



Location, location, location

The value of having a port in the neighbourhood

NZIER report to Ports of Auckland Limited

October 2019

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Key points

There has always been a port in downtown Auckland. This gives firms in Auckland a competitive advantage: the final leg of an import journey is a short one, as is the first leg of an export journey.

Using NZIER's comprehensive model of the New Zealand economy, we have undertaken an innovative exercise to value that proximity.

We ask what the economic cost to New Zealand would be if all the imports and exports that currently enter or leave the country though the downtown Port of Auckland (the Port) had to be moved by road or rail to their destination from another port in New Zealand.

This cost can be interpreted as the benefit that the New Zealand economy receives from having a port located in the centre of its largest city.

This estimate allows us to supplement more traditional measures of the economic impact of the Port.

The Port provides income to its owner

Ports of Auckland Ltd (POAL) is a company undertaking a business in Auckland. Its direct contribution to the Auckland economy is its earnings before interest, taxes, depreciation and amortization (EBITDA) as recorded in the company's financial accounts. If the Port did not exist, the Port's owners (Auckland Council) would forgo approximately \$100 million per year (average over the last five years).¹

The Port and its employees contribute to the local economy

POAL employs people to undertake its operations. Adding compensation paid to employees (\$58 million per year on average over the last five years) to EBITDA measures the direct contribution that the Port makes to the Gross Domestic Product (GDP) of Auckland and the country.

If the Port did not exist, the economy would have been smaller by approximately \$158 million per year over the last five years.

The Port adds value to its customers

The largest, and most difficult to measure contribution that the Port makes is through the services that it provides to its customers. The location of the Port is fundamental to understanding these wider impacts.

People use the Port because it is the most cost-effective way of all the alternatives to move goods into and out of Auckland and New Zealand. If it wasn't, they would use an alternative.

Auckland is both the largest source of import demand in New Zealand, and the largest concentration of commercial activity. An equally profitable port elsewhere, employing the

¹ The Port has paid the Auckland Council a dividend of ~\$50 million per annum in recent years.

same number of people, would have a similar direct effect on its local economy, but its wider economic effect, would depend on how efficiently their customers' exports and imports moved from the port to their doors.

We have modelled three scenarios to estimate this impact. In each scenario we assume that the activity currently handled by the Port has moved elsewhere. The three scenarios are:

- Port of Tauranga (PoT). Move the Port's activity to Tauranga and use the roads to transport products to Auckland
- Northport. Move the Port's activity to Whangarei and use road to transport products to Auckland
- Rail. Move the Port's activity to either Tauranga or Whangarei and use rail to transport products to Auckland.

The benefits of proximity

Instead of imported goods crossing the wharf in the central business district in Auckland, they first have to be shipped to PoT and then returned to Auckland via road, the national economy (measured by GDP) would be approximately \$1.5 billion smaller per year. Most of that burden would fall on the Auckland region (\$1.3 billion per year), with the Waikato region experiencing a negative impact of \$79 million per year.

If Northport was used instead, and again with road transport being the alternative, national GDP would fall by approximately \$1.3 billion. Auckland region's GDP would fall by \$1.2 billion, while Waikato region's GDP would be \$68 million smaller.

If the imported goods were transported by rail from either Northport or Tauranga back to Auckland, national GDP would fall by approximately \$1.3 billion. Auckland region's GDP would fall by approximately \$1.1 million.

It is likely that transport from either Northport or Tauranga back to Auckland would be by a mix of rail and road, so the true cost lies within these ranges.

Table 1 The location of the Port has national economic impactsChange in GDP, in millions of dollars per annum

Economic indicator	РоТ	Northport	Rail
Consumption	-\$1,112	-\$970	-\$941
Investment	-\$262.0	-\$231.0	-\$221.0
Exports	-\$140.0	-\$129.0	-\$124.0
Imports	\$113.0	\$110.0	\$108.0
Nominal GDP	-\$1,530	-\$1,336	-\$1,292

Source: N7IFR

The location of the Port is worth about \$1.4 billion dollars a year

As well as these economic effects, moving the Port would also have environmental and social impacts. Longer and more frequent road or rail trips would be required to bring imports to their ultimate destination or to the Port for exporting. This would lead to higher greenhouse gas emissions.

Table 2 Alternative ports increase greenhouse gas emissions

Tonnes of CO_2 emitted by using alternative ports per annum

Alternative port	Road	Rail
РоТ	212,862	169,868
Northport	151,075	121,461

Source: NZIER

This study is not a cost benefit analysis

The benefit figure given above represents our estimate of the impact on GDP of the additional cost consumers would bear if the imports currently handled by the Port of Auckland were transported to Auckland from other locations. Consumers do not bear this cost at the moment, so the GDP impact of this avoided cost is the benefit of the Port at its current location. We have selected PoT and Northport as the alternative locations, as they are the closest operating ports to Auckland. If the same analysis were made from a different alternative location, the cost avoided and therefore the GDP impact and locational benefit of the current state would be different. One much-discussed alternative would be a new Port somewhere in Auckland.

The objective of this study has been to isolate the locational benefit of the Port of Auckland at its current site. It is not a cost benefit exercise, designed to establish whether an alternative location would confer net benefits on the New Zealand economy. A costbenefit analysis would need to recognise that much of the additional cost imposed upon consumers would represent extra revenue for the freight sector. In simple terms, the costs borne by consumers would be partially offset by benefits to the freight and related sectors.

We have not modelled this offset. Doing so would have meant undertaking a complete cost benefit study, and we lack the information at present to do this is in a robust, defensible way. In order to undertake a cost-benefit analysis we would need to know precisely what location was being compared to Auckland, what investments will be needed to bring the alternative location into use, and how the operating costs of the new location compare with the *status quo* in Auckland. At present, we only have confidence in how some of the operating costs (the cartage costs) from Northport and the PoT compare with those at Auckland, so we have used those as the basis for our analysis.

The extra spending in the transport sector does not the affect the GDP result presented here. The extra spending is intermediate consumption, that is, it is a benefit to transport businesses but a cost to final consumers. The Computable General Equilibrium (CGE) modelling we have used to calculate the GDP impact nets off these effects.

A preliminary examination

Our methodology undoubtedly underestimates the value of the location of the Port to the New Zealand economy, because we have assumed a costless transfer of business to other

ports. Recovering the cost of any additional infrastructure needed to handle the increased load in those ports would increase the cost even more.

Additional infrastructure investment

As noted above, our analysis does not consider the additional investment needed to bring an alternative port location into use. The precise size of such an investment depends on the location chosen and the characteristics of the infrastructure already present in the links in the supply chain between the new location and the location of final demand for the imports.

We can derive an idea of the sums that could be involved from the recently released Report of the Upper North Island Supply Chain Strategy Working Group,² which gives a total of \$3.9 billion for the road and rail investments needed if the Port of Auckland's cargo task were to be moved to Northport. We note that the \$1 billion listed as the cost of upgrading the Avondale to Southdown rail link was estimated at \$2 billion to \$3 billion by KiwiRail when communicating with NZIER on the 2017 *Future of New Zealand's vehicle supply chain* study. These figures can be taken to indicate the possible level of investment needed if an alternative port location were identified within the Auckland region.

Road versus rail

The cost comparisons do not account for double handling at each railhead at each end of the rail line, the flexibility that the road cartage offers to deliver vehicles at different locations without double handling, and the cost of the lack of coordination between rail and the trucks at each end of the rail line. Cartage by rail is more complex than cartage by road. Cargo needs to be loaded on to a train, taken to a railyard, offloaded, reloaded on to a truck and then driven to its destination. Each step adds cost and time.

Location, location, location

That Auckland is served by an efficient port is a benefit to the economy. That it is served by a port located in the centre of the city is an additional benefit.

An equally profitable port, employing the same number of people, anywhere in Auckland would have about the same direct economic effect on the Auckland economy.

But its wider economic effect, compared to the *status quo*, would depend on how efficiently customers' exports and imports are moved from the port to their door.

Table 3 Removing the Port has high costs to the Auckland region

Change in GDP, in millions of dollars per annum

Economic indicator	РоТ	Northport	Rail
Consumption	-\$1,215	-\$1,056	-\$1,024
Investment	-\$441	-\$384	-\$371
Exports	-\$1,013	-\$884	-\$858

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Upper North Island Supply Chain Strategy: SECOND INTERIM WORKING GROUP REPORT: OPTIONS AND ANALYSIS, October 2019 https://www.transport.govt.nz/assets/2789bfd79c/UNISCS-Second-Interim-Report.pdf

Economic indicator	РоТ	Northport	Rail
Imports	\$626	\$549	\$533
Nominal GDP	-\$1,339	-\$1,177	-\$1,143

Figure 1 Our report in a nutshell



Source: NZIER

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1 Introduction

The downtown port in Auckland serves New Zealand's largest and fastest growing centre of economic activity. In 2018, over \$30 billion worth of cargo was shipped across its wharfs.

Ports of Auckland (POAL) has asked NZIER to estimate its economic impact.

1.1 The Port in Auckland

The Waitematā Harbour, the 'sea of sparkling waters', dominates central Auckland.

In late 1840, the capital of the young colony of New Zealand was moved from Russell in the North to Auckland due to its central location and natural harbour. From crude wharfs on large tidal mudflats at Official Bay and Commercial Bay, Auckland established itself as a hub of a growing overseas and coastal maritime trade.



Figure 2 Auckland and its port, 1886

Source: Auckland Libraries Heritage Collections Map 4641

As the city grew, so did the Port of Auckland (the Port). As waves of technological change revolutionised sea transport, the Port has continued to change its mode of operation, to its currently highly efficient modes of operation.

1.2 POAL is growing

The volume of cargo going across the Port has steadily been growing since 1988.





In terms of the economic contribution of the Port to New Zealand, the value of cargo crossing the wharfs at the Port has grown faster than the volume, especially on the imports side.





Source: Ministry of Transport

Source: Stats NZ

1.3 An import port

As the previous two figures show, the Port handles more imports than exports. This has important implications for the estimation of the economic contribution the Port makes to Auckland and New Zealand.

The value the Port adds to imports is the swift passage of goods across the wharf, through Customs and other processing, and then on to the importer.

The Port's proximity to the destination and the efficiency of transport links out of the Port, matter.

1.4 Types of cargo

In 2018, the Port had visits from 1,200 vessels, with container ships comprising over half (54%) of all inbound and outbound vessels. Vehicle shipments accounted for the second most common purpose for vessels docking at the Port (17%).



Figure 5 Container vessels are the majority of POAL visitors

Source: Ministry of Transport

1.4.1 Containers

Today, especially in Auckland, containers are the largest type of freight. Container operations at the Port are concentrated on the Fergusson Container Terminal.

Containers, the metal boxes loaded on and unloaded from ships, are designed and built for intermodal freight transport, meaning these containers can be used across different modes of transport – from ship to rail to truck – without unloading and reloading their cargo.

Containerisation has revolutionised sea transport and ports. Ships are far larger, but loading and unloading, now undertaken using large cranes and straddle carriers, is much faster. An important consequence is that fewer people are employed at ports loading and unloading unitised cargo such as containers and, importantly, cargo is moved in containers to

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destinations that are far removed from the port. Other non-unitised cargoes such as vehicles, and break bulk require more people to load and unload them, and as land transport within New Zealand is often limited to road it is far more difficult to transport non-unitised cargo by rail. The days when the immediate area surrounding a port were busy areas of trade and port-related activity are over. This has, as a result, led many cities to consider regenerating land and buildings left vacant as port activity shrinks down to the footprint of the port itself.



Figure 6 POAL loaded and discharged 820,000 TEUs in 2018

Source: Ministry of Transport

Containers processed at the Port include a range of 20-foot and 40-foot units. Containers are commonly expressed as TEUs or twenty-foot equivalent units for comparison purposes. In 2018, 820,000 TEUs were handled by POAL at the Fergusson Container Terminal.³

1.4.2 Bulk cargo

Bulk cargo comprises commodity cargo that is transported unpackaged in large quantities, such as petroleum/crude oil, grain, coal, or gravel. This cargo is usually dropped or poured, with a grab, spout or shovel bucket, into a bulk carrier ship's hold. POAL handles over half a million tonnes of cement annually and smaller quantities of bulk cargo like scrap steel, grains, sand and gypsum. POAL's bulk trade is particularly important for the Auckland construction industry.

³ The Ministry of Transport figures presented above ignore the containers handled by POAL's multi-cargo wharfs, which amount to more than 100,000 TEUs per annum. The true figure of total TEUs loaded and discharged in 2018 is therefore above 920,000 TEUs.

Figure 7 Over 100 bulk cargo vessels visited the POAL in 2018



Source: Ministry of Transport

1.4.3 General cargo

Finally, there is 'break bulk cargo' or general cargo, that comprises goods that must be loaded individually. This includes cars and other vehicles, which in Auckland are landed from roll-on/roll-off ships.

Handling break bulk cargo is labour-intensive, as it requires individual items to be moved (although sometimes break bulk cargo will be loaded onto pallets before being placed in the hold of a ship). Break bulk cargo might also need to be handled multiple times before it is placed on a ship. For example, it might be unloaded from a truck into a warehouse, and then onto pallets and then to a dock for loading onto a ship. The same may happen in reverse when break bulk cargo is unloaded.



Figure 8 General cargo vessels at POAL



Source: Ministry of Transport

1.4.4 Passengers

Ports are also still used for passenger transport, although the days of the ocean liner are long gone. Today, cruise ships, which carry tourists, call at many ports in New Zealand.





Source: Ministry of Transport

1.5 POAL is very profitable

As a business POAL performs well. Revenues have averaged \$228.6 million over the last five years and profit before tax has averaged \$63.3 million and EBITDA \$100 million over the same period. POAL provide a sizeable dividend and appears to be on track to meet the financial targets set for it by Auckland Council.

Table 4 Dividends to Auckland Council were over \$53m in 2018

Millions of dollars

Item	2017	2018
Revenue	\$222,368	\$243,201
Expenses	\$119,622	\$142,110
Net profit	\$60,302	\$83,996
Dividends paid	\$49,860	\$53,667

Source: Ports of Auckland Ltd's, Annual report 2018

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The Port has three main economic impacts, each of which needs to be considered in a different way.

2.1 The Port as a company

POAL is a company owned by the Auckland Council.

The direct contribution of a port to an economy can be easily calculated from its financial accounts. Earnings Before Interest, Taxes, Depreciation and Amortisations (EBITDA) is the appropriate measure, as it shows the earnings that can be distributed to various uses (dividends, interest to lenders, retained to finance investment).

This contribution is available in the financial accounts of the company.

On average, POAL contributed \$100 million per annum to its owners over the last five financial years

2.2 The Port as part of the economy

POAL undertakes most of its business in Auckland.⁴ Its direct contribution to the Auckland economy can also be measured from its financial accounts.

At the social level, EBITDA plus compensation of employees represents the amount a company and its employees contribute to the total economy (on the assumption that it is either consumed or saved).

This contribution is also available in the financial accounts of the company. Over the last five years POAL has on average paid its employees \$58 million per annum in wages and salaries.

On average, POAL company contributed \$158 million per annum directly to the Auckland economy over the last five financial years

2.3 The Port adds value to its customers

The largest, and most difficult to measure contribution that the Port makes is through the services that it provides to its customers.

People use the Port because it is the most cost-effective way of all the alternatives to move goods into and out of Auckland and New Zealand.

⁴ As well as the downtown port, POAL has freight hubs in South Auckland, the Waikato, the Bay of Plenty and Manawatu.

Traditional measures of this value estimate the economic contribution of a port by calculating the value added of the firms that ship goods through a port. They do this by using data from Stats NZ that allows the calculation of how the operations of one firm impacts on all other firms in the economy. This technique is often referred to as I/O (for input/output) analysis or multiplier studies. While often not stated explicitly, an I/O analysis would imply that the port simply ceases to exist, and no alternative means of transportation is employed. That is, the value being measured is the value of the final products made using the port, rather than the value-added by the port itself, in its current location. That is not to say that this value added isn't significant or important. POAL have stated publicly that users of their services contribute \$15 billion to the national economy each year and employ over 700,000 people.⁵

In this report, we have taken a different approach, using a different modelling technique to focus on the benefits of the location of the Port.

2.4 A thought experiment; life without the Port of Auckland

We asked what would be the economic cost to New Zealand if, rather than using the Port, all imports passing across the wharfs in downtown Auckland had to use another port?

We must stress that this is a thought experiment, rather than a precise forecast of alternative infrastructure arrangements. For example, our experiment assumes that existing ports can immediately handle any increase in capacity, as can the road and rail networks.

Our purpose in undertaking this modelling is to estimate the value that Auckland and the nation receives from having a port **located where it is**, not as a way of estimating the benefit of the transport itself.

2.4.1 A robust modelling technique

We have used our Computable General Equilibrium (CGE) model to undertake this thought experiment.

Using actual economic data, CGE models estimate how an economy reacts to major projects or changes in policy, technology or other external factors. CGE models are useful whenever we wish to estimate the effect of changes in one part of the economy upon the rest of New Zealand.

In summary, to estimate the effect of some change (referred to as a "shock"), the modeller specifies a starting position for the economy based on data in which supply is equal to demand in all markets (known as being "in equilibrium"), changes parts of the data to reflect the shock and then, using a highly detailed model of the economy and specialised software, determines what needs to happen to return the economy to a new equilibrium. To allow the model to achieve a new equilibrium, some aspects of the economy must remain fixed. These are known as the closures. Common closures, for example, are population and the labour force, the exchange rates, interest rates or export prices. Determining what should be included in the closure and what should be allowed to vary is a key part of any modelling exercise and it is very important that the modeller be very

transparent about what is a result of the modelling and what has been imposed via the closure.

The difference between the old and the new equilibrium can then be analysed to determine the effect of the shock on a range of economic indicators, like Gross Domestic Product (GDP), employment, wages and living standards.

CGE models are now our **preferred method for assessing economic impacts** and are used extensively in New Zealand and internationally. As a recent commentary noted regarding CGE modelling "a well-designed model that is used by skilled practitioners to shed light on issues the model was designed to illuminate can make a significant contribution to policy debates and decision making".⁶

2.4.2 The model we used

For this exercise, we have used our regional CGE model, NZ-TERM. The model is described in more detail in Appendix A. The model includes 106 industries and 201 commodities in its standard form. For reporting purposes, we aggregate the 106 industries into 47 broader sectors, as this makes the presentation easier to follow.

What we have modelled is the effect on regional and national GDP if all the freight now crossing the Port had to be transported some other way.

This approach is an extension, albeit a major one, of the approach we used to determine the value of car imports over Bledisloe Wharf, were we modelled the costs to consumers of having to import vehicles from either Northport or the PoT.⁷

2.4.3 Shock design

Our NZ-TERM CGE model is a static model. That means we can only look at the economic impacts of the Port in a representative year, rather than tracking it across years and seeing how the economy adjusts each year. Essentially, we compare the 'before' situation (having the Port) with the 'after' (moving the Port to another location).

We have designed three scenarios to capture the impact of moving the Port to either Tauranga (PoT) or Whangarei (Northport) and using road or rail to transport goods to their final destination. We have selected PoT and Northport as they are the closest operating ports to Auckland where the largest demand for goods and products in New Zealand comes from.

To measure the economic impact of the Port we assume moving the Port to another location will add extra costs of trade for both exporters and importers. Therefore, we impose two shocks at the same time to the model.

- **Export shock:** a negative shock to the exports of Auckland region, simply removing the export value from the Port in Auckland. This negative shock is not imposed on products using Auckland airport as a gateway for exports.
- **Import shock:** using another port is like increasing the price of products imported through the Port. To measure this, we need to assume that other closer ports to Auckland have the capacity of operation and we only add the extra cost of

⁶ Denniss, R. (2012) *The use and abuse of economic modelling in Australia*, Australia Institute Technical Brief No. 12.

⁷ Future of New Zealand's vehicle supply chain, 2017.

transportation to containers and bulk products to move imported products to the current location in Auckland (Waitemata seaport).

There are two ways of increasing an import price in the region. The first method is to impose an import tariff and the second way is to increase the delivered price of products to the region through a variable called an 'import augmenting technological variable'.

Although imposing an import tariff increases the price of imported goods, they also generate revenue for the government. So, modelling the location shift as a tariff would require a complicated adjustment to account for this revenue and its welfare effects (that is, we would have to make an assumption about what the government does with the revenue and what effect this has).

An import augmenting technological variable is akin to adding 'sand in the wheels' of trade.⁸ Use of this variable changes the delivered price of a product as a result of an efficiency loss/gain in trade facilitation for consumers in a region. For example, the imported price of products in Auckland increases as we lose some efficiency in port handling. Therefore, an import augmenting technological variable is more appropriate to use when we are talking about trade facilitation and helps us to avoid misunderstanding the welfare effect. We used this approach to calculate the shocks in the various scenarios we modelled.

Scenario	Description
РоТ	Move the Port to Tauranga and use road to transport products to Auckland
Northport	Move the Port to Whangarei and use road to transport products to Auckland
Rail ¹	Move the port to either Tauranga or Whangarei and use rail to transport products to Auckland

Table 5 We tested three scenarios

Notes

1 Cost of transportation from either Tauranga or Whangarei to Auckland is similar according to data provided by POAL.

Source: NZIER

2.5 Results

Not surprisingly, these shocks have a negative impact.

When interpreting these results, it is important to remember that we are not adjusting the amount of goods that are imported into New Zealand. What we are doing is estimating the increase in costs of importing to a more distant port and then transporting the goods to their destination.

By using our CGE model, we can see the effects as these cost increases ripple through the whole economy.

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See Fugazza, Marco, and Jean-Christophe Maur. 2008. "Non-Tariff Barriers in CGE Models: How Useful for Policy?" Journal of Policy Modeling 30 (3): 475–90. https://doi.org/10.1016/j.jpolmod.2007.10.001.

We focus on key macroeconomic metrics particularly, GDP and its components including consumption (as a measure of household welfare), investment, and imports and exports.

Table 6 shows changes in macroeconomic aggregates at the national level for the three scenarios. Detailed regional results across these metrics are shown in Appendix B.

The bottom-line figure is GDP, which is a measure of the value of all goods and service produced in New Zealand (less imports).

Table 6 Macroeconomic impacts at the national level Millions of dollars

Economic indicator	РоТ	Northport	Rail
Consumption	-\$1,112	-\$970	-\$941
Investment	-\$262	-\$231	-\$221
Exports	-\$140	-\$129	-\$124
Imports	\$113	\$110	\$108
Nominal GDP	-\$1,530	-\$1,336	-\$1,292

Source: NZIER

2.5.1 What the results show

We use the example of consumption to explain the results in more detail.

Consumption falls because of the increase in price of imported goods and the effect that this has through the economy. Goods and services that use imported goods (for example, courier services that use imported delivery vans) will face increase costs that will influence demand for those services. Restaurants that use imported ingredients will also face cost increases.

Using the regional breakdown of results produced by the NZ-TERM model, we can see that it is not just the people and businesses of Auckland that would be affected by the closure of the Port.

As Table 7shows, consumption in Northland and Waikato also falls. This is due to the ripple effects of increasing costs for everyone that use goods and services that, at least in part, are transported through Auckland. The increase in consumption in Wellington is an example of the effect of the shocks on relative prices through the country. Goods and services that do not use imported components become relatively cheaper. Demand for them will increase.

Table 7 Consumption changes by region Millions of dollars

Area	РоТ	Northport	Rail	
Northland	-\$4	-\$4	-\$4	
Auckland	-\$1,215	-\$1,056	-\$1,024	
Waikato	-\$4	-\$4	-\$4	
Bay of Plenty	\$2	\$1	\$2	
Wellington	\$42	\$36	\$34	

Source: NZIER calculations

2.6 What then, is the value of the Port of Auckland?

By the traditional measure of profits and incomes of workers, the Port adds \$99.5 million and \$58.4 million, respectively to the economy.

By far the largest contribution, however, is from the value added by users of the Port's services.

Using our thought experiment approach, we estimate that the location of the Port adds between \$1.4 and \$1.6 billion dollars to the economy each year

Table 8 The economic contribution	of the Port per annum
Millions of dollars	

Economic indicator	Value
EBITDA	\$99.5
EBITBA plus compensation of employees	\$58.4
Value added	\$1,654.69 –\$1,403.13

Source: Ports of Auckland Ltd, NZIER calculations

2.7 Other effects of location

The results above show the effect of the location of the Port on a range of economic indicators.

As well as these economic effects, moving the Port would also change the environmental and social impacts of importing and exporting. Longer and more frequent road or rail trips would be required to bring imports to their ultimate destination or to the Port for exporting. We looked at two: greenhouse gas emissions and the number of trucks on the road.



Table 9 Alternative ports increase greenhouse gas emissions

Tonnes of CO₂ emitted by using alternative ports

Alternative port	Road	Rail
РоТ	212,862	169,868
Northport	151,075	121,461

Source: NZIER

To put these figures in context, the Port emitted 14,894 tonnes of CO_2 from its operations on the waterfront in 2018-19.⁹

3 Location, location, location

This report has assessed the economic benefits that the Auckland region and New Zealand receive from the location of the Port.

3.1 Location advantage

That Auckland is served by a port located in the centre of the city is of considerable benefit to the city and the national economy.

An equally profitable port, employing the same number of people, anywhere in Auckland would have about the same direct economic effect on the Auckland economy. Likewise, an equally profitable port, employing the same number of people anywhere in New Zealand would make the same contribution to the national economy.

But adding value to customers is not just a function of how efficiently goods can be moved off ships and out of the port precinct. The transportation of those goods to their final destination is also important.

The introduction of the issue of location makes the results more plausible and is also of considerable interest to discussions about the costs and benefits of a downtown port. The location of the Port and any alternative and the enduring effects of moving the Port, not just the one-off costs, need to be considered together.

3.2 Alternative locations

What this report has not considered in any detail is the much wider question of where ports in the upper North Island should be located.

There have been many studies over the last 20 years that have considered this issue, at least in part.

Moving the Port would allow land to be used for other purposes, but it would involve two separate issues: the costs of building a new port and the attendant infrastructure, and the additional costs and benefits of moving goods from the new port to their destination. Both elements will need to be factored into any calculations. A port on the Manukau Harbour, for example, might involve lower transport costs for importers located in and around the

⁹ We have no data on the amount of CO₂ emitted from transporting freight to and from the Port by road.

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industrial areas of south Auckland, but might add costs for transporting goods to the north and west of the city.



Appendix A Our CGE model

A.1 Description of the model

We used our NZ-TERM ("The Enormous Regional Model") CGE model of the New Zealand economy and its regions for this economic impact analysis.

NZIER's NZ-TERM has been built in consultation with CGE experts at Centre of Policy Studies (COPS) which is now based at Victoria University, Melbourne. COPS is well-regarded internationally and recognised as a world leader in CGE modelling.

A CGE model works by using data to describe the economy in a benchmark year, and then specifying hundreds of mathematical equations to represent the relationships between data values. The model includes 106 industries, 201 commodities and 15 regions, including the Auckland regional economy.

For this modelling exercise, we map the 201 commodities into 99 commodity groups to match with harmonised system level 2 (HS2) to analysis the trade impact of the Port.

NZ-TERM is a bottom-up regional CGE model which treats each region as a separate economy. All regions are linked via inter-regional trade in commodities and movements in labour and capital. The model captures the various inter-linkages between sectors, as well as their links to households (via the labour market), the government sector, capital markets and the global economy (via imports and exports). Key features of the model are:

- Each industry can produce a number of different commodities
- Production inputs are intermediate commodities (domestic and imported) and primary factors (labour, land and capital)
- The demand for primary factors and the choice between imported and domestic commodities are determined by Constant Elasticity of Substitution (CES) production nests. This means an increase in price of one input shifts sourcing towards another input
- Intermediate goods, primary factors and other costs are combined using a Leontief production function. This means the proportion of production inputs is held constant for all levels of output
- The production mix of each industry is dependent on the relative prices of each commodity. The proportion of output exported or consumed domestically is also dependent on relative prices
- Within each region, any changes to the economy have multiple direct and indirect (flow-on) impacts, including beyond the sectors initially affected. So, changes to the Auckland economy due to removing the Port from Auckland will, themselves, flow on to other regions.

Price changes (e.g. wage increases, shifts in the exchange rate) as a result of a change to the regional economy in one sector also affect all other sectors, both within the region and across the rest of the country. The method allows us to model the effects of the Port on the Auckland and New Zealand economies and identify how the removal of the Port impacts those regional economies, including impacts on upstream and downstream sectors.

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A visual representation of NZ-TERM is shown in Figure 10. It highlights the complex and multidirectional relationships between the various parts of each regional economy and how they interact with other New Zealand regions and rest of the world.



Figure 10 CGE models show the whole economy

Source: NZIER

A.2 The modelling database

The database has been sourced initially from Stats NZ's 2013 Inter-industry tables. We prepared regional input-output tables using regional employment data and regional population estimates.

We updated the 2013 Input-Output table to 2018 using the latest national accounts data for the year ended March 2018.

Trade data at the port level were obtained from Stats NZ imports/exports dataset for 2018. More granular data about the number of containers and bulk products were taken from POAL's 2018, Annual report. Also, POAL provided transportation costs of moving containers and bulk products.



Appendix B Results

We now present the detailed results of our modelling across a range of indicators across the regions.

B.1 Regional macroeconomic results

A change in consumption is the aggregate impact of change in the prices and quantities of goods and services demanded. In some regions this impact is negative as both price and quantity have decreased. But in some regions the mixed effect increases consumption. For example, in PoT scenario, the consumption change in Wellington due to price is -\$35 million while the quantity of consumption increased by \$77 million, therefore the mixed effect results in a \$42 million increase in the consumption in the region.

Changes in investment, exports and imports are all due to the mix of change in the price and quantity in all the regions.

B.1.1 Consumption

Table 10 Consumption changes by region

Millions of dollars

	РоТ	Northport	Rail
Northland	-\$4	-\$4	-\$4
Auckland	-\$1,215	-\$1,056	-\$1,024
Waikato	-\$4	-\$4	-\$4
Bay of Plenty	\$2	\$1	\$2
Wellington	\$42	\$36	\$34
Rest of North Island	\$4	\$4	\$4
South Island	\$62	\$53	\$51
National	-\$1,113	-\$970	-\$941

B.1.2 Investment

Table 11 Investment changes by region

Millions of dollars

	РоТ	Northport	Rail
Northland	\$6	\$5	\$5
Auckland	-\$441	-\$384	-\$371
Waikato	\$14	\$12	\$12
Bay of Plenty	\$12	\$11	\$11
Wellington	\$53	\$46	\$44
Rest of North Island	\$24	\$19	\$19
South Island	\$70	\$60	\$59
National	-\$262	-\$231	-\$221

Source: NZIER calculations

B.1.3 Government

Table 12 Changes in the size of government by region Millions of dollars

	РоТ	Northport	Rail
Northland	-\$4	-\$4	-\$3
Auckland	-\$9	-\$9	-\$9
Waikato	-\$13	-\$12	-\$11
Bay of Plenty	-\$9	-\$8	-\$8
Wellington	-\$25	-\$22	-\$21
Rest of North Island	-\$22	-\$18	-\$18
South Island	-\$47	-\$40	-\$40
National	-\$129	-\$113	-\$110

B.1.4 Cost of Exports

Note that negative numbers in this table indicate an increase in the cost of exports.

Table 13 Changes in the cost of exports by region

Millions of dollars

	РоТ	Northport	Rail
Northland	\$56	\$47	\$46
Auckland	-\$1,013	-\$884	-\$858
Waikato	\$83	\$71	\$70
Bay of Plenty	\$69	\$58	\$57
Wellington	\$203	\$175	\$170
Rest of North Island	\$138	\$121	\$117
South Island	\$324	\$283	\$274
National	-\$140	-\$129	-\$124

Source: NZIER calculations

B.1.5 Cost of Imports

Because we are estimating that the economy is smaller, there will be a reduction in the quantity of goods imported into the economy. This effect is independent of the location of the Port and would be seen across all regions. The change in the cost of imports is presented in Table 14. In this table a positive value indicates an increase in the cost of imports.

Table 14 Changes in the cost of imports by region

Millions of dollars

	РоТ	Northport	Rail
Northland	-\$46	-\$40	-\$39
Auckland	\$626	\$549	\$533
Waikato	-\$47	-\$40	-\$39
Bay of Plenty	-\$43	-\$36	-\$35
Wellington	-\$112	-\$97	-\$93
Rest of North Island	-\$80	-\$67	-\$66
South Island	-\$185	-\$159	-\$153
National	\$113	\$110	\$108

B.1.6 Gross domestic product

As GDP is equal to consumption + investment+ government spending + exports – imports (GDP = C+I+G+X-M), we can combine all the above figures into a single metric. We show both nominal and real figures.

Table 15 Changes in nominal GDP

Millions of dollars

	РоТ	Northport	Rail
Northland	-\$56	-\$50	-\$47
Auckland	-\$1,339	-\$1,177	-\$1,143
Waikato	-\$79	-\$68	-\$65
Bay of Plenty	-\$37	-\$31	-\$29
Wellington	-\$19	-\$16	-\$15
Rest of North Island	-\$37	-\$28	-\$28
South Island	\$37	\$34	\$35
National	-\$1,530	-\$1,336	-\$1,292

Source: NZIER calculations

Table 16 Changes in real GDP

Millions of dollars

	РоТ	Northport	Rail
Northland	-\$51	-\$45	-\$43
Auckland	-\$2,304	-\$2,004	-\$1,943
Waikato	-\$57	-\$48	-\$47
Bay of Plenty	-\$17	-\$13	-\$12
Wellington	\$65	\$58	\$56
Rest of North Island	\$21	\$22	\$22
South Island	\$206	\$183	\$181
National	-\$2,137	-\$1,847	-\$1,786