in both case studies, the impact of the airports via tourism was found to be substantial, reflecting the tourism-centric nature of both locations; and
- The culmination of this project will see the development of a tool which will help IFC to estimate ex-ante how their investments will affect the future economic impact of the airport—it is important that this tool continues to evolve as more evidence is gathered about the impact of IFC's airport investments.

1. INTRODUCTION

The International Finance Corporation (IFC), a member of the World Bank Group, is the largest global development institution focused exclusively on providing financial support to the private sector in developing countries, which it does through loans, venture capital and equity. Alongside this financial support, IFC uses it expertise to provide advice in areas such as environmental sustainability, corporate governance and public-private partnerships.

A central plank of IFC's investment portfolio is infrastructure, where its investments, typically in fast-growing cities, help meet expanding demand for power, utilities and transport. Often its investments take the form of public-private partnerships. The developmental footprint of these projects is substantial in terms of what they deliver and the difference they make to ordinary lives. In 2014, IFC-financed investments supplied power to just shy of 100 million customers and water to over 23 million people and it is estimated that the infrastructure clients it invested in together supported 280,000 jobs worldwide in that same year.[7]

Within IFC's infrastructure portfolio, airports represent a vital asset class. In 2014, more than 17 million passengers, all over the developing world, had travelled through airports that had been the beneficiaries of IFC support, comprising both greenfield developments and upgrades to existing facilities.[8]

Given the prominence of airports as an investment class for IFC, understanding how its investments make a difference to host economies is crucial. IFC's existing framework—the Development Outcome Tracking System (DOTS)—that monitors investment performance, effectively tracks the financial return on investments but contains relatively little detail on any given project's economic impact. In this light, IFC commissioned Oxford Economics to explore how the organisation can more effectively evaluate the economic impact of its investments.

The report does this by establishing a best practice approach to economic impact analysis for airports, which is then applied to two airports in which IFC has previously invested: Montego Bay Airport (MBJ) in Jamaica and Punta Cana Airport (PUJ) in the Dominican Republic. The economic impact of these airports during the latest calendar year (2015) has been quantified with a particular focus on effects via tourism and trade—two stated priority areas for the relevant IFC working group. This economic impact methodology is complemented by a qualitative assessment—drawing on insights and information gathered during a field trip to each location and a desk-based review of available evidence—of what IFC's investment meant for each airport. By association it explores the role that IFC has played in driving the observed economic impact attributable to each of the airports examined.

[7] "Infrasture overview: IFC", in *IFC website* <http://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/Infrastructure> [accessed 2016]
[8] Ibid.

2. PROJECT CONTEXT

This chapter sets the scene for the rest of the report providing detail on the project including its background and objectives and outlining a methodological framework for our quantitative analysis.

2.1 OVERARCHING OBJECTIVES

As touched on in the introduction, for IFC the project has three key purposes:

(1) to inform the organisation about methods to accurately measure and track the economic impact of airports;
(2) to evaluate the effect of its investments in two case study airports in the Dominican Republic and Jamaica; and
(3) to develop a tool which will help IFC to estimate ex-ante how its investments will support a change in the economic footprint of the airport.

2.2 IDENTIFYING THE ECONOMIC IMPACT OF AN AIRPORT

The channels, through which airports contribute to economic activity, can be categorised broadly into what are known in the economic impact literature as 'core' and 'catalytic' effects. Airports are often substantial business hubs in their own right with significant numbers employed on-site. Within a standard impact approach, this is known as the direct impact and forms one part of an airport's core impact. On top of this are the supply chain and consumer spending effects that flow from that direct impact (see box overleaf for an overview of economic impact analysis).

The 'catalytic' effects of an airport, by contrast, go far beyond the 'core' operational footprint. They represent the wider benefits to governments, consumers, society and industries, resulting indirectly from the movement of passengers and cargo. By connecting people and businesses to different markets, airports help to facilitate a wide range of economic activity in the local and global economy: from enabling business interaction to stimulating foreign investment, and encouraging trade and tourism. Ultimately, these inter-related 'catalytic' benefits act to boost the productivity of an economy and hence GDP. One of the most important observable outcomes of this greater 'connectivity' is the tourism that is facilitated by the presence or development of an airport.

Air transport lies at the heart of international tourism and business travel and airports provide the gateways through which people and cargo move across borders, expanding the possibilities of world travel for tourists and business travellers alike. Without strong air transport infrastructure, for example, it is likely that many of the international visitors that have visited either Jamaica or the Dominican Republic would not have come. The spending of the 1.7 million international visitors landing at MBJ in Jamaica, for example, will leave a considerable economic footprint. This is likely to be of central importance to tourism-centric economies such as those in which IFC has invested and which can be quantified to give a measure of tourism impact that has been enabled.

A similar assessment is possible in relation to the role an airport plays in increasing the ease of trade and encouraging Foreign Direct Investment (FDI) with potential knock-on implications for trend productivity. Despite the rise of mediums for virtual communication, business relationships are still often underpinned by face-to-face contact. International travel helps firms to foster relationships between a firm and its customers and suppliers. Moreover, better connectivity provides a competitive advantage to locations in terms of the receipt of inward FDI.

Fig. 3. Core and catalytic effects of airports

Core
Direct operational impact of the airport on-site.
Indirect activity supported via the airport's domestic supply chain expenditure.
Induced activity sustained via wage spending by the airport's employees and those employed in its supply chains.
Catalytic
Activity supported by the spending of tourists who arrive via the airport, and associated indirect and induced effects.
The airport's direct role in facilitating international trade in goods via air freight.
Other (non-tourism) trade effects enabled by the airport's contribution to the economy's connectivity.

2.3 DEVELOPING A THEORY OF CHANGE

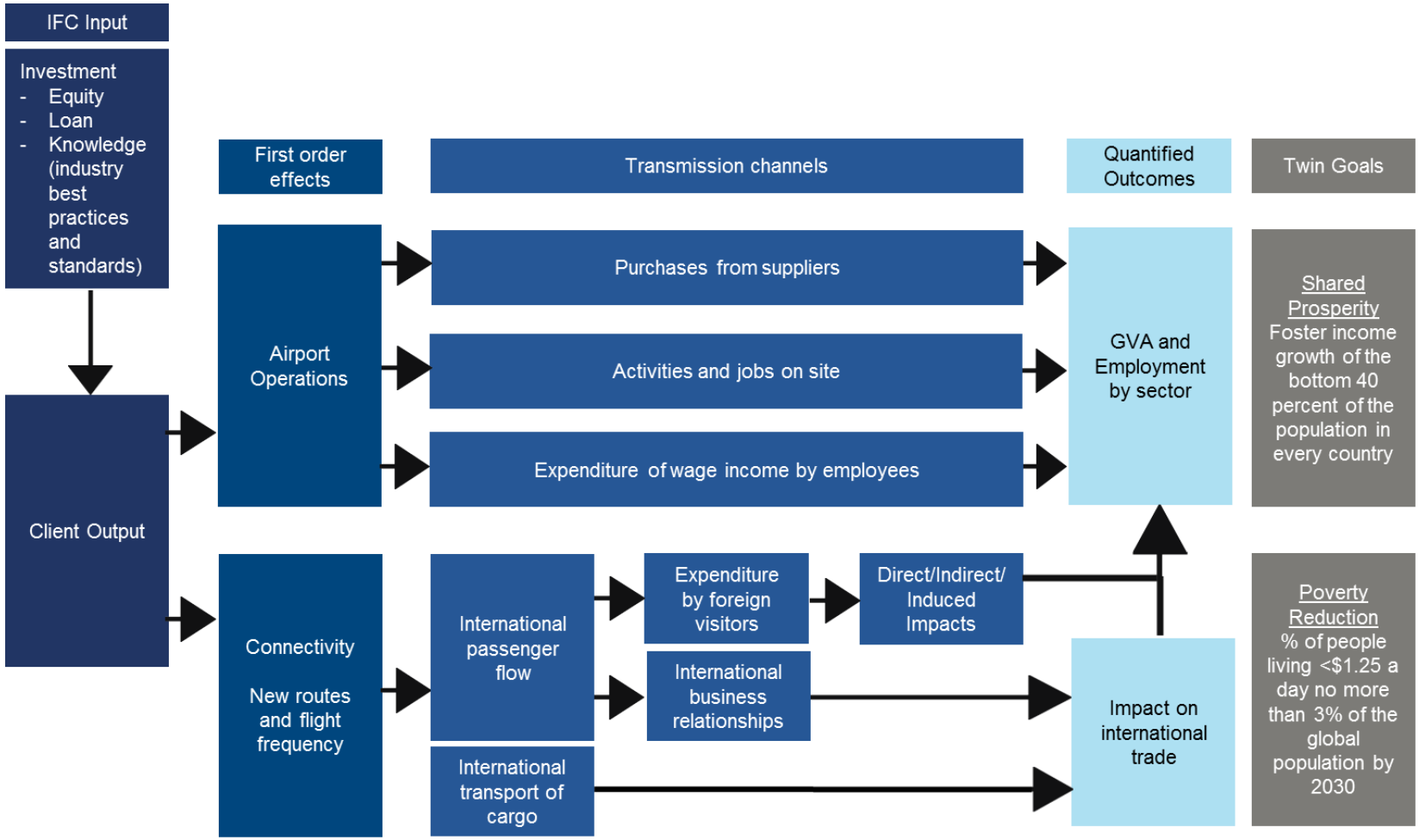
As a starting point, Oxford Economics worked with IFC to develop a Theory of Change (ToC) model for IFC's investments in airports (Fig. 4) that would take into account the channels identified in section 2.2. This illustrates the channels through which IFC might expect their investments to support economic activity and thereby furthering the World Bank Group's twin goals of boosting shared prosperity and poverty reduction.

For the purposes of this study, our unit of analysis covers both the business activities of the airport operator and the wider effects, which are supported by the airport's role in facilitating international passenger travel. This represents a fairly broad definition but is consistent with much of the previous literature on the economic impact of airports.[9]

Further associated channels of impact were identified as part of a methodological review but were excluded for a variety of reasons. These included the activity on-site which does not form part of the airport's direct footprint, notably in retail and food and beverage stores. Given that the vast majority of arrivals at both airports are non-residents, most of the jobs and value added generated via this channel will be picked up in the tourism model. In addition, the revenues earned by domestic airlines on routes involving the airport have been excluded. The extra stakeholder engagement required to gather data to support this estimate was judged to not be feasible within the time constraints of the field trips.

[9] Appendix 6 in this report contains a description of some past studies which attest to this point.

Fig. 4. Theory of change model for airports



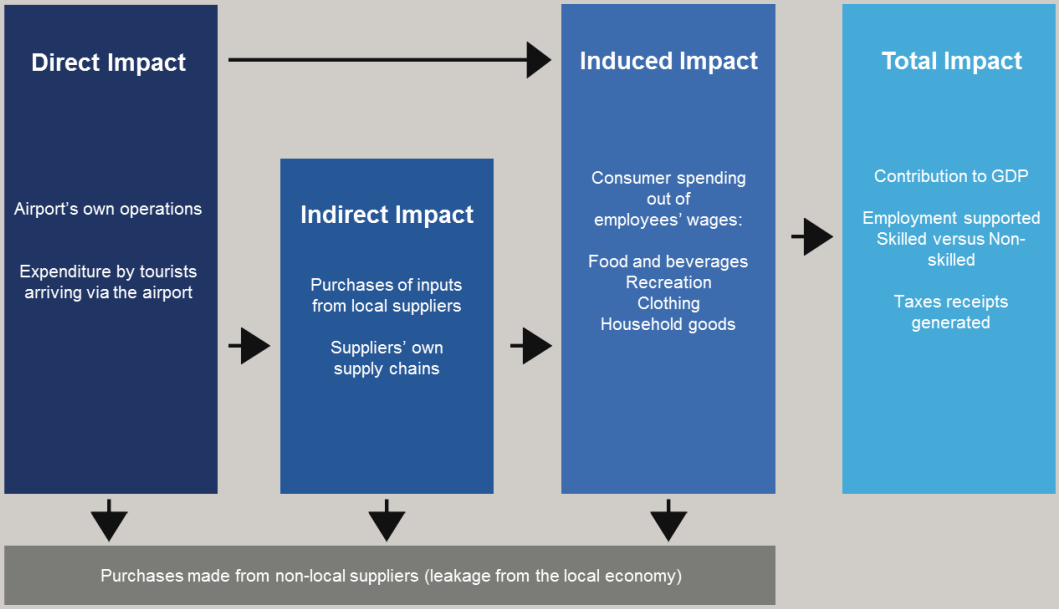
2.4 INTRODUCTION TO ECONOMIC IMPACT ANALYSIS

Our modelling of the economic impact of the new development was completed using a conventional economic impact framework. This framework measures the level of economic value supported by a project in terms of three distinct channels as outlined below:

- The first channel of impact is the **direct** effect. This is the economic activity generated by the direct unit of analysis—so, in this context, either the airport's operations or the expenditure of tourists that arrive via the airport;
- The second channel of impact is the **indirect** effect, which is the employment and activity which is stimulated along the supply chain, as a result of the direct unit of analysis' purchases of inputs of goods and services from domestic suppliers; and
- The final channel, known as the **induced** effect, captures the economic activity supported by staff and those employed in direct supply chains spending their wages on goods and services in the domestic economy.

This framework enables the modeller to quantify the economic impact in terms of both Gross Value Added (GVA)[10] and headcount employment. In addition, a secondary tax model was developed using the results from the main model and information on the tax structure of the domestic economy during 2015.

Fig. 5. The channels of economic impact



2.5 OVERALL METHODOLOGICAL APPROACH

The approach to economic impact measurement adopted in this study was agreed following an extensive review of competing methodologies. During the first phase of this project Oxford Economics produced an inception

[10] GVA is an accounting term used by economists and statisticians to measure the economic contribution of a sector or an organisation to the economy's GDP.

report which included a detailed review of three alternative methodologies for measuring economic impact: Input-Output (I-O) modelling; Social Accounting Matrix (SAM) modelling; and Computable General Equilibrium (CGE) modelling. Overall, it was judged that SAM modelling represented the optimal approach given budget constraints. Appendix 7 of this report contains a discussion of findings from the literature review. Further theoretical background on SAM modelling is provided in the box at the end of this chapter.[11]

Model development and shock calibration were underpinned by an extensive data gathering exercise including a field trip to each location. In order to support model development and to robustly calibrate shocks, a comprehensive data collection exercise was undertaken. Initially, this was done via a web-based search of resources published by relevant statistics-collecting organisations. This was supplemented by a week-long field trip to each location during which meetings were held with organisations responsible for relevant data publication and the with different stakeholders at each airport.

It was necessary to adopt a mixed methods approach to explore all of IFC's questions of interest. SAM modelling was used to quantify the economic impact of the airport's operations and the impact of tourist's expenditure in the wider economy. On the other hand, a SAM model's framework is not suited to understanding wider effects on (non-tourist) international trade via connectivity. These were quantified via a gravity model equation which explains observed changes in bi-lateral trade based on a set of explanatory variables including GDP, population, shared language, distance and, in this instance, air connectivity.[12]

Finally an assessment of the role of IFC's investments was undertaken on the basis of a qualitative review of evidence collected as part of a desk-based review and during the field trip. In our view, accurately establishing causation using the type of econometric work required to produce a quantitative estimate of the impact of each investment would be extremely challenging. Instead, drawing on evidence gathered during the respective field trips and a desk-based review of available data, we have produced a qualitative assessment. This includes a commentary on how the investments have contributed to current operational performance and analysis of how the operational performance of the airports has evolved since the investments.

As part of this qualitative review an attribution rule was established, which related a fraction of the airport's current economic footprint to IFC's investment based on the extent to which the investment relieved a binding capacity constraint. In the case that an investment enhances the capacity of an airport, and passenger flow subsequently exceeds this capacity, the associated additional economic activity that results—via operations, tourism

[11] Additional more technical information specific to the models developed in this project can be found in Appendix 1.

[12] Connectivity was measured by the level of non-visitor arrivals by country of origin (on a residency basis). Although it is also possible to measure connectivity on the basis of routes data this would have been problematic in the context of a gravity model as direct aviation routes do not exist between each host economy and a number of their trading partners. Further detail on the derivation of the gravity model is contained in Appendix 2.

and trade—was enabled by the project.[13] This rule was applied in the two case studies.

[13] Further detail on this approach is contained in Appendix 4.

2.6 INTRODUCTION TO A SAM MODEL

A SAM is comprehensive in the sense that it captures all types of activity undertaken in an economy (consumption, production, accumulation and distribution).[14] In addition, it is generally accepted that for a SAM to truly deserve the label 'social' it needs to contain some detail on distributional features of the household sector.[15]

A SAM is laid out in a square matrix format with each row and column representing an 'account'.[16] It is built on the principle of double-entry accounting so that the sum of each row and column must equal and by implication that total revenue equals total expenditure.

Fig. 6. Structure of a SAM[17]

		Activities C1	Commodities C2	Factors C3	Households C4	Government C5	Savings and investment C6	Rest of world C7	Total
		Expenditure columns							
Activities R1	Income rows		Domestic supply						Activity income
Commodities R2		Intermediate demand			Consumption spending (C)	Recurrent spending (G)	Investment demand (I)	Export earnings (E)	Total demand
Factors R3		Value-added							Total factor income
Households R4				Factor payments to households		Social transfers		Foreign remittances	Total household income
Government R5			Sales taxes and import tariffs		Direct taxes			Foreign grants and loans	Government income
Savings and investment R6					Private savings	Fiscal surplus		Current account balance	Total savings
Rest of world R7			Import payments (M)						Foreign exchange outflow
Total		Gross output	Total supply	Total factor spending	Total household spending	Government expenditure	Total investment spending	Foreign exchange inflow	

[14] J Round, "Social Accounting Matrices and SAM-based Multiplier Analysis," in *Techniques for Evaluating the Poverty Impact of Economic Policies* ([n.p]: World Bank and Oxford University Press, 2003), Chapter 14.
[15] Ibid.
[16] C, Thomas, M and Thurlow, J Breisinger, *Social Accounting Matricies and Mutliplier Analysis: An introduction with exercises* ([n.p]: International Food Policy Research Institute, 2010).
[17] Ibid.

Similar to an I-O model, the SAM framework enables an analogous multiplier analysis to be carried out, with the user able to quantify the total change in demand supported by a one unit increase in industry output. These multipliers will provide a slightly more complete treatment of the circular flow of income so that all income (including profits) receipts are recycled into final demand. As a result a SAM type II multiplier will be higher than its equivalent from an I-O model.[18] However, analysis has demonstrated that the difference compared to an I-O approach is unlikely to be substantial.[19]

Although a SAM model does provide a means to comprehensively track expenditure flows through the economy following a demand-side shock it is premised on a number of simplifying assumptions documented below:

- **Constant returns to scale**: it is assumed that the quantity of inputs used is directly proportionate to the level of output produced;
- **Fixed input structure**: it is assumed that firms in each sector do not vary the mixture of inputs used including between domestically-produced and imported goods and services;
- **No capacity constraints**: the supply of factors of production (land, labour and capital) is essentially assumed to be unlimited so that any increase in demand can immediately met by an increase in supply; and
- **Fixed prices**: prices of all goods, services and factors of production are assumed to remain unchanged.

2.7 STRUCTURE OF THIS DOCUMENT

The remainder of this document presents the results of our economic analysis and evaluates the specific role of IFC's investments in this context. The chapter structure is as follows:

- Chapter 3 outlines the results from our economic impact analysis for the MBJ case study and discusses the role of IFC's investments in each case;
- Chapter 4 contains similar analysis for the PUJ case study;
- Chapter 5 concludes by summarising the major findings from both case studies;
- Chapter 6 sets out the lessons learned for IFC about both investments;
- Chapter 7 presents a set of recommendations for future airport investments in the light of the content in this report; and
- Appendices 1-8 provide further detail on areas such as the methodological approach, economic modelling results and the field trip itineraries.

[18] This rests on the assumption that the I-O model that has been developed uses the compensation of employees' row from the I-O table to represent household income. An alternative method would be to use GVA instead but this can lead to a significant overstatement of the true type II multiplier.

[19] For example see D and Wyeth, P Holland, "SAM Multipliers: Their Decomposition, Interpretation and Relationship to Input-Output Multipliers" (Research Bulletin, Washington State University, 1993).

3. THE IMPACT OF IFC'S INVESTMENT AT MBJ, JAMAICA

In this chapter we explore how investments that were part-financed by IFC at MBJ contributed to economic activity in the Jamaican economy during 2015 across the channels outlined in chapter two.

3.1 INVESTMENT BACKGROUND

In April 2003 the Government of Jamaica granted a concession license to Montego Bay Airports Limited (MBA) following a competitive bidding process. The concession grants MBA exclusive rights to provide core airport services under the supervision of the Jamaica Civil Aviation Authority. In return, the agreement requires MBA to pay a revenue-related concession fee to the Airports Authority of Jamaica (AAJ). AAJ continues to monitor MBJ's performance with ad-hoc reviews focusing on customer service performance, compliance with environmental obligations and adequate spending on maintenance and upkeep.

Under the terms of the concession agreement granted by the Government, MBJ was required to make a number of investments in upgrading airport facilities, all of which have been part-financed by IFC. These investments were separated into three phases with an additional project supported by IFC in 2007 as described in Fig. 7. Overall, the investments have supported substantive improvements to landside and airside facilities. A new concourse was constructed significantly expanding the airport's offer in terms of retail and food and beverage amenities. Other investments have modernised check-in and baggage handling facilities, helping to improve customer experience. In this section, we do not seek to assess the marginal contribution of individual investments and simply focus on their effect in aggregate.

Fig. 7. Overview of IFC's investments in MBJ

IFC financial support	Investment timeline	Short description
A loan of up to US $20 million for IFC's own account.	2004-2006	Led to the development of the existing apron and the renovation of existing on-site buildings.
A loan of up to US $25 million for IFC's own account.	2004-2006	Construction of a new airside building, the installation of 11 new passenger bridges and a new apron.
A loan of up to US $21 million for IFC's own account and a B loan of up to US $21 million for MBA's account.	2006-2008	Provided for the construction of a new landside terminal facility and the renovation of the existing landside terminal to provide additional arrival, baggage claim and customs facilities, departure lounges, retail concessions and food courts.
A loan of up to US $5 million for IFC's own account	2007-2008	Upgrades of existing Common Use Terminal Equipment (CUTE) and Baggage Handling and Screening (BHS) systems. The CUTE system includes electronic check-in terminals, gate podiums and systems for monitoring and reconciling checked bags moving through the airport. The BHS systems covered baggage processing and screening equipment facilitating a more efficient check-in experience.

Source: IFC

IFC's role in the process went well beyond simply providing the finance, to helping to design the concession agreement framework. Interview evidence collected during the field trip revealed that IFC had helped to shape the design of the initial concession agreement, drawing on its expertise in such arrangements. IFC also helped to ensure that suitable policies with regard to environmental sustainability were implemented and provided technical advice on engineering design issues.

3.2 HOW THE INVESTMENTS HAVE AFFECTED OPERATIONS

The stream of investments that has been implemented since privatisation has significantly increased the airport's capacity, albeit that much of this is currently not used. Interview feedback from the field trip suggested that, in aggregate, the investments have helped to treble the airport's capacity. A relatively modest share of this increase in capacity enabled by the investments is currently being utilised.

The modernisation of the airport has helped to improve the customer experience by significantly cutting down on waiting times. The Common Use Terminal Equipment (CUTE) and the Baggage Handling System (BHS) systems introduced following the completion of IFC's latest investment have increased the number of check-in desks available to passengers and helped to reduce waiting times for check-in. The airport has begun to track customer experience ratings via a passenger survey. However, insufficient time series data is available to inform a judgement about the impact of the investments in this context.

The new concourse has significantly expanded the airport's capacity to provide amenity services to passengers. The expansion of the airside facilities, including the new terminal building, has significantly increased the airport's offer to passengers in terms of amenities such as food and beverage and retail outlets. Greater choice is likely to have improved customers' experiences in the airport whilst waiting for departures.

3.3 OPERATIONAL PERFORMANCE SINCE THE INVESTMENTS

The trend in revenues and profits analysed in the study is consistent with the investments helping to support a substantial increase in operational efficiency at MBJ. Revenue per US $ of labour compensation has more than doubled since 2005 in real terms, indicating that there has been a significant improvement in the operational efficiency at the airport over the past ten years. Such a trend is likely to be partially attributable to IFC investments particularly those that financed efficiency-enhancing machinery and equipment. The new capital equipment may have led to a displacement of labour, helping MBJ to boost efficiency and increase margins.

3.4 OPERATIONAL IMPACT OF THE AIRPORT

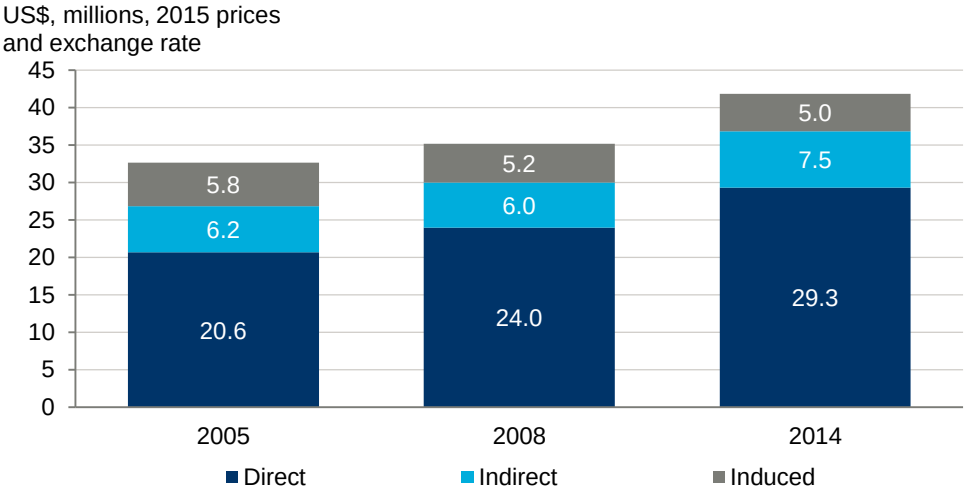
As set out in chapter two, we are able to quantify the economic impact of the airport as a whole on Jamaica's economy, in terms of GDP, employment and taxes. The effects are set out in some detail below, and broken down by direct, indirect (supply chain) and induced (consumer spending) channels of impact. We begin by providing a high-level overview of how the airport's operational

impact has evolved since IFC's initial investments before providing a more detailed assessment of MBJ's operational footprint as of 2015.[20]

3.4.1 MBJ's operational impact from 2005-2014

Since 2005, MBJ's total contribution to Jamaican GDP has increased significantly, driven by activity on-site. Between 2005 and 2014 MBJ's total contribution to GDP increased by almost 30 percent in real terms. This growth was overwhelmingly driven by the increased value of activity on-site with the combined GVA from indirect and induced effects rising by just over five percent during this period. MBJ's direct contribution to Jamaican GDP spiked dramatically in 2008—the point at which IFC's investment programme was completed. Given that total passenger flow through MBJ actually fell in 2008, this trend reflects a significant improvement in the operational efficiency at MBJ, as discussed in the previous section. As a share of economy GDP, MBJ's footprint has increased from 0.17 percent in 2005 to 0.25 percent in 2014.

Fig. 8. MBJ's total contribution to GDP over time



Source: Oxford Economics, MBJ

MBJ's indirect contribution to GDP has risen steadily over time reflecting increases in its procurement budget. In real terms, total procurement expenditure by MBJ increased by just over 20 percent between 2005 and 2014. This increase in the volume of total purchases is likely to have resulted in an increase in the airport's indirect contribution to GDP. Assuming that procurement patterns were similar to those seen in 2015, we estimate that MBJ's indirect impact on GDP has grown by just over two percent per year since 2005.

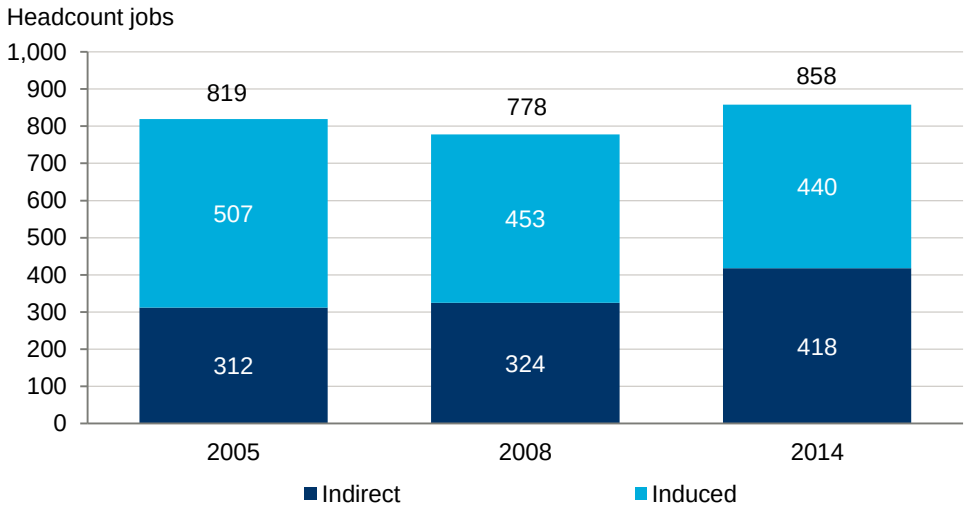
In contrast, a fall in the level of direct employee compensation implies that the level of induced GVA has likely contracted since 2005. We estimate that MBJ's induced contribution to GDP fell by almost 13 percent in real terms between 2005 and 2014. The decline reflects lower compensation of employees on-site. Although MBJ do not keep a historical record of headcount

[20] Figures on the year-by-year economic impact of MBJ during this historical period can be found in Appendix 3.

employment, such a strong decrease implies that the number of jobs at MBJ has fallen considerably since 2005.

Employment supported by multiplier effects has grown at a very modest rate since 2005. Overall, the number of jobs sustained via indirect and induced effects increased by just under five percent between 2005 to 2014, equivalent to an annual growth rate of just 0.5 percent. Jobs supported via the airport's supply chain expenditure have increased at a much faster rate reflecting the steady increase in MBJ's real procurement expenditure during this period. However, this was partially offset by a fall in the number of jobs estimated to be supported by the induced impact of MBJ's operations driven by the decline in real compensation of direct employees.

Fig. 9. Employment supported by MBJ via indirect and induced effects, 2005-2014

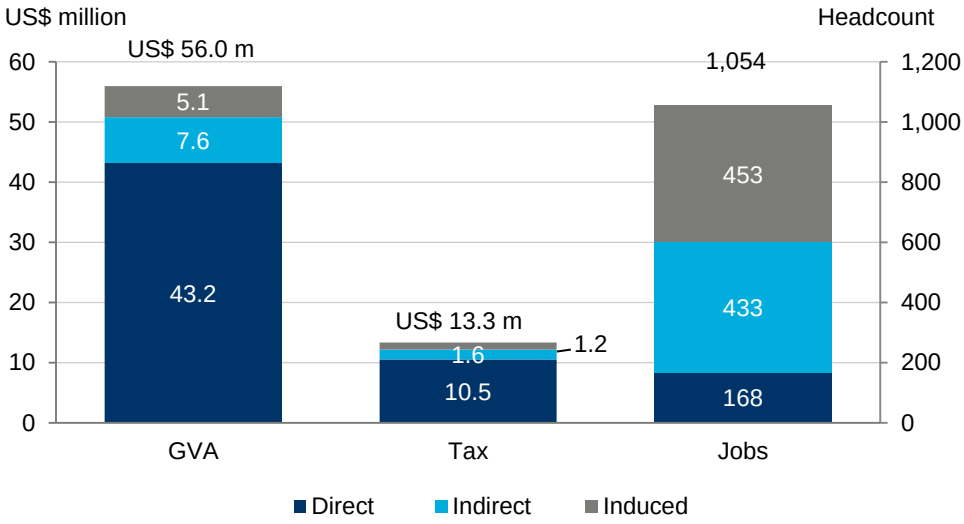


Source: Oxford Economics

3.4.2 MBJ's impact in 2015

In 2015 MBJ made a total value added contribution of US $56.0 million to Jamaica's GDP. This was sufficient to support 1,054 jobs and US $13.3 million in tax revenues. As the chart below shows, the majority of the GVA and tax contributions were accounted for by the airport's own (direct) activity, with more modest impacts due to knock-on effects via the indirect and induced channels. However, due to the high productivity of airport-based activities, relative to the rest of the island's economy, the direct provision of jobs is comparatively modest, while the indirect and induced employment effects make more significant contributions to the 1,054 total jobs impact.

Fig. 10. The operational impact of MBJ

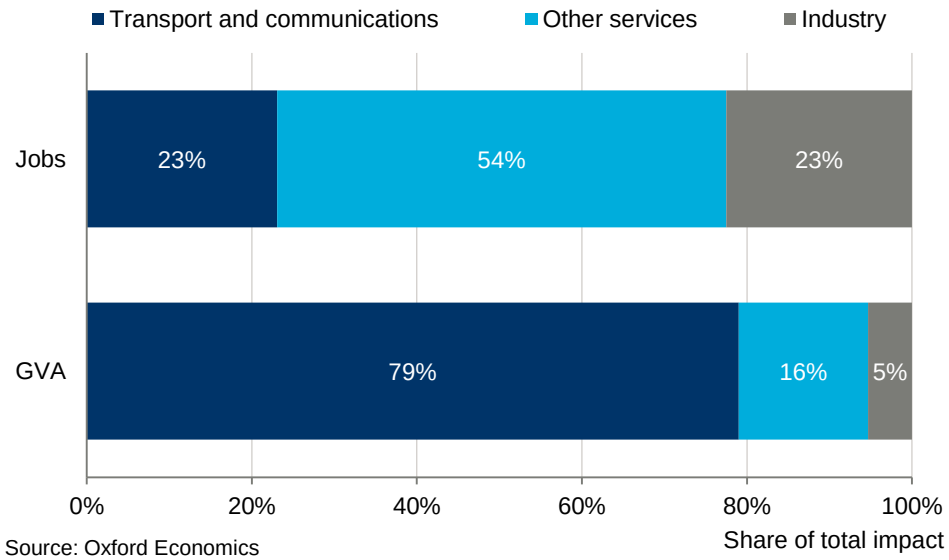


Source: Oxford Economics

The airport's total contribution to GVA accounts for around 0.45 percent of the Jamaica's economy-wide GVA, while its total contribution to employment accounts for around 0.10 percent of whole economy employment.

The GVA supported by MBJ's operations was highly concentrated in the transport and communications sector but the associated employment was spread much more broadly across the Jamaican economy. Reflecting the high concentration of GVA on-site, almost four-fifths of total value added was sustained in the transport and communications sector. In contrast, over three-quarters of all jobs supported were located in other sectors of the economy, most notably business services, distribution (retail and wholesale trade) and agriculture. Further detail on the sectoral composition of GVA and employment is provided in subsequent sub-sections of this chapter with a full breakdown available in Appendix 3.

Fig. 11. Sectoral breakdown of MBJ's total GVA and employment impact



Source: Oxford Economics

3.4.3 The indirect impact of MBJ in 2015

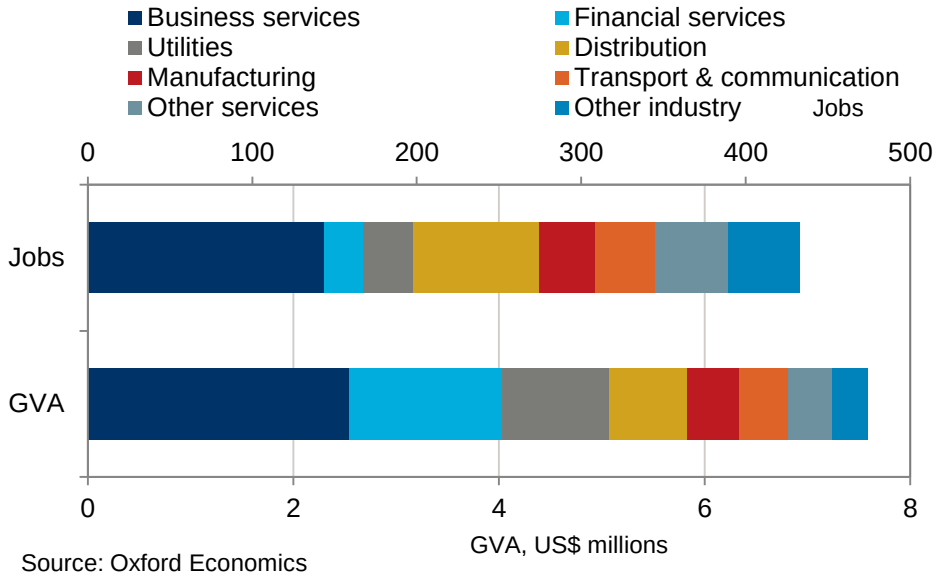
Around 45 percent of MBJ purchases went to firms based in Jamaica in the first instance, supporting GVA and jobs in the local supply chain.

This local procurement is estimated to have supported US $7.6 million of GVA in the Jamaican supply chain. Procurement expenditure by MBJ is estimated to have sustained US $7.6 million of GVA, with the remaining amount reflecting content that is ultimately imported. Indirect GVA is spread more evenly across the industrial sectors than the airport's own purchases from the 'first round' of suppliers, reflecting, amongst other things, the comparatively high share of imports in locally-sourced energy supplies. As a consequence, the energy and water supply sector accounts for some 13 percent of indirect GVA, compared with 41 percent of the airport's domestic procurement bill. By contrast, construction activity accounts for 3.5 percent of indirect GVA, compared with just 0.3 percent of the airport's domestic procurement.

Although indirect GVA is modest compared with MBJ's direct value added, it supports more jobs—some 433—as a result of relative productivity effects. The average productivity of jobs supported by the airport's supply chain was around US $17,400. Although this is still some 50 percent above the national average, it is considerably lower than that of the airport's directly-employed staff. The implication of this is that the indirect employment impact (433) was over 2.5 times as large as the direct employment impact (168), despite the fact that indirect GVA was considerably smaller than direct GVA.

Indirect employment is relatively more concentrated in lower-productivity sectors where a given level of GVA sustains more jobs. The pattern of indirect employment differs from that of indirect GVA, reflecting significant productivity variation between the sectors as illustrated by Fig. 12. For example, financial services account for just six percent of indirect jobs, compared with 19 percent of indirect GVA, while distribution accounts for almost one-fifth of all indirect jobs despite receiving only one-tenth of indirect GVA.

Fig. 12. Sectoral split of indirect GVA and employment

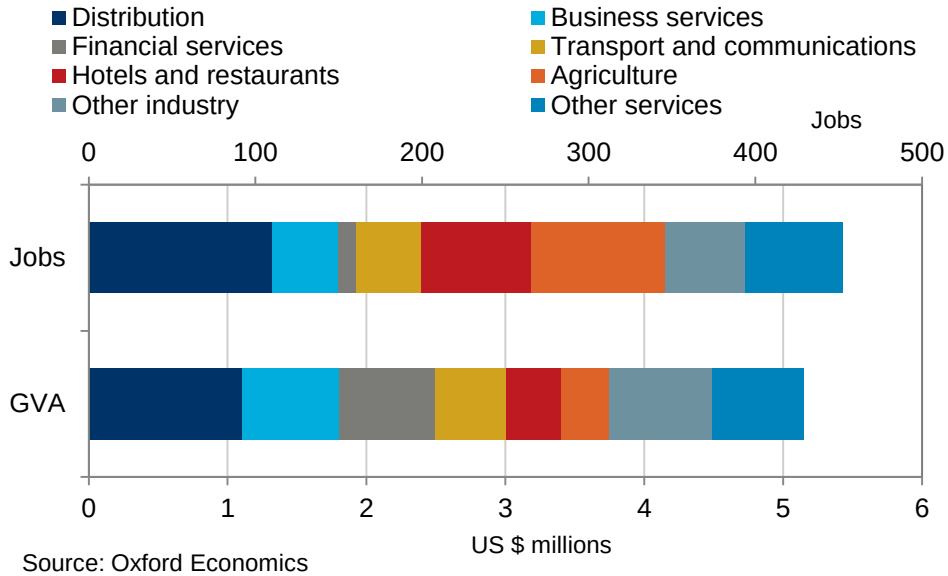


Source: Oxford Economics

3.4.4 The induced impact of MBJ in 2015

Induced GVA of US $5.1 million supported 453 jobs in 2015, with the pattern of activity rather different to that found in the airport's supply chain. Induced GVA—associated with the spending of employees—was US $5.1 million in 2015. The majority of this activity was sustained in the service sector, reflecting the pattern Jamaican consumer expenditure. However, the agricultural and manufacturing sectors did benefit as the ultimate suppliers of goods that these consumers purchased from retailers. In total, this activity supported 453 jobs across the Jamaican economy. Again, there are some notable differences between the sectoral distribution of induced GVA and employment. Almost one-third of induced jobs were supported in the agriculture and hotels and restaurants sector compared to just 15 percent of induced GVA. In contrast, just 24 jobs (two percent) were supported in the financial services industry despite the sector generating 13 percent of total induced value added.

Fig. 13. Sectoral split of induced GVA and employment



Source: Oxford Economics

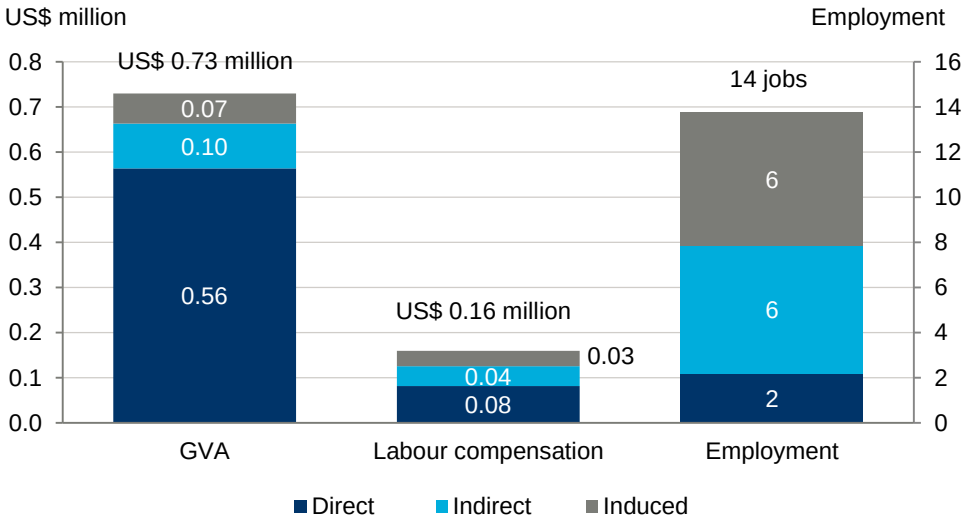
3.4.5 Multiplier analysis

Each US $1 million of revenue generated by MBJ in 2015 supported US $0.73 million in GVA, US $0.16 million in labour compensation and 14 jobs across the economy of Jamaica. A common method to assess the strength of an organisation or sector's linkages to the wider economy. In this report, we present output 'effects' which quantify how each US $1 million of output (or revenue) supports economic activity across the economy inclusive of direct, indirect and induced effects. At MBJ in 2015, our analysis indicates a GVA effect of US $0.73 million and an employment effect of 14 jobs. Both figures are relatively low which reflects a number of factors including:

(1) A relatively high share of procurement expenditure was imported (56 percent)—this naturally diminishes the relative size of the indirect impact;
(2) A high proportion of direct GVA was generated via profits rather than employee compensation—this naturally diminishes the relative size of the induced impact; and
(3) As noted, the airport is an extremely productive organisation—as measured by GVA per worker—relative to the rest of the economy. As over three-quarters of GVA is sustained at the airport this significantly limits the size of the employment effect.

From a developmental perspective it is notable that a low proportion of this GVA was in the form of employee compensation. Fig. 14 also illustrates that the labour compensation effect is substantially lower than the GVA effect. This largely reflects the very high share of profits in direct GVA. Since capital is more mobile than labour, there is a higher chance that this value will shift out of the country e.g. via the repatriation of profits by a Multi-National Corporation. Therefore, the size of the labour compensation effect was disappointing from a developmental perspective.

Fig. 14. GVA and employment effects of MBJ in 2015



Source: Oxford Economics

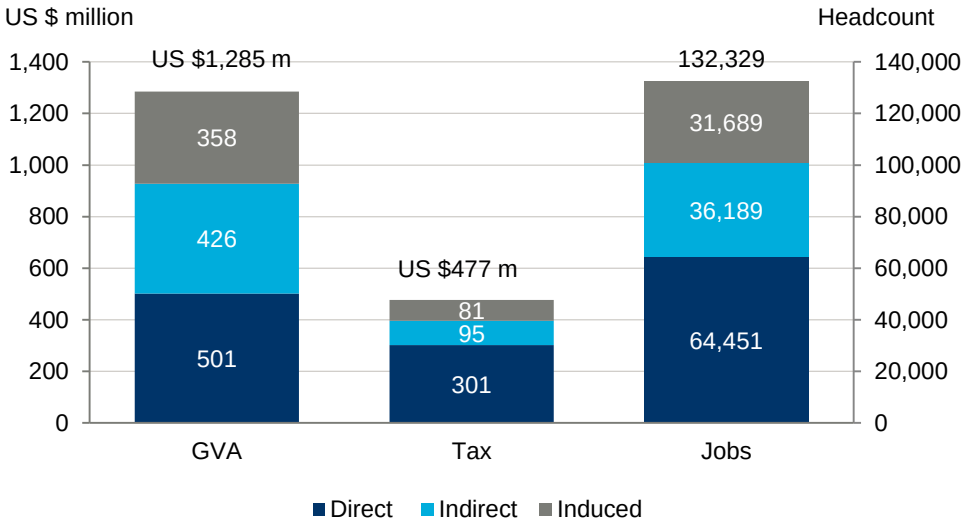
3.4.6 Tax revenue

In 2015, the total tax contribution is estimated to have been US $13.3 million, with well over half of this accounted for by the airport's own company income tax bill. Economic activity in the airport directly and through the indirect and induced channels also generates fiscal benefits for the government, contributing to public service provision. The total tax contribution takes into account the main taxes on business income and spending, and on employees' income and spending.

3.5 TOURISM IMPACT

Tourists arriving at MBJ generated almost US $1.3 billion in GVA in 2015, supporting 132,000 jobs and US $477 million of tax revenues. Taking into account the direct, indirect and induced channels, the total contribution to Jamaican GVA of international tourists arriving at the airport, as a result of their expenditure while on the island, is estimated to have been US $1.28 billion in 2015, sufficient to support some 132,300 jobs and almost US $477 million in tax revenues. Fig. 15 shows how the indirect and induced channels make a fairly significant contribution to this total, on top of the impact of businesses selling directly to the visitors.

Fig. 15. Total economic contribution of tourists arriving at MBJ



Source: Oxford Economics

These total contributions represented 10.4 percent of whole-economy GVA and 12.2 percent of whole-economy employment respectively. This activity is not directly attributable to MBJ but is enabled by the airport.

3.5.1 Tourist's expenditure patterns in Jamaica

In 2015, 1.7 million tourists entered Jamaica via MBJ, spending an estimated total of US $1.8 billion on goods and services while in the country. In 2015, 1.7 million stopover tourists used MBJ as a gateway to Jamaica. We estimate that around 40 percent (712,000) of these visitors stayed in the Montego Bay area, with the majority of the remainder heading to other major leisure tourist hubs such as Negril and Ocho Rios. Overall, based on average spending patterns in these different locations, we estimate that these visitors spent US $1.8 billion in-country or approximately three-quarters of total inbound tourist spending in 2015.[21]

Fig. 16. Non-resident arrivals at Montego Bay and their spending in 2015

Resort being visited	2015 international arrivals	Spend per visitor (US $)	Estimated total spend (US $ million)
Kingston	17,135	646	11
Mandeville	86,843	1,029	89
Montego Bay	712,008	1,112	792
Negril	407,724	1,162	474
Ocho Rios	272,853	1,133	309
Other Region	23,257	767	18
Port Antonio	6,580	693	5
Runaway Bay	169,529	767	130

[21] Based on Balance of Payments data on travel export revenues published by the IMF.

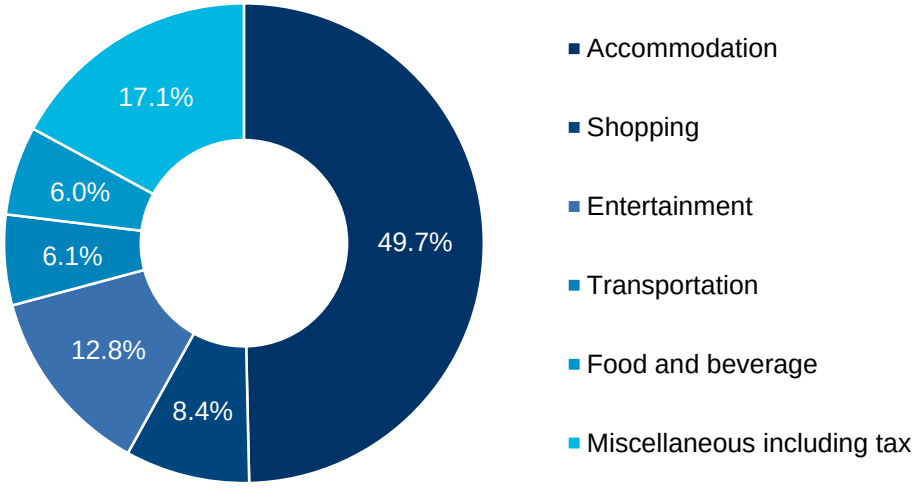
Total	1,695,929		1,828

Source: Jamaica Tourist Board, Oxford Economics analysis

This US $1.8 billion of spending supported activity across a wide range of predominantly service-sector industries. According to survey data, around half of spending by stopover visitors to Jamaica goes on accommodation facilities. Other major categories of expenditure include shopping for souvenirs, clothing etc. which amounted to over US $150 million and spending on transportation services, such as taxis, sailing boats and coaches, at US $230 million.

Fig. 17. Official estimate of the pattern of expenditure by tourist arrivals

Percentage of total tourist spending



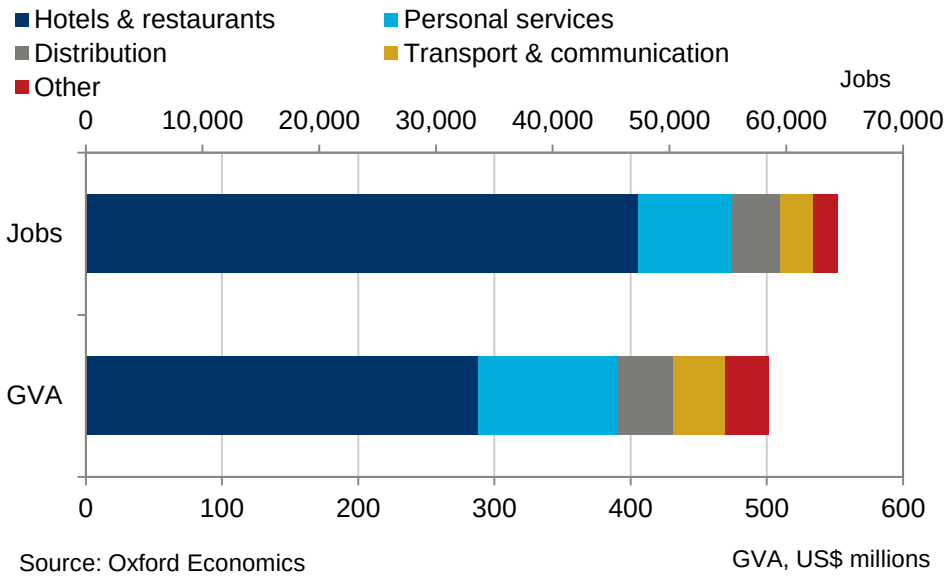
Source: Jamaica Tourist Board

3.5.2 Direct tourism impact

This expenditure created US $501 million in direct value added across tourism-facing industries, most notably the hotels and restaurants sector. Over half of direct value added (US $288 million) was generated in the hotels and restaurants sector, reflecting the concentration of tourist expenditure on accommodation and eating out. Over US $100 million of GVA was also directly sustained in the personal services sector which provides tourists with opportunities to enjoy sporting, cultural and other recreational pursuits. These tourists' expenditure also supported over US $40 million of activity in the transport and distribution sectors.

This GVA was sufficient to support over 64,000 jobs, with employment even more concentrated in hotels and restaurants. Overall, spending by tourists who used MBJ directly sustained over 64,000 jobs of which approximately three-quarters were in the hotels and restaurants industry. The higher concentration of jobs in the sector (relative to its share of direct GVA) reflects the relatively low level of labour productivity.

Fig. 18. Sectoral distribution of direct tourism GVA and jobs



Source: Oxford Economics

3.5.3 Indirect and induced impacts from tourist expenditure

The indirect and induced tourism channels add significantly to the total tourism GVA and jobs impacts. The associated indirect GVA impact is estimated to be worth some US $426 million, with wholesale & retail, finance, business-type services and manufacturing benefiting the most. This is associated with just under 36,200 jobs, with around half of these split between the hotel & restaurant and agricultural sectors. Induced tourism GVA meanwhile is put at US $358 million, benefiting wholesale & retail, business-type services, finance and manufacturing the most. This is associated with around 31,700 jobs, some 40 percent of which were split between the wholesale & retail and agricultural sectors.

Fig. 19. Direct, indirect and induced tourism impacts: GVA and jobs

	Direct	Indirect	Induced	Total
Gross value added (US $ millions)	501	426	358	1,285
Employment	64,451	36,189	31,689	132,329

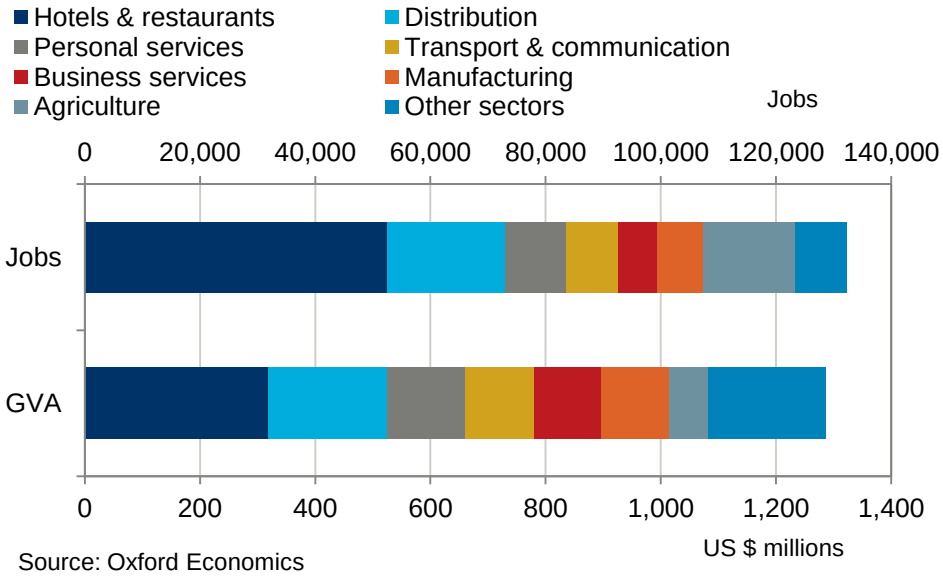
3.5.4 Total tourism impact

In total, tourists that used MBJ supported US $1.3 billion in GVA in 2015 in sectors across the economy. Taking the direct, indirect and induced tourism impacts together, the total tourism impact was US $1.3 billion. The largest beneficiaries of this total value were the traditional tourist-facing industries identified in Fig. 18. However, indirect and induced impacts ensure that total GVA is dispersed across a wide group of sectors—notably both domestic manufacturing and agriculture were found to benefit as suppliers of goods consumed by tourists and those employed via their spending.

This output was found to have supported over 130,000 jobs, of which two-fifths were in the hotels and restaurants sector. In total, over 130,000 jobs

were sustained by the expenditure of tourists passing through MBJ in 2015. 40 percent (52,500) of these were in the hotels and restaurants sector—equivalent to three-fifths of total employment in the industry across Jamaica. Considerable employment impacts were also found in distribution (20,500 jobs) and agriculture (16,000 jobs).

Fig. 20. Total tourism GVA and employment by sector



Source: Oxford Economics

In aggregate, economic activity sustained by MBJ-enabled tourism expenditure raised US $477 million in tax revenue for the Jamaican government. Revenues raised directly from tourists included US $121 million in general consumption and education taxes levied on their expenditure, and US $59 million in departure tax. In addition, US $127 million was raised on the income of companies and workers in the tourist-facing industries and their supply chains, and a further US $185 million from general consumption and education taxes on the spending of these employees. Tariffs on supply chain imports raised a further US $22 million, bringing total tourist-driven revenues to US $616 million.

Fig. 21. Tourism tax impact by channel and type of tax

US $ million	Direct	Indirect	Induced	Total
Departure tax on tourists	59			59
General consumption tax on tourist spending	113			113
Education tax on tourist spending	8			8
Income tax on employees	28	21	18	66
Income tax on company profits	22	22	17	61
General consumption tax on employee spending	54	40	35	128
Education tax on employee spending	8	6	5	18
Duties on imports	9	7	5	22
Total	301	95	81	477

Source: Oxford Economics

3.6 TRADE IMPACT

3.6.1 The impact of MBJ's connectivity on trade

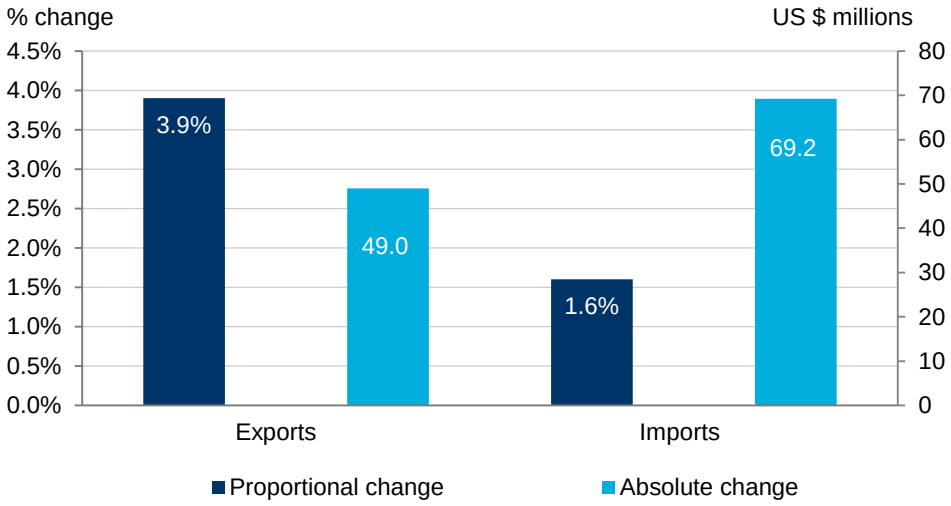
Air connections enhance Jamaica's ability to trade goods internationally via two major channels. Firstly, an airport provides a direct mode through which international trade takes place. This includes cargo that is transported to and from countries in the form of air freight. Secondly, the international movement of people can promote trade via more indirect channels. For example, increased connectivity (and therefore ease of international travel) should enable entrepreneurs to foster relationships with foreign customers and suppliers. The ability to form such business relationships can significantly enhance a country's capacity to trade internationally, a link that was borne out by our econometric modelling of trading patterns in Jamaica.

Our modelling suggests that for each 10 percent increase in connectivity in Jamaica, goods exports rise by 2.1 percent and goods imports by 0.8 percent. This represents the aggregate relationship for all airports across Jamaica—most notably, alongside MBJ, this includes Norman Manley International Airport (KIN) in Kingston which is the country's other major international hub. Intuitively, it would be expected that the effect was stronger for international arrivals at KIN given that the Kingston area represents the principle hub for manufacturing FDI in Jamaica and that most non-resident arrivals at MBJ arrive for leisure purposes. This was, to a certain extent, borne out by qualitative evidence collected during the fieldtrip but discussions with relevant experts also indicated that connectivity at MBJ has facilitated international (non-tourism) trade via a number of channels. For example, representatives at JAMPRO, the country's Trade and Investment Promotion Agency, indicated that they were aware of investments in Jamaica's goods-producing industries which were spurred by an initial leisure trip to the island, albeit that these were typically small-scale. In addition, it is also worth noting that the Montego Bay area has developed a sizeable outsourcing industry in the region's Free Zone. JAMPRO felt that the connectivity provided by MBJ has provided a key competitive advantage for the Montego Bay Free zone. However, it is important to note that the majority of this activity involves the export of (non-tourism) services in sectors such as telecommunications, accountancy and customer relations. These fall outside the scope of the gravity model which focuses solely on explaining patterns in goods trade.

Applying these relationships to the observed increase in non-resident arrivals at MBJ since the completion of IFC's investments implies that international goods trade across Jamaica was 2.1 percent higher (US $118 million) than it would otherwise have been.[22] Drilling down, the export impact was worth some US $49 million (3.9 percent) and the import impact amounted to US $69 million (1.6 percent). However, given the discussion in the preceding paragraph, we consider these figures to be at the top-end of the potential impact.

[22] There is no clear rationale for the application of these results over a specific period. The coefficients estimated refer to the average relationship between connectivity and trade over a 15-year period (2000-2015).

Fig. 22. Impact of MBJ's connectivity on international goods trade in Jamaica since 2008



Source: Oxford Economics

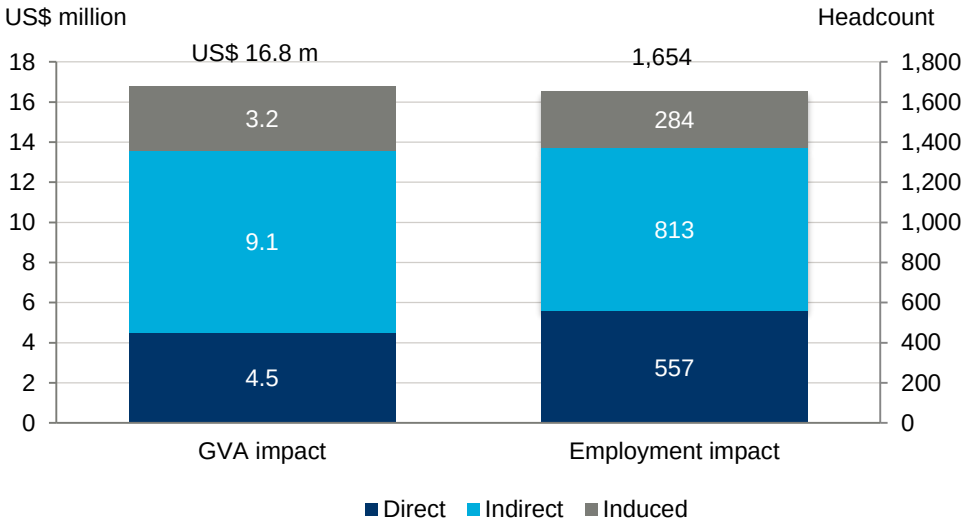
3.6.2 The economic impact of increased trade

The resulting increased level of international trade provided a range of benefits for the Jamaican economy. The estimated increase in exports will have supported economic activity in a similar fashion to that described for the operational and tourism impact of MBJ. Export sales sustain GVA and jobs across the economy via direct, indirect and induced effects. In addition, increased trade (both exports and imports) helps to boost productivity across the economy by enhancing competition and facilitating greater specialisation. Both channels are described in more detail below.

We estimate that additional export sales, associated with higher connectivity, supported US $16.8 million in GVA and over 1,650 jobs. The gravity model does not provide any direct insight into the type of goods exports that are supported via this connectivity effect. However, in order to model the economic footprint of these additional sales we have assumed that the product composition matched the pattern of Jamaican goods exports in 2015.[23] On this basis, the additional exports would have sustained a direct GVA impact of around US $4.5 million, sufficient to support over 550 jobs directly in the exporting industries. Taking into account the indirect and induced channels as well, the total impact of these additional sales in 2015 was to support US $16.8 million of GVA and over 1,650 jobs.

[23] According to data from STATIN, 6 percent of Jamaican goods exports in 2015 were agricultural, 71 percent were produced by the mining and quarrying sector (mainly bauxite and aluminium) and the remaining 22 percent were manufactured goods. Data were sourced from here.

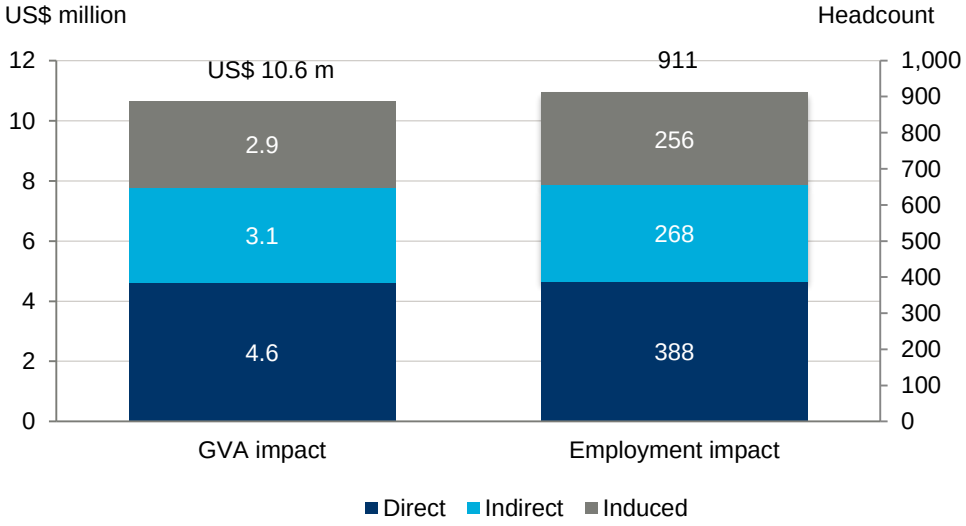
Fig. 23. Economic impact of 'connectivity' exports



Source: Oxford Economics

The additional imports resulting from increased connectivity also enabled a further US $10.6 million of GVA, which sustained over 900 jobs. The extra US $69 million of imports also helped to support economic activity by being used as inputs to domestic production. We estimate that, in total, these imports enabled an extra US $13.4 million in additional output, which supported US $10.6 million in GVA and over 900 jobs inclusive of indirect and induced impacts.

Fig. 24. Economic impact of import connectivity impact at MBJ



Source: Oxford Economics

More generally, trade is an important driver of higher productivity and therefore enhanced living standards. International trade enables a country to concentrate production in those areas where it is relatively more productive, with additional output exported and the proceeds used to purchase imported products. The introduction of new foreign suppliers into domestic markets can also enhance competition, benefiting consumers and potentially acting as a

spur to innovation and enterprise amongst domestic firms. Such dynamic gains from trade are an important source of productivity growth which in turn drives higher living standards.

3.7 OTHER CATALYTIC EFFECTS

The benefits from enhanced connectivity extend beyond the improvements in trade quantified in the previous section. As well as improving the opportunities for trade, connectivity can facilitate an increase in inward FDI. Greenfield FDI in new offices and plants directly boosts the economy's capital stock and, as a result, its capacity to supply goods and services. In addition, this investment is often associated with higher total factor productivity than an otherwise equivalent investment by a domestic firm. That reflects the way in which it facilitates the spread of world standard equipment and production techniques, with these standards subsequently adopted by domestic businesses as they seek to remain competitive.

Part of the activity on-site at the airport is not captured by either our estimate of operational and tourism impacts—this is estimated to have been worth around US $5.5 million in GVA in 2015. Based on economy-wide productivity trends in relevant sectors we estimate that these employees contributed around US $5.5 million to Jamaican GDP in 2015. The majority of this value will have been captured in our estimates of the tourism impact since much of the spending which sustains this activity is carried out by non-residents. However, based on the share of residents in total arrivals, we estimate that around ten percent of this activity may fall outside of the figures presented earlier in this chapter.

The wider economy stands to benefit from the airport's investment in human capital. The airport spent on training will increase potential productivity, benefiting not just the airport and the workers concerned, but also future employers and work colleagues and—through the associated potentially higher tax take—Jamaican society at large.

3.8 ASSESSMENT OF THE IMPACT OF IFC'S INVESTMENTS

The operational efficiency of MBJ has increased substantially since 2008—it is our view that this trend is strongly linked to IFC's investments. Operational efficiency at MBJ increased substantially in 2008 and has remained at an elevated level up to 2015. Moreover, labour compensation has fallen in real terms during this period—this trend is consistent with the investments having enabled MBJ to substitute capital for labour.

Since the completion of IFC's investment programme, MBJ's operational contribution to GDP has grown strongly while total employment growth has been much more modest—we think that these trends are linked to IFC's investments. Growth in total GVA has come predominantly from the airport's direct impact, and is related to it having much higher gross margins than before. Indirect supply chain GVA has also increased steadily while induced GVA, which results from the consumer spending of airport and supply chain employees, has fallen since 2008, a reflection of the real terms decline in wage expenditure during this period.

Since passenger handling capacity would have been limited to around three million without the investments, it can be concluded that approximately 21 percent of the airport's footprint in 2015 (US $288 million and close to 29,000 jobs) was enabled by IFC's intervention. Inbound passenger arrivals are the driving force of all three of the identified channels of impact. In the context of Jamaica, it seems unlikely that many of these additional passengers would have used an alternative route to enter the country given that travelling from the other international airport (Kingston Norman Manley) to the tourism locations around Montego Bay is very time-consuming.

Fig. 25. Activity enabled by IFC's investment at MBJ in 2015[24]

	GVA	Employment	Tax
	US$ millions	Headcount jobs	US$ millions
Operations	12	222	3
Tourism spending	271	27,884	101
Trade	6	540	2
Total	**288**	**28,647**	**105**

Source: Oxford Economics

IFC's investment can be regarded as a necessary but not a sufficient condition in supporting this additional level of economic activity. This impact cannot be fully attributed to IFC's investment but the increased capacity at MBJ is part of a wider ecosystem of infrastructure vital to ensuring that Jamaica can cater for the demands of tourists who come to enjoy holidays and do business.

[24] Figures may not sum due to rounding.

4. THE IMPACT OF IFC'S INVESTMENT AT PUJ, DOMINICAN REPUBLIC

In this chapter we explore how investments that were part-financed by IFC at PUJ contributed to economic activity in the economy of the Dominican Republic during 2015 across the channels outlined in chapter 2.

4.1 INVESTMENT BACKGROUND

In 2009, IFC part-financed a significant expansion programme in PUJ, contributing US $20 million of the US $61 million financing requirement. IFC's financial intervention was in the form of an A loan worth US $20 million to the Punta Cana Group (PCG) who control the airport and a considerable proportion of business activities in the surrounding resort area.

The investment financed a range of on-site developments including the construction of a new runway, the expansion of an existing passenger terminal and the installation of new safety equipment. IFC's investment supported a range of upgrades throughout the airport. These included:

(1) The construction of a new runway and taxiway;
(2) An expansion of the existing passenger terminal;
(3) The installation of new safety equipment including a control tower, a new fire and rescue brigade building and instrument landing systems; and
(4) Repair work to the existing runway.

The Board Paper for the PUJ investment states that the project was expected to increase the airport's effective passenger handling capacity, to raise service levels and to diversify its origin markets.[25] It was also expected that the investment would help the operator to meet international security standard.

4.2 HOW THE INVESTMENTS HAVE AFFECTED OPERATIONS

The new runway that has been installed handles the vast majority of flights at PUJ. Although exact data is not available, airport personnel estimate that between 90-95 percent of flights currently operating through PUJ use the newly installed runway. This share has remained broadly stable since the opening of the runway in 2011.

The airport's original runway has opened up some new business opportunities in terms of air freight although these are yet to be fully exploited. The original runway at PUJ is increasingly used to operate cargo flights. In general, air freight activity through the airport remains relatively small-scale with the Las Americas airport in Santo Domingo still the dominant cargo hub in the Dominican Republic. However, senior management at PUJ indicated that one of the strategic aims of the organisation was to develop its air freight

[25] IFC Board Paper, paragraph 3, p.1.

handling capacity assisted by potential future investments in warehouse facilities.

At the time of the investment, PUJ was operating well below its passenger-handling capacity threshold. Although we have not been able to identify the passenger-handling capacity of PUJ, our discussions with airport operatives indicated that the airport would have been able to receive the passenger volume recorded in 2015, irrespective of the investments part-financed by IFC.

The expansion of an existing passenger terminal has improved PUJ's offer in terms of passenger-processing facilities, thereby enhancing customer experience. The new terminal building meant a substantial addition to the area of departure hall (double the size of the original terminal), and included an expanded check-in area now equipped with 40 stations and baggage belts.

The investments have helped to enhance the safety standards of PUJ, to ensure that they complied with international benchmarks. Other developments supported by IFC's funding such as the control tower have ensured that PUJ complied with regulations set out in the Runway End Safety Area (RESA) specified by the International Civil Aviation Organisation (ICAO). Finally, the new runway orientation was also claimed to have helped to reduce crosswind speed which can represent a significant safety risk.[26]

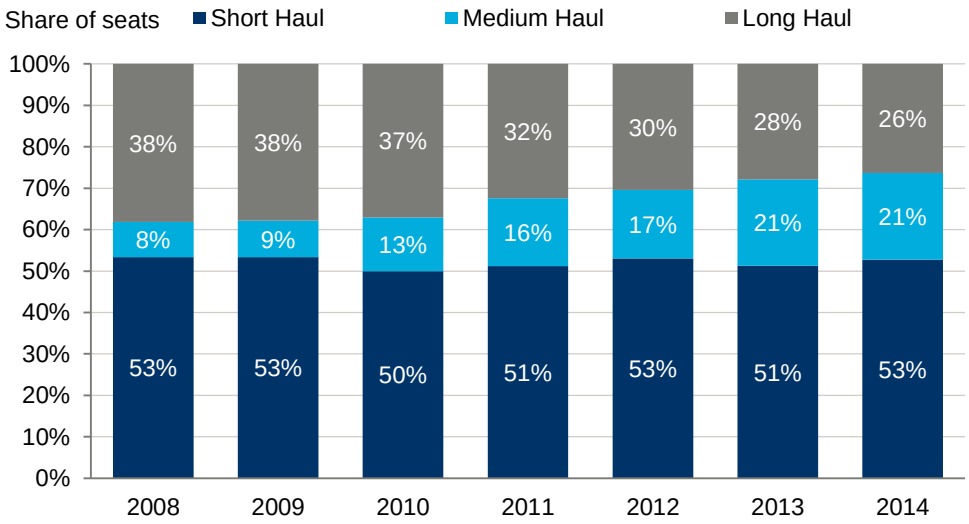
Discussions with IFC industry specialists indicated that although the new runway had not relieved a capacity constraint, the investments had enabled PUJ to handle larger aircraft It has been claimed that improvements in the pavement structure have meant the new runway is able to receive all 4 E Type aircraft, opening up the possibility of longer-haul flight routes from origin markets such as Russia.[27] However, it has been suggested that this assertion is implausible given that satellite imagery shows that the dimensions of the new runway are identical to the old runway.

Irrespective of whether the investment did enable the handling of larger aircraft, the growth of long-haul routes since 2011 has been constrained by subdued demand in relevant origin markets. The proportion of both flights and seats covered by long-haul flights has fallen significantly since 2010. On the other hand, the share of medium-haul routes, typically to either the United States or Canada, has risen commensurately. This pattern would appear to reflect demand-side factors given the very muted growth performance of key long-haul origin markets in Europe compared to both the US and Canada during this period. We estimate that total outbound flights from origin markets that are either short- or medium-haul (to PUJ) grew by around 17 percent between 2011 and 2015, almost three times the rate of growth for long-haul markets during the equivalent period.

[26] This assertion was made by a former IFC engineer. However, there is no information to confirm it. .

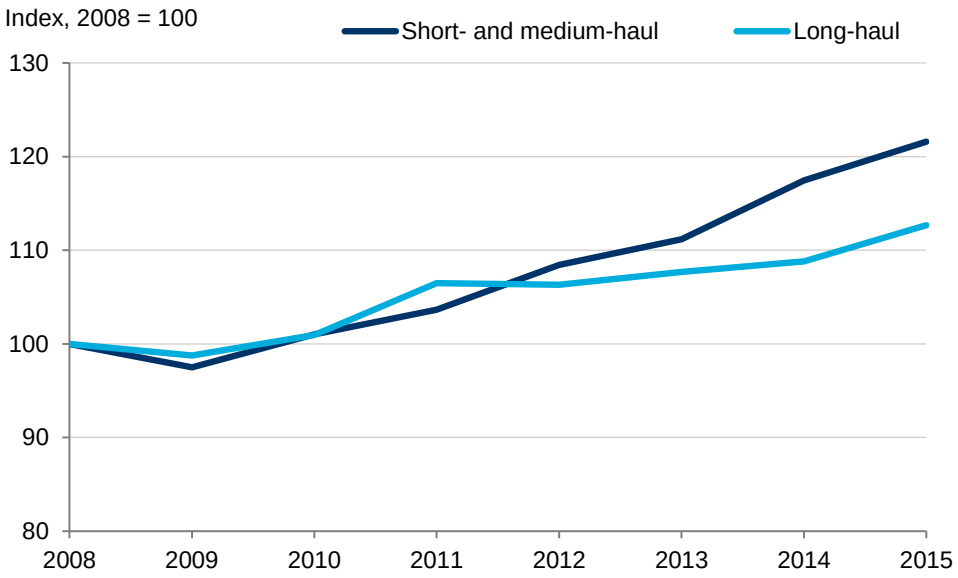
[27] For example the IFC Board Paper noted that the project would finance the "construction of a new runway and taxiway suitable for large aircraft" (p.1).

Fig. 26. PUJ routes 2008-2014



Source: Oxford Economics, Diio

Fig. 27. Demand for flights by origin market type



Source: Oxford Economics

4.3 OPERATIONAL PERFORMANCE SINCE THE INVESTMENTS

In 2015, passenger flow through PUJ was some 60 percent higher than in 2010 when the IFC-backed investment was completed, and more than double the flow seen in 2005.

Revenues have grown in real terms over the past five years, building on even stronger growth over the previous five years, consistent with improved profits and efficiency.

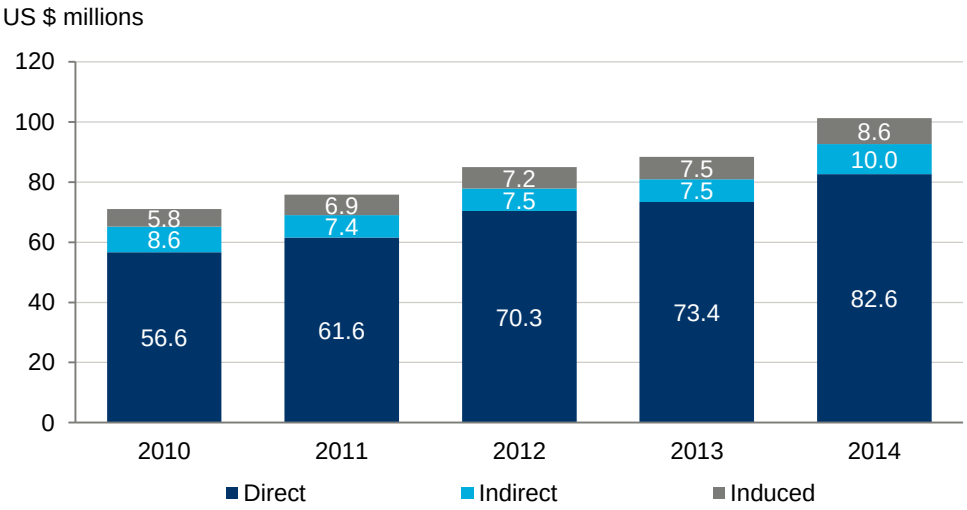
4.4 OPERATIONAL IMPACT OF THE AIRPORT

As set out in chapter two, we are able to quantify the economic impact of the airport as a whole on the economy, in terms of GDP, employment and taxes. The effects are set out in some detail below, and broken down by direct, indirect (supply chain) and induced (consumer spending) channels of impact. We begin by providing a high-level overview of how the airport's operational impact has evolved since IFC's initial investments before providing a more detailed assessment of PUJ's operational footprint as of 2015.

4.4.1 PUJ's operational impact from 2010-2014

PUJ's contribution to GVA via its operations has grown steadily since IFC's investment programme commensurate with the strong growth in turnover. In real terms, PUJ's total contribution to GVA rose by over nine percent per year, on average, between 2010 and 2014. As a share of economy-wide GVA, PUJ's total contribution rose from 0.14 to 0.16 percent during this period.

Fig. 28. PUJ's contribution to GVA, 2010-2014



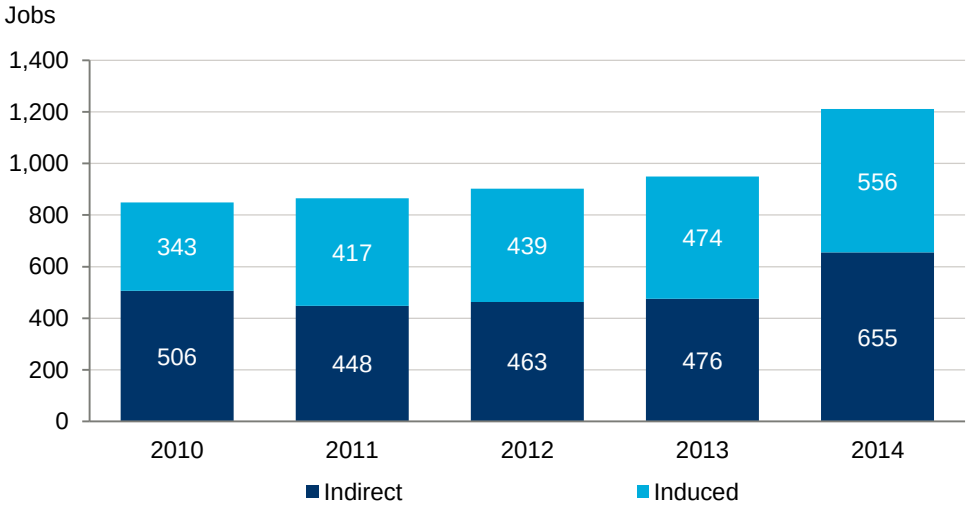
Source: Oxford Economics

PUJ's indirect contribution to GDP is estimated to have grown by 4.1 percent per year, on average, between 2010 and 2014. In real terms, total procurement expenditure by PUJ increased by just over 17 percent between 2010 and 2014. This increase in the volume of total purchases is likely to have resulted in an increase in the airport's indirect contribution to GDP. Assuming that procurement patterns were similar to those seen in 2015, we estimate that PUJ's indirect impact on GDP has grown by just over four percent per year since 2010.

Induced GVA is estimated to have grown considerably more strongly at just over 10 percent per year during this period. This trend was driven by the very strong rise in employee compensation on-site. According to data supplied by PUJ, this rose by close to 60 percent in real terms between 2010 and 2014, with the resulting consumer expenditure therefore sustaining a rapidly growing economic footprint outside of the airport during this period.

Employment supported by multiplier effects has grown by over nine percent per year, on average, since 2010. Jobs, supported by the airport's supply chain expenditure, have risen at a slightly more modest pace reflecting the relatively slower growth of PUJ's real procurement expenditure. On the other hand, induced employment is estimated to have grown by close to 13 percent per year on average between 2010 and 2014, helped by the very strong growth in employee compensation at PUJ. Although no historic data on headcount on-site was made available, this latter trend suggests that growth in direct employment is also likely to have been very strong.

Fig. 29. PUJ's indirect and induced employment, 2010-2014

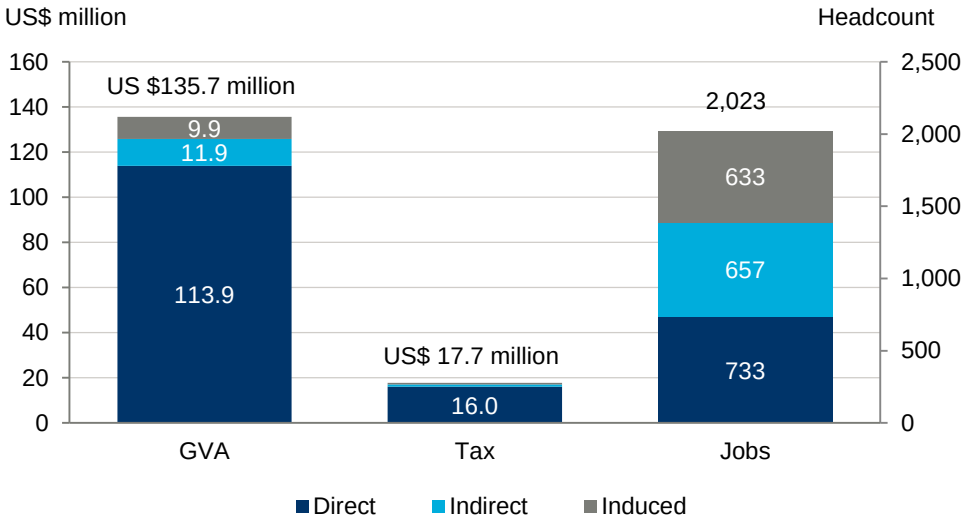


Source: Oxford Economics

4.4.2 PUJ's impact in 2015

In 2015 the airport made a total contribution to GDP of US $135.7 million helping to support over 2,000 jobs and US $17.7 million in tax revenue. Similar to MBJ, the majority of the GVA and tax contributions reflect the airport's direct activity, with more modest impacts through indirect and induced channels. However, reflecting the high productivity of airport-based activities, relative to the rest of the Republic's economy, the indirect and induced employment effects are more marked relative to the direct employment effect.

Fig. 30. The operational impact of PUJ in 2015

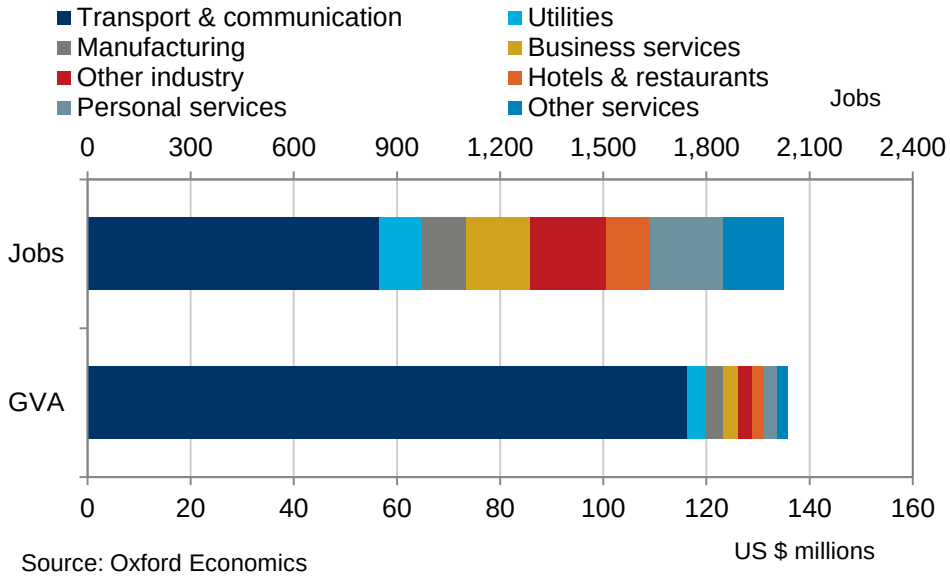


Source: Oxford Economics

The airport's total contribution to GVA accounts for around 0.25 percent of the Dominican Republic's economy-wide GVA, while its total contribution to employment accounts for around 0.05 percent of whole economy employment.

Taking the direct, indirect and induced channels together, the vast majority of GVA is accounted for by the airport's own operations, but jobs are spread across a broader range of activities. As the airport's direct economic impact accounted for 81 percent of the total GVA impact, the transport & communication sector as a whole contributed 83 percent of that overall impact. Personal services etc. ranked second with just four percent of the total. But the total employment impact is spread more broadly, with transport & communication accounting for 35 percent of posts, personal services for 23 percent, and agriculture for 7 percent.

Fig. 31. Sectoral breakdown of PUJ's total GVA and employment impact



Source: Oxford Economics

4.4.3 The indirect impact of PUJ in 2015

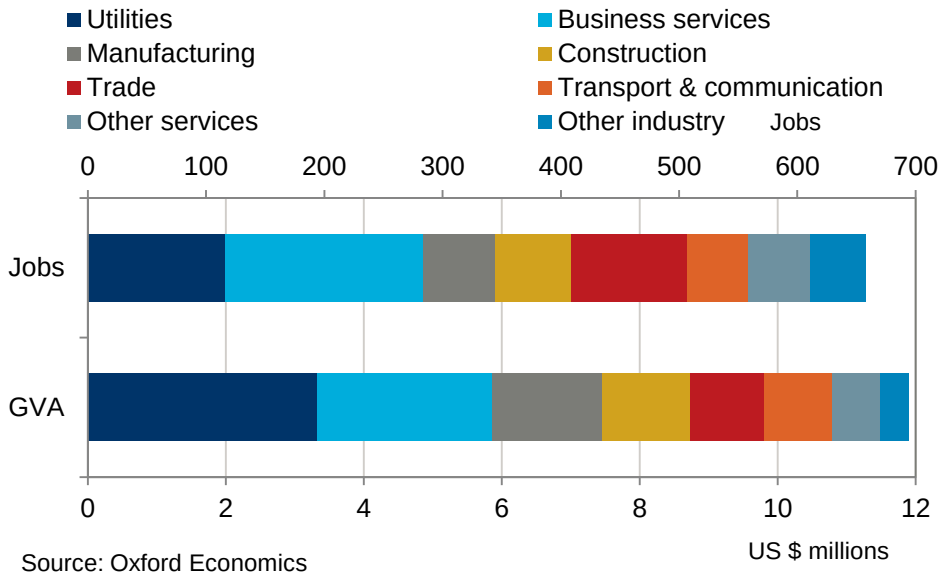
Around 87 percent of PUJ's procurement expenditure was brought in from businesses located in the Dominican Republic.

The airport's local procurement is estimated to support US $11.9 million of GVA in the DR-based supply chain. Procurement expenditure in 2015 is estimated to have supported around US $11.9 million of indirect GVA across the Dominican Republic, with the remainder reflecting content that is ultimately imported. Indirect GVA is spread across more industrial sectors than the airport's own purchases from the 'first round' of suppliers, with for example the agricultural sector ultimately benefiting from the airport's purchases of manufactured foodstuffs.

While indirect GVA is small compared with the airport's direct GVA, it sustains a similar number of jobs—some 657—as a result of comparative productivity effects. Average productivity in the airport's supply chain works out at around US $18,095 per employee. This is around a third above the national average but significantly lower than that of the airport's own activity. As a result, the indirect employment effect is only ten percent lower than the number of people employed on-site at PUJ despite the indirect GVA impact being just a tenth of the size of direct GVA.

The pattern of indirect jobs differs from that of indirect GVA with proportionately more jobs sustained in lower productivity industries. The pattern of indirect employment differs from that of indirect GVA, reflecting significant productivity variation between the sectors. For example, personal, social and community services account for account for 19 percent of indirect GVA but for 37 percent of supply chain jobs, whereas manufacturing and energy & water supply account for 35 percent of indirect GVA between them but for just 19 percent of supply chain jobs.

Fig. 32. Indirect GVA and employment by sector

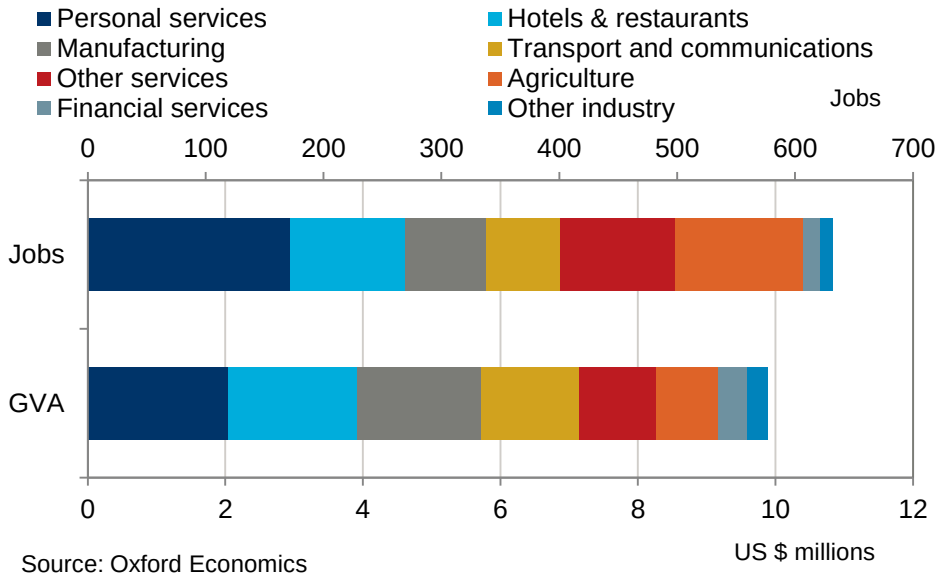


Source: Oxford Economics

4.4.4 The induced impact of PUJ in 2015

Induced GVA of US $9.9 million supported 633 jobs in 2015, with activity mainly supported in consumer facing service sector industries and parts of the industrial sector that supply producer goods. Spending of wage income by direct and indirect employees supported a further US $9.9 million in value added across the economy sustaining over 600 jobs. This activity was widely spread across industrial sectors with some of the primary beneficiaries including personal services providers in leisure and recreation and hotels and restaurants. Significant activity was also sustained in the agricultural and consumer goods manufacturing sectors.

Fig. 33. Induced GVA and employment by sector



Source: Oxford Economics

4.4.5 Multiplier analysis

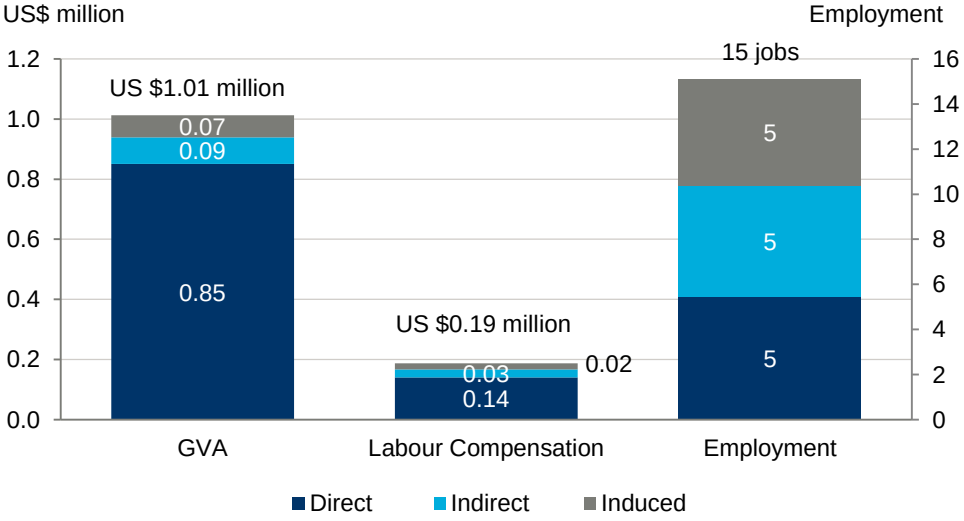
Each US $1 million of revenue generated by PUJ in 2015 supported US $1.01 million in GVA, US $0.19 million in labour compensation and 15 jobs across the economy of the Dominican Republic. A common method to assess the strength of an organisation or sector's linkages to the wider economy. In this report, we present output 'effects' which quantify how each US $1 million of output (or revenue) supports economic activity across the economy inclusive of direct, indirect and induced effects. At PUJ in 2015, our analysis indicates a GVA effect of US $1.01 million and an employment effect of 15 jobs. The GVA effect is broadly in line with the economy-wide average but the employment effect is relatively low—on average, US $1 million of turnover split equally between all sectors in the economy would have sustained 68 jobs in 2015. This pattern reflects a number of factors including:

(1) The vast majority of procurement expenditure (87 percent) was purchased from domestic suppliers ensuring that the level of 'leakage'; from the economy along the supply chain was relatively low;
(2) This was offset by the low share of labour compensation in direct GVA—this naturally diminishes the size of the induced impact; and

(3) As noted, the airport is an extremely productive organisation—as measured by GVA per worker—relative to the rest of the economy. Around 85 percent of the total GVA effect was sustained at the airport but this activity supported very few jobs compared to the average pattern across the economy.

Although the GVA effect was relatively high the labour compensation effect was fairly low reflecting the high share of profits in direct GVA. Overall each US $1 million of revenue at PUJ supported US $0.19 million in labour compensation across the economy. This ratio is somewhat lower than the economy-wide average of around 35 percent.[28] As discussed in the previous chapter, it may be that from a developmental perspective, labour compensation and employment effects are the most relevant measures of impact.

Fig. 34. GVA and employment effects of PUJ in 2015



Source: Oxford Economics

4.4.6 Tax revenue

The total tax contribution is estimated to have been US $17.7 million, the clear majority of which was accounted for by the airport's own corporate income tax bill. As the table below shows, the direct tax impact (including taxes on the spending of direct employees) is put at US $16.0 million, with the indirect tax impact estimated to be US $1.0 million, and the induced contribution US $0.7 million. By type of tax, company income taxes contribute US $13.6 million, including US $12.6 million paid by the airport itself. Some US $2.2 million was raised by income tax on employees and a further US $1.4 million from ITBIS (value added tax) and tariff revenue relating to employee spending and business supply chain transactions.

[28] This value is calculated by shocking the SAM model with US $1 million of output across all sectors simultaneously.

Fig. 35. Total tax contribution by channel and tax type

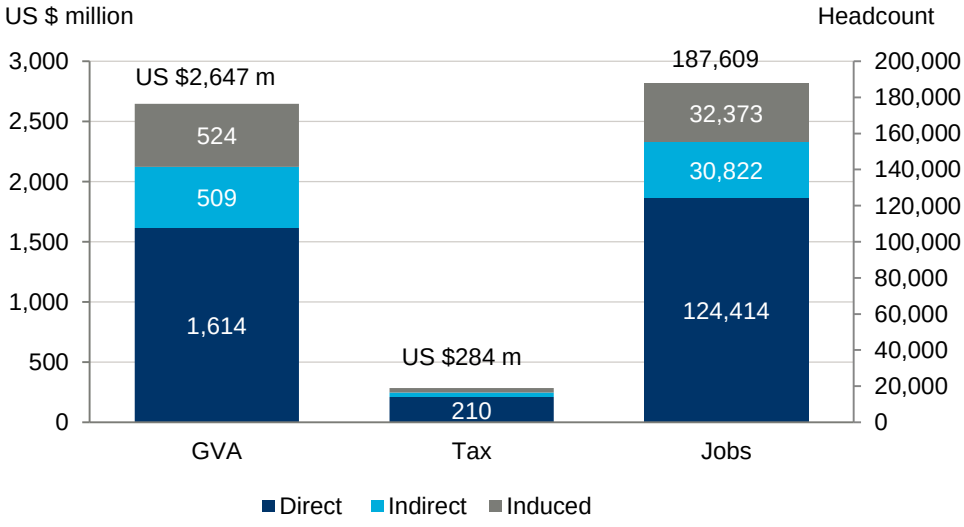
US $ million	Direct	Indirect	Induced	Total
Taxes paid by businesses				
Company income tax	12.57	0.45	0.37	13.39
Employers' national insurance	0.74			0.74
Taxes on supply chain transactions				
Tariff revenue	0.06	0.16	0.04	0.27
Taxes on employee income				
Individual income tax	1.96	0.13	0.10	2.19
Taxes on employee spending				
Internal ITBIS	0.40	0.13	0.11	0.64
External ITBIS	0.29	0.10	0.08	0.47
Total	16.03	0.96	0.70	17.69

Source: Oxford Economics

4.5 TOURISM IMPACT

In 2015 tourists arriving at PUJ supported some US $2.6 billion in GVA, activity that sustained 188,000 jobs across the island and US $284 million in tax revenue. Having used PUJ as a gateway to the resort of Punta Cana, international tourists provide a hugely valuable source of demand via their expenditure on goods and services in the hospitality, leisure and transport sectors. We estimate that in 2015, this spending sustained over US $2.6 billion in GVA across the economy inclusive of indirect and induced effects. Around 60 percent of this output was supported directly in tourist-facing sectors with the remainder of GVA sustained approximately equally by indirect and induced effects. All this activity supported over 188,000 jobs across the Dominican Republic, primarily in direct providers of tourist services such as hotels and restaurants, transport and cultural and recreational services.

Fig. 36. Total economic contribution of tourists arriving at Punta Cana



Source: Oxford Economics

These tourist's total contribution to GVA accounts for around 4.9 percent of the Dominican Republic's economy-wide GVA, while its total contribution to employment accounts for 4.6 percent of whole economy employment.

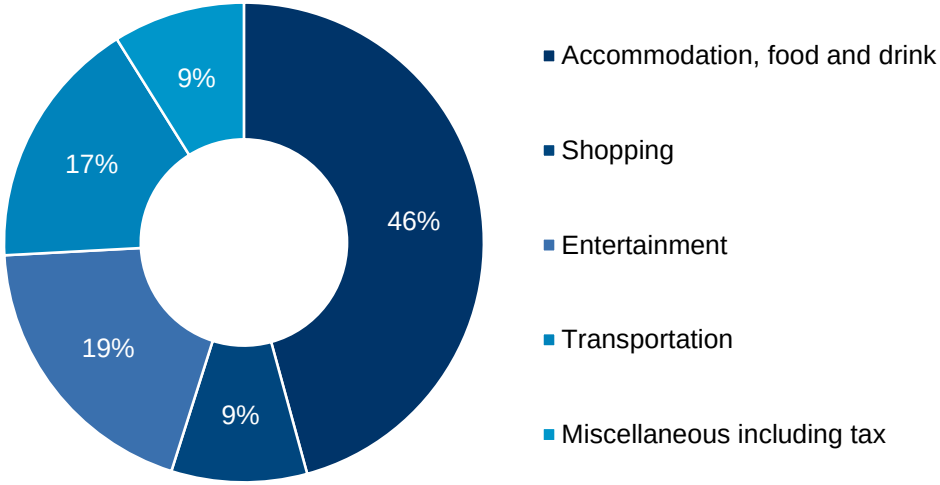
4.5.1 Tourist's expenditure patterns

In 2015, 3.2 million international tourists visited the Dominican Republic, spending around US $2.6 billion on goods and services while in-country. During 2015, 3.2 million non-residents used PUJ as a gateway to the Dominican Republic. Information gathered during the field trip indicated that the overwhelming majority of these visitors stayed in Punta Cana, enjoying the wide range of amenities on offer at the all-inclusive resort. According to survey data, stopover visitors to Punta Cana spent on average US $852 per trip in-country, suggesting that aggregate expenditure by these visitors amounted to some US $2.6 billion in 2015 or 43 percent of total tourism exports.

Tourist expenditure in the Dominican Republic is concentrated on a few major items with accommodation, food, entertainment and transportation services together accounting for over 80 percent of total spending. Based on survey data we estimate that tourist arrivals via PUJ spent around US $1.2 billion in 2015 on accommodation and eating out in restaurants, cafés and other food and beverage establishments. Other popular items included entertainment services, such as bars, cultural visits and recreational and sporting pursuits, which accounted for US $509 million of spending and transportation services, primarily taxis and other land-based transport, which took up US $448 million of spending.

Fig. 37. Official estimate of the pattern of expenditure by tourist arrivals

Percentage of total tourist spending



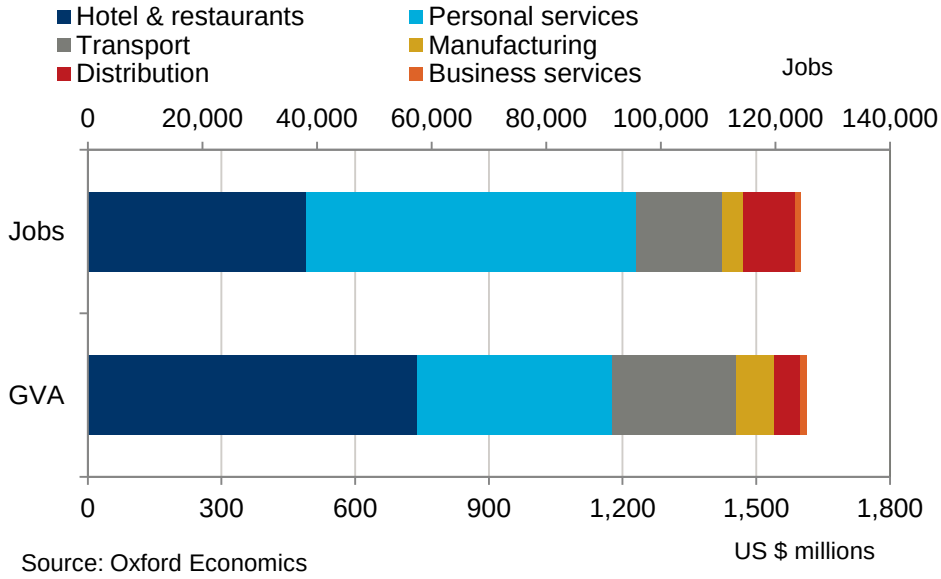
Source: BCRD

4.5.2 Direct tourism impact

The direct GVA generated by this spending is estimated to be just over US $1.6 billion, helping to sustain almost 125,000 jobs. The expenditure by these foreign visitors supported a considerable level of activity at direct-recipient industries. Primarily, this included GVA and jobs in the hotels and

restaurants and firms in the personal services sector who provided recreational, sporting and cultural services to tourists. Together, almost three-quarters of both direct GVA and jobs was sustained in these two industries.

Fig. 38. Direct tourism GVA and employment by industrial sector

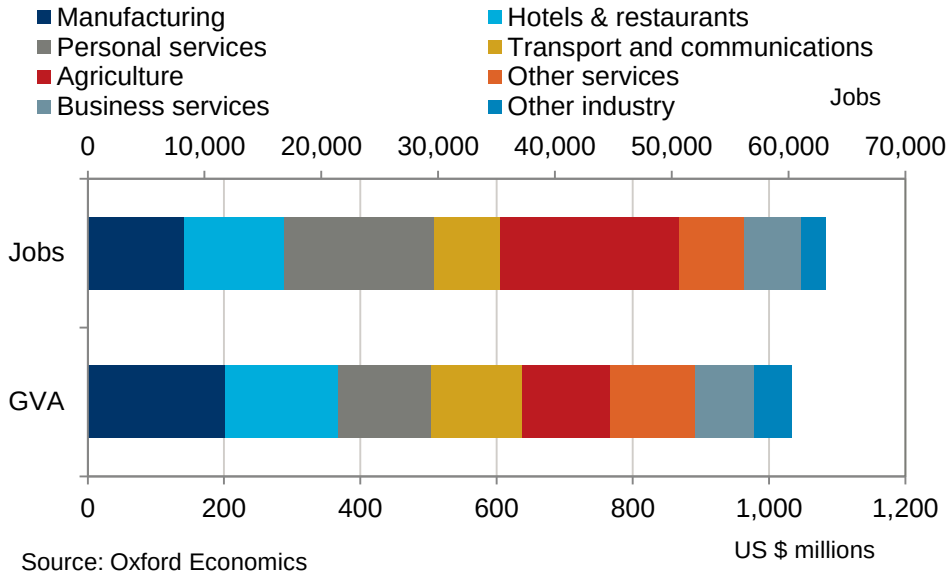


Source: Oxford Economics

4.5.3 Multiplier effects from tourist expenditure

The spending of these tourists sustains over US $1.0 billion in GVA and 62,000 jobs via indirect and induced effects. The associated indirect GVA impact is estimated to be worth some US $509 million, with manufacturing, agriculture, finance, business-type services, hotels & restaurants and transport & communication benefiting the most. This is associated with some 30,820 jobs, with over a quarter of these in the agricultural sector. Induced tourism GVA meanwhile is put at US $524 million, benefiting personal services, manufacturing and hotels & restaurants the most. This is associated with some 32,370 jobs, with personal services and agriculture accounting for almost a half of these posts.

Fig. 39. Sectoral distribution of indirect and induced GVA and employment

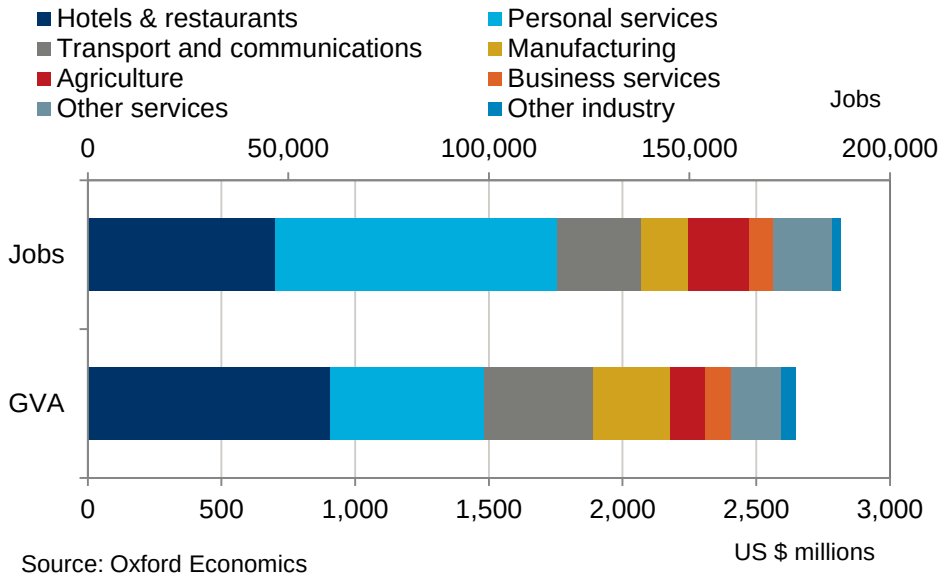


Source: Oxford Economics

4.5.4 Total tourism impact

The total tourism GVA impact worth over US $2.6 billion was spread across a range of sectors, led by hotels & restaurants. Given the importance of the direct channel, the sectors benefiting the most are hotels and restaurants, personal services and transport & communication. However, all sectors of the economy are found to benefit, including sectors such as agriculture and finance for which the direct tourism impact is negligible.

Fig. 40. Sectoral distribution of total tourism GVA and employment



Source: Oxford Economics

The economic activity supported by tourism expenditure was sufficient to raise US $284 million in tax receipts for the government in 2015.

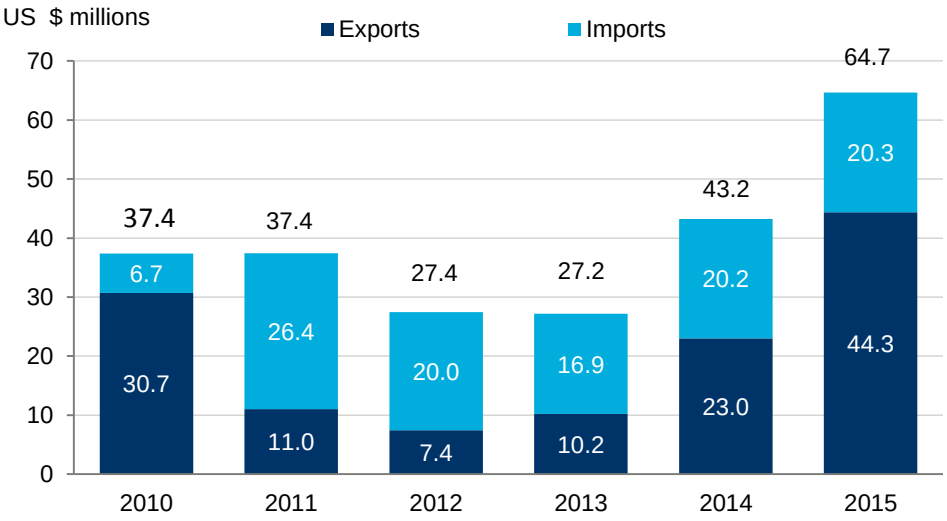
4.6 TRADE IMPACT

4.6.1 The impact of PUJ on the tradeable sector

Air connections enhance the Dominican Republic's ability to trade goods internationally via two major channels. Firstly, an airport provides a direct mode through which international trade takes place. This includes cargo that is transported to and from countries in the form of air freight. Secondly, the international movement of people can promote trade via more indirect channels. For example, increased connectivity (and therefore ease of international travel) should enable entrepreneurs to foster relationships with foreign customers and suppliers. The ability to form such business relationships can significantly enhance a country's capacity to trade internationally, a link that was borne out by our econometric modelling of trading patterns in the Dominican Republic.

During 2015, the value of cargo trade via PUJ amounted to some US $64.7 million, of which over two thirds was exports. The value of air freight rose sharply to US $64.7 million driven by a rise in cargo exports to US $44.3 million. Drilling down, the most important export categories were perishable agricultural goods and pharmaceutical products—a full breakdown of cargo exports and imports trading via PUJ is provided in Appendix 3. Overall, Santo Domingo remains the predominant airport in the Dominican Republic for air freight. However, discussions during the field trip with the CEO of PUJ indicated that it was the airport's ambition to increase cargo volumes substantially going forward so this picture could be subject to change.

Fig. 41. Value of air freight transported via PUJ



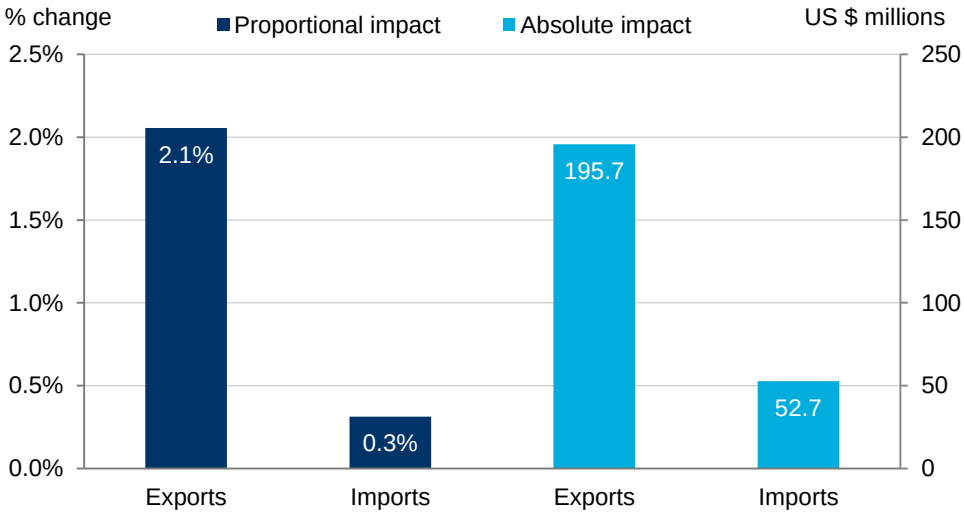
Source: ONE

Our modelling suggests that for each 10 percent increase in connectivity in the Dominican Republic, goods exports rise by 0.9 percent and goods imports by 0.1 percent. These findings reflect the average relationship across all airports in the Dominican Republic. Intuitively, the fact that PUJ predominantly handles leisure arrivals suggests that its impact, in this respect, is likely to be weaker than average. Moreover, the regional economy around PUJ is characterised by very little goods-producing capacity. However,

information gathered during the field trip highlighted that leisure trips in the Dominican Republic have often acted as a catalyst to foreign investors choosing to base in the Dominican Republic with knock-on effects on the country's capacity to trade. For example, a discussion with representatives from the national Export and Investment Centre (CEI-RD) indicated that they were aware of many examples of foreign entrepreneurs who had become alerted to potential opportunities following a holiday in the Dominican Republic.

Based on the aggregate relationships, the increase in connectivity at PUJ over the past five years[29] would have led to international goods trade being 0.9 percent higher (US $249 million) than it would otherwise have been. Drilling down, the export impact was worth some US $196 million (2.1 percent) and the import impact amounted to US $53 million (0.3 percent). Given the discussion in the preceding paragraph, these figures should be viewed as representing the top-end of the potential impact.

Fig. 42. Impact on increased connectivity at PUJ on goods trade since IFC investments



Source: Oxford Economics

The impact on international trade via connectivity has been significantly higher than the observed increase in cargo trade at PUJ over the past five years. The connectivity effect was found to be around nine times greater than the increase in the value of cargo trade (US $27.3) million since 2011. This result underscores the importance of attempting to factor in the more indirect channels through which airports affect international goods trade when carrying out an impact assessment.

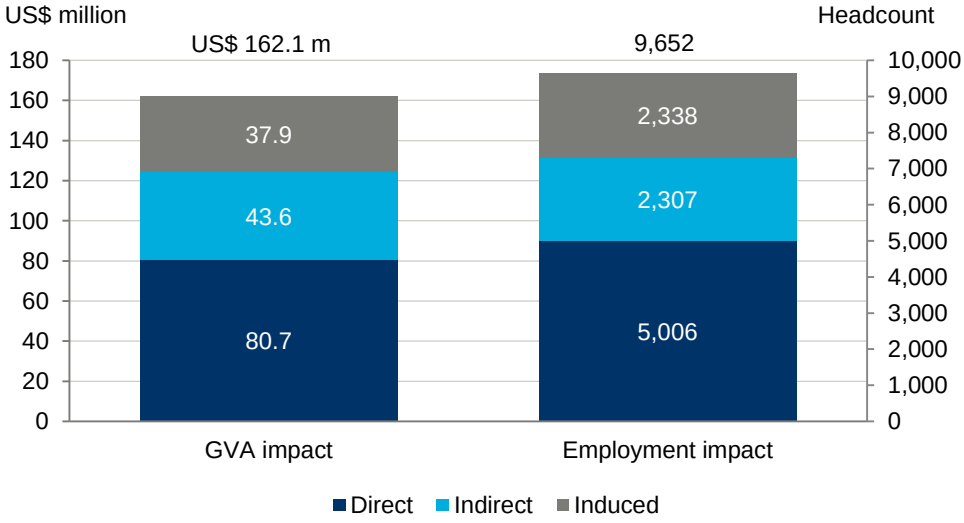
4.6.2 The economic impact of increased trade

This improvement in exports would be sufficient to generate US $162 million in GVA, supporting over 9,600 jobs. The gravity model does not

[29] There is no clear rationale for the application of these results over a specific period. The coefficients estimated refer to the average relationship between connectivity and trade over a 15-year period (2000-2015).

provide any direct insight into the type of goods exports that are supported via this connectivity effect. However, in order to model the economic footprint of these additional sales we have assumed that the product composition matched the pattern of Dominican goods exports in 2015.[30] On this basis, the additional exports would have sustained a direct GVA impact of around US $81 million, sufficient to support over 5,000 jobs directly in the exporting industries. Taking into account the indirect and induced channels as well, the total impact of these additional sales in 2015 was to support US $162 million of GVA and over 9,600 jobs.

Fig. 43. Economic impact of export connectivity impact at PUJ

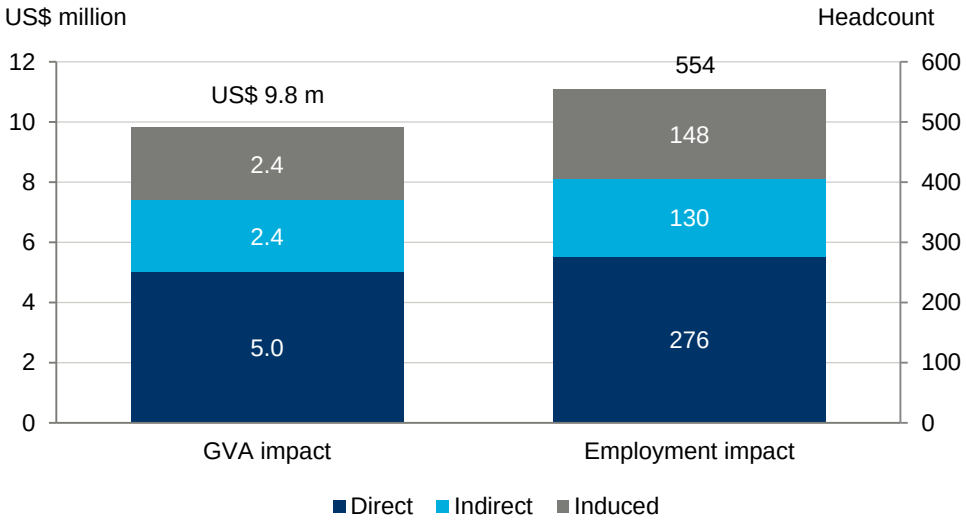


Source: Oxford Economics

The additional imports resulting from increased connectivity also enabled a further US $9.8 million of GVA, which sustained over 550 jobs. The extra US $53 million of imports also helped to support economic activity by being used as inputs to domestic production. We estimate that, in total, these imports enabled an extra US $10.7 million in additional output, which supported almost US $10 million in GVA and over 550 jobs inclusive of indirect and induced impacts.

[30] According to data from NBRD, eight percent of Dominican goods exports in 2015 were agricultural, 14 percent were produced by the mining and quarrying sector and the remaining 78 percent were manufactured goods. Data were sourced here.

Fig. 44. Economic impact of import connectivity impact at PUJ



Source: Oxford Economics

More generally, trade is an important driver of higher productivity and therefore enhanced living standards. International trade enables a country to concentrate production in those areas where it is relatively more productive, with additional output exported and the proceeds used to purchase imported products. The introduction of new foreign suppliers into domestic markets can also enhance competition, benefiting consumers and potentially acting as a spur to innovation and enterprise amongst domestic firms. Such dynamic gains from trade are an important source of productivity growth which in turn drives higher living standards.

4.7 OTHER CATALYTIC EFFECTS

The economy of the Dominican Republic will further benefit from the impact of increased FDI due to expansion at the airport. However, the impact on FDI, and consequent additional economic benefits not captured in any of our quantitative estimates (as outlined in the previous chapter concerned with Montego Bay airport), is likely to be significant.

PUJ's investment in human capital supports spill over benefits across the economy. The airport is a consistent investor in its staff. Its investments in training to staff create wider benefits for the Dominican economy with other local firms benefiting when newly upskilled workers move on to join their company. More generally, these investments in human capital help to develop the supply side capacity of the local economy and, as a result, long-run economic growth.

The wider Punta Cana Group (PCG) which controls the airport has made considerable investments which should help to alleviate the issue of affordable housing going forward. The wider PCG (which controls PUJ) has led recent efforts to significantly expand the stock of residential property in the Punta Cana resort area. The investments are focused on developing units which are affordable for lower-income workers in the area, many of whom currently have to commute long distances. The project will eventually see the construction of apartments, of which approximately two thirds are expected to

house for existing workers with the remainder targeted to cater for projected future demand.

4.8 ASSESSMENT OF THE IMPACT OF IFC'S INVESTMENTS

Prior to the investment, PUJ was operating well below its passenger-handling capacity, a feature that remained the case in 2015. Despite the very strong growth in arrivals enjoyed by PUJ since 2011, there is no evidence that this level of passenger flow could not have been accommodated at PUJ without the investment supported by IFC. This conclusion was reached after a detailed consultation with IFC industry specialists to determine whether the investment had affected the passenger handling capacity of PUJ. Therefore, using our attribution rule, none of the airport's economic footprint in 2015 was enabled by IFC's investment at PUJ.

However, the investment has been important in supporting a wider set of non-monetised benefits including reducing PUJ's environmental footprint and improving safety standards. Following consultation with industry specialists, it was concluded that the orientation of the new runway has ensured that the environmental impact of additional arrivals—in terms of noise pollution—has been minimised, yielding welfare gains for residents who would otherwise have been more adversely affected. In addition, the resultant improvements in safety standards have also conferred benefits to passengers, airline staff etc. These impacts are not quantified since they fall outside the scope of the ToC model.

Irrespective of whether the investments did indeed enable PUJ to operate longer-haul flights, much of the growth in arrivals since 2011 has come from short- and medium-haul origin markets, reflecting demand-side factors. Time series analysis of flights operating out of PUJ indicates that growth in passenger numbers, since the completion of IFC's investments, has been driven by short- and medium-haul destinations, in particular from the US and Canada. This likely reflects demand side factors—we estimate that the growth of outbound air passengers from short- and medium-haul markets has been three times as strong as from long-haul markets between 2011 and 2015.

5. CONCLUSION

This chapter of the report provides a comparative analysis of the two case studies drawing on the findings summarised in the previous two chapters. Our focus in on the main areas of interest for IFC as specified in the Terms Of Reference (TOR) document.[31] The main points of interest are paraphrased below:

(1) **Air transport linkages:** IFC was interested in quantifying the economic impact of direct, indirect and induced effects stemming from the operation of each airport;
(2) **Tourism sector:** IFC was interested in gaining insight on the volume and expenditure patterns of tourist arrivals using each airport as a gateway to the country. Furthermore, it sought to quantify the economic footprint of this spending across the economy inclusive of indirect and induced effects; and
(3) **Tradable sector:** IFC was interested in understanding how each airport supported international trade beyond the tourism sector via its connectivity and provision of air freight services.

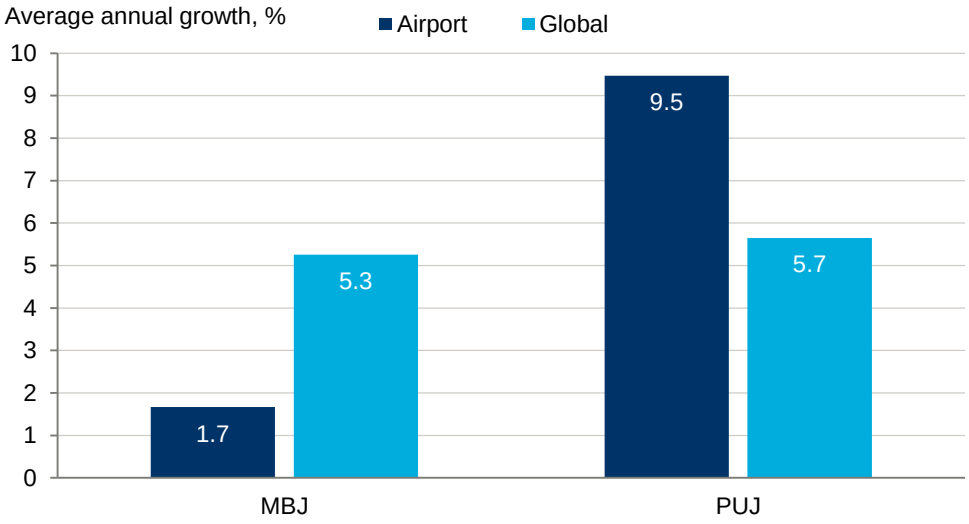
With regard to all three items above, it was also expected that the analysis would cover the role of IFC's investments within these key points of interest.

5.1 COMPARATIVE ANALYSIS

Growth in passenger arrivals, and hence associated economic impacts via tourism and trade, has been much stronger post-investment at one of the airports. The difference in the growth of passenger arrivals at both airports can be attributed to the very rapid development of the tourist offer across the Punta Cana region. According to data from ONE, the number of hotel rooms in Punta Cana more than doubled between 2011 and 2015—in contrast, data from JTB indicates that the stock of hotel rooms in the Montego Bay area has remained static during the same period. During the field trip, the unique business model—whereby the PCG controls a significant proportion of businesses operating in the local area—was suggested as having helped to facilitate this growth. It was felt that the centralisation of operational control had assisted the coordination of investment in various capital projects essential for catering for increased tourist demand e.g. accommodation, transport infrastructure, restaurants.

[31] The full text of the TOR can be found in Appendix 5 of this report.

Fig. 45. Passenger growth since the completion of IFC's investments at each airport



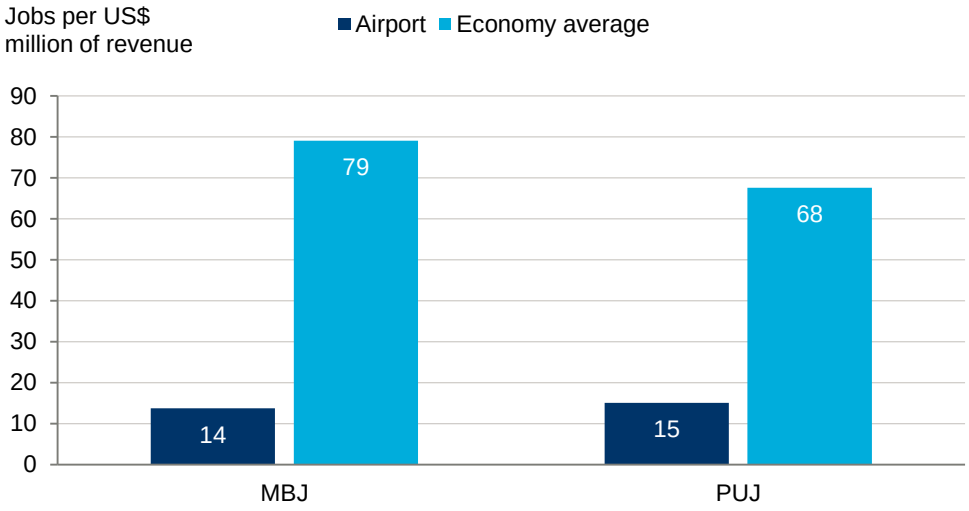
Source: MBJ, PUJ, Oxford Economics

In both case studies the vast majority of the total operational contribution to GDP was created on-site at each airport. At both PUJ and MBJ around four-fifths of the airport's total operational impact was sustained on-site, a ratio that was substantially higher than the economy-wide average of approximately 50 percent.[32] Therefore, in both cases, the airports had relatively weak linkages with the rest of the domestic economy via indirect and induced effects.

In both case studies, the number of jobs sustained due to each airport's operations, was relatively low, even including multiplier effects. At both MBJ and PUJ the level of employment supported by US $1 million of output in 2015, inclusive of indirect and induced effects, was virtually identical. More significantly, in both cases this employment effect was substantially lower than the economy-wide average. This reflected the fact that the vast majority of value sustained in each case was retained at the airport and both organisations have exceptionally high productivity in comparison to the wider economy.

[32] This value was calculated by shocking the SAM model applying a US $1 million shock to output across all sectors of the economy.

Fig. 46. Employment sustained by US $1 million of revenue in 2015 including indirect and induced impacts



Source: MBJ, PUJ, Oxford Economics

In both case studies, each airport's operational economic impact was dwarfed by the impact of the expenditure of tourists who used the airport as a gateway to the local economy. Our analysis has indicated that the economic impact of each airport is considerably smaller than the activity supported by the expenditure of tourists who used the airport to enter the country. This is likely to be the case for most airports but in our view two factors contributed to the discrepancy being particularly large in these cases:

(1) Both airports are gateways to prime hubs for leisure tourists. In general, leisure tourists have a larger economic footprint than those arriving for business. For example, data from UNWTO indicates that leisure tourists' spending per trip is around three times higher than business tourists in the Dominican Republic; and
(2) At both airports the vast majority of passengers who used the airport were non-residents. Airports generate revenue from passengers irrespective of residency. However, the tourism impact we quantified is purely driven by non-resident passengers using the airport. Therefore, a high proportion of non-resident users will naturally skew the relative size of the two effects.

In the PUJ case study, the indirect impact via connectivity on the tradable sector was substantial and was likely considerably larger than the observed increase in cargo trade through each airport. This finding is interesting in that it suggests that documenting trends in cargo trade alone as a way to judge trade effects may significantly understate an airport's impact on the tradable sector. However, it is important to note that PUJ has a relatively limited cargo operation—as such, it may be that the relative importance of these connectivity effects is exaggerated by this structural feature of the two airports in our case studies. In addition, as discussed in detail in section 4.6, we think there are valid reasons to suggest that the impact on international trade that is calculated by applying economy-wide results to the observed increase in connectivity at PUJ may be overstated.

Data indicate that IFC's investments in MBJ have supported a substantial increase in operational efficiency, a trend that is much less apparent at PUJ. Measured by a number of metrics, operational efficiency at MBJ has increased substantially since the completion of IFC's investment programme in 2008. Moreover, given the nature of some of the investments, it is plausible that these projects have played a material role in supporting this trend. Such a pattern is not evident at PUJ—since 2011, passenger growth has been very strong, helping to drive turnover but operating costs (such as labour compensation and procurement) have risen broadly in proportion.

5.2 CONSISTENCY WITH THE TOC FRAMEWORK

Overall, the findings from our analysis are consistent with the channels of impact identified within the ToC framework. Quantitative analysis from both case studies illustrated how each airport's operations support economic activity across the economy via indirect and induced effects. In addition, the analysis has demonstrated how airports enable very significant spillover benefits via the tourism and trade sectors, as identified in the ToC.

Although the findings from the economic impact analysis were consistent with the ToC, the analysis has underscored that the framework is suited to measuring the contribution of IFC's investments in the case that the project did not relieve a binding capacity constraint. The nature of our analytical framework means that measured benefits ultimately stem from passenger flow (whether via their effect on an airport's revenues or their associated effect on tourism and trade). An investment that has no discernible impact on an airport's connectivity, in terms of the frequency and diversity of scheduled flights, cannot plausibly be associated with any subsequent change in passenger flow. Therefore, an alternative framework to the ToC used in our report would be suited to measuring the impact of an investment such as that in PUJ.

6. LESSONS LEARNED

One of the ultimate objectives of this study is to use insights gathered via the two case studies to influence IFC's day-to-day practice in impact assessment—both ex-ante and ex-post. The next two chapters seek to accomplish this. Here, we outline a set of lessons learned, while Chapter 7 distils these into a set of practical recommendations.

The number of jobs created from an airport's operations may be relatively low reflecting high profit margins, and very high labour productivity, on-site. This was certainly the case in both case studies where the number of jobs supported across the economy per US $1 million of output was significantly lower than the economy average. Clearly the sample size is small which prohibits a generalised conclusion on this topic. In our view, it is likely that labour productivity at an airport will be above-average in a developing country given relatively high demand for skilled labour. In both case studies the factor that drove the concentration of value on-site was high profit margins enjoyed by both organisations—we are not in a position to judge how atypical this pattern is.

When interpreting the economic impact of an airport via its GVA contribution to GDP it is important to also consider the split between labour and capital. In both case studies, a very high proportion of GVA supported by the airport's operations was in the form of profits as opposed to wages. The latter may, however, be more preferable from a developmental perspective due to the risk of profits being repatriated from the country where the recipient operates as a multinational corporation. In such situations, it may better suit IFC's overarching objectives to set and measure targets primarily in terms of labour compensation rather than GVA.

Airports help to activity across a wide variety of economic sectors through multiplier effects and the impact of tourism expenditure. A key point of interest for IFC at the outset of the study was to precisely identify how airports helped to sustain activity beyond the transport sector in the domestic economy. The evidence from both case studies illustrated that significant linkages exist for a wide group of sectors. Fig. 47 documents the ranking of sectors by total (including indirect and induced effects) GVA for each airport and impact channel. For the tourism effect, traditional tourism facing industries (hotels and restaurants, transport, recreational services) did benefit most from this spending but the relatively high ranking for the manufacturing sector (a non-direct recipient of tourism expenditure) is clear evidence of the importance of factoring in domestic linkages as part of any impact assessment.

Fig. 47. Sectoral ranking of total GVA impact by airport and channel of impact

	MBJ		PUJ	
Sector	Operations	Tourism	Operations	Tourism
Agriculture	10	8	8	5
Extraction	12	12	12	12

Manufacturing	6	6	3	4
Utilities	5	10	2	9
Construction	11	9	7	11
Distribution	4	2	10	8
Hotels and restaurants	9	1	5	1
Transport and communications	1	4	1	3
Financial services	3	7	9	7
Business services	2	5	4	6
Government services	7	11	11	10
Other services	8	3	6	2

Source: Oxford Economics

In both case studies the size of the operational impact was dwarfed by the associated footprint of tourists—this trend is likely to hold in most cases although we think the discrepancy was exaggerated by structural factors in the two case studies. In both case studies the airport's operational impact was a mere fraction of the footprint generated by the wider spending of tourists who used the airport as a gateway to the country. Our view is that the scale of this discrepancy was exaggerated by certain structural features of both case studies: the very high proportion of passengers that are non-residents; and the fact that both airports are situated in highly popular resort areas for leisure tourists. However, in most cases, this catalytic effect will be larger than the operational impact of the airport itself since revenue per passenger is likely to be substantially lower than average in-country expenditure by tourists using an airport.

Airports can provide important wider benefits to the tradable sector via connectivity. In both case studies, our analysis identified that the airport had supported a wider boost to the tradable sector via connectivity. Indeed, in the case of PUJ, the boost to trade attributed to increased connectivity at the airport since IFC's investment was significantly higher than the observed increase in the value of air freight going through the airport over the same period.

Whether an investment contributed to the relief of a binding capacity constraint at both airports is important in assessing the role of these projects. Formally quantifying the impact of IFC's investments was not feasible given methodological constraints. However, due to the fact that a binding capacity constraint was lifted at MBJ, a firm conclusion could reached in this case study over the extent to which activity measured in 2015 was enabled by IFC's investment. In contrast, the absence of this feature in the PUJ has meant that our conclusions in this respect are much more tentative. Essentially, the economic benefits measured in this study (whether via operations, tourism or trade) are underpinned by the connectivity provided by the airport which, in turn, can be affected by supply-side investments which create additional passenger-handling capacity.

Our findings from this research underline that an alternative measurement framework may be required to assess the impact of other non-capacity related investments. Building on the previous point, in cases

where an airport investment is known to have had no impact on capacity, an alternative methodological approach should be used to assess its effects. For example, a Cost Benefit Analysis (CBA) framework would be more suitable for assessing the impact of an investment which was focused on improving the operational efficiency of the airport and/or customer experience without expanding passenger-handling capacity.

In evaluating the role of IFC's airport investments it is important to collect information on wider trends in order to contextualise the findings. For example, demand for the airport's services will have been affected by a wide variety of factors beyond developments on-site. In the case of tourism-centric airports such as MBJ and PUJ, changes in the quality of the tourist offer, the stock of accommodation etc. will be important drivers of external demand. Understanding these trends should form an important part of any assessment of the role of IFC's investments.

7. APPLICATION FOR FUTURE AIRPORT INVESTMENTS AND RECOMMENDATIONS

The current monitoring programme offered by DOTS should be enhanced to include a wider set of impact channels. As it stands, DOTS provides a very strong platform to monitor the financial performance of IFC's investments. However, as has been demonstrated by the findings from the two case studies in this report, DOTS does not provide a comprehensive framework for tracking the economic and developmental effects stemming from airport investments. This suggests that there is scope to improve the design of the DOTS tool to ensure that it provides a more representative account of the channels through which IFC's investments support economic development.

In turn, the methodological framework adopted to assess the impact of an IFC airport investment should be tailored based on the type of project that was financed. For example, an investment which has no impact on the airport's connectivity will not contribute to economic activity via the catalytic channels identified in this study. In cases where the investment is purely focused on driving an operational improvement in efficiency it may be necessary to adopt a completely different analytical framework e.g. Cost Benefit Analysis (CBA).

The culmination of this project will see the development of a tool which will help IFC to make impact projections in advance of investment—it is important that this tool continues to evolve as more evidence is gathered about the impact of IFC's airport investments. The impact tool will be designed on the basis of the evidence collected in the two case studies and OE's experience from previous impact analysis in the sector. This represents a fairly small sample set. As such, it should be IFC's intention to continue to develop and refine the tool over time as further evidence is gathered from impact assessments undertaken after investments have been implemented and monitored over time.

When evaluating the nature and potential scale of investment impacts in advance, IFC should account for the structure of the host economy and other contextual factors. In this study, both airports were found to support a particularly large level of economic activity via catalytic tourism effects. This reflects the fact that the airports provide a gateway to prime tourism hubs within tourism-centric economies. Where these characteristics do not exist, impacts via tourism are likely to be commensurately smaller. This illustrates that expectations about how an airport will impact upon the economy and the associated ToC framework should factor in contextual factors such as the structural characteristics of the host economy.

8. APPENDIX 1 – ECONOMIC IMPACT MODELLING

MODELLING APPROACH

The choice of modelling approach was determined following a detailed review of three competing frameworks: I-O modelling; SAM modelling; and CGE modelling. Of the three, it was judged that a CGE framework was not feasible within with budget constraints of the project. Overall, both I-O and SAM modelling frameworks were judged to be suitable to answering the primary questions of interest and practically applicable given data availability. The SAM modelling approach was chosen on the basis that it would provide additional insight about the distribution of labour compensation between skilled and unskilled workers.

SAM MODEL DEVELOPMENT

For both case studies a bespoke SAM model was developed underpinned by data accessed from GTAP. This included: supply-use data on the structure of domestic intermediate consumption between different economic sectors; an import matrix showing the structure of intermediate purchases brought in from foreign suppliers by sector; detail on the allocation of GVA between factors of production (land, labour, capital and natural resources) by sector; and detail on the composition of household consumption by product group.

For both countries data was initially downloaded from the GTAP model for a group of 58 sectors. In both cases, this sectoral breakdown was adjusted to fit with available data on sectoral economic activity in Jamaica and the Dominican Republic. The country models available from GTAP place a greater focus on goods- rather than service-producing sectors, reflecting the GTAP's model's primary function of modelling international trade flows. Given one of the primary functions of the project was to simulate the impact of tourist expenditure (which cuts across mostly service-providing sectors) adjustment was felt worthwhile to facilitate a more accurate tracing of subsequent economic activity.

Specifically, in both country models activity in the trade sector was disaggregated between the hotels and restaurants and wholesale and retail trade and repairs sub-sectors. Similarly, in the Dominican Republic model the business services sector was split into the real estate and professional, scientific and technical services sub-sectors.[33]

The sectoral breakdown of the final SAM model used for MBJ was as follows:

[33] This change was not done to the Jamaica model because of the lack of data on employment in the real estate and professional, scientific and technical services sub-sectors.

- Agriculture, hunting, forestry & fishing;
- Mining & quarrying;
- Manufacturing;
- Electricity, gas and water supply;
- Construction
- Wholesale and retail trade, repairs;
- Hotels and restaurants;
- Transport, storage and communication;
- Financial intermediation;
- Real estate, renting & business activities;
- Public administration and defence, health and education; and
- Other community, social and personal service activities

The sectoral breakdown of the final SAM model used for PUJ was as follows:

- Crop farming;
- Livestock, forestry and fishing;
- Mining and quarrying;
- Manufacture of food;
- Manufacture of beverages and tobacco;
- Manufacture of petroleum products and chemicals;
- Other manufacturing;
- Electricity, gas and water supply;
- Construction
- Retail and wholesale trade;
- Hotels and restaurants;
- Transport and storage;
- Telecommunications;
- Financial intermediation and insurance;
- Real estate;
- Professional, scientific and technical services;
- Public administration and defence, health and education;
- Other community, social and personal service activities; and
- Dwellings

Following the injection of a demand-side shock (such as the procurement expenditure of the airport), the SAM model simulates the level of Gross Output (turnover) by sector for both indirect and induced effects. In order to estimate the associated contribution to GDP these figures were scaled down based on the average level of GVA per unit of output in that sector. This scaling factor is calculated using the relationships specified in the SAM.[34] The associated level of employment was estimated based on sectoral productivity (as measured by GVA per worker). Official statistical agencies in both Jamaica and the Dominican Republic publish data on both GVA and employment by sector which can be used to quantify this metric.

Fig. 48. Data sources used to develop the SAM model in each case study

Jamaica			
Data	Source	Latest year available	Notes

SAM	GTAP	2007	The table contains a 57 sector breakdown of the economy.
GVA by sector	Statistical Institute of Jamaica	2015	Data in time-series format available for 2002-2014. In this dataset the economy is broken down into 12 sectors.
Employment by sector	Statistical Institute of Jamaica	2014	As part of their labour force survey employment by industry is published broken down into 14 sectors. The latest available data online found
Employment (total)	IMF	2015	The IMF also produces annual data on total employment. A time series from 1985-2015 is available via their International Financial Statistics (IFS) database.
Dominican Republic			
Data	Source	Latest year available	Notes
SAM	GTAP	2007	The table contains a 57 sector breakdown of the economy.
GVA by sector	Oficina Nacional de Estadística	2015	The latest available data we could find was for the first three quarters of 2015 but we expect that Q4 data has been published and we can obtain this directly during the field trip.
Employment by sector	Oficina Nacional de Estadística	2015	Available for 11 sectors from 2002-2015.

Source: Oxford Economics

SHOCK CALIBRATION

Economic impact of the airport's operations

In both case studies, the shocks to our SAM models to simulate indirect and induced effects as a result of the airport's operational activity were calibrated based on detailed information provided by the airport. Specifically, both airports provided:

[34] In certain industries, this relationship can be quite volatile and may also be affected by the stage of the economic cycle. For example, a recession typically results in a fall in profit margins which tends to lower the share of value added in turnover. However, in the absence of time series data on the relationship between gross output and value added by industry this represents the optimal approach.

(1) A breakdown of procurement expenditure in 2015 split out between domestic and foreign (imported) purchases. Domestic purchases were then split out between major items and for goods purchases, an indication of whether they had been bought from a distributor (wholesale or retail company) or directly from a producer; and
(2) Data on the compensation paid to direct employees including how it was split out between: gross salaries; income tax paid by employees; national insurance contributions of employees; employer's national insurance contributions; contributions to occupational pension schemes; and other benefits (such as health insurance and work permits).

In both cases, these transactions were mapped directly to sectors within the SAM model. In the case of the former this was based on the descriptions provided by the airports and information on the Standard Industrial Classification (SIC) of activity by sector used in each country. In the case of the latter, it was assumed that the sectoral composition of consumer spending of the airport's employees was equal to the distribution of household spending as displayed in the SAM.

The shock to our Type I (indirect only) model was calibrated based on the data provided in reference to point (1) and the shock to our Type II (indirect and induced) model was calibrated based on data provided in reference to points (1) and (2). The shock to the Type I model only contains activity related to supply-chain purchases, suitable for measuring the indirect impact. For the modelling of the induced impact (Type II model), on the other hand, we are including an estimate of how direct employees spend their wages and—via the procurement expenditure shock—also incorporating the spending of indirect employees (the effects of supply chain activity were appropriately netted off the presented results for the induced effect).

Economic impact of tourist arrivals

In both case studies, public data is available on the number of non-residents using the respective airports as a gateway to enter the country. Data based on a residency criterion is ideal for this purpose since tourists are defined by their place of residence rather than their nationality.

The shock to the model was calibrated by estimating the scale and the composition of spending by these visitors. In both case studies this was done by leveraging the results from recent tourism expenditure surveys. These provide an estimated breakdown of foreign visitor spending across major categories such as accommodation, food and beverages, entertainment, transport services and shopping. Both surveys provide differentiated results at the resort-level.

In the case of Punta Cana, information gathered during the field trip suggested that the overwhelming majority of visitors that use Punta Cana as a gateway to the Dominican Republic stay in the Punta Cana resort area for the duration of their stay. Therefore, it was assumed that all arrivals follow the average expenditure patterns for the Punta Cana region as specified in the expenditure survey.

For MBJ, visitor arrivals at the airport stay in a variety of resorts including Montego Bay, Negril and Ocho Rios. Therefore, a bespoke breakdown of non-resident arrivals using MBJ by intended place of stay (based on immigration data) for 2015 provided by JTB was used to allocate non-resident arrivals between resorts. Total expenditure in each location was then calculated based on average spending per person per trip in that region according to the latest tourism expenditure survey data. Since this related to 2014, an

adjustment was made to account for the change in average spending per foreign visitor in 2015 based on the aggregate travel export receipts data collated in the Balance of Payments accounts for Jamaica (published by the IMF).

Fig. 49. Data sources used to quantify change in foreign visitor expenditure

Jamaica			
Data	Source	Latest year available	Notes
Visitor arrivals	Jamaica Tourist Board	2015	Data breaks down visitor arrivals by country of origin (on a residency basis) and by airport.
Tourism expenditure survey	Jamaica Tourist Board	2014	Based on an exit survey of foreign visitors. Data collected for one week each month from visitors at the two major international airports in Jamaica. Average composition of spending broken down according to accommodation type and area of stay. An updated version of this data is contained within the 2014 Annual Travel Statistics document published by the Tourist Board.
Travel export receipts	IMF	2015	Time series data that goes back to 1976. No split out of spending by purpose.
Dominican Republic			
Data	Source	Latest year available	Notes
Visitor arrivals	Banco Central de la Republica Dominicana	2015	Data breaks down visitor arrivals by country of origin (on a residency basis) and by airport. Time series data has been collected back to 2000.
Tourism expenditure survey	Banco Central de la Republica Dominicana	2015	

Source: Oxford Economics

Finally, total spending was mapped to different economic sectors in the SAM model according to the compositional breakdowns in the respective expenditure surveys. Fig. 50 breaks down the composition of visitor expenditure according to the survey data and documents how each item was mapped to a sector within the respective country models. In each case, the survey documented a residual 'miscellaneous' category where no further information was available with regard to the nature of expenditure. In Jamaica, this accounted for 17.1 percent of total spending. This was assumed to be broken down as follows:

- 2.0 percent on car rental hire fees which is equivalent to the historical average share of spending by foreign visitors according to the most recent Jamaican Tourism Satellite Account (TSA);
- 3.2 percent on departure tax calculated based on the assumption that each non-resident paid US $35;
- 0.1 percent on travel agents fees which is equivalent to the historical average share of spending by foreign visitors according to the most recent Jamaican Tourism Satellite Account (TSA);
- The remaining 11.7 percent was divided between miscellaneous goods (mapped to the retail sector) and miscellaneous services (mapped to the business services and other community and personal services sectors).

A similar breakdown was assumed for the Dominican Republic to decompose the 8.9 percent of recorded miscellaneous spending.

Fig. 50. Breakdown of expenditure survey sectoral mapping[35]

Jamaica		
Item	**Share of visitor expenditure**	**Sector mapping**
Accommodation	49.7 percent	Hotels and restaurants
Shopping	8.4 percent	Wholesale and retail trade, repairs
Entertainment	12.8 percent	Other community, social and personal service activities
Transportation	6.1 percent	Transport, storage and communication
Food and beverage	6.0 percent	Hotels and restaurants
Miscellaneous including tax, of which:		
Car rental	2.0 percent	Wholesale and retail trade, repairs
Other products	10.0 percent	Wholesale and retail trade, repairs
Departure tax	3.2 percent	N/A
Travel agencies	0.1 percent	Real Estate Renting & Business Activities
Other services	1.7 percent	Real estate, renting and business activities & Other community, social and personal service activities
Dominican Republic		
Item	**Share of visitor expenditure**	**Sector mapping**
Accommodation, food and drink	45.8 percent	Hotels and restaurants
Shopping	9.1 percent	Retail and wholesale trade
Entertainment	19.3 percent	Other community, social and personal service activities
Transportation	17.0 percent	Transport and storage
Miscellaneous including tax, of which:		
Other products	6.5 percent	Wholesale and retail trade, repairs
Visa on arrival	1.2 percent	N/A
Travel agencies	0.1 percent	Professional, scientific and technical services
Other services	1.1 percent	Professional, scientific and technical services and Other community, social and personal service activities

Sources: Jamaica Tourist Board, Central Bank of the Dominican Republic, Oxford Economics estimates

[35] For the 'other services' section of miscellaneous expenditure, the spending was split between relevant sectors in each country model in a 50:50 ratio.

9. APPENDIX 2 – GRAVITY MODEL

MODEL SPECIFICATION

The specification and estimation of the econometric models presented in this report were informed by the existing literature on trade. Owing to its robustness, the gravity modelling framework was chosen to test our key hypotheses.

Gravity models allow us to analyse the impact on trade of trade-related policies, from tariffs to other regulatory barriers. Since Tinbergen[36], the gravity model approach has been used extensively in the trade literature, covering a wide variety of regions, time periods and sectors. The gravity model is capable of capturing stylised patterns in international trade and production by linking trade flows with economic size and inversely with trade costs. Leamer and Levinsohn[37] argued that the gravity model has produced "some of the clearest and most robust findings in empirical economics".

The theoretical foundations of the gravity approach were further developed by Helpman and Krugman[38], Deardoff[39], Feenstra and Markusen[40], Andersen and van Wincoop[41].

A basic gravity model set-up is as follows:

$$\log X_{ij} = constant + \log GDP_i + \log GDP_j + \log Pop_i + \log Pop_j + T_{ij} + error\ term$$

Where: X_{ij} indicates trade from country i to country j, GDP is each country's gross domestic product, Pop_i represents the population in country i, Pop_j represents population in country j, T_{ij} represents other possible factors that influence trade flows between country i and country j, including distance, historical, cultural and linguistic links, geographic characteristics (whether or not a country is landlocked, or trade partners share a borders), sector-specific characteristics or regulatory barriers.

The term gravity comes from the fact that the nonlinear equation underlying these models resembles Newton's law of gravity, in that trade is directly proportional to the exporting and importing countries' economic mass (GDP), and inversely proportional to the distance between them. This suggests that we can expect country pairs with larger GDP to trade more, but countries that are further apart to trade less.

Since their inception, the use of gravity models has expanded beyond trade in goods to trade

[36] Jan Tinbergen, "Shaping the World Economy: Suggestions for an International Economic Policy.", in *The first use of gravity model to analyse international trade flows.* (New York: Twentieth Century Fund, 1962).
[37] Edward Leamer and James Levinsohn, *International trade theory: The evidence* ([n.p]: Elsevier, 1995), Chapter 26 in Handbook of International Economics, vol. 3.:pp 1339-1394.
[38] E. and P. Krugman Helpman, *Market Structure and International Trade.* ([n.p]: MIT Press, 1985).
[39] Alan V. Deardorff, *Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?*, ed. Jeffrey A. Frankel ([n.p]: Chicago: University of Chicago Press, 1998), In The Regionalization of the World Economy:7–22.
[40] James R. Markusen Robert C. Feenstra, "Using the gravity equation to differentiate among alternative theories of trade", *Canadian Journal of Economics/Revue canadienne d'économique*, vol 34 (2001): pages 430 - 447.
[41] James E. Anderson and Eric van Wincoop, "Gravity with Gravitas: A Solution to the Border Puzzle", *American Economic Review*, Vol. 93 No. 1 (2003).

in services (Kimura and Lee[42]). Grunfeld and Moxnes[43], Kimura and Lee[7] and Mirza and Nicoletti[44] apply the gravity model framework on the OECD dataset on bilateral trade in services to assess the determinants of bilateral trade in services. These studies have generally found that the size of the host country's market is an important determinant of trade flows, as well as common cultural links (Park[45]). The effects of trade partner characteristics, such as common border, common language and legal origin and colonial links tend to be accounted for using dummy variables (Bhattacharya and Wolde[46] and Bussiere *et al.*[47]).

DATA SOURCES

Fig. 51 below outlines data sources used to estimate the gravity model.

Fig. 51. Overview of data sources used for gravity model

Indicator	Data provider	Weblink
GDP	OE Databank	
GDP per capita	OE Databank	
Population	OE Databank	
Common Language (official)	cepii.fr (geodist dataset)	http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=6
Common Language (ethnicity)	cepii.fr (geodist dataset)	http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=6
Distance (km)	cepii.fr (geodist dataset)	http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=6
Landlocked	Wikipedia	https://en.wikipedia.org/wiki/Landlocked_country
Common Border	Macalester edu	http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeData.html#Gravity
Colonial link	cepii.fr (geodist dataset)	http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=6
Merchandise imports	IMF	http://data.imf.org/?sk=7CB6619C-CF87-48DC-9443-2973E161ABEB
Merchandise exports	IMF	http://data.imf.org/?sk=7CB6619C-CF87-48DC-9443-2973E161ABEB
Tarrif Rates	World Bank	http://databank.worldbank.org/data/reports.aspx?source=2&series=TM.TAX.MRCH.WM.AR.ZS&country=
Non-resident arrivals	Central Bank of Dominican Republic, JTB	

Source: Oxford Economics

[42] Fukunari Kimura and Hyun-Hoon Lee, "The Gravity Equation in International Trade in Services", *Review of World Economics* , vol. 142 (2006): pages 92-121.

[43] L. and Moxnes, A. Grunfeld, "The Intangible Globalisation: Explaining Patterns of International Trade in Services.", *Norwegian Institute of International Affairs Paper*, No. 657 (2003).

[44] Daniel Mirza and Giuseppe Nicoletti, "What is So Special about Trade in Services?", *University of Nottingham Research Paper* , No. 2004/02 (2004).

[45] S.-C. Park, "Measuring Tariff Equivalents in Cross-Border Trade in Services. ", *Korea Institute for International Economic Policy Working Paper.*, No. 02-15. (2002).

[46] Rina Bhattacharya and Hirut Wolde, "Constraints on Trade in the MENA Region ", *IMF Working Paper*, WP/10/31 (2010).

[47] Matthieu Bussière, Michael Fidora and Roland Straub Thierry Bracke, "A FRAMEWORK FOR ASSESSING GLOBAL IMBALANCES", *European Central Bank*, NO 78 (2008).

Fig. 52. Trading partners in each gravity model

Jamaica export and import models		Dominican Republic export and import models	
Australia	Israel	Argentina	India
Austria	Italy	Aruba	Ireland
Bahamas	Japan	Australia	Israel
Barbados	Netherlands	Austria	Italy
Belgium	New Zealand	Bahamas	Jamaica
Belize	Nicaragua	Belgium	Japan
Brazil	Norway	Bolivia	Luxembourg
Chile	Pakistan	Brazil	Mexico
China	Panama	Bulgaria	Nicaragua
Colombia	Paraguay	Canada	Norway
Costa Rica	Peru	Chile	Panama
Denmark	Philippines	China	Peru
Dominica	Poland	Colombia	Poland
Ecuador	Portugal	Costa Rica	Portugal
El Salvador	Russia	Czech	Romania
Finland	Saudi Arabia	Denmark	Russia
France	Singapore	Ecuador	Spain
Germany	Spain	El Salvador	Sweden
Greece	Sweden	Finland	Switzerland
Grenada	Switzerland	France	Taiwan
Guatemala	Turkey	Germany	Trinidad
Guyana	Ukraine	Greece	United Kingdom
Honduras	United States	Guatemala	United States
Ireland	Uruguay	Haiti	Uruguay
		Honduras	

The following tables document the major findings from our econometric models. The coefficient on arrivals represents the elasticity of exports with respect to connectivity. So, for example, in the Jamaica export model, the coefficient of 0.206 indicates that for each 10 percent increase in arrivals, goods exports increase by 2.06 percent.

Fig. 53. Jamaica export model

	Dynamic GMM
lagged export	0.357***
GDP host	2.887***
GDP partner	0.151***
Population host	-6.269***
Population partner	0.034***
Distance	-0.213***
Common language	0.628***
Arrivals	0.206***
Number of observations	670
Robustness tests	
Arellano-Bond test AR (2)	Passed
Sargan test	Passed

Legend: * p<.1; ** p<.05; *** p<.01. All the variables are in natural logarithm with the exception of the language dummy.

Fig. 54. Jamaica import model

	Dynamic GMM
lagged import	0.580***
GDP host	2.452***
GDP partner	0.198***
Population host	-5.067***
Population partner	0.064***
Distance	-0.506***
Common language	0.361***
Arrivals	0.083***

Number of observations	706
Robustness tests	
Arellano-Bond test AR (2)	Passed
Sargan test	Passed
Legend: * p<.1; ** p<.05; *** p<.01. All the variables are in natural logarithm with the exception of the language dummy.	

Fig. 55. Dominican Republic export model

	Dynamic GMM
lagged export	0.560***
GDP host	1.126***
GDP partner	0.240***
Population host	-2.077***
Population partner	0.075***
Distance	-0.688***
Real exchange rate	-0.0002**
Landlocked	-0.087*
Arrivals	0.092***
Number of observations	673
Robustness tests	
Arellano-Bond test AR (2)	Passed
Sargan test	Passed
Legend: * p<.1; ** p<.05; *** p<.01. All the variables are in natural logarithm with the exception of the landlocked dummy and the real exchange rate variable.	

Fig. 56. Dominican Republic import model

	Dynamic GMM
lagged import	0.480***

GDP host	1.109***
GDP partner	1.718***
Population host	-5.432***
Population partner	-1. 437***
Distance	-0.927***
Real exchange rate	0.0003*
Landlocked	-1.303***
Arrivals	0.014 (significant at 15 percent)
Number of observations	687
Robustness tests	
Arellano-Bond test AR (2)	Passed
Sargan test	Passed

Legend: * p<.1; ** p<.05; *** p<.01. All the variables are in natural logarithm with the exception of the landlocked dummy and the real exchange rate variable.

In a dynamic econometric model, the first lagged dependent variable is, by construction, correlated with the model error term in the presence of serial correlation. Such a feature indicates a problem with endogeneity (whereby there is reverse causality the dependent and one of the independent variables). In the presence of endogeneity, the coefficient on the lagged dependent variable will be biased and hence unreliable.

The solution to the endogeneity problem is to use another variable which is correlated with the endogenous variable but uncorrelated with the error term. Such a variable is known as an instrument and this approach is known as the instrumental variable approach e.g. the Dynamic GMM approach is an example of an instrumental variable based approach.

The instruments used in our present context are the distant lags of the lagged dependent variable. For the model to be valid, these lags have to be uncorrelated with the model residuals/error term. The Arrelano-Bond test AR (2) and Sargan tests are both used to assess whether the instruments are uncorrelated with the model error term. Specifically, the former test does this by testing for serial correlation in the residuals differences. Whilst the Arellano-Bond test AR (2) has a null hypothesis of no autocorrelation, the Sargan test has a null hypothesis that the instruments used as a group are exogenous. Ultimately, both tests are used to answer the same question of whether the instruments are valid.

Modelling the economic impact of additional exports

The first stage of quantifying the impact of increased exports is to calibrate the value of additional sales based on the gravity modelling results and international trade data in the host economy. The coefficient on connectivity in the equation can be interpreted as representing

the average relationship between the two variables over the model horizon (in this case 2000-2015). To make our analysis more applicable to IFC, we decided to measure the connectivity effect over the investment horizon i.e. from investment completion up to 2015. In each case, the percentage change in connectivity was calculated using data on passenger arrivals at airports across the country. This was applied to the connectivity coefficient from the relevant gravity model to quantify the percentage change in exports attributable to the airport. Finally, the absolute change in exports (in US $ terms) was calculated based on the value of that country's exports in 2015.

The gravity model framework does not provide any information on the composition of trade that was supported by additional connectivity. Therefore, to model the economic impact of these additional exports, we needed to make an assumption about their product composition. In each case, this was done based on available data on merchandise trade by product in 2015 as shown in the table below.

Fig. 57. Breakdown of export sectoral mapping[48]

Jamaica model	
Sector mapping in the SAM model	Share of goods exports
Agriculture, hunting, forestry and fishing	6.3 percent
Mining and quarrying	71.5 percent
Manufacturing	22.3 percent
Dominican Republic model	
Sector mapping in the SAM model	Share of goods exports
Crop farming	7.0 percent
Livestock, forestry and fishing	0.9 percent
Mining and quarrying	14.2 percent
Manufacture of food	3.5 percent
Manufacture of beverages and tobacco	8.2 percent
Manufacture of petroleum products and chemicals	7.9 percent
Other manufacturing	58.2 percent

Sources: Jamaica Tourist Board, Central Bank of the Dominican Republic, Oxford Economics assumptions

Modelling the economic impact of additional imports

Conceptually, an injection of exports is not equivalent to an increase in imports. Whereas is the former can be modelled as a simple change in final demand, with the associated increase in production simulated via a SAM model, the latter needs to be conceptually treated as enabling an increase in supply, by relieving a production constraint.

[48] For the 'other services' section of miscellaneous expenditure, the spending was split between relevant sectors in each country model in a 50:50 ratio.

Following an approach used in previous studies, we have used findings from the literature on the relationship between imports and production growth to calibrate the shock.[49] Previous research for four countries in Southeast Asia found an import elasticity of between 0.226-0.443 for Total Final Expenditure (TFE) growth. In this project, we have used the (mean) average of these four values (0.346) and applied it to the change in imports (in value terms) quantified by the gravity model. To translate the change in TFE into Gross Output (GO), we then further scaled this value based on the economy-wide ratio between TFE and GO (sourced from the latest supply use data for each economy).

The resulting values (US $15.1 million for the Dominican Republic and US $20.8 million for Jamaica) reflect the total increase in production enabled by the additional imports. The shock was allocated across economic sectors based on their share of imported goods intermediate consumption—these shares are documented in Fig. 58. Finally, it is worth noting that the GO values, as constructed here, represent the total increase in economy-wide production inclusive of the supply chain. Therefore, in the case of the Dominican Republic, the shock needed to be calibrated so that the sum of direct GO and indirect GO equalled US $15.1 million. This was achieved using the Type I multipliers to back out a direct shock that would achieve a Type I GO impact of US $15.1 million.

Fig. 58. Breakdown of imported intermediate consumption sectoral mapping

Jamaica model	
Sector mapping in the SAM model	Share of goods imports intermediate consumption
Agriculture, hunting, forestry and fishing	2.7 percent
Mining and quarrying	2.7 percent
Manufacturing	39.8 percent
Electricity Gas and Water Supply	10.7 percent
Construction	10.1 percent
Wholesale and retail trade, repairs	11.1 percent
Transport Storage and Communication	13.9 percent
Financial Intermediation	0.6 percent
Real Estate Renting & Business Activities	1.0 percent
Public administration and defence, health and education	2.8 percent
Other Community Social and Personal Service Activities	4.6 percent
Dominican Republic model	
Sector mapping in the SAM model	Share of goods imports intermediate consumption
Crop farming	3.1 percent
Livestock, forestry and fishing	1.4 percent
Mining and quarrying	16.9 percent
Manufacture of food	6.7 percent
Manufacture of beverages and tobacco	1.9 percent

[49] K and Tavakoli, A Marwah, "The effect of foreign capital and imports on economic growth: further evidence from four Asian countries (1970-1988)", *Journal of Asian Economics*, 15 (2) (April 2004): 399-413.

Manufacture of petroleum products and chemicals	6.9 percent
Other manufacturing	12.3 percent
Electricity, gas and water Supply	15.3 percent
Construction	12.9 percent
Retail and wholesale trade	3.5 percent
Transport and storage	13.8 percent
Telecommunications	1.6 percent
Financial Intermediation and insurance	0.6 percent
Professional, scientific and technical services	0.3 percent
Public administration and defence, health and education	2.7 percent
Other Community Social and Personal Service Activities	0.2 percent

Sources: Jamaica Tourist Board, Central Bank of the Dominican Republic, Oxford Economics assumptions

10. APPENDIX 3 – DETAILED RESULTS

DETAILED RESULTS BY INDUSTRIAL SECTOR

MBJ

Fig. 59. Operational impact by industrial sector: GVA

US $ million, 2015	Direct	Indirect	Induced	Total
Agriculture		0.1	0.3	0.4
Mining & quarrying		0.0	0.0	0.0
Manufacturing		0.5	0.5	1.0
Electricity, gas & water supply		1.0	0.1	1.2
Construction		0.3	0.1	0.4
Wholesale & retail		0.8	1.1	1.9
Hotels & restaurants		0.0	0.4	0.4
Transport & communication	43.2	0.5	0.5	44.2
Financial services		1.5	0.7	2.2
Business services & real estate		2.5	0.7	3.2
Public administration, health & education		0.3	0.3	0.6
Other social & personal services		0.1	0.4	0.4
Total	43.2	7.6	5.1	56.0

Source: Oxford Economics

Fig. 60. Operational impact by industrial sector: employment

Headcount, 2015	Direct	Indirect	Induced	Total
Agriculture		19	80	99
Mining & quarrying		0	0	0
Manufacturing		34	34	69
Electricity, gas & water supply		30	4	34
Construction		25	11	35
Wholesale & retail		76	110	186
Hotels & restaurants		6	65	71
Transport & communication	168	36	39	243
Financial services		24	11	35
Business services & real estate		144	39	183
Public administration, health & education		34	29	63
Other social & personal services		5	29	34
Total	168	433	453	1,054

Source: Oxford Economics

Fig. 61. Tourism impact by industrial sector: GVA

US $ million, 2015	Direct	Indirect	Induced	Total
Agriculture	0.0	42.2	25.8	67.9
Mining & quarrying	0.0	0.0	0.0	0.0
Manufacturing	23.7	56.8	36.6	117.1
Electricity, gas & water supply	0.0	19.8	8.5	28.3
Construction	0.0	31.2	8.2	39.4
Wholesale & retail	41.0	92.6	72.5	206.1
Hotels & restaurants	287.7	3.3	27.8	318.8
Transport & communication	38.1	46.6	35.5	120.3
Financial services	0.0	60.0	48.1	108.1
Business services & real estate	8.0	60.4	48.7	117.1
Public administration, health & education	0.0	7.4	20.2	27.6
Other social & personal services	102.7	6.2	26.0	134.9
Total	501.2	426.4	357.8	1,285.4

Source: Oxford Economics

Fig. 62. Tourism impact by industrial sector: employment

Headcount, 2015	Direct	Indirect	Induced	Total
Agriculture	0	9,941	6,074	16,015
Mining & quarrying	0	0	0	0
Manufacturing	1,630	3,904	2,516	8,050
Electricity, gas & water supply	0	580	248	828
Construction	0	2,828	744	3,573
Wholesale & retail	4,087	9,234	7,230	20,550
Hotels & restaurants	47,348	549	4,571	52,469
Transport & communication	2,896	3,541	2,701	9,138
Financial services	0	978	784	1,762
Business services & real estate	450	3,401	2,742	6,593
Public administration, health & education	0	744	2,042	2,786
Other social & personal services	8,040	489	2,037	10,565
Total	64,451	36,189	31,689	132,329

Source: Oxford Economics

Fig. 63. Export impact by industrial sector: GVA

US$ million, 2015	Direct	Indirect	Induced	Total
Agriculture	1.5	1.1	0.2	2.8
Mining & quarrying	0.2	0.0	0.0	0.2

Manufacturing	2.8	3.5	0.3	6.6
Electricity, gas & water supply	0.0	0.3	0.1	0.4
Construction	0.0	0.2	0.1	0.2
Wholesale & retail	0.0	1.8	0.6	2.5
Hotels & restaurants	0.0	0.0	0.2	0.3
Transport & communication	0.0	0.8	0.3	1.1
Financial services	0.0	0.8	0.4	1.2
Business services & real estate	0.0	0.6	0.4	1.0
Public administration, health & education	0.0	0.1	0.2	0.3
Other social & personal services	0.0	0.0	0.2	0.3
Total	4.5	9.1	3.2	16.8

Source: Oxford Economics

Fig. 64. Export impact by industrial sector: employment

Headcount, 2015	Direct	Indirect	Induced	Total
Agriculture	359	252	54	666
Mining & quarrying	8	0	0	8
Manufacturing	191	239	23	452
Electricity, gas & water supply	0	9	2	11
Construction	0	14	7	21
Wholesale & retail	0	180	65	244
Hotels & restaurants	0	4	41	45
Transport & communication	0	57	24	82
Financial services	0	13	7	20
Business services & real estate	0	31	25	56
Public administration, health & education	0	9	18	27
Other social & personal services	0	4	18	22
Total	557	813	284	1,654

Source: Oxford Economics

Fig. 65. Import impact by industrial sector: GVA

US$ million, 2015	Direct	Indirect	Induced	Total
Agriculture	0.2	0.3	0.2	0.7
Mining & quarrying	0.0	0.0	0.0	0.0
Manufacturing	1.4	0.5	0.3	2.1
Electricity, gas & water supply	0.3	0.1	0.1	0.4
Construction	0.6	0.1	0.1	0.8
Wholesale & retail	0.8	0.8	0.6	2.2
Hotels & restaurants	0.0	0.0	0.2	0.2
Transport & communication	0.7	0.5	0.3	1.5

Financial services	0.0	0.4	0.4	0.9
Business services & real estate	0.1	0.4	0.4	0.9
Public administration, health & education	0.2	0.0	0.2	0.5
Other social & personal services	0.3	0.0	0.2	0.5
Total	4.6	3.1	2.9	10.6

Source: Oxford Economics

Fig. 66. Import impact by industrial sector: employment

Headcount, 2015	Direct	Indirect	Induced	Total
Agriculture	42	68	49	160
Mining & quarrying	0	0	0	0
Manufacturing	93	33	20	147
Electricity, gas & water supply	8	3	2	12
Construction	57	9	6	72
Wholesale & retail	81	78	58	217
Hotels & restaurants	0	4	37	41
Transport & communication	56	37	22	115
Financial services	1	7	6	14
Business services & real estate	4	22	22	49
Public administration, health & education	25	5	16	46
Other social & personal services	21	2	16	39
Total	388	268	256	911

Source: Oxford Economics

PUJ

Fig. 67. Operational impact by industrial sector: GVA

US $ million, 2015	Direct	Indirect	Induced	Total
Crop farming		0.1	0.3	0.5
Livestock, forestry & fishing		0.3	0.6	0.8
Mining & quarrying		0.0	0.0	0.0
Manufacture of food		0.6	0.9	1.5
Beverages and tobacco		0.0	0.4	0.5
Petroleum products & chemicals		0.5	0.2	0.7
Other manufacturing		0.5	0.2	0.7
Electricity, gas & water supply		3.3	0.2	3.6
Construction		1.3	0.0	1.3
Retail & wholesale		0.4	0.3	0.7
Hotels & restaurants		0.6	1.9	2.5
Transport & storage	113.9	0.9	1.1	116.0
Telecommunications		0.1	0.3	0.4
Financial services		0.4	0.4	0.8
Real estate		0.3	0.1	0.4
Professional services		2.2	0.2	2.4

Public administration, health & education		0.0	0.5	0.5
Other social & personal services		0.3	0.6	0.9
Domestic personnel		0.0	1.4	1.5
Total	113.9	11.9	9.9	135.7

Source: Oxford Economics

Fig. 68. Operational impact by industrial sector: employment

Headcount, 2015	Direct	Indirect	Induced	Total
Crop farming		23	57	80
Livestock, forestry & fishing		23	52	75
Mining & quarrying		0	0	0
Manufacture of food		17	27	44
Manufacture of beverages & tobacco		3	23	26
Petroleum products & chemicals		15	7	22
Other manufacturing		27	11	38
Electricity, gas & water supply		116	9	125
Construction		64	2	66
Retail & wholesale		66	42	108
Hotels & restaurants		32	97	129
Transport & storage	733	51	61	844
Telecommunications		1	3	3
Financial services		14	15	29
Real estate		5	2	6
Professional services		162	16	179
Public administration, health & education		1	37	38
Other social & personal services		38	82	120
Domestic personnel		0	90	90
Total	733	657	633	2,023

Source: Oxford Economics

Fig. 69. Tourism impact by industrial sector: GVA

US$ millions, 2015	Direct	Indirect	Induced	Total
Crop farming	0	25	21	46
Livestock, forestry & fishing	0	51	32	83
Mining & quarrying	0	1	0	1
Manufacture of food	45	24	57	126
Manufacture of beverages & tobacco	14	41	24	80
Petroleum products & chemicals	0	21	14	34
Other manufacturing	26	10	11	47
Electricity, gas & water supply	0	33	13	46
Construction	0	6	2	8
Retail & wholesale	60	0	0	60
Hotels & restaurants	740	66	100	906
Transport & storage	278	42	58	377
Telecommunications	0	17	17	33

Financial services	0	75	22	97
Real estate	0	17	7	24
Professional services	13	52	11	76
Public administration, health & education	0	1	26	28
Other social & personal services	438	28	33	499
Domestic personnel	0	0	76	76
Total	1,614	509	524	2,647

Source: Oxford Economics

Fig. 70. Tourism impact by industrial sector: employment

Headcount, 2015	Direct	Indirect	Induced	Total
Crop farming	0	4,141	3,468	7,609
Livestock, forestry & fishing	0	4,714	2,987	7,701
Mining & quarrying	0	7	3	10
Manufacture of food	1,290	698	1,631	3,619
Manufacture of beverages & tobacco	815	2,319	1,376	4,510
Petroleum products & chemicals	0	608	405	1,013
Other manufacturing	1,483	600	623	2,707
Electricity, gas & water supply	0	1,149	466	1,615
Construction	0	308	121	429
Retail & wholesale	9,053	0	0	9,053
Hotels & restaurants	38,084	3,393	5,163	46,640
Transport & storage	15,078	2,269	3,144	20,491
Telecommunications	0	133	134	267
Financial services	0	2,659	781	3,440
Real estate	0	254	96	349
Professional services	988	3,793	813	5,594
Public administration, health & education	0	104	1,986	2,090
Other social & personal services	57,622	3,673	4,383	65,679
Domestic personnel	0	0	4,794	4,794
Total	124,414	30,822	32,373	187,609

Source: Oxford Economics

Fig. 71. Export impact by industrial sector: GVA

US$ millions, 2015	Direct	Indirect	Induced	Total
Crop farming	9.1	1.2	1.5	11.8
Livestock, forestry & fishing	1.2	1.9	2.3	5.4
Mining & quarrying	8.5	0.4	0.0	9.0
Manufacture of food	3.1	0.6	4.1	7.8

Manufacture of beverages & tobacco	9.7	1.3	1.8	12.7
Petroleum products & chemicals	6.5	4.2	1.0	11.8
Other manufacturing	42.5	4.9	0.8	48.2
Electricity, gas & water supply	0.0	7.7	1.0	8.7
Construction	0.0	0.2	0.2	0.4
Retail & wholesale	0.0	0.0	0.0	0.0
Hotels & restaurants	0.0	6.8	7.2	14.0
Transport & storage	0.0	3.0	4.2	7.2
Telecommunications	0.0	0.9	1.2	2.1
Financial services	0.0	4.4	1.6	5.9
Real estate	0.0	0.7	0.5	1.2
Professional services	0.0	3.7	0.8	4.5
Public administration, health & education	0.0	0.2	1.9	2.1
Other social & personal services	0.0	1.3	2.4	3.7
Domestic personnel	0.0	0.0	5.5	5.5
Total	80.7	43.6	37.9	162.1

Source: Oxford Economics

Fig. 72. Export impact by industrial sector: employment

Headcount, 2015	Direct	Indirect	Induced	Total
Crop farming	1,510	202	250	1,963
Livestock, forestry & fishing	112	175	216	503
Mining & quarrying	112	6	0	118
Manufacture of food	89	17	118	224
Manufacture of beverages & tobacco	548	73	99	720
Petroleum products & chemicals	192	125	29	346
Other manufacturing	2,443	281	45	2,768
Electricity, gas & water supply	0	271	34	305
Construction	0	11	9	20
Retail & wholesale	0	0	0	0
Hotels & restaurants	0	350	373	723
Transport & storage	0	165	227	392
Telecommunications	0	7	10	17
Financial services	0	155	56	211
Real estate	0	10	7	17
Professional services	0	272	59	330
Public administration, health & education	0	19	143	162
Other social & personal services	0	169	317	486
Domestic personnel	0	0	346	346
Total	5,006	2,307	2,338	9,652

Source: Oxford Economics

Fig. 73. Import impact by industrial sector: GVA

US$ millions, 2015	Direct	Indirect	Induced	Total
Crop farming	0.2	0.1	0.1	0.4
Livestock, forestry & fishing	0.1	0.2	0.1	0.4
Mining & quarrying	0.6	0.0	0.0	0.6
Manufacture of food	0.3	0.0	0.3	0.6
Manufacture of beverages & tobacco	0.1	0.0	0.1	0.3
Petroleum products & chemicals	0.3	0.3	0.1	0.6
Other manufacturing	0.5	0.2	0.0	0.7
Electricity, gas & water supply	0.6	0.3	0.1	1.0
Construction	0.7	0.0	0.0	0.7
Retail & wholesale	0.2	0.0	0.0	0.2
Hotels & restaurants	0.0	0.4	0.5	0.9
Transport & storage	0.9	0.2	0.3	1.4
Telecommunications	0.1	0.1	0.1	0.2
Financial services	0.0	0.3	0.1	0.4
Real estate	0.0	0.0	0.0	0.1
Professional services	0.0	0.2	0.1	0.3
Public administration, health & education	0.2	0.0	0.1	0.4
Other social & personal services	0.0	0.1	0.2	0.2
Domestic personnel	0.0	0.0	0.3	0.3
Total	5.0	2.4	2.4	9.8

Source: Oxford Economics

Fig. 74. Import impact by industrial sector: employment

Headcount, 2015	Direct	Indirect	Induced	Total
Crop farming	36	13	16	66
Livestock, forestry & fishing	10	15	14	38
Mining & quarrying	7	0	0	8
Manufacture of food	9	1	7	18
Manufacture of beverages & tobacco	7	2	6	15
Petroleum products & chemicals	9	8	2	19
Other manufacturing	28	9	3	40
Electricity, gas & water supply	21	11	2	34
Construction	36	1	1	37
Retail & wholesale	37	0	0	37
Hotels & restaurants	0	21	24	45
Transport & storage	52	12	14	78
Telecommunications	1	1	1	2
Financial services	1	10	4	15
Real estate	0	0	0	1

Professional services	2	16	4	21
Public administration, health & education	17	1	9	27
Other social & personal services	3	9	20	32
Domestic personnel	0	0	22	22
Total	276	130	148	554

Source: Oxford Economics

11. APPENDIX 4 – EVALUATING THE ROLE OF IFC'S INVESTMENTS

In this study, we have provided a qualitative assessment of the role of IFC's investments. This choice was partly motivated by data and resource constraints. For example, a CGE modelling approach would have lent itself to a quantitative answer to this question, controlling for relevant feedback effects across the economy. However, CGE modelling is an extremely time- and resource-intensive exercise and was judged to be too costly for this project.

An alternative means of quantifying the impact of IFC's investment would have been to use an econometric model using a so-called 'difference in difference' method. This would involve quantifying the economic contribution of the airport on a time series basis and using an econometric model to assess the change that can be attributed to the investment whilst controlling for other factors. However, the identification and appropriate measurement of these control factors would have been very challenging in this context As such it was judged that a qualitative assessment was the most appropriate method in this project.

In this context, a crucial feature to judge is whether the investment relieved a capacity constraint that would have otherwise become binding. In general, official data on airport capacity is not published, so here we relied on discussions with airport officials during the respective fieldtrips. In the case that the investment was found to have lifted a binding capacity constraint i.e. passenger flow subsequently rose above the identified threshold, it is reasonable to conclude that the associated share of economic activity supported by the airport was enabled by the investment. To explicate this logic, we use the example of MBJ.

- Discussions with personnel at MBJ indicated that the airport's passenger handling capacity was around three million prior to IFC's investments.
- In 2015, passenger flow was just over 3.8 million, of whom approximately 22 percent would not have been able to use the airport without the investment.
- Since passengers are the ultimate drivers of economic activity (either via operations, tourism or trade) it is in turn possible to conclude that 22 percent of MBJ's 2015 footprint was enabled by IFC's investment—that is, it was a necessary but not a sufficient condition for this economic activity.

A final element to consider when evaluating the impact of the investment is the counterfactual of how any additional passengers would have behaved. Broadly speaking, two alternatives exist: they would have used an alternative mode of travel to access the host economy; or they would have opted to travel elsewhere or simply to not make the trip. The former would imply that any net impact on the national economy whereas the latter would imply that the economy would have lost out on the economic activity (via operations, trade and tourism) sustained by this passenger.

A judgement on the balance between these two options can be informed by an understanding of the following factors:

- **The availability of alternative modes of travel:** the ease with which the passenger could arrive at the destination via an alternative mode of transport will influence the decision-making of these passengers. In the case of MBJ, the only other mode of international travel is via Kingston Norman Manley, which has poor connectivity to

resort locations around Montego Bay. This would suggest that the absence of a seat on a flight into MBJ would act as a significant deterrent to a potential visitor;

- **The availability of alternative locations in-country:** the viability of a passenger choosing to travel elsewhere in-country will depend on the presence and ease of access to relatively substitutable locations. For example, other locations with a similar offer to Punta Cana do exist in the Dominican Republic which can be accessed directly by air e.g. around Puerto Plata. This suggests that some of the extra passengers could have opted to switch to an alternative resort in the Dominican Republic; and
- **The purpose of visit of passengers to the airport:** leisure visitors are likely to be more sensitive to the additional cost (time and money) of a different route to their ultimate location. Given that the vast majority of arrivals to both MBJ and PUJ were leisure passengers, this makes it more likely that they would have opted to travel elsewhere.

12. APPENDIX 5 – FIELD TRIP DETAIL

BACKGROUDN INFORMATION

As part of the project field trips were carried out to each location. The trip to the Dominican Republic took place between May 30 and June 3 while the trip to Jamaica took place June 6 and June 10. Both trips involved meetings in each country's respective capital city (Santo Domingo and Kingston) and at on-site at the airports. Details on the meetings conducted are shown below.

STAKEHOLDERS INTERVIEWED

Dominican Republic

- Meeting with Punta Cana Airport Group including Frank J Libre, CEO and Rafael Ramirez Medina, CFO
- Meeting with Christian Medina, Construction Developer and and La Altagracia Developers and Constructors Association (ADECLA)
- Meeting with Oficina Nacional de Estadistica, those present included: Luis Madera, Head of Economic Statistics; and Juan De Aza, Head of Sectoral Trade and Foreign Trade Division
- Meeting with Banco Central de la Republica Dominicana, those present included: Ramon Gonzalez Hernandez, Director of the Department of National Accounts and Economic Statistics; Joel Tejeda Compres, Assistant Manager of Monetary, Exchange Rates and Financial policy; Julio Anduar Scheker, Director of Monetary programming and economic research; and Elina Rosario Rodriquez, Deputy Director, Department of National Accounts and Economic Statistics
- Meeting with Centro de Exportacion e Inversion de la Republica Dominicana, those present included: Gerson Perez Alvarez, New Business Deputy Manager; Mildred Santos, FDI Market Intelligence Manager; and Jean Alain Rodriquez, Executive Director
- Meeting with Simon Suarez, President of Asonahores

Jamaica

- Meeting with Trade and Investment Promotion Agency (JAMPRO), those present included: Shulette Cox, Vice President for Corporate Development and Competitiveness.
- Meeting with the Jamaica Airports Authority, those present included Audley Deidrick; Samuel Manning; John McFarlane; Alfred McDonald; and Verona Vacianna
- Meeting with Ministry of Tourism and Jamaica Tourist Board, those present included: Jennifer Griffith, Permanent Secretary of Ministry of Tourism; Geraldine Wright; and Antoinette Lynn, Research and Markets Intelligence Officer.
- Meeting with the Statistical Institute of Jamaica (STATIN), those present included: Carol Coy, Director General; and Yvonne Newland, Director of the Economic Accounting Division.
- Meeting with representatives from MBJ Airport
- Meeting with the Business Processing Industry Association (BPIA), those present included: Dr. Guna Muppuri, President and CEO of BPIA; and Julaire Hall.
- Meeting with Peter Hall, Acting Chief Operating Officer, MBJ Airport
- Meeting with David Hall, Owner of MBJ Business Lounge
- Meeting with Roland Clarke, Express Catering
- Meeting with Shane Munroe, Acting Chief Technology Officer, MBJ Airport
- Meeting with Denton Campbell, former CEO of Sangster International Airport (SIA)

13. APPENDIX 6 – TERMS OF REFERENCE

CONTEXT

In the past 10 years, IFC has committed US $1.6 billion towards financing the construction, expansion and modernization of airport infrastructure in over 10 countries. Airport infrastructure is not only a fundamental enabler of air transport operation, but also plays an important role in the job creation and economic activity of other sectors. While IFC has an understanding of the direct effects of its investment services on airports, the effects on other sectors remain unmeasured.

Airport infrastructure is a valuable asset that contributes to employment and economic growth. Conceptually, an investment on airport infrastructure directly benefits different economic agents, including:

(1) **Households** that are employed during the construction/operation/expansion/modernization phase of the airport
(2) ***Airport operators*** that benefit from increased # of passengers and operations
(3) ***Government*** which obtains concession fees and taxes from the operation of airports
(4) ***Firms*** in the tradable sector which benefit from greater access and more efficient airport and air industry services, and in some cases, at a lower cost.

Airports have important spill over effects in the economy. Most of the effects (indirect and induced) are linked to increased consumption, investment, and job creation through various transmission channels. Some examples are as follows:

(1) Linkages between the airport operation and the air transport industry which lead to greater demand and supply of services, and consequently to indirect and induced job creation. These services include: airlines, freight, aircraft maintenance, catering, fueling, air navigation, and other on- site airport services.
(2) Airport operations have a strong linkage with the tourism sector through consumption, as visitors/tourists demand not only airport operations and on-site services, but also other local services such as hotel accommodations, tourism operator services, restaurants, retail, entertainment, and financial services. In its turn, an increase in tourism sector activities leads to indirect and induced job creation.
(3) Air operations also have broad benefits in the tradable sector by improving the efficiency of the supply chain and hence local firms' competitiveness. To the extent that firms take advantage of these efficiency gains, this should lead to economic growth. Sectors with greater access to markets become more attractive to foreign investors. Foreign investors benefit from improved connectivity with global markets, as they base their decisions to outsource or relocate to the economy that has improved its airport operations.

While some of the effects depicted above are a good starting point for economic impact assessments, their magnitude remains unquantified.

OBJECTIVES

The purpose of the assessment is (1) to provide a review of the best practice methodologies to assess the broad job creation (direct, indirect, and induced) and economic growth effects of

airports investments, and (2) to apply this methodology to IFC investments in airports in the economies of Jamaica and Dominican Republic . The review of best practice methodologies should identify those subsectors and categories of economic activities that are more likely to benefit from airport construction, operations, expansion, and modernization. The evidence will allow quantifying the direct, indirect, induced effects on job creation and economic growth, in the context of economies that are highly dependent on tourism.

METHODOLOGY

The assessment will be underpinned by a systematic review of methodologies and two case studies.

The review of best practice methodologies should identify the sectors, subsectors and categories of economic activities that are more likely to benefit from airport construction, operations, expansion, and modernization. As such, it will specify linkages, considering the most meaningful effects for economies that are highly dependent on tourism.

The review will evaluated different macroeconomic models available, such as Input-Output, SAM and CGE to select a methodology most applicable to estimate indirect and induced growth job effects.

The methodology review will also serve the purpose of informing the case studies by establishing a conceptual framework on the linkages of investment in airport infrastructure with other sectors. The specific assessment of the economic effects of IFC investments on airports will be carried out by applying the best practice methodology in the context of the two case studies, namely: Jamaica and Dominican Republic. The methodology review is expected to capture the following effects:

- Direct, indirect, and induced job effects and value added effects in the airport industry (where the investments themselves take place).
- Direct, indirect, and induced job effects, as well as value added effects in the tourism and tradable industries.
- Overall effect on economic growth of the economy from the airport investments.

KEY QUESTIONS

Below are a set of questions that should be addressed in the methodology review and case studies.

Methodology review

(1) What are the best practice methods used to identify linkages between the construction/expansion/modernization of an airport, the air industry supply chain, and other sectors of the economy? What are the major sectors and sub-sectors of the economy affected by the aforementioned interventions?
(2) What are the best practice methods and models used to quantify the direct, indirect, induced effects of airports on job creation and GDP? This should include an extensive review of macro models with pros and cons (Input - Output, SAM, CGE) to estimate direct, indirect and induced job effects.
(3) Considering the strengths, weaknesses, and caveats of the aforementioned, what is the recommended method that best suits the assessment of the two case studies?

Case studies[50]

IFC is interested in obtaining quantitative estimates and qualitative conclusions for country employment and GDP growth across the following dimensions:

(1) Air transport linkages: What are the direct, indirect, and induced job creation and value added effects (and their size) of the construction of Montego Bay/Punta Cana airport on the air transport sector including the effects on operations of airlines services, and support services (freight, aircraft maintenance, catering, fueling, air navigation, etc.)?
(2) Tourism:

- What is the effect of the construction of Montego Bay/Punta Cana airport on the tourism activities of Jamaica/Dominican Republic? Which specific tourism activities within the tourism sector benefited the most?
- To what extent has the construction of the airport led to increased expenditure by tourists, and to increased economic activity of tourism operations, hotel accommodation, restaurants, retail, entertainment services and other economic activities related to tourism?
- What are the direct, indirect, and induced effects (and their size) on the creation of jobs and value added in the tourism sector?

(3) Tradable sector:

- What is the effect of the construction of Montego Bay/Punta Cana airport on the economic activity of the tradable sector?
- Has the airport led to improved efficiency of the supply chain and access to markets for local firms in Jamaica and Dominica Republic? What is the magnitude of this effect in their turnover and job creation?
- To what extent has the construction of the airport led to increased foreign trade by local firms?
- What are the direct, indirect, and induced effects (and the size of these effects) on jobs and value added in the tradable sector?

(4) What were the effects on the other sectors, if it is found that a specific airport has a substantial impact on a sector not mentioned above?
(5) What are the overall effects on the GDP of the economies from the Montego Bay/Punta Cana airport?

DELIVERABLES

(1) A first report: containing i) a review of existing literature on best practice methods to assess economic direct, indirect and induced effects of airports on GDP and employment; and ii) a recommendation on the best practice methods to use for the case studies of Jamaica and Dominican Republic (Beginning of April, 2016).

Internal Decision taken by IFC and Let's Work to apply identified method to country case studies (Due by mid-April 2016)

(2) A draft report containing estimates of the direct, indirect, and induced effects of IFC investment in airports on jobs and GDP in Jamaica and Dominican Republic. The estimates will be made by applying the best practice methodology identified in deliverable 1 and by conducting necessary field work in Jamaica and Dominican Republic. (Due mid-June 2016).
(3) A final report containing estimates of the direct, indirect, induced effects of IFC investment in airports on jobs and GDP in Jamaica and Dominican Republic. (Due mid-July, 2016).
(4) A template to estimate job and economic growth effects of tourism airport projects for future IFC funded airport projects (Due end- July, 2016).

Acceptance of Deliverables:

Deliverables 1-4 will be reviewed by the IFC Task Team and cleared by Let's Work Team.

QUALIFICATIONS

The firm carrying out this work shall satisfy the following requested qualifications:

- At least 15 years of experience in the formulation, implementation, monitoring, evaluation and assessment of private sector development projects, particularly in infrastructure and in the transportation sector.
- Previous experience in conducting rigorous quantitative and qualitative studies in the international development context.
- A solid background in economics, development finance, economic modelling, with an emphasis in the infrastructure sector, particularly in multi-modal transport and air transport sectors and associated economic linkages.
- Specialized experience in methodologies related to: Input-Output, CGE, micro surveys with firms; macro econometric and regional economic models; Land Use / Transportation Interaction (LUTI) models; Multiplier models; agglomeration economics
- Strong analytical, technical and writing skills in English.

[50] The questions included in this section will be adjusted on the basis of the systematic literature review.

14. APPENDIX 7 – ALTERNATIVE MODELLING APPROACHES

As part of the inception phase of this project, we conducted a comprehensive literature review around three alternative methodologies that have been used to quantify the economic impact of airports. Below, we detail some of the main theoretical and empirical findings from this exercise.

THEORETICAL OVERVIEW

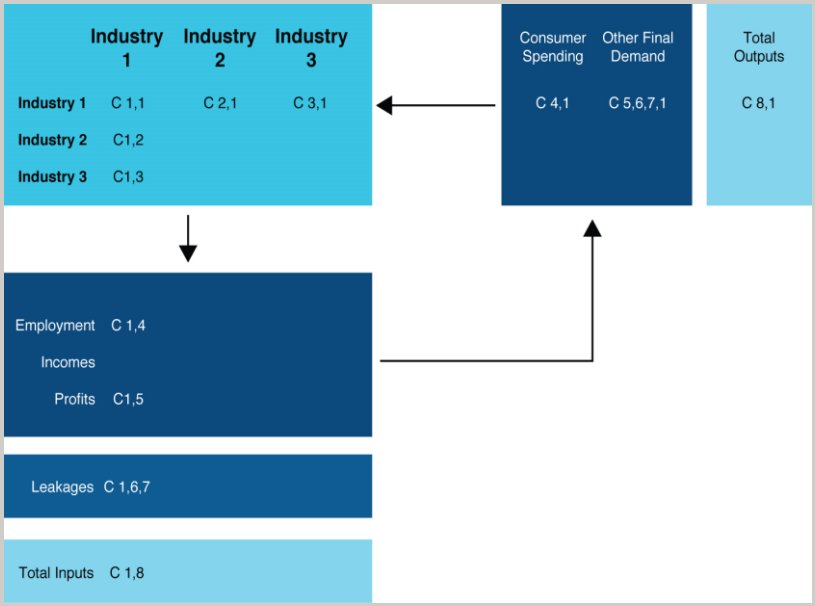
I-O models

I-O models essentially demonstrate the input-output linkages between different industries in an economy. An I-O table provides a snapshot of an economy at a particular point in time, showing the major spending flows from "final demand" (i.e. consumer spending, government spending and exports to the rest of the world); the interaction between different sectors in the economy in terms of intermediate spending (supply chain expenditures); the proportion of spending that is retained within the economy (rather than being used to purchase imports); and the distribution of income between employment and other sources (mainly profits).

The core of an I-O table demonstrates the linkages between firms in different sectors of the economy. Typically, these sectors are defined according to internationally recognised criteria such as the International Standard Industrial Classification (ISIC) published by the UN. The columns of an I-O table document purchases and the rows track sales during the reference period. Each sectoral column maps how that industry's gross output (revenue) is distributed between value added and intermediate consumption (both domestic and imported).

Using the data in an I-O table, it is possible to calculate supply chain and wage consumption multipliers for each industry. Supply chain multipliers illustrate the change in inputs across sectors required to meet a one unit increase in industry output. Meanwhile, wage consumption multipliers measure the impact of changes in industry output on wages, subsequent changes in household spending and the resulting economy-wide impact. Together, these multipliers provide an indication of how an increase in output in one industry supports economic activity across the economy.

Fig. 75. A stylised I-O model



An I-O model's main attribute is its ability to comprehensively treat expenditure flows through the economy following an exogenous demand shock. However, the model is premised on a number of simplifying assumptions documented below:

- **Constant returns to scale**: it is assumed that the quantity of inputs used is directly proportionate to the level of output produced;
- **Fixed input structure**: it is assumed that firms in each sector do not vary the mixture of inputs used including between domestically-produced and imported goods and services;
- **No capacity constraints**: the supply of factors of production (land, labour and capital) is essentially assumed to be unlimited so that any increase in demand can immediately met by an increase in supply; and
- **Fixed prices**: prices of all goods, services and factors of production are assumed to remain unchanged.

These limitations are important to consider when interpreting the results from I-O analysis. For example, to the extent that an increase in demand is not matched by an increase in that economy's capacity to supply goods and services prices will rise. Such price rises weaken the external competitiveness of domestic firms and may trigger other changes such as a rise in interest rates which act to reduce demand. Such responses are generically described as "crowding out" effects and, in themselves, imply that the I-O framework is likely to overstate the economic impact of an exogenous change in demand.

SAM model

In comparison to an I-O table, a SAM provides a more complete view of the circular flow of income from production to factor incomes, household income to household consumption and back to production. A SAM extends the I-O framework, by demonstrating the interaction between production activities, factors of productions, different economic agents (households,

governments), capital accounts and foreign entities (imports, exports) and, often, the distribution of this income.

A SAM is comprehensive in the sense that it captures all types of activity undertaken in an economy (consumption, production, accumulation and distribution).[51] In addition, it is generally accepted that for a SAM to truly deserve the label 'social' it needs to contain some detail on distributional features of the household sector.[52]

A SAM is laid out in a square matrix format with each row and column representing an 'account'.[53] It is built on the principle of double-entry accounting so that the sum of each row and column must equal and by implication that total revenue equals total expenditure.

Fig. 76. Structure of a SAM[54]

		Activities C1	Commodities C2	Factors C3	Households C4	Government C5	Savings and investment C6	Rest of world C7	Total
		Expenditure columns							
Activities R1	Income rows		Domestic supply						Activity income
Commodities R2		Intermediate demand			Consumption spending (C)	Recurrent spending (G)	Investment demand (I)	Export earnings (E)	Total demand
Factors R3		Value-added							Total factor income
Households R4				Factor payments to households		Social transfers		Foreign remittances	Total household income
Government R5			Sales taxes and import tariffs		Direct taxes			Foreign grants and loans	Government income
Savings and investment R6					Private savings	Fiscal surplus		Current account balance	Total savings
Rest of world R7			Import payments (M)						Foreign exchange outflow

[51] J Round, "Social Accounting Matrices and SAM-based Multiplier Analysis," in *Techniques for Evaluating the Poverty Impact of Economic Policies* ([n.p]: World Bank and Oxford University Press, 2003), Chapter 14.
[52] Ibid.
[53] C, Thomas, M and Thurlow, J Breisinger, *Social Accounting Matricies and Mutliplier Analysis: An introduction with exercises* ([n.p]: International Food Policy Research Institute, 2010).
[54] Ibid.

Total		Gross output	Total supply	Total factor spending	Total household spending	Government expenditure	Total investment spending	Foreign exchange inflow	

Similar to an I-O model, the SAM framework enables an analogous multiplier analysis to be carried out, with the user able to quantify the total change in demand supported by a one unit increase in industry output. These multipliers will provide a slightly more complete treatment of the circular flow of income so that all income (including profits) receipts are recycled into final demand. As a result a SAM type II multiplier will be higher than its equivalent from an I-O model.[55] However, analysis has demonstrated that the difference compared to an I-O approach is unlikely to be substantial.[56]

In comparison to an I-O model, a SAM model has greater flexibility in terms of its capability to assess policy questions. For example, a SAM could be used to quantify the impact of a government transfer to a particular household group with this change modelled by an accompanying increase in spending by this group which then works through the rest of the economy.

A SAM model makes most of the same simplifying assumptions as an I-O model (constant returns to scale, no capacity constraints etc.). As such, broadly the same limitations apply as discussed in the I-O sub-section.

CGE MODEL

Finally, a CGE model is built on the foundations of Walrasian General Equilibrium theory. A CGE model is based on a SAM and thus provides a comprehensive treatment of the circular flow of income. It assumes that the demand for and supply of each commodity and factor are balanced. The external sector is typically simplified to absorb all host-economy exports dependent on the level of supply and to supply all imports depending on host-economy demand.[57]

CGE models are similar to Dynamic Stochastic General Equilibrium (DSGE) models in that they have very strong microeconomic foundations and equations are not developed on past historic relationships.[58] The implication is that a CGE model is much more suited to long-term policy and economic impact analysis but is not equipped to produce economic forecasts. In contrast, the Vector Autoregression (VAR) suite of models have very strong short-term forecasting properties but are not suited to policy analysis.

Functionally, a CGE model simply represents a set of equations that numerically simulate the economic behaviours and interactions of agents (consumers, producers, government, investors, etc...) in the economy. After a policy shock (e.g. an expansion in airport capacity), agents adjust to changes in relative prices until equilibrium is restored. The user is then able

[55] This rests on the assumption that the I-O model that has been developed uses the compensation of employees' row from the I-O table to represent household income. An alternative method would be to use GVA instead but this can lead to a significant overstatement of the true type II multiplier.

[56] For example see D and Wyeth, P Holland, "SAM Multipliers: Their Decomposition, Interpretation and Relationship to Input-Output Multipliers" (Research Bulletin, Washington State University, 1993).

[57] It is possible to develop multi-regional CGE trade models. The most prominent example is the model developed by the Global Trade Analysis Project (GTAP).

[58] HMRC, "HMRC's CGE model documentation" (User guide, HMRC, 2013).

to compare the difference between the baseline and policy shock scenarios to assess the economic effects of the policy change.

In contrast to both the I-O and SAM models, a CGE can simulate how a shock affects an economy through time. CGE models can be classed as either dynamic or comparative static. The former can provide a full temporal analysis e.g. year-by-year impacts. The latter would not detail the impact of any "shock" through time but would illustrate how the economy would adjust in the long-run.

APPLICATION TO MODELLING THE OPERATION OF AN AIRPORT

Having set out the differences in theory, this section aims to further develop these ideas in the context of modelling airport expansion. In particular, we focus on the theoretical capability of each approach to quantify the type of effects identified in the ToC model.

Core channels of impact

All three modelling approaches are well suited to capturing the effects of the three core channels of impact (direct, indirect and induced). All three models contain sufficient information to trace the economic activity sustained by an exogenous demand side shock. Moreover, all three approaches would enable the user to quantify these effects in terms of their impact on GDP, employment and tax revenue.

In comparison to an I-O model a SAM model would provide additional insight into the distributional consequences of the associated changes in economic activity for different household groups. Given IFC's overarching objectives this type of insight is likely to be of value. In comparison to an I-O model a SAM model would also provide a fuller treatment of how value added supported by the airport expansion is distributed to the household sector.

On the other hand, modelling the core impact channels via a CGE would enable IFC to understand the economic effects via a wider set of feedback channels, in particular those which result from changes in the price of factors of production (land, labour and capital), goods and services and foreign exchange (the exchange rate).

In general, the incorporation of these additional channels is almost certain to diminish the measured size of the economic impact. This is because the increase in demand (to the extent that it is not matched by an equivalent increase in the economy's capacity to supply goods and services) should cause prices to rise generating crowding out effects as described previously.

In addition, a CGE model would be able to quantify the economic impact across a wider still set of metrics (compared to I-O/SAM) including consumer prices, the exchange rate, trade and wages. We understand that trade effects are of significant interest to the IFC working group. However, we would stress that the trade effects that are supported by the core economic channels will be very much second-order in comparison to those supported by the catalytic effects. Imports are likely to increase via absorption effects whilst the shock would also affect the relative price of domestically produced and imported goods and services with knock-on implications for trade. The former effect can be assessed via any of the modelling approaches but the latter would only be captured by a CGE model.

However, despite its much more sophisticated structure, it is important to be aware that a CGE model is only useful if it represents a good approximation of the economy it simulates. A robust CGE model depends on the quality of the behavioural parameters fed into the model. As such, there is a risk that the potentially superior output of the CGE modelling approach could confer

an unjustified sense of confidence in the validity of the modelling results. Careful sourcing of the parameters and judicious calibration of the model are important in minimising these risks.

Catalytic effects

In most cases the three modelling approaches are not sufficient in isolation to assess the impact of the catalytic effects and would need to be supplemented by other analysis. The exception is the potential impact of the relaxation of a capacity constraint. This could be simulated endogenously in a CGE model (but not in either an I-O or a SAM).

However, the catalytic effects that result from enhanced 'connectivity' (whether measured in terms of tourism, trade or productivity) would need to be calibrated using separate analysis. We discuss calibration in more detail in Chapter **Error! Reference source not found.** but ere we focus on the differences between the three modelling approaches in terms of the ability to integrate the exogenous shocks calibrated to simulate the catalytic effects.

All three modelling approaches would be well suited to modelling the impact of the increase in tourist arrivals. Essentially, such a change would represent an exogenous demand shock akin to the construction and operational effects described in the previous section. Again there is a clear distinction between I-O/SAM and CGE in terms of the latter simulating knock-on effects in general equilibrium as opposed to partial equilibrium.

On the other hand, a CGE model is much more suited to simulating the impact of any resulting change in Total Factor Productivity (TFP).[59] This is because a CGE model has a fully specified supply side. In theory it would be possible to make an assumption about how this increase in TFP was allocated across different sectors and model this as an exogenous increase in output in these sectors. However, such an approach is likely to provide a somewhat misleading view of the transmission mechanisms through which an exogenous productivity shock would affect economic activity. Initially the shock would increase producer's margins and, depending on the reaction of producers, help firms to capture external market share by lowering export prices.

DATA AVAILABILITY AND IMPLICATIONS FOR MODEL FEASIBILITY

The decision over modelling choice should be informed by available data. The three approaches vary somewhat in terms of data requirements and the quality of available data will affect the validity of the modelling approach. Below we review how available data for Jamaica and the Dominican Republic affects the viability of each modelling approach.

A high level overview of data availability for each country is provided in Fig. 77. Our review indicates that data availability is sufficient for any of the modelling approaches. Through GTAP an estimated SAM is available for both countries including an I-O table. The former is the key data requirement underpinning either a SAM or a CGE model whilst the latter is the basis for developing an I-O model.

Fig. 77. Overview of data availability by country[60]

Data type	Jamaica	Dominican Republic

[59] TFP measures the efficiency with which an economy uses its inputs (capital and labour). It captures the impact of factors such as technology, institutional arrangements, innovation and market structure.

[60] This reflects findings from our initial data review. It may be that further data becomes available following meetings with statistical providers during the field trips.

SAM*	GTAP	GTAP
GVA by sector	Statistical Institute of Jamaica	Banco Central de la Republica Dominicana
Employment by sector	Statistical Institute of Jamaica	Banco Central de la Republica Dominicana
Composition of tax revenue	Statistical Institute of Jamaica	Ministerio de Hacienda

Source: Oxford Economics

*Each SAM contains an I-O table

The basis of a CGE model is a SAM. In addition, the development of a CGE would require forming assumptions about various parameters that govern the behaviour of different agents in response to changes in economic conditions. Many of these parameters take the form of elasticities which will determine model properties such as:

- **Tourist elasticity of demand**: how foreign tourists respond to changes in the relative price of holidaying in Jamaica/Dominican Republic compared to competitor markets;
- **Elasticities of substitution (households):** these govern how households react to changes in economic conditions e.g. how households switch their consumption habits between different goods and services following a change in relative prices, how households opt to switch between work and leisure following a change in wages etc.;
- **Elasticities of substitution (firms):** similar to the above but applied to firms. Examples include how firms substitute between domestically produced and imported inputs following a change in relative prices and how they substitute between capital and labour following a change in relative prices.
- **Closure rules**: these are specifications used to ensure that the model can generate a stable solution. For example, the model may be calibrated with a 'balanced budget' rule so that government expenditure changes to match any change in government revenue.

In general, in CGE models, these parameters are determined by a combination of econometric estimation and calibration (taking elasticities estimated in related previous research). In general, the literature that would be directly applicable to these countries is not well developed. The exception to this is in the tourism sector - for both countries our literature review has identified research which could be used to calibrate the elasticity of demand for tourism.[61] Meanwhile, estimation will be challenging due to the lack of high quality time series data.

Therefore, our CGE model is likely to be highly reliant on elasticities taken from the GTAP multi-country trade model. Previously, elasticities for Caribbean countries used to be estimated as an average for the whole region. However, in the latest version of GTAP (version 9), separate elasticity values are provided for Jamaica and Dominican Republic – using these should enhance the validity of our model.

CONCLUSION

[61] Examples include L Rochester, "Modelling tourism demand in the Caribbean: An approach using spatial econometrics" (Research paper, Bank of Jamaica, 2011). and N, Mwase, N, Park, J and Zhou, Y Lafromboise, "Revisiting Tourism Flows to the Caribbean: What is Driving Arrivals?" (Working paper, IMF, 2014).

The decision over the optimal modelling approach should reflect careful consideration of the following factors:

- Its theoretical applicability to answer the user's questions of interest;
- The extent to which this theoretical applicability is affected by restrictions on available data; and
- Relative cost.

We think that a CGE based modelling approach is not practical within the project's overall budget of US $180,000. Therefore, we disregard that option despite the theoretical advantages of a CGE model described above.

In comparison both the I-O and SAM modelling approaches suffer from the same major limitations in terms of being partial equilibrium based analyses. A well-specified SAM model would offer benefits to IFC in terms of providing insight into the distribution of the economic impact across the household sector.

Overall, we recommend that a SAM modelling approach supplemented by additional analysis to capture the size of catalytic effects is optimal given budgetary and data constraints. The next chapter provides a detailed overview of our project approach in light of this recommendation.

15. APPENDIX 8 – PROJECT TEAM

Ian Mulheirn, Director of Consultancy Services

Ian was the project director assuming responsibility for quality assurance

Ian Mulheirn is the Director of Oxford Economics' consulting services for EMEA and Asia Pacific. He joined the company in 2013, after five years as the Director of the Social Market Foundation, an award-winning Westminster public policy think tank specialising in economic research and policy design. There he led the organisation's influential work on topics ranging from economic growth to the commissioning of public services. As part of his role Ian was invited to appear before a number of parliamentary select committees as an expert witness, he also wrote for national newspapers including The Financial Times, The Guardian and the Sunday Times.

Prior to the SMF Ian was an economic adviser at HM Treasury where, among other things, he undertook extensive labour market analysis, publishing econometric evaluations of the labour supply impact of the minimum wage, the UK government's tax credit reforms and the dynamics of the London labour market. He also has substantial central government policymaking experience, and sits on the Mayor of London's Employment and Skills Working Group. Ian holds degrees in economics from Oxford University and University College London. In 2014 he was awarded the Society of Business Economists' Rybczynski Prize.

Henry Worthington, Associate Director

Henry was the project manager coordinating activity and assuming responsibility for the timely submission of all relevant deliverables.

Henry is an Associate Director in Oxford Economics' consultancy division. He joined Oxford Economics in September 2008, originally as part of the global macroeconomics team. As well as overseeing the forecasts for Russia, Hungary, and Poland, Henry was involved in a range of projects including estimating the currency composition of China's foreign exchange reserves, scenario analysis of the UK fiscal position for KPMG and modelling alternative global investment scenarios for the IFC. In May 2010, Henry moved to the consultancy team.

He has since gained experience working on a wide range of consultancy projects, employing a wide range of methodological techniques including economic impact analysis, welfare valuation techniques and macroeconomic model development, forecasting and scenario analysis. Henry project managed previous economic impact research on behalf of IFC focused on the hotel sector. He has strong experience of the economics of the tourism sector having contributed to the annual forecast of the economic contribution of the tourism sector on behalf of the WTTC and project managed the development of a Tourism Satellite Account (TSA) in Montenegro.

Henry was educated at the University of Cambridge, where he gained a first-class degree in Economics, becoming the William Stone Scholar of Economics, and an MPhil in Modern Society and Global Transformations.

Sam Moore – Managing Director of Consultancy and Cities Services

Sam acted as a project advisor

Sam Moore is Managing Director of economic impact and cities and regions forecasting services. He manages Oxford Economics' London office and is responsible for coordinating and managing many of Oxford Economics' major consultancy projects.

Sam manages projects across all sectors of the economy and has lead Oxford's recent work for Airbus, AT&T, BAE Systems, CBI, Deloitte, Etihad Airways, GE, JLL, Pinewood Studios, Rolls-Royce, SAP, UK Space Agency, UPS, and the World Wide Web Foundation.

Prior to joining Oxford Economics, Sam spent the previous eight years with Experian, where he managed a team of economists responsible for economic modelling. Prior to joining Experian in 1998, Sam worked in the macroeconomics division at the Office for National Statistics. He graduated from Warwick University, from which he also has an MSc in Economics, gaining a distinction for his dissertation.

Dave Goodger – Director of Tourism Economics, Europe

Dave provided strategic advice the tourism-related aspects of the project

David Goodger is a Director within Tourism Economics, and primarily concentrates on tourism demand forecasting and market sizing. He has also taken an active role in further model development for specific purposes, with an emphasis on examining the economic contributions of particular sectors and the impact of different policies. He has conducted ground-breaking analysis of the business travel sector for the WTTC and the US Travel Association which estimates the return on investment of corporate spending on travel and he has developed models to define destination marketing allocations.

Since joining Oxford Economics in 2000, David Goodger has been involved in a wide range of forecasting and modelling activities. He has been part of the macroeconomic forecasting and the industrial forecasting teams contributing to both regular reports and specific client studies as well as assisting in the development of detailed forecasting and simulation models.

David was educated at the University of Bristol, England, where he gained a first class degree in Economics with Statistics; and at the London School of Economics and Political Science, England, where he graduated with an MSc in Econometrics and Mathematical Economics.

James Lambert – Lead Economist

James lead the field work in the Dominican Republic

James spent over six years in the Government Economic Service, working in analytical departments of the Cabinet Office, Foreign and Commonwealth Office and Department for Transport. He has experience of microeconomic analysis and impact assessment, as well as international macroeconomics, economic risk analysis and energy security issues. James is a proficient Spanish speaker and spent a year in Peru researching and producing educational guides on issues around child labour.

Prior to joining the UK government, James worked for the International Labour Organisation on projects in Sub-Saharan Africa and Latin America. James has a BSc in Economics and Economic History from the University of Warwick and an MSc in Development Economics from the University of Manchester.

Dr Nishaal Gooroochurn – Head of Econometrics and CGE Modelling

Nishaal contributed to the theoretical review in the project inception report

Nishaal joined Oxford Economics as Head of Econometrics in July 2015. Prior to this, Nishaal worked for over five years at HMRC in the Knowledge, Analysis and Intelligence team where he was head of income tax economics, and computable general equilibrium (CGE) teams. He led on a wide range of econometric and CGE projects and advised HMT, OBR and HMRC on various policy measures. Examples of projects include: a study of the macroeconomic effects of the budget; estimating the capital gains tax elasticity; difference in difference evaluation of tax policies; examination of the macroeconomic, efficiency and equity effects of tax policies; analysis of the EU emission trading scheme; and work on the economic implications airport capacity constraints in the UK.

Prior to joining HMRC, Nishaal taught economics and econometrics at the University of Nottingham for 5 years. Nishaal published several academic papers on a range of topics (taxation, tourism, productivity, corruption, innovation, foreign portfolio investment, macroeconomic impact) in top economic journals such as World Development and Journal of Economics and Statistics. He has also undertaken consultancy projects for various organisations including the World Bank, HMT, DECC, DEFRA, DfT, DCMS, Visit Scotland and WTTC.

Nishaal holds a PhD in CGE modelling and MSc in Econometrics from the University of Nottingham.

Pete Collings, Lead Economist

Pete lead work on the I-O or SAM based modelling

Pete has considerable experience in economic impact and tax modelling, conducting surveys and constructing input-output tables.

Pete's work on air transport-related projects includes estimating the economic impact of aviation in Dubai for Emirates, an economic impact study on Dubai Airports for ADAC; an economic impact study on Etihad, identifying alternative regimes for the UK's Air Passenger Duty that are beneficial for the UK economy; estimating the economic impact of Boeing across Europe; and calculating the economic impact of Rolls-Royce on both the UK and the global economy.

Prior to joining Oxford Economics, Pete spent two years on the ODI Fellowship Scheme in Zanzibar. While in Zanzibar, Pete worked as an economist in the Fiscal Policy Unit of the Ministry of Finance and Economic Affairs, where he was responsible for conducting budget performance assessments and assessing and improving government tax structures; he also created the Ministry's first VAT projection model. During his time in Zanzibar, Pete was also a member of the team conducting the second cross-sector Public Expenditure Review for HIV and AIDS on behalf of the Zanzibar AIDS Commission and UNDP.

Matt Tinsley – Economist

Matt provided research support in data collection and modelling

Matt is an Economist in the consultancy team, having joined Oxford Economics in March 2014. Since joining Matt has worked on a range of projects of relevance to this exercise including: building a microeconomic model to understand the impact of the introduction of VAT to quantify the impact on prices of different categories of goods and services in the Bahamas; modelling the economic impact of the TATA Group and its affiliate members across the UK;

quantifying the economic contribution of the UK's high-end fashion manufacturing sector and developing a number of scenarios related to future growth prospects; and quantifying the economic impact of live music tourism in the UK.

Before joining Oxford Economics Matthew worked as a research fellow for Westminster think tank Policy Exchange, focusing on a range of economic and social policy areas. Matthew holds a master's degree in economics from the University of Bristol.

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