Cost Benefit Analysis of accommodating growth with existing policies

Report for Upper Hutt District Council

December 13 2019

SENSE PARTNERS

DATA LOGIC ACTION

Context

In the first half of 2019, Upper Hutt District Council asked Sense Partners to carry out a "status quo cost-benefit analysis" that assessed the costs and benefits to the local community of using existing plans to accommodate growth. The CBA informs Upper Hutt City Council's review of the Rural and Residential Chapters of the District Plan.

The CBA needed to be consistent with s32 of the Resource Management Act and establish a framework for smaller CBAs applied to plans at a more granular spatial level.

At this point, Upper Hutt City Council seek answers on:

- the likely costs of allowing the current plan and rules to continue
- the likely benefits of continuing the current plan and rules
- the outcomes – jobs, housing affordability, transport, amenity value –likely to be key in determining alternative plans
- the aspects of the CBA that need to be prioritised to accommodate likely options at the smaller spatial level.

Key points

Upper Hutt is set to grow…

- Over the past 5 years, Upper Hutt's population has grown by 9.5%.
- Expect population growth to continue. Available projections produced prior to the census suggest growth of 21.4% by 2047.
- More rapid population growth is also possible. High projections suggest an additional 12,800 residents (growth of 29%) by 2047.

…how we plan to accommodate growth will shape Upper Hutt

- Developers, firms and households will ultimately determine where growth will occur.
- But Council has a role to help set the rules and regulations that govern what gets built where and when.
- After a period of moderate population growth it makes sense to test the likely shape of growth under the status quo rules.

Status quo Cost-Benefit Analysis tests outcomes under current rules

- Our CBA show costs and benefits to accommodating growth under current settings.
- We adopt a broad approach that looks at environmental, social, cultural and economic costs and benefits.
- Our economic approach focuses on pull factors that draw residents to Upper Hutt, primarily jobs, local amenities and lower housing costs than elsewhere in the region.
- But we also consider push factors: transport costs, including commute times and the rising cost of housing. Historically, Upper Hutt has had the lowest housing costs relative to incomes in the Greater Wellington Metropolitan area.

Costs and benefits are uncertain….

- Many of the costs and benefits associated with accommodating growth within Upper Hutt are necessarily uncertain.
- Several costs and benefits relate to the provision of amenities – such as parks and open spaces – that have no market price.
- Residents will also have a variety of preferences over amenities, jobs, transport costs and housing options that we aggregate.

….so we use a mixed approach to triangulate likely costs and benefits

- Rather than rely on a single method we use information from a variety of sources to tests the costs and benefits of accommodating growth under current policies.
- We first draw on the international literature that suggests the type of amenities residents desire and indicative values.
- Next we look at New Zealand specific estimates of a range of amenities.
- Then we use a housing model that provides information on likely amenity values in Upper Hutt that we augment with other factors.

We find opportunity and not barriers to accommodating growth

- We find residents value land, access to the CBD, local parks and sunshine but value of historic sites is not from ease of access.
- Population growth will make more jobs available, increase incomes a little but makes for increased traffic congestion.
- Costs and benefits are not associated with one specific city form: greenfield and intensification both can work.
- Our work should inform specific local policy options by assessing specific costs and benefits with local zoning regulations.

Contents

Figures

1. Overview

Upper Hutt is growing…

Upper Hutt's population is set to grow by up to 21 percent over the next thirty years, adding a little over 9,000 extra residents.

This growth presents an opportunity to improve outcomes for residents. But the rules and regulation that govern how growth is accommodated by the market can have a material impact on the experience of residents.

…CBA helps find rules that best accommodate growth

Conducting cost-benefit analysis (CBA) across alternative rules settings can help reveal how rules can help the market allocate activity, to increase benefits relative to costs.

The general purpose of CBA is improved decision-making. Within this study we limit ourselves to assessment of costs and benefits under *status quo policy settings* for several reasons:

i. We have no agreed policy alternatives in hand.

ii. Assessing costs and benefits under the status quo can highlight the need for change by showing costs and benefits.

iii. Assessing costs and benefits can reveal the rules and approaches that might lift benefits and reduces costs.

But before we assess costs and benefits we first examine local trends and population growth. This ensures we understand the local context and the extent of likely future growth, at least without change in regulations. At this stage we also clarify whose costs and benefits we refer to: existing residents and future Upper Hutt residents.

Existing rules drive the impact of future growth

Existing planning rules and regulations – that regulate what can be built and what activities can take place in what locations where – will help determine outcomes across Upper Hutt. Identifying the regulations likely to impact on future growth is the second stage of our cost-benefit analysis.

Before testing if tweaks to existing rules can better manage growth, the costs and benefits of status quo regulations requires assessment.

Our CBA includes economic factors but also social costs and benefits

Such an assessment requires first identifying the economic pull factors that attract people to Upper Hutt, employment opportunities and local amenities, but also the push factors that can drive people away. These factors are housing costs and the time cost of commuting.

But our assessment needs to look more broadly than economic costs and benefits and span social, cultural and environmental impacts. Identifying these costs and benefits is the third stage of our cost-benefit analysis.

Assessing impacts can be complex…

Areas such as Upper Hutt are complex, with many interrelated factors determining outcomes for residents. Nevertheless, we quantify the relative costs and benefits to help inform District Plan decisions. This forms the fourth and final step of our cost-benefit analysis of using status quo policy settings to accommodate future growth (see Figure 1).

FIGURE 1: OUR CBA WORKS THROUGH CLEAR STAGES

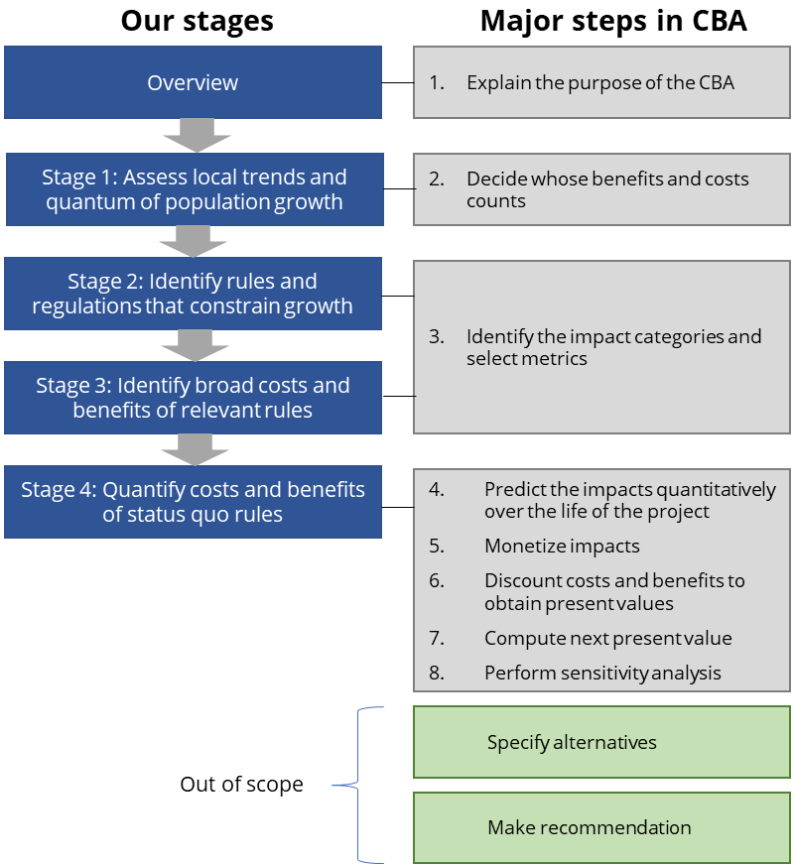


Figure 1 also shows our stages against the major steps in cost-benefit analysis.[1] At least for now, specifying alternative policies are out-of-scope and likely to be informed by detailed data at a local level. As such, no recommendation is needed in our assessment of the costs and benefits of the status quo rules and regulations.

Accounting for the Act

But in terms of scope, the Resource Management Act is clear. We need to be broad and:

(a) identify and assess the benefits and costs of the environmental, economic, social, and cultural effects that are anticipated from the implementation of the provisions, including the opportunities for:

i. economic growth that are anticipated to be provided or reduced; and

ii. employment that are anticipated to be provided or reduced.

and:

(b) if practicable, quantify the benefits and costs referred to in paragraph (a);

and

(c) assess the risk of acting or not acting if there is uncertain or insufficient information about the subject matter of the provisions.

So we require cost-benefit analysis to inform the District Plan.

[1] Boardman et al. 2018.

2. Assessing future growth

Upper Hutt today

Upper Hutt lies within predominantly flat, open land constrained by hills either side of the valley floor. Access to the Wellington CBD is 34 kilometres to the South.

Most of the housing stock comprises single level dwellings on flat sections sufficiently large enough for outdoor areas. Similar sized properties are significantly more expensive within Wellington and Lower Hutt. Along with easy access to many outdoor amenities, relative affordability of housing has attracted families to Upper Hutt who mix with older residents. Across all residents, Upper Hutt is ageing at a similar rate to the rest of New Zealand (see Figure 2).

Over half the local workforce pursue opportunities outside the local area, primarily commuting into the Wellington CBD (see Figure 16). More people move in and out of Upper Hutt than any other local council and is a key feature of the local landscape. Many residents are choosing relatively affordable housing and local amenities over higher transport costs, including commute times.

Prior to the Global Financial Crisis, employment opportunities within Upper Hutt used to be manufacturing. But today, administration, retail and education outstrip manufacturing employment within Upper Hutt (see Figure 3). Other opportunities are similar to other medium-sized cities in New Zealand.

FIGURE 2: UPPER HUTT IS AGEING LIKE THE REST OF NEW ZEALAND

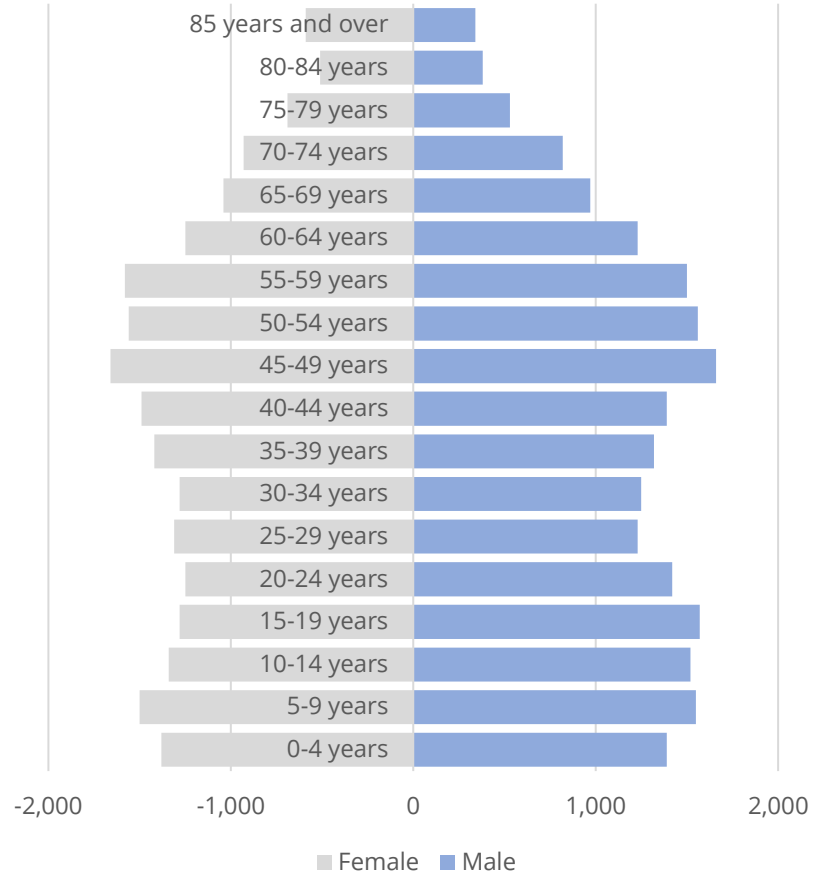


FIGURE 3: ADMINISTRATION PROVIDES MANY JOB OPPORTUNITIES

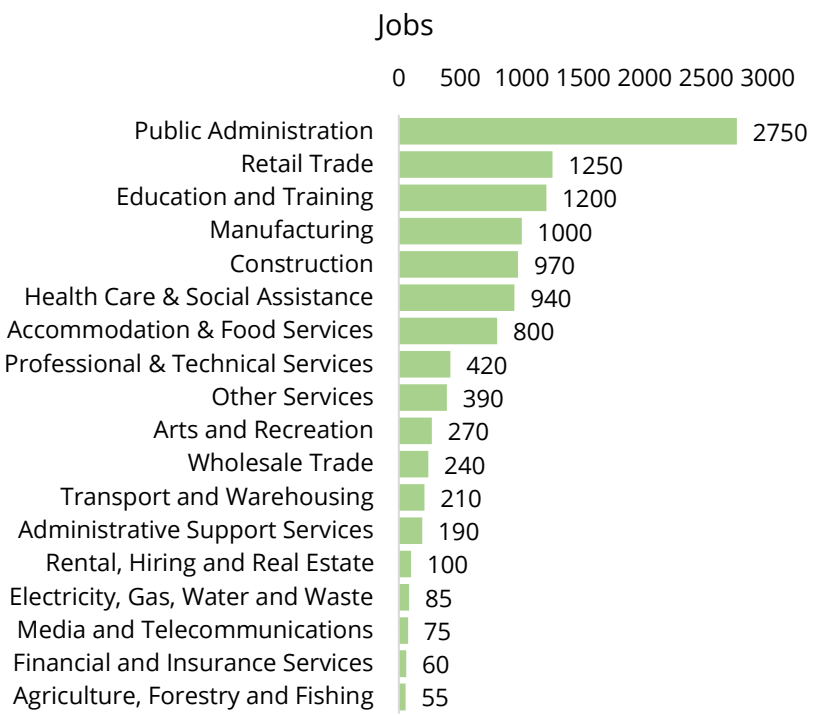
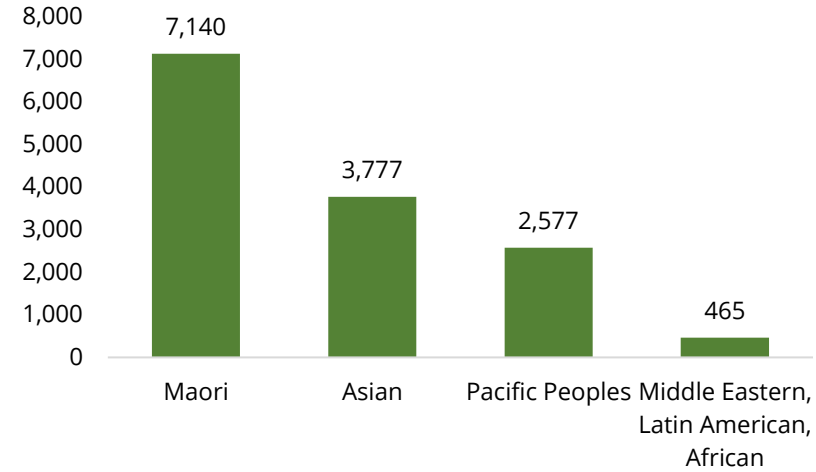


FIGURE 4: UPPER HUTT IS HOME TO DIVERSE COMMUNITIES



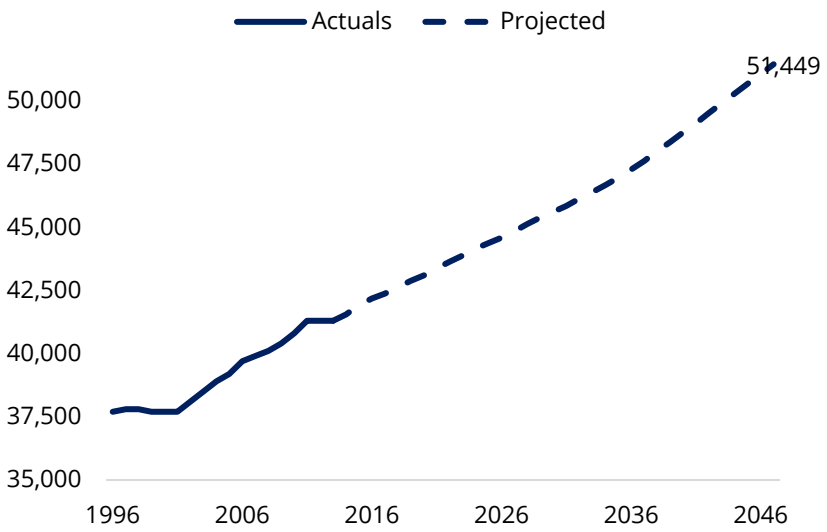
Source: Statistics New Zealand 2018 census

Local trends

Population

Figure 5 shows the extent of population growth Upper Hutt should expect. Of course, rules and regulations can accommodate or constrain growth. But without change, expect about 9,000 extra residents or an increase of just over 21 percent in the local population.

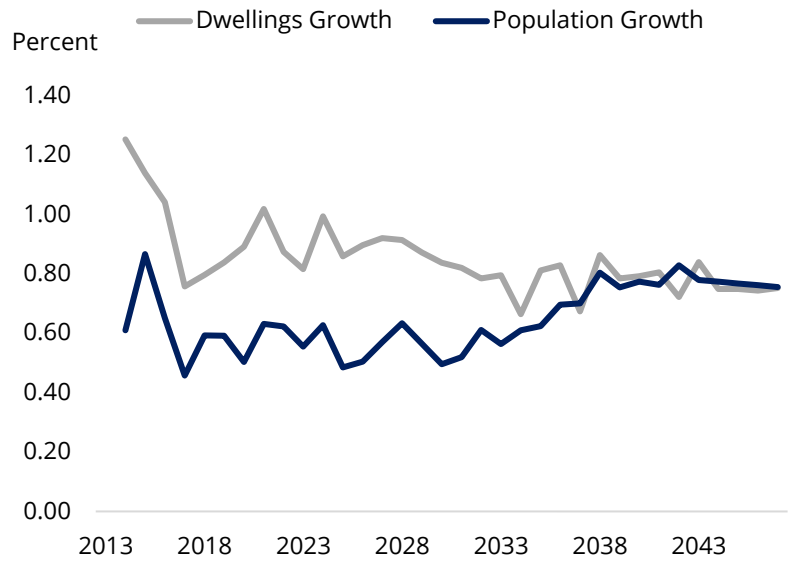
FIGURE 5: UPPER HUTT EXPECTED TO GROW



Sources: Statistics NZ, forecast id

But the demographic composition of population growth matters. Upper Hutt will continue to age a little. Since older residents are less likely to live with families, additional dwellings are required to accommodate the ageing of the local population (see Figure 6) in addition to population growth.

FIGURE 6: AGEING POPULATION REQUIRES MORE DWELLINGS

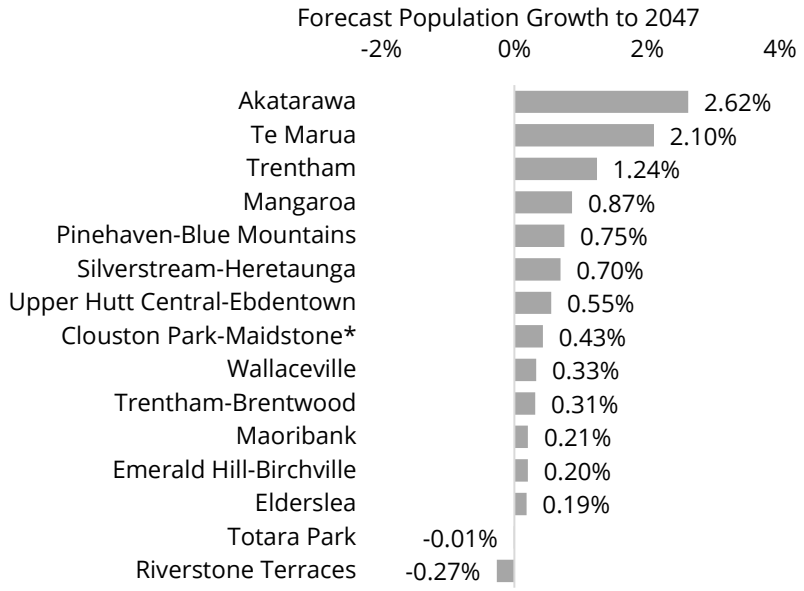


Sources: Statistics NZ, forecast id

These projections suggest Upper Hutt will need to integrate more people and more dwellings in the next thirty years. Local planning can influence the extent to which growth is accommodated. In addition, local planning can influence where growth occurs.

We should expect growth to be uneven, with some suburbs and areas better equipped to absorb growth than others. Based on existing rules and regulation Figure 7 shows that growth is likely to occur unevenly.

FIGURE 7: EXPECT GROWTH TO BE ACCOMMODATED UNEVENLY



*Includes Kingsley Heights

Sources: Statistics NZ, forecast id

Usefully, in response to the National Policy Statement on Urban Development Capacity, existing modelling suggests the likely areas and housing types to accommodate future population growth. Figure 8 shows stand-alone housing is expected to grow substantially with smaller but non-trivial increases in terraced, apartments and other dwellings to 2047.

FIGURE 8: STAND-ALONE TAKES THE LION'S SHARE OF DEMAND

PANEL (A): MEDIUM GROWTH SCENARIO

	Short term, (2017-20)	Med term, (2020-27	Long term, (2027-47)	Total, (2017-47)
Standalone	362	858	2,887	4,107
Terraced	132	377	415	924
Apartments	6	11	66	83
Other Dwellings	28	73	178	279
Total:	**527**	**1,319**	**3,546**	**5,392**

PANEL (B): HIGH GROWTH SCENARIO

	Short term, (2017-20)	Med term, (2020-27	Long term, (2027-47)	Total, (2017-47)
Standalone	576	1,234	2,932	4,742
Terraced	172	452	437	1,061
Apartments	13	16	68	98
Other Dwellings	41	95	181	317
Total:	**802**	**1,798**	**3,619**	**6,218**

In addition, previous work by council has identified where growth is likely to occur and identified existing constraints. For example, the 2016 Land Use Strategy identified potential greenfield growth areas including Wallaceville, Gillespies Road, the Southern Growth Area and Gabites Block. Additional sensitivity tests by MR Cagney suggests additional capacity is possible in the absence of land use regulations (see Figure 9).

FIGURE 9: UDC GREENFIELD SENSITIVITY TESTS

Greenfield site	Initial UDC estimate	Sensitivity test	Additional dwellings	Percent difference
Southern Growth Area (Guildford)	1,116	1,511	+395	+35%
Wallaceville	445	572	+127	+29%
Riverstone Terraces	99	129	+30	+30%
Kingsley Heights	369	856	+487	+132%
Fairview, Crest Rd, Gillespies	567	1,735	+1,168	+206%
Gabites Block	198	457	+259	+131%
Emerald Hill	24	31	+7	+29%
Total:	***2,818***	***5,291***	**+2,473**	**+88%**

Figure 8 and Figure 9 both provide a useful starting point for our CBA. They show the likely direction of growth when only accounting for economic feasibility, without changes in rules and regulations. Alternative rules and regulation might be expected to promote intensification or greenfields at different locations across Upper Hutt. Figure 8 and Figure 9 provide a base case for consideration.

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Economy

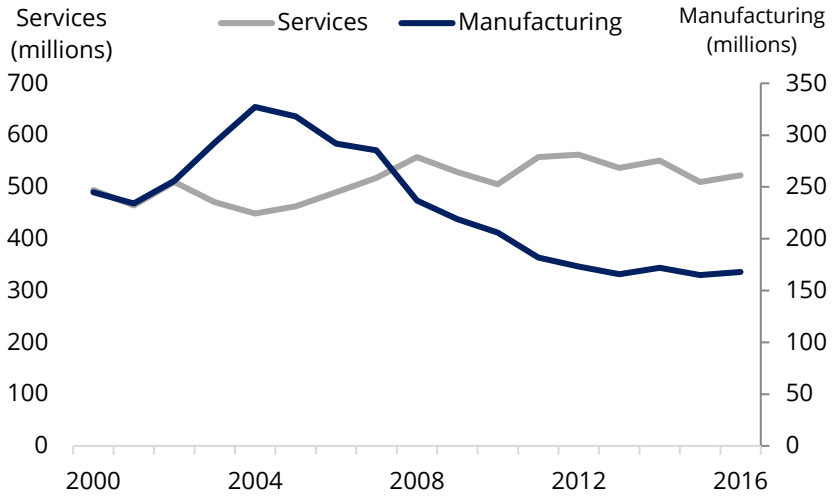
But planning regulations alone will not determine what happens in Upper Hutt. The strength and shape of the local economy will also determine outcomes. It is important to fully recognise the marked hollowing out of the local economy after the Global Financial Crisis (GFC) that continues to colour the shape of local activity.

After the GFC, many manufacturing firms struggled to return to profitability. Right across New Zealand the economy has progressively switched from manufacturing towards services (such as retail trade, accommodation, health care and education) across several decades.

To an extent, the GFC sped-up the pace of change with services pushing ahead locally while manufacturing failed to fully recover (see Figure 10 that shows manufacturing activity declining sharply).

FIGURE 10: MANUFACTURING ACTIVITY IS MUCH WEAKER

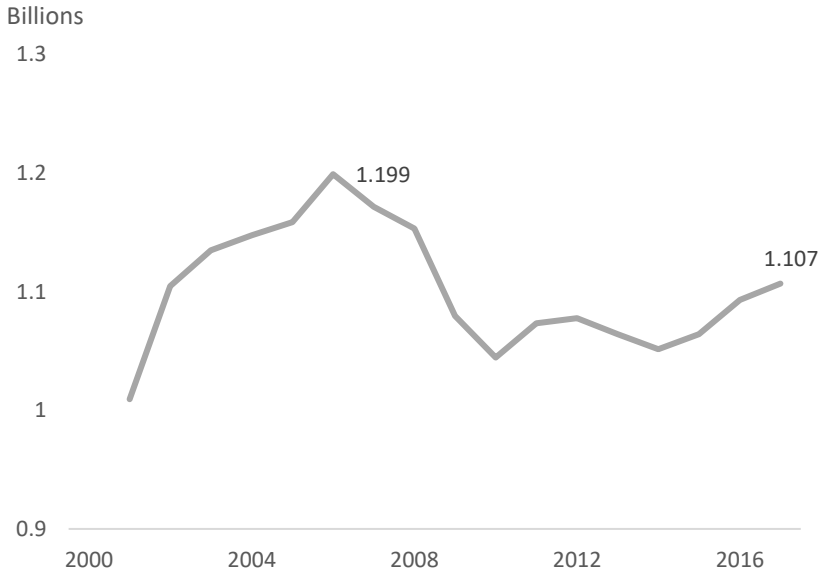
Estimated GDP for Services and Manufacturing, Upper Hutt



Sources: MBIE, Sense Partners

The decline in manufacturing pulled down economic activity for several years. Since 2014, the decline in activity has been arrested and estimates of GDP within the area have posted modest growth (see Figure 11).

FIGURE 11: ECONOMIC ACTIVITY ON THE RISE AGAIN



NB: Economic Activity is MBIE's modelling of real GDP($m). See:

https://www.mbie.govt.nz/business-and-employment/economic-development/regional-economic-development/modelled-territorial-authority-gross-domestic-product/

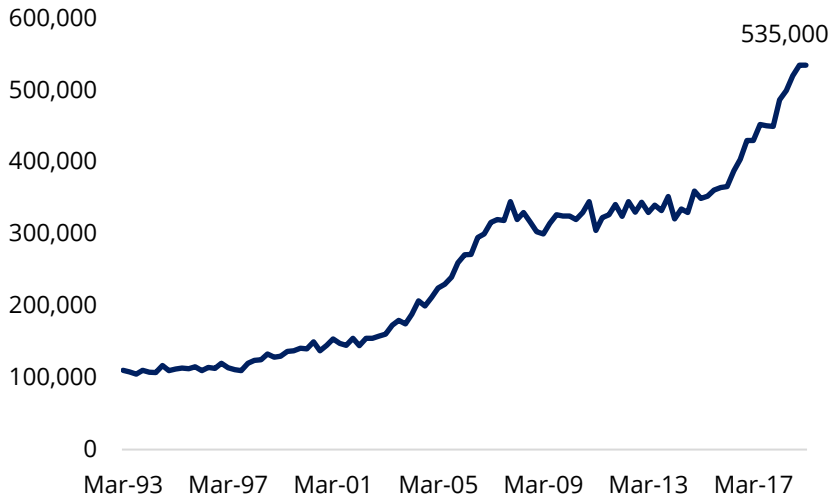
But even today, employment within Upper Hutt remains lower than prior to the crisis (see Figure 12), some ten years after the peak. But the most recent years show employment is growing again, suggesting the local economy will begin to draw additional residents to the local area again.

FIGURE 12: LOCAL EMPLOYMENT YET TO ATTAIN PRE-GFC LEVELS

Housing

Despite modest economic growth, house prices have soared over the past three years, fueled in part by lower interest rates, but also the lack of affordable housing across the broader Wellington region (see Figure 13). House prices have increased by an average of 15 percent over the past three years.

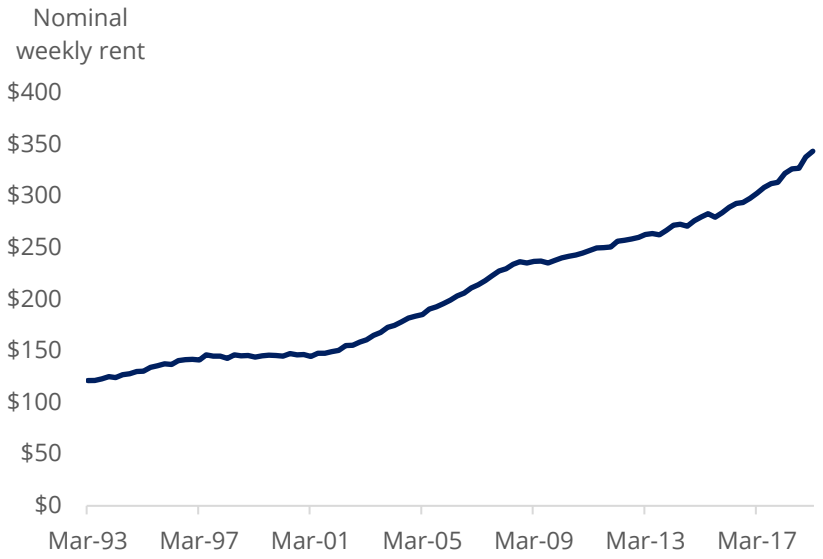
FIGURE 13: OVER THE PAST 3 YEARS HOUSE PRICES HAVE SOARED



Sources: MBIE

As residents weight up the decision to buy increasingly expensive property, rents have also moved higher – up 24 percent or about 8 percent per year over the same period.

FIGURE 14: RENTS HAVE ALSO TRACKED HIGHER



Sources: MBIE

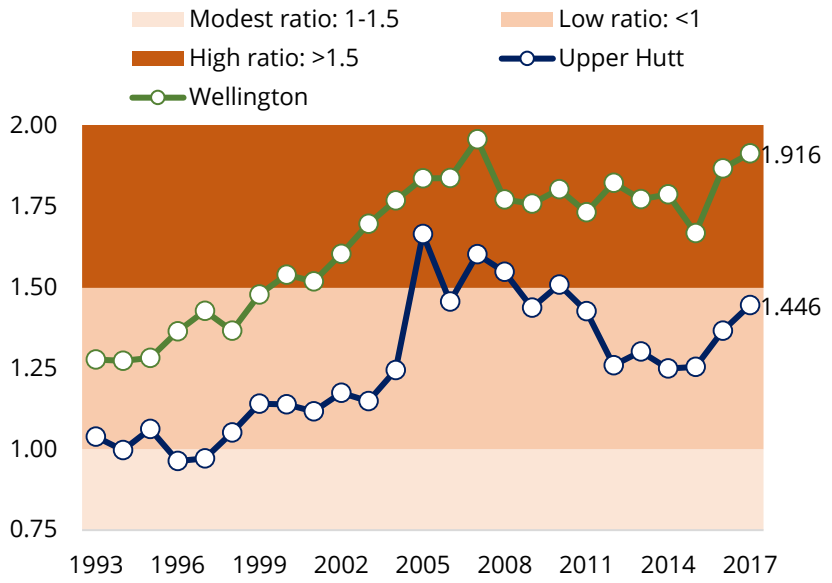
House prices of this size erode much of the value proposition Upper Hutt holds for residents – good housing situated close to amenities at affordable prices. This reduces the attractiveness of Upper Hutt as a location.

When a house sells and exchanges hands, assets are transferred between one group of people and another. So at least at first-pass, increases in house prices merely increase benefits for one group that are offset by costs for another group. Traditionally, these transfers of assets have been treated as offsetting. So changes in house prices are not usually included in Cost-Benefit Analysis, even though the cost of housing is clearly rising, reducing the welfare of renters, for example

A quick guide to the extent to which land use regulations might be playing a role can be garnered by looking at the price-cost indicator – the costs of building relative to the price of the current housing stock. If land use regulations are particularly restrictive and costly, then over time, the current housing stock will sell at a premium to the cost of a new build.

Figure 15 shows that for Upper Hutt, while house prices have been rising relative to the cost of new builds, this ratio does not appear relative to historical experience of other regions of New Zealand such as Auckland and Wellington City.

FIGURE 15: HOUSE PRICE GROWTH OUTSTRIPS BUILD COSTS



Sources: Statistics NZ, forecast id

Box A: The price-cost indicator

The price-cost indicator shows how responsive land supply is to demand.

When land supply is responsive and there are enough infrastructure-ready sections to meet demand, land should be a minor part of the cost of a home and the price of a home should mostly reflect the cost to build it.

If house prices mostly reflect the cost of building then the ratio of the house price to the cost of its construction should be close to one. But if there is a shortage of available land, then land prices can push house prices far beyond their construction costs. So the gap between house prices and construction costs – the price-cost ratio – can be used as a general indicator of the flexibility of land markets to accommodate new homes. Ratios calculated by MBIE for other New Zealand cities suggest:

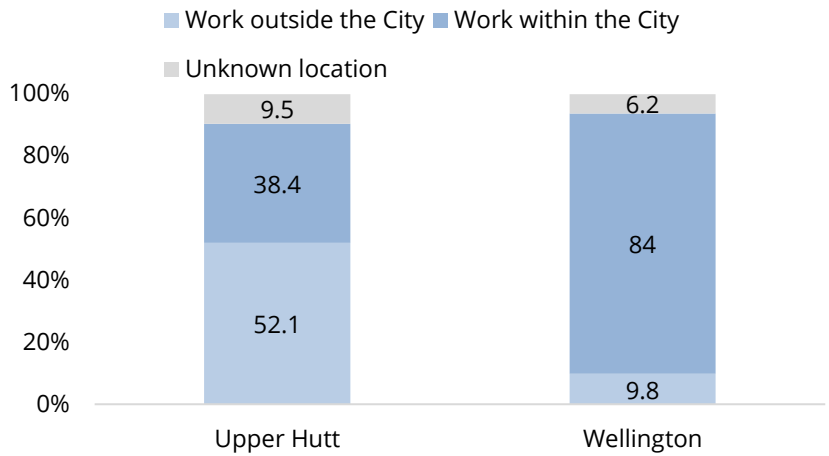
- ratios below 1 might occur in places or times where there is no growth, with houses selling below the construction cost to replace them.
- Ratios between 1 and 1.5 (that is, where the cost of an infrastructure serviced section comprises up to one-third of the price of a home) are common where the supply of land and development opportunities are relatively responsive to demand.
- Ratios above 1.5 signal that the supply of sections and development opportunities is not keeping pace with demand and land prices are materially increasing house prices.

So at least for now, existing rules and regulations do not appear to be the primary driver of house price growth in Upper Hutt.

Transport

Perhaps the defining feature of Upper Hutt is the number of people that live within Upper Hutt but find employment outside the city limits. Figure 16 shows that over half the residents in employment work outside Upper Hutt – one of the highest rates of commuting for employment outside the local area for any local council. As a point of comparison workers from Wellington City are almost all employed within the city limits.

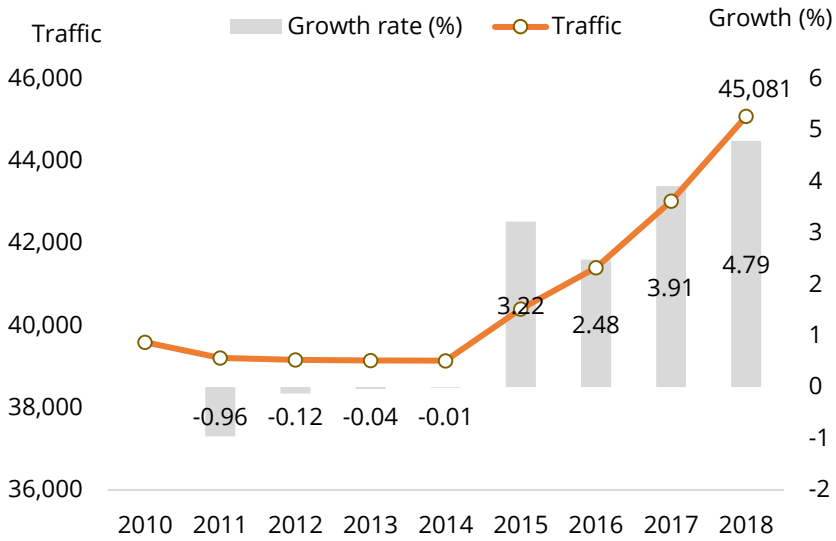
FIGURE 16: MOST RESIDENTS WORK OUTSIDE UPPER HUTT



One implication of such high commute flows points to the comparative advantage of Upper Hutt to provide housing and amenity locally, but employment opportunities that reside elsewhere. This presents a risk that if housing costs rise relative to the broader Wellington region, the benefits of living in Upper Hutt are eroded.

With so many workers leaving for Wellington each day, commute times are an important determinant of the relative opportunity of living in Upper Hutt. Figure 17 shows that traffic flows have been steadily increasing after a period of flat demand.

FIGURE 17: STATE HIGHWAY 2 TRAFFIC ARE VOLUMES GROWING



Sources: NZTA, aggregated selected sites north and south of Upper Hutt

3. The critical land use regulations

Promoting land supply

At times local land use regulations often face a tradeoff between promoting land and housing supply and often mitigating negative spillovers from activity that might occur in unregulated environments.

Recent National Policy Statements (the NPS-UDC for example) have aimed to increase supply by refocusing existing local authority efforts to ensure sufficient housing and business demand needs are met.

Before considering spillovers Panel (a) of Figure 18 shows the impact of an increase in demand for housing – consistent with the ageing and increase in the Upper Hutt population we expect over the next thirty years. The stock of housing increases and the price of housing rises.

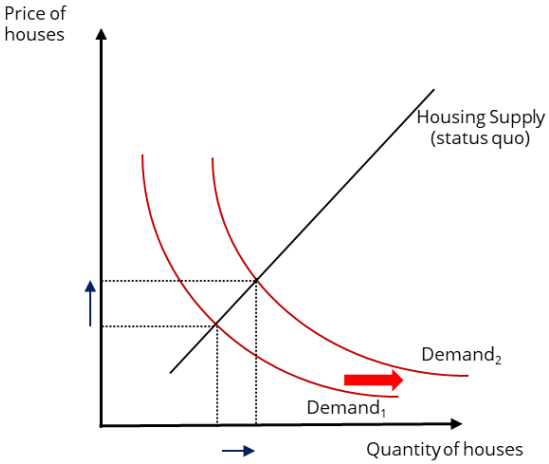
Panel (b) shows the case where housing supply is more flexible and accommodates a greater increase in the housing stock that moderates the increase in prices from the initial increase in demand.

On its own, the increase in demand in panel (a) is not problematic. From a welfare perspective, new and existing homeowners trade homes with existing homeowners. Prospective buyers find it more difficult when prices rise but sellers benefit.

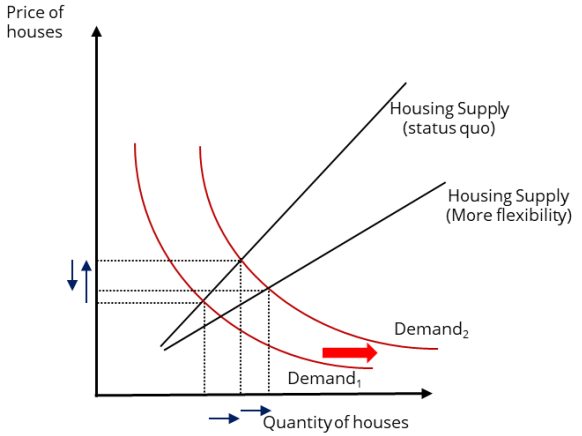
But under panel (b) the consumer surplus, that is, the difference between what consumers pay and are willing to pay, has increased .The responsiveness of demand and supply of housing to changes in price will determine the extent to which suppliers of new housing benefit any change in conditions.

FIGURE 18: FLEXIBLE HOUSING SUPPLY ACCOMMODATES DEMAND

Panel (a) Population and ageing increases housing demand for Upper Hutt



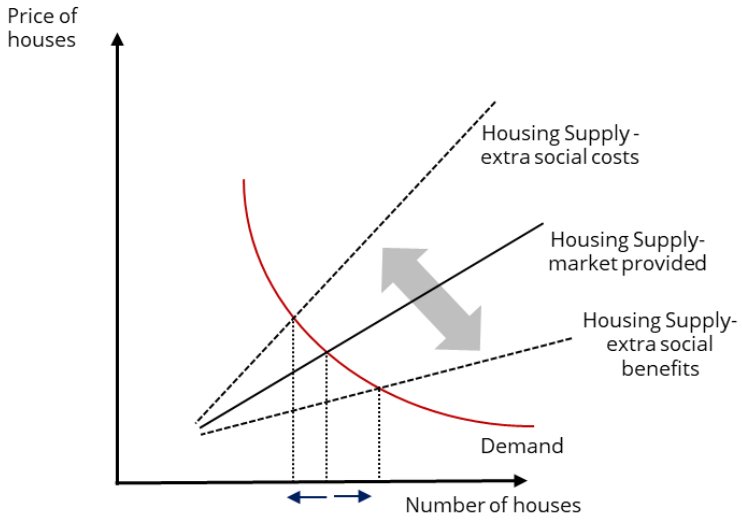
Panel (b) More flexible supply reduces the house price impact



Beware of negative externalities, nurture positive spillovers

But people do not live and work in a vacuum. Some activities can carry local benefits while other activities can carry costs to residents. So the type and quantum of housing supply can either promote or inhibit the *social costs and benefits* of housing supply (see Figure 19).

FIGURE 19: RULES NEED TO ADDRESS SOCIAL COSTS AND BENEFITS



Classes of key land use regulations

Before determining the costs and benefits of growth under the status quo rules and regulations, we first identify the relevant rules likely to generate material impacts. We set to one side bylaws (for example the Brothels Bylaw, Control of Temporary Signs Bylaw and the Dog Control Bylaw) to focus on land use regulations that determine what can be built where.[2]

We distinguish five classes of regulations: [3]

(i) location controls,
(ii) density regulation,
(iii) design controls,
(iv) controls on alterations to existing buildings and
(v) controls that manage environmental impacts.

One key rule for urban rules and regulations is to help mitigate the negative side of urban growth (such as the noise and pollution from heavy industrial activities that de Vor and de Groot 2011 quantify, transport congestion and environmental impacts such as storm-water run-off) and promote the positive benefits (such as helping shape links between dwellings and parks and transport links).

Rules and regulations are important. Firms and households determine outcomes, not the rules and regulations on their own. Figure 20 lists our 5 classes of regulations alongside some examples. Impacts from changes to these rules will be location-specific so only potential benefits and general scales of impact are possible without recourse to detailed proposals.

[2] Section 32(1c) of the Resource Management Act directs "a level of detail that corresponds to the scale and significance of the environmental, economic, social and cultural effects that are anticipated from the implementation of the proposal."

[3] See for example the theoretical treatment in McDonald and McMillen (2003), the general explainer by Nunns and Rohani (2016) and Lees (2014, 2015) for the case of Auckland.

FIGURE 20: LIKELY IMPACTS OF SUITE OF REGULATIONS

Regulations classes	Examples of regulations	Potential benefits	Amenities affected	General scale of impact
Controlling location	• Residential zones – eg permitting one dwelling per site, controlling 2 or more dwellings on a single site	Manage activities in a specific location	Housing affordability	High
	• Business zones – eg controls on service stations, motor vehicle garages and public car parks		Housing affordability	Medium
	• Regulating open space zones, permitting organised fireworks displays and active recreation – as a discretionary activity.	Promote positive public *externalities*, which generate broader benefits for others market prices don't capture	Open space	Low – little overall impact on amenity or housing
Regulating density	• Building height limits -not higher than 8 metres	Protect sunlight to minimise negative externalities when others suffer costs from market transactions	Sunshine	Medium – Willingness-to-pay estimates for sunshine are high
	• Maximum site coverage – eg 45% for Comprehensive Residential Development in the Residential (Centres Overlay) Areas	Minimise *negative* externalities, which impose, social costs not captured by market prices	Sunshine, open space, land	Medium
	• Setbacks – eg 4 metres from the boundary along all other roads	Minimise *negative* externalities, which impose, social costs not captured by market prices	Sunshine, open space, land	Medium – likely to have some impact on development
	• Minimum lot sizes – eg 400 square metres (6m minimum frontage)	Minimise *negative* externalities, which impose, social costs	Sunshine, open space, land	Medium – will impact number of houses in new subdivisions
	• Density controls - No more than three non-resident persons may be	Minimise *negative* externalities, which impose,	Sunshine, open space, land	Medium – won't change stock but impacts new growth

Regulations classes	Examples of regulations	Potential benefits	Amenities affected	General scale of impact
	engaged in the home occupation at any one time.	social costs not captured by market prices		
	• Subdivision controls – Council may impose conditions on: car access, earthworks, financial contributions and protection of special amenities	Minimise *negative* externalities, which impose, social costs not captured by market prices	Sunshine, open space, land	High – large impact on ability of greenfields to accommodate growth
Controlling design	• Minimum parking requirements – Two per dwelling unit or 1 per dwelling unit for Comprehensive Residential Developments		Can raise costs of dwellings	Low
	• Minimum dwelling size		Housing affordability	Medium
	• Outlook and daylight controls – on all side and rear boundaries		Views, sunshine, housing affordability	Medium
	• Landscaping requirements – accommodated in part by setbacks	Landscaping provides *non-rival* benefits, benefits which cannot be excluded for enjoyment by many – likely to be under-provided	Environment	Low
	• Street design rules	Safety and promote efficient commuting times	Environment, congestion	Low
Controlling alteration	Heritage demolition controls including if a building, feature or site has strong historic associations with significant events or notable people or groups for inclusion in schedule.	Has public good benefits for neighbours and public	Environment	Low – unlikely to have large impacts on supply in Upper Hutt
	• Tree protection, eg trees assessed as having amenity using STEM method	Has public good benefits for neighbour and public	Environment, open space	Medium

Regulations classes	Examples of regulations	Potential benefits	Amenities affected	General scale of impact
	• Cultural sites – including whether adequate consultation has taken place and the importance of the feature to tangata whenua	Meet Treaty principles, inclusive treatment of different community views	Unknown	Unknown – test with survey or stakeholder meetings
Managing the environment	• Significant ecological areas	Reduce environmental externalities	Environment	Unknown – test with survey or stakeholder meetings
	• Limits on development in sensitive ecological areas, eg new buildings (except underground cables and lines) within 20m of the bank of any waterway with a width of 3m or more	Reduce environmental externalities, reduce conflict between different users, impact on the Hutt River and tributaries	Environment	Unknown – test with survey or stakeholder meetings
	• Earthworks controls	Reduce environmental externalities	Environment	Unknown – test with survey or stakeholder meetings
	• Transport noise corridors	Reduce environmental externalities	Environment	Unknown – test with survey or stakeholder meetings
Rural zone rules	• Subdivision activities (eg lots need road access)	Reduces rural land *fungibility*, i.e., opportunity to transform the land into other types	Open space, housing affordability	Low – expect market to generally provide lots with road access
	• Minimum standards for subdivision eg setbacks	Reduces rural land *fungibility*, transforming the land into other types	Open space, housing affordability	Low
	• Permitted land use activities (eg farming, forestry permitted, topsoil removal is discretionary)	Reduce environmental externalities, GWRC will also have responsibilities	Environment	Low
	• Restricted discretionary activities	Reduce environmental externalities	Environment	Low – not clear

Location controls are common. Design tries to minimise the spillovers from one class of activity to other activities. Historically, zoning separated noise and pollution from heavy industrial activity from residential locations. Location controls extend not just to the location of activity but to controls over what activities can operate within each zone. Location controls also manage open spaces.

Our second tranche of controls manage density. These controls regulate the maximum number of dwellings and the type of dwellings within at a location. Some density controls, such as limits on building heights and the minimum size of apartments, might be expected to bind tightly in large cities. Other controls – that manage minimum lot sizes and maximum site coverage – can have large impacts on the ability of inner-city suburbs to intensify and absorb population growth.

Many regulations also focus on controlling the design of not just common spaces such as street design, but also dwellings. These design controls can stipulate requirements to provide natural light, street outlooks and land-scape requirements. These regulations might be expected to have less impact on overall costs and benefits than regulations that control location, but research shows many design aspects can have positive benefits and others appear to have costs that outweigh benefits, at least in some contexts (see MR Cagney 2013).

A fourth tranche of planning regulations act to preserve existing sites that may have significant heritage, environmental or cultural amenity. Since these values are non-rival and return to the public, rather than only private citizens, these broader values are unlikely to be captured by market prices.

A final set of regulations sets out controls and standards to preserve the environment. These controls include air and water quality controls and limit activity that might otherwise undermine the local environment. Since Upper Hutt is in a valley with a large waterway and has many natural areas that provide amenity. These regulations could be expected to play more of a material role than in some other locations.

Measuring impacts

Complex urban environments need a broad set of metrics

Our cost-benefit analysis spans many factors that impact on impact on how residents – and future residents – experience living in Upper Hutt. This spans more than the employment and economy activity the Resource Management Act requires us to have regard to. So in our framework, we need to include environmental, social and cultural elements alongside economic impacts (see Figure 21).

Some social and environment factors can be revealed through the observed willingness-to-pay for locations that provide different amenities. And consistent with much of the urban cost-benefit literature, we use a hedonic pricing model to reveal the amenity value of some factors.

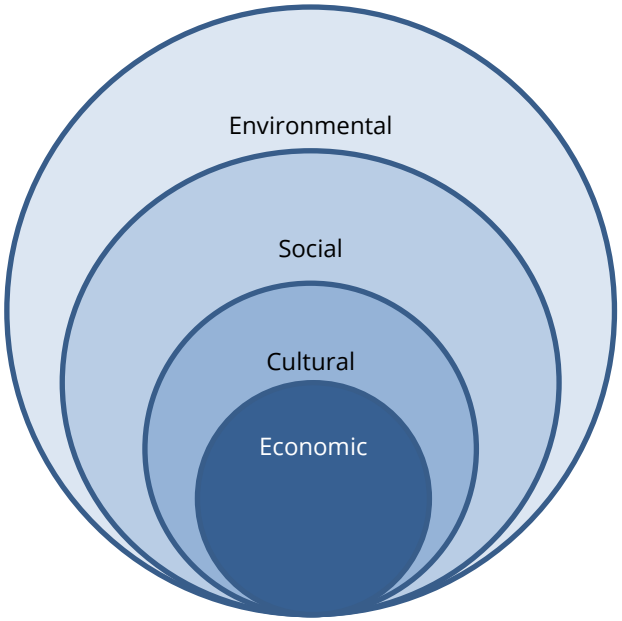
But some factors are harder. If changes in the environment are likely to be substantive, then non-use values may be needed to measure impacts.[4] We

[4] See Clough and Bealing (2018) for detail on non-use values that are value that accrues from knowing a particular feature of the environment will exist in the future – aside from any value from using the feature.

lean on the literature and other studies to help quantify the size of local effects.

These effects include the variety of consumption and services that denser areas and consumer markets generally provide (see Schiff 2015, Couture 2016 and Ahnfeldt 2019).

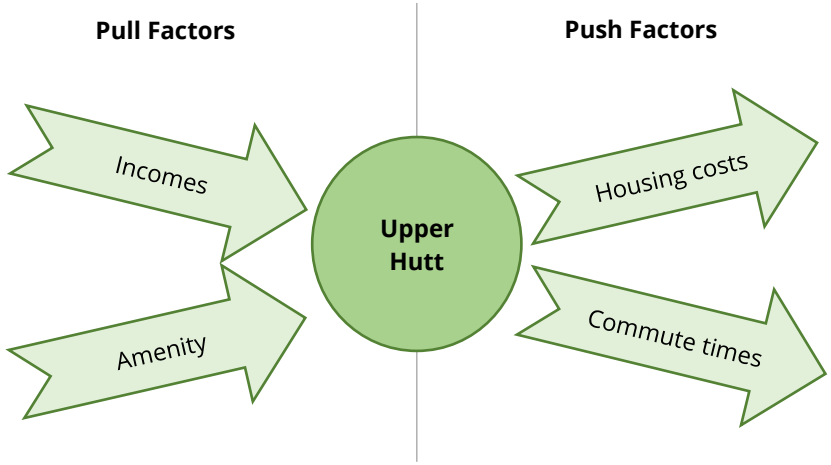
FIGURE 21: OUR METRICS MUST SPAN A RANGE OF FACTORS



We will integrate existing supply-side assessments by using development feasibility models. This assessment is critical to show the interactions between supply and demand that determine the quantity of housing that will likely be provided and the likely cost of housing under existing regulations. Development can occur outside of plan enabled capacity and not all commercially feasible development is likely to occur.

To quantify the economic factors, we distinguish between "pull" factors that encourage people to move into Upper Hutt and "push" factors that drive people away (see Figure 22).

FIGURE 22: THE ECONOMIC APPROACH EMPHASISES THE FORCES THAT DRIVE SPATIAL EQUILIBRIUM



Our approach to evaluating economic factors uses spatial equilibrium to assess relative costs and benefits. In equilibrium, the population of Upper Hutt is constant relative to other areas. This can only occur when the pull and push factors are balanced. So at a high-level, population flows provide a strong indication of the relative attractiveness of a given location.

Our three-pronged approach spans theory, international and domestic evidence to triangulate on values

Since the scope of the cost-benefit analysis is broad and likely to require several metrics that are not easily quantified, our approach to CBA is to use a three-pronged approach to obtain the relevant parameters and estimates.

FIGURE 23: WE MEASURE ECONOMIC PUSH AND PULL DRIVERS

Pull factors		Push factors	
Income	• Job opportunities • Agglomeration benefits • Spillovers	Housing costs	• Rent • House prices • Housing quality
Amenity	• Open spaces • Views & sunlight • Green spaces • Environment	Transportation costs	• Public transport costs • Congestion costs

We use:

(i) simple economic theory to characterise the likely impacts and sign (where known) of impacts
(ii) qualitative information from the international economic literature to assess likely magnitudes
(iii) existing quantitative estimates for New Zealand.
(iv) where possible existing estimates for Upper Hutt
(v) an empirical hedonic pricing model for Upper Hutt.

Although theory might be silent on quantities, often theory has sharp implications on the direction (costs or benefits) of different regulations, at least at a local level. So we draw on theory to make a first assessment of the costs and benefits of the suite of regulations we identified in Figure 20.

Next, we scan the international literature for quantitative estimates of relevant parameters. Since these parameters are likely to be location-specific, in general we skew these estimates based on their applicability to Upper Hutt.

For many factors, there exist some estimates for New Zealand, but the urban economics literature is not as rich as elsewhere. Often these estimates (for example, the impact of building heights and urban limits) are estimated for Auckland but not elsewhere.

At times we can use local estimates (for example, the infrastructure costs associated with greenfield development) but for many important amenity values, local estimates are missing. So, we construct a hedonic pricing model that deconstructs house prices into characteristics that include amenity values derive from living in that location. Appendix A provides the details of the estimation of the hedonic model.

Hedonic price models have a long history in urban economics and have been applied to reveal the underlying price of a wide variety of characteristics including:

- heritage (see Ahlfeldt 2017 and Lazrak et al. 2014)
- open space (Geoghegan 2002, Brander and Koetse 2011, and Daams et al. 2016)
- parks (Crompton 2001 and Allpress et al. 2016)
- views (Samarasinghe and Sharp 2008 and Jim and Chen 2009)
- sunshine (see Fleming et al. 2018).

These papers all use hedonic methods to reveal willingness-to-pay for different amenities. We draw on these studies to assess the direction of likely impacts in Figure 24 and approximate size (nil, slight, low, medium,

high) before quantifying estimates based on the literature and a hedonic price model that uses house prices to reveal amenity value.

The first column of Figure 24 shows the benefit or opportunity to increase the attractiveness of Upper Hutt by increasing pull factors and reducing push factors. A positive result is better for Upper Hutt residents, while negative results decrease attractiveness.[5]

For example, the first column of Figure 24 shows the impact of rules that control location, including residential zones (that permit one dwelling per site for example) and business zones (that control the location of service stations and other business activities). These rules are likely to have a slight negative impact on jobs and incomes, since they restrict the type of economic activity in specific locations. But these rules, particularly with regard to controls of residential location, have positive impacts on amenities, providing more open spaces and limiting overshadowing relative to no controls on location at all.

One of the key benefits of cities is the labour market opportunities that are made available by locating close to a larger pool of firms. Bigger cities contain a large number of potential jobs and a large number of potential applicants, increasing the likelihood of a good match between firms and are likely to have a negative impact on jobs, since workers.

Additional opportunities also raise the prospect of specialisation that for firms help raise the productivity of each worker, allowing workers to in turn reap a higher return for their labour. Such specialisation allows manufacturing workers to specialise as food manufacturing workers who in turn can specialise as craft brewers. Without sufficient scale, such specialisation is made more difficult.

Cities also provide firms and workers with *agglomeration* benefits, that is, the benefits and knowledge transfer that occurs when workers interact in spaces facilitated by the close connections provided by cities rather than distance. Well-functioning rural environments also provide amenities so we include both sets of factors in Figure 24.

[5] Some rules impact on more than one category. These rules generate trade-offs that require a detailed understanding of what residents want and how to weight the needs and wants of the local community.

FIGURE 24: THEORETICAL IMPACTS OF SUITE OF REGULATIONS ON THE COSTS AND BENEFITS OF ACCOMMODATING POPULATION GROWTH

Stylised representation of cost-benefit framework						
Indicative Cost / benefit	Controlling location	Density regulations	Controlling design	Controlling alteration	Managing environment	Rural zone rules
Income related costs and benefits						
More job opportunities	-ve (slight)	-ve (low)	-ve (slight)	nil	-ve (slight)	nil
Higher agglomeration benefits	-ve (slight)	-ve (low)	-ve (slight)	nil	-ve (slight)	nil
Increase incomes	-ve (slight)	-ve (low)	-ve (slight)	nil	-ve (slight)	-ve (slight)
Variety in consumption	-ve (slight)	-ve (slight)	nil	nil	+ve (slight)	Nil
Amenity related costs and benefits						
More open spaces	+ve (med)	+ve (low)	+ve (slight)	+ve (slight)	+ve (med)	+ve (med)
Limit overshadowing	+ve (low)	+ve (med)	+ve (low)	+ve (low)	+ve (slight)	+ve (slight)
Lift social infrastructure	-ve (low)	-ve (low)	+ve (slight)	+ve (slight)	+ve (slight)	+ve (slight)
Housing costs						
Reduce house prices	-ve (med)	-ve (med)	-ve (low)	-ve (slight)	-ve (low)	-ve (slight)
Lower rents	-ve (med)	-ve (med)	-ve (low)	-ve (slight)	-ve (low)	-ve (slight)
Infrastructure costs	-ve(med)	-ve(med)	nil	nil	-ve (low)	+ve (low)
Transportation Costs						
Reduce congestion	-ve (low)	-ve (low)	-ve (low)	-ve (low)	-ve (low)	nil
Reduce pollution	-ve (slight)	-ve (slight)	-ve (slight)	-ve (slight)	-ve (slight)	nil
Other costs						
Improve water quality	+ve (slight)	+ve (slight)	+ve (slight)	+ve (low)	+ve (med)	+ve (slight)
Reduce noise	+ve (low)	+ve (low)	+ve (low)	+ve (low)	+ve (low)	nil

Key: +ve (high), -ve (med), -ve (low), +ve (slight), nil, -ve (slight), -ve (low), -ve (med), -ve (high)

4. Evaluating local costs and benefits

Modelling Approach

Our objective is to estimate values that can be used to assess the relative benefits of alternative rules and regulations that govern what can be built where across Upper Hutt. These values need to span some key factors that underpin amenity across the city and the demand for space – traditionally a driver of house prices in many contexts.

There are also a wide range of factors that drive house prices that we are less interested in. These include for example the build quality of the dwelling, the construction type, the number of garages, whether the house has a deck, and several other factors that we need to account for before looking at factors that help determine amenity values.

Here we lay out the broad method approach before presenting results in Appendix A.

What we find

Our baseline results suggest that increases in land area by one percent increases the value of the property by 0.14 percent for the broad model and 0.15 percent for the narrow model. Given the average price and average land parcel across the sample, an extra 120 square metres of land increases the average sale price by about $6,200. Evidently, people are willing to pay for the opportunities provided by additional land area.

But importantly, once we control for factors generally associated with low density living, including land, we find very little to distinguish high density to low density living. In fact, our typology estimates (that compare willingness to pay for medium/high density and low-density dwellings to vacant land) show a slight premium for medium/high density dwellings of $253.80.

We find a mild premium for living close to the CBD since the distance to the CBD variable takes a negative coefficient, reducing the price of dwellings far from the CBD. The coefficient is relatively small however – residents appear to be willing to pay $1,420.78 to move on average 200 metres closer to the CBD (about 200 metres).

We also find small but statistically significant benefits from moving closer to parks that we list in Figure 27. Dwellings 10 percent closer to the park (a little over 60 metres) are worth almost $500 more ($491.92), adding approximately one percent to the average house sale.

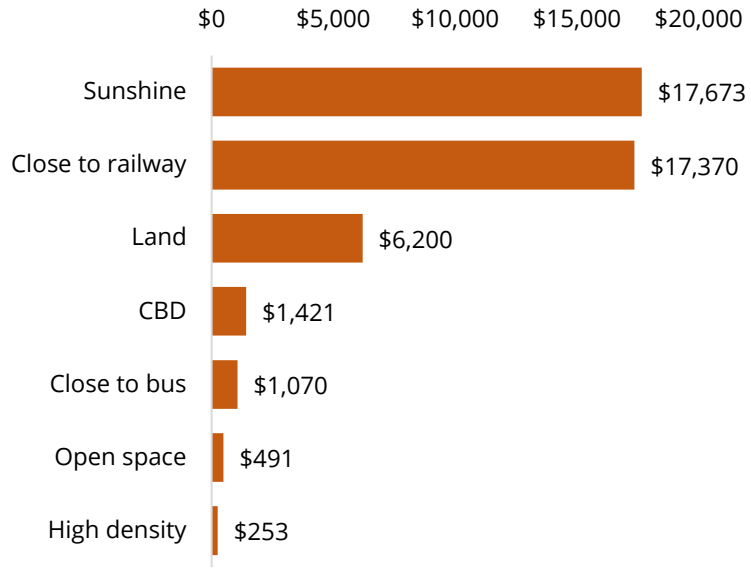
But at least for historical sites we list in Figure 28, we find no significant premium for living on average closer to these sites.[6] Instead, our coefficient is positive, suggesting houses that are further from historical

[6] We use the average distance since we expect people tend to drive to these sites that are on average further away than the nearest park.

sites are valued more highly than dwellings close to these sites. The most likely reason for is that our variable is proxying for some unobserved feature not captured elsewhere in our regression variables.

Finally, like other studies, we find sunshine hours have a marked impact on the value of a property. For our preferred dwelling model, a 1 percent increase in daily sunshine hours (adjusted for clouds) generates a 3 percent increase in the value of a dwelling without these additional hours. So access to sunshine is highly valued.

FIGURE 25: WE MEASURE ECONOMIC PUSH AND PULL DRIVERS



Income-related effects

Mostly likely the key impact of the district plan will be imposed limits on the quantity and type of housing. These efforts should be prioritised over labour market issues and consumer markets that might be more substantive in larger jurisdictions.

Nevertheless, we estimate the benefits of agglomeration impacts and estimate the number of additional local jobs that could be expected in 2047 based on the UDC at 2018. Figure 31 in Appendix A shows that the real additional income from these effects per household is small – about $100 a year.

Agglomeration impacts occur when workers exchange ideas that generate productivity improvements. These interactions typically are thought to occur more easily when density increases and are typically believed to drive productivity in urban settings, increasing incomes.

Upper Hutt is likely to experience a mild increase in density (we assume additional jobs are accommodating within the current business footprint) but nevertheless the estimates provided by Mare and Graham 2003 and Melo, Graham and Noland 2009, suggest accounting for agglomeration effects for even small New Zealand regions can be important.

We use these studies to calibrate a 0.69 percent increase in productivity for a 10 percent increase in worker density. We assume the increase in productivity generates returns to workers in the form of increased wages that we show inFigure 31. The cumulated impact of increases in density results in a $255.21 increase in the annual nominal wage by 2047.

We then discount the stream of nominal income by a real interest rate of 2.25 percent. This rate is much lower than even Treasury's alternative 3 percent real interest rate (see the CBAx tool) but is likely to be appropriate since decision-making that includes change to urban form are likely to have long-lived impacts, including on infrastructure projects, that typically use lower real discount rates.[7] In addition, a discount rate of 2.25 percent implies that costs and benefits that occur in thirty years' time are considered to take half the value of costs and benefits that occur today. Higher discount rates seem inappropriately short-sighted given the requirement for councils to undertake long-term planning.

Infrastructure costs

We also examine likely infrastructure costs associated with accommodating growth under status quo policies. Since these costs will be met by households with willingness to pay rates, it is important that these costs are not double-counted and are appropriately offset when evaluated across a range of policies (such as intensification or accommodating growth at a particular greenfield site).

Transportation costs and benefits

Based on current trends, accommodating growth is also likely to increase commute times and local travel, increasing costs for local residents.

The NZTA manual and Donovan and Munro (2013) provide some guidance on how to price transportation costs that include commute times. We start with their current cost for an hour of commuting time at $7.80 (in 2002) with additional costs of commuting in congestion of $3.13. Non-work costs are set at $6.90 with an additional charge for non-work congestion of $2.75.[8]

We then use average real wage growth since 2000 (of 3.2 percent) to rate forward these costs. We allow for very modest increases in commute times based on current trends, from 35 minutes to 37.4 by 2047. Non commute times are assumed to increase at 80 % of the rate of increase in commuting times. We assume commuting numbers grow at the rate of population growth so the modest growth implicitly reflects emerging technologies that might be expected to reduce congestion and travel times.

Figure 32 in Appendix A shows that this set of assumptions generates an annual real cost of total travel of $53 million dollars. These costs include status quo costs of existing travel patterns, but the assumptions could be

[7] See https://treasury.govt.nz/publications/guide/cbax-tool-user-guidance

[8] The NZTA 2013 manual differentiates between travel while at work, commuting to and from work (most travel costs) and travel neither at work or commuting to work.

used to underpin broad assessment of alternative patterns of growth across Upper Hutt.

Amenity-related effects

To estimate amenity-related effects at the local level we primarily rely on our hedonic house price model to estimate effects.

One standard effect that is found to consistently drive house prices is land size as part of the overall house and -land package (see for example Fernandez 2019). Land is valued for a variety of home uses and this is factored into house prices. This effect is a prime mechanism for determining density and city size.

For many cities, access to the CBD provides amenity valuable through better access to a range of consumer and social activities, and by reducing commute times. Simple theoretical models even use access to the CBD as a prime determinant of location across a city (see Lees 2014 for example). So we test the extent to which Upper Hutt residents reveal a willingness to pay for access to the CBD.

Perhaps one of the key features of Upper Hutt is the predominance of parks and open space. Internationally, many studies reveal access to open space and parks is associated with higher house prices (see Brander and Koetse 2011, for example). Closer to home, other studies also show that residents are willing to pay for access to parks and open space (see Allpress et al. 2016 for the case of Auckland).

To test the importance of open space and parks we construct a variable that is the minimum distance to a park for every sale in our database (see Appendix A). In turns out that this variable is a positive determinant of house price: residents are willing to pay for access to parks.

Overall, the surveyed literature suggests a number of channels through which the benefits of increased access to sunshine for a residential dwelling may accrue: (i) increased sunshine may be treated as a natural amenity which is valued for its own sake – and this may influence location choices both within and between cities; (ii) increased sunshine may reduce energy costs, at least in some contexts; and (iii) increased sunshine may improve some aspects of health.

In addition, the sales database contains a flag that allows for identification of medium- or high-density dwellings or low-density dwellings. These datapoints are important since they can distinguish amenity that comes from density – having accounted for the features that typically are associated with density, such as smaller living area and land. Interestingly, the two density types show similar parameters: the market reveals very little distinction between low and high density – if anything, high density take a small premium.

It's important to realise that the house price estimates embed the full discounted stream of amenities provided by each dwelling. So discounting these effects at the same rates as we discount transport and commuting costs suggests reasonably small numbers for each year (see Figure 33 in Appendix A). We should consider other information – including asking for community views – to better inform collective wisdom on the drivers of amenity across Upper Hutt.

Public transport

One of the key provisions local councils facilitate with Greater Wellington Regional Council is public transport. We test for willingness to pay for access to public transport using our hedonic house sales model.

We first geocode each of Upper Hutt's bus stations, distinguishing between bus-stops on high traffic routes (route 110) and other bus-stops. Then we geocode railway stations.

Next, we calculate the distance between each dwelling in our property sale database and the nearest bus-stop - distinguishing between high traffic routes. We also calculate the distance to the nearest railway station.

Then we construct three indicators (i) a railway station close proximity indicator that takes a value of one when the dwelling is within 150 metres of a railway station; (ii) a bus-stop close indicator that takes a value of one when the dwelling is within 75 metres of a bus-stop.

We find that the railway indicator is statistically significant: residents are willing to pay for access to railway stations – above and beyond any negative externality that might accrue from closeness to the noise from trains (see Figure 30). The coefficient is also economically significant: a dwelling within 150 metres of the railway station is worth 3.4 percent more than dwellings without close access to the railway station. This translates to about $17,370 extra value on a $500,000 property with the same features.

Figure 30 shows that access to bus-stops are far less important. Although each of our four estimates is correctly signed, only one is significant (at the ten percent level). On average the coefficients are economically less significant than access to railways. Good access to bus-stops adds about $1,070 to the value of a $500,000 home.

One possibility is that bus-stops are highly correlated with busy streets that might have more noise and pollution and appear less enticing places to live. So we construct a dummy variable for dwellings on Fergusson Drive and Main Road alongside our bus-stop indicator. This variable is never significant across our four models and in addition, the bus-stop indicator is no more significant and turns negative in one model.

It could be the case that access to specific bus routes are more valuable than others. So we experimented with a high traffic bus-stop indicator that takes a value of one when the dwelling is within 75 metres of a high traffic bus-stop (mostly the 110 route). But neither on its own, or in conjunction with the other indicators, did this addition improve estimates of the impact of bus-stops on house prices.

Since many residents travel to Wellington for work, it is perhaps unsurprising that Bus-stops do not appear to matter as much as railway station access that can transport workers to Wellington.

It is important to remember that our estimates average across the entire resident population. Some members of the community may highly value access to the local bus network.

5. Assessing evidence on costs and benefits

Taking a broad look

We use a variety of approaches to make our status quo assessment. Since the impact of regulation depends on the local market environment, we will begin with an assessment of current land uses, likely trends and shifts in demand. This includes:

- Current demographics, including ageing;
- Drivers of economic growth, including current drivers of employment on an industry by industry basis;
- Current costs of development for residential markets. This needs to be calibrated against the relative price of buying existing stock across a range of housing submarkets.
- A scan of future infrastructure developments that might change trends in the area.

Examining these trends shows the extent to which existing regulations constrain behaviour – if at all. This requires accounting for the quantum of land under existing regulations.

We use existing data and information, including yet-to-be-released information, as far as practical.

An evidence-based approach

Importantly, we also test our local estimates against what we know from other jurisdictions and other parts of New Zealand. Figure 26 provides these comparisons.

While these estimates are useful for gauging magnitude of effects, effects can vary enormously depending on local factors and characteristics. When estimates conflict, we rely on our local evidence base.

FIGURE 26: LIKELY EMPIRICAL IMPACTS OF SUITE OF REGULATIONS

Status Quo cost-benefit assessment	Description	Impact	Evidence		
Indicative cost / benefit			International	New Zealand	Local
Income related					
Job/income opportunity	Population growth means more jobs	More job opportunities within Upper Hutt and Wellington City	"People follow jobs." - Soeter and Keeris (2008), so it is reasonable to roughly equate population growth with job growth	Ten percent increase in population associated with attractive conditions for business but this is correlation not causation (Grimes et al 2019)	Expect 2,116 extra local jobs over the next 30 years
Agglomeration benefits	Agglomeration effects occur when workers increase productivity by sharing knowledge	As Upper Hutt grows, density increases productivity and real wages grow a little	Estimates vary significantly by place and industry (see Melo et al 2009)	Maré and Graham (2013) suggest estimates of 0.063 for Wellington, 0.048, for Canterbury and Auckland 0.056	Maré and Graham (2013) support a calibration of 0.069 for Upper Hutt, equating to a $1,878 total wage benefit over the 20 years to 2047
Variety in consumption	Location with dense populations have more options for goods and services consumption	Residents are better off with a broader set of options (not just one takeaway, but more choice)	Hard to measure (see Coutoure 2016) but 40% of gains from density could be shorter trips and 60% greater variety	No New Zealand based studies	Too hard to measure quantitatively but starting point suggests additional density supports wider range of shopping options eg Brewtown
Amenity related					
Open space	Residents enjoy access to open spaces including parks and other areas	Research repeatedly finds positive impact of open space revealed in house prices	Geoghegan (2002) finds permanent open space is 3 times more valuable to local residents than developable open space in Maryland, US.	Allpress et al. (2016) estimate Auckland apartments 500 metres away from the nearest park are 13.7 per cent less valuable than	Upper Hutt estimates suggest moving a $500,000 dwelling from the average 690 metres to a park to immediately

Status Quo cost-benefit assessment	Description	Impact	Evidence		
Indicative cost / benefit			International	New Zealand	Local
			Brander and Koetse (2011) find a significant positive relationship between value of urban open space and density	apartments immediately next to the park	next to the park increases value by $3,467
Sunshine	Dwellings enjoy more sunshine hours per day	Anecdotally & intuitively expect sunshine to have a positive impact due to warming and heating	Few existing estimates	Preston et al. 2018 show New Zealanders move to sunnier cities. An extra hour of sunlight/day brings a 2% increase house prices (Fleming et al 2018)	Upper Hutt has similar sunshine hours. Increasing sunshine hours from average to the top 5% of houses lifts value by 2.4 %.
Social infrastructure	Population density means literal distance between friends can be reduced. Variety of social activities can be greater.	Dense populations can hold more connections between family and friends including social capital and trust	Few empirical estimates	Statistics New Zealand's show Aucklanders report better connections to family then elsewhere (General Social Survey)	Unknown
Housing costs					
House prices	Specific projects can impact on housing supply and hence house prices	Test local development impacts using methods in McDonald (2001)[9]	Cross country regression put New Zealand's response at 0.7 (see Caldera and Johansson 2011)	Grimes and Aitken (2006) suggest house prices raise supply by between 0.5 and 1.1 %	Unknown

[9] McDonald (2001) tests the value of allocating industrial land to housing as the market values of houses on the land minus the capital cost of additional houses, the rental rate of housing and minus local government taxes or rates relative to the value householders derive from provision of local services.

Status Quo cost-benefit assessment	Description	Impact	Evidence		
Indicative cost / benefit			International	New Zealand	Local
Rents	Lack of housing supply can drive up rents	Impacts can be large and drive inequality across communities	Estimates vary by region	High – Grimes et al. (2013) estimate rents rise 5.94% for a 5% Manukau population increase	Unknown
Transportation Costs					
Congestion	Without additional infrastructure more people generates congestion	Can be significant: time cost of commuting can be high			
Pollution				NZTA manual estimates suggest an additional tonne of CO2 pollution costs $4.13 in 2016	Unknown
Other costs					
Freshwater impact and noise	Without new infrastructure, higher population adds congestion	Can be significant, commuting costs include time cost of travel		The NZTA manual suggests using the methods in Kingett, Mitchell and Associates 1992 to test water quality and Dravitzki et al. 2001 for traffic noise	

6. Conclusion

Upper Hutt is set to grow by 21.4 percent by 2047 or an additional 9,071 people. The census suggests a growth rate of 9.5 percent in the five years to 2018 or approximately 1.8 percent growth each year.[10] If the current pace of growth continues then accommodating growth will be the theme for decades to come.[11] High projections suggest an additional 12,800 residents (growth of 29%) by 2047

The community – including firms, workers, households and developers – will all shape how and where growth occurs. But there is a key role for council – setting the rules and regulations set that the boundaries of where and when growth can occur.

Setting rules always requires a good understanding of costs and benefits of alternative policies. Cost-benefit analysis can help determine appropriate values but not all values can be easily measured or shared across the community. So there is an onus on councils to talk with the community to improve local decision-making.

Our "status quo" CBA does not seek to compare across alternative policies. Instead, the aim is to better understand the types of policies and outcomes that contribute the most to better outcomes for the community.

In addition, the Resource Management Act requires rules have an eye to the environmental, cultural, social and economic costs and benefits local rules and regulations can bring about.

Mostly, we focus on many economic factors, including the pull factors that include amenity and job opportunities that bring people of Upper Hutt, but also include the push factors, like housing and transport costs that push people out of Upper Hutt to other locations.

Our assessment draws on international evidence and estimates but also makes use of a local housing model that helps assess the benefits of local amenities such as parks, sunshine, views, land and access to the CBD and public transport.

In general, our assessment to date suggests many more opportunities than threats from population growth for Upper Hutt. Given likely growth areas, costs from accommodating growth are probably modest relative to material benefits from attracting more people to Upper Hutt.

Costs will differ and depend on how growth is accommodated. And these costs are best assessed when armed with detailed alternative plans of when and where growth is likely to occur.

But there are no showstoppers from either greenfield of intensification. Both policies are likely to enable benefits rather than requiring harsh trade-offs across costs and benefits and groups in the community.

As options develop, we believe this cost-benefits framework can help assist decision-makers make the rules and regulations that can best help the community to grow by maximizing benefits and limiting costs.

[10] See https://www.stats.govt.nz/information-releases/2018-census-population-and-dwelling-counts-nz-stat-tables

[11] These growth rates would outstrip Statistics New Zealand's projections high growth rate of a 29% population increase to 2047.

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Appendix A: Hedonic Model

Methodology

Overview

Our objective is to estimates values that can be used to assess the relative benefits of alternative rules and regulations that govern what can be built where across Upper Hutt. These values need to span some the key factors that underpin amenity across the city and the demand for space – traditionally a driver of house prices in many contexts.

There are also a wide range of factors that drive house prices that we are less interested in. These include for example the build quality of the dwelling, the construction type, the number of garages, whether the house has deck, and several other factors that we need to account for before looking at factors that help determine amenity values.

Controls

To estimate the hedonic model, we use the population of sales data from the third quarter of 2006 to the third quarter of 2018. We estimate two models: (i) what we call a broad model, that includes apartments and single dwellings; (ii) a narrow model that excludes apartments. We are interested in the value of space. Since apartments have zero space we test whether including apartments generates materially different estimates for the value of space within Upper Hutt.

We also choose to filter out a number of sales from out dataset prior to estimation:

- A small number of house sales not associated with a residential code from LINZ
- Less than 50 houses with total living area smaller than 50 squares metres or greater than 400 square metres
- Sales with very low (less than $75,000) or very high (more than $2,500,000) prices
- Sales with large land areas (greater than 4,000 square metres) and for the narrow model, land area less than 100 square metres
- We also exclude 90 sales that have an outlier flag attached in the sales record.

This yields a total of 10,468 single dwellings and apartments for our broad model and 8,688 single dwellings for the narrow model.

Amenity

In addition to a relatively standard list of control variables, we construct several variables that we believe are likely to be associated with underlying amenity values. Equation 1 describe the model:

$$\log(home\ price) = \log(land\ area) + other\ controls + amenities + \varepsilon_t \quad (1)$$

In terms of amenities, first we obtained estimates of daily sunshine hours from NIWA for each sales location. Sunshine hours have been shown to be a significant influence on house prices (see Fleming et al. 2018).

Next we geocode all the parks in Upper Hutt and calculate the distance to each property sale. Then we include the natural logarithm of the minimum distance to a park as a variable to parameterise the amenity value of parks (Figure 27).

We also include a variable to capture possible benefits of heritage. House price models have been to reveal amenity value in some cities (see Ahlfeldt and Maennig 2010 for the case of Berlin) although our prior belief is that we expect any impacts to very small for Upper Hutt. We geocode the heritage sites in the Upper Hutt district plan and include the natural logarithm of the average distance to Heritage sites in the hedonic model.

Finally, we also include a flag that indicates the presence of low or high/medium density, given the other factors captured by the model. This is important since low density properties will typically have larger land areas that are already captured by our modelling.

Model estimation

We start both the raw broad model (that includes apartments) and the raw narrow model (that excludes apartments) with the full set of variables (see Figure 29) and then reduce to a preferred model by removing insignificant coefficients (at the ten percent level), retaining any dummy variables that are significant as a class. The adjusted R^2 statistic on the preferred broad model is 0.850 and the model as a whole is statistically significant (testing the F-statistic at the one percent level).

Similarly, the narrow model returns an adjusted R^2 statistic of 0.858 and is statistically significant at the one percent level. Importantly, the key coefficients of interest associated with amenity are statistically significant and similar in magnitude even when insignificant variables are removed from the regression.

Interpretation

One of the repeated findings across hedonic models is the impact of land area on price. Homes with larger land areas are worth more, either directly for the amenity provided by space, or by the facility to extend or include additional dwellings on the section.

It is important to recognise that some of these values are relatively small. Houses generate a stream of amenity values returned each year for the upfront investment in a housing asset.

Our results (see Figure 30) suggest that:

(i) A myriad of factors including the suburb, build type, quality, age of the dwelling contribute to house prices

(ii) Residents are prepared to pay more for dwellings with additional land

(iii) There is nothing to suggest medium to high density dwellings are undesirable on their own.

(iv) Access to parks is valuable to residents

(v) Access to the CBD is value to residents

(vi) Access to historical sites of interest is not incorporated into house prices

(vii) Residents are willing to pay for dwellings with significantly higher sunshine hours each day.

FIGURE 27: PARKS WE USE TO CALCULATE DISTANCE TO PARK

Park	Address	Latitude	Longitude	Park	Address	Latitude	Longitude	Park	Address	Latitude	Longitude
Awakairangi Park	Totara Park Rd	-41.1123	175.0858	**McLeod Park**	Elderslea	-41.1167	175.0578	**Maidstone Park**		-41.1298	175.0765
Benge Park	Clouston Park	-41.1165	175.0832	**McLeod St Play Area**	Elderslea	-41.1186	175.0543	**Kurth Reserve**	Silverstream	-41.1519	175.0082
Birchville Park	Birchville	-41.0974	175.1098	**Moehau Park**	Trentham	-41.1286	175.0309	**Keith George Park**	Upper Hutt	-41.1414	174.999
Brown Owl Park	Timberlea	-41.1038	175.1014	**Moonshine Park**	Upper Hutt 5018	-41.1256	175.0344	**Karapoti Park**	Akatarawa Valley	-41.0619	175.1115
California Park	Upper Hutt 5018	-41.1056	175.0872	**Ngati Tama Park**	Upper Hutt 5018	-41.1091	175.0925	**Hoggard Park**	Birchville,	-41.0978	175.0918
Clouston Park	Upper Hutt 5372	-41.0021	175.1221	**Oxford Park**	Ebdentown	-41.1189	175.0722	**Heretaunga**	Upper Hutt 5018	-41.1388	175.0141
Clyma Park	Elderslea, Upper Hutt	-41.1204	175.0598	**Pine Avenue Park**	Upper Hutt 5018	-41.1164	175.0756	**Harcourt Park**	Birchville	-41.0991	175.0949
Nicholson Park	Clouston Park	-41.1168	175.0902	**Trentham Memorial**	Upper Hutt 5018	-41.1331	175.0306	**Emerald Hill Park**	Brown Owl	-41.0991	175.099
Duncraig Reserve	Silverstream	-41.1548	175.0085	**Whakatiki Park**	Trentham	-41.1186	175.0506	**Ecclesfield Reserve**	Blue Mountains	-41.1537	175.0152
Dunns Park	Silverstream	-41.1516	175.0113	**Maoribank Park**	Upper Hutt 5018	-41.1121	175.0933				

FIGURE 28: HISTORICAL FEATURES WE USE TO CALCULATE AVERAGE DISTANCE TO SIGNFICIANT HISTORICAL SITES

Num.	Place	Detail	Type	Lat	Long	Num.	Place	Detail	Type	Lat	Long
R27	**Pakuratahi Rail Tunnel**	Notable for use of on site cast cement block construction	NZHPT Historic Area	-41.086	175.185	U7	Harcourt Park	Earthquake fault terrace sequence, Pt Lot 1 DP 7230	Local	-41.099	175.095
R27	**Pakuratahi River Bridge**	Wooden Truss with steel bracing	NZHPT Historic Area	-41.086	175.185	U8	Emerald Hill	Earthquake fault terrace feature Lots 13 & 14 DP 83099	Local	-41.100	175.099
R28	**Ladle Bend Bridge**	Cement block and wood construction	NZHPT Historic Area	-41.086	175.185	R19	Te Marua Earthquake fault terrace	Pt Sec 172 and Lot 2 DP 17413	Local	-41.090	175.117
U25	**Redoubt Blockhouse**	McHardie Street, Built for protection during Taranaki land wars.	NZHPT Cat. 1	-41.130	175.051	R28	Railway Summit Tunnel	576.5m tunnel, part of original Wellington to Masterton railway	NZHPT Historic Area	-41.115	175.232
R12	**Oven site (Maymorn Ridge area)**	Two umu (oven) dated to approximately 1300 AD	NZHPT NZAA site	-41.108	175.135		Rimutaka Railway - original line.	7 large cuttings, concrete culvert under made between 1874-'78	NZHPT Historic Area	-41.110	175.214
U35	**St. John's Church**	Burial place of Richard Barton and significant 1863 architecture.	NZHPT Cat II	-41.130	175.044	U40	Pumpkin Cottage site	Colonial cottage built 1860's. Residence centre for artists	Local	-41.146	175.004
U37	**Animal Research Centre**	Research centre main building constructed c1905, 62, Ward St	NZHPT Cat I	-41.131	175.056	R19	Whakataka pa	Pa site and lookout on cliff by Te Rauparaha in heke 1819/20.	Local	-41.068	175.197

Num.	Place	Detail	Type	Lat	Long	Num.	Place	Detail	Type	Lat	Long
U43	**Trentham Camp clock tower**	Four faced wooden clock tower built in 1917, ANZAC Drive.	NZHPT Cat II	-41.144	175.038	U1	Akatarawa Cemetery	Early residents to present day. Earliest grave 1903.	Local	-41.086	175.102
U34	**Tweed House,**	Dwelling house, 5 Brentwood Street	NZHPT Cat I	-41.134	175.036	R28	Fell Railway Summit and rail yard	Scattered remnants of rail yards and station and remains of houses.	NZHPT Historic Area	-41.086	175.185
U42	**Restormel,**	Dwelling house, 53 Chatsworth Road	NZHPT	-41.148	175.023	U1	Tea Bureau Rotunda	Very unusual facility, donated by tea producers, in 1949.	Local	-41.092	175.099
U42	**Woodhill**	Dwelling house, 71 Chatsworth Road	NZHPT Cat I	-41.148	175.025	R28	Cairn and Plaque	Commemorative of the first European crossing of the Rimutaka Ranges	Local	-41.086	175.185
U26	**Golder's Cottage and outbuildings,**	Historic Place and Museum, 707 Fergusson Drive	NZHPT Cat II	-41.126	175.056	U37	Hopkirk Building	Hopkirk Building. Significant 1940s architecture	NZHPT	-41.133	175.059
U6	**Earthquake fault feature, California Pk**	Lots 2 & 3, DP 31603	Local	-41.106	175.087	U37	Incinerator	Significant remnant of Wallaceville Agicultural Research Centre	NZHPT	-41.167	175.167

FIGURE 29: CONTROL VARIABLES FOR THE HEDONIC PRICING MODEL

	Field	Description
		Controls
1	Suburb	This field provides the suburb where the dwelling is located.
2	Off-street parking	Records the total number of formed car parks on a rating unit, including uncovered car parks.
3	Wall type	We construct dummy variables for brick and 'other' wall types, that is an aggregate of all other construction types.
4	Roof type	We construct dummy variables for tile and 'other' roof types, that includes iron.
5	Wall quality	We construct dummy variables for quality that include average, good and other.
6	Roof quality	We construct dummy variables for quality that include average, good and other.
7	Nearby improvements	LINZ valuation standards require description of class of surrounding improvements: (i) Poor Quality, (ii) Below Average, (iii) Average Quality, (iv) Above Average Quality, (v) Superior Quality
8	Landscaping	We construct dummy variables for quality that include average, good, fair and poor.
9	Addition of deck	Takes a value of 1 if there is a deck that includes reasonably substantial open verandas, terraces and outdoor living areas attached to the principal building, made of any material; 0 otherwise.
10	Separate laundry	Takes a value of 1 if there is a separate workshop or laundry, including an unlined basement, a detached workshop or laundry, and any storage or workshop space in a basement garage excess to parking requirements; 0 otherwise.
11	Drive-on access	Does the property have, or have the potential to have, drive-on access?

	Field	Description
12	Formed driveway	Does the property have a properly formed and covered driveway?
13	Garage under main roof	The number of covered car spaces under the main roof.
14	Quality	An assessment of the quality of the property (i) Good, (ii) Average, (iii) Poor
15	Build decade	The estimated decade the dwellings was built
16	Quality of foundations	Are the foundations in poor condition? Yes or no.
17	Contour of property	We translate the two-character code to a 1–3 scale where 1 = level, 2 = easy to moderate rise/fall and 3 = steep rise/fall.
18	Total living area	Total living area is the sum of all living spaces, recorded to the nearest square metre. Examples of living spaces include living rooms, kitchens, bedrooms and bathrooms.
19	Modernisation	Has the dwelling interior been renovated? Yes or no
20	Free-standing garages.	Records the number of free-standing garages
21	Contour	Records the contour of the land: (i) steep fall, (ii) easy fall, (iii) level, (iv) easy rise, (v) steep rise
22	Type	Type of property: (i) bare land, (ii) conversion, (iii) dwellings, (iv) rental flats, (v) vacant, (vi) warehousing, (vii) other.
23	House type	Record the appearance of the main dwelling
24	Freestanding garage	The number of covered car spaces under a freestanding garage.

	Field	Description
		Amenity
1	View from living area	We translate the view code to a 0–2 scale where 0 = no appreciable view, 1 = view other than water, such as city, suburban or landscape view, and 2 = view where the focal point is water.
2	Scope of view from living area	We translate the scope of view code to a 0–3 scale where 0 = no view, 1 = slight view of up to 45°, 2 = moderate view up to 145° and 3 = wide view of over 145°.
3	Sunlight hours	Average hours of sun per day (adjusted for expected cloud cover) from NIWA Solarview
4	Access to parks	Natural logarithm of the minimum distance to local parks (see Figure 27).
5	Access to heritage	Natural logarithm of the average distance to historical sites (see Figure 28).
6	Access to CBD	Natural logarithm of the average distance to the CBD.
7	Access to railway stations	Indicator that takes a value of 1 when dwelling is within 150 metres of a railway station (excluding Maymorn).
8	Low density living	Indicator that takes a value of 1 for low density living
9	Med/high living	Indicator that takes a value of 1 for medium/high density living

Source: Land Information New Zealand, Sense Partners

FIGURE 30: ESTIMATION RESULTS FOR THE HEDONIC PRICE MODEL

		Raw broad model		Preferred broad model		Raw narrow model		Preferred narrow model	
Class	Variable	estimate	*p*.value	estimate	*p*.value	estimate	*p*.value	estimate	*p*.value
Intercept	Intercept	-17.4882	(0.0028)‡	-22.2292	(0.0002)‡	-31.5883	(0.0000)‡	-32.0136	(0.0000)‡
Suburb	Akatarawa	0.0105	(0.6279)	0.0082	(0.7060)	0.0049	(0.7983)	-0.0015	(0.9394)
Suburb	Birchville	0.0077	(0.7119)	0.0074	(0.7213)	-0.0069	(0.7170)	-0.0125	(0.5094)
Suburb	Brown Owl	0.0160	(0.4645)	0.0187	(0.3918)	0.0122	(0.5404)	0.003	(0.8799)
Suburb	Central	0.0293	(0.1448)	0.0248	(0.2188)	0.0312	(0.0876)*	0.0226	(0.2176)
Suburb	Ebdentown	-0.0036	(0.8818)	-0.0063	(0.7945)	0.0088	(0.7116)	0.0012	(0.9608)
Suburb	Heretaunga	0.1128	(0.0000)	0.1177	(0.0000)‡	0.1588	(0.0000)‡	0.1498	(0.0000)‡
Suburb	Kingsley Hgts	-0.0651	(0.0029)	-0.0747	(0.0007)‡	-0.0467	(0.0191)†	-0.0596	(0.0028)‡
Suburb	Mangaroa	0.0200	(0.4281)	0.0202	(0.4246)	0.0775	(0.0018)‡	0.0785	(0.0017)‡
Suburb	Maoribank	-0.0296	(0.1509)	-0.0309	(0.1330)	-0.0297	(0.1129)	-0.0366	(0.0512)*
Suburb	Maymorn	0.0539	(0.0383)	0.0483	(0.0650)*	0.0416	(0.0711)*	0.0387	(0.0945)*
Suburb	Other	0.0428	(0.0230)	0.0329	(0.0820)*	0.0363	(0.0341)†	0.0299	(0.0830)*
Suburb	Pinehaven	-0.0025	(0.8784)	-0.0138	(0.3993)	0.0093	(0.5228)	-0.0131	(0.3637)
Suburb	Riverstone Tces	0.0178	(0.3221)	0.0114	(0.5266)	0.0348	(0.0300)†	0.0342	(0.0337)†
Suburb	Silverstream	0.0649	(0.0002)	0.0696	(0.0001)‡	0.0992	(0.0000)‡	0.0884	(0.0000)‡
Suburb	Te Marua	0.0098	(0.7110)	0.0091	(0.7320)	-0.0187	(0.4235)	-0.0285	(0.2252)
Suburb	The Plateau	0.0412	(0.0666)	0.0356	(0.1132)	0.0227	(0.2548)	0.0122	(0.5409)
Suburb	Timberlea	-0.1016	(0.0000)	-0.1185	(0.0000)‡	-0.1260	(0.0000)‡	-0.1454	(0.0000)‡
Suburb	Totara Park	0.0153	(0.4661)	0.0499	(0.0167)†	0.0024	(0.8990)	-0.0002	(0.9905)
Suburb	Trentham	0.0043	(0.8044)	0.0003	(0.9882)	0.0506	(0.0012)‡	0.0428	(0.0062)‡
Suburb	Wallaceville	0.0084	(0.6595)	0.0044	(0.8171)	0.0222	(0.2100)	0.0178	(0.3188)
Carparking	None	-0.0472	(0.0000)	-0.0570	(0.0000)‡	-0.0290	(0.0093)‡	-0.0434	(0.0001)‡
Carparking	Single	-0.0148	(0.0442)	-0.0215	(0.0035)‡	-0.0186	(0.0050)‡	-0.0261	(0.0001)‡
Carparking	Double	-0.0001	(0.9812)	-0.0001	(0.9864)	-0.0086	(0.0977)*	-0.0119	(0.0218)†
Wall-type	Brick	-0.0336	(0.0000)	-0.0359	(0.0000)‡	-0.0148	(0.0001)‡	-0.0143	(0.0002)‡
Wall-type	Other	-0.0336	(0.0000)	-0.0350	(0.0000)‡	-0.0132	(0.0001)‡	-0.0129	(0.0002)‡
Roof-type	Filte	-0.0162	(0.0000)	-0.0177	(0.0000)‡	-0.0143	(0.0000)‡	-0.0153	(0.0000)‡
Roof-type	Other	-0.0219	(0.0334)	-0.0275	(0.0068)‡	-0.0190	(0.0414)†	-0.0218	(0.0169)†
Wall construction	Average	0.0574	(0.0036)	0.0927	(0.0000)‡	0.0680	(0.0001)‡	0.0871	(0.0000)‡
Wall construction	Good	0.0351	(0.0608)	0.0629	(0.0002)‡	0.0525	(0.0020)‡	0.0655	(0.0000)‡
Roof construction	Average	0.0325	(0.1197)			0.0217	(0.2745)		

		Raw broad model		Preferred broad model		Raw narrow model		Preferred narrow model	
Class	Variable	estimate	*p*.value	estimate	*p*.value	estimate	*p*.value	estimate	*p*.value
Roof construction	Good	0.0304	(0.1228)			0.0153	(0.4177)		
Nearby improvements	Below average	-0.1095	(0.4432)						
Nearby improvements	Average	-0.0917	(0.0001)			-0.0732	(0.0019)‡		
Nearby improvements	Above average	-0.0580	(0.0000)			-0.0430	(0.0006)‡		
Nearby improvements	Superior	0.0006	(0.9655)			0.0119	(0.3487)		
Landscaping	Average	0.0423	(0.1505)			0.0567	(0.0510)*		
Landscaping	Fair	0.0446	(0.0000)			0.0373	(0.0000)‡		
Landscaping	Good	-0.0025	(0.9377)			-0.0213	(0.4637)		
Landscaping	Poor	0.0593	(0.0000)			0.0531	(0.0000)‡		
View	Water	-0.1271	(0.0465)	-0.1008	(0.0055)‡	-0.1536	(0.0065)‡	-0.0666	(0.2954)
View	None	-0.0031	(0.9760)	-0.0329	(0.1855)	-0.0006	(0.9951)	-0.0315	(0.3908)
View	Other	-0.0263	(0.2864)	-0.0230	(0.3517)	-0.0387	(0.0717)*	0.0232	(0.7922)
Deck	Yes	0.0223	(0.5328)			-0.0348	(0.3588)		
Deck	No	-0.0216	(0.0000)			-0.0167	(0.6591)		
Laundry	Yes	0.0109	(0.7792)			0.0049	(0.8956)		
Laundry	No	-0.0159	(0.0000)			-0.0097	(0.0014)‡		
Drive-on access	Yes	-0.0810	(0.5728)			-0.0194	(0.2922)		
Drive-on access	No	-0.0158	(0.4820)			-0.0146	(0.5295)		
Properly formed driveway	Yes	0.0793	(0.5774)			-0.0256	(0.0001)‡		
Properly formed driveway	No	-0.0001	(0.9888)						
Garaging under main roof	None	-0.1755	(0.0819)	-0.1972	(0.0534)*	-0.1047	(0.2342)	0.0725	(0.0059)‡
Garaging under main roof	1	-0.1145	(0.2560)	-0.1284	(0.2081)	-0.0883	(0.3147)	0.0512	(0.0111)†
Garaging under main roof	2	-0.0602	(0.5496)	-0.0737	(0.4692)	-0.0353	(0.6872)	-0.0107	(0.0737)*
Garaging under main roof	3	-0.0211	(0.8351)	-0.0364	(0.7233)	-0.0011	(0.9902)	0.0704	(0.0402)†
Garaging under main roof	4	-0.0834	(0.4405)	-0.0988	(0.3669)	-0.0602	(0.5227)	-0.1259	(0.0312)†
Garaging under main roof	5+	0.0319	(0.8550)	-0.0151	(0.9317)	0.0387	(0.7991)	-0.0303	(0.0559)*
Quality	A	0.2831	(0.0038)	0.2932	(0.0031)‡	0.3061	(0.0003)‡	-0.0338	(0.0049)‡
Quality	B	0.0499	(0.0066)	0.0637	(0.0006)‡	0.1042	(0.0000)‡	-0.0928	(0.0001)‡
Quality	C	0.0292	(0.0882)	0.0367	(0.0333)†	0.0543	(0.0007)‡	-0.0760	(0.0000)‡
Build decade	Unknown	-0.8375	(0.0000)	-0.8584	(0.0000)‡	-0.8950	(0.0000)‡	-0.0233	(0.0000)‡
Build decade	1910s	0.2277	(0.0024)	0.2296	(0.0025)‡	0.1839	(0.0051)‡	0.0108	(0.4306)
Build decade	1920s	0.2318	(0.0017)	0.2322	(0.0019)‡	0.1874	(0.0037)‡	-0.0461	(0.0013)‡

		Raw broad model		Preferred broad model		Raw narrow model		Preferred narrow model	
Class	Variable	estimate	*p*.value	estimate	*p*.value	estimate	*p*.value	estimate	*p*.value
Build decade	1930s	0.2161	(0.0033)	0.2141	(0.0040)‡	0.1707	(0.0079)‡	0.0222	(0.0000)‡
Build decade	1940s	0.1656	(0.0223)	0.1651	(0.0244)†	0.1215	(0.0545)*	0.3072	(0.0000)‡
Build decade	1950s	0.1787	(0.0134)	0.1824	(0.0127)†	0.1346	(0.0327)†	0.1062	(0.0065)‡
Build decade	1960s	0.1427	(0.0485)	0.1486	(0.0424)†	0.1423	(0.0240)†	0.0565	(0.0107)†
Build decade	1970s	0.1060	(0.1429)	0.1185	(0.1055)	0.1274	(0.0436)†	-0.9027	(0.0146)†
Build decade	1980s	0.1924	(0.0080)	0.2002	(0.0063)‡	0.1808	(0.0043)‡	0.1746	(0.0173)†
Build decade	1990s	0.2747	(0.0002)	0.2764	(0.0002)‡	0.2573	(0.0001)‡	0.1788	(0.0363)†
Build decade	2000s	0.3391	(0.0000)	0.3440	(0.0000)‡	0.3257	(0.0000)‡	0.1643	(0.0603)*
Build decade	2010s	0.4216	(0.0000)	0.4140	(0.0000)‡	0.4063	(0.0000)‡	0.1140	(0.0088)‡
Build decade	Many buildings	0.0904	(0.5795)	0.0768	(0.6416)	-0.1110	(0.4384)	0.1304	(0.0011)‡
Build decade	Composite	0.4437	(0.0000)	0.4429	(0.0000)‡	0.2844	(0.0011)‡	0.1370	(0.0000)‡
Foundations poor?	No	0.1007	(0.0229)			-0.0151	(0.7371)		
Foundations poor?	Yes	0.0813	(0.0788)			0.0312	(0.0129)†		
Modernisation	Yes	-0.0591	(0.0000)	-0.0703	(0.0000)‡	-0.0617	(0.0000)‡	0.1216	(0.0000)‡
Modernisation	No	-0.0476	(0.0000)	-0.0525	(0.0000)‡	-0.0441	(0.0000)‡	0.1794	(0.5913)
Scope	Wide	0.0222	(0.7481)			0.0000	(0.9999)		
Scope	Moderate	-0.0004	(0.9610)			0.0006	(0.9328)		
Scope	None	-0.0380	(0.7087)			-0.0473	(0.5936)		
Scope	Slight	-0.0091	(0.3075)			-0.0022	(0.7851)		
Free-standing garages	None	-0.4000	(0.0054)	-0.3670	(0.0116)†	-0.3357	(0.0076)‡	0.2590	(0.0143)†
Free-standing garage	1	-0.3351	(0.0198)	-0.2953	(0.0423)†	-0.3195	(0.0110)†	0.3297	(0.1187)
Free-standing garage	2	-0.3114	(0.0304)	-0.2745	(0.0592)*	-0.3048	(0.0153)†	0.4020	(0.8736)
Free-standing garage	3	-0.2938	(0.0413)	-0.2555	(0.0794)*	-0.2955	(0.0189)†	-0.1137	(0.0361)†
Free-standing garage	4	-0.2713	(0.0608)	-0.2300	(0.1159)	-0.2613	(0.0388)†	0.2814	(0.0000)‡
Free-standing garage	5	-0.2514	(0.1051)	-0.2095	(0.1818)	-0.2472	(0.0682)*	-0.0745	(0.2435)
Free-standing garage	6	-0.3800	(0.0150)	-0.3388	(0.0322)†	-0.3576	(0.0087)‡	-0.0472	(0.3184)
Contour	Steep fall	0.0551	(0.3600)			0.0914	(0.1383)		
Contour	Easy fall	0.0318	(0.0036)			0.0515	(0.0000)‡		
Contour	Level	0.0292	(0.0040)			0.0459	(0.0000)‡		
Contour	Easy rise	0.0418	(0.0000)			0.0716	(0.0000)‡		
Contour	Steep rise	-0.0049	(0.7979)			0.0068	(0.6846)		
Type	Bare land	0.0236	(0.0220)	0.0245	(0.0172)†	0.0319	(0.0005)‡	-0.3448	(0.0291)†

		Raw broad model		Preferred broad model		Raw narrow model		Preferred narrow model	
Class	Variable	estimate	*p*.value	estimate	*p*.value	estimate	*p*.value	estimate	*p*.value
Type	Conversion	0.0838	(0.0000)	0.0916	(0.0000)‡	0.0744	(0.0000)‡	-0.3235	(0.0023)‡
Type	Dwellings	0.0676	(0.0000)	0.0762	(0.0000)‡	0.0512	(0.0001)‡	-0.3093	(0.0000)‡
Type	Rental flats	0.0217	(0.0885)	0.0215	(0.0928)*	0.0261	(0.0310)†	-0.3018	(0.0002)‡
Type	Vacant	0.1599	(0.0000)	0.1716	(0.0000)‡	0.1421	(0.0000)‡	-0.2667	(0.0073)‡
Type	Warehousing	0.0446	(0.2226)	0.0444	(0.2277)	0.0284	(0.3731)	-0.2567	(0.0000)‡
Type	Other	0.0476	(0.3180)	0.0570	(0.2368)	0.0597	(0.1506)	-0.3597	(0.0000)‡
House Type	Apartment	0.0230	(0.6450)	0.0272	(0.5840)	-0.0602	(0.2024)	0.0298	(0.0000)‡
House Type	B'glow Post-war	0.0266	(0.8541)	0.0110	(0.9402)	-0.0096	(0.9395)	0.0713	(0.0000)‡
House Type	Contemporary	0.0508	(0.0445)	0.0464	(0.0687)*	0.0279	(0.2147)	0.0492	(0.0000)‡
House Type	Cottage	0.0846	(0.0021)	0.0858	(0.0019)‡	0.0653	(0.0075)‡	0.0237	(0.0000)‡
House Type	B'glow Pre-war	0.0166	(0.5709)	0.0015	(0.9596)	-0.0221	(0.4029)	0.1473	(0.0000)‡
House Type	Quality B'glow	0.0262	(0.2643)	0.0238	(0.3141)	0.0070	(0.7354)	0.0172	(0.0000)‡
House Type	Quality Old	0.0828	(0.0016)	0.0914	(0.0005)‡	0.0505	(0.0308)†	0.0608	(0.0000)‡
House Type	Spanish B'glow	0.1652	(0.0000)	0.1837	(0.0000)‡	0.1514	(0.0000)‡	-0.0560	(0.0000)‡
House Type	State Rental	0.0998	(0.0019)	0.0894	(0.0056)‡	0.0408	(0.1557)	-0.0144	(0.0000)‡
House Type	Tce Apartments	0.0618	(0.0354)	0.0630	(0.0335)†	0.0277	(0.2964)	0.0251	(0.0000)‡
House Type	Townhouse	0.0534	(0.0706)	0.0384	(0.1973)	-0.0159	(0.5471)	0.0600	(0.0000)‡
House Type	Unit	0.0633	(0.1028)	0.0572	(0.1296)	-0.0140	(0.8023)	-0.0411	(0.0000)‡
House Type	Villa	0.0662	(0.3423)	0.0733	(0.2986)	0.7738	(0.0000)‡	0.0033	(0.0000)‡
Living area	Living area	0.5421	(0.0000)	0.5635	(0.0000)‡	0.4342	(0.0000)‡	0.0491	(0.0000)‡
Land area	Land area	0.1473	(0.0000)	0.1441	(0.0000)‡	0.0953	(0.0000)‡	0.1518	(0.0000)‡
Amenity	Low density	0.1910	(0.0000)	0.1829	(0.0000)‡	0.0851	(0.0182)†	0.0336	(0.0000)‡
Amenity	High/med dens.	0.2524	(0.0000)	0.2402	(0.0000)‡	0.1252	(0.0009)‡	0.0266	(0.0000)‡
Amenity	Dist. to CBD	-0.0200	(0.0009)	-0.0213	(0.0004)‡	-0.0308	(0.0000)‡	-0.0303	(0.0000)‡
Amenity	Dist to Park[1]	-0.0093	(0.0014)	-0.0092	(0.0017)‡	-0.0104	(0.0001)‡	-0.0119	(0.0000)‡
Amenity	Historical sites[2]	0.0964	(0.0022)	0.1012	(0.0013)‡	0.0903	(0.0022)‡	0.0795	(0.0073)‡
Amenity	Sunshine[3]	1.9592	(0.0000)	2.2925	(0.0000)‡	3.0139	(0.0000)‡	3.0458	(0.0000)‡
Amenity	Dist to bus-stop	0.0000	(0.3950)	0.0082	(0.1420)	0.0000	(0.8510)	0.0000	(0.2227)
Amenity	Dist to Stations	0.0404	(0.0189)†	0.0368	(0.0189)[4]†	0.0323	(0.0302)†	0.0271	(0.0745) *

Discounted amenity values

FIGURE 31: FRAMEWORK FOR STATUS QUO AGGLOMERATION BENEFITS

Year	Mean income	Cumulative density increase	Additional income including density	Net additional income	Discounting	Real additional income	Additional Upper Hutt jobs
2018	$59,320.14	0.00575	$59,323.55	$3.41	100.00	$3.41	59
2019	$61,219.36	0.01150	$61,226.40	$7.04	97.75	$6.88	117
2020	$63,179.38	0.01725	$63,190.28	$10.90	95.55	$10.41	168
2021	$65,202.16	0.02300	$65,217.15	$15.00	93.40	$14.01	231
2022	$67,289.69	0.02875	$67,309.04	$19.35	91.30	$17.66	294
2023	$69,444.07	0.03450	$69,468.03	$23.96	89.24	$21.38	351
2024	$71,667.42	0.04025	$71,696.26	$28.85	87.24	$25.16	415
2025	$73,961.95	0.04600	$73,995.97	$34.02	85.27	$29.01	465
2026	$76,329.94	0.05175	$76,369.44	$39.50	83.36	$32.93	517
2027	$78,773.75	0.05750	$78,819.05	$45.29	81.48	$36.91	576
2028	$81,295.80	0.06325	$81,347.22	$51.42	79.65	$40.95	642
2029	$83,898.60	0.06900	$83,956.49	$57.89	77.85	$45.07	702
2030	$86,584.73	0.07475	$86,649.46	$64.72	76.10	$49.26	754
2031	$89,356.86	0.08050	$89,428.80	$71.93	74.39	$53.51	810
2032	$92,217.75	0.08625	$92,297.29	$79.54	72.72	$57.84	875
2033	$95,170.23	0.09200	$95,257.78	$87.56	71.08	$62.24	936
2034	$98,217.24	0.09775	$98,313.24	$96.01	69.48	$66.71	1002
2035	$101,361.80	0.10350	$101,466.71	$104.91	67.92	$71.25	1069
2036	$104,607.04	0.10925	$104,721.32	$114.28	66.39	$75.87	1146
2037	$107,956.18	0.11500	$108,080.33	$124.15	64.90	$80.57	1223
2038	$111,412.54	0.12075	$111,547.07	$134.53	63.44	$85.34	1312
2039	$114,979.57	0.12650	$115,125.02	$145.45	62.01	$90.19	1397
2040	$118,660.80	0.13225	$118,817.73	$156.93	60.61	$95.12	1484
2041	$122,459.89	0.13800	$122,628.89	$168.99	59.25	$100.13	1571
2042	$126,380.62	0.14375	$126,562.29	$181.67	57.92	$105.22	1666
2043	$130,426.87	0.14950	$130,621.86	$194.99	56.61	$110.39	1756
2044	$134,602.67	0.15525	$134,811.64	$208.97	55.34	$115.64	1846
2045	$138,912.16	0.16100	$139,135.81	$223.65	54.09	$120.98	1936
2046	$143,359.63	0.16675	$143,598.68	$239.05	52.88	$126.40	2026
2047	$147,949.48	0.17250	$148,204.70	$255.21	51.69	$131.91	2116

FIGURE 32: FRAMEWORK FOR CALCULATING TRANSPORT COSTS UNDER STATUS QUO

Year	Commute numbers	Commute time	Non-commute	Non-work travel	Cost/hour	Total cost	Discounted costs
2017	6,250	35	4,688	25			
2018	6,292	35.08	4,713	25.04	$133,147	$33,286,854	$33,286,854
2019	6,334	35.16	4,738	25.08	$133,147	$33,286,854	$32,537,900
2020	6,376	35.24	4,763	25.12	$138,643	$34,660,752	$33,118,565
2021	6,418	35.32	4,788	25.16	$144,358	$36,089,582	$33,707,935
2022	6,461	35.4	4,813	25.2	$150,302	$37,575,490	$34,306,129
2023	6,504	35.48	4,838	25.24	$156,507	$39,126,756	$34,918,668
2024	6,547	35.56	4,863	25.28	$162,960	$40,740,052	$35,540,389
2025	6,591	35.64	4,889	25.32	$169,671	$42,417,798	$36,171,414
2026	6,635	35.72	4,915	25.36	$176,677	$44,169,210	$36,817,455
2027	6,679	35.8	4,941	25.4	$183,963	$45,990,656	$37,473,175
2028	6,723	35.88	4,967	25.44	$191,539	$47,884,867	$38,138,706
2029	6,768	35.96	4,993	25.48	$199,419	$49,854,683	$38,814,177
2030	6,813	36.04	5,019	25.52	$207,643	$51,910,719	$39,505,561
2031	6,858	36.12	5,045	25.56	$216,196	$54,048,890	$40,207,284
2032	6,904	36.2	5,071	25.6	$225,090	$56,272,398	$40,919,484
2033	6,950	36.28	5,098	25.64	$234,372	$58,593,056	$41,648,335
2034	6,996	36.36	5,125	25.68	$244,026	$61,006,411	$42,388,079
2035	7,043	36.44	5,152	25.72	$254,064	$63,516,077	$43,138,863
2036	7,090	36.52	5,179	25.76	$264,541	$66,135,196	$43,907,068
2037	7,137	36.6	5,206	25.81	$275,436	$68,858,917	$44,686,747
2038	7,184	36.68	5,233	25.86	$286,765	$71,691,317	$45,478,055
2039	7,232	36.76	5,260	25.91	$298,547	$74,636,631	$46,281,147
2040	7,280	36.84	5,288	25.96	$310,840	$77,709,997	$47,102,694
2041	7,328	36.92	5,316	26.01	$323,624	$80,905,970	$47,936,485
2042	7,377	37	5,344	26.06	$336,917	$84,229,324	$48,782,685
2043	7,426	37.08	5,372	26.11	$350,788	$87,696,905	$49,648,190
2044	7,475	37.16	5,400	26.16	$365,211	$91,302,785	$50,526,585
2045	7,525	37.24	5,428	26.21	$380,209	$95,052,349	$51,418,042
2046	7,575	37.32	5,456	26.26	$395,857	$98,964,338	$52,329,692
2047	7,625	37.4	5,485	26.31	$412,129	$103,032,305	$53,254,907

FIGURE 33: FRAMEWORK FOR CALCULATING INDICATIVE AMENITY VALUES

Year	Pop.	H'holds	New H'holds	Discount rate	House prices	CBD	Open Space	Sunshine	Land	High density
2013	41,300	15,069								
2014	41,552	15,161	92							
2015	41,912	15,292	223							
2016	42,185	15,392	323							
2017	42,378	15,462	393							
2018	42,629	15,554	485	100	$589,084	$64.62	$22.33	$803.69	$281.96	$11.51
2019	42,881	15,646	577	97.75	$612,648	$63.17	$21.83	$785.61	$275.61	$11.25
2020	43,097	15,725	656	95.55	$637,154	$61.75	$21.34	$767.93	$269.41	$10.99
2021	43,369	15,824	755	93.4	$662,640	$60.36	$20.86	$750.65	$263.35	$10.75
2022	43,639	15,922	853	91.3	$689,146	$59.00	$20.39	$733.77	$257.43	$10.50
2023	43,881	16,011	942	89.24	$716,712	$57.67	$19.93	$717.22	$251.62	$10.27
2024	44,156	16,111	1,042	87.24	$745,380	$56.38	$19.48	$701.14	$245.98	$10.04
2025	44,370	16,189	1,120	85.27	$775,195	$55.10	$19.04	$685.31	$240.43	$9.81
2026	44,594	16,271	1,202	83.36	$806,203	$53.87	$18.61	$669.96	$235.04	$9.59
2027	44,848	16,364	1,295	81.48	$838,451	$52.65	$18.19	$654.85	$229.74	$9.37
2028	45,132	16,467	1,398	79.65	$871,989	$51.47	$17.79	$640.14	$224.58	$9.16
2029	45,387	16,560	1,491	77.85	$906,869	$50.31	$17.38	$625.68	$219.50	$8.96
2030	45,612	16,642	1,573	76.1	$943,144	$49.18	$16.99	$611.61	$214.57	$8.76
2031	45,849	16,729	1,660	74.39	$980,870	$48.07	$16.61	$597.87	$209.75	$8.56
2032	46,129	16,831	1,762	72.72	$1,020,105	$46.99	$16.24	$584.45	$205.04	$8.37
2033	46,389	16,926	1,857	71.08	$1,060,909	$45.93	$15.87	$571.27	$200.42	$8.18
2034	46,672	17,029	1,960	69.48	$1,103,345	$44.90	$15.51	$558.41	$195.90	$7.99
2035	46,963	17,135	2,066	67.92	$1,147,479	$43.89	$15.17	$545.87	$191.51	$7.81
2036	47,290	17,255	2,186	66.39	$1,193,378	$42.90	$14.82	$533.57	$187.19	$7.64
2037	47,621	17,375	2,306	64.9	$1,241,113	$41.94	$14.49	$521.60	$182.99	$7.47
2038	48,004	17,515	2,446	63.44	$1,290,758	$41.00	$14.17	$509.86	$178.87	$7.30
2039	48,366	17,647	2,578	62.01	$1,342,388	$40.07	$13.85	$498.37	$174.84	$7.13
2040	48,740	17,784	2,715	60.61	$1,396,084	$39.17	$13.53	$487.12	$170.89	$6.97
2041	49,112	17,919	2,850	59.25	$1,451,927	$38.29	$13.23	$476.19	$167.06	$6.82
2042	49,519	18,068	2,999	57.92	$1,510,004	$37.43	$12.93	$465.50	$163.31	$6.66
2043	49,905	18,209	3,140	56.61	$1,570,404	$36.58	$12.64	$454.97	$159.62	$6.51
2044	50,291	18,350	3,281	55.34	$1,633,220	$35.76	$12.36	$444.76	$156.04	$6.37
2045	50,677	18,490	3,421	54.09	$1,698,549	$34.95	$12.08	$434.72	$152.51	$6.22
2046	51,063	18,631	3,562	52.88	$1,766,491	$34.17	$11.81	$424.99	$149.10	$6.08
2047	51,449	18,772	3,703	51.69	$1,837,151	$33.40	$11.54	$415.43	$145.74	$5.95