



Economic impact of ending new oil and gas exploration permits outside onshore Taranaki

A regional CGE analysis

NZIER report to PEPANZ

February 2019

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Authorship

This paper was prepared at NZIER by Laurence Kubiak, Eugene Isack and Mieke Welvaert. Quality Assurance was provided by Dr Milad Maralani.

The technical advice of Dr Erwin Corong is gratefully acknowledged.



L13 Willeston House, 22-28 Willeston St | PO Box 3479, Wellington 6140
Tel +64 4 472 1880 | econ@nzier.org.nz

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Executive summary

The New Zealand Government's decision to ban new oil and gas exploration permits will see a series of strongly negative impacts ripple through the economy. The decision prevents the granting of new exploration permits outside of onshore Taranaki and was given effect through the Crown Minerals (Petroleum) Amendment Act 2018. This report refers to this policy in shorthand as "the ban".

NZIER has calculated the macroeconomic impacts of this ban at both the national and regional levels

- The ban will be felt most keenly in the Taranaki region, but even at the national level the ban will reduce real gross domestic product (GDP) by between \$15 billion (3%) and \$38 billion (7.4%). The medium scenario is a reduction of \$28 billion (5.4%).¹
- Household consumption (the best measure of economic wellbeing and discretionary income) will reduce by between \$7 billion (2.4%) and \$20 billion (7%).
- Per household, this represents a \$4,800 to \$14,200 fall in consumption spending on average for each year between 2020 and 2050, with a \$9,400 drop in the medium scenario.
- Investment will reduce by between \$4 billion (5.4%) and \$7 billion (8.4%).
- Export revenue will reduce by between \$3 billion (1.6%) and \$10 billion (5.2%).

Taranaki will bear the brunt of these impacts

- In Taranaki the ban will reduce real GDP by between 35% and 53%, or \$16 billion and \$40 billion, with a medium scenario of 46% (~\$30 billion²). The impacts on regional consumption, investment and export revenue are also strongly negative.
- Households in Taranaki will see a substantial reduction in their standard of living. From 2020 to 2050, real GDP per household in Taranaki will fall by \$623,000, in the medium scenario. This is equivalent to a \$20,774 fall in household incomes each year for the next 30 years.
- The ban is unlikely to cause any appreciable reduction in employment at the national level, but job losses within the sector (between 33% and 40%) and within Taranaki (between 3.2% and 6.6%) will be severe. Estimates of the number of jobs provided by the sector vary, but the 37% reduction estimated for the medium scenario applied to the job number figures presented in the Regulatory Impact Statement³ gives job losses of 3,107 for New Zealand.

¹ Annualised over 25 years, the GDP reduction of \$28 billion is roughly equivalent to the Government's annual capital expenditure on schools, or its annual expenditure on disability services.

² The drop in Taranaki's real GDP is larger than the national total. Other regions will benefit from capital and labour shifting away from the oil and gas industry. These shifts will push up investment, government spending, and exports revenues in regions outside Taranaki, offsetting a small part of the decline in overall real GDP.

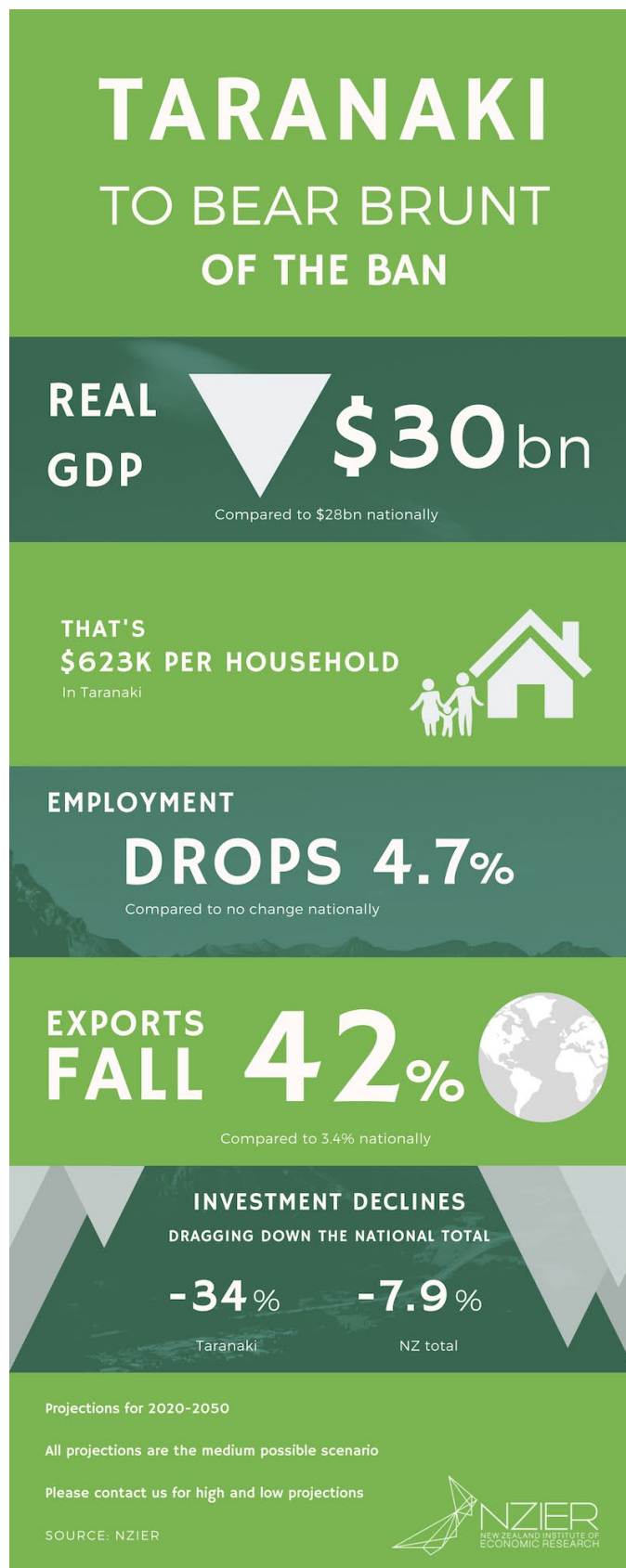
³ Using direct, indirect, and induced employment estimates.

- The impact of the ban is not limited to the oil and gas sector, the overall spill-over effects on other sectors are also negative. The nominal gross value added by the oil and gas industry to other sectors will decline by between \$13 billion and \$30 billion, with a medium scenario of \$23 billion (\$757 million per year over 30 years).
- The reduction in the nominal gross value added by the oil and gas industry to other sectors in Taranaki will be between \$12 billion and \$29 billion, with a medium scenario of \$22 billion (\$736 million per year over 30 years).

[We used NZIER’s regional computable general equilibrium \(CGE\) methodology to carry out this modelling](#)

- CGE is generally accepted as the most robust methodology for assessing the effect of economic shock – such as a drastic reduction in oil and gas exploration – across the wider economy.
- The scenarios used for the modelling are based on the government’s official analysis which is set out in the Regulatory Impact Statement (RIS) which accompanied the Cabinet paper prepared in support of the Crown Minerals (Petroleum) Amendment Bill (which has subsequently been enacted).

Figure 1 Taranaki will be most affected by the ban



Source: NZIER

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1. Objectives and scope

The Petroleum Exploration and Production Association of New Zealand (PEPANZ) commissioned NZIER to estimate the macroeconomic and regional economic impacts of the Government decision to ban the granting of new oil and gas exploration permits outside onshore Taranaki. This ban was given effect through the Crown Minerals (Petroleum) Amendment Act 2018, and this report refers to this policy in shorthand as “the ban”

To date, publicly available economic analysis on the decision has been limited to primarily the fiscal analysis contained in the Regulatory Impact Statement⁴ (RIS) accompanying the Cabinet paper,⁵ prepared in support of the Crown Minerals (Petroleum) Amendment Bill. This outlined the regulatory changes required to implement the ban and focused on the fiscal impacts to the Government through taxes and royalties, rather than the wider economic impacts. It is important to note that this analysis on financial impacts to the Crown was conducted *after* the policy had already been announced.

According to Stats NZ’s 2013 input-output table, the oil and gas industry contributed \$2.5 billion dollars in Gross Value Added (GVA) or roughly 1.29% of New Zealand’s total GDP. There has been no modelling of the potential macroeconomic and regional implications of the ban. This report uses NZIER’s static regional Computable General Equilibrium (CGE) model of the New Zealand economy to estimate the potential impacts on GDP, welfare, exports, the labour market, etc.

Excluded from the scope of this research is any quantitative analysis of the impacts of the ban on greenhouse gas emissions in New Zealand or globally. However, almost all of the oil produced in New Zealand is exported (11 million barrels out of 12.5 million barrels in 2016). As a result, the effect on New Zealand’s emissions is minimal. Similarly, natural gas provides between 10% and 15% of New Zealand’s electricity generation,⁶ with the remainder being used for industrial processes such as feedstock for the fertiliser industry.

We note the Regulatory Impact Statement prepared by the Ministry of Business, Innovation and Employment on the legislation to enact the ban stated “Net impact on global emissions is uncertain but more likely to be negative than positive” and “any reduction in domestic oil and gas production will simply be displaced by other, more likely higher emitting, sources overseas” (MBIE, 2018c, pp.30 – 32).

⁴ RIS: Proposed changes to the CMA <https://www.mbie.govt.nz/assets/1bad579c3a/regulatory-impact-analysis-proposed-changes-to-the-crown-minerals-amendment-act-1991.pdf>

⁵ Cabinet Paper: Final policy decisions for tranche one of the CMA review
<https://www.mbie.govt.nz/assets/18e95c38ab/tranche-one-crown-minerals-act.pdf>

Cabinet paper: Proposed changes to the CMA: <https://www.mbie.govt.nz/assets/10261fbac8/crown-minerals-act-1991-proposed-changes-cabinet-paper.pdf>

The Crown Minerals Act regime page which contains the links to the documents listed above
<https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-generation-and-markets/liquid-fuel-market/crown-minerals-act-regime/>

⁶ Tranpower Energy Futures *Te Mauri Hiko* 2018,
<https://www.transpower.co.nz/sites/default/files/publications/resources/TP%20Energy%20Futures%20-%20Te%20Mauri%20Hiko%2011%20June%2718.pdf>

Overall, New Zealand's contribution to the global reduction of emissions is undetectable.

As with any CGE economic modelling exercise, the results presented here are not precise forecasts. They are an indication of the direction and magnitude of economic impacts, given the assumptions employed. We consider a range of scenarios, informed by MBIE's (2018c) RIS, to account for the inherent uncertainty of activity in the oil and gas exploration industry.

2. Overview of our modelling approach⁷

CGE models: the basics

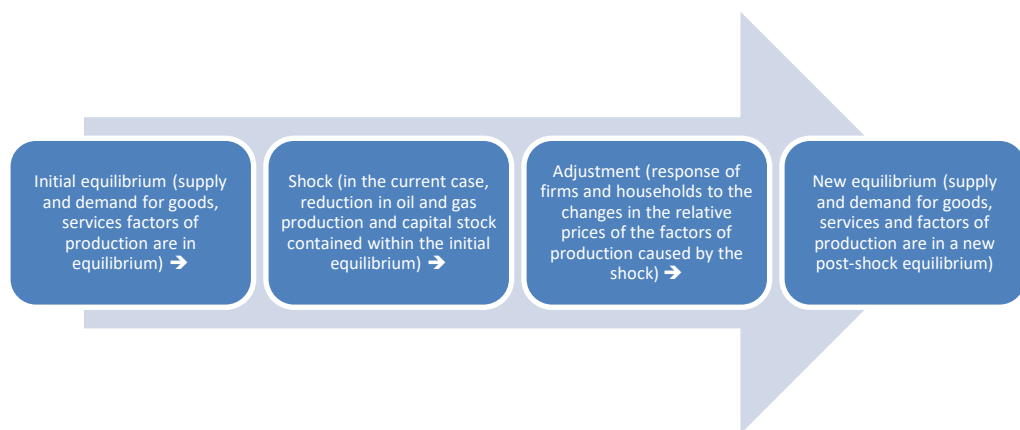
A CGE model consists of equations and model variables representing an economy. It uses detailed data on the structure of the economy that is consistent with these model equations. This data provides a snapshot of the economy in a particular year, which is used as a starting point (or Base) against which to compare policy simulations or economic changes.

The model data is linked together through a set of equations which capture how the economy adjusts in response to a shock. These equations simulate how firms and households respond to the changes in relative prices of the factors of production and the intermediate outputs which arise from the shock.

The difference between the initial and the post-shock equilibrium can then be analysed to determine the effect of the shock on a range of economic indicators, such as GDP, household consumption, employment, wages and welfare etc.

Figure 2 represents the chain of adjustment captured by a CGE model.

Figure 2 Chain of adjustment captured by a CGE model



Source: NZIER

In any CGE model, we must choose what is to be determined within the model (the endogenous variables) and what is to be considered external to the model (the exogenous variables). A CGE model explains the endogenous variables in terms of the exogenous variables.

Several factors, including the model's purpose, help us draw the line between exogenous and endogenous variables and to decide which variables can change or have to remain fixed within the simulation. This choice is not simply based on a CGE model's mathematical properties (i.e., finding a solution) but based on how the

⁷ This section is largely taken from NZIER (2018).

economy works and the expected duration of the shock. We call this choice, the model ‘closure’.

Our CGE model contains details on 106 industries

NZIER’s TERM-NZ CGE model is a static bottom-up regional CGE model of the New Zealand economy and its key regions. The core model structure is based on the original TERM-NZ model of Australia which has been applied to many countries.⁸

Our detailed regional CGE model contains information on 106 industries and 201 commodities in 15 regions in its basic form. We aggregate these industries to reduce the model’s run time and simplify reporting of industry results.

The model draws its economic database from Stats NZ’s 2013 Inter-Industry or Input-Output table which details economic linkages within the New Zealand economy – i.e. how commodities produced by industries are either used for intermediate consumption by various industries or for final consumption by households, investors, government and for exports. TERM-NZ’s database also uses Stats NZ’s regional accounts.

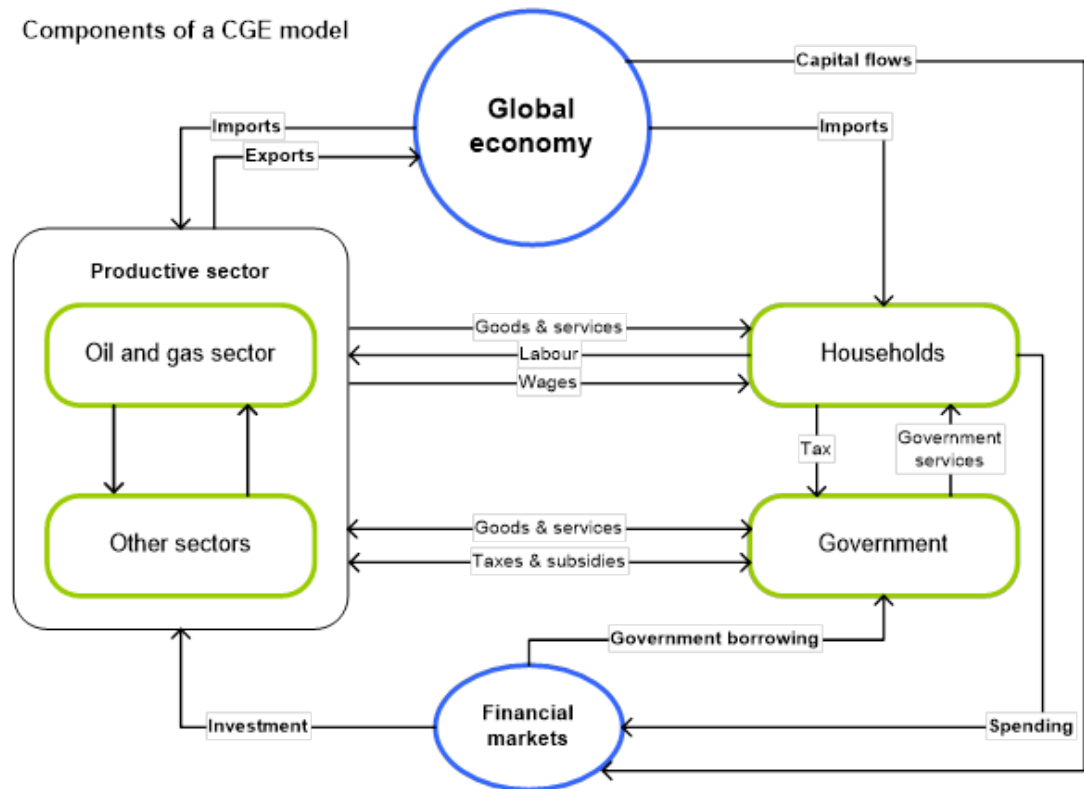
A visual representation of TERM-NZ is shown in Figure 3. It highlights the complex and multidirectional relationships between the various parts of each regional economy and how they interact with other New Zealand regions and rest of the world.

We updated the 2013 Input-Output table with 2018 data using the latest national accounts data for the year ended March 2018. We also aggregated the regions into two separate but inter-linked economies: Taranaki and the rest of New Zealand. This means that we can account for region-specific inter-linkages between industries, as well as their links to households (via the labour market), the local and central government, capital markets, the rest of New Zealand (via inter-regional trade) and the global economy (via imports and exports).

This regional aggregation reflects the importance of oil and gas industry in Taranaki’s regional economy. The aggregation also allows us to trace how the ban may affect both Taranaki and the rest of New Zealand.

⁸ TERM-NZ stands for “The Enormous Regional Model” of the New Zealand economy. The database and model were developed at NZIER in 2013 by Dr Erwin Corong based on the original Australian TERM model created by Professor Mark Horridge of the Centre of Policy Studies, Victoria University-Melbourne, Australia. <http://www.copsmodels.com/term.htm>

Figure 3 Perspective of the NZIER regional CGE model



Source: NZIER

Our base scenario is a forecast of the New Zealand economy out to 2050

The RIS provides oil and gas output projections and was underpinned by operational expenditure (opex) and capital expenditure (capex) requirements out to 2050. We used this material to model low, medium and high oil and gas exploration scenarios. We then produced *ban* and *no ban* variants for each of these scenarios.

Since economic benefits or costs associated with oil and gas exploration – ban or no ban – policies accrue to 2050 as per the RIS, we project the model and its database from 2018 to 2050 using NZIER’s latest *Quarterly Predictions* GDP forecasts. We also project the model’s oil and gas industry output and investment (capex) requirements to 2050 using the low, medium and high oil and gas exploration (i.e. no ban) scenarios as per the RIS.⁹ These changes allow us to update the various inter-linkages between the industries and commodities, as well as their links to households (via the labour market), the government sector, capital markets (via investment) and the global economy (via imports and exports) to 2050.

The low, medium and high no ban pre-simulation runs provide three base economic representations of New Zealand’s economy which are then used as starting points

⁹ We did not use the operational expenditure (opex) values in the RIS as TERM-NZ internally calculates the intermediate input and value added requirements per unit of output.

against which to compare the post-shock equilibrium low, medium and high ban scenarios.

How the economy adjusts under the ban on the granting of new oil and gas exploration permits outside onshore Taranaki

We use a comparative static version of TERM-NZ which means we can analyse economic changes by comparing the initial and post-shock equilibria of the New Zealand economy.

Although we have implemented TERM-NZ in static mode, we have used a closure that allows us to capture investment decisions typically employed in long run dynamic models. Recall that our closure is our choices of exogenous and endogenous variables. We do this by implementing a “long run” closure wherein economic agents and resources fully adjust as the economy moves towards a new equilibrium.

The long run closure¹⁰ includes:

- **Labour market adjustment** – we hold national employment fixed to base levels, but allow for employment to vary by industry and region via adjustment in real wages. This labour market representation allows us to analyse how laid-off labour moves from one industry or region to another in search of employment and higher regional wages.
- **Capital mobility** – we allow capital to move across industries and regions based on rates of return (i.e. profitability). Investment by industry and regions also vary by following movements in capital stocks. This mechanism allows us to capture investment and capital changes as investors search for industries and regions with higher returns.

We also include two standard welfare-neutral closures to prevent over- or under-estimation of economic impacts:

- **Changes in current account and capital account** – we hold the current and capital account as a fixed proportion of base GDP. This prevents New Zealand from infinitely borrowing from abroad to finance a recurring current and/or capital account deficit without worrying how to pay for debts incurred.
- **Government consumption** – we hold aggregate real government consumption fixed at base levels. This prevents the government from buying more goods and services (at the aggregate level but allows for compositional changes in government consumption) to stimulate demand in response to output contraction in New Zealand industries.

Together, these four closure mechanisms allow us to use aggregate household consumption results as a consistent measure of New Zealand’s overall welfare. A downward movement in aggregate household consumption points to a reduction in discretionary income.

¹⁰ In this section variables being fixed to base levels means relative to 2050 pre-simulation levels.

Why use CGE to analyse the effect of the ban?

A key benefit of using a CGE model is that it is based on Stats NZ's input-output and national accounts database that identifies the structure of all sectors in the New Zealand economy. A second key benefit of CGE modelling, compared to cost-benefit analysis, is that it captures the economy-wide effects (i.e. direct and indirect flow-on effects) associated with a ban on new petroleum exploration permits outside onshore Taranaki.

CGE modelling is well-suited to address our key questions:

- What would be the impact on gross domestic product (GDP)?
- What would happen to household welfare, as measured by household consumption?
- What would be the effect on employment and wages?
- What are the direct and indirect flow-on effects, and do any offsetting effects associated with the ban exist?

Another limitation is that Stats NZ's inter-industry database only provides a total production tax imposed on each industry. This means we are not able to explicitly reflect the proportion of royalties from the total production tax imposed on oil and gas industries accruing to the Government.

3. Scenario design

Oil and gas exploration is an inherently uncertain business. It is affected by a range of factors, such as the world oil price, investor confidence, climate change policies, and exchange rates, and is only possible where geological conditions and engineering technology makes it feasible.

To reflect this uncertainty in our modelling, we draw on the RIS to develop three sets of scenarios: low, medium and high exploration. The RIS uses two factors to specify the three scenario sets: the global oil price and the strength of global climate change policy, for which they use carbon price as the proxy.

In each scenario we consider oil and gas exploration activity in New Zealand:

- *Without* any ban in place, activity occurs at:
 - Taranaki onshore
 - Taranaki offshore
 - Canterbury Far
 - Canterbury Near
 - Northland
 - Pegasus
 - Raukumara
- *With* the ban in place:
 - Taranaki onshore only.

The scenarios are summarised below. We have not considered a scenario in which onshore Taranaki exploration is phased out as well. Such a scenario would further worsen the impacts we report in this paper.

Table 1 Summary of scenarios

Scenario name	Global oil price	Strength of global climate change policy	Production from 2018-2050, PJ without ban	Production from 2018-2050, PJ with ban	% change in production from 2018-2050 caused by the ban
Low	Low	High	2,520	956	-62.1%
Medium	Medium	Medium	3,727	1,474	-60.5%
High	High	Low	4,903	1,579	-67.8%

Source: NZIER

We present our results in the next section as either percentage changes or total dollar values relative to the base against which the post-shock equilibrium is compared. The dollar values are reported either in nominal or *real* (i.e. inflation adjusted) value.

4. Modelling results

We focus on key macroeconomic metrics, particularly GDP and household welfare. GDP measures the total value of goods and services produced in the New Zealand economy in a given year. Household consumption is a measure of economic wellbeing (i.e. the amount that New Zealanders spend on goods and services as a proportion of their income). We also evaluate the employment effects and then trace the direct and flow-on effects to other parts of the economy.

4.1. Macroeconomic impacts

Table 2 reports the percentage changes in macroeconomic aggregates for the three scenarios resulting from the ban.

Table 2 Macroeconomic impacts

% change from base

Economic indicator	Low	Medium	High
Consumption	-2.4	-4.7	-7.0
Investment	-5.4	-7.9	-8.4
Exports	-1.6	-3.4	-5.2
Imports	0.8	0.5	-0.1
Real GDP	-3.0	-5.4	-7.4
GDP price index	0.6	1.4	2.1
Nominal GDP*	-2.4	-4.1	-5.5
Real wages	1.4	2.9	4.1
Capital return	-1.6	-2.5	-3.4
Real exchange rate (depreciation)	0.8	1.3	1.8

*Note: Nominal GDP (-2.4%) = Real GDP (-3.0%) – GDP price index (0.6%)

Source: NZIER

Real GDP contracts by between 3%, 5.4% and 7.4%, respectively in the low, medium and high scenarios. This equates to annual real GDP reductions of 0.12, 0.22 and 0.3 percentage points spread over 25 years. Nominal GDP falls by less than the real GDP due to the higher GDP price index which increases by 0.6%, 1.4% and 2.1%, respectively in the low, medium, and high scenarios. A positive GDP price index change means higher prices faced by New Zealand residents due to higher costs of domestic production.

Real household consumption (that is, economic wellbeing) falls by between 2.4% and 7% due to higher domestic prices and lower income due to lower capital returns. Per household, this represents a \$4,800 to \$14,200 fall in consumption spending on

average for each year between 2020 and 2050, with a \$9,400 fall in the medium scenario.

Aggregate investment also falls by between 5.4% and 8.4% due to reduced production, exports and profitability (i.e. capital returns).

In each scenario, the ban results in lower oil and gas exports, which causes the real exchange rate to depreciate, making imported products more expensive in New Zealand. The depreciation in the New Zealand dollar also increases domestic production costs, especially for import-intensive and petroleum-reliant industries.

As for trade, aggregate imports rise due to higher demand for petroleum-related commodities to substitute for foregone domestic oil and gas supply, while aggregate exports fall due to lower oil production.

Figure 5 presents the real dollar value changes for the low, medium and high scenarios. In these scenarios, between 2020 and 2050, the ban will cumulatively reduce:

- Real household consumption by between \$7.0 billion and \$20 billion
- Real investment by between \$4.2 billion and \$7 billion.
- Aggregate real exports revenue by between \$3.3 billion and \$10 billion.
- Nominal GDP by \$21 billion in the medium scenario, with low and high scenarios of \$12 billion and \$28 billion, respectively.
- Real GDP by \$28 billion in the medium scenario, with low and high scenarios of \$15 billion and \$38 billion, respectively.

Real GDP provides a better measure of economic impacts than nominal GDP. Nominal GDP values are higher than real GDP as the latter is price (i.e. inflation) adjusted.

Figure 4 Losing New Zealand's oil and gas industry



Source: NZIER

The net present value associated with the nominal GDP losses at 3%, 6% and 8% discount rates, respectively for low, medium and high scenarios spread over 30 years are shown in Table 3.

Table 3 Net present value of nominal GDP

\$ billions

Discount rate	Low	Medium	High
3%	-3.5	-6.0	-8.0
6%	-2.1	-3.5	-4.7
8%	-1.6	-2.8	-3.7

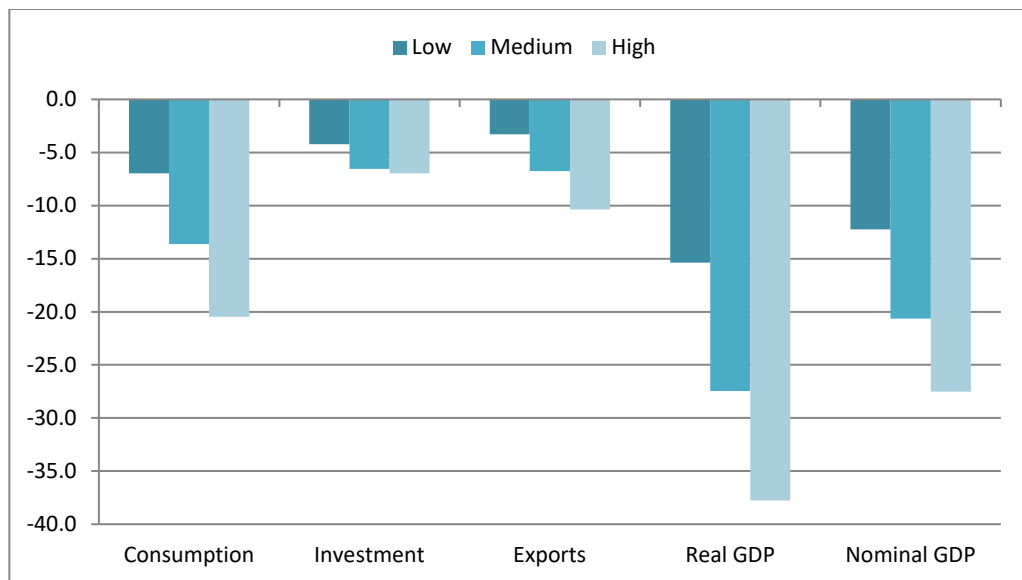
Source: NZIER

These are large GDP impacts. At \$2.1 billion in the low scenario, the GDP impact is equivalent to the current GDP value of the entire commercial fishing sector in New Zealand, and larger than the forestry and logging sector.

New Zealand’s productive capacity will also be smaller in the post-shock world. Some installed capital will become less productive, as it is re-allocated to its second-best use.

Figure 5 Macroeconomic impacts

Real \$ billions



Note: All dollar values are in real terms (price or inflation adjusted prices) except Nominal GDP

Source: NZIER

4.2. Exports

Table 4 shows changes in export quantities resulting from the ban. Unsurprisingly, crude oil exports suffer the greatest fall, with a 46%, 54% and 62% reduction, respectively in the low, medium and high scenarios. Refined petroleum exports fall by between 20% and 48% due to lower domestic supply of oil and gas intermediate inputs.

Impacts on other exported commodities are mainly driven by the real exchange rate depreciation effects.¹¹ Commodities that do not rely on imported intermediate inputs, like agriculture and processed food benefit from the depreciation of the real exchange rate as it makes their products relatively cheaper abroad. Minerals, wood and timber, which use imported petroleum inputs intensively, experience higher production costs that offset the real exchange rate depreciation effects.

Table 4 Export changes

% change from base

	Low	Medium	High
Fruits and vegetables	2.5	4.6	6.5
Crops	0.8	1.6	2.3
Sheep and beef	0.1	0.9	1.6
Other livestock	2.5	4.2	5.6
Forestry and fishing	3.8	6.0	8.4
Wood and timber	-2.6	-6.8	-9.3
Coal	2.5	1.2	1.7
Crude oil	-46.2	-54.0	-61.8
Minerals	-24.2	-34.3	-43.1
Processed meat and fish	1.9	3.6	5.1
Dairy	1.6	3.0	4.1
Processed food	3.7	7.4	10.8
Other manufactures	3.3	6.7	9.6
Petroleum products	-19.8	-37.6	-48.1
Chemical rubber and plastics	-2.6	5.6	9.3

Source: NZIER

¹¹ This result is also partly driven by our capital and current account closure which is held fixed as a proportion of GDP. This closure means that aggregate import bill must be paid for by aggregate exports revenue—i.e. any foregone oil and gas export revenue must be compensated by revenue from other commodity exports to pay for aggregate imports.

4.3. Regional impacts

The ban will significantly affect Taranaki's economy

Table 5 shows Taranaki's *nominal* regional gross domestic product (NRGDP) falls by \$12.8 billion, \$23.5 billion and \$27.5 billion, respectively in the low, medium and high scenarios. *Real* regional gross domestic product (RRGDP), which is adjusted for price changes, falls more – i.e. by \$16 billion, \$30 billion and \$40 billion, respectively in the low, medium and high scenarios. A higher GDP price index softens the nominal impact but exacerbates the real impact.

Table 5 also shows:

- The GDP price index for all regions rises in all scenarios. This means that the higher cost of domestic production is felt in both Taranaki and other regions.
- NRGDP and RRGDP for the rest of New Zealand improve slightly as resources move away from Taranaki.
- Household consumption falls more in the rest of New Zealand than in Taranaki (in dollar terms). The widespread drop in consumption suggests that the ban will impose higher domestic prices and lower incomes on households around the country. The larger reduction in household consumption in other regions is also driven by scale effects – i.e. a larger proportion of households live outside Taranaki.
- Investment falls significantly in Taranaki but rises marginally in other regions as investors move their investment away from the oil and gas industry to non-oil and gas industries within Taranaki and to other regions.
- Factor incomes (e.g. wages) fall across all regions especially Taranaki. The larger decrease in capital returns offset the marginal increase in factor wages accruing to other regions.
- Production and commodity tax revenues – that is, GST, levies and duties paid to the government – also fall by between \$1 billion and \$2.7 billion in total, or between \$35 million and \$91 million per annum over 30 years.¹² This is in addition to the mid-point royalty and tax figure reported in the RIS of \$7.9 billion.

¹² It is not possible to explicitly account for the foregone oil and gas royalties in the simulation results. This is because the input-output table does not explicitly reflect the proportion of royalties, from total production tax imposed on oil and gas industries, accruing to the government.

Table 5 GDP impacts by region

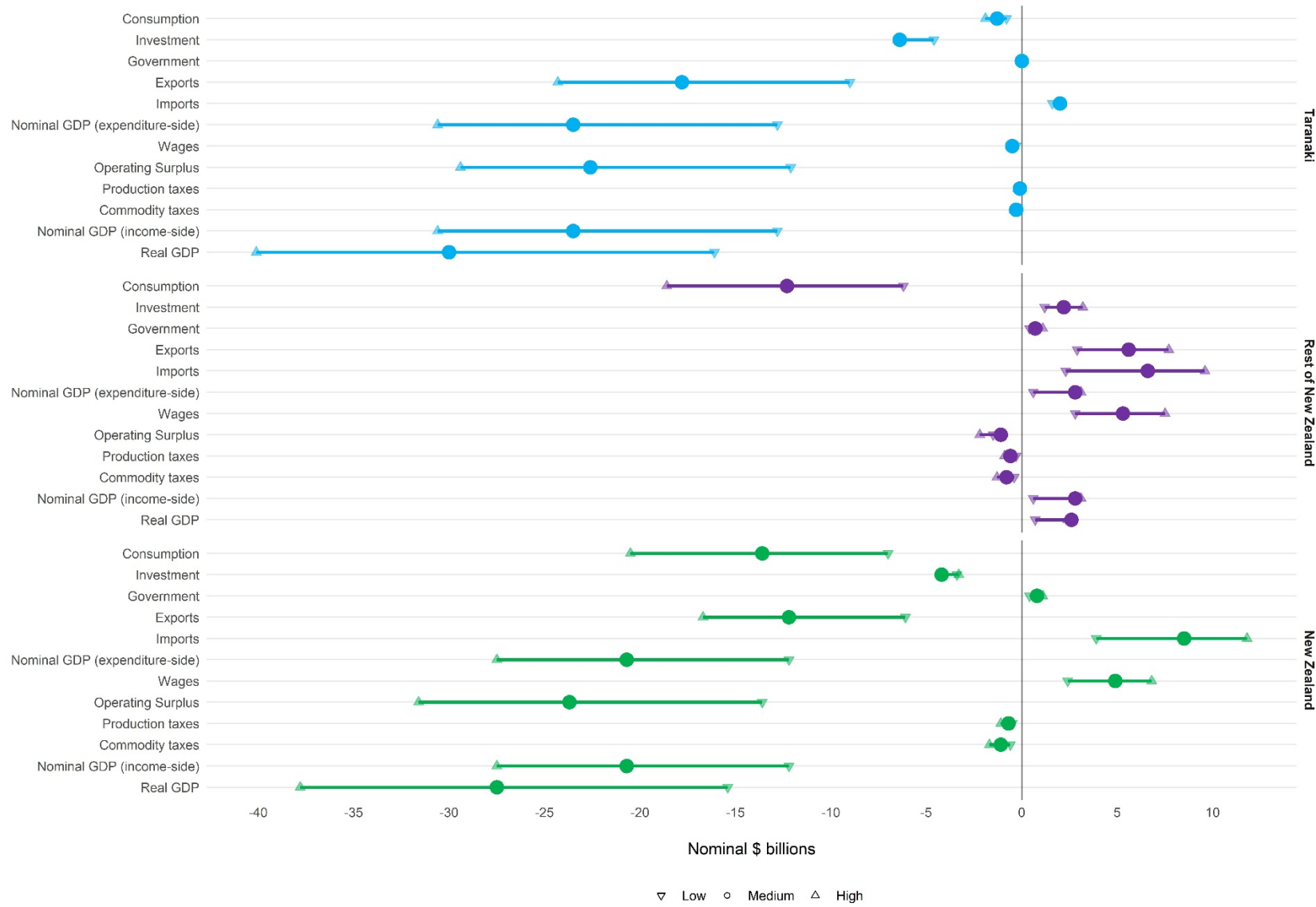
Nominal \$ billions, unless indicated

	Low			Medium			High		
	Taranaki	Rest of NZ	NZ	Taranaki	Rest of NZ	NZ	Taranaki	Rest of NZ	NZ
Consumption	-0.8	-6.2	-7.0	-1.3	-12.3	-13.6	-1.9	-18.6	-20.5
Investment	-4.6	1.2	-3.4	-6.4	2.2	-4.2	-6.5	3.2	-3.3
Government	0.0	0.4	0.4	0.0	0.7	0.8	0.0	1.1	1.1
Exports	-9.0	2.9	-6.1	-17.8	5.6	-12.2	-24.3	7.7	-16.7
Imports	1.6	2.3	3.9	2.0	6.6	8.5	2.1	9.6	11.8
Nominal GDP (expenditure)	-12.8	0.6	-12.2	-23.5	2.8	-20.7	-30.6	3.1	-27.5
Wages	-0.3	2.8	2.4	-0.5	5.3	4.9	-0.6	7.5	6.8
Operating Surplus	-12.1	-1.5	-13.6	-22.6	-1.1	-23.7	-29.4	-2.2	-31.6
Production taxes	-0.1	-0.3	-0.5	-0.1	-0.6	-0.7	-0.2	-0.9	-1.1
Commodity taxes	-0.2	-0.4	-0.6	-0.3	-0.8	-1.1	-0.4	-1.3	-1.7
Nominal GDP (income)	-12.8	0.6	-12.2	-23.5	2.8	-20.7	-30.6	3.1	-27.5
Real GDP	-16.1	0.7	-15.4	-30.0	2.6	-27.5	-40.1	2.4	-37.8

Source: NZIER

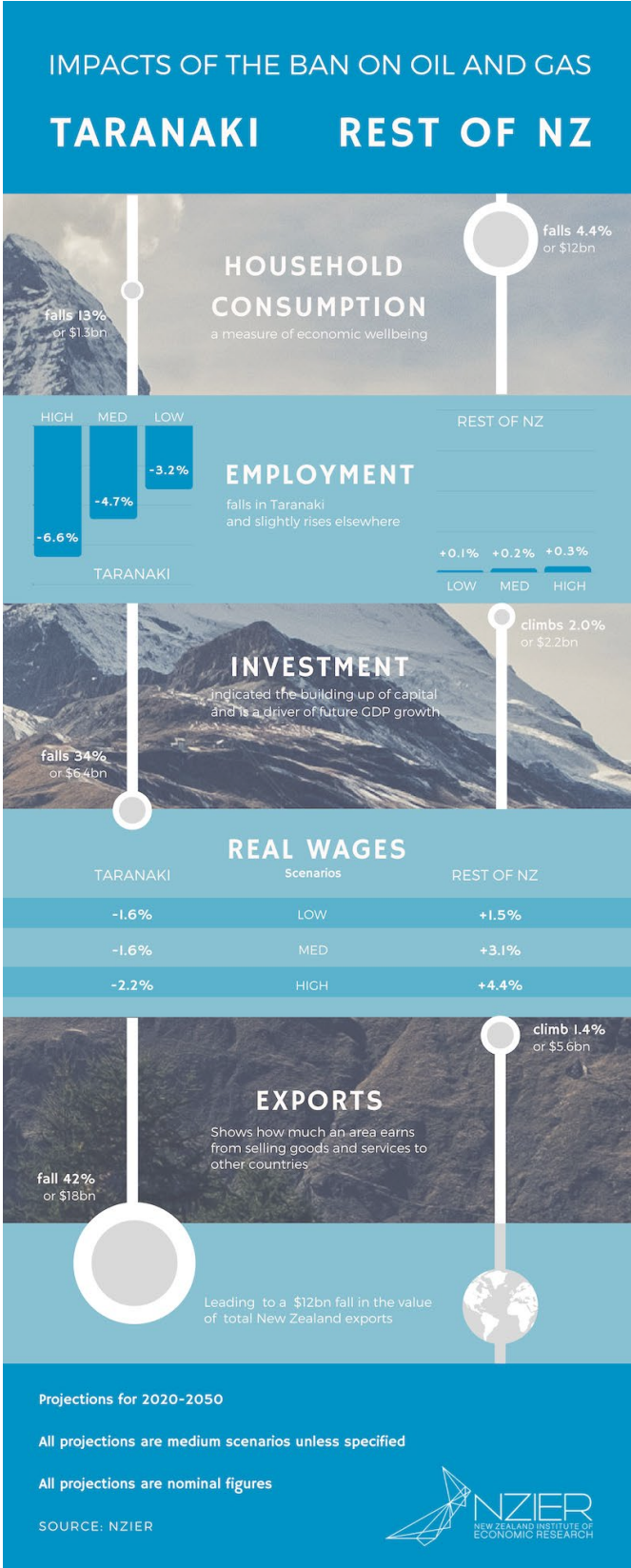
Figure 6 shows the *nominal* gross domestic product impacts (unless otherwise stated) by region. Medium scenario results are represented by the circular points while low and high scenarios are represented using triangles. The connecting line between scenarios show the sensitivity range.

Figure 6 GDP impacts by region (in nominal \$ billions)



Source: NZIER

Figure 7 Impacts on the Taranaki and national economies under the medium scenario



Source: NZIER

4.4. Direct and indirect impacts

Table 6 shows the direct and indirect flow on impacts on gross value added by industry and regions.

The impacts of the ban are significant:

- Nominal gross value added in the oil and gas industry declines by \$13 billion, \$23 billion and \$30 billion, respectively in the low, medium and high scenarios, or roughly \$0.4 billion, \$0.8 billion and \$1 billion per year spread over 30 years.
- Taranaki's oil and gas industry bears much of the reductions in nominal gross value added with \$12 billion, \$22 billion and \$29 billion, respectively in the low medium and high scenarios, or \$0.39 billion, \$0.74 billion, \$0.96 billion per year spread over 30 years. Other New Zealand regions are also affected by the ban.

Table 6 also shows indirect flow-on effects summarised by:

- **Supplying industries** – industries that supply commodities or services to the oil and gas industry. These industries are limited to business services, given the capital intensive nature of the oil and gas industry.
- **Dependent industries** – industries that rely on the output of oil and gas industries for further processing. These industries are utilities (including electricity generation which significantly rely on natural gas inputs produced by the oil and gas industry) and chemical rubber and plastics.
- **Household-oriented industries** – industries that produce commodities for final household consumption are likely to lose due to decreased factor incomes. These are trade and personal and recreation services.
- **Other export-oriented industries** – industries that gain as a result of resource re-allocation effects as labour and capital resources move away from the oil and gas industry. These industries include agriculture, food processing, other (non-oil and gas) mining and exploration activities, wood manufacturing industries, and other industries.

Table 6 Regional gross value added

Nominal \$ billions, unless indicated

	Low			Medium			High		
	Taranaki	Rest of NZ	NZ	Taranaki	Rest of NZ	NZ	Taranaki	Rest of NZ	NZ
Oil & Gas	-11.6	-1.4	-13.0	-22.1	-0.6	-22.7	-28.7	-1.4	-30.0
Supplying industries									
Business Services	-0.5	-1.3	-1.8	-0.9	-2.7	-3.6	-1.1	-4.1	-5.3
Downstream industries									
Utilities	-0.8	0.7	-0.1	-0.6	0.6	0.0	-0.7	0.7	0.0
Chemical, rubber & plastics	0.0	-0.2	-0.2	0.0	0.4	0.4	0.0	0.6	0.7
Household-oriented industries									
Personal and Recreation	-0.1	-0.4	-0.4	-0.1	-0.7	-0.9	-0.2	-1.1	-1.3
Trade	-0.1	0.2	0.1	-0.2	0.5	0.3	-0.3	0.7	0.4
Other industries									
Horticulture	0.0	0.1	0.1	0.0	0.2	0.2	0.0	0.2	0.2
Sheep, beef, dairy cattle	0.0	0.6	0.6	0.1	1.0	1.1	0.1	1.3	1.4
Other agriculture, forestry & fishing	0.0	0.3	0.3	0.0	0.5	0.5	0.0	0.7	0.7
Food processing	0.0	0.2	0.2	0.0	0.4	0.4	0.0	0.6	0.6
Wood & paper	0.0	0.6	0.6	0.0	1.4	1.4	0.0	2.0	2.0
Other Mining	0.1	0.3	0.4	0.0	0.2	0.3	0.0	0.3	0.3
Other industries	0.4	1.2	1.5	0.6	2.3	2.9	0.5	3.7	4.2
Total gross value added (direct + indirect) impacts	-12.6	0.8	-11.8	-23.1	3.5	-19.7	-30.2	4.2	-26.0
Add: Commodity taxes	-0.2	-0.4	-0.6	-0.3	-0.8	-1.1	-0.4	-1.3	-1.7
Nominal GDP	-12.8	0.6	-12.3	-23.5	2.6	-20.8	-30.6	2.9	-27.7
Real GDP	-16.1	0.7	-15.4	-30.0	2.6	-27.5	-40.1	2.4	-37.8
GDP price deflator (% change)	9.4%	0.0%	0.6%	14.3%	0.0%	1.4%	19.5%	0.2%	2.1%

Source: NZIER

4.5. Employment

Table 7 shows that employment in the oil and gas industry falls by 33%, 37% and 40%, respectively in the low, medium and high scenarios.¹³ Whilst most of these employment reductions are in Taranaki, Table 7 also shows the ban results in completely reducing oil and gas employment outside of Taranaki.

Employment in Taranaki moves in two directions. First, labour re-allocates within Taranaki by moving towards non-oil and gas industries such as agriculture, food processing and business services. Second, labour moves away from Taranaki and towards other regions. As a result, employment in Taranaki falls by between 3.2% and 6.6%, whilst employment in other New Zealand regions increases by between 0.1% and 0.3%.

The employment reduction in other services (between 1.1% and 3.8%) is driven by lower consumer demand for these commodities. All other industries expand, as the exploration ban gives them access to labour and capital resources that leave the oil and gas industry.

¹³ Computed as % change in employment in Table 7.

Table 7 Employment changes

% change from base

	Low			Medium			High		
	Taranaki	Rest of NZ	NZ	Taranaki	Rest of NZ	NZ	Taranaki	Rest of NZ	NZ
Horticulture	3.0	1.0	1.0	3.0	2.0	2.0	4.0	3.0	3.0
Sheep & beef	2.0	1.0	1.0	3.0	2.0	2.0	4.0	3.0	3.0
Other agriculture	3.0	1.0	2.0	2.0	2.0	2.0	3.0	3.0	3.0
Forestry & fishing	2.0	2.0	2.0	2.0	3.0	3.0	3.0	5.0	5.0
Oil & gas	-33.0	-100.0	-33.0	-37.0	-100.0	-37.0	-40.0	-100.0	-40.0
Mining & exploration	28.0	9.0	13.0	11.0	8.0	8.0	10.0	10.0	10.0
Food processing	2.0	0.0	1.0	2.0	1.0	1.0	3.0	1.0	1.0
Dairy	1.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0	1.0
Wood & paper	6.0	6.0	6.0	9.0	17.0	17.0	9.0	27.0	27.0
Petroleum, chemical, rubber & plastics	-7.0	-3.0	-4.0	13.0	1.0	1.0	18.0	1.0	2.0
Other manufacturing	-3.0	2.0	2.0	-4.0	3.0	3.0	-4.0	5.0	4.0
Utilities	-31.0	4.0	0.0	-22.0	3.0	-1.0	-24.0	3.0	-1.0
Trade	-8.0	0.0	-1.0	-13.0	-1.0	-1.0	-17.0	-1.0	-1.0
Business services	4.0	1.0	1.0	16.0	1.0	2.0	34.0	2.0	3.0
Other services	5.0	-1.0	-1.0	5.0	-2.0	-1.0	1.0	-2.0	-2.0
Aggregate employment	-3.2	0.14	-	-4.7	0.21	-	-6.6	0.31	-

Source: NZIER

The reductions in oil and gas employment are equivalent to 1,722 jobs lost in the medium scenario. These job estimates are based on figures from MBIE (2018b), which come from research produced by Martin Jenkins in 2014. Venture Taranaki’s (2015) report on oil and gas employment uses slightly higher figures, also from research by Martin Jenkins (but reported in 2015). Martin Jenkins acquired this employment data “through survey, publicly available information and direct company contact”. MBIE noted that employment figures will most likely be lower now, due to the downturn in oil and gas commodity prices.

We have used both these figures to calculate the job loss impact shown in Table 9. Table 8 shows the initial measures of oil and gas industry employment.

For a highly conservative view, we have taken Stats NZ’s employee count for the oil and gas extraction industry (by ANZSIC06 code). Stats NZ’s figures are much lower than

those used by MBIE and Venture Taranaki as they only count people employed directly in this segment. This data may also not adequately account for the number of contractors employed in oil and gas extraction.

Table 8 Different measures for oil and gas employment

Employment numbers

Data source	Measure	Taranaki	NZ
MBIE (2018b)	Direct employment (FTE)	3,936	4,653
	Direct, indirect, and induced employment (FTE)	5,941	8,481
Venture Taranaki (2015)	Direct employment (FTE)	4,340	5,068
	Direct, indirect, and induced employment (FTE)	7,070	11,720
Stats NZ ANZSIC06 (2018)	Employee count	710	910

Source: NZIER

Table 9 Oil and gas job losses

Number of jobs

Employment	Low		Medium		High	
	Taranaki	NZ	Taranaki	NZ	Taranaki	NZ
MBIE (direct FTE)	1,287	1,553	1,437	1,704	1,571	1,869
MBIE (direct, indirect, and induced FTE)	1,942	2,830	2,169	3,107	2,371	3,406
Venture Taranaki (direct FTE)	1,419	1,691	1,584	1,857	1,732	2,035
Venture Taranaki (direct, indirect, and induced FTE)	2,312	3,911	2,581	4,293	2,822	4,707
Stats NZ ANZSIC06 (2018)	232	304	259	333	283	365

Source: NZIER

5. Conclusion

The decision to ban the granting of new oil and gas exploration permits drives a series of strongly negative economic impacts. Our CGE model shows that even in a low scenario, household consumption spending will fall, real GDP will drop, and New Zealand will spend more on imports to keep other petroleum-dependent industries going.

These are large GDP impacts. Taking the net present value shows that even in the low scenario, the GDP loss from the ban is equivalent to the current GDP value of New Zealand's commercial fishing sector and larger than the forestry and logging sector.

Over 3,000 people will lose their jobs in the medium scenario, a 37% drop in the number of FTEs employed directly and indirectly by the oil and gas industry, according to MBIE (2018b).

Positive impacts of the ban are few and incidental, and are dwarfed by the scale of the negative impacts.

- Employment across all industries will grow slightly in the rest of New Zealand, but this growth will come at the cost of steep job losses in Taranaki, forcing people to move outside the region for work. Overall employment will remain unchanged under the ban, but at the cost of social upheaval.
- Exports from regions other than Taranaki will also benefit from the ban, but overall export earnings will be billions of dollars lower than if a ban wasn't put in place.

Lower export earnings will put downward pressure on the New Zealand dollar exchange rate. An exchange rate depreciation will push up the cost of imported inputs, raising costs especially for import-intensive and petroleum-reliant industries.

The ban will reduce New Zealand's productive capacity, limiting potential future economic growth. Re-allocating capital away from oil and gas, as well as other negatively affected industries, will mean that some capital will be put to its second-best use. This re-allocation of capital to less efficient uses will reduce New Zealand's overall ability to produce.

In Taranaki, all indicators of economic growth and wellbeing will decline. The medium scenario drop in real GDP for Taranaki is roughly equivalent to a \$21,000 reduction in household incomes each year. Employment will fall by between 3.2% and 6.6% in the region. People will seek jobs in the primary sector or other service sectors in the region or leave. Under the ban, investment in Taranaki will drop by between 29% and 37%, and exports fall 42% under the medium scenario.

Some industries will benefit from the ban, but their contribution to the economy pales in comparison to the loss of the oil and gas industry. Even in the low scenario, the \$13 billion drop in nominal GDP from oil and gas far outweighs the \$0.7 billion growth in other industries.

This all-region, all-industry approach to measuring the impacts of the ban shows that the resulting loss in oil and gas production will severely reduce economic wellbeing in Taranaki and knock back New Zealand's overall economic success.

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