NZIER
NEW ZEALAND INSTITUTE OF ECONOMIC RESEARCH

Economic impact of Wellington's screen industry

NZIER report to Wellington Regional Economic Development Agency

November 2018

About NZIER

NZIER is a specialist consulting firm that uses applied economic research and analysis to provide a wide range of strategic advice to clients in the public and private sectors, throughout New Zealand and Australia, and further afield.

NZIER is also known for its long-established Quarterly Survey of Business Opinion and Quarterly Predictions.

Our aim is to be the premier centre of applied economic research in New Zealand. We pride ourselves on our reputation for independence and delivering quality analysis in the right form, and at the right time, for our clients. We ensure quality through teamwork on individual projects, critical review at internal seminars, and by peer review at various stages through a project by a senior staff member otherwise not involved in the project.

Each year NZIER devotes resources to undertake and make freely available economic research and thinking aimed at promoting a better understanding of New Zealand's important economic challenges.

NZIER was established in 1958.

Authorship

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Key points

NZIER was commissioned by the Wellington Regional Economic Development Agency (WREDA) to demonstrate the value that the Wellington screen industry adds to the regional economy.

Wellington's screen industry occupies a unique position in New Zealand

In 2017, it generated $705 million in gross revenue, and $3.5 billion from 2013 to 2017.

Overall, the screen industry in Wellington generated 19.9% of the total revenue produced by the New Zealand screen industry in 2017.

Wellington is known as a centre of excellence for post-production work including visual effects. In 2017, post-production activities generated $449 million in revenue. This represents 70% of the post-production gross earnings in New Zealand.

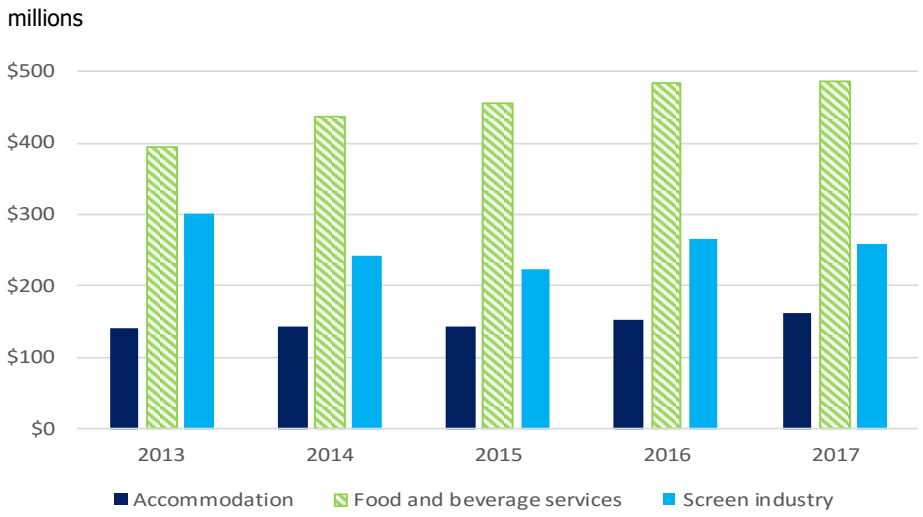
Wellington's screen industry directly contributed an estimated $260 million to the region's GDP in 2017

From 2013 to 2017 the estimated direct contribution of the screen industry to GDP was $1.29 billion, which is 0.8% of regional GDP over that period.

In 2017, we estimate that on average 2,500 people were working in the screen industry in Wellington. This includes those engaged by screen companies and those engaged in film productions while in production in Wellington. The number of people working in the screen industry depends on the number of domestic and international productions which are attracted to Wellington.

The screen industry directly contributes more to Wellington's GDP than the accommodation industry, and more than half of the food industry's contribution to regional GDP (see Figure 1).

Figure 1 Screen industry's contribution to GDP compared to other industries



Source: NZIER based on Stats NZ *Screen Industry Survey 2016/17* and Regional GDP estimates

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1. Objectives and scope

The Wellington Regional Economic Development Agency (WREDA) has asked NZIER to demonstrate the economic contribution that the screen industry in Wellington makes to the regional economy.

The scope of the report

The report covers the following economic impact aspects:

- The structure of the screen industry in the Wellington region
- The impact of the industry on regional GDP, household spending, earnings and employment
- Its linkages with other industries.

What we did

We used Stats NZ's *Screen Industry Survey* in conjunction with information provided to NZIER by industry sources to develop a picture of the trends in Wellington's screen industry.

We also used one of our suite of Computable General Equilibrium (CGE) models to show the impact of the screen industry on the Wellington economy. CGE models are data-driven and used to capture the effects of changes or 'shocks' to the economy. They capture the direct and flow-on effects of these changes. Relative to other economic impact methodologies, CGE models produce conservative results as they account for resource constraints.

Coverage

The screen industry covers five sub-industries the are defined as follows by Stats NZ:

- **Production**: all work leading up to and including filming, such as development, pre-production, and principal photography
- **Post-production:** all activities involved in putting together scenes to make a production complete; for example editing, duplication, visual effects, and audio.
- **Broadcasting**: the distribution of works through media such as television or the internet
- **Distribution**: the process of delivering the completed work for display to the public market, including marketing
- **Exhibition**: the display of a completed work to the public at pre-set locations, such as cinemas or museum displays.[1]

Film tourism is beyond the scope of what is captured by Stats NZ's *Screen Industry Survey*.

[1] Stats NZ (2018). Screen Industry Survey Data Dictionary

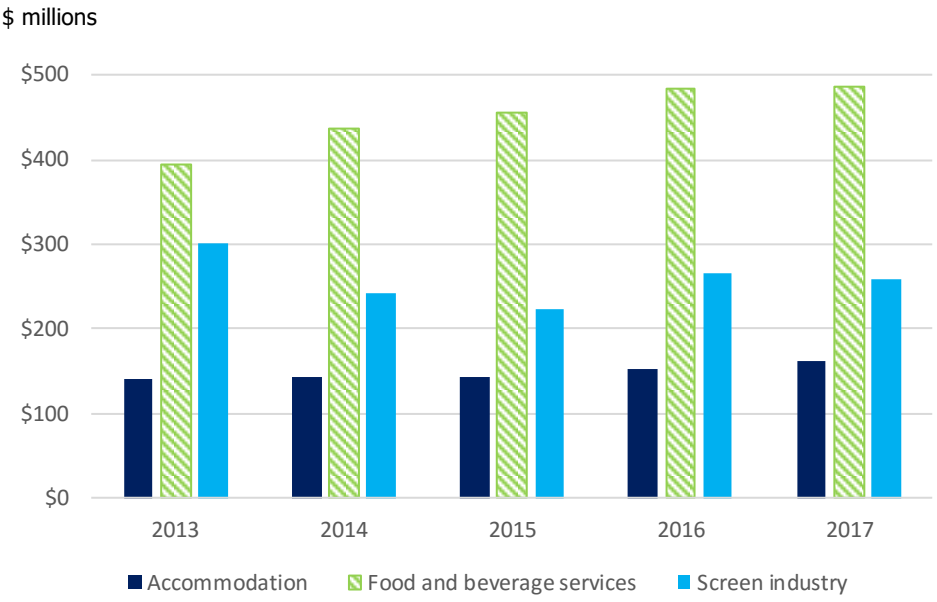
2. Current economic contribution

2.1. Contribution to Wellington's GDP

In 2017, the screen industry in Wellington directly contributed an estimated $260 million to the region's GDP. From 2013 to 2017, the estimated direct contribution was $1.29 billion, which is 0.8% of the regional GDP over that period.

The screen industry's contribution was more than the direct contribution of the accommodation industry, and more than half of the food industry's direct contribution to the region's GDP (see Figure 2). The screen industry is equivalent to 9.7% of the overall information, media and telecommunications industry in the Wellington region.

Figure 2 Screen industry's contribution to GDP compared to other industries



Source: NZIER based on Stats NZ *Screen Industry Survey 2016/17* and Regional GDP estimates

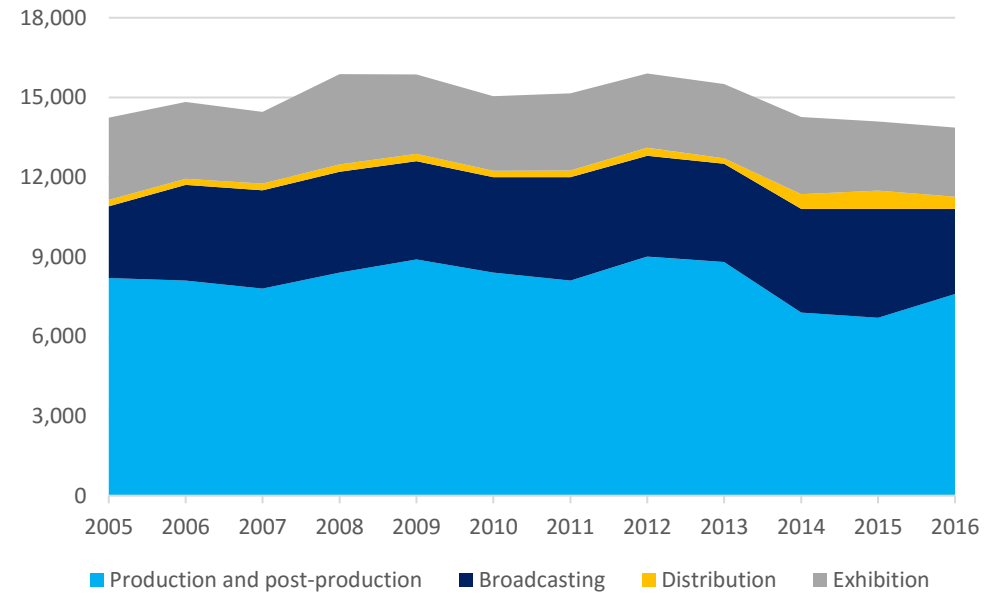
2.2. Contribution to regional employment

The number of people working in New Zealand's screen industry has fluctuated over time (see Figure 3). The most recent estimate from Stats NZ is that 13,500 people worked in the screen industry across New Zealand in 2016.

The number of people working in the screen industry is influenced by the number of productions in any given year. This is determined by the combination of demand from international and domestic productions.

The screen industry workforce is globally mobile. Talent moves to the locations of productions. Some screen industry workers also move within the industry and to related industries like the game development industry, because their skills and knowledge are transferable across both industries.

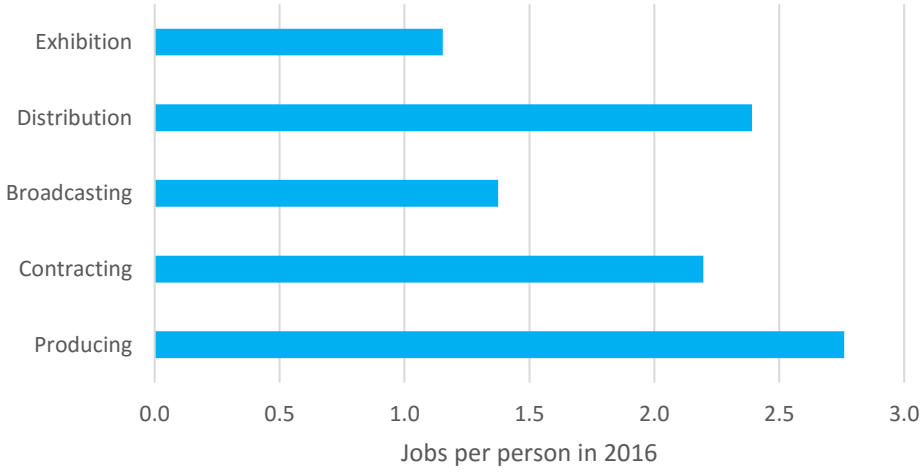
Figure 3 People working in New Zealand's screen industry



Source: Stats NZ *Screen Industry Survey 2016/17*

People working in the screen industry are generally contractors who typically work more than one contract per year (see Figure 4). The average number of jobs per worker in 2016 was 1.9. Contracts vary in length, which affects the number of people working on a production over the life of the project.

Figure 4 Screen industry jobs per person in the industry



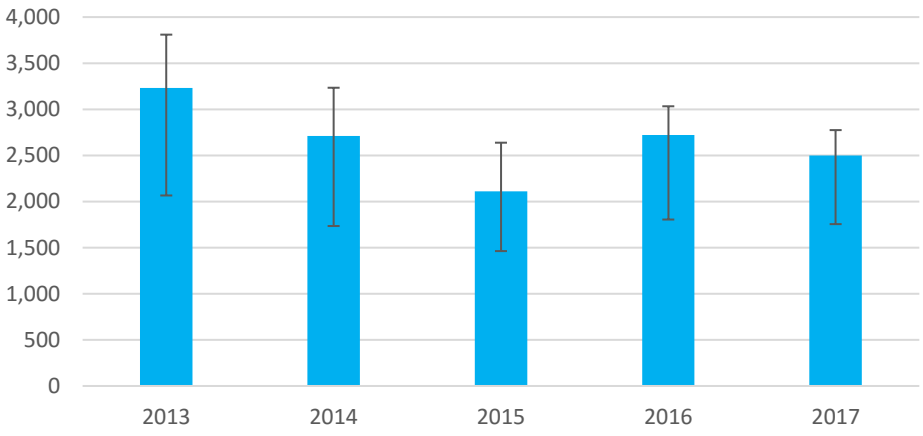
Source: NZIER based on Stats NZ *Screen Industry Survey 2016/17*

In 2017, we estimate that on average there were 2,500 people working in the screen industry in Wellington. Figure 5 shows our estimates of the number of people working in the Wellington screen industry from 2013 to 2017.

This is based on the region's share of revenue and staff numbers from industry leaders. The error bars show the estimate variation between minimum crew and peak crew numbers based on industry information.

Figure 5 Screen industry jobs in Wellington

People



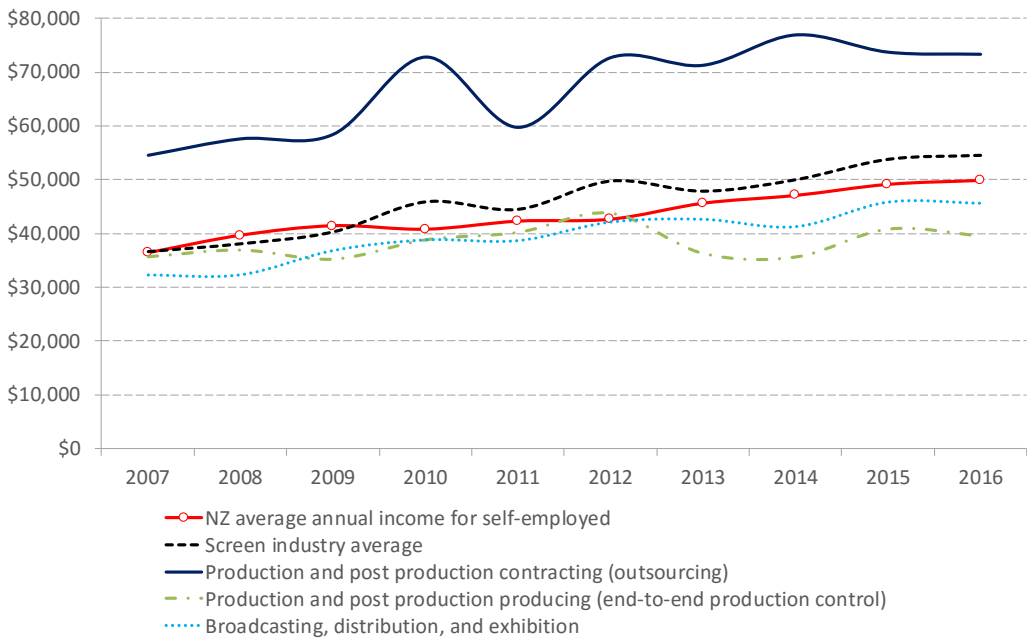
Source: NZIER

2.3. Contribution to household incomes

There are gaps in the data on screen industry earnings at the regional level. However, at the national level, screen industry workers earned $55,000 on average in 2016. This is 14% higher than the average annual earnings of self-employed people.

In 2016, production and post-production workers that worked for firms that sub-contracted to producing firms on average earned $73,000. Highly skilled specialists can earn much more. For example, visual effects specialists can earn around $150,000 per year, based on industry intelligence.

Figure 6 Average annual earnings



Source: NZIER based on Stats NZ *Screen Industry Survey 2016/17*

2.4. Screen industry revenue in Wellington

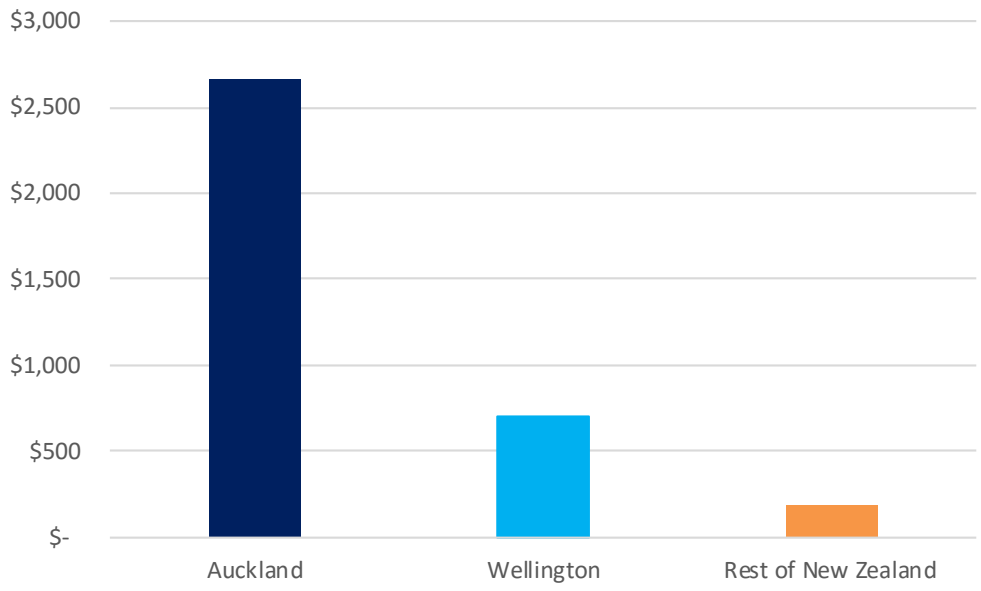
In 2017, the screen industry in Wellington generated an estimated $705 million in gross revenue[2] – 19.9% of the estimated gross revenue for the entire screen industry in New Zealand.

In contrast, the screen industry in Auckland generated $2.66 billion in gross revenue (75.0%), driven by television and production. The rest of New Zealand generated $182 million (5.1%) in gross revenue (see Figure 7).

[2] Gross revenue is larger than GDP or value added because the latter is calculated as gross revenue less costs of intermediate inputs to production.

Figure 7 Screen industry's gross revenue

$ millions, in 2017



Source: Stats NZ *Screen Industry Survey 2016/17*

Wellington's screen industry occupies a unique position in New Zealand. Wellington is New Zealand's top earner of post-production revenue. Post-production activities include digital enhancements, editing, visual effects and sound editing that happen after the initial capture phase of a production.

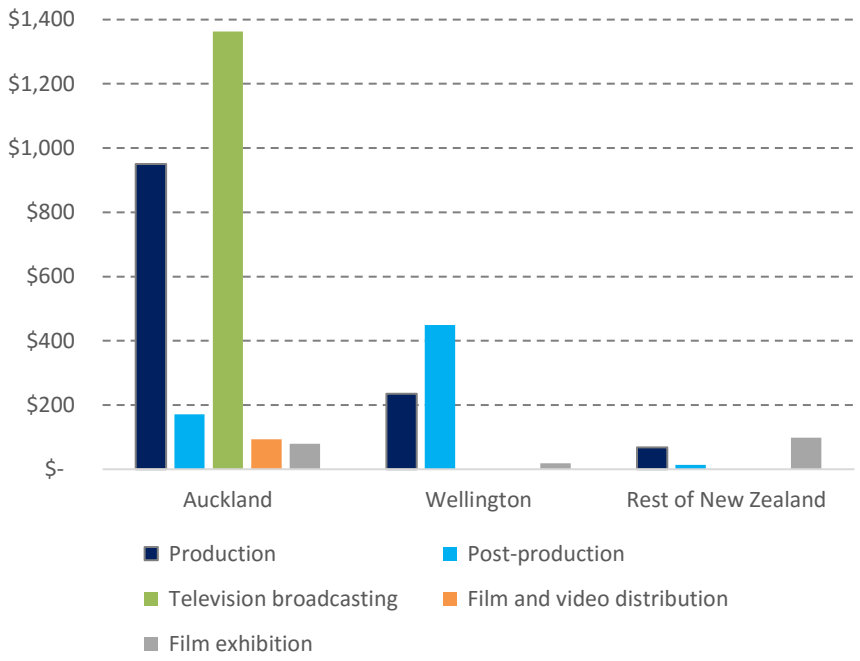
Post-production activities generated $449 million for the screen industry in Wellington during 2017. This represents 70.8% of the gross revenue generated from post-production that year in New Zealand.

In 2017, Wellington's screen industry's gross revenue came from the following four types of activity:

- Production ($235 million)
- Post-production ($449 million)
- Distribution ($1 million)
- Exhibition ($19 million).

Figure 8 Sources of revenue by sub-industry

$ millions, 2017

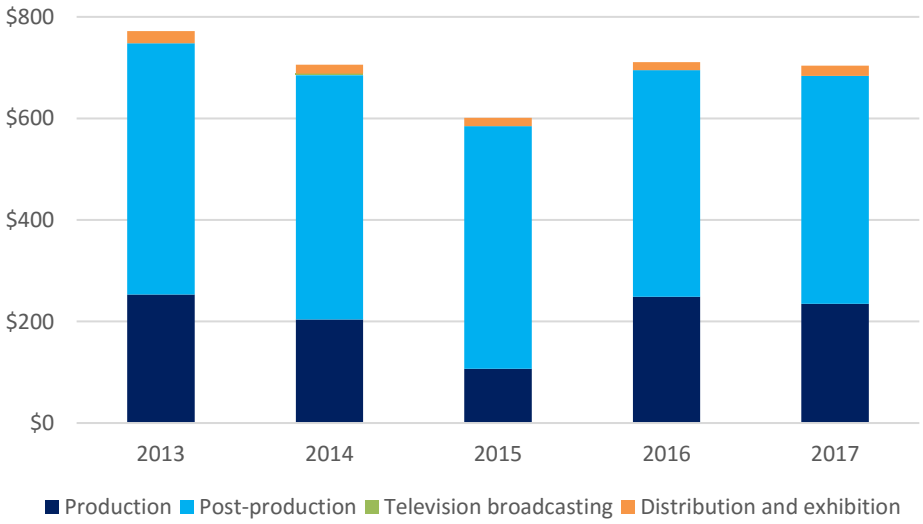


Source: Stats NZ *Screen Industry Survey 2016/17*

Wellington's screen industry's annual revenue between 2013 and 2017 ranged from $605 million to $770 million. Total revenue over the five years was $3.5 billion. Post-production revenue accounted for slightly more than two-thirds (67%) of the total revenue generated over that period.

Figure 9 Wellington's screen industry revenue trend

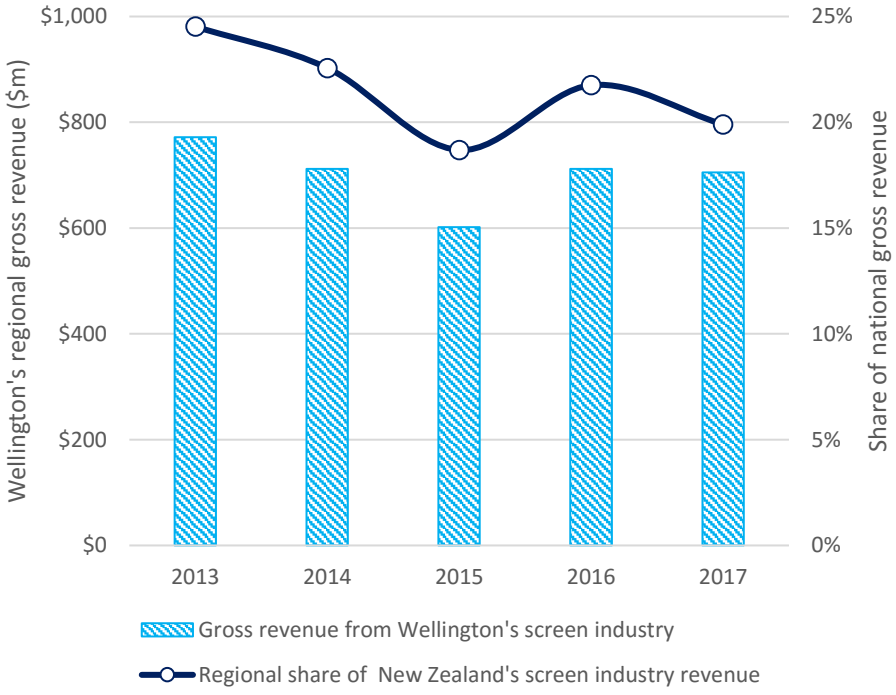
$ millions



Source: Stats NZ *Screen Industry Surveys 2015/16* and *2016/17*

The screen industry in New Zealand generated $16.3 billion in gross revenue between 2013 and 2017. The screen industry in Wellington contributed 21.4% of the revenue. Figure 10 shows the regional share of revenue generated varied from 19% to 24% over the five-year period.

Figure 10 Screen industry revenue generated by Wellington



Source: Stats NZ *Screen Industry Surveys 2015/16* and *2016/17*

3. The wider regional impact of the screen industry

The screen industry in Wellington also generates spending in and economic value through the procurement of goods and services from across the wider economy and other sectors.

To explore the wider economic contribution (direct and indirect) of Wellington's screen industry, we impose a 50% decrease in its revenue for 2017. We 'shocked' the industry decreasing its gross revenue by $352.5 million.

The rationale for halving the screen industry's revenue is to show what would happen if the industry was to shrink. It is a hypothetical scenario used to demonstrate the economic knock-on effects at the regional and national levels on GDP, household consumption, exports, wages and employment.

Wellington's economy would shrink by almost $150 million; and spending would fall by over $120 per person

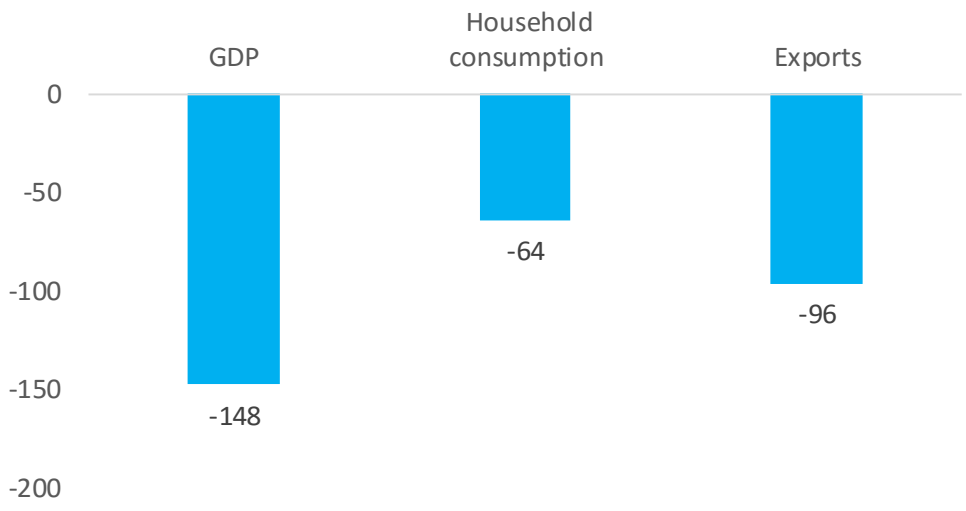
Figure 11 shows that a 50% reduction in screen industry revenue would reduce Wellington's GDP by $148 million.

Household spending, which is our proxy for well-being, would decrease by $64 million, or $123 per man, woman and child in Wellington.

International exports would decrease by $96 million, indicating that the Wellington's screen industry is export-oriented.

Figure 11 Regional impacts from shrinking Wellington's screen industry's revenue by 50%

Change from baseline (2017 $ millions)



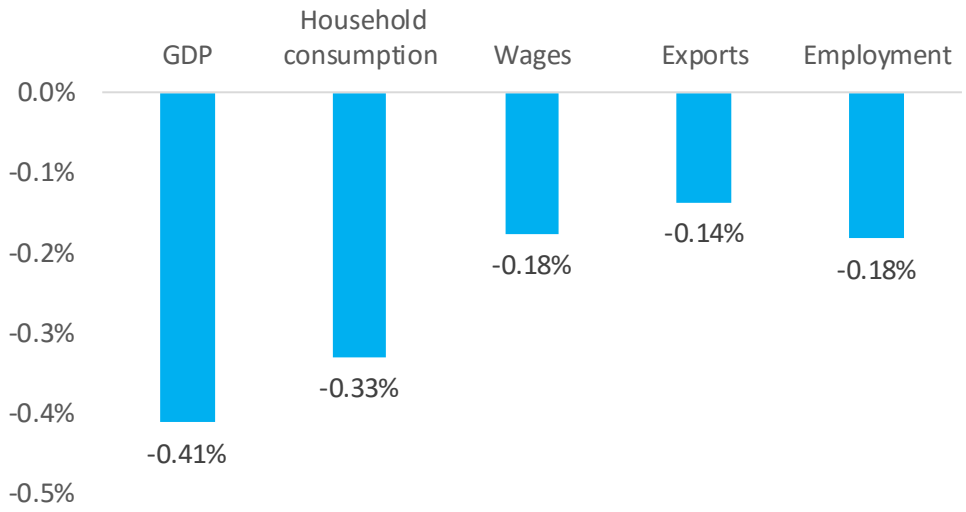
Source: NZIER

Regional GDP and household consumption would be 0.41% and 0.33% lower, than the 2017 baseline, respectively. Regional export volumes would fall by 0.14% and regional wages and employment both decrease by 0.18% (see Figure 12).

Based on 2017 employment data for Wellington, the 0.18% decrease in employment would equate to around 460 jobs across the economy being lost from a halving in the screen industry's revenue.[3]

Figure 12 Changes to the regional baseline from shrinking the screen industry in Wellington

% change from baseline (2017)



Source: NZIER

A contraction in the screen industry would also affect other industries

The screen industry plays an important role in supporting other activities in the regional and national economies. It has many linkages to other industries due to the complex nature of the goods and services produced and the diverse range of inputs required.

Figure 13 presents the flow-on effects on selected industries from reducing the screen industry by half.

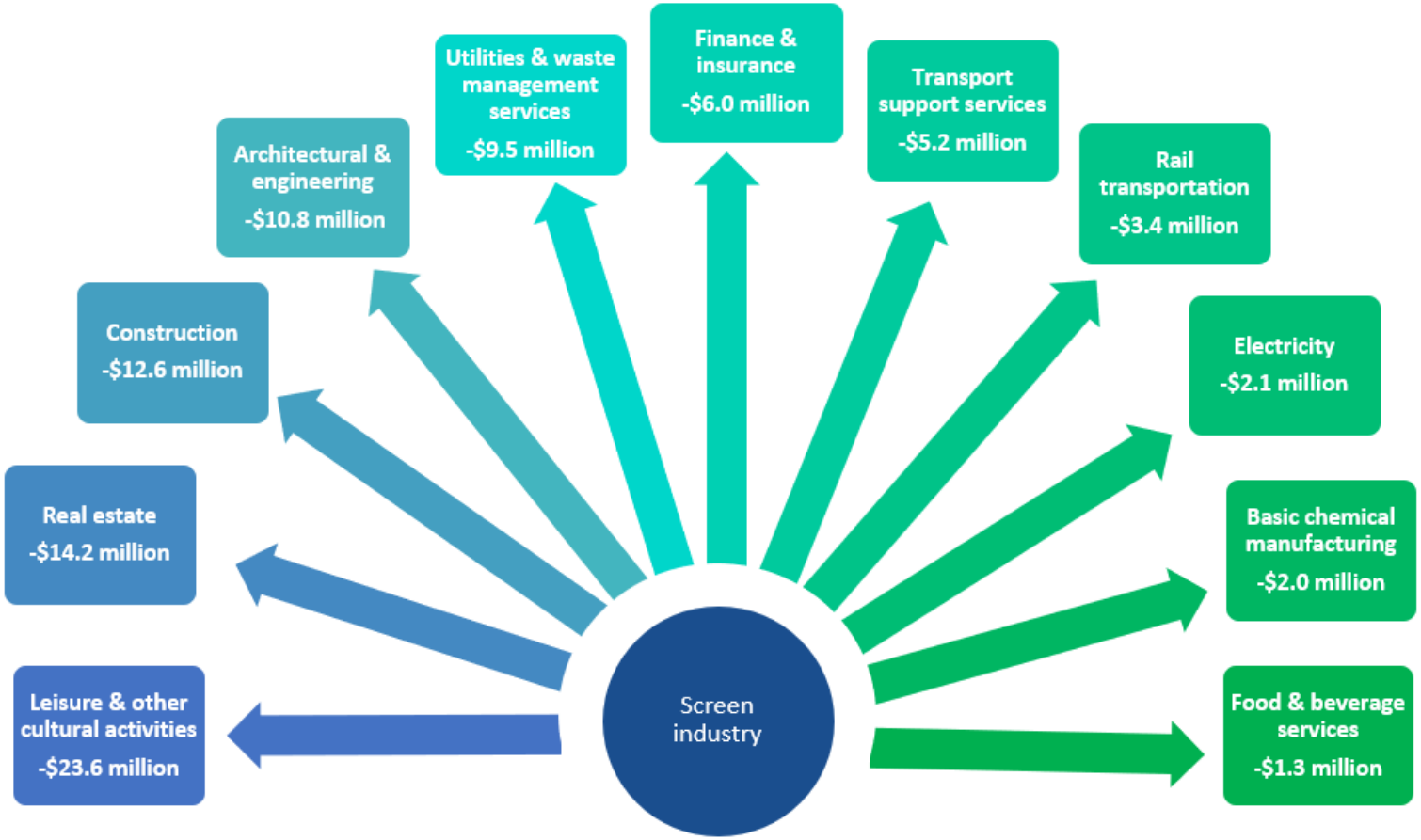
Supplying industries, which supply intermediate inputs to the screen industry, are expected to contract. Leisure and other cultural activities is the most-affected industry, with a $23.6 million decrease in its output. Leisure and culture activities covers visiting museums, galleries and attractions, plus sport and receation activities.

Real estate and construction are also strongly affected with reductions of $14.2 million and $12.6 million, respectively. See Appendix A for the impacts on all industries.

[3] Based on Stats NZ Business Demography data to February 2018. In our regional CGE model, Wellington workers who lose their job in one industry are able to find employment in other industries or regions over time. This moderates the overall negative impacts on economywide employment.

Figure 13 Flow-on effects on selected industries in Wellington when the screen industry is halved

Industry outputs, in $ millions



Source: NZIER

3.1. Gaps linking the industry to tourism

Wellington's screen industry has had an impact on growing New Zealand's tourism industry, particularly via the Lord of the Rings and Hobbit trilogies. In 2016, 292,000 international holiday visitors (18%) cited The Hobbit Trilogy as a reason for their initial interest in New Zealand.[4]

The economic impact of The Hobbit trilogy in New Zealand was previously estimated to have:

- Increased household welfare by $268.2 million
- Increased international visitor spending by $1.11 billion
- Increased tourism-related industry exports by $861.3 million.[5]

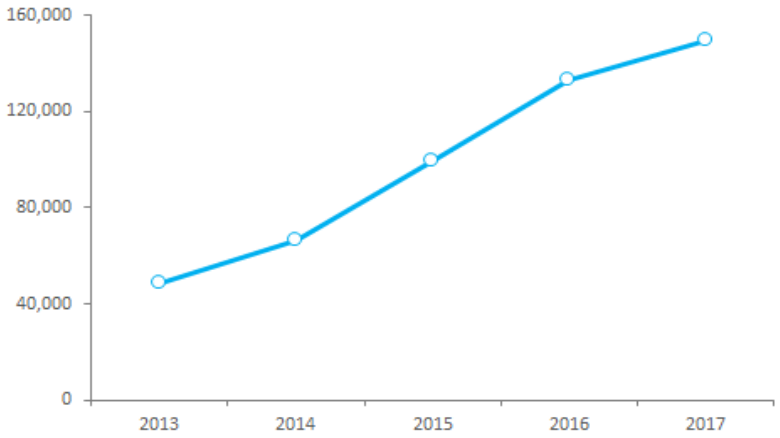
More tourists have visited New Zealand since these estimates were completed, so the economic impact will be larger.

Our modelling of the impact of Wellington's screen industry on the regional economy does not fully capture the effect of the screen industry on tourism. Tourism is the combination of a range of industries including, transport, accommodation, restaurants and attractions. This makes tourism quite challenging to capture in economic modelling, although as Figure 13 above shows, any contraction in the Wellington screen industry will have negative flow-on effects for food and beverage services and various transport industries. More research is needed to robustly establish the linkages between the Wellington screen industry and tourism in the region, and around the country.

What we do know is the number people taking Weta Studios Tours at Weta Workshop in Miramar continues to increase every year (see Figure 14). The number of people taking paid tours at Weta Workshop increased from 48,863 in 2013 to 149,579 in 2017.

Figure 14 Paid Weta Studios Tours

People on paid tours p.a.



Source: Weta Workshop

[4] https://www.tourismnewzealand.com/news/maximising-film-tourism-for-new-zealand/

[5] Li, S., Li, H., Song, H., Lundberg, C., & Shen, S., 2017. The Economic Impact of On-Screen Tourism: The Case of The Lord of the Rings and the Hobbit. *Tourism Management*, 60, 177-187.

4. Summary

Wellington's screen industry is a crucial part of the regional economy. In 2017 it generated:

- $705 million in revenue – around 20% of the national total
- $260 million of GDP
- Around 2,500 jobs
- Incomes that are higher than the national average for self-employed people.

Any contraction in the Wellington screen industry will have a material impact on the regional economy.

By way of example, if the Wellington screen industry halved in size:

- Regional GDP would fall by almost $150 million
- Overseas exports would drop by almost $100 million
- On average, every person in the region would spend $123 less on goods and services
- Regional employment would drop by around 460 jobs
- Supporting industries, such as leisure and other cultural activities, food and beverage services, construction and transport would also suffer.

There are also important tourism and cultural benefits associated with the Wellington screen industry that cannot easily be quantified, but on top of the economic benefits identified above, all combine to make the screen industry a vital cog in the Wellington economic machine.

Appendix A Additional results

Table 1 Industry impacts of halving Wellington's screen industry

Change from baseline (2017); Wellington industries only

Industry	Output change (in %)	Output change (in $m)
Leisure and other cultural activities	-1.28%	-23.62
Real estate	-0.33%	-14.27
Construction	-0.25%	-12.56
Scientific, architectural, and engineering services	-0.42%	-10.85
Utilities & Waste management	-1.28%	-9.54
Finance & Insurance	-0.13%	-6.03
Transport & storage	-0.60%	-5.17
Rail transport	-1.63%	-3.39
Electricity generation & transmission	-0.08%	-2.13
Petroleum and coal product manufacturing	-0.05%	-2.00
Food and beverage services	-0.13%	-1.30
Other transport equipment and parts	-0.26%	-0.84
Air and space transport	-0.14%	-0.73
Accommodation	-0.16%	-0.52
Mining & exploration	-0.13%	-0.33
Beverage and tobacco product manufacturing	-0.08%	-0.28
Education & health	0.00%	-0.26
Wholesale	-0.01%	-0.25
Fruit, oil, cereal, and other food product manufacturing	-0.03%	-0.17
Pharmaceutical, cleaning, and other chemical manufacturing	-0.11%	-0.15
Meat and meat product manufacturing	-0.02%	-0.14
Motor vehicle and motor vehicle parts wholesaling	-0.13%	-0.13
Poultry, deer, and other livestock farming	-0.10%	-0.12
Coal, oil and gas	-0.01%	-0.09
Textiles	-0.01%	-0.03

Industry	Output change (in %)	Output change (in $m)
Other manufacturing	-0.02%	-0.03
Metal manufacturing	0.00%	-0.02
Fishing and aquaculture	0.01%	0.00
Seafood processing	0.25%	0.03
Horticulture and fruit growing	0.04%	0.04
Sheep, beef cattle, and grain farming	0.01%	0.06
Dairy product manufacturing	0.05%	0.07
Machinery manufacturing	0.05%	0.11
Forestry and logging	0.06%	0.11
Clothing	0.48%	0.12
Dairy cattle farming	0.04%	0.12
Agriculture, forestry, and fishing support services	0.14%	0.13
Fertiliser and pesticide manufacturing	0.08%	0.16
Local government administration services	0.05%	0.17
Polymer product and rubber product manufacturing	0.04%	0.20
Wood product manufacturing	0.07%	0.21
Basic chemical and basic polymer manufacturing	0.33%	0.30
Electronic and electrical equipment manufacturing	0.20%	0.47
Central government administration	0.01%	0.48
Transport equipment manufacturing	0.36%	0.57
Road transport	0.11%	0.75
Recreational, clothing, footwear, and personal accessory retailing	0.22%	0.78
Publishing (except internet and music publishing)	0.62%	1.69
Paper & printing	0.53%	2.77
Retail	0.38%	6.82
Communication services	0.57%	14.07
Sport and recreation services	12.97%	44.82
Business services	0.98%	66.40
Total	**-0.50%**	**-323.93**

Source: NZIER

Appendix B CGE modelling

B.1 General equilibrium modelling captures the full impact of a contraction in the Wellington screen industry

To capture the full impact of the screen industry on the regional economy and New Zealand as a whole, we use one of our suite of CGE models.

CGE models are data-driven and used to capture the effects of a new policy or technology or other external shocks affecting economic activity. They capture the economy-wide effects of changes ('shocks' in modelling jargon) directly on the affected industry, as well as indirectly on supplying industries, competing industries, and factor markets (labour and capital).

CGE models also estimate the effect of a shock on macroeconomic variables such as GDP, employment, wages and trade.

CGE models are powerful tools, allowing economists to explore empirically many issues on which econometrics or multiplier analysis would be unusable. For these reasons, CGE models have become widely used internationally (e.g. by OECD, IMF, World Bank) for economic impact analysis.

B.2 Why do we prefer CGE over multipliers?

Multiplier studies[6] are popular for economic impact analysis as they are relatively cheap and produce appealing big figures. However, they are based on several assumptions which requires them to be interpreted and considered with considerably care.

Key caveats include that multiplier studies:

- Do not consider any adjustment path between the status quo and the future state of the economy
- Do not consider the impacts of policy changes on the price of goods, services, intermediate inputs, labour (wages) and capital
- Assume that land, labour and capital are available in unlimited quantities, and at no additional cost to firms
- Cannot consider the opportunity cost of using additional resources in one industry on the rest of the economy – there are almost never any losers (i.e. contracting industries) in multiplier studies.

Because of these assumptions, multipliers overestimate the impacts of a change in a particular industry on the rest of the economy. Both the Ministry of Business, Innovation and Employment (MBIE) and Treasury have highlighted the inherent flaws in using multiplier studies for serious economic analysis.[7] NZIER no longer offers

6 Also known as 'input-output studies'.

7 For an overview of these weaknesses, see the New Zealand Treasury and MBIE. Both documents, and Gretton (2013), clearly state that multipliers over-state economic impacts and thus lack credibility for economic analysis. Or in Treasury's words: "Unless there is significant unemployment of people with the requisite skills, **it is therefore likely that multiplier effects do not exist**".

multiplier-based analysis to our clients as they no longer align with our independence and reputation for delivering high quality, data-driven analysis.

For all these reasons, we prefer to use CGE models.

A CGE model provides an estimation of opportunity costs (between action and inaction), winners and losers. Resources are limited. It also considers price impacts of shocks and can capture regional linkages between industries as well as spill-over effects.

B.3 How do CGE models work?

A CGE model consists of equations which describe model variables. It also 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 for a baseline (or business as usual (BAU)) 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 evolves over time in response to a shock. These equations, which are based on the economic theory of general equilibrium, ensure supply and demand for goods, services and factors of production in the economy are balanced, and determine how firms and households react in response to changes in incentives.

Most CGE models are written and solved in a specific software system, usually GAMS[8] or GEMPACK.[9]

In any CGE model, we must choose as to 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 is just a way of explaining the endogenous variables in terms of the exogenous variables.

Where we draw the line between endogenous and exogenous variables, and which ones can vary or have to remain fixed, depends on a number of factors, including the purpose for which the model simulations are to be used. The choice that we make is called the model 'closure'.

Determining the closure is a key part of any modelling exercise and it is very important that the modeller be transparent about what is a result of the modelling and what has been imposed by assumption via the closure.

The difference between the initial and the new equilibrium can then be analysed to determine the effect of the shock on a range of economic indicators, such as GDP, employment, wages and living standards.

8 General Algebraic Modelling System: https://www.gams.com/

9 General Equilibrium Modelling Package: https://www.copsmodels.com/gempack.htm

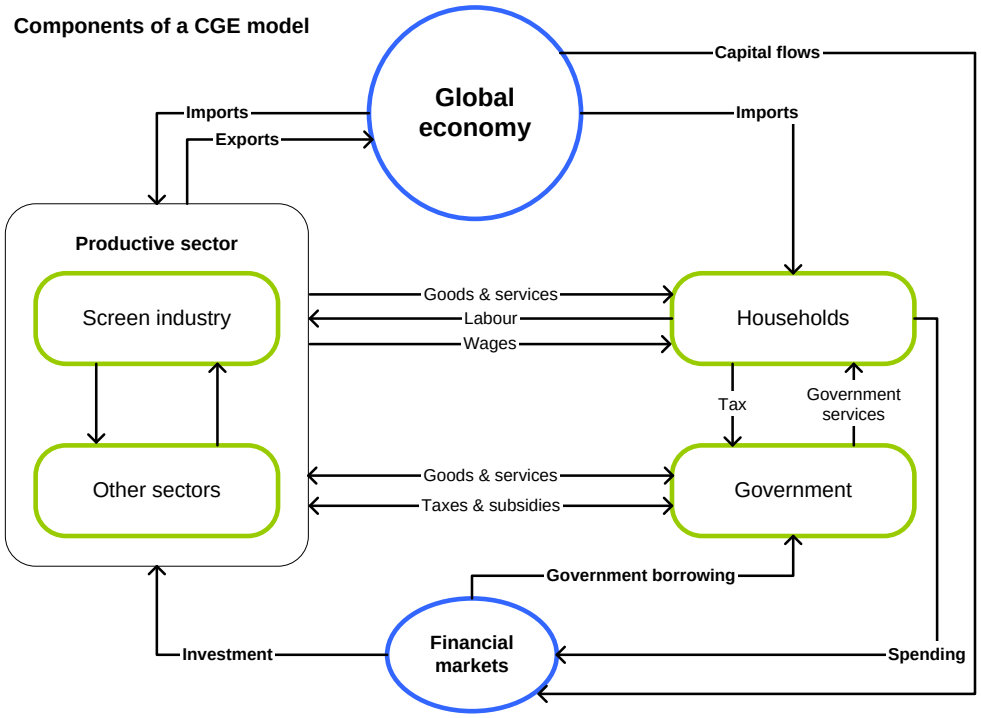
B.4 Our regional CGE model TERM-NZ

NZIER's TERM-NZ[10] model is the only top-down regional CGE model of the New Zealand economy.

TERM-NZ is based on Stats NZ's Input-Output tables that identify the structure of the industries involved. It contains information on 106 industries, 201 commodities and fifteen regions. It therefore offers a unique capability to highlight the contribution the screen industry makes to the national and regional economies.

Figure 15 shows how the model captures the complex and multidirectional flows between the various actors of each regional economy and how they interact with the rest of New Zealand and the rest of the world. More technical details on the model are available upon request.

Figure 15 Our CGE model represents the circular flows between all the agents and activities in the economy



Source: NZIER

B.5 Our modelling approach

B.5.1 Business as usual 2017

We want to assess the economic contribution of the screen industry in Wellington.

We first need to develop a baseline or BAU picture of the economy. To do so, we calibrate our model of the regional and national economies to the latest available data

[10] TERM-NZ was developed at NZIER based on the original Australian ORANI model created by Professor Mark Horridge of the Centre of Policy Studies, Victoria University-Melbourne, Australia. http://www.copsmodels.com/term.htm. NZIER maintains close connections with the Centre, ensuring that our modelling techniques reflect international best-practice.

from Stats NZ. This allows us to ensure we correctly benchmark the size of the various industries and gives us a BAU snapshot of the local, regional and national economies.

B.5.2 Modelling the economic impact of halving the screen industry in Wellington

To estimate the economic contribution of the Wellington's screen industry, we impose a 50% decrease in its revenue for 2017. The rationale for halving the screen industry is to show what would happen if the industry was to shrink. It is a hypothetical scenario used to demonstrate the economic knock-on effects at the regional and national levels on GDP, household consumption, exports, wages and employment.

We then determine the flow-on effects of our shocks throughout the national and regional economies on GDP and industry output.

B.6 Closure

As noted previously, in any CGE model, it is important to understand which factors have been allowed to vary and which remain fixed by assumption (also known as exogenous variables). The particular combination of fixed factors is known as the closure.

Since our CGE model is static, we don't know the solution path over time. Instead, we assume that the New Zealand economy operates within a certain timeframe, either long-run or a short-run, depending on the purpose of our simulations.

In the case of halving the screen industry in Wellington, we choose a long-run closure. The main assumptions which characterise a long-run closure are the following (see Table 2):

- National employment is fixed but labour is completely mobile between industries and regions, and real wages adjust. This is consistent with the idea that, both the labour force and the rate of employment are, in the long run, determined by mechanisms outside the model
- Household and government expenditures move together to accommodate a fixed balance of trade as a share of GDP
- Rates of return are exogenous, and capital is mobile between industries and regions. This mobility can occur either in the form of machinery etc. being physically moved, or capital in one industry/region being allowed to depreciate without replacement while investment builds up the stock of another industry/region
- Foreign currency prices of imports are naturally exogenous
- Real government consumption is also exogenous
- Other exogenous variables include rates of production tax, technological coefficients, national population, and national labour supply.

Table 2 Long-run closure

Fixed variables
Taxes on production
Technological change
Government demand
Gross growth rate of capital
Gross rate of return on capital
Number of households
National population
National labour supply
Import prices, foreign currency
Foreign demand for New Zealand exports
Land use

Source: NZIER