TORONTO PEARSON'S ECONOMIC IMPACT

A report for the Greater Toronto Airports Authority

20 October 2016

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1 INTRODUCTION

1.1 Background and objective

Part of the mandate of the Greater Toronto Airports Authority (GTAA) is to operate and develop Toronto Pearson International Airport to enhance the economic development of the community.

32%

Increase in passengers since 2006.

To assess the economic impact of the airport, over the years, the GTAA and its predecessor (Transport Canada) have conducted many economic impact studies of Toronto Pearson International Airport. The last economic impact assessment was undertaken in 2006 but since then Toronto Pearson Airport has grown substantially, from 31 million passengers to more than 41 million in 2015, representing a 32% increase. The airport has cemented its status as a global hub airport with international passenger volumes increasing at an even faster rate from 17.5 million in 2006 to 25.0 million in 2015, representing a 46% increase. At the same time connecting passenger volumes have increased from 7.1 million in 2006 to 12.8 million in 2015, an increase of 82%.[1] The airport has also increased the number of direct international destinations by 14% from 126 in 2006 to 144 in 2015.

These figures illustrate that the airport now plays a different role in the economy as connectivity has increased substantially since the last economic impact assessment.

In 2014, Toronto Pearson published its Global Hub Economic Development Strategy that for the first time provided an assessment of the catalytic impact, or the number of jobs facilitated by virtue of trade and investment made easier by Toronto Pearson's connectivity.

In 2016 the GTAA determined, based on the strong growth that Toronto Pearson continues to exhibit, that a comprehensive update of its economic update was warranted. The objective of this report is to provide an updated estimate of Toronto Pearson's economic impact - both in terms of jobs generated and facilitated - with a particular focus on how these jobs are distributed geographically across Southern Ontario.

Future work is planned to assess Toronto Pearson's impact on specific sectors of the economy, for example, how international connectivity at Pearson enhances the productivity of the professional services sector.

Frontier Economics, a leading economics consultancy that undertook the 2014 Global Hub Economic Development Study has undertaken this study together

[1] New connections have been measured as those which had zero departures in 2012 and at least 52 departures in 2016, which equates to one a week, on average.

with Quod, a UK based specialist planning, socio-economic and development economics consultancy and MNP is a leading national accounting, tax and business consulting firm in Canada.

1.2 Structure of this report

The main body of the report provides a brief overview of our approach and our results. The report is structured as follows:

- Section 2 provides an overview of how we measure Toronto Pearson's economic impact;
- Section 3 provides our overall results;
- Section 4 discusses where the jobs generated and facilitated by Toronto Pearson are located;
- Section 5 provides our conclusion.

Annex A provides a more detailed description of the economic impact in the municipalities of the Greater Toronto Area including Peel, Halton, the City of Toronto, York and Durham.

Annex B to F provide a detailed description of the methodology we have used:

- Direct job estimates – Annex B;
- Indirect job estimates – Annex C;
- Tourism – Annex D;
- Catalytic impacts – Annex E; and
- Spatial breakdown – Annex F.

2 HOW DO WE MEASURE TORONTO PEARSON'S ECONOMIC IMPACT?

The airport's overall economic impact consists of three parts:

- Primary impacts, the **direct, indirect and induced** (often referred to as "DII impacts") which include jobs generated from on-going operations at the airport;
- Secondary impacts, that is, jobs facilitated by **inbound visitor spending**; and
- Tertiary or **catalytic impacts**, that is, jobs facilitated via increased **trade and foreign direct investment** that is supported by the international connectivity provided by Toronto Pearson.

In this section, we provide a brief overview of our approach to estimating these impacts. A detailed explanation of our methodology and assumptions can be found in Annexes B to E.

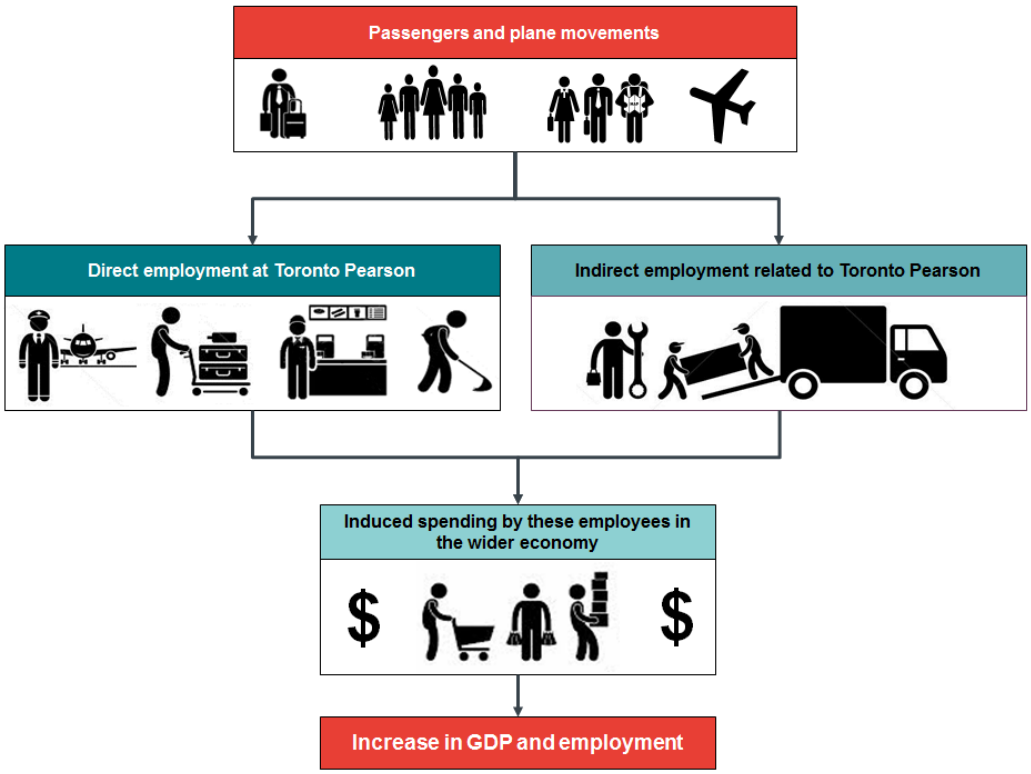
2.1 Primary impact: Direct, indirect and induced employment

The airport's primary impact comprises three components, collectively referred to as DII jobs:

- **Direct jobs** – These include jobs located at or close to the airport that are directly reliant on the ongoing activity of the airport. These are estimated as jobs either directly related to the operation of the airport located within a two-mile (3.2 km) radius of the airport or those jobs that are in airport-related sectors within 5 miles (8 km). An example of a direct employee is the person driving the catering truck and loading the food trays onto a plane. Another example is a person employed in one of the retail shops that are located at Toronto Pearson. We have estimated the direct impact using data from Statistics Canada and a survey of employers.
- **Indirect jobs** – These include jobs supported by the airport's supply chain (the goods and services it buys for day-to-day operation). For example, this would include the person repairing the catering truck in a garage in Mississauga. We estimated the indirect impact using multipliers produced by Statistics Canada.
- **Induced jobs** – These include jobs facilitated by the spending of people whose jobs are directly or indirectly related to the airport. So, if the catering employee and the mechanic described above spent money at a coffee shop, the Barista would count as an induced employee. This is because their job is supported by the wages earned by the direct and indirect employees. We estimated induced jobs estimated using multipliers produced by Statistics Canada.

All of our DII estimates are based on a standard approach which addresses the question: "what-if the airport did not exist?" As a result, all of the DII impact is estimated as gross total employment. This means we estimate the employment that is generated by the airport by comparing it to a situation where the airport does not exist and the activities are not replaced. This static approach is a standard way of estimating DII employment. Figure 1 summarises our methodology.

Figure 1. Overview of direct, indirect and induced impacts



Source: Frontier Economics

2.2 Secondary impact: Employment facilitated by inbound visitor spending

The connectivity provided by the airport enables people from other parts of Canada and the rest of the world to visit Ontario and the GTA. Visitors may be arriving at Toronto Pearson to visit friends and family, vacation in the GTA or Ontario, or for business.

All visitors will spend money on goods and services during their time in Toronto or Ontario. This expenditure, which can be classified as inbound visitor spending, will lead to an increase in GDP and facilitate employment in the GTA, mainly in retail, food and drink service, cultural, recreation and accommodation services.

We estimate total visitor spending using data on tourism spending per passenger-visit from a number of sources, including Statistics Canada, the Ministry of Tourism, Culture and Sport, the Canadian Tourism Commission and the Ontario Ministry of Tourism, Culture and Sport. The approach for estimating employment facilitated by inbound visitor spending is the same as for DII estimates. We estimate the total gross inbound visitor spending. In estimating this impact, we have therefore assumed that the spending by inbound visitors would not have incurred had the airport not existed. Our approach is described in Figure 2 below.

Figure 2. Overview of impact through inbound visitor spending

Source: Quod and Frontier Economics

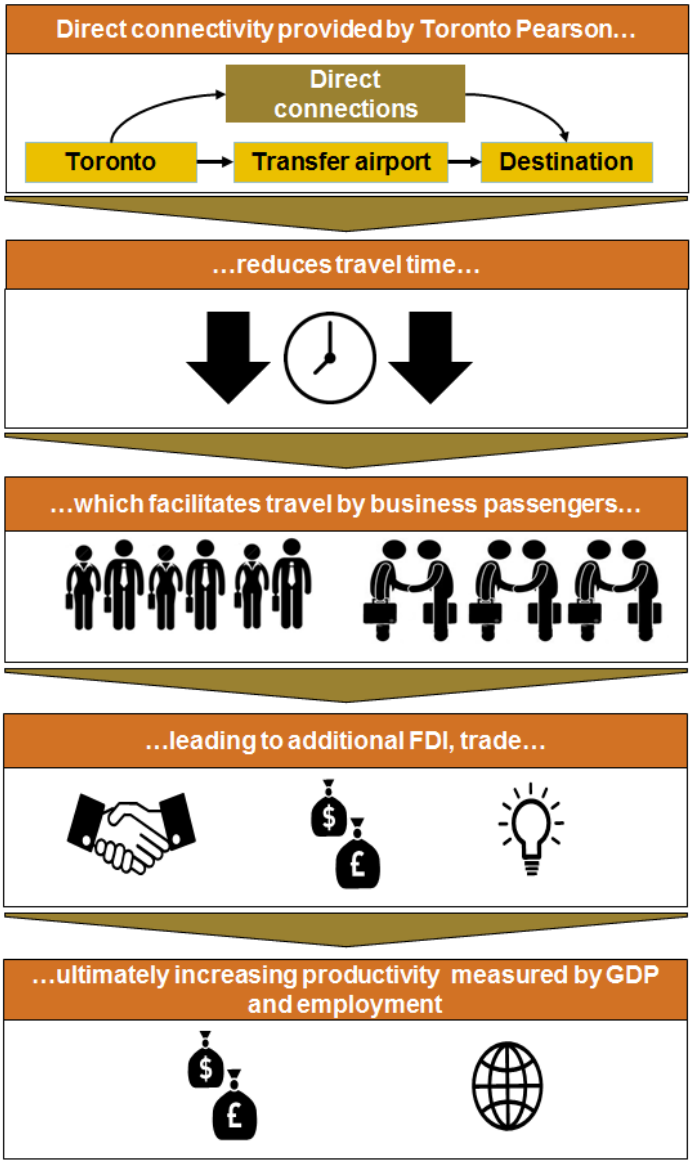
2.3 Tertiary impact: Catalytic employment through connectivity

The catalytic impact includes jobs that are facilitated by the airport's international connectivity. This impact is estimated based on the following causality chain:

- Toronto Pearson provides substantial international connectivity to a wide range of destinations;
- Direct flights to a wide range of countries reduce the cost of travel to the business passenger as they represent a significant time saving;
- As a result, direct connections increase the likelihood for business passengers to travel;
- The resulting increase face-to-face meetings with international business partners increase the likelihood of closing business deals
- This has a positive impact on trade and foreign direct investment;
- Increased trade and FDI leads to improvements in productivity as the economy is more open – this has a positive impact on GDP and jobs.

These links are described in Figure 3 below.

Figure 3. Overview of methodology for catalytic impact



Source: Frontier Economics

Importantly, the approach for estimating catalytic impacts is different from the DII impacts and inbound visitor spending impacts. In this case, our estimates are based on a "what-if" scenario that assumes Toronto Pearson does not provide direct flights, so all passengers have to take indirect flights via another hub airport to get to their final destinations. This "what-if" scenario measures the economic value of being directly connected to destinations. This provides a more meaningful and realistic approach to valuing the Toronto Pearson's connectivity as a hub airport than a scenario where we assume the airport does not exist. It also represents a conservative approach.

WHAT THE "WHAT-IF" SCENARIOS SAY ABOUT ADDITIONALITY

Our approach to estimating the DII, tourism and catalytic impact are based on two different "what-if" scenarios. The "what-if" scenarios have implications for the "additionality" of the economic value facilitated by Toronto Pearson. For DII and tourism economic impact, the estimates are gross figures. This means they describe the employment that is currently generated by the airport compared to a situation where the airport does not exist and it is not replaced by other economic activity. This is a common way of estimating DII and tourism impacts. In addition, the tourism impacts only consider inbound spending and do not take into account spending by Canadians abroad. Therefore, DII and tourism jobs facilitated by Toronto Pearson are not necessarily additional as there may alternative sources of employment in the absence of the airport.

In contrast, the jobs resulting from the FDI and trade facilitated by the airport are additional; these are jobs that would not exist if the airport did not provide direct connections. This is because in the "what-if" scenario, we have assumed that the airport continues to exist but it no longer provides direct connections. The FDI and trade facilitated are therefore attributable to the additional connectivity provided by the airport, connectivity that would not be available if the direct connections did not exist.

3 WHAT IS TORONTO PEARSON'S ECONOMIC IMPACT?

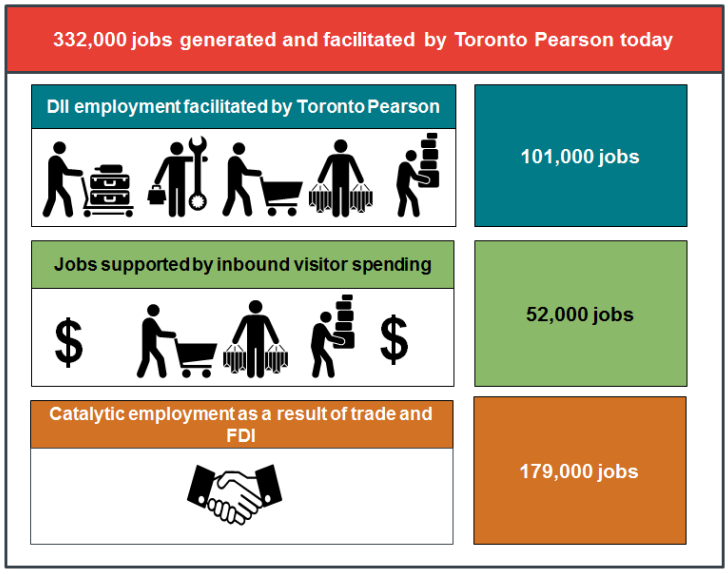
3.1 Economic impact today

In total we estimate that Toronto Pearson Airport currently generates and facilitates **332,000 jobs**. These can be broken down as follows:[2]

- **101,000** direct, indirect and induced jobs generated by the airport's operations.
- **52,000** jobs as a result of the effects of inbound visitor expenditure. 41,000 of these are direct jobs and 11,000 are indirect jobs; and
- **179,000** jobs facilitated as a result of the additional trade and foreign direct investment facilitated by direct international connectivity provided by the airport.

Figure 4 summarises these results.

Figure 4. Toronto Pearson's economic impact today



Source: MNP, Quod and Frontier Economics

The **101,000** DII jobs can be further disaggregated as follows:

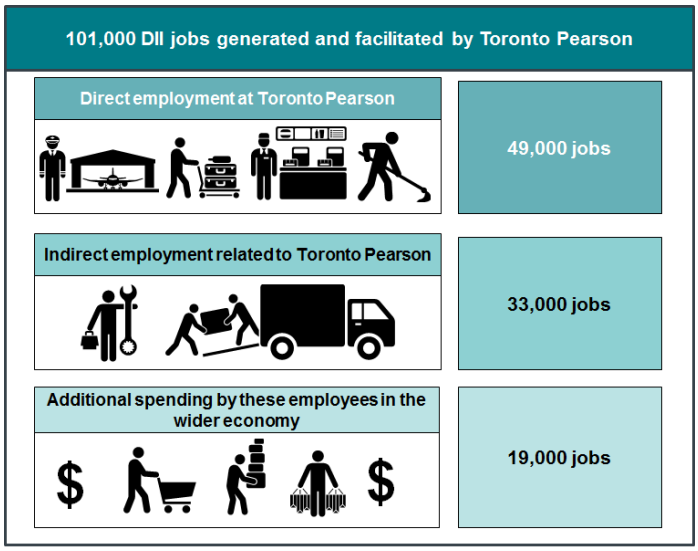
- **49,000** are direct jobs associated with on-going operations.
- **33,000** are indirect jobs as a result of the operations at the airport.

[2] Our results are based on the latest available data. The DII and inbound spending impact is based on 2015/6 data while the catalytic impact is based on 2014 passenger data.

- **19,000** are induced jobs as a result of the spending generated by direct and indirect employees.

This has been illustrated in Figure 5 below.

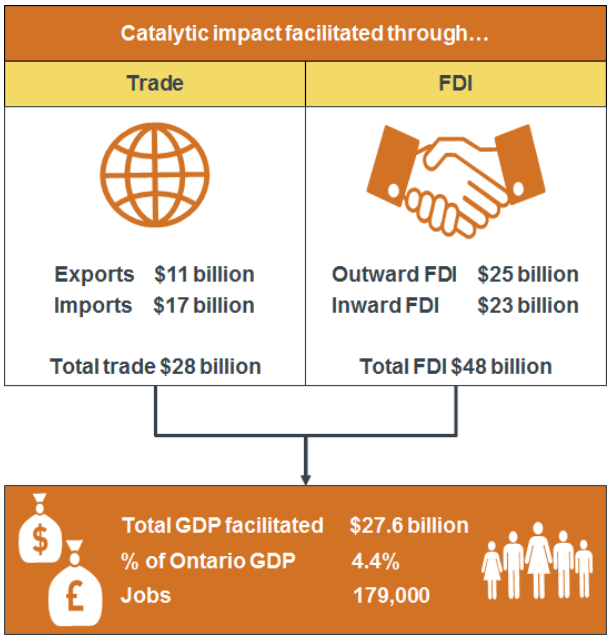
Figure 5. Toronto Pearson's DII impact today



Source: MNP, Quod and Frontier Economics

The catalytic impact can be broken down into that facilitated by the trade and FDI, as can be seen in Figure 4 below.

Figure 6. Catalytic impact facilitated by Toronto Pearson today

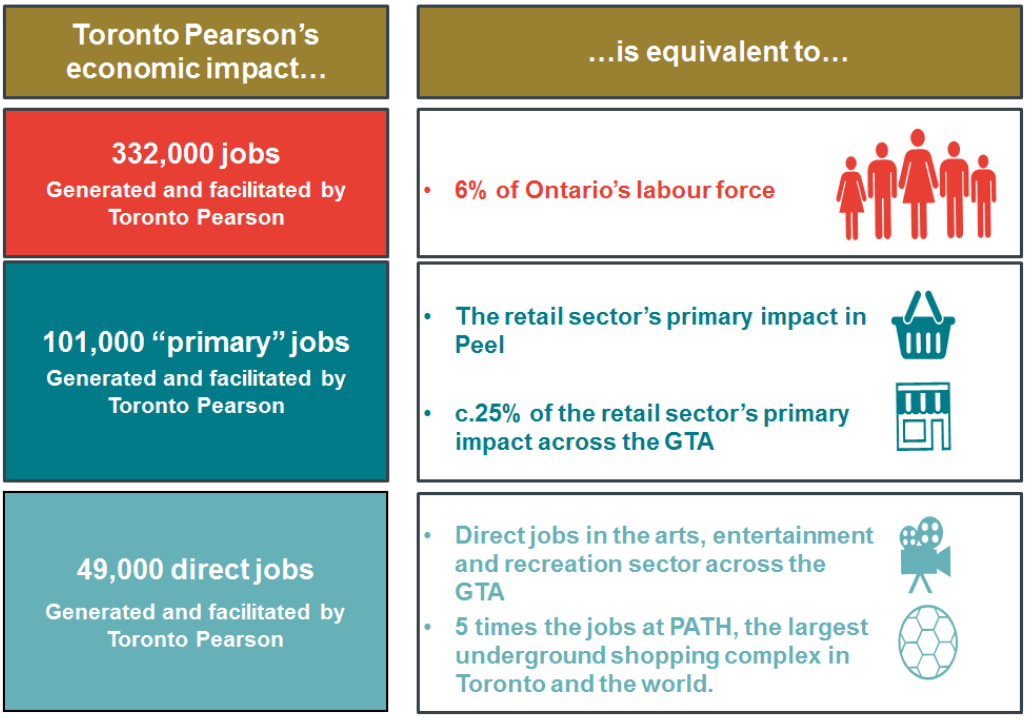


Source: Frontier Economics, numbers may not add up due to rounding

How do these numbers compare with other industries in the GTA?

Figure 7 provides a comparison of the jobs generated and facilitated by Toronto Pearson with that of other industries to help readers visualise the scale of the impact.[3]

Figure 7. Comparison of jobs generated and facilitated by Toronto Pearson



Source: MNP, Quod and Frontier Economics

By way of further comparison, the **GDP** generated by the DII employment facilitated by Toronto Pearson is:

- Around 2% of Ontario's total GDP[4];
- Around the same as the nominal GDP of Madagascar or Malta in 2015.

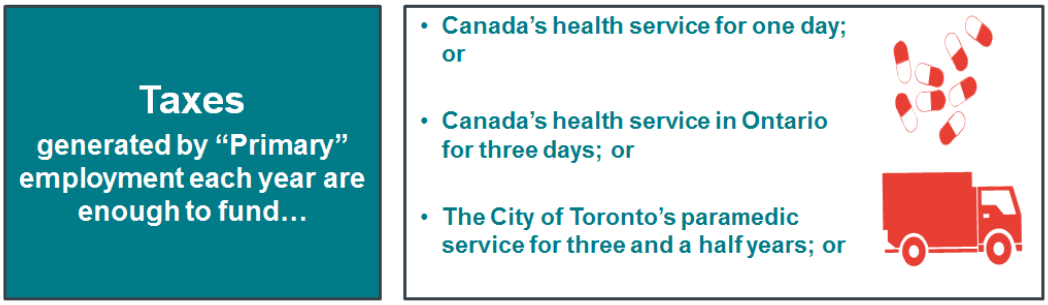
As a final means to contextualise the scale of "primary" or DII employment facilitated by Toronto Pearson, we have estimated the **taxes** generated by these employees each year at around $696m.[5] This is presented in Figure 8.

[3] These comparisons are therefore not intended as a scientific comparison of sectors, rather as a tool for visualisation.

[4] Based on StatCan GDP Multipliers

[5] Based on Federal and Provincial tax derived from average annual earnings per employee in a job facilitated by Toronto Pearson

Figure 8. Estimating the taxes generated by DII employment facilitated by Toronto Pearson each year



Source: Quod and Frontier Economics

How does the current economic impact compare with previous estimates?

Figure 9 compares our estimates with those calculated in previous studies for Toronto Pearson in 2012[6].

Figure 9. Comparing Toronto Pearson's economic impact today with yesterday's

Type of Job	2012	2016
Direct	33,000	49,000
Indirect	30,000	33,000
Induced	16,000	19,000
Total DII	**79,000**	**101,000**
Those supported by inbound visitor spending	30,000 (+11,000 indirect)	41,000 (+11,000)
DII + Inbound visitor spending jobs	109,000 (+11,000)	142,000 (+11,000)
Catalytic	153,000	179,000
Combined	**273,000**	**332,000**

Source: MNP, Quod, Frontier Economics and HDR Economics

This comparison shows that the airport's direct, indirect and induced employment has increased by 22,000 since 2012 (approx. 28% growth). It also shows that Catalytic employment has grown by 26,000 jobs across Ontario (around 17%);

Overall combined growth since 2012 is around 59,000 jobs, or 22% growth. This implies that Toronto Pearson has facilitated twice the rate of job growth as Toronto (9%), and five times the rate of Ontario (4%) since 2012. Furthermore, Toronto Pearson has facilitated about as many 'new' jobs as the professional, scientific and technical sector in the whole of Toronto since 2012.

[6] The previous study used a slightly different methodology and set of definitions, which we have disaggregated and re-built to enable direct comparison by type of job. Previously, direct employment has been based on a modelled approach using the number of passengers passing through the airport each year, whereas this assessment identifies actual data on existing jobs in the area by sector.

Figure 10 shows how the total GDP impact has evolved since the previous report on Toronto Pearson's economic impact. In the previous report, the impact represented 5.6% of Ontario's GDP. This has increased to $42 billion which represents approximately 6% of the Ontarian GDP.

$42 billion

GDP facilitated and generated by Toronto Pearson airport today.

Figure 10 also shows how the components of the overall GDP impact have evolved over time. The catalytic impact, which captures the economic impact facilitated by the airport's connectivity, has increased from 3.6% of the Ontarian GDP to 4.4% of the GDP in 2016. The impact through inbound visitor spending has also increased. In contrast, the DII impact has fallen over the same period. This reduction means that the airport is providing its services more efficiently as it has increased connectivity without a proportionate increase in direct and indirect jobs.

Figure 10. Comparison of total GDP impact

	2014	2016
DII impact	1.8%	1.6%
Impact through inbound visitor spending	0.2%	0.3%
Catalytic impact	3.6%	4.4%
Total	5.6%	6.3%

Source: Frontier and Quod

Note: Note that the 2014 catalytic impact is based on passenger 2012 data, the 2016 catalytic impact is based on passenger 2014 data. Note also that numbers may not add up due to rounding.

What do these estimates mean on a per-flight basis?

The economic impact generated and facilitated by Toronto Pearson airport can also be expressed per international flight. We have calculated the economic impact per international flight, by estimating the GDP impact facilitated by the DII and catalytic effects on a per flight basis.

400 jobs

facilitated and generated by a daily international service.

We estimate that each international flight landing at Toronto Pearson in 2014[7] facilitated on average:

- $31,000 of GDP or approximately 0.28 direct, indirect and induced jobs.

[7] This is because the catalytic impact is based on 2014 passenger data.

- $5,000 of GDP or approximately 0.13 jobs through inbound visitor spending.
- $113,000 of GDP or approximately 0.7 jobs through catalytic impacts.[8]

The catalytic impact per flight is based on a weighted average of the GDP impact per international movement by continent. The GDP impact of DII employment can be estimated by first applying the average GDP per worker in Canada to the direct jobs. This gives us the GDP impact facilitated by direct employment, which is used as a starting point. Appropriate sectoral multipliers from Statistics Canada are then applied to this "direct" GDP figure to estimate the total indirect and induced GDP, from which average GDP per movement can be derived.[9]

$149,000

GDP facilitated and generated per international flight.

To estimate the DII impact per international flight, we use a conservative approach by comparing the total GDP impact to the total number of movements. Because international flights tend to be use wide-bodied aircraft, an international flight can carry more passengers than a short-haul domestic flight (which often involves narrow-bodied aircraft). Therefore, the DII impact of an international flight would likely be higher than that estimated above. However, it is difficult to robustly disaggregate the impact between international and domestic travel.[10]

$54 million

GDP facilitated and generated by a daily international service.

For similar reasons, the approach to estimate the inbound tourism expenditure per plane is also conservative as it compares the total GDP impact from inbound spending to total movements. This is because international visitors tend to spend more than visitors from other Canadian provinces, implying that the impact per international flight would be higher than that estimated above.

Another way to express the economic impact

[8] This refers to the average GDP impact of an international flight i.e. excluding Canada. If the US were also to be excluded, the average international flight would facilitate £200,000 of GDP while each flight to the US would facilitate £80,000 of GDP through catalytic impacts.

[9] We have also reviewed the relationship between direct employment and passenger numbers (PAX) and direct employment and air transport movements (ATMs) to identify the correlation, and calculate the number of Direct, Indirect and Induced jobs per average international movement. These approaches reach broadly the same conclusions.

[10] Direct employment is the starting point for calculating the GDP impact. This can be apportioned to domestic and international travel by using the passenger split between domestic and international travel as a proxy. This implicitly assumes a linear relationship between passengers and employment which may not be correct because of factors such as economies of scale. Alternatively, the split of GDP between the different regions estimated in the catalytic impact could be used as a proxy for the split of DII GDP. This may also be inaccurate because the driver for the catalytic impact is connectivity at Toronto Pearson, while the driver for the DII impact is the airport acting as a consumer of goods and services. Therefore, the most robust and conservative approach is to visualise the total DII impact relative to total movements and this is likely a lower bound for the impact relative to an international movement.

generated and facilitated by Toronto Pearson airport is to consider it on a 'per daily connection' basis. [11] We estimate that each daily service operating from Toronto Pearson facilitates:

- $11 million of GDP or approximately 101 direct, indirect and induced jobs.
- $ 2 million of GDP or approximately 50 jobs through inbound visitor spending.
- $ 41 million of GDP or approximately 250 jobs through catalytic impacts.

3.2 Economic impact tomorrow

We have used projections on traffic growth to estimate Toronto Pearson's economic impact in 2030. In total, we project that Toronto Pearson Airport will handle 63 million passengers and generate and facilitate **542,000 jobs**. These can be broken down as follows:[12]

- **136,000** direct, indirect and induced jobs generated by the airport's operations.
- **131,000** jobs as a result of the effects of inbound visitor expenditure. **103,000** of these are direct jobs and **28,000** are indirect jobs; and
- **275,000** jobs facilitated as a result of the additional trade and foreign direct investment facilitated by direct international connectivity provided by the airport.

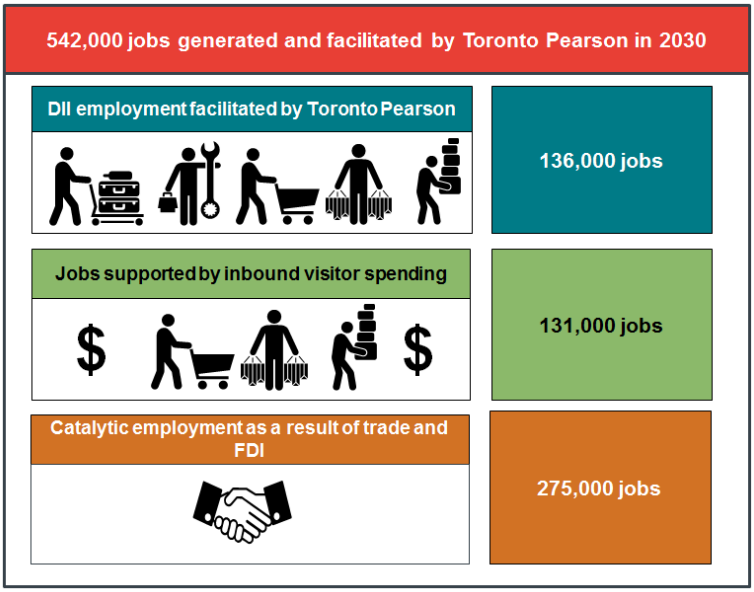
542,000 jobs facilitated and generated by Toronto Pearson in 2030.

Figure 11 summarises our results.

[11] To do so, we would multiply the "per international flight" figures by 365 to approximate a daily service.

[12] Our results are based on the latest available data i.e. 2014 data.

Figure 11. Toronto Pearson's economic impact tomorrow



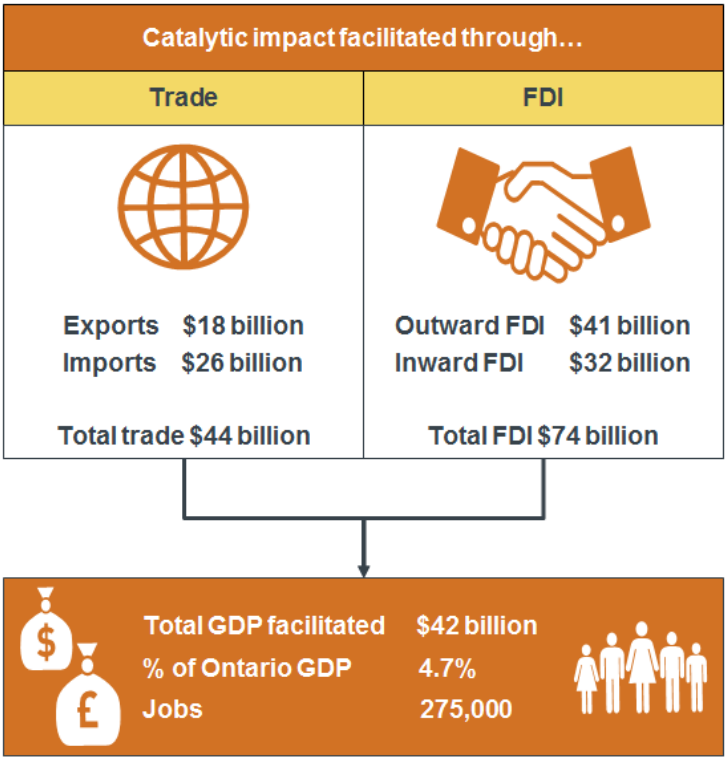
Source: MNP, Quod and Frontier Economics

$63 billion

GDP facilitated and generated by Toronto Pearson in 2030.

We further estimate that the overall GDP facilitated and generated by Toronto Pearson in 2030 (i.e. including DII, inbound visitor spending and catalytic impacts) will be approximately $63 billion, which equates to 6.8% of Ontario's GDP in 2030. The GDP impact of the catalytic effects, in particular, could constitute 4.7% of Ontario's GDP in 2030. Figure 12 presents the airport's estimated catalytic impact in 2030.

Figure 12. Catalytic impact facilitated in 2030



Source: Frontier Economics, numbers may not add up due to rounding

4 WHERE ARE THE JOBS FACILITATED BY TORONTO PEARSON?

The jobs generated and facilitated by Toronto Pearson are not confined just to the airport boundary, but extend beyond the airport and even beyond the GTA. To provide an overview of the location of the 332,000 jobs facilitated by the airport, we estimate that:

- just under two-thirds of these jobs are located in the GTA - at least 195,000 in total;
- a third of the jobs it facilitates are located in Ontario but outside the GTA; and
- around 182,000 people who live in the GTA have jobs that are facilitated by the airport.

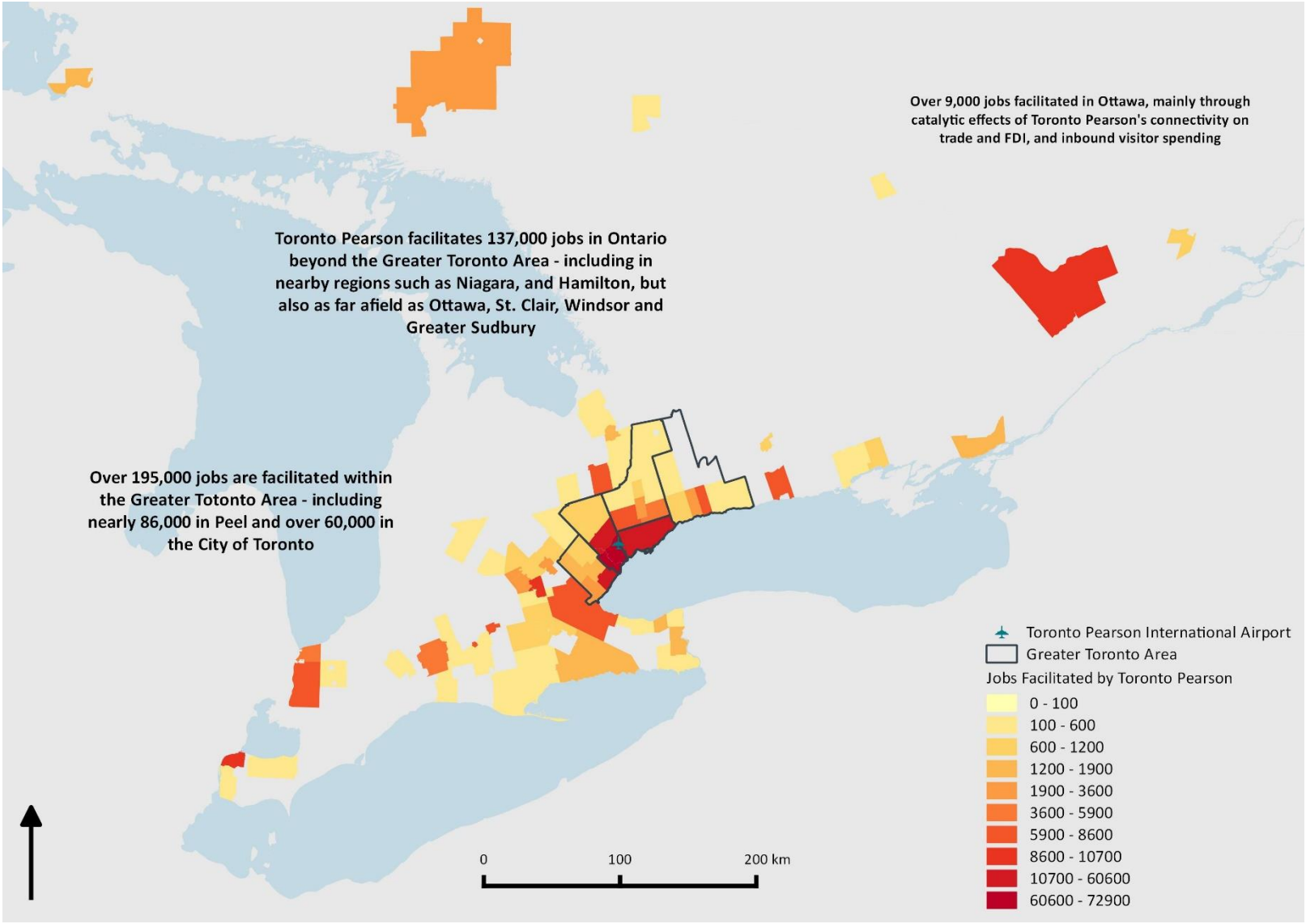
When considering the location of job, there are two perspectives we have considered:

- The locations of the job at the place of employment– this gives a sense of the location of the economic activity itself; and
- The residences of those carrying out the jobs – this provides an overview of the geographic spread of the communities benefiting from these job opportunities.

Figure 13 and Figure 14 show how the jobs facilitated by the airport, and residents in work facilitated by the airport, are distributed around the GTA and more widely in Ontario.

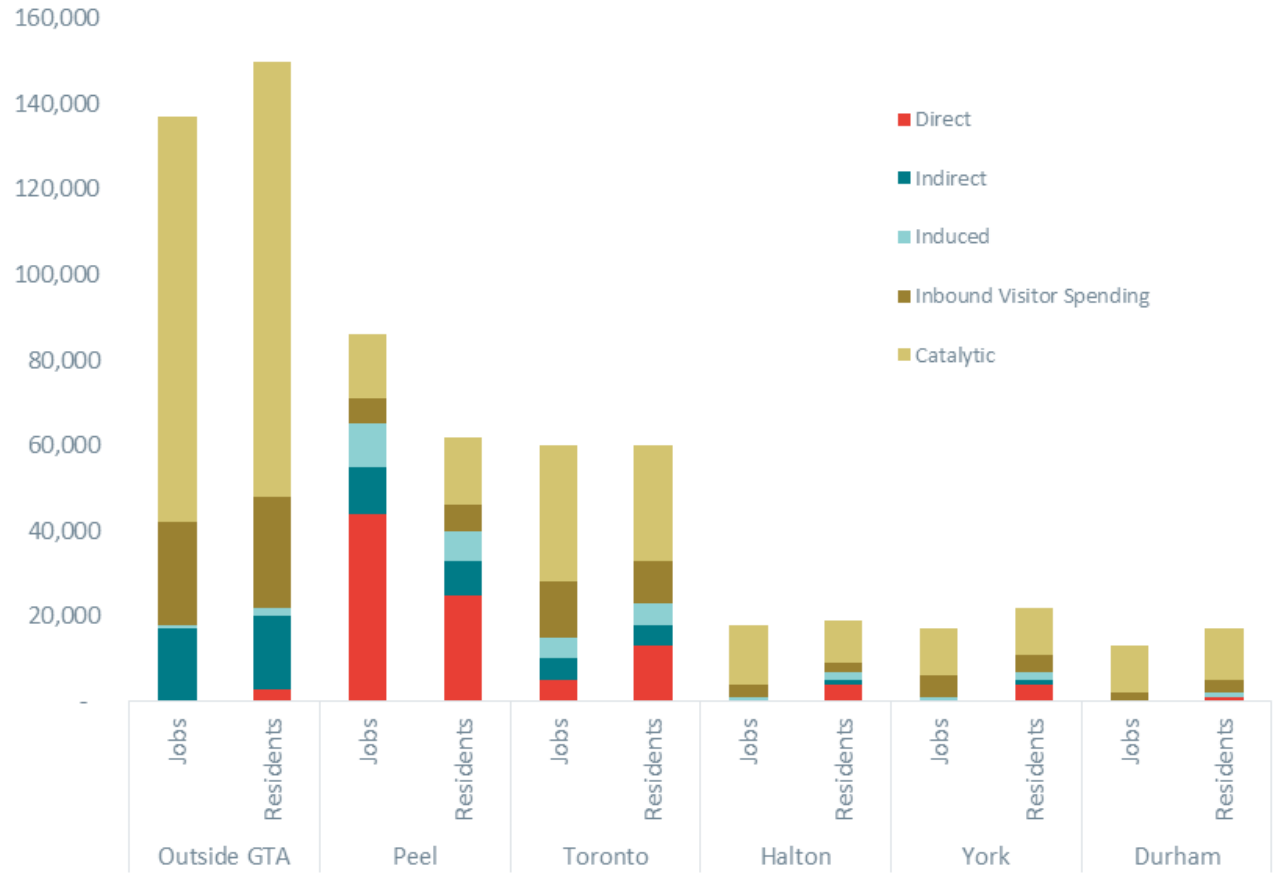
In the rest of this section, we present a geographic disaggregation for each type of employment estimate to illustrate the airport's economic reach.

Figure 13. Where is Toronto Pearson's overall economic impact?



Source: MNP, Quod, Frontier Economics and Statistics Canada

Figure 14. How is Toronto Pearson's overall economic impact distributed?



Source: MNP, Quod, Frontier Economics and Statistics Canada

4.1 Where is the airport's primary economic impact?

4.1.1 Direct employment

We have estimated direct jobs as those located within a two-mile radius of the airport or within a five-mile radius if they are in airport-related sectors. These jobs are therefore located in close proximity to the airport. To provide a more detailed map of the communities that benefit from these jobs, we have mapped where Toronto Pearson's 49,000 direct employees reside (see Figure 18). The map shows that Toronto Pearson's direct economic impact is spread throughout the GTA and beyond with 51% of direct employees living in the Region of Peel and 25% in the City of Toronto.

Figure 18 also shows that Peel is the contributor of the airport's direct employees, with 25,000 of its residents directly employed by the airport. This implies that approximately **1 in 30 Peel** residents in work is in a job directly related to the airport.

4.1.2 Indirect employment

Figure 19 shows the location of indirect jobs facilitated by the annual spending of the GTAA itself - estimated at around 5,000 jobs. These indirect jobs include those jobs that are not physically located at the airport but are created by the airport's supply chain. The map shows that the majority of those jobs are located in the GTA, but a significant amount of contract value is procured from further afield, for example around 600 jobs are located in London, as a result of construction, repair and maintenance, hardware and professional services procured from a contractor associated with terminal building enhancement.

The other activities at the airport - for example the operations of airlines, retailers, security, transit, accommodation and facilities/maintenance - also create indirect employment in the supply chain.

Based on a study of the sectors that the air transport industry buys goods and services from, and of the business concentration around the airport, we estimate that around 13,000 indirect jobs (not including GTAA-related jobs) are located within 5 miles of Toronto Pearson.

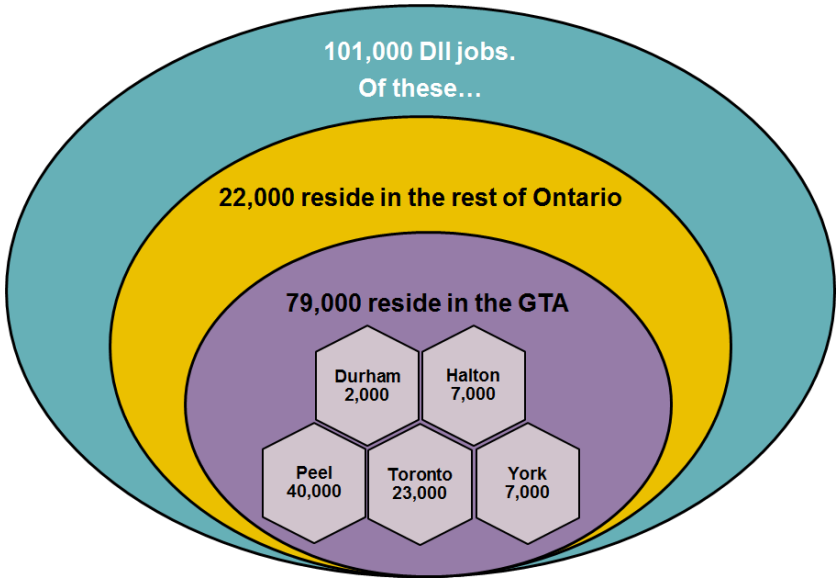
Overall, we estimate that up to around 50% of the total 33,000 indirect jobs facilitated by the airport are likely to be within 10 miles of the airport.

4.1.3 Induced employment

The spending by direct and indirect employees supports around 19,000 induced jobs, of which around 18,000 are in the GTA. Figure 20 provides a spatial disaggregation of these jobs. As can be seen, whilst the majority of induced jobs are concentrated in Peel and Toronto, jobs are spread as far as Northumberland and Niagara.

Figure 15 below summarises our estimates of where the 101,000 DII employees reside within Ontario.

Figure 15. Where do Toronto Pearson's DII employees reside?



Source: MNP, Quod and Frontier Economics
Note: Numbers may not add up due to rounding

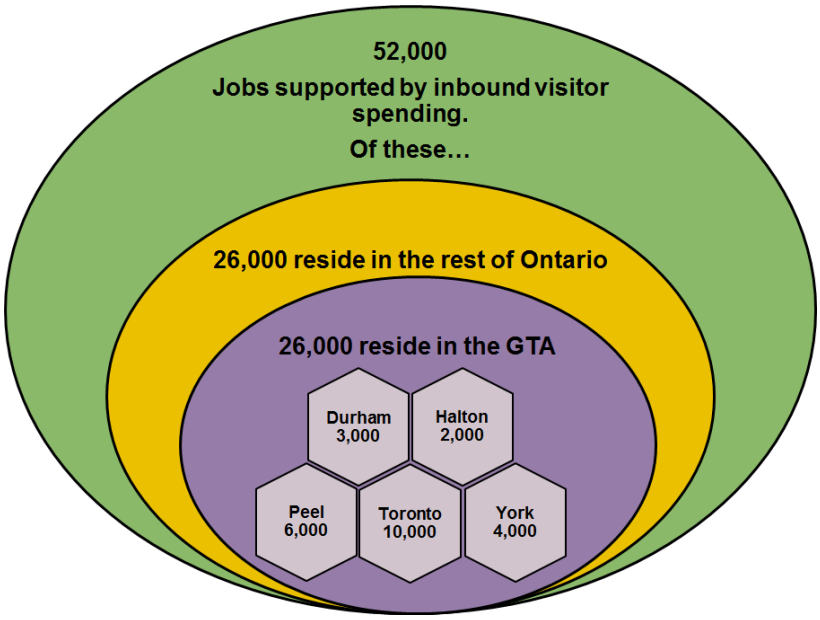
4.2 Where is the airport's secondary impact?

The employment generated as a result of the **spending of inbound visitors** travelling via Toronto Pearson is captured in the secondary impact. For example, this generates employment in retail, food and drink service, accommodation and recreation sectors in Toronto and across Ontario depending on where inbound visitors travel.

Based on spending patterns and output per job supported in these sectors, we estimate that around half of the 52,000 (direct and indirect) jobs resulting from this spending are likely to be within the GTA. This can be seen in Figure 21.

Figure 16 summarises our estimates of where those with jobs supported by inbound visitor spending reside. The exhibit shows that almost 50% of the employees in jobs facilitated by this spending reside outside the GTA, demonstrating the impact of Toronto Pearson on the wider Ontarian economy.

Figure 16. Where do the employees in jobs supported by inbound visitor spending reside?



Source: Quod and Frontier Economics
Note: Numbers may not add up due to rounding

4.3 Where are the airport's tertiary effects?

Catalytic impacts are driven by business travel and the airport's role in facilitating international trade and investment. In total, around 179,000 jobs are facilitated in Ontario as a result of this catalytic impact,

Using data on the distribution of exporting sectors and sectors with high reliance on FDI, we have estimated that the catalytic impacts are distributed across Ontario as shown in Figure 22.

The map shows that of the 179,000 catalytic jobs, around 84,000 are likely to be within the GTA mainly within the Region of Peel and the City of Toronto. We also estimate that at least 10,000 jobs are in each of York, Durham and Halton. Around 4,600 of the catalytic jobs are in Ottawa - showing Toronto Pearson's gravity beyond the GTA as Canada's main gateway to the rest of the world.

This distribution reflects the locations of businesses using the airport for business travel in the GTA and surrounding areas, along with the concentration of employment in FDI-intensive sectors (such as finance) and goods manufacturing sectors that trade internationally.

Around 1 in 5 of these jobs is in the City of Toronto, and around half are in the GTA - reflecting the importance of access to the airport, along with the higher job density and FDI-heavy sectors located downtown.

The remainder of the jobs are spread across the southern Ontario area and in Ottawa - partly reflecting the location of jobs in the trade-intensive manufacturing sectors, whose deals are facilitated through the airport.

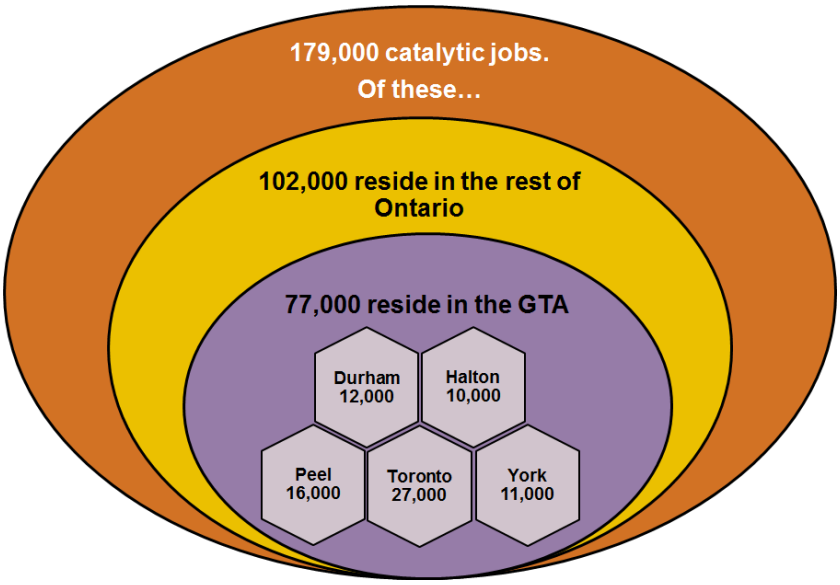
Around 4,600 of the catalytic jobs are in Ottawa - showing Toronto Pearson's gravity beyond the GTA as Canada's main gateway to the rest of the world.

The distribution of catalytic jobs is likely to be influenced by the origin of business travellers using Toronto Pearson. Exhibit 18 therefore also shows the location (origins) of Toronto Pearson's business travellers, which confirms that the airport's reach extends beyond the GTA to surrounding cities and town, as far as Ottawa, and reflects the distribution of jobs both within the GTA and in the rest of Ontario.

This distribution reflects the locations of businesses using the airport for business travel in the GTA and surrounding areas, along with the concentration of employment in FDI-intensive sectors (such as finance) and goods manufacturing sectors that trade internationally.

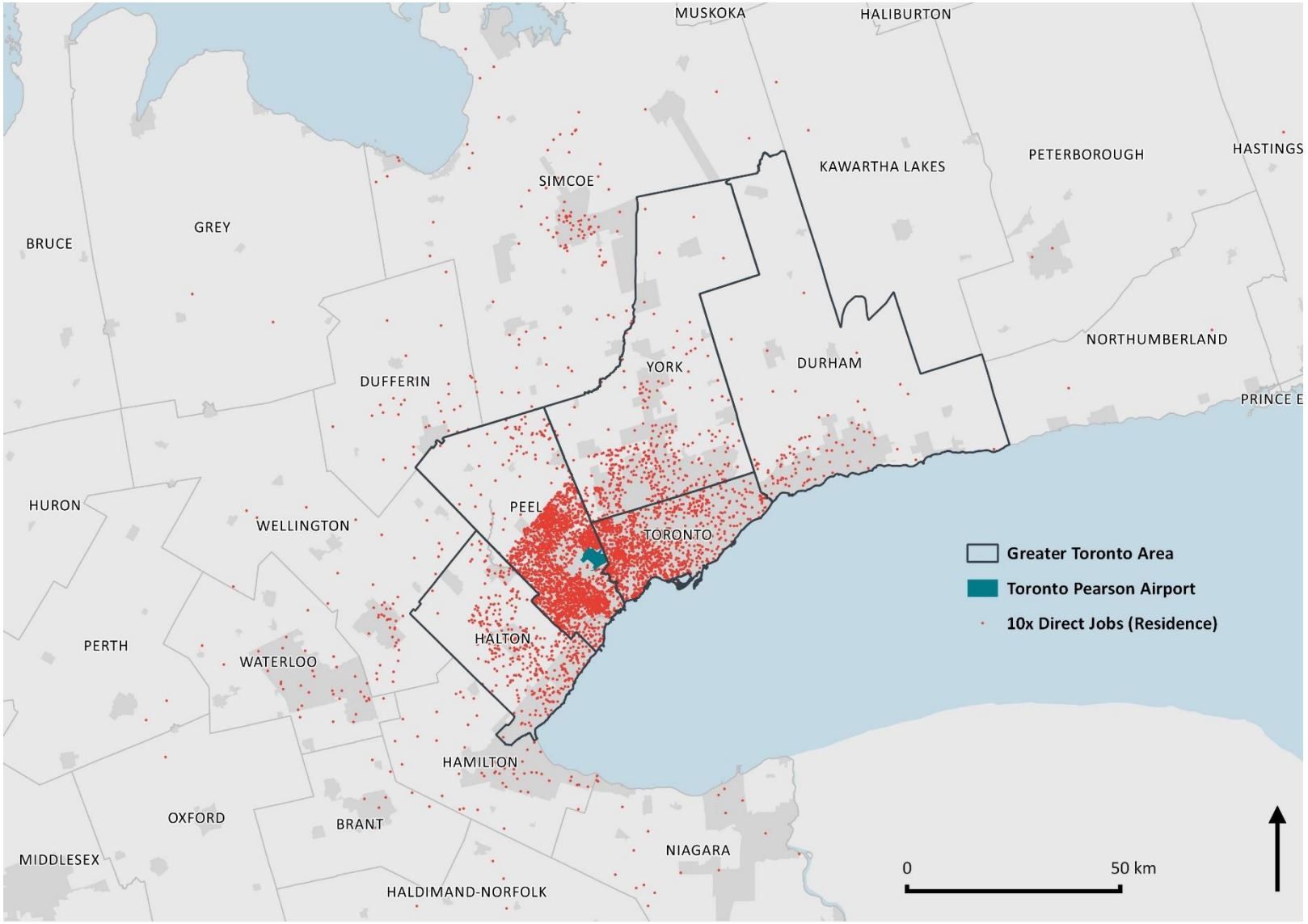
Figure 17 shows our estimate of the residences of those with jobs facilitated by the catalytic impact of the airport. It is clear that the airport's catalytic impact extends well beyond the GTA; the majority of those employed in jobs facilitated by the catalytic impact reside outside the GTA.

Figure 17. Where do the employees with catalytic jobs live?



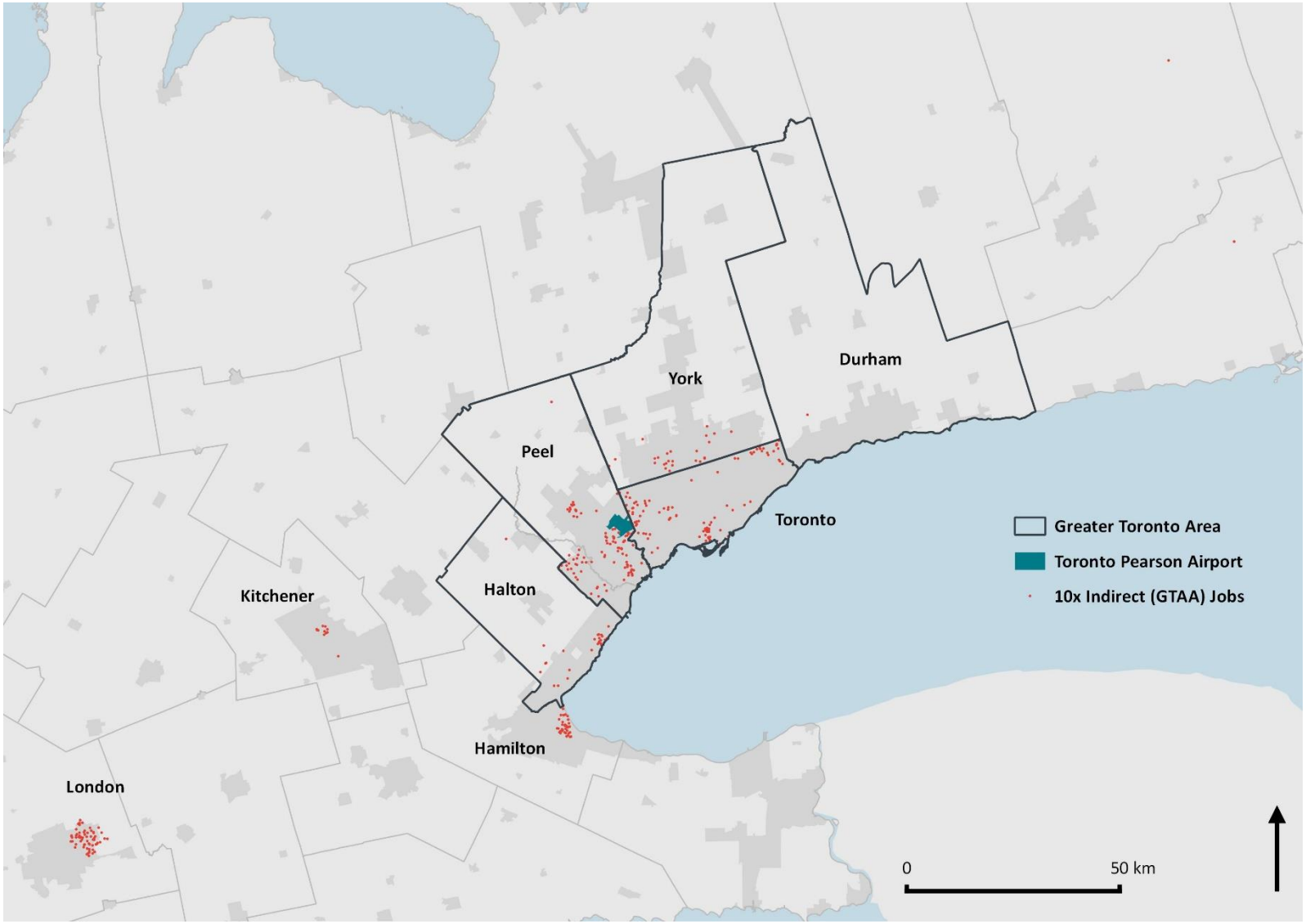
Source: MNP, Quod and Frontier Economics
Note: Numbers may not add up due to rounding

Figure 18. Where are the residents with direct jobs?



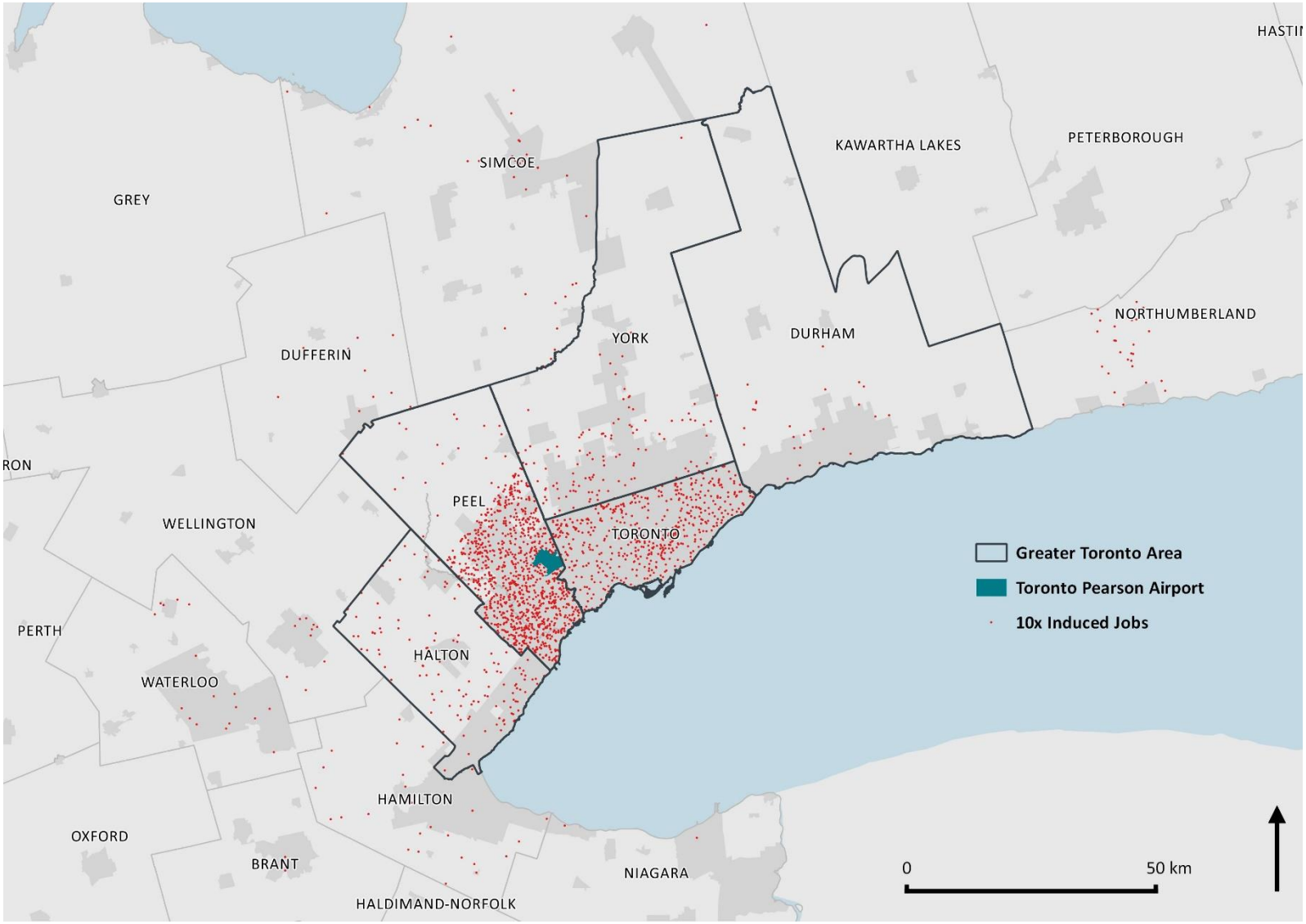
Source: MNP, Quod and Statistics Canada

Figure 19. Where are the indirect jobs created by GTAA's annual spending at Toronto Pearson?



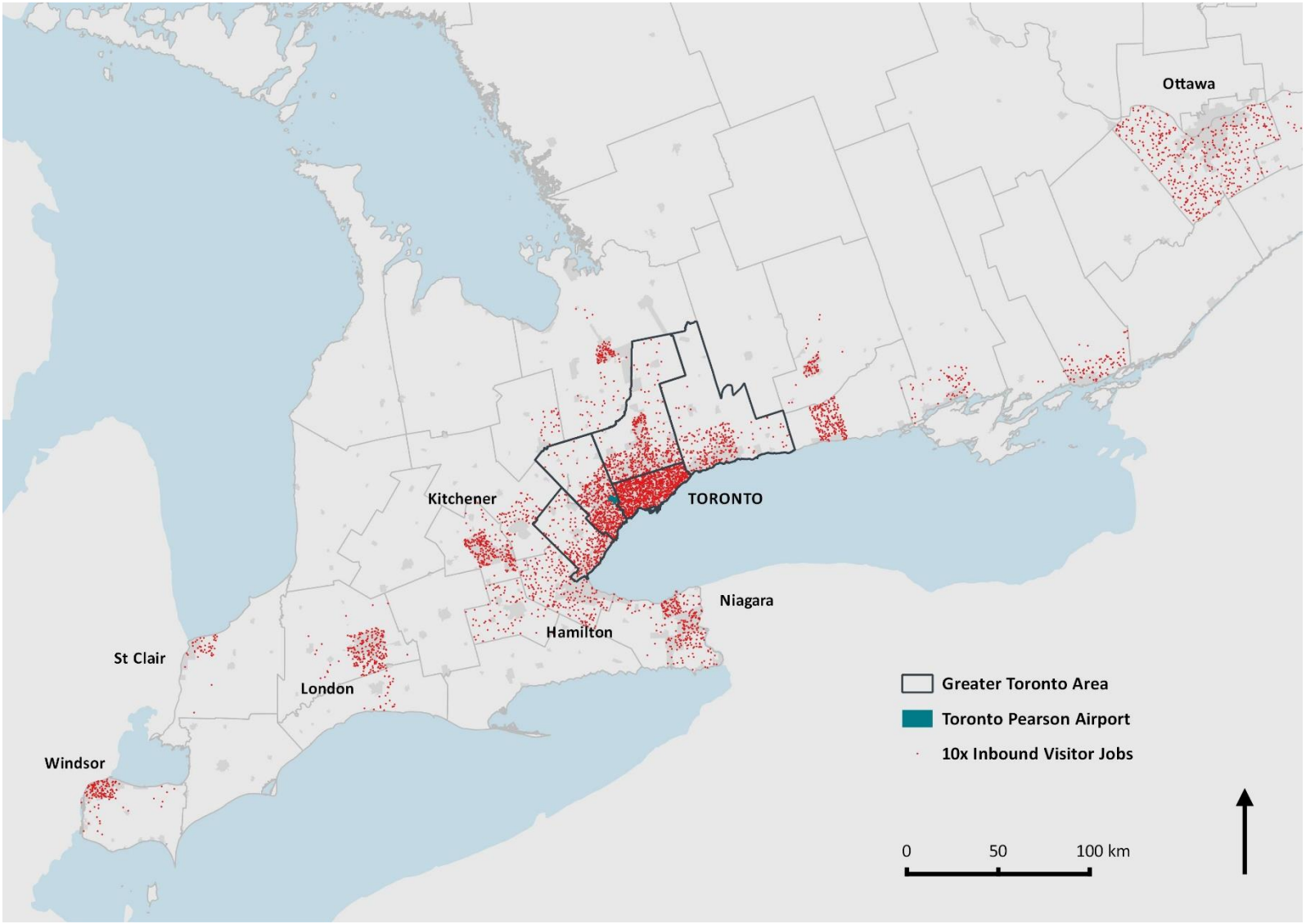
Source: MNP, Quod and Statistics Canada

Figure 20. Where are the induced jobs facilitated by Toronto Pearson?



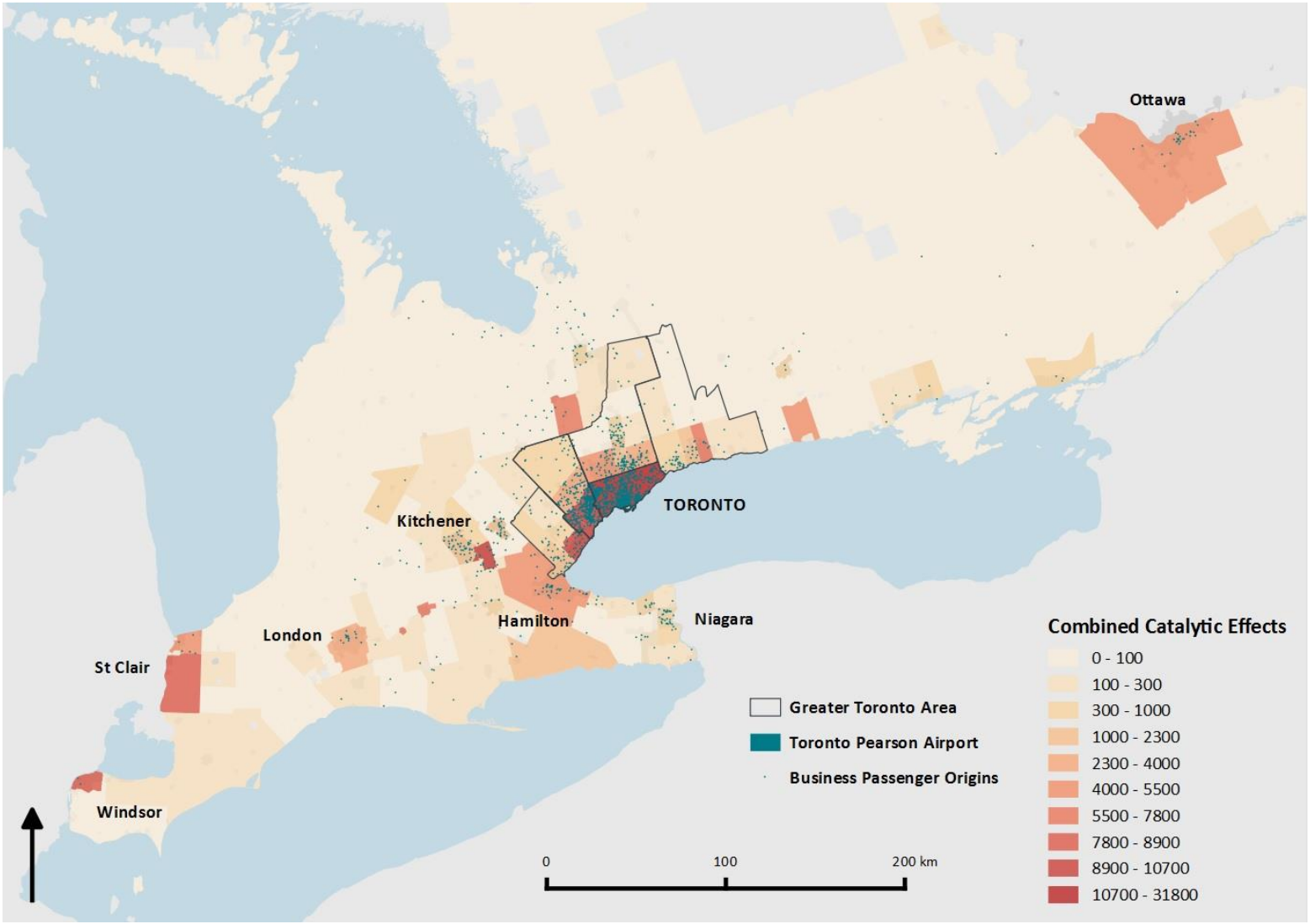
Source: MNP, Quod and Statistics Canada

Figure 21. Where are the jobs facilitated through spending by inbound visitors?



Source: MNP, Quod and Statistics Canada

Figure 22. How are catalytic impacts distributed across Ontario?



Source: MNP, Quod, Frontier Economics and Statistics Canada

5 CONCLUSION

Part of the mandate of the Greater Toronto Airports Authority (GTAA) is to operate and develop Toronto Pearson International Airport to enhance the economic development of our community. Over the past decade, Toronto Pearson has experienced significant traffic growth from 35 million passengers in 2006 to 41 million passengers today. In the context of the substantial increase in international connectivity, the objective of this report is to provide an updated estimate of Toronto Pearson's economic impact both in terms of jobs generated and facilitated with a particular focus on how these jobs are distributed geographically across Southern Ontario.

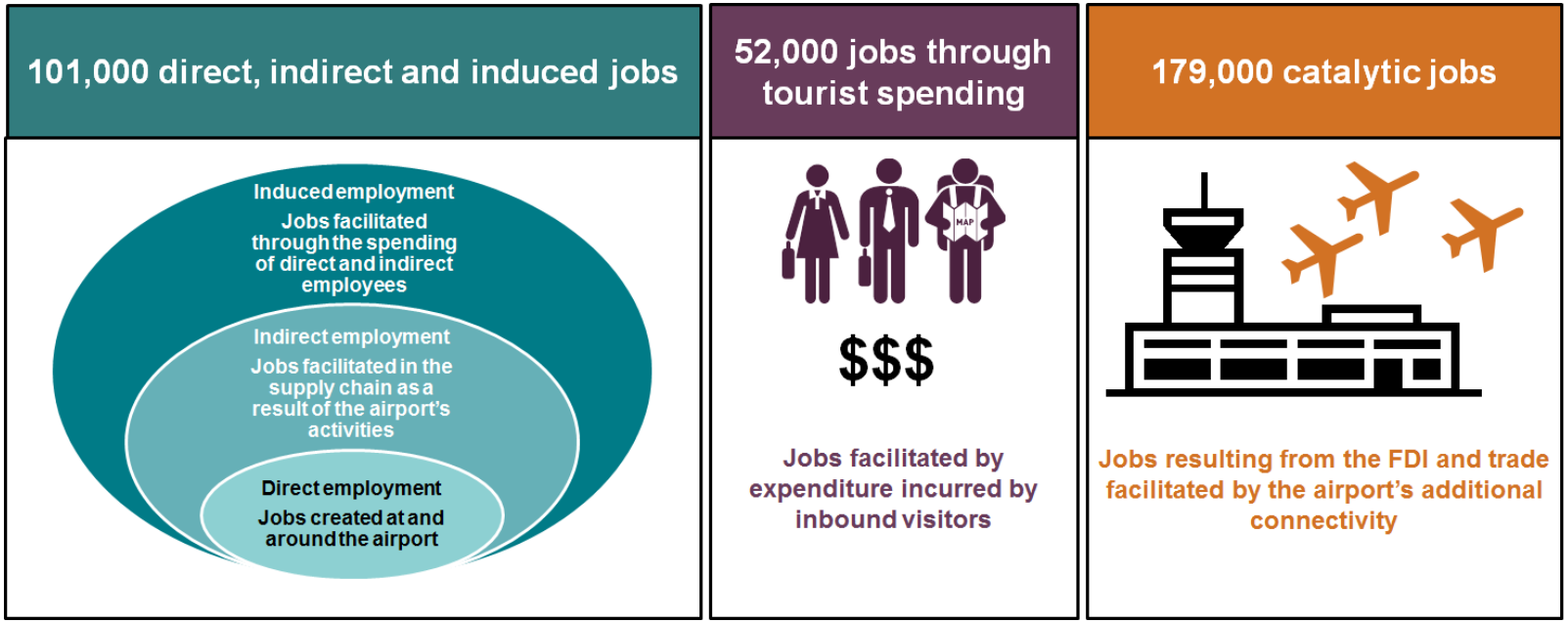
We have estimated that Toronto Pearson generates and facilitates **332,000 jobs**. These can be broken down as follows:

- **101,000** direct, indirect and induced jobs generated by the airport's operations.
- **52,000** jobs as a result of the effects of inbound visitor expenditure. 41,000 of these are direct jobs and 11,000 are indirect jobs); and
- **179,000** jobs facilitated as a result of the additional trade and foreign direct investment facilitated by direct international connectivity provided by the airport.

Figure 23 summarises these overall results.

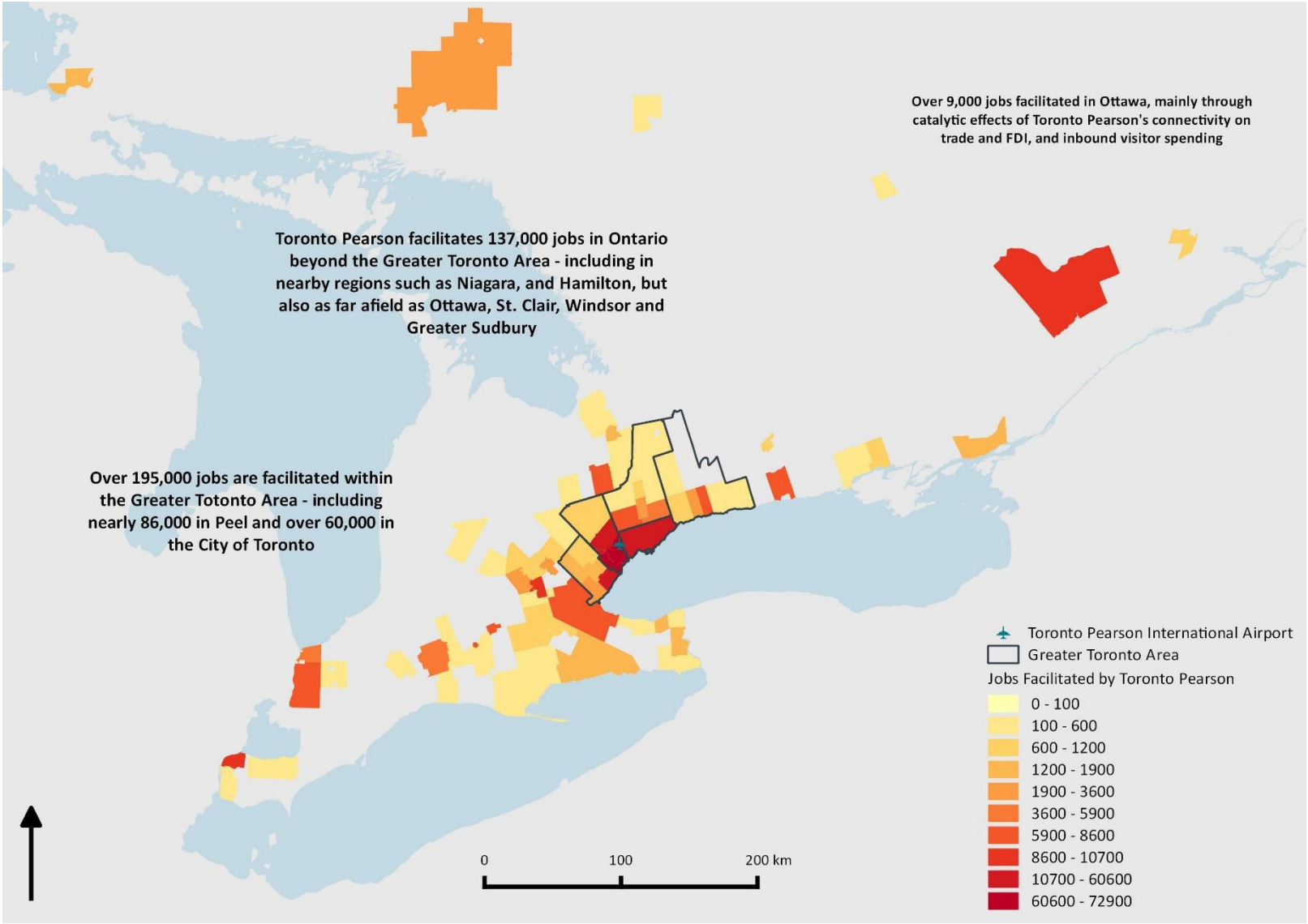
Figure 24 presents a spatial disaggregation of these jobs to illustrate the airport's economic reach. It shows that the economic impact is concentrated on the GTA (in particular the city Region of Peel and City of Toronto), but other parts of Ontario also benefit from Toronto Pearson's activities through the location of direct employees and their spending, the supply chains that support the airport's operation, and the effect on international trade of, and investment in, Ontarian companies.

Figure 23. Summary of overall results



Source: Frontier Economics, Quod and MNP.

Figure 24. Where is Toronto Pearson's overall economic impact?



Source: MNP, Quod, Frontier Economics and Statistics Canada

ANNEX A WHAT IS THE ECONOMIC IMPACT OF THE AIRPORT ON THE GTA?

In this annex, we provide a detailed break-down of Toronto Pearson's economic impact on each municipality within the GTA.

Overall, around **332,000** jobs are facilitated by the airport.

- Just under two thirds of these jobs are located in the GTA - at least 195,000 in total
- Around 182,000 people who live in the GTA have jobs that are facilitated by the airport

The airport's economic effect is wider than this with over a third of the jobs it facilitates going to Ontarians outside of the GTA.

As most of the impact is concentrated on the GTA, Figure 25 provides a breakdown of the DII and catalytic impact on each of the municipalities within the GTA in terms of the location of **jobs**, and Figure 26 shows the estimated home location of these workers:

33%

The proportion of jobs facilitated by Toronto Pearson which go to Ontarians outside the GTA.

Figure 25. Economic impact of Toronto Pearson in GTA (Location of jobs)

	DII	Jobs supported by Inbound visitor spending	Catalytic	Total
Halton	1,000	3,000	14,000	18,000
Peel	65,000	6,000	15,000	86,000
Toronto	15,000	13,000	32,000	60,000
York	1,000	5,000	11,000	17,000
Durham	<1,000	2,000	11,000	13,000
Greater Toronto Area	**83,000**	**28,000**	**84,000**	**195,000**
Rest of Ontario	**18,000**	**24,000**	**95,000**	**137,000**
Total	**101,000**	**52,000**	**179,000**	**332,000**

Source: Quod

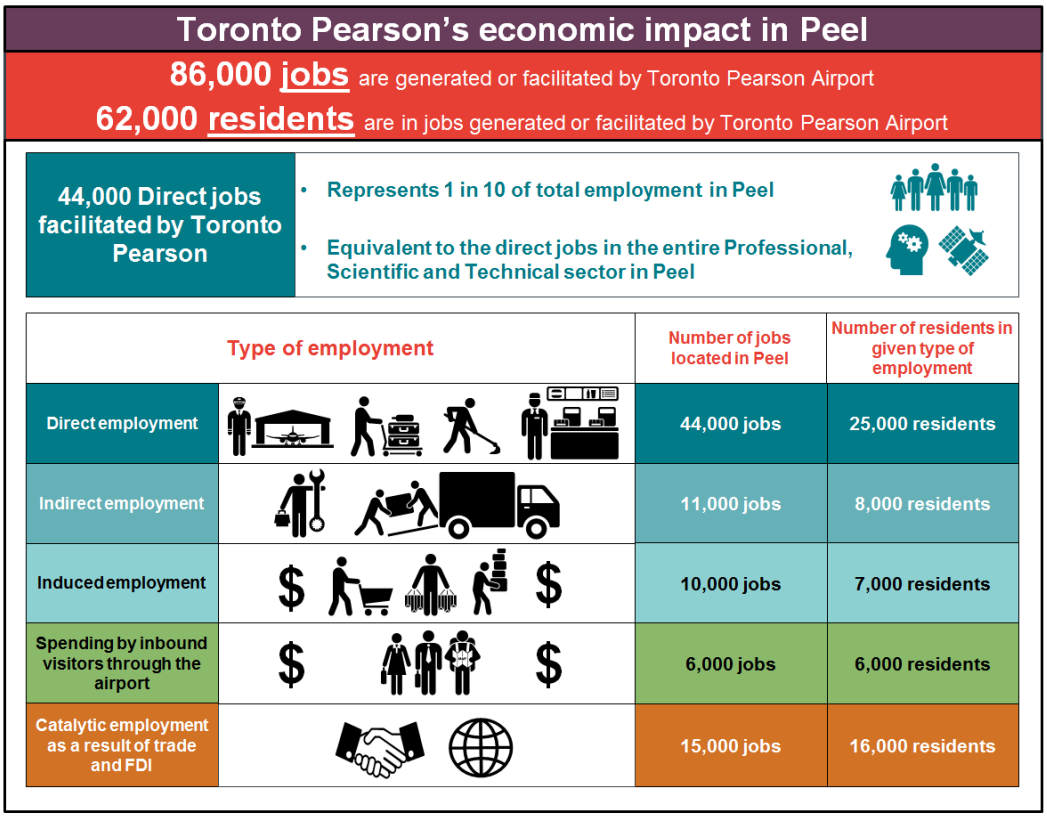
Figure 26. Economic impact of Toronto Pearson in GTA (Location of residents)

	DII	Jobs supported by Inbound visitor spending	Catalytic	Total
Halton	7,000	2,000	10,000	19,000
Peel	40,000	6,000	16,000	62,000
Toronto	23,000	10,000	27,000	60,000
York	7,000	4,000	11,000	22,000
Durham	2,000	3,000	12,000	17,000
Greater Toronto Area	**79,000**	**26,000**	**77,000**	**182,000**
Rest of Ontario	**22,000**	**26,000**	**102,000**	**150,000**
Total	**101,000**	**52,000**	**179,000**	**332,000**

Source: Quod

A.1 The Impact on Peel

Figure 27. The Region of Peel's Economic Characteristics



Source: Quod, Statistics Canada NHS 2011, Region of Peel, Frontier Economics

- There are 49,395 jobs at and around the airport that are **directly** reliant on the airport's operation - given the airport's location, around 44,000 of these jobs are in Peel – including all jobs at the airport and the majority of those in the surrounding area.
  - The airport's **direct employment effect alone** is equivalent to **nearly 1 in 10 of all jobs in Peel**, and **13% of all jobs in the City of Mississauga**.
  - The airport provides **as many direct jobs in Peel as the health sector**; or
  - More than **twice the number of jobs in the public administration sector**; or
  - Around the **same amount of jobs as Peel's professional, scientific and technical** sector.

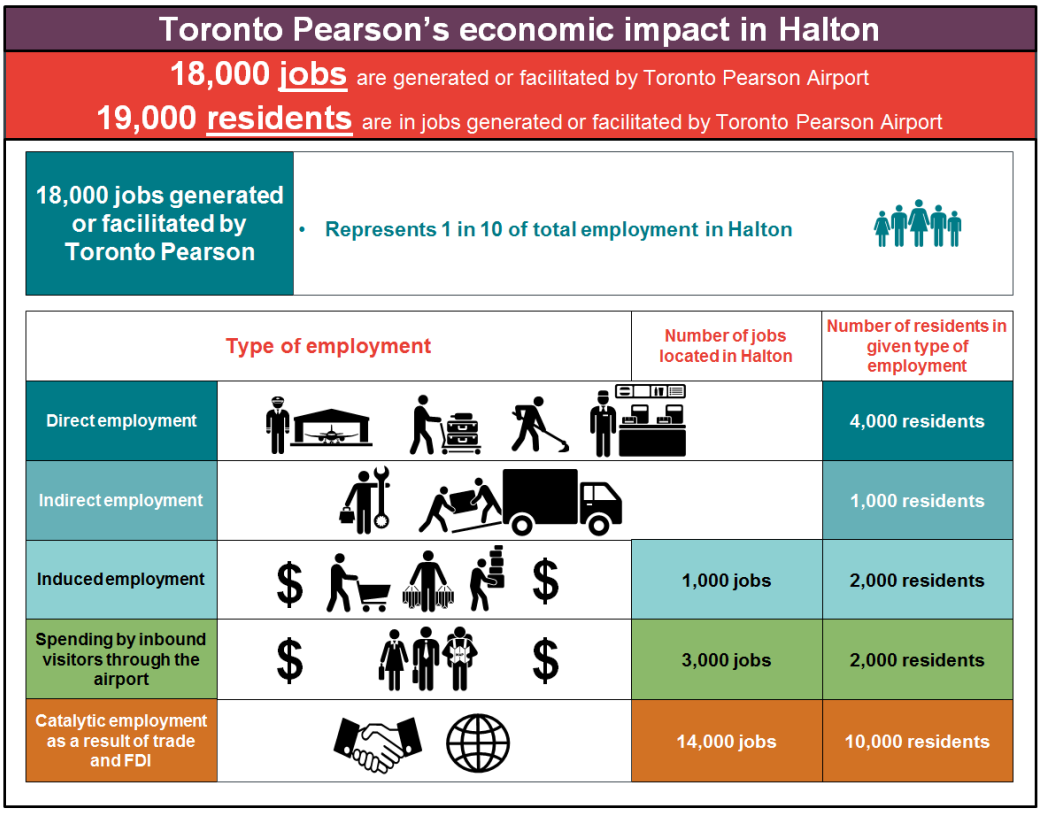
More than 1 in 10

Number of jobs in Peel at Toronto Pearson.

- These direct jobs support an additional **11,000 indirect jobs** in Peel within the airport's supply chain – supplying the airport with goods and services that it needs to operate – these jobs range from service sectors, to manufacturing, freight, consultancy, construction and many other sectors – delivering a range of skills for Peel's labour force.
- The 25,000 people who work at the airport and live in Peel, combined with the 8,000 who live in Peel and whose job is indirectly related to the airport, generate a significant amount of spending. This in turn creates jobs in the local area – in retail, service and other sectors that people need at and around their home. This **'induced' employment effect is likely to support over 10,000 more jobs in Peel**.
- We also know that the airport brings **inbound visitors** to Peel, who will spend money in the local economy on accommodation, transport, food, drink and other goods during their stay. A broad estimate of the value of this spending to Peel suggests that it might support **up to 6,000 jobs** in the region in these sectors.
- Finally, the airport has a significant effect in improving connectivity to Peel businesses – facilitating them to trade internationally and attract inward investment. Based on the distribution of trading sectors, FDI-heavy sectors, and the actual origin of business passengers through the airport, we estimate that the airport's connectivity supports **around 15,000 jobs in Peel**.
- If we include i**ndirect, induced, inbound visitor spending-related and catalytic employment**, the airport facilitates a **combined 86,000 jobs in Peel**.
- **62,000 Peel residents have jobs that are facilitated by the airport** (Over a third of these - 25,000) are in work directly related to or at the airport) - combined, this is equivalent to **over 1 in 10 Peel residents with a full time job**.
- The 25,000 Peel residents who work in jobs directly related to the operation of the airport account for over half of the airport's direct workforce.

A.2 The Impact on Halton

Figure 28. Halton's Economic Characteristics



Source: Quod, Statistics Canada, Frontier Economics

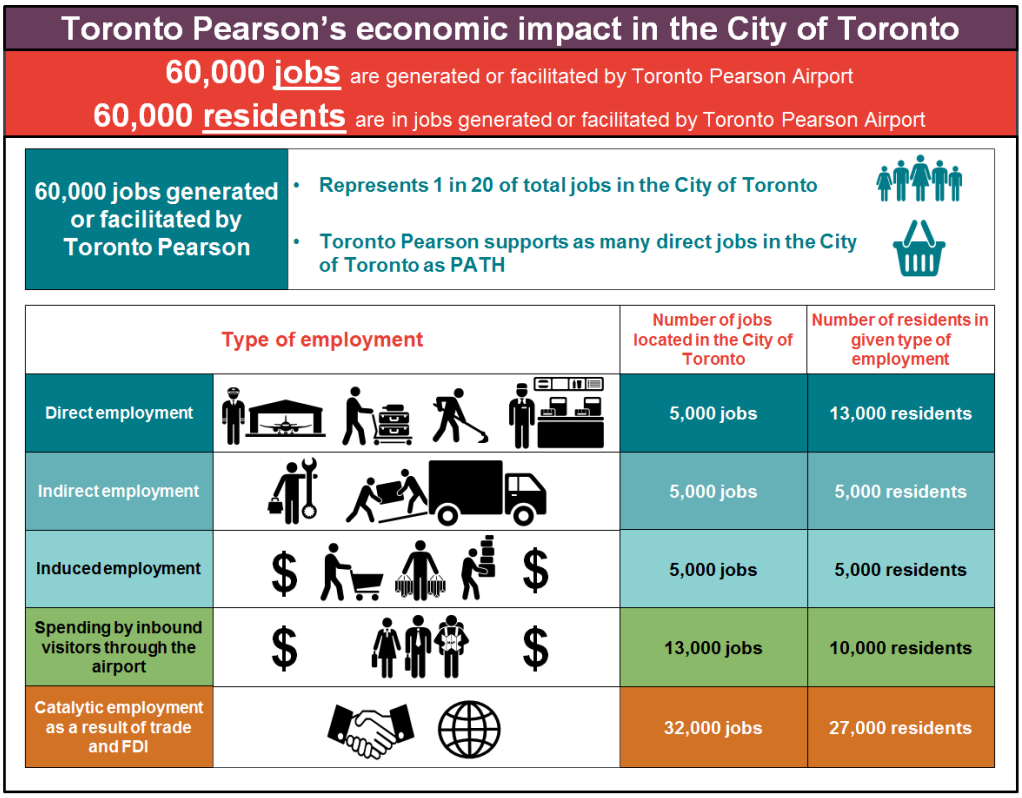
- Around 4,000 of Toronto Pearson's **direct jobs** are taken by residents of Halton.
- Toronto Pearson - and the GTAA - relies on Halton for part of its local supply chain workforce. Around 1,000 Halton residents work in **indirect** jobs related to the airport's supply chain through activities such as commercial and professional services, construction, finance and service sectors that supply the airport and its operations with the goods and services it needs to operate.
- The 4,000 people who work at the airport and live in Halton, combined with the 1,000 who live in Halton and whose job is indirectly related to the airport, generate a significant amount of spending. This in turn creates jobs in the local area – in retail, service and other sectors that people need at and around their home. This **'induced' employment effect is likely to support 1,000 more jobs in Halton**.
  - Many of the induced jobs (jobs facilitated by the direct and indirect workforce's spending) are located in the City of Toronto and Region of Peel, but are taken by people who live outside of the city - in places like

Halton. As a result, **almost 2,000 Halton residents have jobs that are facilitated by direct and indirect workers' expenditure**.

- Given Halton's proximity to the airport, the region is positioned to benefit from the spending effects of inbound visitors. The **spending of these visitors during their time in Ontario supports around 3,000 (direct and indirect) jobs in Halton**, and **around 2,000 Halton residents are in work facilitated by this spending**.
- Halton is also a key location for businesses in sectors that rely on international connectivity - including major international corporation HQs like Evertz Microsystems, UTC Aerospace, Siemens, Ford and Amec FW. As a result, Halton is estimated to be **home to 14,000 jobs that are facilitated by Toronto Pearson's international connectivity benefits**.
- The **combined effects of Toronto Pearson are estimated to support around 18,000 jobs in Halton**, and provide employment for about 19,000 Halton residents.
  - This is equivalent to around 1 in 10 jobs in Halton.

A.3 The Impact on the City of Toronto

Figure 29. The City of Toronto's Economic Characteristics



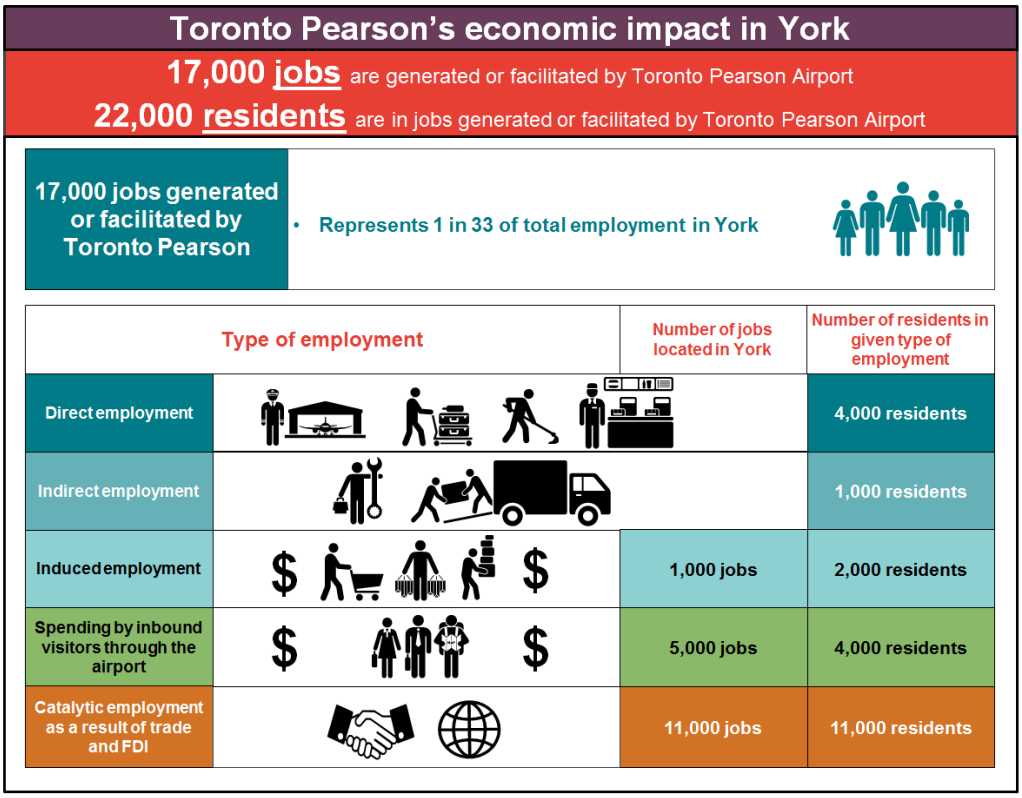
Source: Quod / Statistics Canada / City of Toronto

- Around 5,000 of Toronto Pearson's **direct jobs** are in the City of Toronto, likely to be close to the airport in hotel, parking and transportation sectors. Toronto Pearson therefore supports as many direct jobs in the City as PATH.
  - Given the City's high population density and good accessibility, it also provides a home for around 13,000 **people who work at the airport**.
- Toronto Pearson - and the GTAA - relies on the City of Toronto for its supply chain, supporting in the region of (at least) 5,000 **indirect jobs** through activities such as commercial and professional services, construction, finance and service sectors that supply the airport and its operations with the goods and services it needs to operate. Around 5,000 Toronto residents are in work indirectly related to the airport.
- The 13,000 people who work at the airport directly and live in Toronto, combined with the 5,000 who live in Toronto and whose job is indirectly related to the airport, generate a significant amount of spending. This in turn creates jobs in the local area – in retail, service and other sectors that people need at and around their home. This **'induced' employment effect is likely to support 5,000 more jobs in Toronto**.

- The City of Toronto is well defined as a leisure, recreation, retail and accommodation hub for inbound passengers arriving in Ontario through Toronto Pearson. The **spending of these visitors during their time in Toronto supports around 13,000 (direct and indirect) jobs in the City**, and **around 10,000 Toronto residents are in work facilitated by this spending**.
- Toronto is also a key location for businesses in sectors that rely on international connectivity - for example finance - and international trade. It is an area of dense, high-skilled and high-earning employment and is the driver of Ontario's GDP. As a result, the city of Toronto is estimated to be **home to 32,000 jobs that are facilitated by Toronto Pearson's international connectivity benefits**.
- The **combined effects of Toronto Pearson are estimated to support around 60,000 jobs in Toronto**, and provide employment for about 60,000 Toronto residents.
  - This is equivalent to around 1 in 20 jobs in the City of Toronto.

A.4 The Impact on York

Figure 30. York's Economic Characteristics



Source: Quod, Statistics Canada, Frontier Economics

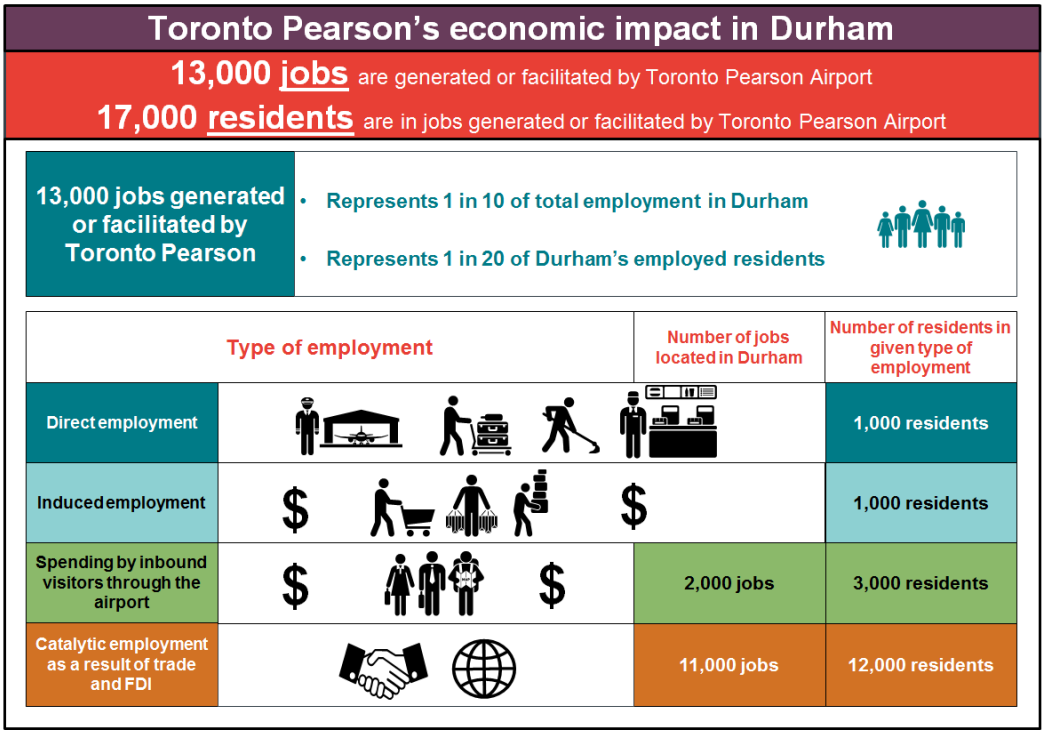
- Around 4,000 of Toronto Pearson's **direct jobs** are taken by residents of York.
- Toronto Pearson - and the GTAA - relies on York for part of its local supply chain workforce. Around 1,000 York residents work in **indirect** jobs related to the airport's supply chain through activities such as commercial and professional services, construction, finance and service sectors that supply the airport and its operations with the goods and services it needs to operate.
- The 4,000 people who work at the airport directly and live in York, combined with the 1,000 who live in York and whose job is indirectly related to the airport, generate a significant amount of spending. This in turn creates jobs in the local area – in retail, service and other sectors that people need at and around their home. This **'induced' employment effect is likely to support 1,000 more jobs in York**.
  - Many of the induced jobs (jobs facilitated by the direct and indirect workforce's spending) are located in the City of Toronto and Region of Peel, but are taken by people who live outside of the city - in places like

York. As a result, **almost 2,000 York residents have jobs that are facilitated by direct and indirect workers' expenditure**.

- Given York's relatively close proximity to the airport, the region is well positioned to benefit from the spending effects of inbound visitors. The **spending of these visitors during their time in Ontario supports around 5,000 (direct and indirect) jobs in York**, and **around 4,000 York residents are in work facilitated by this spending**.
- York is also a key location for businesses in sectors that rely on international connectivity for trade and investment, for example transport and warehousing and goods-producing sectors (manufacturing in York, especially in transportation equipment - one of Canada's most prominent export commodities - has shown significant growth in recent years). As a result, York is estimated to be **home to 11,000 jobs that are facilitated by Toronto Pearson's international connectivity benefits**.
- The **combined effects of Toronto Pearson are estimated to support around 17,000 jobs in York**, and provide employment for about 22,000 York residents.
  - This is equivalent to around 1 in 33 jobs in York.

A.5 The Impact on Durham

Figure 31. Durham's Economic Characteristics



Source: Quod, Statistics Canada, Frontier Economics

- Over 1,000 of Toronto Pearson's **direct jobs** and indirect (supply chain) jobs are taken by residents of Durham.
- Spending by people who live in Durham and work in jobs directly or indirectly related to the airport in turn creates more jobs in the local area – in retail, service and other sectors that people need at and around their home. This **'induced' employment effect is likely to support up to 1,000 more jobs in Durham**.
- Given Durham's links to the airport, the region is positioned to benefit from the spending effects of some inbound visitors. The **spending of these visitors during their time in Ontario supports around 2,000 (direct and indirect) jobs in Durham**, and **around 3,000 Durham residents are in work facilitated by this spending**.
- Durham is also a key location for global, national and provincial businesses in sectors that rely on international connectivity - for example engineering and automotive technology (General Motors and TDS), logistics and business services. As a result, Durham is estimated to be **home to 11,000 jobs that are facilitated by Toronto Pearson's international connectivity benefits**.

- The **combined effects of Toronto Pearson are estimated to support around 13,000 jobs in Durham**, and provide employment for about 17,000 Durham residents.
  - This is equivalent to around 1 in 10 jobs in Durham.
  - Around 1 in 20 of the Durham's employed residents is in a job facilitated by Toronto Pearson.

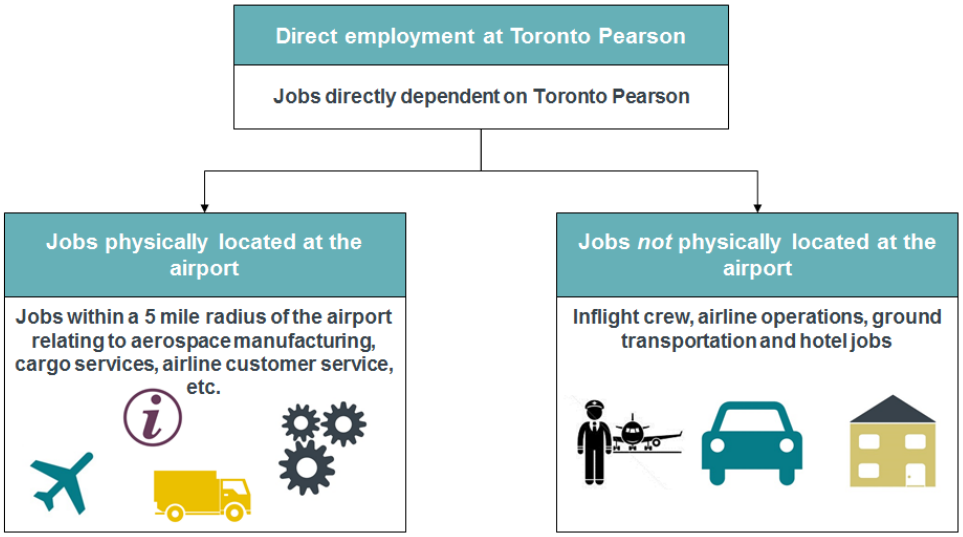
ANNEX B DETAILED METHODOLOGY FOR DIRECT EMPLOYMENT ESTIMATES

The starting point for any economic impact assessment is the direct employment facilitated by the airport. MNP has drawn on a wide range of data sources to develop estimates for direct employment. In this annex, the methodology used by MNP for estimating direct employment at Toronto Pearson is provided.

B.1 How do we define employment at Toronto Pearson?

To estimate employment associated with the ongoing operations of Toronto Pearson Airport, MNP first needed to define the types of employment that are relevant. Figure 32 shows the two types of direct employment.

Figure 32. Direct employment at Toronto Pearson



As can be seen above, the employment associated with the ongoing operations of Toronto Pearson falls into the following two categories:

- **Jobs that are physically located at Toronto Pearson** which includes:
  - Employment of the Greater Toronto Airports Authority (GTAA);
  - Employment associated with the ongoing maintenance of Toronto Pearson's facilities (for example, landscaping, snow removal, janitorial, and pest removal);
  - Employment of businesses, organizations and government agencies located at, or operating from Toronto Pearson (for example airline

customer service staff, ground handling, retail shops in the terminals, air traffic control, cargo handlers, and security);

- Employment located in the vicinity of Toronto Pearson that is related to the provision of cargo services (for example, couriers, trucking and cargo handlers);
- Employment of businesses engaged in aerospace manufacturing located in the vicinity of Toronto Pearson; and

- **Jobs that are not physically located Toronto Pearson** – for example, taxi, limousine and bus drivers, Union Pearson Express attendants, and inflight crew based out of Toronto Pearson as well as hotel employment.

Employment associated with capital investment projects was excluded from the estimates. This is because employment as a result of capital projects such as construction workers is only temporary and not part of the ongoing employment at Toronto Pearson.

What are our data sources?

MNP used a number of different data sources to develop the employment estimate. These include:

- Publicly available sources such as Statistics Canada for the number of jobs located at Toronto Pearson;
- Administrative data provided by GTAA such as Restricted Area Identify Cards and data from the Ground Transportation Survey; and
- Data collected from an online survey of businesses operating at Toronto Pearson.

The online survey of businesses was conducted between May 16, 2016 and June 6, 2016, and was designed to gather information on the number of full-time, part-time and contract employees, and payroll at businesses and organizations operating at Toronto Pearson airport. The survey was distributed to 186 businesses and organizations and a total of 53 responses were received.

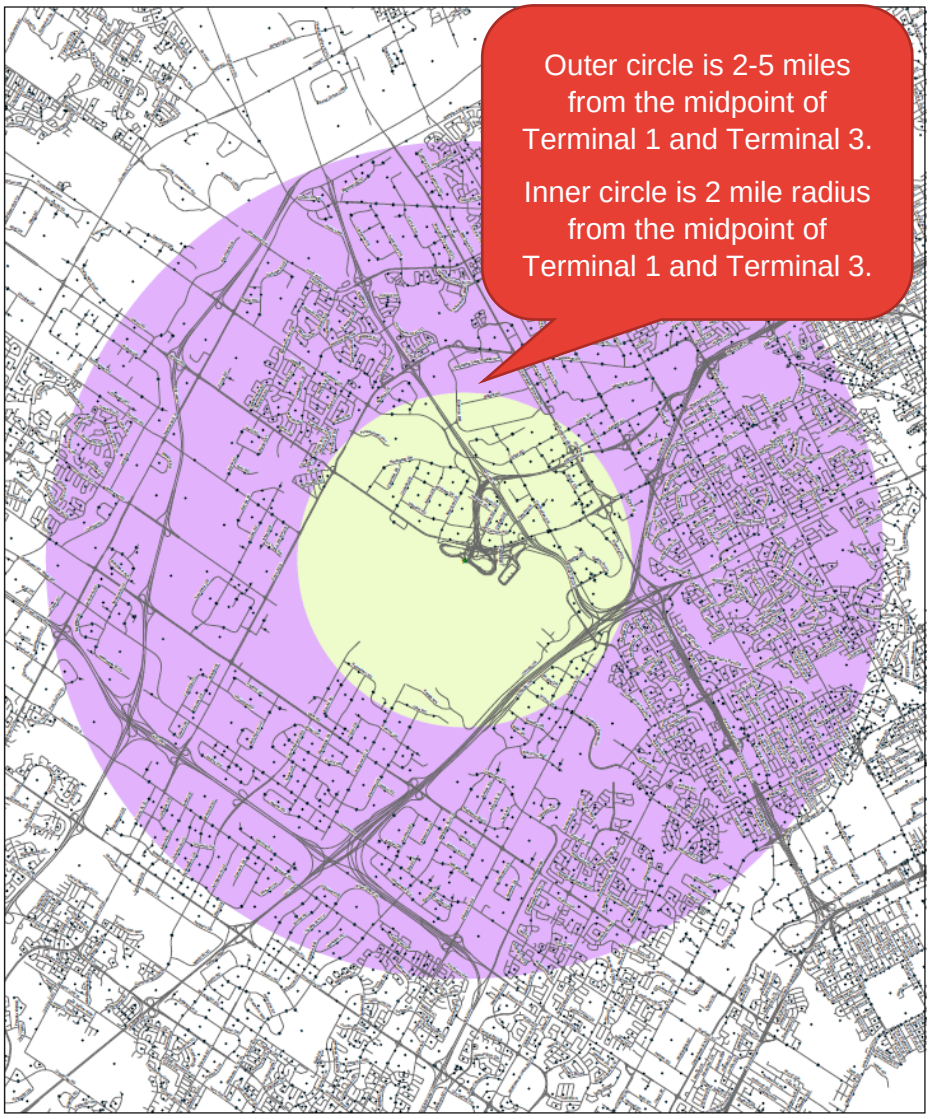
B.2 How do we estimate employment at Toronto Pearson?

B.2.1 Jobs physically located at Toronto Pearson

To estimate jobs that were physically located at Toronto Pearson, data on employment within a five mile radius[13] of Toronto Pearson from Statistics Canada's National Household Survey (`NHS`) 2011 was used. The area located within a five mile radius of Toronto Pearson is shown in Figure 33.

[13] The five mile radius was measured from the midpoint between Terminal 1 and Terminal 3

Figure 33: Two and Five Mile Radii of Toronto Pearson



Source: GTAA

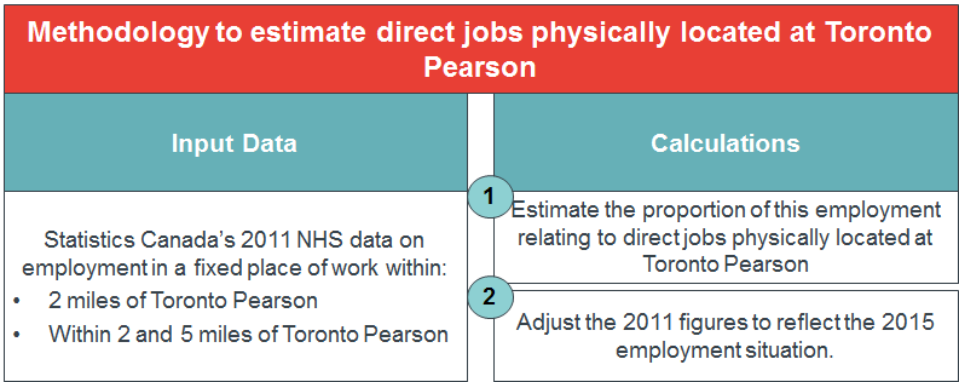
- According to the NHS data, in 2011 there were approximately 288,475 people working at a fixed place of work within a five-mile radius of Toronto Pearson and of those, 44,805 worked within two miles of Toronto Pearson. To estimate which of those jobs were related to the ongoing operations of Toronto Pearson MNP conducted a detailed examination of the four-digit North American Industry Classification System (NAICS) codes associated with the NHS data and identified the jobs in industries that were relevant to the operations of Toronto Pearson. The list of relevant industries and the associated jobs were reviewed and agreed with the GTAA.
- Within the industries relevant to the operations of Toronto Pearson, all jobs within the two-mile radius were assumed to be related to Toronto Pearson's ongoing operations. Within the two to five-mile radius only those jobs in aerospace manufacturing, support activities for air transportation, and

scheduled and non-scheduled air transportation were assumed to be related to the ongoing operations of Toronto Pearson.

As data for jobs within the two and five-mile radius is only available from Statistics Canada for 2011, MNP needed to adjust the 2011 figures to reflect the 2015 employment situation. To estimate employment in 2015, MNP adjusted the 2011 figure based on the percentage change in employment by industry between 2011 and 2015 in Ontario from Statistics Canada`s CANSIM Table 281-0024 Survey of Employment, Payrolls and Hours (SEPH), employment by type of employee and detailed North American Industry Classification System (NAICS).

This is summarised in Figure 12 below.

Figure 34. Estimating direct jobs physically located at Toronto Pearson



B.2.2 Jobs not physically located at Toronto Pearson

MNP estimated the number of jobs related to airline staff, ground transportation and hotel employment. Each of the categories requires a number of assumptions.

Airline Staff

These include inflight crew based out of Toronto Pearson and Air Canada operations centre employees handling flights at Toronto Pearson.

The number of inflight crew jobs based out of Toronto Pearson was estimated based on the number of Restricted Area Identify Cards by airline, estimated employment attributed to scheduled air transportation from the NHS and information gathered from airlines through the survey of businesses.

The number of Air Canada operations centre jobs was estimated using publicly available information from Air Canada's website on the number of flights operated from Toronto Pearson and the number of employees at the operations centre.[14]

[14] Air Canada's Operations Centre moved to Brampton, Ontario in 2013/14. According to the press release there are 400 employees at the operations centre and they handle 600 flights a day. (http://aircanada.mediaroom.com/index.php?s=43&item=682). Air Canada operates approximately 355 flights operate out of Toronto Pearson daily (http://www.aircanada.com/en/travelinfo/airport/toronto.html).

Ground Transportation

This refers to employment related to the operation of taxis, limousines, buses, hotel shuttles and the Union-Pearson Express.

The number of ground transportation jobs was estimated based on administrative data provided by the GTAA on the number of trips by mode and information on average trip length by mode from the GTA 2011 Ground Transportation Survey. The number of trips by mode was converted to number of hours of operation using the assumptions shown in Figure 35. The number of hours were converted to full-time equivalents (FTEs) based on 1 FTE = 1,800 hours. [15]

Figure 35: Assumptions Used to Convert Number of Trips to Hours of Operation

Mode	Average Trip Distance*	Assumptions
Taxi and limousines	Regular trip – 37 km Short trip – 7.7 km	Distance travelled per hour is 50 km. Time cab is occupied is 50 percent[16]
Uber		Distance travelled per hours is 50km. Time car is occupied is 75 percent.
Pre-arranged and itinerant buses		Distance travelled per hour is 50 km. Time per trip is twice the travel time to account for loading, unloading and standing.
Out of town shuttles (AGTA T1/T3)	84 km	Distance travelled per hour is 90 km. Time per trip is twice the travel time to account for loading, unloading and standing.
Hotel courtesy shuttles	Not applicable	Two trips per hour.

*Weighted average by mode from the GTA 2011 Ground Transportation Survey

Employment associated with the TTC 192 Rocket shuttle bus service was estimated using data on the annual hours of operation provided by the Toronto Transit Commission. Union-Pearson Express employment was estimated based on information provided through the survey of businesses.

Hotel Employment

With the exception of the onsite hotel properties, not all hotel employment within five miles of the airport is directly attributable to Toronto Pearson. Consequently MNP has estimated it separately and included both employment within 5 miles and employment outside of five miles.

Hotel employment at properties located onsite at Toronto Pearson was assumed to be associated with the ongoing operations of Toronto Pearson and was estimated based on information provided through the survey of businesses.

[15] This is a standard full-time work definition in North America. It assumes an individual works 37.5 hours per week and has some combination of vacation and leave equal to 4 weeks each year.

[16] Standing time was determined based on information in a study of New York Taxi Cabs http://www.nyc.gov/html/tlc/downloads/pdf/2014_taxicab_fact_book.pdf and prior work undertaken by MNP.

Employment at off-site properties was calculated based on estimates of the number of room nights attributable to passengers and air crew and estimates of the employment/room ratio published by the American Lodging Association (0.38 jobs per room).[17]

Room nights attributable to passengers were estimated using information provided by the GTAA on the number of passengers travelling through Toronto Pearson and the share of passengers travelling on hotel shuttles from the 2011 Ground Transportation Survey. For each passenger travelling on a hotel shuttle there was one room night attributed to Toronto Pearson. This assumption is considered reasonable as not all hotel patrons take the shuttle bus to/from the airport.

Room nights associated with airline crew were estimated using information provided through the survey of businesses on the number of rooms purchased outside of a five-mile radius of Toronto Pearson.

B.2.3 What additional assumptions are required?

To develop the total direct employment estimates, MNP had to make a number of assumptions:

- **Conversion to full-time equivalent (FTEs) jobs** – where information on the number of FTEs was not available, the number of jobs was converted to FTEs based on the ratio of FTEs to jobs for the relevant category of business received from the survey of businesses.
- **Payroll** was calculated based on average earnings for the relevant category of business from the survey of businesses and annual earnings in Ontario by NAICS from Statistics Canada`s CANSIM Table 281-0027 Survey of Employment, Payrolls and Hours (SEPH), average weekly earnings by type of employee, overtime status and detailed North American Industry Classification System (NAICS), annual (current dollars).

B.3 What are our results?

B.3.1 Jobs physically located at Toronto Pearson

According to the NHS data, in 2011 there were approximately:

- 288,475 people working at a fixed place of work within a five-mile radius of Toronto Pearson and of those;
- 44,805 worked within two miles of Toronto Pearson.

As stated above, MNP undertook a detailed analysis of the types of jobs in the two and five-mile radius based on NHS data for 2011 and then adjusted these to reflect growth in jobs since 2011. The results are shown in Figure 36 which

[17] See Lodging Industry Trends 2015, American Hotel and Lodging Association. Available at https://www.ahla.com/uploadedFiles/_Common/pdf/Lodging_Industry_Trends_2015.pdf

shows that the total employment physically located at Toronto Pearson is estimated at approximately 38,900 FTEs.

Figure 36: Number of People Working at a Fixed Place of Work within Five Miles of Toronto Pearson

Distance From Toronto Pearson Airport	Total Employed Labour Force, 2011 (NHS)	Baseline Estimated Employment Associated with Toronto Pearson, 2011	Estimated Employment Associated with Toronto Pearson, 2015
0 - 2 miles	44,805	18,721	21,050
2 - 5 miles	243,670	15,162	17,850
Total	288,475	33,883	38,900

Source: Statistics Canada, National Household Survey 2011, Custom Tabulation and MNP Estimates

B.3.2 Jobs not physically located at Toronto Pearson

As stated above, there are three categories of jobs that are related to ongoing operations but not physically located at Toronto Pearson:

- Airline staff including inflight crew based out of Toronto Pearson and Air Canada operations centre employees handling flights at Toronto Pearson;
- Ground transportation employment related to the operation of taxis, limousines, buses, hotel shuttles and the Union-Pearson Express; and
- Hotel employment.

Figure 37 shows that MNP estimated the number of jobs not physically located at Toronto Pearson at approximately 10,500.

Figure 37: Estimated number of Jobs not Physically Located at Toronto Pearson

Category	Jobs
Airline Staff	6,700
Ground Transportation Employment	2,600
Hotel Employment	1,200
Total	10,500

B.3.3 Total number of jobs at Toronto Pearson

Overall, we estimated that the total number of jobs facilitated directly by Toronto Pearson is approximately 49,400. This includes jobs physically located at the airport and those related to the airport such as ground transportation, hotel employment and air crew.

Figure 38. Total estimate of direct jobs at Toronto Pearson

Jobs physically located at Toronto Pearson	38,900
Jobs not physically located at Toronto Pearson	10,500
Total	49,400

ANNEX C DETAILED METHODOLOGY FOR INDIRECT AND INDUCED ESTIMATES

This annex describes the process used by Quod for defining and estimating the **indirect** and **induced** employment impacts resulting from direct employment at the airport, as described in Annex B.

C.1 Defining indirect employment

Indirect employment is defined as employment in the airport's supply chain that supports the direct activity of the airport. This can include the provision of goods and services, for example the purchase of fuel or food/drink by an airline, maintenance contracts by the GTAA, and supplies for retailers.

C.2 Calculating indirect employment

C.2.1 Indirect employment in 2016

In order to estimate the scale of this type of employment, we use a combination of the identified direct employment identified, and published data form Statistics Canada's (2010) Input-Output tables[18], which capture the relationship between direct employment (by 3-digit NAICS) and Type I multipliers within Ontario.

The Type I multiplier takes account of the direct and indirect effect of a one unit increase in demand for the output of an industry. For example, a Type I multiplier of 1.5 for an item or sector implies that demanding the production of an additional item unit would lead to an increase of 0.5 units in the industries that produce inputs for the production of the item.

As identified in Annex B, the main outputs produced directly by Toronto Pearson are in the form of jobs in the Air Transport and Support Services for Transportation sectors (accounting for around half of the direct jobs). These sectors have Type I employment multipliers (within Ontario) of 1.90 and 2.06 respectively - higher than the average for all sectors combined (1.44). This reflects the capital intensive supply chains of these sectors specifically - for example the need to produce goods, materials, fuels, value-added services that keep the sector in operation. Furthermore, air transportation is a high wage industry and generates demand for goods and services in other high wage industries such as mining (oil & gas) and finance, insurance and real estate.

It should be noted that these are not the only direct outputs of the airport - around half of the direct employment is accounted for by other sectors including

[18] Statistics Canada *Provincial Input-Output Multipliers* (2010) Cat. No. 15F0046XDB

transport, administrative and support services, retail accommodation, food and drink, security and maintenance and other sectors.

As such, we have applied each Statistics Canada multiplier specific to each direct sector identified, by the number of direct FTEs in those sectors. This generates a total of 32,971 jobs, and creates an aggregate Type I multiplier for the airport of 1.67 (i.e. each direct job supports 0.67 jobs in the economy as a result of supply chain spending). The following table identifies the sector-specific multipliers used to calculate this figure, and the sub-sectoral effects of each direct job on indirect employment. It also includes Type II employment multipliers for induced employment effects described later in this annex:

Figure 39. Direct Employment, Type I/II Employment Multipliers and calculated Indirect and Induced Employment

Direct Sector	Direct Jobs	Type I Multiplier	Indirect Jobs	Type II Multiplier	Induced Jobs
Machinery Manufacturing	65	1.48	31	1.86	25
Navigational, measuring, medical and control instruments manufacturing	528	1.49	257	1.89	212
Aerospace Manufacturing	1,760	1.39	694	1.76	653
Food and Beverage Stores	734	1.17	125	1.34	122
Clothing and Accessories	1,482	1.25	363	1.43	268
Air Transportation	18,244	1.90	16,349	2.42	9,491
Rail Transportation	25	1.67	17	2.09	10
Truck Transportation	1,040	1.44	453	1.67	242
Transit and Ground Passenger Transportation	2,945	1.21	632	1.40	559
Support Activities for Transportation	8,902	2.06	9,471	2.51	3,967
Postal Services	140	1.29	41	1.55	37
Couriers and Messengers	709	1.29	206	1.55	186
Warehousing and Storage	538	1.14	76	1.39	131
Telecommunications	40	1.79	31	2.26	19
Rental and Leasing Services	1,158	1.71	828	2.06	396
Professional, Scientific and Technical Services	781	1.32	252	1.61	226
Management of companies and enterprises	155	1.66	102	2.17	79
Administrative and Support Services	3,265	1.23	753	1.45	731
Waste Management and Remediation	135	1.39	53	1.69	40
Accommodation Services	1,231	1.32	397	1.57	299
Food Services and Drinking Places	1,538	1.29	444	1.47	276
Repair and Maintenance	343	1.21	72	1.39	61
Personal and laundry services	519	1.21	108	1.32	58
Professional and Similar organizations	668	1.36	243	1.67	205
Federal Government Public Administration	1,095	1.46	504	1.94	522
Wholesale Trade	336	1.54	183	1.91	123
Other Retail Trade	1,020	1.28	285	1.50	220
TOTAL	**49,395**	**1.67**	**32,971**	**1.23**	**19,156**

Source: MNP, Quod and Statistics Canada

C.2.2 Indirect employment in 2030

Indirect employment is calculated based on the total number and sectors of direct employment, as described above. Therefore, any estimate of future indirect employment is likely to be proportional to the number and type of **direct** jobs in the future.

It is not possible to state with any degree of confidence the sectoral breakdown of jobs directly related to the operation of the airport - there will be productivity gains, technological advancements and operational efficiencies, and commercial decisions that affect this breakdown. It is therefore assumed that, on average, the overall multiplier for the aggregated direct sectors should be used as a baseline.

It is, however, possible to estimate the overall number of direct jobs in the future, based on projected relationships between aircraft movements/million passengers p/a (MPPA) per job. Previous research undertaken by HRD/HLB Decision Economics (2012) in collaboration with GTAA estimated the relationship between direct employment in aviation, operations, commercial services and cargo at the airport and passenger movements, forecasting this forward to 2030. The overall number of jobs per MPPA in 2030 was estimated to be around 81.9% of today's value due to aggregated overall productivity/efficiency gains.

Using Toronto Pearson's estimates for future MPPAs (around 63 in 2030, supporting 66,167 direct jobs), this would support around 44,166 indirect jobs in 2030 using today's multipliers. Evidence from Statistics Canada's historical Input-Output tables suggests that weighted multipliers do not change significantly over time.

C.3 Defining induced employment

Induced employment is defined as employment supported by the spending of people whose job is directly or indirectly related to the airport, in their home location. This spending supports a range of service-sector jobs, for example retail jobs in local shops, personal service and care sectors, and public services.

C.4 Calculating induced employment

C.4.1 Induced employment in 2016

To calculate induced employment, we have used Statistics Canada's (2010) Input-Output tables and the Type II employment multipliers, by detailed 3-digit NAICS sector, for Ontario. As we know the breakdown of direct employment by 3-digit NAIC sector, we can use this table to calculate an aggregated multiplier based on the distribution of direct and indirect jobs by sector, using the methodology described above.

Using this methodology, the aggregated Type II multiplier generated by the direct and indirect employment is approximately 1.23 (i.e. each direct and indirect job supports 0.23 jobs in the economy as a result of supply chain spending).

As such, 49,395 direct jobs and 32,971 indirect jobs support an additional 19,156 jobs through induced spending.

C.4.2 Induced employment in 2030

Induced employment is calculated based on the total number and sectors of direct employment, and indirect employment as described above. Therefore, any

estimate of future induced employment is likely to be proportional to the number and type of **direct and indirect** jobs in the future.

It is not possible to state with any degree of confidence the sectoral breakdown of jobs directly related to the operation of the airport - there will be productivity gains, technological advancements and operational efficiencies, and commercial decisions that affect this breakdown. It is therefore assumed that, on average, the overall multiplier for the aggregated direct sectors should be used as a baseline.

It is, however, possible to estimate the overall number of direct jobs in the future, based on projected relationships between aircraft movements/million passengers p/a (MPPA) per job. Previous research undertaken by HRD/HLB Decision Economics (2012) in collaboration with GTAA estimated the relationship between direct employment in aviation, operations, commercial services and cargo at the airport and passenger movements, forecasting this forward to 2030. The overall number of jobs per MPPA in 2030 was estimated to be around 81.9% of today's value due to aggregated overall productivity/efficiency gains.

Using Toronto Pearson's estimates for future MPPAs (around 63 in 2030, supporting 66,167 direct jobs), this would support around 44,166 indirect jobs in 2030 using today's multipliers. Applying this total to today's Type II employment multipliers results in approximately 25,661 induced jobs in 2030. Evidence from Statistics Canada's historical Input-Output tables suggests that weighted multipliers do not change significantly over time.

C.5 Literature and Comparisons

A review of literature and other studies suggests that this is broadly in line with other relationships found between direct and indirect employment. For example:

- Research by the Canadian Airports Council (2013)[19] explains that, combined, the Air Transport and Support Services for Transportation sector could have a combined (Type I and II) multiplier of up to 3.46 (not including other direct non-air-transport sectors at Canadian Airports). Including all activity at Canadian airports, the employment multiplier is estimated at around 2.26.
  - This study includes reference to other industry-wide DII studies by NACC (2010)[20], Oxford Economics (2011)[21] and SLI/CBoC (2012)[22], which estimate a range of multipliers from 1.83 to 2.83.
- Frontier Economics' (2014) research for Heathrow Airport in the UK as part of the airport's submission to the Davies Commission found that Heathrow's Indirect multiplier effect on GVA (converted to employment) is approximately 1.63[23] using ONS Input-Output tables;

[19] Canadian Airports Council (2013) *The Economic Impact of Air Transportation in Canada*

[20] DF Lazar / NACC (2010) *The Economic Impact of Member Carriers of the National Airlines Council of Canada*

[21] Oxford Economics (2011) *Economic Benefits of Air Transportation in Canada*

[22] Conference Board of Canada (2012) *Driven Away: Why More Canadian Airports are Choosing Cross-Border Airports*

[23] Heathrow Airport Ltd (2014) *Taking Britain Further: Technical Submission Vol. 2*

- Optimal Economics' (2011) research into the scale of Heathrow-related employment included a detailed survey methodology for identifying indirect effects, including a census of direct employment at the airport and a telephone survey of indirect employment, based on information on the airport's supply chain sectors. This identified a Type I multiplier effect of around 1.52[24].
- Research undertaken by the Association for European Transport (2006)[25] included a review of various multipliers from airports across Europe and North America, finding that multipliers vary from around 1.3 to 8.5, with an average of around 2.6, including 1.5 at Brussels and 4.1 in Milan. It also found that there is no evident correlation between annual traffic and the size of the multiplier. Research by ATAG (2005)[26] found that overall multipliers tend to be towards the lower end of identified ranges.

[24] Optimal Economics (2011) *Heathrow-related Employment*

[25] AET / Molde University College (2006) *An Inquiry into the link between Air Transport and Employment in Norway*

[26] ATAG (2005) *The Economic and Social Benefits of Air Transport*

ANNEX D DETAILED METHODOLOGY FOR IMPACT OF TOURIST SPENDING BY INBOUND VISITORS

Our 'what-if' scenario for estimating this impact is to assume that the airport did not exist. There will therefore be a direct effect on spending by inbound visitors: if fewer people visit Ontario (regardless of the purpose of their travel), inbound visitor spending decreases. Inbound visitor spending includes spending on (for example) accommodation, food and beverages, entertainment and land transport.

Figure 40. Overview of impact through tourist spending by inbound visitors

Source: Quod and Frontier Economics

D.1 Relationship between connectivity and inbound visitor spending

Passengers who travel to and from Ontario will generate tourism spending regardless of their trip purpose through their spending on subsistence, goods and services, etc. A decrease in the number of passengers travelling to Ontario will inevitably result in a decrease in inbound total tourism spending (or tourism exports).

Likewise, a decrease in the number of outbound passengers from Ontario (which would happen in our what-if scenario if the airport did not exist) results in a decrease in outbound tourism spending (or tourism imports). For the purpose of this report, we have calculated the gross effect of inbound tourism rather than the net effect by subtracting the effect of outbound tourism. This enables us to estimate the impact on employment in the GTA.

To estimate the impact of connectivity on tourism spending, we have obtained data on tourism spending per passenger-visit. Evidence on tourism spending on a country of origin basis is limited. In general, most evidence is based on tourism surveys. We have reviewed the a range of data sources from Statistics Canada, the Ministry of Tourism, Culture and Sport, the Canadian Tourism Commission and the Ontario Ministry of Tourism, Culture and Sport.

Our assumptions on tourism spending per passenger-visit by country of origin are based on the Statistics Canada International Travel 2010 survey. It provides the most comprehensive country-level data. It provides data on a person's average spending per trip for 14 countries across four continents, as well as data by continent and region. We cross-checked our assumptions with the other sources to ensure they were consistent.

Given that data on tourism spending by non-Canadians in Ontario was not available for every country, we used either the respective continent and regional values or a geographically similar country where there was missing data. For example, for Taiwan we used China's average spending per person-trip and an 'Other European' average for Albania.

We use the Ontario Ministry of Tourism, Culture and Sport's visits and spending statistics for our assumption on tourism spending between different provinces. This provides an average tourism spend by Canadians from other provinces in Ontario of CAN$366, in 2011.

Figure 41 below summaries our assumptions on tourism spending per passenger-visit.

Figure 41. Tourism spending per passenger-visit

Direction	Location	Average tourism spending per passenger visit
Inbound (tourism exports)	Rest of world (including US) to Ontario	$440 - $1,990
	Canadian provinces to Ontario	$360

Note: These figures are rounded and are in Canadian dollars

D.2 A change in inbound visitor spending has an impact on GDP and employment

Inbound visitor spending supports direct and indirect employment. Spending by visitors in Ontario positively impacts on the economy, given it involves an inward flow of economic value in the purchase of goods and services from (for example) the food and drink, accommodation, recreation and travel sectors. We have estimated that inbound visitors spent approximately $3.1 billion in 2014 during their time in Ontario. We further estimate that inbound tourist spending will amount to $7.8 billion in 2030.

We can convert this spending to employment and estimate the GDP generated using a number of methods.

Firstly, we can use data on employment in the tourist industry in Canada (approx. 630,000 jobs in. We also know how much money is spent by tourists in Canada, and can therefore estimate an average spend per job – around $112,000 per job. This would suggest that the annual spend of $3.1bn would support around

27,600 jobs in Ontario's tourist-related sectors (predominantly accommodation, food and drink service, retail, art/culture).

Alternatively, we can use information from Statistics Canada to calculate the total employment in retail, accommodation and food service activities in Canada, and the GDP that these sectors produce, to estimate the GDP per job supported in these sectors. On aggregate, this is around $37,000 GDP per job for the combined sectors.

We can then calculate the ratio of GVA (approximately GDP in this case) to turnover (or spending in this case) using the 2010 Supply and Use tables published by Statistics Canada for these sectors. The ratio is approximately 0.54, resulting in a spend-per-job of around $57,300. As such, spending of $3.1bn in Ontario would support up to 54,000 jobs.

Both methods are valid approaches – as such we have taken a mid-point for the estimate of 40,900 direct inbound visitor spending jobs used in this report.

These jobs will support additional supply chain employment. Using the same methodology as described in Annex C, we have established Type I multipliers for the accommodation and food and drink service and retail sectors using Input-Output tables. These multipliers (1.31 and 1.25 respectively), applied to the direct inbound visitor spending employment calculated, results in a total estimate of approximately 52,000 jobs in these sectors in Ontario as a result of the $3.1bn annual inbound visitor spend. Using the average GDP per job above, this spending activity and resulting employment supported can be estimated to contribute around $1.9bn per year in GDP to Ontario's economy.

Assuming productivity remains constant, inbound visitor spending of $7.8bn in 2030 could support up to 131,000 jobs and contribute $4.8bn to Ontario's GDP using the same methodology.

ANNEX E DETAILED METHODOLOGY FOR CATALYTIC IMPACT

This Annex provides a detailed description of our methodology for estimating catalytic employment estimates.

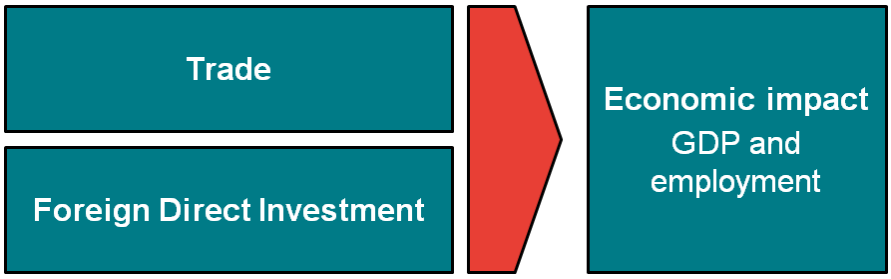
E.1 How does air connectivity facilitate economic value?

This section provides an overview of the key elements of our approach. We first clarify how we define economic value in the context of connectivity and discuss the issue of causality. We also provide a detailed description of the key relationships that underpin our analysis. Lastly, we discuss the role of connecting passengers and our approach to estimating economic value in the future.

E.1.1 What do we mean by economic value?

Our analysis is aimed at estimating the economic value facilitated by Toronto Pearson Airport. It is therefore useful to clarify what we mean by economic value. Ultimately we are interested in Toronto Pearson's contribution to Ontario's GDP and employment. GDP is generally defined as the sum of all goods and services produced in the economy, and is therefore closely related to living standards. Similarly, employment is one of the key factors that determine economic well-being. The way in which air travel relates to GDP and employment – through trade and foreign direct investment (FDI) – is indirect. This is illustrated in Figure 42 below.

Figure 42. Drivers of economic value considered in analysis



Source: Frontier Economics

For trade and FDI we consider two-way flows so we have included imports and exports, as well as outward and inward FDI flows.

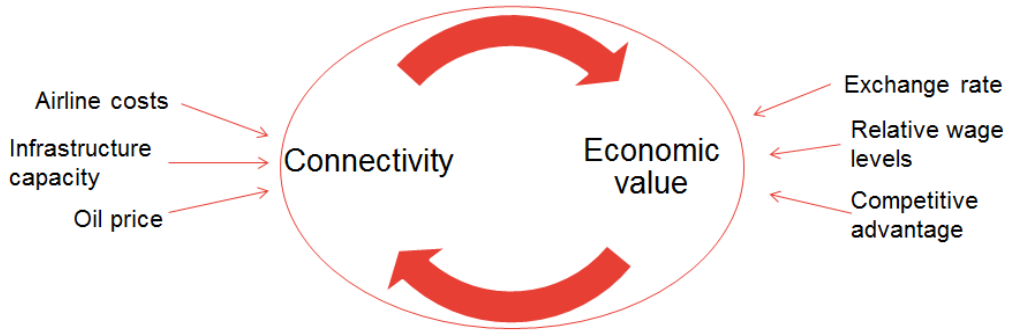
E.1.2 What about causality?

Studies on the relationship between connectivity and economic value are often criticized as there are a range of other factors that influence economic value. This implies that connectivity should be viewed as one of the factors contributing

to economic value. While connectivity is one important factor that enables international business relationships to develop, alone connectivity is not a sufficient condition for economic growth. Clearly, other factors influence both connectivity and economic value.

In addition, we acknowledge that there is a two-way relationship between connectivity and economic value. As such, we interpret our results as the economic value *facilitated* by the airport rather than the economic value *generated* by the airport. The best way to describe this relationship is a virtuous circle (shown in Figure 42 below). The relationship goes both ways: economic growth creates demand for connectivity, but connectivity enables growth. But the fact that causation works both ways does not devalue the vital and unique contribution that an airport like Toronto Pearson makes to its local economy. The best way of thinking about this is that connectivity represents an element in a virtuous circle of economic activity and growth. The connectivity enabled by Toronto Pearson is not a sufficient condition on its own for creating economic activity, but the role the Airport plays in the economy is a necessary condition in helping a well-functioning and open economy to achieve its full potential.

Figure 43. The virtuous circle between connectivity and economic value



Source: Frontier Economics

E.1.3 What is our overall approach?

To quantify Toronto Pearson's' contribution to economic value today, we consider the economic value that would be lost if Toronto Pearson did not provide the current level of connectivity. The size of the loss can then be interpreted as the value facilitated by the current level of connectivity. There are a number of options for defining the "what-if" or counterfactual scenario.

First, we considered a "what-if" scenario in which Toronto Pearson does not exist. In this scenario air connectivity to and from Toronto would be severely decreased and travel times would increase substantially. However, we do no not think this is a credible approach as it would lead to an unrealistically large estimate of Toronto Pearson's value.

Instead, we took a more conservative approach. Our "what-if" scenario assumes that Toronto Pearson does not provide any direct flights, so all passengers have

to take indirect flights via another hub airport to get to their final destinations. As such, our "what-if" scenario measures the economic value of being directly connected to destinations. We concluded that this provides a realistic approach to valuing Toronto Pearson's connectivity as a hub airport.

To develop a realistic view of the alternative travel times of indirect connections, we selected four North American hub airports for indirect international connections from Toronto. These were: Chicago, Atlanta, New York and Los Angeles. For indirect connections in Canada we added 2.5 hours of travel time to reflect the availability of a range of airports that could be used for connections. In addition, we also considered road and rail alternatives to destinations within 800 kilometres of Toronto to capture the possibility that some passengers would use these modes of transport as an alternative to flying.

We can illustrate the "what-if" scenario with the following example: passengers travelling on a direct flight from Toronto to London, UK take about 7 hours. In the "what-if" scenario the travel time increases by just less than three hours, as passengers would have to fly via New York. As a result, a small proportion of passengers would choose not to take the trip as the increase in travel time implies that the trip is not worthwhile. It is the impact of this reduction in passengers that measures the economic value of a direct connection to London, UK provided by Toronto Pearson.

In addition to the reduction in passengers in the what-if scenario, there may also be loss of productivity for the remaining passengers who must spend more time on essential business travel. However, we do not attempt to measure this effect as it requires a number of assumptions on the effect of increased travel time on economic output. This can be considered a conservative assumption.

To estimate the economic value facilitated by Toronto Pearson we need to distinguish different passenger types. Figure 44 shows that we have assumed 40 per cent business passengers, based on survey data provided by Toronto Pearson. As detailed information on the split of Canadian and foreign passengers on each route is not available, we have used an aggregate figure from Statistics Canada that is applied to all routes.

Figure 44. Assumptions on passenger types

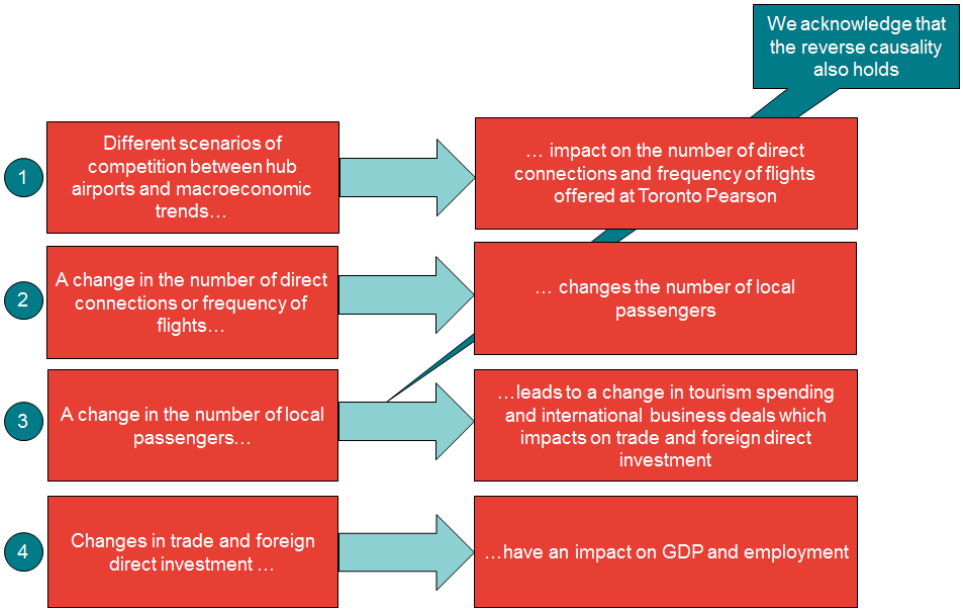
Parameter	Assumed value	Rationale/Source
Business passengers	40 per cent	Based on Toronto Pearson survey data
Proportion of Canadian/ non-Canadians on each route	70 per cent Canadian / 30 per cent non-Canadian	Based on Statistics Canada this is an aggregate figure for all routes.

E.2 How do we quantify the catalytic economic impact of Toronto Pearson?

In order to quantify Toronto Pearson's contribution to economic value, we divided the relationship between connectivity and economic value into a number of steps.

Figure 45 summarizes the four key relationships we have identified. Each of the relationships is explained in detail below.

Figure 45. Key relationships



Source: Frontier Economics

E.2.1 Key relationship 1 – Macroeconomic trends and hub competition determine connectivity at Toronto Pearson

We define connectivity at Toronto Pearson as the number of direct connections and the frequency of flights. For the "current" economic impact of Toronto Pearson, we have used passenger data for 2014. Passenger numbers in the 2030 baseline scenario are based on the following assumptions:

- **GDP growth** - we have obtained projections of GDP growth from HSBC Bank (2012).[27] We have used the HSBC source as it provides projections for a large number of countries up until 2030. There are few alternative sources that provide projections for so many counties over such a long time period. To ensure the robustness of the HSBC projections we have cross-checked them against a range of international sources including the IMF.
- **Income elasticities** - the income elasticity describes the increase in demand for travel for every 1 per cent increase in GDP. We have reviewed a number of sources (such as IATA (2007) and UK Department for Transport (2013)) that suggest that the income elasticity is likely to be between 1 and 2. We also found evidence to suggest that the income elasticity is higher in countries with a lower GDP per capita. As a result, we have differentiated income elasticities for countries with different levels of GDP per capita.

[27] Note that GTAA has not updated the GDP forecasts in the latest version of the model.

- **Ticket price growth** - we have researched likely movements in the ticket price based on changes in cost inputs. IATA (2012) suggests that the oil price is one of the main drivers of changes in ticket prices as it accounts for as much as 34 per cent of total input costs. Oil price projections by the World Bank show a slight decline in the oil price. This would suggest a potential reduction in ticket prices. We have assumed no change in ticket prices as the oil price decline may be offset by increases in other input costs.

Combining income elasticities with GDP forecasts, we estimated Toronto Pearson to grow from around 38 million passengers in 2014 to around 63 million passengers by 2030. This represents a 65 per cent increase in size over the period 2014-2030, or an average annual growth rate of around 3.2 per cent

Different scenarios of competition with other North American hub airports can also have an impact on the number of passengers connecting through Toronto Pearson. For the base case results presented in this report we have not assumed any significant increase in Toronto Pearson's market share.

Figure 46 summarises our main assumptions.

Figure 46. Overview of key assumptions and selected values

Parameter	Assumed value	Rationale/Source
Parameter	Assumed value	Rationale / Source
Annual GDP forecast by country 2014-2030	0.7 per cent - 7.7 per cent depending on country	HSBC (2012) growth forecasts, cross-checked against IMF forecasts
Annual real ticket price change	Zero change	The key input is oil prices (accounts for 34 per cent of total airline costs according to IATA), oil price forecast to decrease so we used zero as a conservative assumption. This is in line with Airbus' assumption (Airbus, 2012). This assumes nominal prices will increase in line with inflation.
Annual technology growth in aircraft size	1 per cent	We expect aircraft size to grow and have used 1 per cent as a conservative assumption.
Frequency elasticity	For low-frequency countries: 0.8 For high-frequency countries: 0.6	The frequency elasticities are based on a literature review. Frequency cut-off (flights per day based on 2011 data): 0.5
Income elasticities	Various between 1.22 and 2.03	Based on IATA (2007)

E.2.2 Key relationship 2 – A change in connectivity has an impact on demand

A change in connectivity has an impact on the travel times for local passengers. For example, an indirect flight may take an additional 2-3 hours in travel time when compared to a direct flight. A passenger makes a decision to travel based,

in part, on the travel time. As a direct connection is always faster than flying indirect via another airport, some passengers will choose not to travel if there is no direct connection available or may travel less frequently.

The relationship can be seen in the following formula:

((Additional travel time x Value of time)/ Ticket price) x Price elasticity of demand =

Change in number of passengers

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

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

Distance is calculated on the basis of great circle routes.[28] We add additional connecting time at the airport. Our results are based on an assumption of 2 hours of connecting time. This implies that passengers would need 2 hours between landing and take-off for their connecting flights. We consider this assumption to be conservative, as this is likely to be close to the minimum rather than the average connecting time. The total additional connecting time is therefore equal to the additional flight time plus the connecting time. Our results show that the additional travel time varies from 2.4 hours to 3.5 hours.

Second, we monetized the additional travel time by applying a "value of time" to the additional journey time. This approach is commonly used in land transport evaluation. For business travellers, we assumed a value of time of $75 per hour and for leisure travellers we assumed a value of $24.50 per hour. These are based on average wage rates as shown in Figure 47. We further assumed that there would be no change in ticket prices between direct and indirect routes. This assumption was informed by an analysis of price data from Sabre that shows no difference in average ticket prices for indirect and direct flights on the same route. Finally, we used price elasticities of demand to estimate the change in demand as a result of the price increasing due to an increase in travel time. We distinguish different price elasticities for different countries, based on a study by IATA (2007).

Figure 47 provides the assumptions we have used to quantify key relationship 2.

[28] The great circle route methodology can underestimate the flight time, which implies that our estimates of time-savings and so, catalytic impact are conservative.

Figure 47. Assumptions on key relationship 2

Parameter	Assumed value	Rationale/Source
Flight speed	500mph during flight, 250mph for take-off/landing	Based on industry standards.
Average airport connecting time	2 hours	Based on a conservative estimate of the minimum connection time.
Travel Time Value Business Travellers	$75 per hour	Double the average wage rate of management occupations (Statistics Canada Table 282-0070 Labour force survey estimates (LFS), wages of employees by type of work)
Travel Time Value Leisure and VFR (visiting friends and relatives)	$24.50 per hour	Based on average wage (Statistics Canada Table 282-0070 Labour force survey estimates (LFS), wages of employees by type of work)
Price Increase for direct v. Indirect Routing	Zero	Based on data from Sabre on fares which revealed that there is no price difference between direct and indirect flights on the same route from/to Toronto Pearson
Price elasticities	Transatlantic: -0.72 Transpacific: -0.36 Intra America (including of North and South America): -0.60	Based on IATA (2007)

E.2.3 Key relationship 3 – A change in the number of local passengers impacts international business deals

A change in the number of local passengers has an impact on international business deals that drive trade and foreign direct investment.

Our analysis of the value of Toronto Pearson's connectivity requires us to make an assumption on the relationship between air travel, trade and FDI. Despite the rise of technologies such as videoconferencing, face-to-face meetings still play an important role in developing and maintaining successful business relationships. Most relationships are built on trust between business partners and face-to-face meetings are still the most effective way to build and establish trust. In addition, in-person meetings can be used to inspect production sites and meet larger teams which cannot be done through videoconferencing.

Face-to-face meetings as a result of air travel increase the likelihood of closing business deals which has a positive impact on trade and FDI. Face-to-face meetings are also important to manage increasingly globalized supply chains. This relationship is supported by qualitative literature, but it is difficult to quantify the relationship.

The relationship between face-to-face meetings and trade and FDI is unlikely to be the same for all of Ontario's business relationships. We think that the

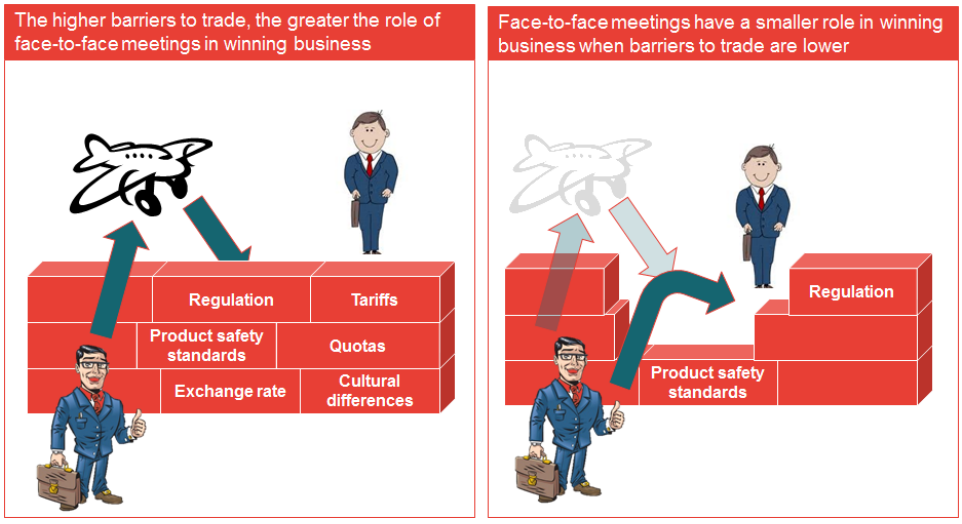
relationship is likely to differ for transactions between Ontario and other provinces, the US and other international countries. This is because face-to-face meetings are likely to play a bigger role in overcoming trade and FDI barriers between economies that are more dissimilar. The most common barriers include:

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

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

These barriers are much lower when considering trade and FDI between Ontario and the US compared to international transactions. This is because cultural differences are much smaller (for example, common language), formal trade barriers have been removed by NAFTA and product marker regulations are more likely to be aligned. Trade barriers between Ontario and other provinces in Canada are likely to be even lower as there is no exchange rate risk and product market regulation is even more likely to be harmonized. Figure 12 illustrates this concept.

Figure 48. Illustration of how air travel helps overcome trade barriers



Source: Frontier Economics

There is a range of qualitative, survey-based evidence that suggests face-to-face meetings play an important role in business relationships. The importance of in-person meetings for trade facilitation is also supported by the existence of trade missions. For example, the Canada Trade Commissioner Service organizes a number of trade missions to different countries each year. These trade missions provide access to foreign markets, including networking opportunities, first-hand experiences and opportunities to initiate business relationships (Government of Canada, 2012).

The World Travel and Tourism Council (2012) finds that sales conversion rates with an in-person meeting are 50 per cent, compared to conversion rates of 31 per cent without an in-person meeting. The results are based on surveys in Brazil, China, Germany, the UK and the USA and are consistent across these countries. In 2011, the WTTC conducted another survey on the importance of business travel and found that 28 per cent of existing business could be lost without face-to-face meetings and sales conversion rates are estimated to be 20-25 per cent higher with face-to-face meetings. This is further supported by a range of qualitative studies.

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

- Boeh & Beamish (2012) demonstrate that travel time between different locations has a significant predictive power in firm governance and location decisions, as travel time could otherwise be employed for productive purposes.
- Napier University (2004) finds that *"[…] air transport per se is not a necessary condition, but what is important are: the extent to which that area is plugged directly into other major international hubs - availability and efficiency of routes (direct, hubbed); costs and the level of competition in global transport market, and; perceived and actual interchange efficiencies. This is a key consideration in the level of foreign investment into an area and is most important for firms with international trading or contacts such as, high-tech firms, financial services and pharmaceutical firms".*

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

- One extra dollar invested in international business travel would generate on average US$17 in trade; and
- One extra dollar invested in domestic US business travel by companies results in an increase in revenue of US$9.50.
- This implies that the return on investment for international travel is roughly half of domestic travel.

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

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

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

- Cristea (2011) found robust evidence that the demand for business-class air travel is directly related to volume and composition of exports in differentiated products. The paper finds that trade in R&D intensive manufactures and goods facing contractual frictions is most dependent on face-to-face meetings. Contractual frictions are more likely to occur with higher trade

barriers so this would support a lower elasticity for trade between Ontario and the US/Canada compared to the rest of the world.

- Poole (2010) finds that business travel for the purpose of communication acts as an input to international trade. The effect is stronger for differentiated products and for higher-skilled travellers, reflecting the information intensive nature of differentiated products. The effect is driven by travel from non-English speaking countries, for which communication with the U.S. by other means may be less effective. The findings therefore also confirm our view that business travel plays a bigger role when connecting firms from different cultural backgrounds.

Quantitative evidence on the relationship between face-to-face meetings and trade/FDI is difficult to obtain. We considered a range of values and concluded that an assumption of 0.3 is reasonable as this value is at the lower end of the spectrum. So we assume that a 1 per cent increase in face-to-face meetings increases trade and FDI by 0.3 per cent.

This is based on the following evidence:

- The UK Airports Commission (2015) assessed the need for a new runway in the southeast of England. Part of the comprehensive assessment was an estimate of the wider economic benefits which include productivity gains from trade. The Airports Commission used elasticities of around 0.3 for the relationship between air connectivity and exports. The Commission estimated a negative relationship for imports.
- Analysis of exports and outbound flights as well as inward FDI and inbound flights at Toronto Pearson suggests an elasticity of air connectivity with respect to trade of 1.15 and an elasticity of air connectivity with respect to FDI of 0.6. The regression coefficients will be overstated as the regressions omit other explanatory variables that influence trade and FDI. However, we can interpret the coefficient as the upper value elasticity, as introducing other variables would always reduce the coefficient.
- The World Travel and Tourism Council (WTTC) performed an analysis of the link between trade and business travel for a range of countries as shown in Figure 49. The figure shows the correlation coefficient as well as the results of the Granger test for causality. The figure shows that the correlations vary between 0.17 for outbound business travel from Italy to 0.98 for outbound business travel from Brazil. It also estimates that 38% of customers would be lost without face-to-face meetings.
- Similarly the US Travel Association (2009) estimates that 25% of customers and 28% of revenue would be lost without in-person meetings.
- Aradhyule and Tronstad (2003) estimate that the impact of an individual's venture visit to explore a joint business or trade opportunity to site visit to a similar business increases the probability of cross-border trade for this individual by 51.5%

- Poole (2010) estimates that a 1% increase in inbound business travel leads to 0.13% increase in volume of exports.
- A survey of businesses in Munich estimated that 55% of foreign businesses would not be located in the region if air connectivity in the region was not satisfactory.

Figure 49. Trade and business travel by country

Trade & Business Travel by country

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

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

Our evidence also suggests that the elasticities should be lower for trade/FDI between Ontario and the US and even lower for trade/FDI between Ontario and other provinces as compared to the rest of the world. As there is little evidence on the magnitude of the difference, we consider the following assumptions to be conservative estimates:

- Ontario and rest of the world: 1 per cent increase in face-to-face meetings increases trade and FDI by 0.3 per cent;
- Ontario and US: 1 per cent increase in face-to-face meetings increases trade and FDI by 0.2 per cent; and
- Ontario and other Canadian Provinces: 1 per cent increase in face-to-face meetings increases trade and FDI by 0.1 per cent.
- These assumptions are broadly consistent with the WTTC findings.

Figure 50 summarizes our assumptions for key relationship 3.

Figure 50. Assumptions on Key Relationship 3

Parameter	Assumed value	Rationale/Source
Business travel elasticity of trade - change in trade as a result of a 1 per cent drop in business travel	0.3	For travel between Ontario and international countries except the US. Based on literature review, see Appendix 1 for more detail
	0.2	For travel between Ontario and the US.
	0.1	For travel between Ontario and other provinces in Canada.
Business travel elasticity of FDI - Change in FDI as a result of a 1 per cent drop in business travel.	0.3	For travel between Ontario and international countries except the US. Based on literature review, see Appendix 1 for more detail
	0.2	For travel between Ontario and the US.
	0.1	For travel between Ontario and other provinces in Canada.

E.2.4 Key relationship 4 – A change in trade and FDI spending has an impact on GDP and employment

Changes in trade and foreign direct investment affect GDP and employment. We have distinguished the short-term static impact on GDP and the long-term dynamic impact. The short-term view of trade is that exports have a positive impact on GDP and imports have a negative impact – this is based on a country's trade balance in an accounting context. The same holds for inward and outward investment. An equal increase in exports and imports would therefore have no impact on GDP, as the positive impact of exports would cancel out the negative impact of imports.

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

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

- **Innovation** – Trade is one of the key "transmitters" of innovation as it exposes companies to a wider range of products and processes in other countries. FDI can provide access to new technologies and cheaper inputs,

which has a positive impact on productivity. This is particularly true for imports and outward investment.

- **Competition** puts pressure on companies to be more efficient. Exporting companies are faced with more competition as they compete in a larger market. Imports also put more pressure on domestic firms as they compete with a greater number of competitors.
- **Economies of scale** – Larger market sizes imply that production processes can benefit from economies of scale. Both trade and FDI can provide access to markets outside Ontario so that firms can reduce costs by realizing economies of scale. This is particularly true for exporting firms who can access foreign markets and therefore increase their size.

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

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

Instead of focusing on the short-term impact of trade and FDI on GDP our methodology emphasises the long-term benefit that trade and FDI generate by increasing "openness" of the economy. Therefore, our conclusion is that both exports, imports alongside inward and outward investment, have positive long-term effects on an economy.

The OECD has undertaken a study with data from 21 high-income countries over nearly 30 years controlling for other factors: every 10-percentage point increase in trade exposure (as measured by trade share of GDP) contributes a 4-percent increase in GDP per capita. This study is quoted by the Canadian government in "The State of Trade 2012" and provides the main evidence source for our assumption.

We have also reviewed evidence to suggest that the impact of trade on productivity may be lower when comparing domestic trade to international trade:

- Therrien and Hanel (2012) provide evidence supporting the idea that the productivity gains from trade are stronger with trade to foreign markets compared to the domestic market: they find that Canadian firms who export to foreign markets have higher labour productivity. Their results are based on the following steps.
  - They find that Canadian firms who export to non-US markets and US markets are more likely to innovate than firms who do not.
  - Canadian firms who innovate more have higher innovation-related sales.
  - Finally, firms that have higher innovation-related sales also have higher labour productivity.

- Ito (2011) examines whether first-time Japanese exporters achieve productivity improvements through learning-by-exporting effects. The results suggest that exporting to North America or Europe has a strong positive effect on sales and employment growth, R&D activity, and productivity growth. On the other hand, exporting to Asia does not have any strong productivity enhancing effects. This would suggest that exporting to countries that are more similar (or geographically close) has a lower impact on productivity.

However, on the other hand we also found a range of papers that do not identify a difference. For example, Wagner (2012) undertakes a literature review of the impact of trade on productivity and finds that exporters are more productive than non-exporters but finds no difference to where you export.

On the specific question of the impact of Canadian internal trade on productivity, we have found that:

- Agnosteva and Anderson (2013) estimate the existence and impact of intra-provincial trade barriers. They find that there is substantial intra-provincial 'home bias'. Home bias is the tendency to trade much more within a region than to another region, and is often a sign of the presence of formal or informal trade barriers. This suggests that the Canadian provinces and territories are not fully integrated yet and there is significant scope for internal trade policy intervention.
- This would suggest that inter-provincial trade still has some impact on productivity.

We have relied on the findings by the OECD (reported by the Canadian government) to assume that a 1 per cent increase in real openness (ratio of trade to GDP) increases GDP by 0.4 per cent. We apply this assumption to international trade. The evidence suggests that the impact of interprovincial trade is likely to be lower. We therefore assume that a 1 per cent increase in interprovincial trade increases GDP by 0.2 per cent.

To convert the contribution of GDP into employment, we have used the same conversion rate as Foreign Affairs and International Trade in their analyses of free trade agreements: for every $150,000 of GDP, one full-time job is created.

Both inward and outward FDI have a positive impact on productivity and competitiveness. Our research suggests that access to new markets, cheaper inputs and new technology or know-how boosts the scale and efficiency of domestic production. The underlying theory is similar to that applied to free trade agreements. Evidence on the specific impact of FDI on productivity is limited. We have found the following studies:

- DIW (2009) studies the relationship between outward FDI and economic growth. They find that FDI enables firms to enter new markets, import intermediate goods from foreign affiliates at lower costs and access foreign technology. As a result the domestic economy benefits from outward FDI due to increased competitiveness of the investing companies and associated

productivity spill-over to local firms. The analysis shows that for every 1 per cent increase in outward FDI stock, local GDP increases by 0.19 per cent.

- Korea Institute for International Economic Policy (2008) studies the relationship of inward FDI and productivity using Ireland as a case study. They find that FDI advances new foreign technology or import of new intermediary goods and enhances growth by accumulation of human capital by means of labour training or absorption of technology and new management techniques. Their analysis shows that for a 1 per cent increase in inward FDI stock, local GDP increases by 0.24 per cent.

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

- a 1 per cent increase in inward FDI increases productivity by 0.24 per cent; and
- a 1 per cent increase in outward FDI increases productivity by 0.19 per cent.

We have investigated the potential to use a different elasticity for the US. For example, Borensztein, Gregorio and Lee (1998) analyze FDI flows from industrial to developing countries. They find that FDI contributes to economic growth only if a minimum level of human capital is met in the receiving country. This is likely to hold for most connected countries. Similarly, Alfaro, Chanda, Kalemli-Ozcan and Sayek (2006) find that holding FDI constant, financially well-developed economies experience higher growth rates. They identify human capital as one of the key factors that influences this effect. However, none of the literature that we reviewed indicated that the FDI between the US and Canada would be expected to have a different impact on Ontario than FDI with other countries.

Figure 51 provides a summary of the assumptions for key relationship 4.

Figure 51. Assumptions on Key Relationship 4

Parameter		Assumed value	Rationale/Source
Parameter	Assumed value		Rationale / Source
Openness elasticity of GDP (Openness is defined as trade/GDP)	0.44		For international trade, based on OECD study quoted by Canada's State of Trade and Investment Update (2012) by Foreign Affairs and Trade International
	0.2		For interprovincial trade, see Appendix 1 for more detail
Outbound FDI elasticity of GDP	0.19		Based on literature review, see Appendix 1 for more detail
Inbound FDI elasticity of GDP	0.24		Based on literature review, see Appendix 1 for more detail
GDP per job	$150,000		Based on Canadian government figures for free trade agreement impact assessments.

E.3 What are our results?

E.3.1 Economic value facilitated by Toronto Pearson today

Based on the approach and assumptions described in the previous section, the economic value to Ontario facilitated by Toronto Pearson today equates to **4.4 per cent of Ontario's GDP,** equivalent to $28 billion. This implies that Ontario's GDP would be 4.4% lower if Toronto Pearson did not facilitate the direct connections it provides today. This is the value of having direct as opposed to indirect air connections from Toronto Pearson.

Based on this estimate, Toronto Pearson currently facilitates **179,000 jobs** within Ontario. If Toronto Pearson only provided indirect connections instead of direct connections, 179,000 jobs would be lost. GDP and jobs are driven by trade and FDI that is facilitated by connectivity to and from Toronto Pearson, as our results show:

- **Exports:** $11 billion exports, which is equivalent to around 3 per cent of Ontario's total exports. Approximately, 68 per cent of those exports are to the US, 19 per cent to other international countries and 12 per cent to other provinces in Canada.
- **Imports:** $17 billion imports, which represents around 3 per cent of Ontario's total imports. Approximately, 54 per cent of those exports are to the US, 36 per cent to other international countries and 10 per cent to other provinces in Canada.
- **FDI:** $48 billion of the total inward and outward FDI stock, which is around 5 per cent of the Ontario's total FDI stock.

Figure 52. Economic value facilitated by Toronto Pearson today

Economic measure	Result $ million
Exports	11,000
Imports	17,000
Total trade	**28,000**
Outward FDI	25,000
Inward FDI	23,000
Total FDI	**48,000**
Total GDP facilitated	**28,000**
% of Ontario GDP	4.4%
Jobs	**179,000**

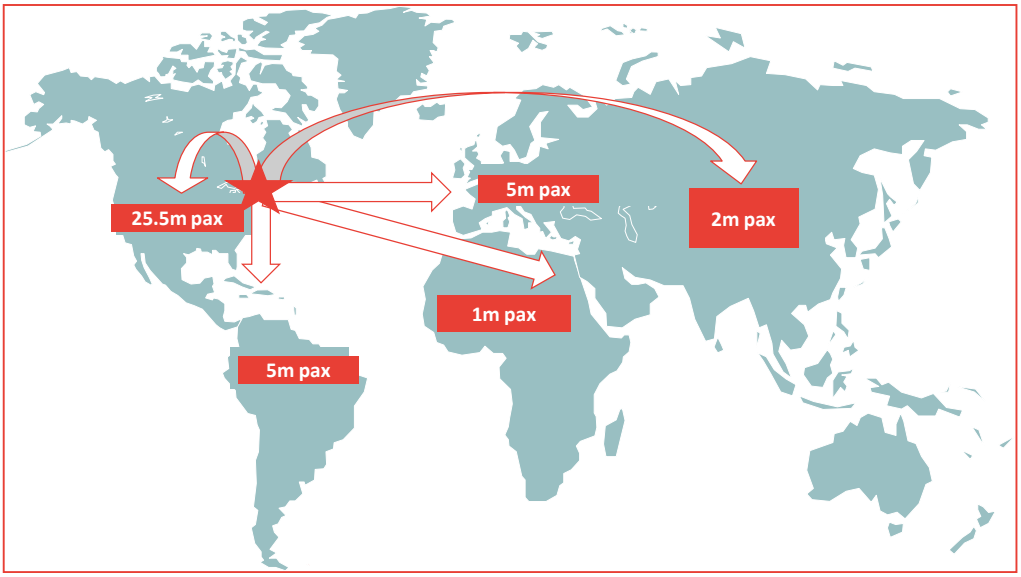
Source: Frontier analysis, numbers may not add up due to rounding

E.3.2 Economic value facilitated by Toronto Pearson in 2030

Passenger volumes in 2030

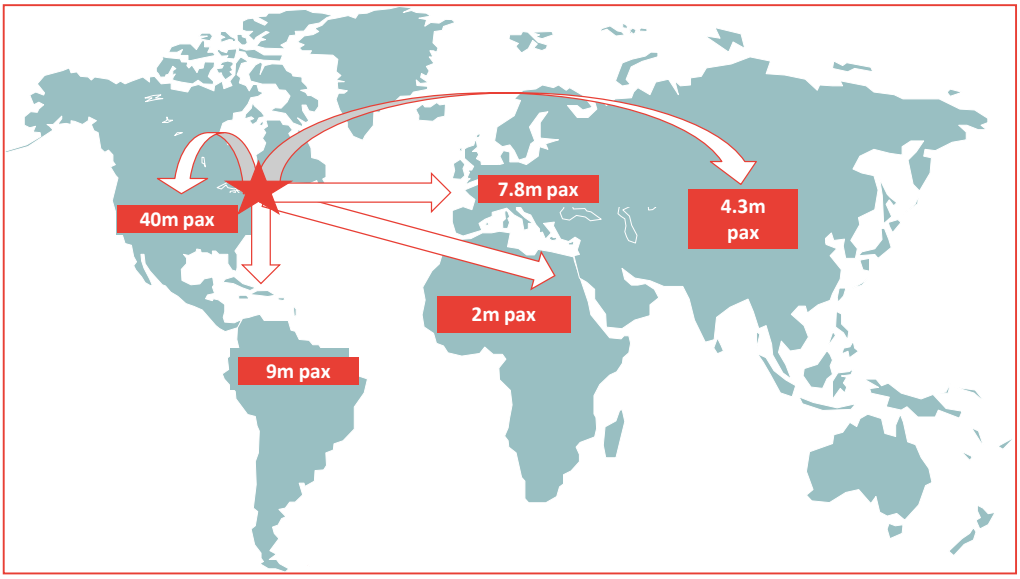
Our baseline projections of travel demand at Toronto Pearson (based on income growth only) suggest that the airport will handle around 63 million passengers in 2030. This is equivalent to an average growth of 3.2 per cent per year. Travel to and from high growth countries such as Brazil, India and China will increase faster than travel to and from North America and Europe. The baseline scenario only takes into account income growth, and it is assumed that Toronto Pearson's market share of the North American connecting passenger market remains unchanged.

Figure 53. Passenger volumes today



Source: Based on Sabre data

Figure 54. Passenger volumes in 2030



Source: Frontier Economics

Results in 2030

Our results suggest that Toronto Pearson will facilitate economic value to Ontario equal to **4.7 per cent of Ontario's GDP** in 2030, equivalent to around $42 billion. The results are bigger than for today, as demand for travel grows faster than Ontario's GDP growth as it is partly based on GDP growth in high growth economies. We estimate that by 2030 that Toronto Pearson will facilitate **275,000 jobs** in Ontario.

Our results for the trade and FDI figures, that underpin the economic value results for 2030, are:

- **Exports:** $18 billion of exports;
- **Imports:** $26 billion of imports; and
- **FDI:** $74 billion of FDI stock.
- The table below shows a breakdown of our results for 2030.

Figure 55. Economic value facilitated by Toronto Pearson in 2030

Economic measure	Result $ million
Exports	18,000
Imports	26,000
Total trade	**44,000**
Outward FDI	41,000
Inward FDI	32,000
Total FDI	**74,000**
Total GDP facilitated	**42,000**
% of Ontario GDP	4.7%
Jobs	**275,000**

Source: Frontier analysis, numbers may not add up due to rounding

ANNEX F DETAILED METHODOLOGY FOR SPATIAL BREAKDOWN

This annex describes the methodology and datasets used to estimate the spatial disaggregation of direct, indirect and induced jobs, jobs supported by inbound visitor spending, and catalytic jobs. This has been informed by data provided or generated by MNP, GTAA, Frontier Economics and Statistics Canada.

F.1 Direct Employment

F.1.1 Workplace

Annex B describes the factors that inform the location of direct jobs – by definition many are located within the boundary of the airport itself, or close to the airport, while others have a less well-defined place of work (including airline staff, ground transportation and hotel employment).

The vast majority of the 49,395 direct jobs are contained within the GTA, with the majority in the Region of Peel (mainly the City of Mississauga) and the remainder in the City of Toronto (Etobicoke). MNP's analysis suggests that:

- 21,050 FTE jobs are located within 0-2 miles (of the centre-point of the airport);
- 17,850 FTE jobs are located within 2-5 miles; and
- 10,500 FTE jobs are related to on-going operations but not physically located at the airport.

F.1.2 Resident Location

In order to estimate the distribution of direct employment at GTAA across the wider area (i.e. where direct workers at the airport live), we have reviewed and triangulated a number of datasets including:

- Data provided by GTAA that shows the residential location of anyone with a RAIC security pass – this includes both direct employees and other staff who access the airport as suppliers, traders etc. – it also double counts to some extent where people have more than one RIAC card.
- NHS Commuter flow for people working within 0-2 miles of the Airport, by occupational groups provided by Statistics Canada[29]; and
- Estimates for direct employment, by NAICS (industry/sector) at the airport generated by MNP (See Annex B).

[29] E2426 Table 2: Commuting Flow, Occupation - National Occupational Classification (NOC 2011) (43), Mode of Transportation (20) and Commuting Duration (7) for the Employed Labour Force 15 Years of Age and Over Having a usual Place of Work of the Greater Golden Horseshoe Area FSAs as Place of Residence and 3 Custom Area Places of Work, 2011 National Household Survey

The first step was to use MNP's breakdown of direct employment and estimate the weighting of occupational classifications within each NAIC sector by applying information from Statistics Canada on occupation by industry. This effectively allows us to estimate the commuting characteristics of the subset of direct employees in this public dataset.

Once this breakdown had been estimated, it was possible to distribute these occupational groupings according to Statistics Canada's commuting flow data for the area around the airport by FSA.

The final step was to take this output distribution data and triangulate it with known travel-to-work patterns from RAIC data in order to give the most reasonable estimate based on a combination of:

- Known patterns of commuting by people working at the airport; and
- Trends in commuting patterns by occupational classification, weighted by the industry of employment at the airport.

The overall estimate for direct employment by sector/occupation was then applied to this weighted distribution. In the absence of data specific to the actual workers, this approach therefore represents the best estimate for the residential location of these direct employees using information available.

The following table and maps show the estimated disaggregation of direct employees at a range of spatial scales from FSA to Division:

Figure 56. ***Distribution of Direct Jobs (Residence) by Selected Geography (Census Division and Sub-Division)***

	Direct Jobs (Rounded)	Per cent
Peel	25,000	51%
of which in Mississauga	*13,000*	*26%*
of which in Brampton	*11,300*	*23%*
of which in Caledon	*700*	*1%*
City of Toronto	12,600	26%
of which in Ebitocoke	*6,000*	*12%*
Halton	3,900	8%
York	3,700	7%
Durham	900	2%
GTA Total	**46,000**	**93%**
Rest of Ontario	3,400	7%
TOTAL	**49,400**	

Source: GTAA, MNP, Statistics Canada, Quod

F.2 Indirect Employment

Indirect employment (i.e. the employment generated in the airport's supply chain) has been split into two elements due to the availability of data. In total, these account for 32,971 jobs, including:

- Employment generated by GTAA's annual spend on various contracts for services, goods and supplies, using data supplied by GTAA's procurement department for 2015; and
- Employment generated by the rest of the activity at the airport – for example airlines, retailers, security, transport and other direct employment generators, using public data on business/employee location by sector from Statistics Canada.

F.2.1 GTAA spend (Workplace)

The GTAA spends a significant amount annually in the local and wider area on goods and services, some generating employment at the airport (e.g. through on-site contractors, construction/maintenance workers, cleaning and other services) and others generating employment in the wider supply chain (e.g. the production of food for flights, or the refining of airline fuel, which may not happen at or even close to the airport).

We have reviewed GTAA's database of contractors and suppliers (having first isolated and extracted those suppliers included in the 'direct' estimates) for a given year (2015 in this case), by sector.

This process included a review of lines to include/exclude in the overall net employment-generating spend based on GTAA's data on the type of spend, date of contract and likelihood for generating employment. For example, through this process we isolated and removed lines related to accounting, landing fees, finance (e.g. debt issuance fees) and HR spend.

The majority of the remaining value - defined as any contract that buys either physical goods (i.e. hardware, software, vehicles etc.) or services/labour (i.e. consultancy, operations, maintenance, repairs etc.) and comprising the bulk of the expenditure made by the airport that generates employment at the airport or elsewhere - was split into sectors.

By way of an example, around 15% of the remaining value was in taxes, 16% in professional services, 15% in repair and maintenance, with smaller proportions split across a variety of other indirect sectors including security, facilities and operations, energy/utilities, parking, waste management, IT software and hardware.

Each contract line also has an associated address, which is the business location of the company from which the goods/service was procured. We recognise that this may not necessarily correspond to the FSA location at which employment is generated, but has been used as a proxy.

The overall contract values were then converted to employment using an average GVA per worker in Ontario, resulting in approximately 4,700 jobs supported by this annual spend. The following table re-aggregates the values from FSA to selected Census Division / Sub-Division level:

Figure 57. ***Distribution of GTAA-related Indirect Jobs (Workplace) by Selected Geography***

	GTAA Indirect Jobs (Rounded)	Per cent
Peel	1,200	26%
of which in Mississauga	*1,000*	*21%*
of which in Brampton	*200*	*4%*
City of Toronto	1,300	28%
Halton	300	6%
York	300	6%
GTA Total	**3,000**	**64%**
Rest of Ontario	1,700	36%
of which Middlesex/London	*600*	*13%*
of which Hamilton	*400*	*9%*
TOTAL	**4,700**	

Source: GTAA and Quod

F.2.2 Other Indirect Employment (Workplace)

In order to estimate the location of the remaining indirect employment (approximately 28,300 jobs), we have undertaken the following process:

- Using a locational quotient approach and aggregated business count data[30] (by size band) at Dissemination Area level, identified the 3-digit NAICS sectors within 5 miles and 10 miles of the airport (not including the jobs identified as Direct jobs in Annex B) that are 'over-represented' (i.e. have a greater representation (number of jobs) in these areas compared to their representation in Canada as a whole);
- Compared the 'over-represented' sectors to the 3-digit NAICS sectors that supply goods and services to the Air Transport sector, using the Statistics Canada Supply and Use tables (2010);
- Identified the sectors which have the following attributes:
  - Are key suppliers to the Air Transport sector;
  - Are concentrated in this area; and
  - Require proximity to the airport in their supply chain role.

[30] December 2011 Establishment Counts by Dissemination Area, 6-digit NAICS and Employment Size Range

- The concentration of sectors has been sense-checked by comparing their concentration at 5-miles and 10-miles, where it is not clear that a sector is in fact located here due to the airport or other external factors.

Where sectors appear in the list of sectors that are the key suppliers to Air Transport, and are also over-represented compared to national average concentrations (using a 'locational quotients' approach), it is considered that this over-representation is primarily as a result of their role in supplying the airport (having first stripped out those jobs/businesses considered 'direct').

The jobs over the 'normal' representation could be assumed to have located in the area as a direct result of the presence of the airport, as contractors or suppliers.

The key sectors identified in this process are:

- Air Transportation (where not included in Direct estimates);
- Warehousing and storage and other ground transportation, truck freight and postal, courier and logistics;
- Rental and leasing;
- Repair and maintenance; and
- Manufacturing and wholesaling sectors including food and drink.

These represent up to approximately 13,000 jobs within 5 miles of the airport, and it is assumed that the remainder are located elsewhere in the GTA, Ontario, Canada and in some cases the rest of the world.

These jobs have been re-disaggregated based on their DA-level distribution within the 5-mile area, and then re-aggregated by CD/CSD to estimate their distribution:

Figure 58. ***Distribution of Other Indirect Jobs (Workplace) by Selected Geography***

	Other Indirect Jobs (Rounded)	Per cent
Within 5 miles	13,100	46%
Peel	9,400	33%
of which in Mississauga	*7,100*	*25%*
of which in Brampton	*2,300*	*8%*
City of Toronto	3,700	13%
TOTAL	**28,300**	

Source: Statistics Canada, Quod

F.2.3 Resident location

In order to estimate the residential location of indirect employment, we have analysed commuting-to-work patterns at a Census Division and Sub-Division scale using data from the 2011 National Household Survey (Statistics Canada)[31].

This identifies the residential CD/CSD for workers in any given location. We have applied the proportional breakdown of residential origins for each CD/CSD to the overall number of indirect jobs identified (workplace) by CD/CSD:

Figure 59. ***Distribution of Combined Indirect Jobs (Residence) by Selected Geography***[32]

	Combined Indirect Jobs (Rounded)	Per cent
Peel	7,300	22%
of which in Mississauga	*4,000*	*12%*
City of Toronto	4,800	15%
Halton	1,300	4%
York	1,300	4%
Durham	400	1%
GTA	**15,100**	**46%**
Rest of Ontario	Up to 17,900	
TOTAL	**33,000**	

Source: Statistics Canada, Quod

F.3 Induced Employment

F.3.1 Location of Jobs

Induced employment is defined as the jobs that are supported by the spending of direct and indirect workers, at home, on goods and services. As such, the spatial distribution of induced jobs is assumed to be directly proportional to the distribution of the residential location of direct and indirect jobs.

These jobs are likely to match the existing sectoral profile of the area (i.e. they are split across the 'normal' distribution of jobs in any location).

As such, the distribution of induced employment requires applying the total number of induced jobs (19,156) to the spatial proportions of direct + indirect jobs identified above, as follows:

[31] NHS Cat. No. 99-012-X2011032 - Commuting Flow - Census Subdivisions: Sex (3) for the Employed Labour Force Aged 15 Years and Over Having a Usual Place of Work, for Census Subdivisions, Flows Greater than or Equal to 20, 2011 National Household Survey

[32] As identified in this section, we have only identified the 'other' indirect jobs within 5 miles

Figure 60. ***Distribution of Induced Jobs by Selected Geography (Census Division and Sub-Division)***

	Induced Jobs (Rounded)	Per cent
Peel	10,300	54%
of which in Mississauga	*6,100*	*32%*
of which in Brampton	*4,000*	*21%*
of which in Caledon	*200*	*1%*
City of Toronto	5,100	27%
Halton	1,200	6%
York	1,100	6%
Durham	200	1%
GTA Total	**17,900**	**93%**
Rest of Ontario	1,300	7%
TOTAL	**19,200**	

Source: Quod

F.3.2 Resident location

In order to estimate the residential location of induced employment, we have analysed commuting-to-work patterns at a Census Division and Sub-Division scale using data from the 2011 National Household Survey (Statistics Canada)[33].

This identifies the residential CD/CSD for workers in any given location. We have applied the proportional breakdown of residential origins for each CD/CSD to the overall number of induced jobs identified (workplace) by CD/CSD:

Figure 61. ***Distribution of Induced Jobs (Residence) by Selected Geography***

	Induced Jobs (Rounded)	Per cent
Peel	7,400	39%
of which in Mississauga	*4,000*	*21%*
City of Toronto	5,100	27%
Halton	1,900	10%
York	1,800	9%
Durham	700	4%
GTA	**16,900**	**88%**
Rest of Ontario	2,300	12%
TOTAL	**19,200**	

Source: Statistics Canada, Quod

[33] NHS Cat. No. 99-012-X2011032 - Commuting Flow - Census Subdivisions: Sex (3) for the Employed Labour Force Aged 15 Years and Over Having a Usual Place of Work, for Census Subdivisions, Flows Greater than or Equal to 20, 2011 National Household Survey

F.4 Inbound Visitor Spending Employment

F.4.1 Location of Jobs

The distribution of jobs supported by inbound visitor spending is directly related to the existing distribution of jobs in the sectors that benefit most from spending – retail, accommodation, food and drink service and art/culture/recreation sectors.

These sectors have been mapped at Census Metropolitan Area and CSD-level across Ontario[34], and the overall number of jobs supported by inbound visitors (see above) applied proportionately:

Figure 62. Distribution of Jobs Supported by Inbound Visitor Spending via YYZ by Selected Geography (Census Division and Sub-Division)

	Direct Jobs (Rounded)	Per cent
Peel	5,600	11%
of which in Mississauga	*3,600*	*7%*
of which in Brampton	*1,800*	*3%*
City of Toronto	12,800	25%
Halton	2,600	5%
York	4,700	9%
Durham	2,400	5%
GTA Total	**28,100**	**54%**
Rest of Ontario	23,900	46%
of which in Ottawa	*4,500*	*9%*
of which in Niagara	*2,700*	*5%*
TOTAL	**52,000**	

Source: Statistics Canada, Quod

F.4.2 Resident location

In order to estimate the residential location of employment supported by inbound visitor expenditure, we have analysed commuting-to-work patterns at a Census Division and Sub-Division scale using data from the 2011 National Household Survey (Statistics Canada)[35].

[34] 2011 NHS EO2102 - Table 3: Place of Work Status (3), Industry - North American Industry Classification System 2007 (21) and work Activity (4) for the Employed Labour Force 15 Years and over in Private Households Having a Usual Place of Work or Working at Home

[35] NHS Cat. No. 99-012-X2011032 - Commuting Flow - Census Subdivisions: Sex (3) for the Employed Labour Force Aged 15 Years and Over Having a Usual Place of Work, for Census Subdivisions, Flows Greater than or Equal to 20, 2011 National Household Survey

This identifies the residential CD/CSD for workers in any given location. We have applied the proportional breakdown of residential origins for each CD/CSD to the overall number of jobs identified (workplace) by CD/CSD:

Figure 63. ***Distribution of Jobs Supported by Inbound Visitor Spending via YYZ (Residence) by Selected Geography***

	Combined Inbound Visitor Jobs (Rounded)	Per cent
Peel	5,600	11%
of which in Mississauga	*3,100*	*6%*
City of Toronto	10,500	20%
Halton	2,400	5%
York	4,500	9%
Durham	3,100	6%
GTA	**26,100**	**50%**
Rest of Ontario	25,900	50%
TOTAL	**52,000**	

Source: Statistics Canada, Quod

F.5 Catalytic Employment

F.5.1 Location of Jobs

In order to estimate the location of jobs supported by the airport's connectivity (as defined at Annex E), we have used a number of datasets held by GTAA and Statistics Canada. The key spatial influences on the distribution of catalytic employment are:

- The local-level **distribution of GDP** within Toronto and Ontario;
- The location of jobs in sectors with a high **dependence on FDI** (I.e. the ratio of GDP to FDI by sector at a local-level);
- The location of **manufacturing sectors and the extent to which they trade internationally**; and
- The **origin of business passengers** who travel internationally through Toronto Pearson.

As identified in Annex E, the two key influences on GDP generated in Ontario by the connectivity supported by Toronto Pearson are through the facilitation of inward investment (FDI) and export trade, in roughly equal measure.

The starting point for this analysis is to identify a theoretical distribution of local-level output, based on the overall GDP produced by each NAICS sector in

Ontario[36], distributed on an assumed equal 'GDP-per-job' basis, based on the distribution of jobs in those sectors around Ontario[37].

The resulting local GDP by sector database can then be weighted based on the ratio of FDI[38] to GDP to account for the spatial concentration of sectors that are more reliant on FDI to generate output. For example, the ratio of FDI:GDP is relatively high in the 'management of companies and enterprises' sector, compared to utilities, transport/warehousing, and agriculture sectors, and as such the weighting will favour locations with more jobs in this sector (e.g. downtown Toronto).

The overall number of catalytic jobs supported by the influence of Toronto Pearson's connectivity on FDI in Ontario (approx. 89,500 jobs) is then applied to this weighting.

In order to estimate the spatial distribution of catalytic jobs facilitated by Toronto Pearson's connectivity on international trade, we have combined the derived dataset on the local-level output and jobs by NAICS sectors across Ontario, with the ratio of GDP to international trade in those sectors that manufacture goods[39]. This allows us to account for the fact that, for example, the 'transport equipment manufacture' sector captures a large proportion of international export trade per job supported, and to map the distribution of those jobs.

A similar process as above was undertaken to disaggregate the catalytic jobs supported by the influence of Toronto Pearson's connectivity on international trade in Ontario, by applying the total number (approx. 89,500 jobs) to this weighting.

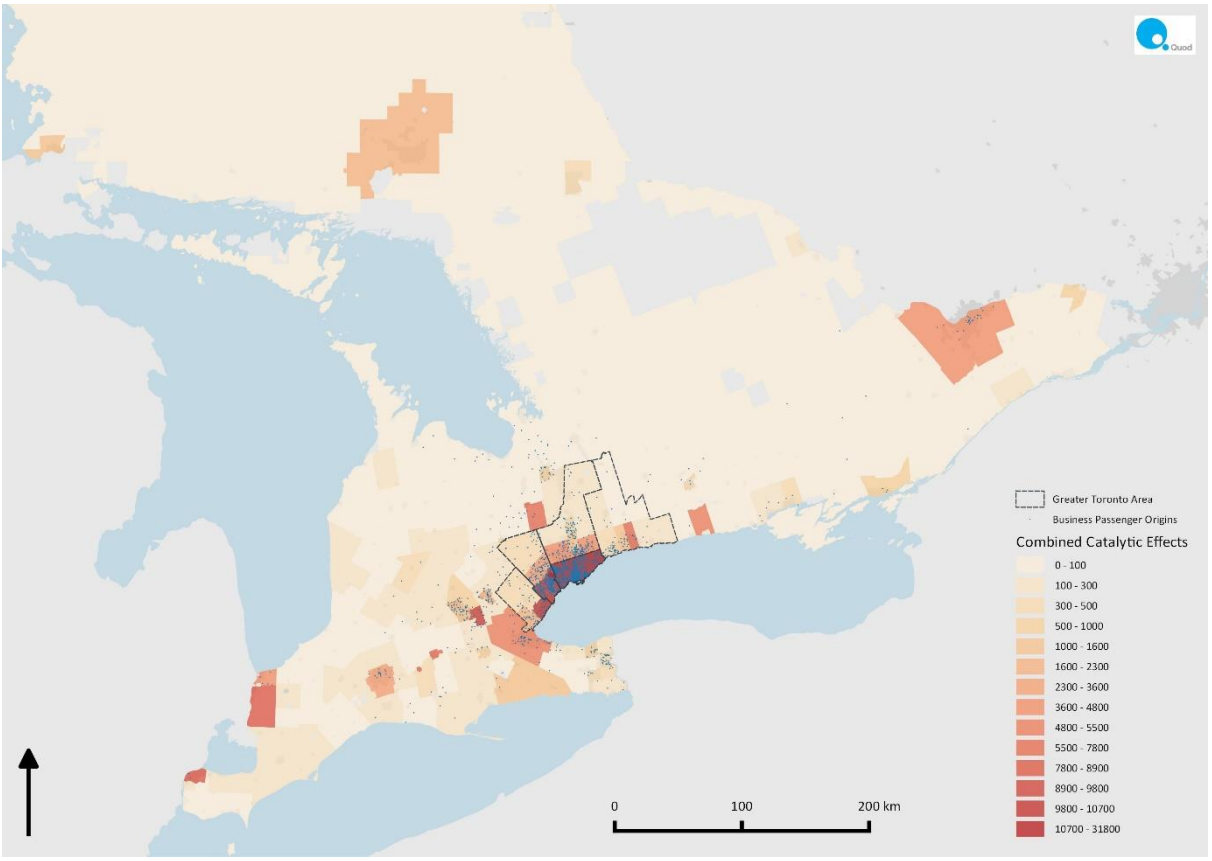
In order to sense-check these assumptions, we then mapped existing data collected by GTAA on the origin of business passengers using Toronto Pearson across Ontario, as shown in the following map:

[36] Statistics Canada Table 379-0030 1, 2, 60, 63, 64: Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS), provinces and territories (annual)

[37] 2011 NHS EO2102 - Table 3: Place of Work Status (3), Industry - North American Industry Classification System 2007 (21) and work Activity (4) for the Employed Labour Force 15 Years and over in Private Households Having a Usual Place of Work or Working at Home

[38] Statistics Canada Table 376-0052 International investment position, Canadian direct investment abroad and foreign direct investment in Canada, by North American Industry Classification System (NAICS) and region (annual)

[39] Statistics Canada & US Census Bureau Trade Data Online (TDO)



The following table summarises the overall catalytic employment distributions:

Figure 64. ***Distribution of Catalytic Jobs by Selected Geography (Census Division and Sub-Division)***

	Catalytic Jobs (FDI) (Rounded)	Catalytic Jobs (Trade) (Rounded)	Total Catalytic (Rounded)	Per cent
Peel	12,300	2,900	15,200	8%
City of Toronto	30,300	2,200	32,500	18%
Halton	4,400	9,400	13,900	8%
York	10,100	1,400	11,500	6%
Durham	2,700	8,200	11,000	6%
GTA Total	**59,900**	**24,100**	**84,000**	**47%**
Rest of Ontario	29,700	65,400	95,000	53%
of which in Ottawa	*16,800*	*300*	*17,100*	*10%*
TOTAL	**89,500**	**89,500**	**179,000**	

Source: Statistics Canada, Quod

F.5.2 Resident location

In order to estimate the residential location of catalytic employment, we have analysed commuting-to-work patterns at a Census Division and Sub-Division scale using data from the 2011 National Household Survey (Statistics Canada)[40].

This identifies the residential CD/CSD for workers in any given location. We have applied the proportional breakdown of residential origins for each CD/CSD to the overall number of jobs identified (workplace) by CD/CSD:

Figure 65. ***Distribution of Catalytic Jobs (Residence) by Selected Geography***

	Catalytic Jobs (Rounded)	Per cent
Peel	15,800	9%
of which in Mississauga	*8,900*	*5%*
City of Toronto	27,200	15%
Halton	10,400	6%
York	11,300	6%
Durham	12,200	7%
GTA	**76,900**	**43%**
Rest of Ontario	102,100	57%
TOTAL	**179,000**	

Source: Statistics Canada, Quod

[40] NHS Cat. No. 99-012-X2011032 - Commuting Flow - Census Subdivisions: Sex (3) for the Employed Labour Force Aged 15 Years and Over Having a Usual Place of Work, for Census Subdivisions, Flows Greater than or Equal to 20, 2011 National Household Survey

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