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MRCagney

Signals of Under-Capacity:

the practicalities of monitoring Price Signals under the National Policy Statement on Urban Development Capacity

Prepared for

Ministry of Business, Innovation & Employment and the Ministry for the Environment

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Executive Summary

Introduction

This study examines possible indicators (or price signals) that could be used to signal a need to make more development capacity available in resource management plans, to meet requirements of the draft National Policy Statement for Urban Development Capacity (NPS-UDC).[1] It identifies market indicators to help councils better understand local land and development markets and to identify whether urban planning policies or infrastructure limits are excessively constraining development opportunities. The study also examines council capabilities and other practical requirements of the use of indicators.

The draft NPS-UDC was developed out of increasing concerns over land prices in New Zealand's major urban areas and the associated concern of housing "unaffordability." It identifies that part of the problem is planning policies that overly constrain development. It offers part of the solution to the problem by directing local authorities to deliver urban planning policies that provide residential and business development capacity that is sufficient to meet demand. **Development capacity** is defined as zoning and infrastructure that enables development of some amount. This includes capacity for development on new greenfield (bare) land and opportunities for additional development in existing urban areas.

The NPS-UDC requires local authorities to provide sufficient development capacity to improve the competitiveness of land and development markets in and around urban areas. Competitive markets are a key mechanism for achieving greater community wellbeing by ensuring that the resources available to the community are allocated to purposes that produce the highest value to the community, taking into account all costs and benefits.

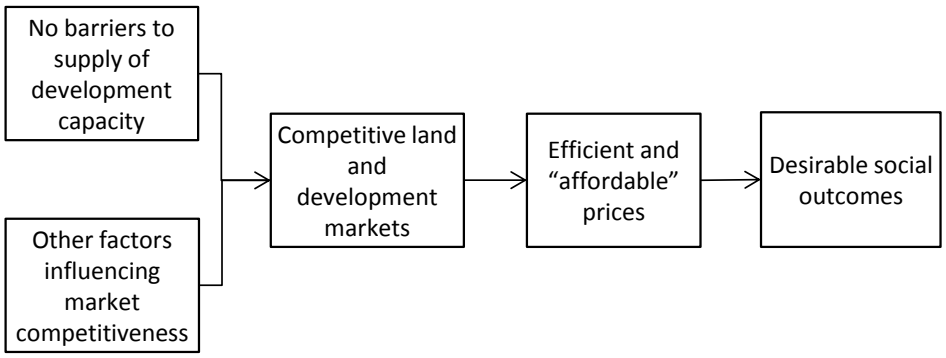
Under the draft NPS-UDC, additional development capacity must be made available when and where analysis suggests it is required. The analysis would include assessments of the demand and supply, and the supply-demand balance for housing and business land in the short, medium and long-terms, taking account of factors that include expected population growth and changes in the size and structure of the economy, as well as regular monitoring of price signals to identify existing or emerging shortfalls of development capacity.

The draft NPS-UDC has a series of requirements for councils which include analysis of data and indicators, and the release of additional development capacity when there is an estimated supply gap relative to demand. The underlying logic behind the requirements might be described as in Figure ES1 below.

[1] Ministry for the Environment and Ministry of Business, Innovation and Employment (2016). Proposed National Policy Statement on Urban Development Capacity: Consultation Document. Wellington: Ministry for the Environment.

It sees affordable prices as being the outcome of well-functioning, competitive land and development markets. Where plans provide adequate development capacity, markets for land and development are more likely to be competitive, and where markets are competitive, prices would be lower and more affordable; as a result, there would be desirable social outcomes, eg the absence of over-crowding.

Figure ES1 The links between adequate supply, competitive markets and affordability



The housing affordability problem is not simply the under-supply of "affordable housing" as a specific category, but rather the presence of several factors that result in uncompetitive markets under which prices are elevated across the whole market. In this context, the solutions are seen as increasing the competitiveness of the market for the supply of development capacity.

Possible Indicators

Indicators could be developed to address different steps on the chain of causality, including indicators of:

- demand and supply, and any supply-demand imbalance;
- degree of market competitiveness;
- market prices and their relationship to wellbeing-maximising prices; and/or
- the wellbeing impacts of unaffordability, eg levels of overcrowding.

We have examined a long list of indicators against criteria of usefulness, understandability, data availability and feasibility.

Recommendations

Indicators

Ideally, a *package* of indicators would be developed covering the following.

- General market information on future demand and supply and any emerging problems, such as:
  - trends in home prices;
  - trends in rents; and
  - the ratio of new build to population growth.

- Housing affordability indicators, including:

    - the ratio of home price to income (new buyers);
    - the ratio of mortgage costs to income (home owners); and
    - the ratio of rental costs to income (renters).

- Efficient price indicators, including:
    - discontinuity in land values in adjacent zones; and
    - the ratio of building costs to market price.

Different indicators may be more appropriate in some places than others, eg apartment sale price to marginal construction cost ratio is only feasible to estimate in Auckland and Wellington (at present). The Herfindahl–Hirschman Index (HHI), an index of competitiveness as measured by market shares, will sometimes be most useful as a communication device and sometimes as an analysis tool.

The preferred set of indicators is shown in Table ES1.

Table ES1 Suggested indicators

Component	Preferred indicators	Description
General market information	1. Home price trends	Trends in home prices over time (inflation adjusted)
	2. Trends in land values	Changes in land values by suburb
	3. Trends in rents	Inflation-adjusted average rents by size category (1-bedroom, 3-bedroom)
Supply-demand balance	4. New build to population growth ratio	Ratio of population growth to: number of new build consents (supplemented by data on average size of new builds and number of buildings in different size categories
Competitiveness	5. HHI	Sum of the squares of market shares (% of development land available) of each landowner in the market.
Price efficiency	6. Price discontinuities	Discontinuities in land values: (1) either side of urban limit; (2) adjacent uses zones, eg residential & industrial; (3) adjacent zones with different density potentials
	7. Cost to market price ratio	Ratio of estimated marginal costs of building to market price, eg for one more floor on an apartment building
Affordability	8. Home price to income ratio	Ratio of lower quartile home price to median household income
	9. Housing costs (owners) to income ratio	Ratio of mortgage payments (100% mortgage, 30-year term, average 2-year fixed & floating interest rate) for median home price to median household income
	10. Housing costs (renters) to income ratio	Ratio of average rent payments to median household income

To the extent possible, data should be published in spatial form, eg as a map of price discontinuities at different locations within the city and the edge of the city. This makes it easier for council staff to interpret the information and provides appropriate local context. Mapped data may be supplementary to numerical analysis.

Interpretation

Figure ES2 illustrates how the indicators might be used to analyse and interpret a problem, and provide information about the need for more development capacity in plans.

Figure ES2 Use of indicators to diagnose the problem

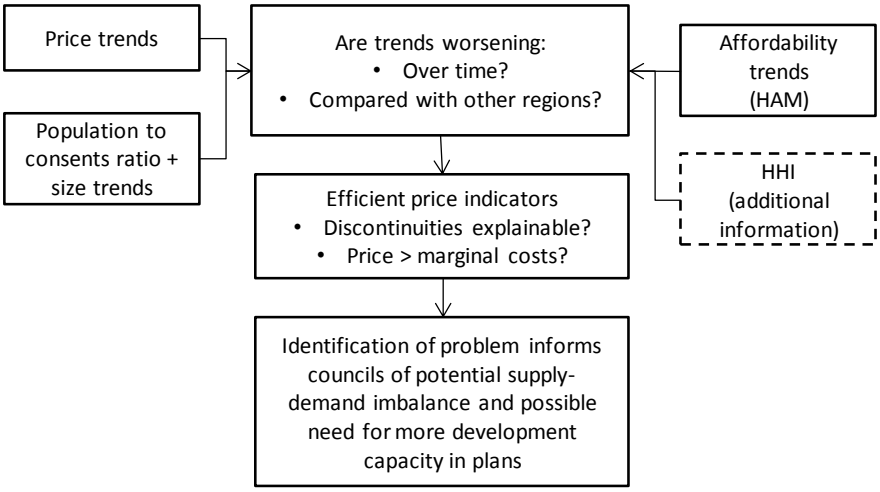


Table ES2 provides more detail relating to the individual recommended indicators and how they might be interpreted to assist decisions.

The way in which the different groups of indicators function is as follows.

- The supply-demand indicators (price trends + population to consents ratio) provide background information that helps to identify if there is an emerging problem that requires further investigation.

- The competitiveness indicator (HHI) can provide information on whether market concentration is a problem.

- The affordability indicators provide information on whether the identified trends are matched by increasing signs of unaffordability. They are best interpreted through comparisons over time and between cities. This may include NZ cities and international examples.

The efficient price indicators are the chief indicators to provide evidence of a problem of uncompetitive markets leading to elevated prices. They require additional information to interpret them, and specifically the costs of development and of building.

Where efficient price indicators suggest that there are significant price differences that are not explainable by other factors, this information indicates that plans should provide additional development capacity. The indicators cannot by themselves lead to conclusions about exactly what kind of capacity or the location, but they are the starting point for that analysis as a matter of urgency.

Table ES2 Interpretation of suggested indicators

Category	Indicator	Interpretation
General market information	1. Home price trends: Inflation-adjusted median home prices	Significantly increasing prices relative to those in other locations should signal a potential for uncompetitive land and development markets, requiring further analysis.
	2. Trends in land values	Significantly increasing prices can be used to identify emerging problems, as can divergence of land and property values.
	3. Trends in rents: Inflation-adjusted mean rent values	Significant differences between changes in price trends for rents and home prices can provide further suggestions on which parts of the market are least competitive.
Supply-demand	4. Population growth to building consents	If ratio of population growth to new building consents is greater than average household size, it suggests that there is insufficient new building.
		Average building size for new consents and number of buildings in different size categories should be used to supplement the analysis and interpret whether: (1) there is a shift to different size categories that might provide more or less total residential space, or (2) if there is a shift to more or less affordable housing types, eg bigger houses.
Competitiveness	5. HHI	1,500 - 2,500: moderately concentrated; >2,500: highly concentrated. If moderate to high concentration is combined with high prices, planning rules should be investigated to see if they can enable greater market entry and more competition.
Efficient prices	6. Discontinuities in land values between zones or at the urban fringe	If there are significant absolute differences in land values across zones which cannot be explained by an analysis of the costs of development of land, it suggests that there is a lack of competitiveness in development markets. Planning rules should be investigated to see if they are providing significant barriers to market entry.
	7. High-rise apartment sale prices against marginal construction costs	If there are significant absolute differences between the price of high-rise apartments (or offices, hotels, etc) and marginal construction costs that cannot be explained by quantifiable factors, such as 'lumpiness' related to earthquake strengthening or building infrastructure costs, it suggests that there is a lack of competitiveness in development markets. Planning rules should be investigated to see if they are providing significant barriers to market entry.
Affordability	8. Home price to income: lower quartile home price to median household income	If the ratio of price to income is increasing it suggests an increasing affordability problem. This should be further investigated by examining trends in housing costs ratio (see below) and by comparing trends between cities to see if the problem is location-specific.
	9. Mortgage repayments to income ratio	If the ratio is increasing it suggests an increasing affordability problem. This should be further investigated by separating the effects of prices versus interest rates. Additional information to assist interpretation would include trends in prices and in incomes, including by age category.
	10. Rent payments to income ratio	If the ratio is increasing it suggests an increasing affordability problem. This should be further investigated by comparing trends in rents with trends in home prices.

Institutional Arrangements

National direction and non-statutory guidance

We recommend that the NPS-UDC includes *some* specific price signals as requirements for councils, and provide guidance that includes additional price signals that are optional to measure. Having a small set of indicators measured across all councils would provide the ability to make comparisons. It is also likely that a small set of indicators would be useful in most circumstances.

Of the indicators listed above, we suggest that:

- the price trend indicators (home prices and rents) are collected by all councils;
- the ratio of population growth to new consents plus data on the size of new consented dwellings are collected by all councils; and
- affordability indicators are published for all council areas using data from the HAM.

Efficient price indicators should be developed where these indicators suggest that:

- prices are rising significantly faster than inflation rates;
- new consents are not keeping pace with population growth or buildings are only meeting the requirements of certain segments of the population; or
- the HAM indicators suggest that affordability is becoming significantly worse.

The role of central and local government:

Central government has better access to consistent data, eg, through its purchase arrangement with CoreLogic and access to administrative data through Statistics New Zealand's Integrated Data Infrastructure, eg tax data. At a minimum, there is a role for central government in providing some data to councils or facilitating this in the most efficient way.

Central government is likely also to have better ability to:

- develop and implement consistent and sophisticated methodologies, and interpret indicators; and/or
- purchase skills without duplicating effort.

Local government potentially has better local information on determinants of prices, development costs, and so on. However, local government capability to develop indicators is mixed, reflecting council size and skill levels of staff. Therefore, partnership approaches between councils, or between councils and central government, should be encouraged.

It is recommended that:

- central government
    - compiles a consistent set of data on home prices and rents which it provides to councils;
    - continues to develop the HAM and provides housing affordability indicator results to councils;
    - provides advice to councils on: (1) the development of models to analyse price discontinuities across zones and (2) the analysis of the differences between prices and marginal construction costs; and
    - provides other technical advice as required;

- local government
    - develops and publishes indicators of price trends, and the ratio of population increase to new building consents with building size data;
    - analyses these data and the HAM indicators;
    - develops efficient price indicators, as required, in response to the initial problem identification; and
    - responds to a significant market problem if identified.

1 Introduction

1.1 Background

1.1.1 The requirement to monitor price signals

This study examines indicators (or price signals) that provide information about demand for and supply of housing and business land, and which could signal a need to make more development capacity available in resource management plans. This is to meet requirements of the National Policy Statement for Urban Development Capacity (NPS-UDC).[2] The study identifies market indicators to help councils better understand local land and development markets and to identify whether urban planning policies or infrastructure limits are excessively constraining supply. It also examines council capabilities and other practical requirements of the development and use of indicators. This information will inform the final NPS-UDC and provide support for its implementation.

A draft NPS-UDC was released for consultation on 3rd June 2016. Its content was underpinned by increasing government concerns over land prices and "unaffordable" housing in New Zealand's major urban areas. It identifies that part of the problem is planning that inappropriately constrains development. It offers part of the solution to the problem, by directing local authorities to provide sufficient residential and business development capacity in their plans to meet demand.

- **Demand** is defined in the draft NPS-UDC as both aggregate demand for housing and business space, and demands for different locations, typologies and price points.

- **Development capacity** is defined as zoning and infrastructure that enables development of some amount.[3] This includes capacity for development on new greenfield (bare) land and opportunities for additional development in existing urban areas.

The NPS-UDC requires plans to provide sufficient development capacity, to improve the competitiveness of land and development markets in and around urban areas. Competitive markets are a key mechanism for achieving greater community wellbeing,

[2] Ministry for the Environment and Ministry of Business, Innovation and Employment (2016). Proposed National Policy Statement on Urban Development Capacity: Consultation Document. Wellington: Ministry for the Environment.

[3] Under the proposed NPS-UDC development capacity is defined to mean "*in relation to residential and business land, the capacity of land for urban development to meet demand, taking into account the following factors:*

- *the zoning, objectives, policies, rules and overlays that apply to the land; and*
- *the provision of adequate infrastructure, existing or likely to exist, to support the development of the land, having regard to*
    - *the relevant proposed and operative regional policy statements, regional plans and district plans; and*
    - *any relevant management plans and strategies prepared under other Acts.*"

by ensuring that the resources available to the community are allocated to purposes that produce the highest value to the community, taking into account all costs and benefits.

The draft NPS-UDC requires additional development capacity to be made available when analysis suggests it is required. The analysis would include assessments of demand for and supply of housing and business land in the short, medium and long-terms, taking account of expected population growth and changes in the size and structure of the economy, as well as regular monitoring of price signals.

1.1.2 Relevant policies in the draft NPS-UDC

The draft NPS-UDC "*aims to help reduce regulatory barriers to the supply of housing and reduce the cost of housing relative to income.*" To do so, the following policies are set out in Section 6 of the draft NPS-UDC. These include:

- Requirements for **all councils** to:
    - enable competitive land and development markets which help to achieve efficient use of land and infrastructure (PA1);
    - provide sufficient residential and business development capacity for the short, medium and long terms (PA2, PA3); and

- Requirements for **medium and high growth councils**[4] to estimate supply and demand in the short, medium and long run (PB1), and the additional development capacity needed to meet demand (PB3), for:
    - housing, by type (of dwelling), location and price category; and
    - business land by type and location.

In estimating supply and demand, councils must consult widely (PB4) and have regard to factors which include:

- underlying determinants of demand—changes in demography and economic structure (PB2);
- the effects of the planning system on markets for housing and business land (PB2), and on development capacity (PB3);
- actual and likely availability of infrastructure (PB3); and
- market prices and thus the commercial feasibility of development capacity and the likelihood of development opportunities being taken up (PB3).

To ensure local authorities are well-informed about "the market's response to planning", the draft NPS-UDC lists the following indicators which must be monitored (PB5):

- the relative affordability of housing, including the ratio of home price to income and the relative cost to rent;
- the increase in home prices and rents;
- the number of resource and building consents granted relative to the growth in population;
- vacancy rates for business land;
- the ratio of the value of land between rural and urban zoned land; and

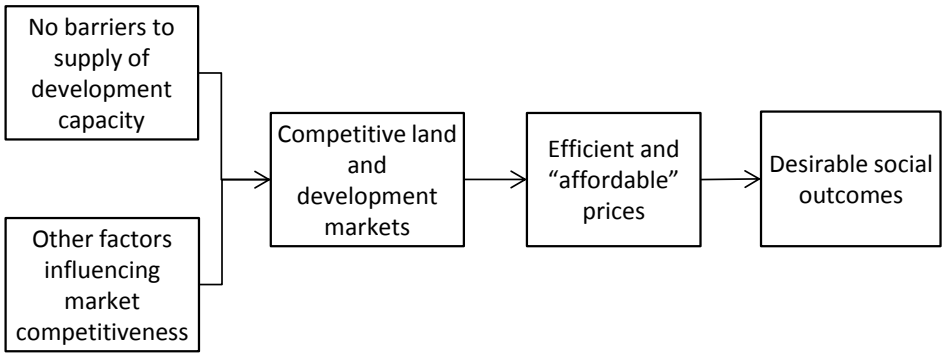
[4] These are defined in the proposed NPS-UDC.

- the ratio of the value of improvements to the value of land within the urban area.

This report will help inform any amendments to these requirements in the final NPS-UDC, and the programme of support for implementing the requirements.

The underlying logic behind these requirements might be described as in Figure 1. It sees affordable prices as being the outcome of competitive land and development markets. Competitive markets have several characteristics[5], which regulation (including planning restrictions) can affect. Where there is adequate supply of development capacity in plans (PA2, PA3), markets for land and development are more likely to be competitive (PA1), and where markets are competitive, prices would be lower and more affordable; as a result, there would be desirable social outcomes, eg the absence of over-crowding.

Figure 1 the links between adequate supply, competitive markets and affordability



The housing affordability problem is not simply the under-supply of "affordable housing" as a specific category, but rather the presence of several factors that result in uncompetitive markets under which prices are elevated across the whole market. In this context, the solutions are seen as increasing the competitiveness of the market for the supply of development opportunities, housing and business space.

We explore these issues and the logic in more detail in the sections to follow.

1.2 Previous Reports

Four recent studies have examined possible indicators to some extent. These are:

- The cost benefit analysis of the proposed NPS-UDC;[6]
- An initial report to MfE and Treasury on the use of land price indicators in guiding regulation;[7]

[5] For example: no barriers to market entry; many buyers and sellers; a (relatively) uniform product; no externalities; perfect information; and zero transaction costs.
[6] MRCagney, Covec and Beca (2016) Cost benefit analysis of policy options for a National Policy Statement on Urban Development Capacity. Final Report to Ministry for the Environment.
[7] NZIER (2015) The price is right. Land prices can help guide land use regulation. NZIER report to the Ministry for the Environment and New Zealand Treasury.

- A report on methodologies for estimating demand and development capacity for housing and business land;[8] and

- A report on demand for and capacity to supply business land.[9]

We discuss these reports in turn below.

1.2.1 Cost Benefit Analysis of the NPS-UDC

The cost benefit analysis of the proposed NPS-UDC[10] examined a number of indicators that suggested an emerging problem of uncompetitive supply of land and housing in a number of New Zealand cities. These indicators of market and/or regulatory failure were:

- discontinuities in land prices, including across the metropolitan urban limit (MUL)—a theoretically competitive land market would be expected to show a smooth reduction in land prices with distance from the centre (or other amenities);

- low elasticities of housing supply to increases in demand—a competitive market would be more elastic (supply would increase more rapidly in response to increases in housing demand, resulting in lower price growth over time);

- the gap between marginal construction costs and sale prices of buildings—in theory prices should reflect the marginal costs of construction;

- land value as a proportion of total property value—land becomes more expensive when it is scarcer, but this can be offset by building up; and

- land use regulation indices which measure the extent and nature of regulatory controls.

Building on the problem assessment, the study examined the benefits of increasing the competitiveness of land supply and compared this with estimates of the external costs of development. The estimated benefits exceeded the costs, suggesting that there was considerable net benefit from introducing policies that moved towards increasing land use flexibility and the competitiveness of land markets in general. The benefits arise from:

- consumer benefits that accrue to new entrants to the housing market who are currently excluded by high prices resulting from uncompetitive markets. They currently are living in accommodation that is less desirable than owning their

[8] Ministry for the Environment (2016) How Councils Estimate Demand and Supply of Development Capacity for Housing and Business. Ministry for the Environment: Wellington.
[9] BERL and Ascari Partners (2016) Business land: problems and causes. Final Report to the Ministry of Business, Innovation and Employment.
[10] MRCagney et al (*op cit*)

own property if it was available at a competitive market price; and

- agglomeration benefits from increased density of households and firms resulting in both increased productivity of economic activity and improved consumption opportunities.

These were offset by external costs of increased development. These included overshadowing, congestion and costs of infrastructure borne by existing residents.

1.2.2 The Price is Right

NZIER examined whether land price differentials (variation in land prices across a city) could be used as a signal of land use regulation that was over-limiting supply of development capacity.[11] The indicators included in its study were land price differentials:

- at the city limit; and

- across residential zones with different levels of control on building height, building coverage, heritage protection and so on.

The NZIER study included three different evaluation strategies which they termed naïve, sophisticated and focussed.

- The **naïve** strategy was a simple comparison of prices across the city limit (or across zones) without adjusting for amenity values, eg land at the city edge may be desirable because of its closeness to rural areas with high amenity.

- The **sophisticated** approach included statistical (spatial hedonic) methods to filter out the effects on price of factors that included views, amenities and infrastructure so that comparisons are made on an equivalent basis.

- The **focussed** approach uses data on price differences in a small geographical area that spans the zoning boundary (city limit) such that many of the differences, that otherwise need to be corrected for, do not apply.

This study undertook additional analysis using real data to explore some of the practical issues involved in building a set of indicators. We build on the lessons learned from this study in our analysis, making use of the sophisticated and focussed approaches.

1.2.3 Methodologies for estimating demand and development capacity for housing and business land

The Ministry for the Environment (MfE) reviewed nine 'high growth' councils' methodologies for estimating demand and development capacity for housing and business land.[12] Estimates of demand and development capacity are very important

[11] NZIER (*op cit*)
[12] Ministry for the Environment (*op cit*)

inputs to planning decisions, especially in high growth urban areas, as they help to inform zoning and infrastructure supply decisions.

MfE found that all councils estimate demand and development capacity, albeit with different approaches and to varying levels of detail.

- While all councils employ Statistics NZ population projections as a basis for estimating future demand, a number of individual councils have commissioned or undertaken additional work to modify these projections or generate alternative projections.

- Most councils consider how demand may be distributed spatially throughout their urban area, although most only focus on greenfield areas. Some councils also consider demand for dwellings in existing urban areas, as well as demand for different types of dwellings (eg apartments vs standalone houses).

- All of the councils surveyed calculate the capacity for future development provided for in plans, usually in terms of the number of dwellings that could be developed, or the number of years of demand that could be met.

- Different councils employ different approaches to estimating development capacity. Some councils only calculate 'theoretical' capacity enabled in resource management plans and serviced with infrastructure. Others apply discount factors to take account of the fact that not all plan-enabled, serviced land will be developed. Recently, Auckland Council, Tauranga City Council, Wellington City Council and Queenstown-Lakes District Council have also begun to factor in how much plan-enabled capacity is commercially feasible to develop, to varying degrees. Christchurch City Council does this on an ad hoc basis.

- Business land demand and development capacity is generally less of a priority for modelling and analysis than residential demand and capacity.

MfE used this information to identify ways that the proposed NPS-UDC could encourage councils to improve on existing practices.

1.2.4 Demand for and capacity to supply business land

BERL and Ascari investigated the sufficiency of the supply of business land in urban areas experiencing the highest population growth in New Zealand.[13] They defined business land as land specifically zoned for productive uses in urban areas, including manufacturing, retail, commercial offices, hospitality and accommodation, and business services.

They concluded that the overall supply of business land is generally sufficient, and in some areas it is likely that there may be an oversupply, contributing to 'hollowing out' of town centres and/or an under-utilisation of infrastructure provided for development that did not occur. However, there was evidence of localised shortages of business land

[13] BERL and Ascari (*op cit*)

in the right locations for specific uses, including industrial land in Auckland and capacity for hotel development in Queenstown.

BERL and Ascari also considered the impact of current planning practices on the supply of business land. They identified some issues related to slow planning responses to increasing demand for business land (or for changes between alternative uses), as well as the potential for reverse sensitivities, or tensions between established (generally industrial) uses and new uses (generally residential) in areas zoned for multiple uses.

1.3 This Report

Building on these previous studies and the requirements of the draft NPS-UDC, this consultancy report assesses the benefits, costs and feasibility of local authorities monitoring the price signals included in the NPS-UDC and other indicators identified in this study. The brief requires it to provide recommendations about:

- the package of price signals that local authorities should monitor, and how frequently;
- the pros and cons of measures;
- any techniques that should or must be undertaken to convert data into meaningful information; and
- desirable local authority responses to the information provided by the price signals.

To identify and analyse suitable indicators we build on the desirable set of market characteristics as illustrated in Figure 1 above. This is used as the basis for defining the problem and for the identification of indicators that could be used to help councils to:

- better understand local markets for land, housing and development capacity;
- identify existing and emerging problems that contribute to unaffordability; and
- help target solutions.

We discuss the problem in more detail in Section 2; we provide an in-principle discussion about how to identify and measure cases where current policy results in insufficient development capacity to meet demands. We next work through the different types of possible indicator might address different steps on the chain of causality.

1. **General market conditions** which set the scene and suggest whether a problem is emerging (Section 3).

2. **Demand, supply and the supply-demand balance**: how much demand and supply is there, where and of what type; is there is sufficient amount of development capacity to meet growth in demand, and are developers actually building new housing or business floorspace in response to demand (Section 4).

3. **Competitiveness**: the extent to which the market for land (or development capacity) is competitive, setting aside constraints arising from planning or

infrastructure supply (Section 5).

4. **Efficient prices:** the extent to which observed market prices for housing, business floorspace, or urban land diverge from prices that would be expected in a fully competitive market (Section 6).

5. **Market outcomes:** indicators of the ultimate policy concerns, ie the degree of "unaffordability" of homes and thus low levels of ownership or of hardship in the form of over-crowding (Section 7).

To conclude, we discuss data availability and capability in councils and central government to implement proposed measures (Section 8) and make recommendations about appropriate metrics for inclusion in the NPS-UDC and non-statutory guidelines (Section 9).

We include short summaries of the recommended indicators as Annexes to the report.

2 Identifying the Problem

This Section sets out the nature of the emerging problem which the draft NPS-UDC is addressing. Ultimately, the concern is with housing affordability and the social outcomes that result. However, the thesis presented here and suggested by the draft NPS-UDC is that the cause is uncompetitive land and development markets, partly as a result of supply limits imposed via planning controls. We step through these components in turn, starting with the market and its participants, the characteristics of an ideal competitive market and the implications of less than full competition.

2.1 Market Definition

Development capacity includes land zoned for development, eg for residential or business use, and the associated infrastructure that allows that development. In the overall context of urban development, although land is the primary good that is exchanged in the market, what determines its value is the set of attributes attached to that land, including the rights to develop. Increasing supply of development capacity is not about increasing the total supply of land but of changing the zoning rules in council plans such that there is an increase in:

- the land that is zoned for development, eg for residential or business purposes rather than rural uses (agriculture, horticulture etc); and/or

- the amount of development that can occur on any land zoned for development (building height, site coverage etc).

Several distinct markets are of interest.

- Land at the edge of cities (greenfield land) which might otherwise be used for some other (non-urban) use, eg agriculture or horticulture. For development to occur it will need to be rezoned, infrastructure needs to be supplied and land may need to be prepared (see below).

- Land within cities which might be made available for more intensive development, including:
    - land currently zoned for residential use but at a low(er) density; and
    - land currently zoned for some other use, eg commercial/industrial land which might be rezoned for residential use.

  This land is likely to have infrastructure provided already, including roads, three waters,[14] energy supply and communications (although it may be capacity constrained).

- Infrastructure which enables urban land use. It may be provided privately or by the Government, councils and council-controlled organisations (CCOs).

[14] Water supply, wastewater and stormwater.

- Land preparation, ie the measures taken to prepare land for residential (or business) purposes, which might include earthworks, drainage and so on.

- Construction markets, ie building housing and buildings for business use.

There are a number of participants in the markets, as listed in Table 1. These include those who actively participate in these markets and those that affect them directly.

Table 1 Market participants in development capacity markets

Participant	Zoning/land supply	Infrastructure	Land preparation & construction
Council	✓	✓	✓
Landowners	✓		
Infrastructure supplier		✓	
Land developer/builder		✓	✓
Building material providers			✓
Banks/financiers	✓	✓	✓

All of these markets have the potential to be more or less competitive and to be more or less under-supplied. Councils interact with most markets and can limit levels of supply, particularly as they aim to meet multiple objectives–enabling development and managing the effects of development. They:

- zone land which determines total capacity;

- are involved in infrastructure provision, either directly or via CCOs, or working with providers in planning for infrastructure; and

- consent buildings and other development activities, thus they influence land preparation and construction markets without participating directly.

In general, other market participants[15] have a narrower set of objectives, aiming to maximise their own net benefits which may be narrowly defined in financial terms.

- Land developers and builders have incentives to increase supply of land and buildings to meet demand.

- Landowners may have mixed objectives, especially with respect to owner-occupied housing. They may wish to retain low density housing for their own use even though there is an option of intensification, or 'land-bank' in the expectation that prices will rise in the future.

[15] Some market participants play several of these roles; for example, significant businesses or utility providers often own, develop and occupy their land. They might be motivated to ensure certainty about their future operation.

- Infrastructure suppliers are typically managed (regardless of ownership) to meet demand efficiently, taking account of economies of scale.

We explore these issues below.

2.2 Competitive Markets for Land and Development

Maximising total community wellbeing is generally the underlying concern of policy makers. Community wellbeing is maximised when all resources available to the community are allocated to purposes that produce the highest value (or greatest net wellbeing). Usually, competitive markets are used to achieve this outcome, because it is assumed that:

- private individuals and companies are best able to understand what gives them wellbeing, which may be some combination of housing security, a vibrant community and environmental quality, and

- that interactions and exchange in markets can enable people to obtain what they value most within income constraints.

However, where markets do not function as they should, prices can be elevated and people may be unable to obtain what would best improve their wellbeing.

Overall community wellbeing is also affected by the distribution of wellbeing within it. Efficient allocation (to highest value uses) may result in more resources being allocated to certain segments of the community, and separate redistribution policies may be required to meet equity concerns. This includes targeted affordable housing policies and programmes. However, shifting towards more efficient markets for land and development is also likely to address distributional issues because efficient allocation would involve lower (more affordable) prices that would broaden the incidence of benefits of home ownership and of lower cost properties more generally (lower housing costs should result in lower rent levels also).

Currently private markets exist for land and property, and for most inputs to development, as discussed above, apart from some government or council (and CCO) provision of infrastructure. However, these markets do not function in a way that is consistent with the competitive ideal market, defined as the market which would allocate resources optimally, ie to maximise total community wellbeing.

The competitive ideal market can be described via a number of characteristics. These include:

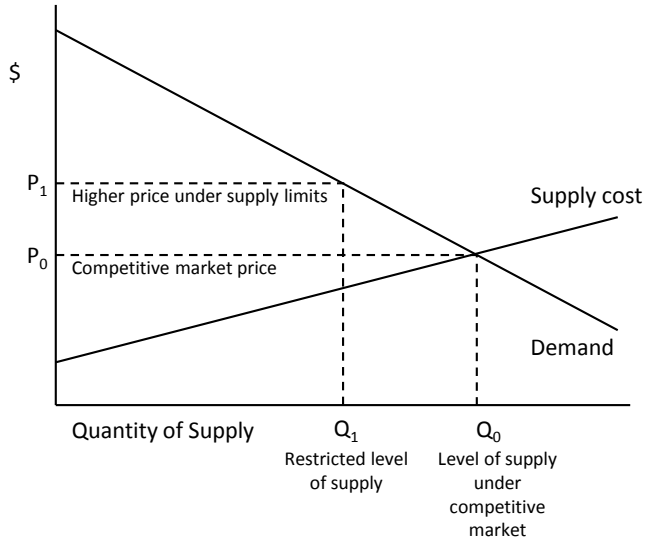
- no barriers to market entry;
- many buyers and sellers;
- a (relatively) uniform product;
- no externalities, ie unpriced effects on those other than the buyers and sellers;
- perfect information; and
- zero transaction costs.

We discuss these components below and the current limits to the operation of a competitive market.

2.2.1 Barriers to Market Entry

Figure 2 is a highly stylised picture of a market for development. It shows the marginal costs of supply[16] as an upward-sloping line, equivalent to the increasing costs of adding another unit of land or development opportunities, eg one more hectare at the edge of a city or one more allowed level of building height within a zone. It slopes upwards on the assumption that, if price is low, a small quantity of the easiest (lowest cost) land is supplied, eg that which is closest to existing infrastructure networks or for which additional height will have the least impact on existing character. As price increases more land or development opportunities are added because there is more land or development opportunities that can be supplied at a cost below that price.

Figure 2 Price impacts of supply limits



The demand line represents the marginal willingness to pay (WTP) for land and development opportunities of households (or developers supplying to households) or businesses (Box 1). The line starts at the left with the small number of people who are willing to pay the most for land and development opportunities and, moving from left to right, as the price falls, more people are willing to purchase land and development capacity.

The lines cross at Q_0 (the equilibrium level of supply). This is the expected market supply of land and development opportunities in a competitive market. If there was no barrier to market entry, suppliers would keep entering the market to meet demand until no supplier is willing to because the price obtained (limited by the WTP) would be less than the costs of supply. In a competitive market, the price of land and development opportunities would be expected to be equal to the cost of supply (P_0) at this equilibrium point.

[16] "Marginal" refers to one additional unit of supply, so marginal costs of supply means the costs of supplying one more unit of capacity, eg the costs of adding one more residential property to the market through rezoning, land development and infrastructure provision.

Box 1 Definition of demand in the proposed NPS-UDC

Demand means:

In relation to residential development, the demand for residential dwellings within an urban area in the short, medium and long-terms, having particular regard to:

a) the total number of dwellings required to meet projected household growth;
b) demand for different types of dwellings;
c) the demand for different locations within the urban area; and
d) the demand for different price points.

recognising that people will trade off (b), (c) and (d) to meet their own needs and preferences.

In relation to business land, the demand for floor area in the short, medium and long-terms, having particular regard to:

a) the quantum of floor area to meet forecast growth in different sectors;
b) the demands of both land extensive and intensive activities; and
a) the demand for different locations within the urban area.

We discuss price issues in more detail below (Section 2.3), including the issue of external costs that are part of the full social costs. If the supply cost equals the full costs to the community of allocating land to urban (residential or business) use (including the external costs of development), then the equilibrium point (Q_0) represents the optimal allocation of land to urban use (it is the level of supply which would maximise community wellbeing) and P_0 would be the efficient (wellbeing-maximising) price.

Barriers to market entry are represented in Figure 2 as an artificial limit to supply of land and development opportunities (Q_1). If such a limit is in place, eg because restrictions are placed on how much land is zoned for development, the price of land for development would be expected to rise to a higher price (P_1). This is possible because those who own the land are able to increase price without facing competition from other suppliers. Supply meets demand but it does so at a higher price than if a greater level of demand was being met.

This is a highly stylised picture of the market but it is used to make the simple point that supply restrictions are likely to result in price increases because power to set price in the market is available to anyone who owns the resource that is most scarce in the market.

Demand Side Factors

The impacts of entry barriers are exacerbated by changes in levels of demand. For example, the Productivity Commission list a number of factors that have led to increased overall demand for residential land, resulting in high or increasing prices. These include easier access to capital, population growth, rising household incomes, low interest rates and a low value of the New Zealand dollar providing incentives for overseas buyers.[17] When demand increases, WTP increases at any given level of supply, resulting in higher prices in a supply-constrained market.

Zoning as a Barrier to Entry

Zoning that limits market entry gives market power to existing landowners to raise prices above the efficient competitive equilibrium price.

[17] NZ Productivity Commission (2012) Housing affordability inquiry.

Supply limits can occur in any of the markets discussed above (Section 2.1 and Table 1) and can occur for reasons that include physical supply limits, such as when there are insufficient builders to meet a rapidly growing demand for housing. However, the chief concern in the draft NPS-UDC is with supply constraints from the operation of the planning system, particularly council plans which zone land for different uses and different densities.

Zoning introduces a barrier to market entry. For example, some landowners may wish to sub-divide their properties but are unable to because of the current zoning. The zoning is a barrier to these landowners adding additional supply of housing to the market.

The planning system introduces these constraints partly to limit external costs and partly to ensure that infrastructure is provided in a coordinated and efficient way. However, this system can be overly restrictive in some locations in a way that effectively limits total supply, thus limiting the competitiveness of urban land and development markets. Thus the Minister of Finance in a 2015 talk on housing affordability noted that "*planning rules … [which] include urban limits, minimum lot sizes which prevent subdivision below a certain size, and maximum site coverage rules which prevent a house covering more than a certain proportion of the lot. … reduce opportunities to develop affordable homes*."[18]

Commercial viability

Efforts to increase the development capacity enabled by zoning and infrastructure need to be undertaken with an understanding of whether development capacity is commercially viable to develop. Zoning might enable development, but only some of it might have infrastructure provided and only a proportion of this will actually be profitable to develop, taking into account development costs and revenues (Figure 3). A number of councils have developed models, started dialogues with developers or collected data to help them to better understand these issues. The issues are further discussed in Section 4.6.

Covenants

Restrictive legal covenants, eg to stop further subdivision or an increase in housing density, are commonly applied to residential subdivisions.[19] These covenants, often called building schemes, place restrictions on the use of land to maintain the perceived quality of the subdivision and the value of the properties subject to the covenant. The restrictions in the covenant will bind future landowners in perpetuity, eg by all owners of land in a development that have been covenanted having enforceable rights over all other covenanted parties. In the context of uncertainty about the optimal future use of land and transaction costs to secure agreement from neighbours to adjust covenants in response to changing circumstances, covenants may become inefficient over time.

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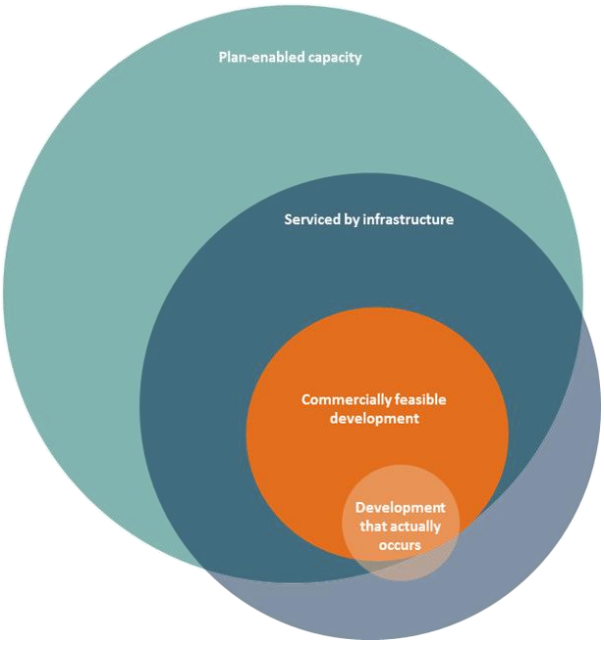
[18] Bill English, Minister of Housing *Speech on Housing Affordability* 29 September, 2015. Accessed 13 July 2016 at: https://www.beehive.govt.nz/speech/speech-housing-affordability

[19] Mead D and Ryan S (2012) Restrictive Covenants – Is There a Case For Public Plans To Control Private Planning Instruments In New Zealand? Paper to: *A Taste of Thigs to Come*. NZPI Conference, 1-4 May 2012, Blenheim.

Figure 3 Supply vs availability



Source: Ministry for the Environment (2016) How Councils Estimate Demand and Supply of Development Capacity for Housing and Business. Ministry for the Environment: Wellington

Mead and Ryan (*op cit*) note that The District Court may modify or extinguish a covenant under s317 of the Property Law Act 2007, but that the focus of the court is generally on the private rights of the parties affected by the covenant, rather than any public interest. Covenants may provide legal barriers to market entry and to further sub-division of land.

Infrastructure Costs

New developments require both network and local infrastructure to be attractive and viable to develop. Infrastructure includes network infrastructure (roads, the three waters,[20] energy supply and communications) and social infrastructure such as parks and reserves, leisure facilities (stadia and sports grounds, recreation centres and swimming pools), and cultural facilities (performing arts centres, museums and galleries).[21] When infrastructure is supplied at a rate, or in locations, that does not respond to demands for development, it can limit development opportunities. Infrastructure provision can act as a barrier to entry for reasons that include:

- the **high fixed costs** of network infrastructure: because there are significant fixed costs of extending a network to a new suburb, these are only justifiable if they can be recovered from the developers or residents of several properties. This means that development has to be coordinated and cannot be flexible to small changes in demand;

[20] Water supply, wastewater and stormwater.
[21] Productivity Commission (2012) Housing affordability inquiry: Final report. Wellington: Productivity Commission.

- **finance costs**: to achieve a competitive supply of development capacity infrastructure is best supplied ahead of demand. This increases costs and the risks of stranding, and requires local councils to fund infrastructure via debt, at least in the short run. This has costs for councils (and ratepayers) and will limit the use of debt for other investments where debt ceilings are at risk of being breached; and

- **coordination**: new residential areas represent viable and attractive communities when all infrastructure types are in place. However, achieving this may require considerable coordination amongst providers, and the involvement of local councils and private infrastructure providers.

These limitations are (generally) less problematic in brownfield areas where there may be spare capacity in (at least some) infrastructure.

2.2.2 Limited Buyers and Sellers

Theory suggests that an ideal market includes many buyers and sellers such that everyone is always able to buy or sell land or homes when they want to and are willing to exchange at the market price. In addition, having many buyers and sellers would mean that no single buyer or seller can set price(s) in the market. A potential seller could not increase price as another landowner would step in and supply at a lower price, and no buyer could drive down prices as someone else would always be willing to purchase at the original price.

In practice, many locations have a limited number of sellers of land and development opportunities. This might reflect limits on supply (barriers to entry), which, in turn, might reflect the limits imposed by the planning system, or the limited numbers of landowners who, as a result, are able to monopolise local land markets. In these cases, prices are likely to be elevated above efficient (wellbeing-maximising) levels (see Section 2.3).

There is some evidence of high costs of building reflecting a number of barriers and lack of competition in some construction markets.[22] Lack of competition in building supplies markets would enable building suppliers to raise prices affecting the costs of development of land but not the costs of the land itself. These issues are beyond the scope of this study. We note that the government has stated that it is currently addressing these issues and has a programme of work to reduce or remove barriers identified.[23]

2.2.3 Uniform Product

If a product bought and sold in a market is uniform, ie the same in all attributes, the market is more competitive because participants are trading in perfect substitutes and it

[22] MBIE (2013) Residential Construction Sector Market Study Issues Paper; MBIE (2013) Residential Construction Sector Market Study Options Paper.
[23] Office of the Minister for Building and Housing, and Office of the Minister of Commerce and Consumer Affairs (2015) Outcomes of the Residential Construction Sector Market Study. Paper to: Cabinet Economic Growth and Infrastructure Committee.

is more likely that additional buyers or sellers can be found. In contrast, land and property markets are characterised by significant differences over space. Potential buyers are purchasing a set of attributes rather than just a home: proximity to school or work, to family and friends, to locations they like and so on. Housing differs in terms of a number of attributes, including:

- dwelling characteristics, such as age, construction materials, size, and design;
- proximity to employment and retail opportunities that can be widely distributed in "polycentric" cities;
- neighbourhood characteristics, such as the presence of more mature trees and more amenities (local shops and so on) in older, more established suburbs;
- localised amenities such as parks, specific views, access to the coast, desirable school zones, and so on; and
- some land uses, such as industrial zones or major roads, may generate localised disamenities that lower surrounding residential property values.

Some property markets get closer to a uniform market, particularly city centre apartments and suburban developments by single developers. People value property diversity, and the planning system enables it, but it reduces the competitiveness of property markets. It is likely that homes would be lower cost on average if they all looked the same and offered similar levels of proximity or amenity.

We have not pursued property uniformity as a desirable policy in this report because of the perceived value placed on diversity, but it may be worthy of future consideration.

2.2.4 Externalities

We explain pricing issues in more detail in Section 2.3. We briefly discuss the issue of external costs here because they are an important consideration in urban planning.

The external costs of development are the impacts on people other than those involved in a land or property transaction. If these are not taken into account by market participants (all buyers and sellers of land and property), land may be allocated and used in ways that do not produce the greatest wellbeing. External effects may include things like over-shadowing of other properties, additional congestion of roads and other networks and a range of other environmental and social impacts. However, not all externalities are negative. The literature on agglomeration economies suggests that there are positive economic benefits from larger and/or denser cities, reflected in higher economic productivity and greater consumption choices for residents.[24]

In theory, there are a number of ways in which to take external effects into account, including via:

- a charge on developers equal to the estimated external cost – this is theoretically possible, but in practice has many measurement difficulties because many external costs of development are site-specific. This approach is commonly advocated in environmental policy to require polluters to 'internalise' the

[24] See MRCagney et al (op cit) for a discussion of the literature.

external costs of their activities;[25]

- private bargaining – any landowner wishing to change the land use might bargain with neighbours, including compensating them for losses. This suffers from potentially high transaction costs from 'holdouts' in addition to the potential for bullying and other methods of suasion for some vulnerable property owners; and

- a planning system involving a mix of zoning and consents – this is the current approach to managing external costs of urban development.

The current system addresses external costs but may not do so efficiently. Although there are externalities and coordination failures that justify intervention, planning rules have often been introduced without considering all the costs and benefits of doing so. For instance, rules that apply across many properties do not necessarily account for the strength of preference locally in favour of a particular use, or the size of local adverse effects. To the extent that planning rules constraining urban development are a significant factor in the housing unaffordability problem, the costs of these restrictions are becoming clearer.

For example, the recent cost benefit analysis (CBA) of the proposed NPS-UDC brought together existing data on the costs of the various externalities of urban land use to estimate whether current constraints on land use had costs that exceeded the benefits.[26] It analysed:

- losses of benefit to households who are unable to afford housing and are choosing housing alternatives that are less desirable than ownership would be if priced at the cost of supply; and

- losses of agglomeration benefits that result from more intensive housing[27] and employment.[28]

The CBA compared the potential benefits of amending planning rules to allow more urban development with the estimated costs of the additional externalities that the planning system is there to protect. It found that the potential benefits of amending planning rules significantly exceeded the costs. However, as many external costs are location-dependent, their magnitude may vary between different sites.

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[25] Baumol WJ and Oates WE (1988) The theory of environmental policy. 2nd Ed. Cambridge.
[26] MRCagney, Covec and Beca (2016) Cost benefit analysis of policy options for a National Policy Statement on Urban Development Capacity. Final Report to Ministry for the Environment.
[27] These agglomeration benefits are the increased consumption opportunities that are likely to be provided including more retail outlets and entertainment facilities because of greater scope for their patronage.
[28] The increased productivity resulting for higher density of employment – see for example: Maré DC and Graham DJ (2009) Agglomeration Elasticities in New Zealand. Motu Working Paper 09-06.

2.2.5 Information Limits

Markets are most competitive when all participants have full information. They know what they are purchasing, how they will use it, the value they will obtain from it and so on. This is complicated for housing markets because homes have many functions. They fill roles as:[29]

- shelters for individuals or groups;
- homes which provide spaces in which human relationships develop and the "backstage for personal life"; and
- investments from which wealth can be accumulated.

Because they have these very different roles, there is considerable uncertainty around how they will perform in fulfilling these roles into the future. This includes uncertainties relating to:

- the location of demand, eg if people will move location in the future for employment or personal reasons;
- changes in household circumstances, eg changes in relationships, children leaving home and so on; and
- future shifts in prices and whether the property will continue to increase in value or not.

In the absence of this information, people can make inefficient decisions about the type of housing they need, and its location. This combined with high transaction costs of buying and selling homes (see below), creates a market with people in a different type of property from their preference given changed circumstances. This can add to supply shortfalls, eg if people are occupying larger homes than would be their preference but are doing so because of the costs of shifting and/or the risks associated with exiting the property market as an investment.

The uncertainties are largely beyond council control. Councils might improve information availability in the property market through provision of information on sale prices and through analysis of factors affecting prices, taking account of data made available by private providers.[30]

2.2.6 Transaction Costs

There are a number of transaction costs of buying and selling property and of property development.

These include real estate agent fees plus the time, stress and other costs associated with buying and selling homes. These costs of exchange reduce the extent to which people will change homes when their circumstances change, eg if they would otherwise move to a smaller or larger home.

[29] Ronald R (2008) The ideology of Home Ownership. Homeowner Societies and the Role of Housing. Palgrave Macmillan.

[30] In this regard we note the recent addition of https://homes.co.nz/ to the suite of data sources.

Transaction costs of development include holding costs incurred because of time lags between land purchase and sales of finished buildings,[31] and costs to design and consent buildings. Some of these transaction costs are influenced by policies in district and regional plans, eg the requirements to obtain resource consent for new housing, while others are not, such as costs to comply with the Building Code.

If transaction costs were lower, property would be exchanged more easily and often, and it would be more likely to be owned by highest value users.

2.3 Efficient Pricing (or What Prices Ideally Should Be)

Ideally, housing and business floorspace would be supplied to meet all demand at the lowest price at which suppliers would be willing to supply. However, barriers to entry and other constraints on market competitiveness tend to result in prices that are higher than they would be without these constraints.

In the efficient market the cost (and price) of land for development is determined by the opportunity costs of supply of that land. Price is not determined by the higher value use of that land (residential vs agricultural). In this section, we discuss the concept of efficient pricing, or the lowest price at which society would be willing to supply appropriately zoned land to meet demand for development.

The efficient price for land or development could be defined as:

$$P = MSCS = MPC + MEC$$

Where: P = the efficient (wellbeing-maximising) price of land or floorspace
MSCS = marginal social cost of supply
MPC = marginal private costs
MEC = marginal external costs

The **marginal social cost of supply (MSCS)** is the cost to the community of supplying one more unit of land (or, equivalently, one more unit of housing or business floorspace) by changing the existing land use and transforming it for residential use. It is made up of two elements: MPC and MEC.

The **marginal private costs (MPC)** are the costs of supplying one more unit of land (or floorspace) to private suppliers. This will include:

- the opportunity costs of converting land between uses, ie the value of land for the next-best alternative use foregone because of development. For example, landowners would be willing to convert agricultural land to housing land only if the value of the land for residential use exceeded the value of the land for agricultural use. When redeveloping sites with existing buildings to a higher density, the opportunity cost of supply would also include the value of existing

[31] Holding costs arise due to the fact that developers face opportunity costs to hold onto assets. For instance, if a developer borrows money from a bank to acquire property, he or she must pay interest charges on the bank loan during the holding period.

lower-density building(s);

- the costs of land development or preparation for urban uses, including costs of surveying, earthworks, subdivision consents, etc; and

- the costs of infrastructure provision that are borne by developers, eg development costs for network infrastructure and costs to build local roads, local water pipes, and on-site or suburb-level stormwater schemes.

The **marginal external costs (MEC)** are the costs of supplying one more unit of land that are borne by the wider community rather than the suppliers (or developers) themselves. These will include:

- the costs of infrastructure provision that are not borne by developers, eg costs to build network infrastructure that are not recouped by development contributions or user charges;

- external impacts of development on neighbours and the wider community, eg over-shadowing effects, foregone access to open space and discharges to water and other environmental impacts;

- the congestion impacts on shared network resources, including roads; and

- environmental impacts, eg impacts on air, soil, water, and biodiversity that are not addressed by the design of the development and supporting infrastructure.

If entry barriers are reduced so that sufficient land is available for development, and if there is an efficient (wellbeing-maximising) approach to tackling external costs, market prices would be expected to be no higher than this efficient price (MPS + MEC). Sufficient development capacity is defined as enough to meet all demand at that efficient price.[32]

Prices will only rise above the marginal social cost of supply, or increase in response to rezoning, if there is an artificial scarcity of land for development. This occurs where total demand for development land, if priced at MSCS, is greater than the available supply. In this scenario, excess demand will push up prices without provoking a countervailing supply response. This point raises two important issues relating to measuring supply and demand:

- **assessing relative supply and demand for housing and business land, as required by PB1, needs to take account of price. Specifically, levels of demand for land and development opportunities should ideally be estimated at a price equal to the marginal social cost of supply**; and

[32] To ensure a more competitive market, additional development capacity over and above the minimum quantity that would fulfil demand is required (See Section 2.5).

- **comparing prices with the estimated costs of supply is a way to estimate whether there is a supply shortfall.**

To identify whether constraints on the supply of land for development are driving up prices, it is necessary to measure prices for land and floorspace and compare them against the marginal social costs of supply, ie:

- the lost value (opportunity cost) of land in some other use;
- the private costs of development of that land, which includes land preparation and infrastructure costs; and
- external costs of development, eg the costs of environmental impacts and public infrastructure costs.

2.4 Undesirable Outcomes of Unaffordable Housing

2.4.1 Unaffordability

The draft NPS-UDC focuses on increasing the supply of development capacity in plans, to enable the market to meet demand. The aim of doing so is to reduce the undesirable consequences for wellbeing outcomes of insufficient urban development. These outcomes are observed particularly in the housing market, although potentially problems can also arise in business land markets.

In the housing market the perceived problems are high prices of land and homes in (some) medium and high growth urban areas. The problem is often broadly described as "unaffordable housing", ie people are unable to purchase or rent properties without getting into financial difficulty.[33] This is linked to a wider range of outcomes.

- **People not purchasing homes** because of high prices in certain locations resulting in:
    - **reduced total rates of home ownership**. The Productivity Commission notes this is of relevance to wellbeing because of a strong link between home ownership and:[34]
        - better educational outcomes and future income prospects for resident children;
        - more civic engagement;
        - higher trust in others and a positive sense of community;
        - family and social stability; and
        - higher average living standards in retirement;
    - **shifts in location** for current and/or potential residents to other places (including in other countries) with more affordable housing. This has potential wellbeing effects when people end up living in locations that would not be their preference if housing was more affordable.

[33] Robinson M, Scobie GM and Hallinan B (2006) Affordability of Housing: Concepts, Measurement and Evidence. New Zealand Treasury Working Paper 06/03

[34] NZ Productivity Commission (2012) Housing affordability inquiry.

- **People who do purchase properties and have reduced available income** after paying for housing costs, resulting in:
    - insufficient income to meet other basic needs such as food, clothing, transport, medical care and education;
    - poor quality housing, that includes damp, cold and/or draughty homes, partly as a result of unaffordability of housing repairs, maintenance and improvement;[35] and
    - overcrowding in which people are sharing a home to reduce per person costs, with a number of related social and health impacts.

The impacts of high housing costs also flow into the rental sector as scarcity of housing relative to demand also pushes up rents.[36]

In business land markets, high prices in some areas may result in business closure or relocation, with consequent impacts on employment accessibility for households and economic productivity.

In his recent speech, the Minister of Finance highlighted the increasing unaffordability of New Zealand housing. [37] Specifically, 25 years ago around 30% of new homes were priced in the bottom quartile of prices in the market as a whole, and a similar percentage in the upper quartile. Currently, only 5% of new homes are priced in the lowest quartile and 60% are priced in the upper quartile. He attributed this lack of supply of affordable housing as the cause of "[home] prices and rents rising disproportionately at the bottom end [of the market]".

This focus on higher value properties is likely to reflect overall limits to availability of land and development opportunities. If there was increased total supply of land and development opportunities, property would continue to be supplied to meet the demands of households with a lower willingness to pay (Figure 2) and prices would be expected to be lower across the market as a whole.

2.4.2 Costs vs Income

Some of the problems attributed to housing unaffordability are problems more attributable to low income. Housing unaffordability is isolated from income-related problems to the extent that the price of property is higher than it should be, as discussed in Section 2.3 above.

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[35] Issues with poor quality housing appear to be worse in rental housing – see eg Buckett NR, Jones MS and Marston NJ (2011) BRANZ 2010 House Condition Survey - Condition Comparison by Tenure. Study Report SR 264(2012)

[36] If there is a persistent shortfall in housing, we would expect rents and home prices to rise. However, the relationship between rents and home prices is mediated by factors such as interest rates, credit conditions, and expectations for future capital gains. For example, lower interest rates tend to push home prices up without affecting rents as they reduce the cost of mortgage servicing.

[37] The Minister of Finance (2015) Speech on housing affordability. Retrieved from https://www.beehive.govt.nz/speech/speech-housing-affordability

2.4.3 Distribution of Effects

Data and research on home ownership and housing affordability suggest that affordability problems are concentrated amongst particular sub-populations of New Zealand.[38]

- The most unaffordable areas tend to be the main urban centres (Auckland, Tauranga, New Plymouth, Palmerston North, and Wellington) or 'holiday' areas (Far North, Thames-Coromandel, Kaikoura, and Queenstown Lakes).[39]

- Housing affordability outcomes are worse for lower-income New Zealanders, who are most affected by rising prices across the market and spend a greater proportion of their income on housing than higher income households.[40]

- Households living in rental accommodation spend a greater proportion of their income on housing than households living in owner-occupied homes (see Figure 4). In part, this reflects higher incomes among owner-occupying households.

- There are large disparities in home ownership between people of European ethnicity and all other ethnic groups. The percentage of people living in owned homes ranges from an average of 70% for Europeans to an average of 33% for Pacific peoples and 43% for Māori. Home ownership rates have fallen for all major ethnic groups since 2001, but Pacific peoples (5.1%), Maori (3.8%) and Asian (3.6%) populations have experienced the greatest decline.[41]

- Households in Auckland spend a greater share of their income on housing, regardless of whether they are renting or living in owner-occupied dwellings (see Figure 4).

- Relative to European countries, residential homes form a greater proportion of New Zealand household wealth and financial asset ownership is far less common.[42] Thus, a continuation of greater decline in homeownership rates among certain ethnicities could further exaggerate wealth inequality between ethnic groups.

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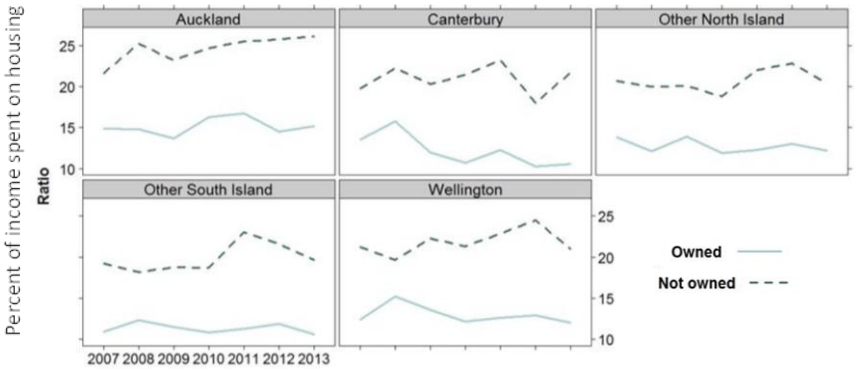
[38] Goodyear R & Fabian A (2014) Housing in Auckland: Trends in housing from the Census of Population and Dwellings 1991 to 2013.
[39] Robinson M, Scobie GM, & Hallinan B (2006) Affordability of housing: concepts, measurement and evidence. New Zealand Treasury working paper 06/03. Wellington: The Treasury.
[40] Law D & Meehan L (2013) Housing affordability in New Zealand: Evidence from household surveys. New Zealand Treasury Working Paper 13/14. Wellington: The Treasury.
[41] Goodyear and Fabian, *op cit*.
[42] Skilling D & Waldegrave AM (2004) The wealth of a nation: the level & distribution of wealth in New Zealand. Discussion paper 2004 / 1. p17

Figure 4 Housing costs as a percentage of household income 2007– 2013



Note: use of median or mean values is not specified
Source: Goodyear R & Fabian A (2014) Housing in Auckland: Trends in housing from the Census of Population and Dwellings 1991 to 2013

2.5 The role of Councils

2.5.1 Estimating Supply and Demand

The draft NPS-UDC requires councils to estimate demand and development capacity for different land uses (residential and business use). However, the quantity of housing or business floorspace demanded will depend on the price at which it is available (Figure 2). For example, if house prices were lower, demand would be greater as it would include people who have currently been rationed out of the market, eg by moving to other locations or continuing to rent rather than buy. Therefore, to make sense of the requirement to meet demand an understanding of this relationship is required.

Adequate supply is best defined as sufficient to meet demand at the ideal target price (P_0 in Figure 2). This is a price equal to the marginal cost of supply, ie the cost of supplying one more unit of development capacity, at the point at which demand is met. This is obviously a somewhat circular definition: the price is determined by the quantity supplied and the quantity is determined by demand at that price. Defining this in practice is likely to be subject to considerable uncertainty, but estimating the adequacy of supply on the basis of existing demand at elevated prices will under-estimate the supply requirements.

In Section 3 we consider some factors that might be required to model changes in demand in response to price. However, detailed discussion of the modelling requirements is beyond the scope of this study.

2.5.2 Increasing Competitiveness of Markets

Table 2 sets out a number of possible impacts of councils on the factors affecting the competitiveness of land and development markets.

Table 2 Role of councils in competitive markets for land and development

Issue	Council Role
Barriers to market entry	Zoning to restrict and use and development density functions as a barrier to entry restricting supply. Councils should examine if current zoning restrictions or the limits to infrastructure provision are likely to reduce competition and lead to price increases that are not justified by the benefits of zoning.
Many buyers and sellers	Market driven – outside council control apart from via the influence of zoning.
Uniform product	The complexity and variation of planning regulations, and selective changes to these (and/or selective infrastructure improvements), can reduce the uniformity of development opportunities and create "spatial monopolies".
Externalities	Addressed via planning system. There is a question over whether it is addressed efficiently. Councils should analyse whether the benefits of zoning (limiting negative externalities and increasing positive externalities) are justified by the costs.
Perfect information	Councils could improve availability of information about regulations and infrastructure to the market through providing additional releases of data on property sales prices and analysis of factors affecting prices.
Transaction costs	Consenting requirements affect development costs, including the time taken for consents.

Reducing Barriers to Market Entry

Councils can influence the competitiveness of markets by the extent to which zoning places limits on market entry relative to demand for development capacity and through the extent to which infrastructure is planned or provided for to enable development of zoned land.

For example, councils may limit zoning for intensification, eg through sub-division or construction of taller buildings, to narrow bands around city centres. Actual intensification will then depend on the preferences of current owners. In greenfield areas land may only be zoned incrementally for more intensive development, rather than allowing out-of-sequence development. Councils can improve this through additional zoning or responding more dynamically and responsively to expressed market demand.

Some barriers to market entry are endemic to land and development markets, including requirements for coordinated infrastructure and time required for development. Given this, markets are likely to only be competitive through over-supply of development capacity. Over-supply trades-off the higher costs of developing ahead with the benefits of a more competitive market. The costs of building infrastructure ahead of demand was examined by MRCagney *et al* in the recent cost benefit analysis (CBA) of the proposed NPS-UDC.[43] That analysis suggested relatively high benefits of more competitive market allocation.

Consistent with this, the draft NPS-UDC defines sufficient supply to include an additional margin above any estimated capacity requirement (Box 2).

[43] MRCagney, Covec and Beca (2016) Cost benefit analysis of policy options for a National Policy Statement on Urban Development Capacity. Final Report to Ministry for the Environment.

Box 2 Definition of Sufficient in the proposed NPS-UDC

Sufficient means the provision of enough development capacity to meet residential and business demand, plus, to take account of the likelihood that not all capacity will be developed, an additional margin of at least:

- 20% over and above projected short and medium-term residential and business demand; and
- 15% over and above projected long-term residential and business demand.

The total capacity should reflect the demands for different types and locations.

Numbers of Buyers and Sellers

Councils have limited ability to influence the numbers of buyers and sellers in the market, apart from via restrictions on market entry.

Product Uniformity

Land is not uniform; each title has unique attributes. However, a market with many buyers and sellers should also have plenty of *comparable* pieces of land or development opportunities.

The application of complex and variegated planning regulations to these pieces of land will reduce the amount of comparable development opportunities. These regulations, or selective changes to them, can create spatial monopolies, ie a small number of owners that hold most of the land zoned for business, or land on which apartments of a certain height can be built.

Managing Externalities

The management of externalities (positive and negative) is a major activity of councils and the justification for the planning system itself. But this can be achieved in a more or less efficient way; greater consideration of costs and benefits of zoning controls could improve decisions.

Information Provision

There are significant market uncertainties relating to prices, and future price trends in particular. Councils have a limited role in reducing such uncertainty but could improve information flow to the market by publishing available data on sales prices and the results of any analysis, eg statistical models, it undertakes on the factors influencing prices. Councils can also reduce uncertainty relating to planning controls and consent requirements, plus via plans for infrastructure provision.

Transaction Costs

The chief ways in which councils can affect transaction costs are through reductions in the time and costs of consents. This includes reducing the uncertainty of consenting processes.

2.6 The Role of Indicators

The purpose of this report is to examine ways in which market indicators might be used to help councils to better understand local markets for land and development opportunities and to identify whether urban planning policies or infrastructure constraints are excessively constraining development capacity. Ideally indicators can be

used to identify the factors that councils might be able to influence from those they cannot.

This section has examined how the current localised problems of housing affordability result from a series of interlocking steps that cause property prices to rise above ideal levels. The causes are broadly associated with less than fully competitive markets for the supply of land for development that are, partly at least, a result of planning and infrastructure constraints to the supply of developable land in appropriate locations.

This report aims to identify indicators which might be used to better understand the problem and its causes. These indicators might address different steps on the chain of causality, including indicators of:

- general market conditions;
- demand and supply, and supply-demand imbalance;
- extent of market competitiveness;
- market prices and their relationship to wellbeing-maximising prices; and/or
- the wellbeing impacts of unaffordability, eg levels of overcrowding.

We address these in turn in the next sections.

3 General Market Indicators

3.1 Introduction

There are a number of indicators of prices and price trends which can provide councils with a starting point of understanding of markets for residential and business land and development markets. Many of these are regularly reported on by real estate companies and/or included in press articles.

Data on price trends, including dwelling prices and rents, can provide an understanding of market trends and dynamics, and complementary information to help assess supply-demand imbalances (see Section 4). They also provide information to assist in calculating housing affordability indicators (Section 7).

Data on price trends are, by themselves, not sufficient to identify the cause of rising (or falling) prices, because of the influence of demand-side factors including incomes and mortgage interest rates. They also would need to be interpreted alongside estimates of efficient prices (see Section 6 below).

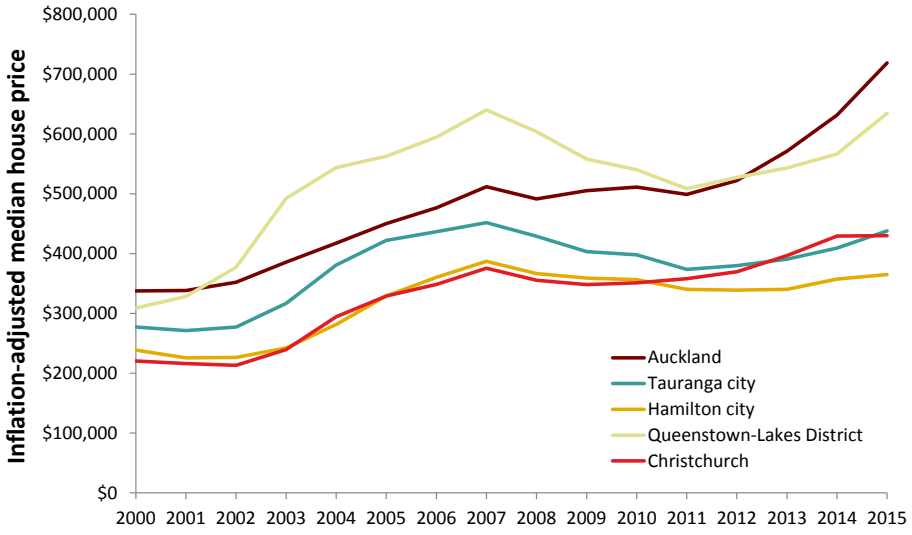
3.2 House Prices

Rapidly rising house prices is one of the significant issues which is driving the development of the NPS-UDC. Thus indicators which provide background information on trends are a useful starting point for analysis and communication of the issues.

3.2.1 Median House Prices

Prices can be measured in both nominal and real terms. Real prices, adjusted using the Consumer Price Index (CPI), remove the effect of inflation to reveal the underlying price trends. As an example, real median house price trends for high growth areas are shown in Figure 5. Changes in real median house prices from 2000 to 2015 range from a 113% increase for Auckland to a 53% increase for Hamilton.

Figure 5 Inflation-adjusted median house prices for high growth areas 2000-2015 (2015$ values)



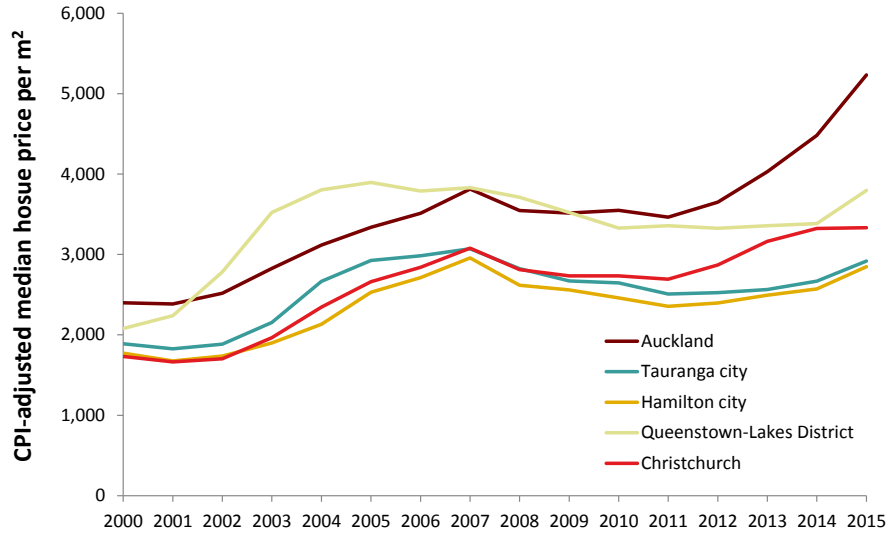
Source: QVNZ and RBNZ

Rising median house prices over time could in part be attributed to an increasing average size of houses (See discussion in Section 4.3). Thus, 'inflation-adjusted median house price per square metre' may better reflect underlying house price trends through controlling for differences in house size.

3.2.2 Price per Square Metre

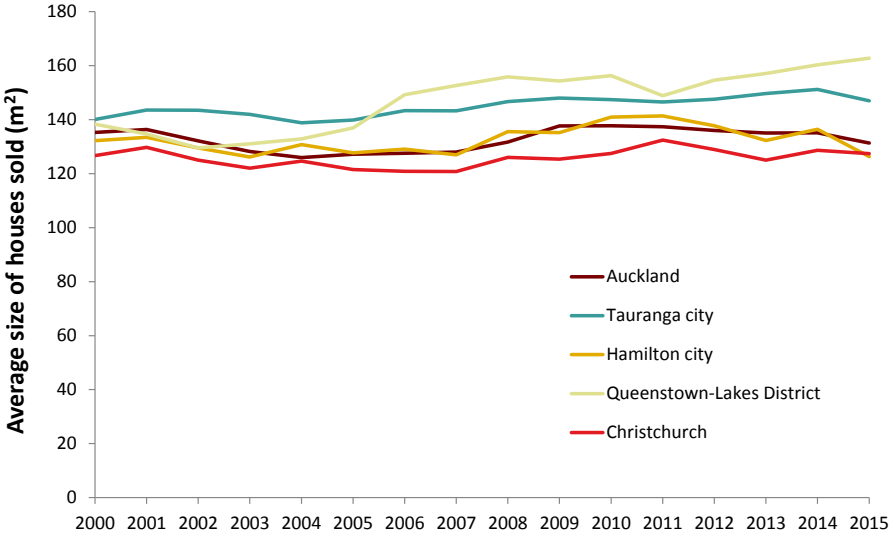
Figure 6 shows that, for most high growth areas, price per square metre has tracked much the same as overall house price trends. However, median house prices in the Queenstown-Lakes District have risen since 2011 yet price per square metre (Figure 6) has been relatively constant, reflecting the increasing average size of houses sold (Figure 7).

Figure 6 Inflation-adjusted median house price per m^2 for high growth areas 2000-2015 (2015$ values)



Source: QVNZ and RBNZ

Figure 7 Average size of house sold in high growth areas 2000-2015



Source: QVNZ

It is worth noting here that, the average size of houses sold in Queenstown and elsewhere is smaller than the average size of new consents (Figure 18 on page 42), and the ongoing trends towards larger houses sold in Figure 7 reflects the larger average size over a number of years rather than the short-turn reduction in large house consents (Figure 20 on page 43).

The average size of houses sold in other high growth areas has been relatively unchanged since 2000, suggesting that the inflation-adjusted median house price would be a sufficient indicator for these areas.

3.3 Land values

Land values should be measured separately from property values, where possible, to gain an understanding of whether there is an increasing scarcity of land for development.

Changes in land prices over time can be used to provide insights into emerging problems, eg rapidly rising prices, and if analysed at a disaggregated level, can provide insights into the location of residential demand. The main data available are valuation data produced for councils for rating purposes based on expert assessments. Valuation data are comprehensive, and separate values into their component parts (land and improvements), but they may differ from market prices and are only updated periodically. In contrast, sales data are available whenever a property is sold, but are not comprehensive and they do not separate out the elements of value. If there are sufficient sales data, it may be possible to use statistical (econometric) analysis to identify the components of property values, including the separate contributions of land and improvements. However, the large data requirements to obtain statistically significant results may only enable this for the largest of councils.

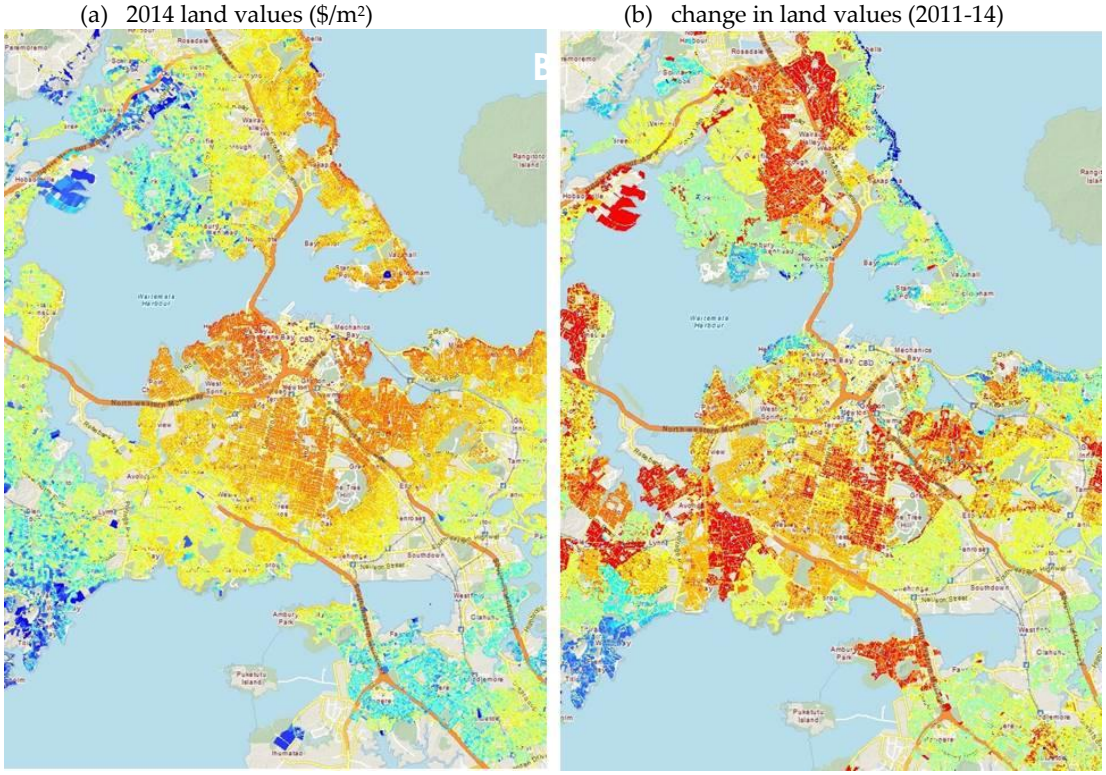
Figure 8 shows "heat maps for Auckland residential land values, generated through Auckland Council's GIS viewer. The left-hand side map (a) shows 2014 land values per square metre, while the right-hand side illustrates the change in values since 2011.

Figure 8(a) illustrates that coastal land and properties in close proximity to the CBD are more valuable than land located elsewhere. Figure 8(b) shows a diverse change in land values across the city from 2011 to 2014. Areas such as Glenfield, Henderson/ Glen Eden, Blockhouse Bay, Epsom/ Mt Eden, and Mangere have seen the greatest increases in land values over this period. Whereas areas of relatively low growth in value include: North Shore coastal suburbs, Birkenhead, Herne Bay, Mission Bay-St Heliers, Onehunga/ Ellerslie and Manukau.

These geographic illustrations allow evaluators to examine data at a more disaggregated level and in a way that is easy to interpret. Statistical and/or graphical analysis can provide similar insights but not in a way that is so easily understood or communicated.

Figure 8 Auckland land values ($/m²)

(a) 2014 land values ($/m²) (b) change in land values (2011-14)



Source: Auckland Council's GIS viewer via http://transportblog.co.nz/2014/11/11/new-auckland-valuation-maps/

As an alternative, monthly sales data, sourced from REINZ,[44] are used to construct a time series of 3-month moving average median house prices by suburb.[45] These data show both similarities to and differences from to the valuation data.

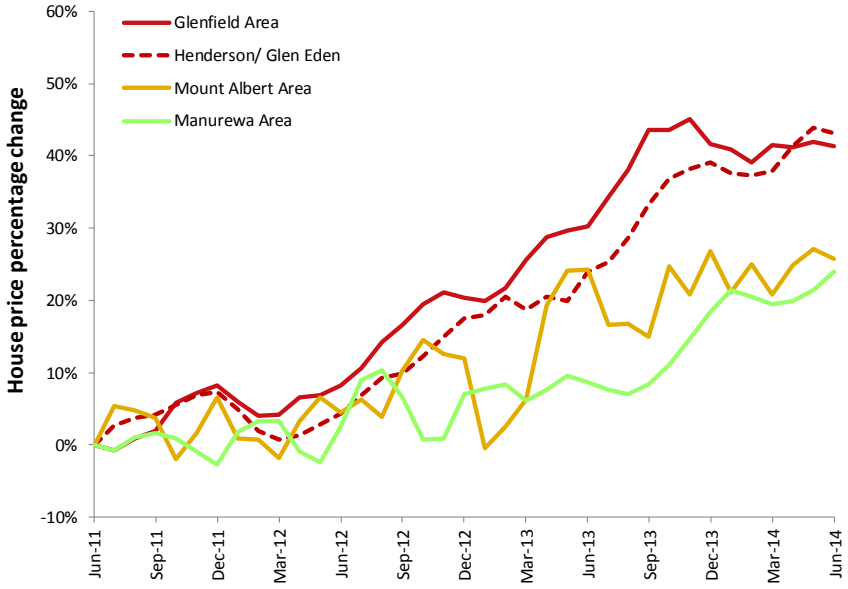
Figure 9 shows the change since mid-2011 in median house prices for a number of Auckland suburbs. The trends are generally consistent with the heat maps above. Areas with relatively high increases in land values (Glenfield and Henderson/ Glen Eden) also experienced comparatively high house price growth. Likewise, areas with relatively small changes in land values (Mount Albert and Manurewa coloured orange and light green respectively in Figure 8b) also experienced smaller percentage changes in prices. Figure 9 also suggests that these suburbs shared a similar growth rate until they began to diverge in late-2012.

Not all of the house price trends are consistent with the land valuation data. For example, Figure 10 shows that Devonport and Onehunga/Penrose experienced relatively strong growth in house prices yet comparatively little change in estimated land value, hence the light green colour in Figure 8b. This might be because of differences in values of land versus properties, differences between the average type of property in each area versus what has sold and/or problems with the valuation estimates. Valuation data are not a consistent proxy for sales prices and vice versa.

[44] Retrieved from landlords.co.nz.

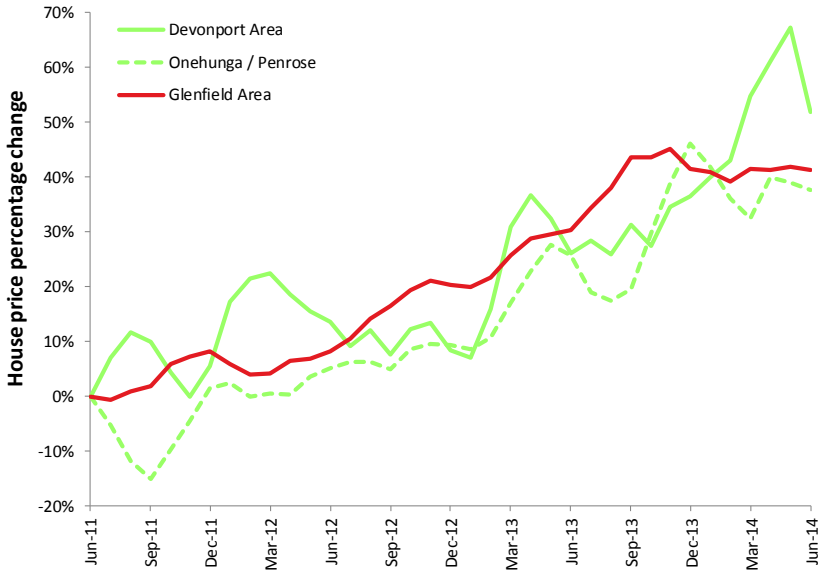
[45] Data are transformed into a three month moving average to smooth out fluctuations within the data.

Figure 9 Median house prices by Auckland suburb since 2011 (three month moving average)



Source: REINZ

Figure 10 Median house prices by Auckland suburb, 2011-2014 (three month moving average)



Source: REINZ

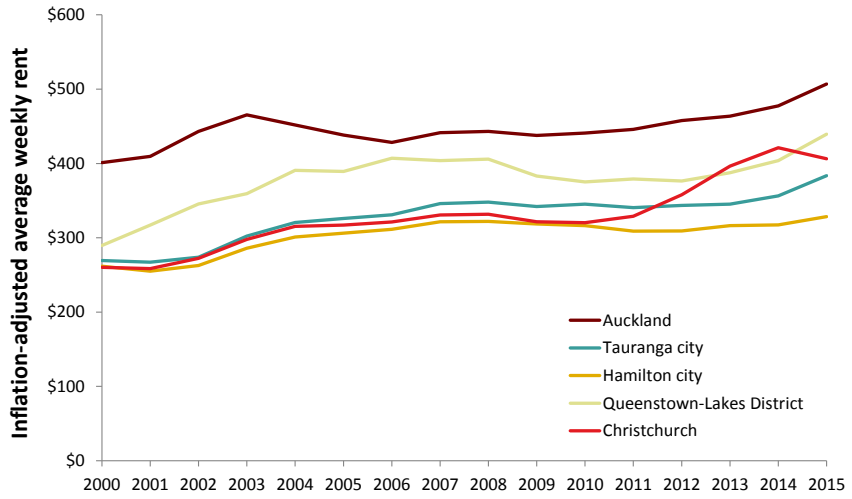
3.4 Rents

3.4.1 Average Rents

Rent data for residential properties are available from the Ministry of Business, Innovation and Employment (MBIE) using the tenancy bond database, which records all rental bonds that are lodged with MBIE.

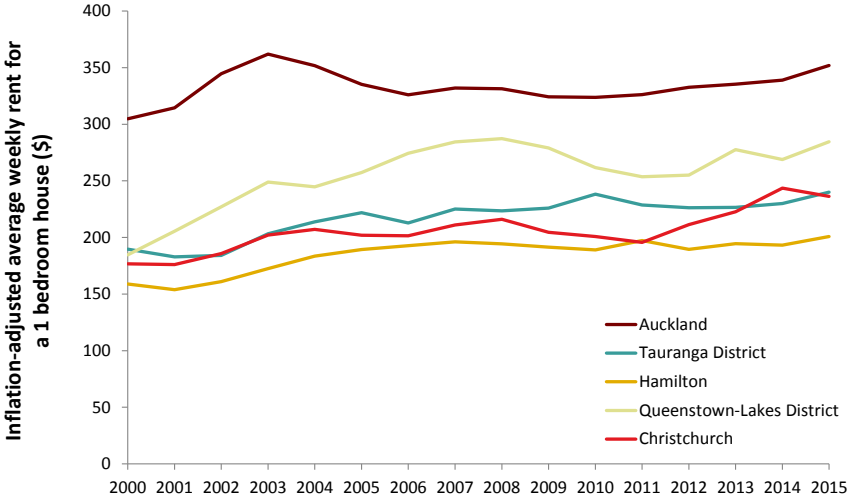
Real average weekly rents for high growth areas are shown in Figure 11.[46] Growth in real rents has been significantly less than growth of median house prices. Auckland's real rents have only risen by 26%, slightly more than that of Hamilton (25%) and less than half as much as that seen in Christchurch (56%).

Figure 11 Inflation-adjusted mean weekly rents for high growth areas 2000-2015 (2015$ values)



As house size is not recorded in the rent data (from MBIE), we use mean weekly rents for 1 and 3 bedroom homes to control for potential changes in the size of rental properties over time (Figure 12 and Figure 13, respectively).

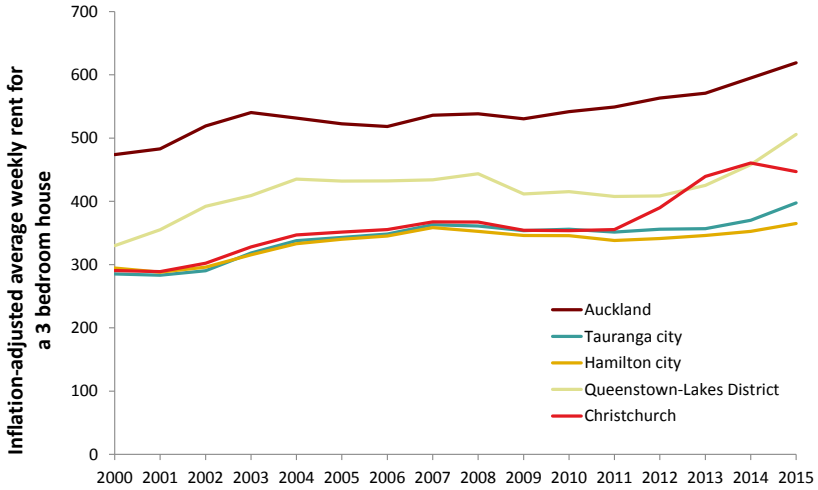
Figure 12 Inflation-adjusted mean weekly rents for 1 bedroom homes 2000-2015 (2015$ values)



Source: MBIE & RBNZ

[46] Median rent values are not available.

Figure 13 Inflation-adjusted mean weekly rents for 3 bedroom homes 2000-2015 (2015$ values)



Source: MBIE & RBNZ

Overall rent price trends, and those specific to 1 and 3 bedroom homes, are quite similar. Differences in trends between 1 and 3 bedroom houses could be attributed to different levels of supply and demand for small and medium sized houses. For example, the post-earthquake increase in 1 bedroom rental prices in Christchurch is far less pronounced than for 3 bedroom houses.

Table 3 shows the percentage change in median real (inflation-adjusted) house prices and average real rents over the ten years from 2005 to 2015. These are included as a total percentage increase over this period and the compound annual growth rate (CAGR).[47]

Table 3 Overall percentage change and CAGR for real house prices and rents from 2005 to 2015

	Real values (CPI-adjusted)				Nominal values			
	median house price		average rent		median house price		average rent	
Area	% change	CAGR[1]	% change	CAGR	% change	CAGR	% change	CAGR
Auckland	60%	4.8%	16%	1.5%	98%	7.1%	44%	3.7%
Tauranga city	4%	0.4%	18%	1.6%	29%	2.6%	46%	3.9%
Hamilton city	11%	1.0%	7%	0.7%	38%	3.3%	33%	2.9%
Queenstown-Lakes District	13%	1.2%	13%	1.2%	40%	3.4%	40%	3.4%
Christchurch	31%	2.7%	28%	2.5%	62%	5.0%	59%	4.8%

[1] CAGR = compound annual growth rate

Source: QVNZ & MBIE and RBNZ

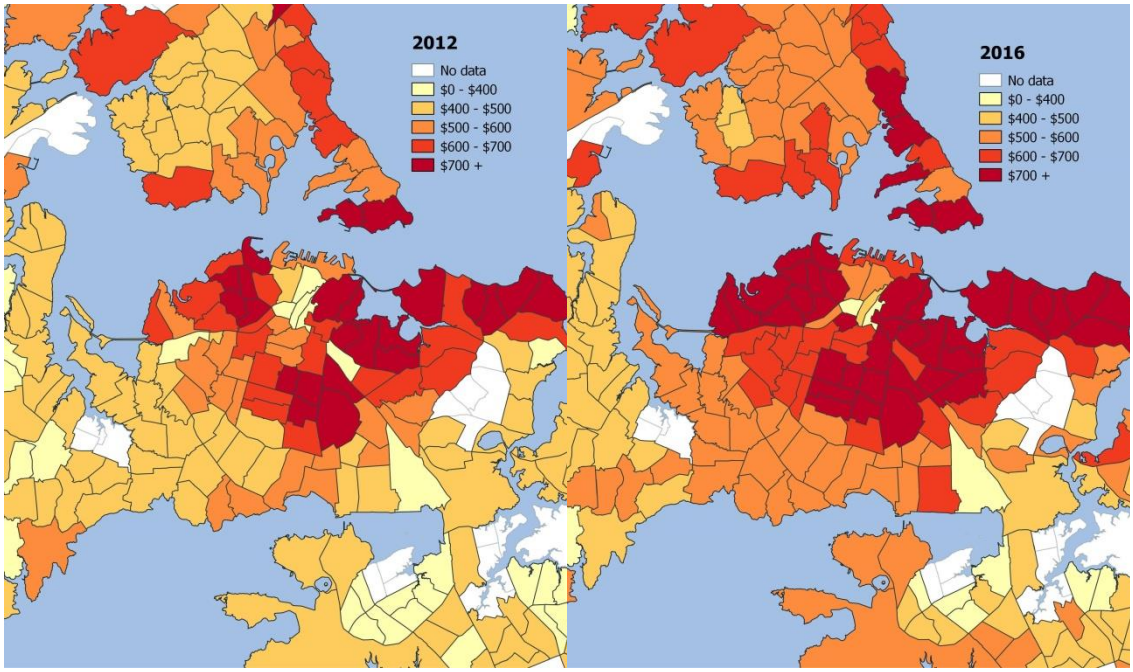
Apart from in Tauranga, increases in house prices over this period have been greater than increases in rents; this is particularly so in Auckland where there has been a 60% real increase in real median house prices (4.8% per annum) but only a 16% real increase in average rents (1.5% per annum).

[47] This is the annual growth rate that, if it applied in every year, would result in the same total increase over that period.

3.4.2 Changes in Rents by Suburb

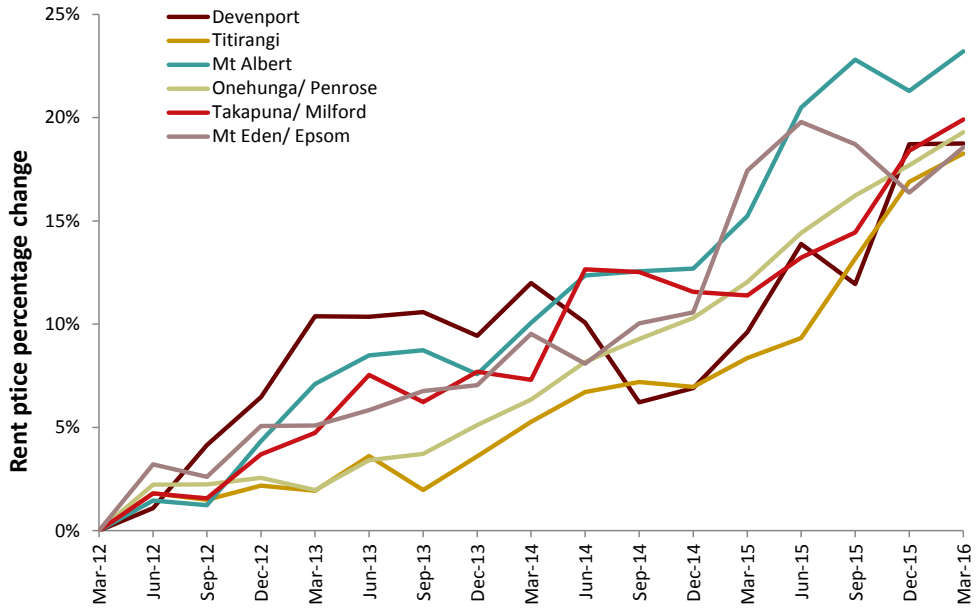
Just as changes in land and property prices by suburb can identify changes in supply and demand, so can changes in rentals. Figure 14 uses MBIE's rent data to show the areas in Auckland with house rentals in different price categories; it illustrates how these have changed between 2012 and 2016. Figure 15 is a line graph that has similar data; the maps have less detailed data but may better communicate the information.

Figure 14 House rental prices by location 2012 and 2016 (houses only)



Source: MBIE rent data and Statistics NZ shape files

Figure 15 Percentage change in rentals by Auckland location (houses only)

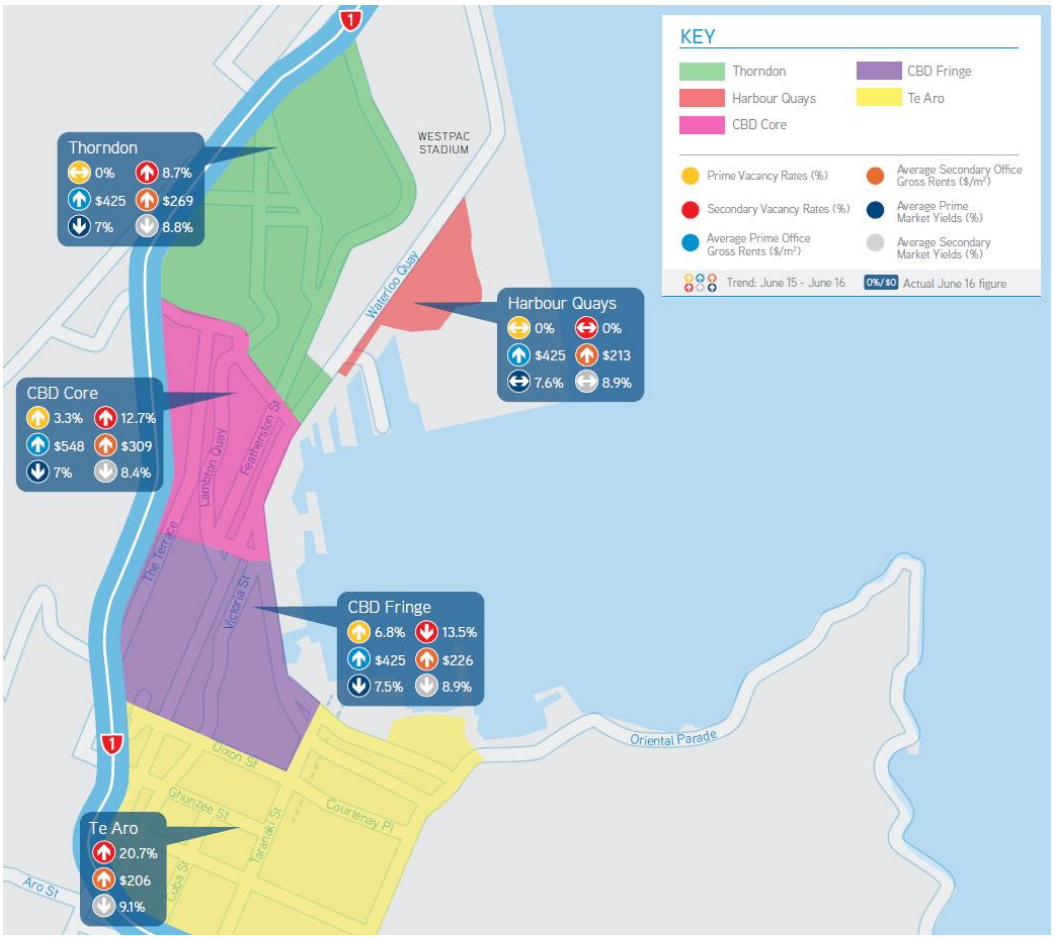


Source: MBIE data

3.5 Business Land Trends

There is limited data available on prices for business land, apart from the land valuation data. A number of real estate agencies collect and publish data based on their property portfolios. An example is provided in Figure 16. It shows data on vacancy rates (see further discussion in Section 4.7.2 below), prices and yields (rent to value ratios). These data are not comprehensive and the quality of the data is uncertain. These data may be of interest to councils, but we do not suggest that they are used as formal indicators.

Figure 16 Wellington CBD office: market statistics 2016



Source: Colliers International - National CBD Office Report 2016

3.6 Conclusions

A number of general market indicators would provide useful background information to assist councils to better understand market trends and dynamics. Those considered here are trends in:

- house prices;
- land values (and using sales prices and econometric analysis where possible); and
- rents.

4 Supply-Demand Indicators

4.1 Introduction

The draft NPS-UDC requires councils to compare estimates of development capacity, including the availability of infrastructure and commercial feasibility of zoned capacity, with future expected demand for housing or business floorspace. The aim is to inform resource management plans, and ensure that they provide sufficient capacity to enable developers to meet demand.

In this section we provide some commentary on approaches to modelling demand and supply,[48] and we explore some possible indicators of supply-demand imbalances.

- First, the extent to which new development is keeping pace with demand from population increase. If new housing construction is lagging behind demographic growth, it may indicate supply-side constraints – especially if prices are simultaneously rising.

- Second, price trends in the housing market (or business land market). If new housing construction is lagging behind demand, it will tend to push up prices.

- Third, models of development capacity that incorporate information on the costs of development (eg land and construction costs) and revenues from development (ie sale prices for new dwellings or business floorspace). These models implicitly incorporate information about the current supply and demand balance in urban development markets.

4.2 Modelling Demand

Indicators alone do not provide a complete picture of supply-demand imbalances. This requires a predictive model that estimates the response of demand to price (Figure 2). Ideally, assessments of demand-supply balance would be undertaken at a price level consistent with optimal land allocation, ie the marginal social cost of supply. This would require economic modelling of:

- the elasticity of demand with respect to price; and
- the marginal social cost of supply, ie the efficient price in a competitive market.

A more sophisticated analysis could identify how some demand for housing in major urban areas has been rationed out of the market to other locations, to more crowded houses or to rental accommodation. However, although these indicators are incomplete, they are complementary to the indicators of efficient pricing discussed in Section 6, which aim to identify cases in which a shortfall of development capacity is pushing up prices above the level that would be expected in a competitive (wellbeing-maximising) market.

[48] This report only briefly discusses the techniques for estimating demand and supply. These will be the subject of guidance on the housing and business assessments that the NPS-UDC requires councils to prepare.

Current housing demand projections often estimate demand simplistically, eg using population growth.[49] Some councils estimate growth by different household types[50] and allocate these to different dwelling types using preference assumptions based on historic data, international trends or recent research.[51]

However, these models tend to assume that future demand will be a reflection of demand at current inflated prices (where relevant), eg future demand is equal to expected population growth times current average household occupancy rate. More sophisticated approaches use hedonic methods[52] to estimate the current structure of prices for different types of property (apartments, compact houses, large houses with gardens), with different characteristics, in different locations. In general, higher prices in some locations reflect higher demand for property in those areas.[53]

Econometric techniques can be used to estimate how demand and consumer utility may respond to changes in factors that include:[54]

- changes to planning policies, eg to allow more land to be reallocated between uses;[55]
- population changes, including changes in age structure and desired household size (which will change with housing costs, but might also reflect demographic issues);
- income (including the relationship between income and demand for housing type and size); and
- costs of ownership based on interest rates and deposit requirements.

In the absence of sophisticated models, information on some of the key factors can be used to adjust current demand estimates upwards or downwards (Table 4). This includes estimating:

- un-met demand within the current population;
- demand from expected population growth; and
- demand from population who would move from elsewhere if prices were lower.

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[49] See discussion of methodologies in Ministry for the Environment (2016) How Councils Estimate Demand and Supply of Development Capacity for Housing and Business. Ministry for the Environment: Wellington.

[50] There are three different household types: one-person households, family households (including couples without children, two-parent families and one-parent families) and other multi-person households.

[51] Ministry for the Environment (*op cit*)

[52] Hedonic methods decompose the contribution of constituent characteristics to the overall value of a good, eg by using regression analysis to analyse price differences between properties with different identifiable characteristics (size, age, proximity to the centre and so on).

[53] Nunns P, Hitchins H and Balderston K (2015) The value of land, floorspace, and amenities: A hedonic price analysis of property sales in Auckland 2011-2014. Auckland Council Technical report 2015/012

[54] Palmquist RB (2005) Property value models. Chapter 16 in: Mäler K-G and Vincent JR (eds) Handbook of Environmental Economics, Vol 2. Elsevier North Holland, pp763-820.

[55] Cheshire P and Sheppard S (2002) The Welfare Economics of Land Use Planning. Journal of Urban Economics, Vol 52.

Some councils effectively take some of these factors into account by using high population growth scenarios.[56]

Table 4 Factors affecting housing demand estimates

Factor	Description	Impacts on demand
High land price	Land prices > efficient prices (see efficient price indicators)	Demand estimates should be adjusted upwards to reflect the impacts of price on demand
Population and demography	Increasing population	Estimated demand increase should be at least as much as growth in population divided by current average people per property (should be adjusted by other factors in this table)
	Aging population	Smaller dwellings
	Increasing demand for smaller/larger houses or households (based on preferences and or demographic change)	Smaller/larger dwellings
Income	Increasing income per capita (should be estimated by age group)	Larger dwellings
Costs of ownership	Decreasing interest rates	Decreasing interest rates should result in increased total demand by increasing willingness to pay
	Increased deposit requirements	An increased deposit requirement reduces the number of people who can enter the housing market. It reduces total demand

Some of these factors have somewhat dynamic effects; they may result in shifts in the types of owners. For example, changes in deposit requirements may reduce demand from investors and result in some price falls, with an associated increase in owner-occupier purchases. However, total demand will be lower than before.

The analysis of demand is further complicated by the interaction of demand for dwellings by owner-occupiers and demand for rental housing, including those who might supply rental housing as rental property owners.

Providing detailed advice on modelling demand is beyond the scope of this project. However, collecting and analysing additional data as noted in Table 4 would be likely to improve demand estimates.

4.3 Ratios of New Build to Population Growth

Estimating the change in the number of consented buildings in proportion to population growth is an unsophisticated analysis of supply-demand balance as it takes no account of price. However, it might provide a rough indication of whether supply is keeping up with population growth and/or if it is starting to address any historical under-supply.

Both population and building consent data are available from Statistics NZ at the territorial authority level. These data can be combined to measure the rate of consented residential development relative to an area's population growth.[57] For example, we can calculate the ratio of the increase in population to the number of building consents

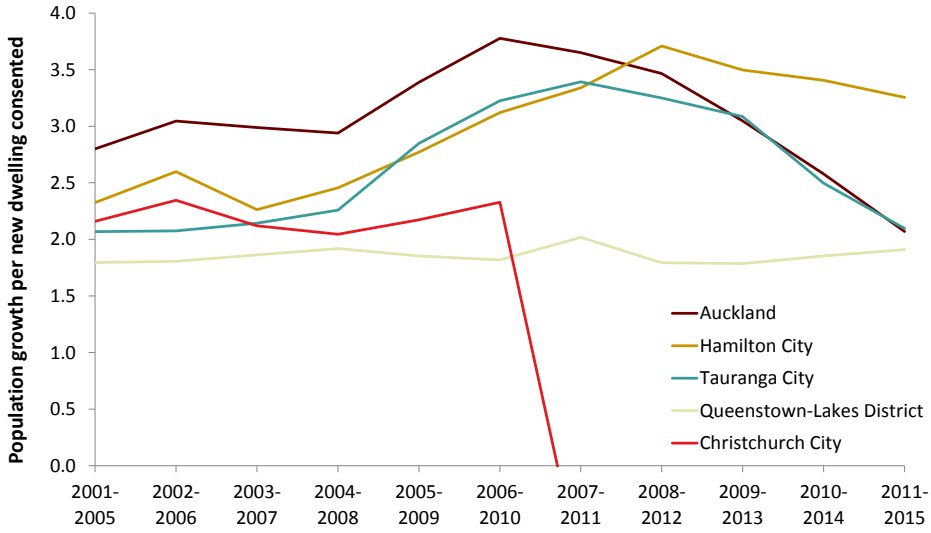
[56] Ministry for the Environment (op cit)

[57] Data are not available on those consented buildings which were subsequently built.

issued per increase in a given year. Higher values indicate that an area's population is increasing at a greater rate than that of new dwelling consents. This can be measured over time for an individual council area or compared between areas.

Figure 17 shows a time series of population growth per new dwelling building consent from 2001 to 2015 for high growth territorial authorities. The data are presented this way around (rather than consents per population growth) for ease of comparison with average household size. The data are shown as a five year moving average because annual fluctuations are not particularly meaningful, eg a population influx in one year might spur an increase in dwelling consents in the following year.

Figure 17 Five year moving average of population growth per building consent for a new dwelling



Source: Data retrieved from Infoshare, Statistics NZ

Areas represented in Figure 17 have averaged a 2-3 person increase in population for every building consent for a new dwelling. Given that the average New Zealand household size is 2.7 persons,[58] this may indicate that, in general, growing areas have kept up with their respective population growth over this period. However, from approximately 2008, all areas except the Queenstown-Lakes District experienced more rapid population growth than dwelling growth. Values below zero, resulting from negative population growth, have been truncated from the chart.

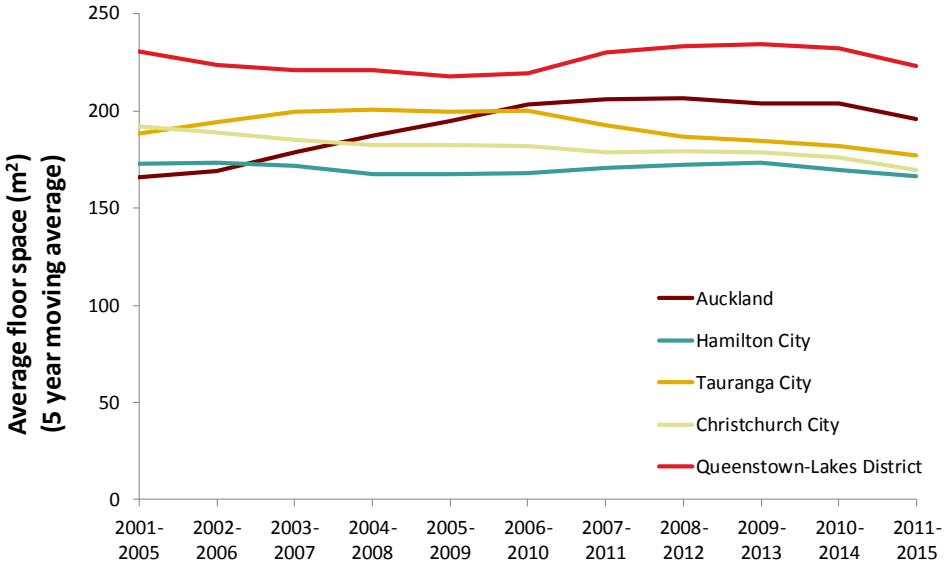
Auckland, Tauranga and Hamilton experienced a period of population growth with little response in housing supply. The recent downward trend for Auckland and Tauranga suggests that building levels are catching up with the growing populations. Hamilton's ratio of population growth to new residential building consents has remained relatively high.

[58] Statistics NZ (2014) 2013 Census QuickStats about families and households. Retrieved from http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/qstats-families-households/households.aspx

A limitation of this measure is that it does not account for the different types or sizes of dwellings that are consented. For example, consenting of one-bedroom apartments will not be providing as much residential capacity as three-bedroom houses but both are registered as one building consent in these data.

The population growth per new building consent indicator can be supplemented by data on the average size of new consents or the number of consents in different size categories. Figure 18 shows average floor areas as a 5 year moving average time series for high growth areas. The average size of new Auckland properties increased significantly from 2002-06 to 2006-10; other areas have been relatively constant over time. Average sizes of new consents in Queenstown-Lakes District are 14% larger than average Auckland properties and 34% larger than in Hamilton. This might reflect some combination of supply (eg land availability or price) and demand (eg income) factors. Christchurch has been excluded from the chart because of the decline in population.

Figure 18 Five year moving average of average new build floor space

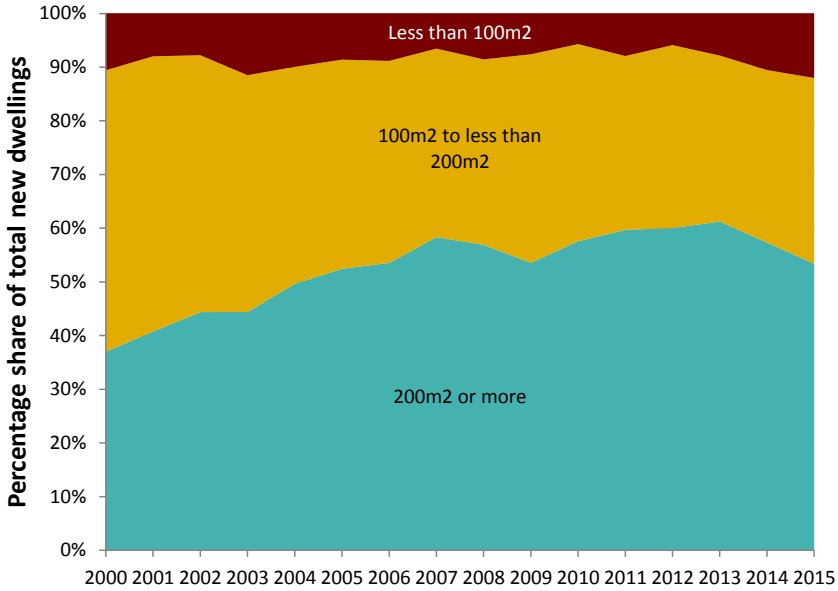


Source: Data retrieved from Infoshare, Statistics NZ

Figure 19 and Figure 20 show the proportion of consents per year for Auckland and Queenstown in different building size categories. In Auckland there was a shift from 2003 to 2007 towards larger dwellings at the expense of medium-sized dwellings, although this has levelled off since and fallen since 2013.

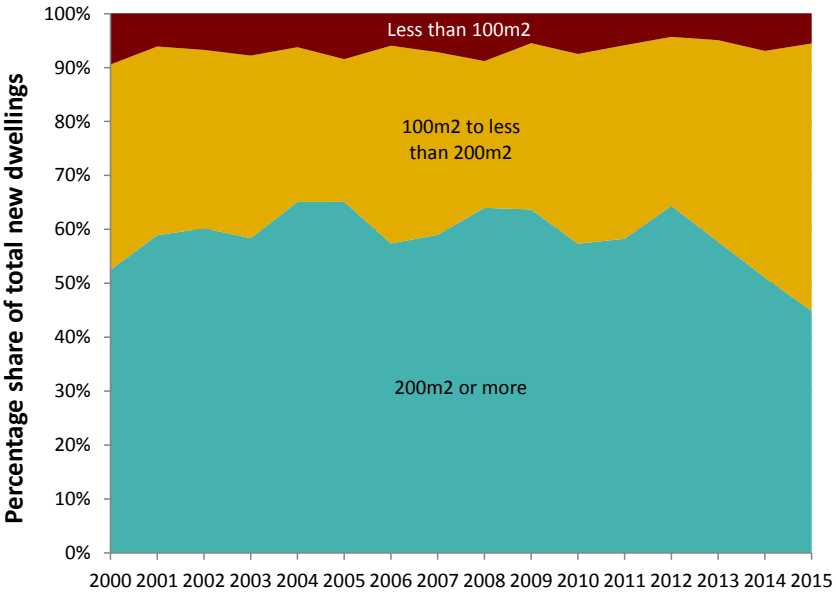
In Queenstown, there was no significant increase (houses have been large historically), but since 2012 there has been a shift towards medium-sized dwellings.

Figure 19 Percentage share of new dwellings consented by size in Auckland 2000-2015



Source: Statistics NZ

Figure 20 Percentage share of new dwellings consented by size in Queenstown 2000-2015



Source: Statistics NZ

4.4 Land leverage Ratio

The land leverage ratio is the ratio between land prices and total capital value (value of land plus improvements). This ratio might provide insights into the overall supply-demand balance for land.

Explanations of differences in land leverage ratios are likely to include:

- land constraints (or planning constraints on development) will result in higher relative land prices and higher ratios; and

- higher average incomes are likely to result in higher improvement values, and to lower leverage ratios where land supply is unconstrained.

Over time, the value of land would be expected to change with the opportunity cost of supply, if unconstrained, or at a greater rate if scarcity increased over time. In contrast, the value of improvements would not be expected to rise faster than the costs of construction, and may decrease over time reflecting a depreciating asset value. Thus for any individual property the ratio would be expected to change over time, because the two elements are affected by different market prices. Researchers have suggested that areas with high leverage ratios tend to have much greater price volatility.[59]

Land leverage ratios can be useful analytical tools for understanding property markets, but they do not yield simple conclusions. They are not recommended here as primary indicators.

These data provide additional information to sit alongside the ratio of consents to population ratio (Figure 17). They can be used to assist in the analysis of whether or not the size of dwellings being built is consistent with what might be most affordable.

4.5 Rent:Property Price Ratios

Trends in the ratio of rents to home prices (rental yields) provide some indication of relative supply-demand balance for the individual markets. Low rent to price ratios would suggest greater relative supply in rental than in ownership markets. Thus these ratios are used to provide guidance on where best to invest in rental properties[60] and for individuals as to whether they are better to purchase or to rent. However, the ratios (and the trends over time) also need to be interpreted in light of changes to the costs of borrowing and expectations of future capital gains.

- People would be expected to be willing to enter the market to provide rental housing when the revenue received from rents exceeded the costs of supply of a new home, ie the costs of a mortgage plus the costs of capital for any equity (the opportunity cost from the lost opportunity to obtain a return in the share market or some lower risk investment, eg term deposits). Lower interest rates would be expected to result in lower rents and lower rents to home price ratios.

- A complicating factor is the expectation of capital gain in the housing market. If people expect a capital return, this adds to the overall expected revenue over time and means that the price at which people would be willing to let a property would be lower in a period of high expected capital gain, and vice versa.

[59] Bostic RW, Longhofer SD and Redferan C (2006) Land Leverage: Decomposing Home Price Dynamics. University of Southern California, Lusk Center for Real Estate Working Paper 2006-1013.
[60] See for example: http://www.interest.co.nz/property/rent-ratio

Rent-price ratios thus provide some useful information but the data need to be carefully interpreted in the light of these other circumstances. Because of the influence of interest rates, both as an indicator of the cost of entering the rental market and (in broad terms) the opportunity cost of holding a property,[61] the ratio between rentals and the costs of ownership (annual mortgage payment) may be a more useful indicator.

These ratios provide information which will assist in analysing the overall supply-demand balance.

4.6 Modelling Supply: Development capacity models

Data gathered to analyse price signals can also be used as an input into development capacity models. While development feasibility is not, strictly speaking, a price signal, it is determined by the relativity between development (eg land, construction, consenting), and development revenues (ie the prices that people are willing to pay for housing and business floorspace).

4.6.1 Interpretation

The amount of development in cities is determined by urban planning policies such as residential or business zoning rules, infrastructure provision, land-owner and developer intentions, and the commercial feasibility of developing new buildings.

The NPS-UDC requires high- and medium-growth urban councils to develop a better understanding of commercial feasibility, as this can have a significant impact on supply outcomes from urban planning policies. For instance, if there is little demand for development in a given area (as evidenced by low housing prices), rezoning it for further growth may not enable an increase in housing supply.

To estimate the commercial feasibility of development, it is necessary to understand relative prices, including:

- development costs, such as land, construction, consenting and design; and
- development revenues, which can be estimated at a point in time based on the prices that people are paying in the market.

One limitation of commercial feasibility models is that they are seldom forward-looking, ie they are a 'snapshot' based on the prices that are *currently* observed in the market. This analysis may be less valid if prices change significantly, eg because of changes in the composition of demand for housing or business floorspace, or changes in regulatory policies that affect the cost of land or consents. As a result, commercial feasibility models should be updated regularly to ensure that they remain current.

4.6.2 Data availability

It is necessary to gather and analyse data on property sale prices, land valuations, and construction or land development costs to estimate several price indicators. These data can also be used, albeit in a different format, as an input into development capacity models. The required data are briefly described in Table 5.

[61] Assuming that mortgage interest rates will move broadly with expected returns in equity markets.

Table 5: Data sources

Data	Source	Description of required data
Data on development costs		
Land valuations	TLAs/CoreLogic	Land valuation data is available from ratings valuations conducted on a three-yearly cycle. Although land valuations are available for individual properties, they can be grouped at a Census area unit or Census meshblock level if this level of detail is not needed.
Land development/ site preparation costs	Construction cost estimators or subdivision companies	Land development costs typically include costs of design and consenting, earthworks, and local infrastructure for subdivisions. As some costs (eg slope reinforcement or stormwater) can be site-dependent, targeted estimates for particular locations are preferred.
Construction costs	Construction cost estimators (eg CoreLogic, RLB)	Construction costs reflect the cost to physically construct a building. They typically differ depending upon: • Building type and construction technology, ie high-rise apartments tend to be more costly than single-storey houses. • Building quality and attributes, eg features like decks or garages add cost.
Design and consenting costs	Construction cost estimators or developers	Developers must incur design costs (eg for architectural and professional services) as well as costs associated with council resource consent and building cost requirements. Design and consenting costs may vary between building types or locations. Consenting costs (and/or the risk of not achieving consent) are likely to be higher for developments that do not fully comply with district plan rules.
Development and financial contributions	Council development contribution policies	Developers are typically obliged to pay development / financial contributions to cover part or all of the cost of network and local infrastructure.
Developers' cost of capital (holding costs)	Developers or general market information	If there is a time-lag between when development costs (eg land acquisition) are incurred and when development revenues are earned, then developers must incur holding costs such as additional interest payments on bank loans.
Data on development revenues		
Sale prices for residential properties	TLAs/CoreLogic / REINZ	Current sale prices for residential properties can be used to estimate revenues from new developments. Data can be summarised by: • Location, eg Census area unit • Dwelling type, eg distinguishing between standalone houses and apartments • Dwelling characteristics and quality, eg number of bedrooms, condition of building. Sale prices could be standardised, eg as revenues per square metre of dwelling.
Sale prices or rents for commercial properties	TLAs / CoreLogic / Bayleys / CBRE	Current sale prices or rents for commercial properties can be used to estimate revenues from new developments. Data can be summarised by: • Location, eg Census area unit or commercial centre • Building type, eg offices, retail buildings, industrial warehouses • Building characteristics and quality, eg A-grade or B-grade offices. Sale prices could be standardised, eg as revenues per square metre of business floorspace.

An important consideration is that some types of costs and revenues vary by location, eg land costs and sale prices for finished buildings, while others are relatively standard across the board within an urban area, eg construction and design costs. Construction costs vary between building types, eg apartment buildings are typically more expensive to construct (on a per-square metre basis) than standalone houses.

A second consideration is that some building types may not exist in all locations, eg apartments tend to be concentrated in the centre of large cities. When assessing the commercial feasibility of development capacity achieved by enabling higher-density dwelling types to locate in more areas of the city, it will be necessary to extrapolate potential prices from existing data.

4.6.3 Examples of Use

Several councils already model development capacity in residential zones, including the commercial feasibility of zoned capacity, using a mix of methods. This includes:

- Auckland Council – model developed in expert conferencing during hearings on the Unitary Plan;
- Queenstown Lakes District Council;
- Lower Hutt District Council;
- Tauranga City Council;
- Western Bay of Plenty District Council; and
- Christchurch City Council – an integrated model looking at environmental impacts as well as commercial feasibility.

4.7 Vacancy Rates

Vacancy rates can be measured for residential property and for business. They have quite different implications reflecting the different uses of these properties.

4.7.1 Residential Property

Vacancy rates (the proportion of residential buildings that are unoccupied) can be an indicator of:

- part of the supply problem, eg properties which have been purchased for investment purposes without any intention of permanent occupancy or rental; or
- over- or under-supply of certain building types, eg properties in areas of falling housing demand.

Vacancy rates can also reflect the ways in which people use property. For example, residential properties can be used for holiday homes or as residencies for people based part-time overseas. These are both elements of total demand for residential properties in New Zealand.

Data on vacancy rates in residential properties are collected in the census every three years. More frequent data might be obtained, in theory, using utility, eg water or energy data. However, low or no use may reflect other reasons, including multiple connections

to a single property or customer switching providers. Utility providers approached for this study have either been reluctant to provide data or advised that it would be too uncertain to be useful. However, in addition to the data problems, it is ambiguous as to whether vacant properties are an element of the problem or simply a reflection of diverse usage.

4.7.2 Business Land and Commercial Property

Business land vacancy is one of several indicators recommended in the draft NPS-UDC for local authorities in medium or high growth urban areas. Vacancy rates can provide insight to the changes in the supply and demand dynamics, especially when combined with other information on supply (eg consents for non-residential buildings) and demand (eg growth in sectoral employment and numbers of business units) (see below). Low vacancy rates would suggest that demand levels are close to levels of supply, which will have different implications depending on the trends in vacancy rates and changes in other estimates of supply and demand.

Business vacancy data are collected and published by several property companies. Data are collected using surveys of the occupancy status of each industrial, office and retail premises within a given area. These surveys are carried out most extensively in Auckland, Wellington and Christchurch, but data are also available for Hamilton, Tauranga and Dunedin.

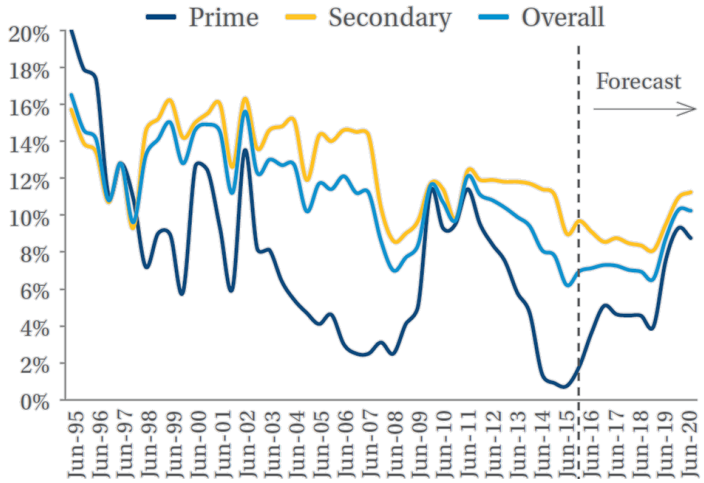
Figure 21 shows Colliers' estimate of the decline in vacancy rates for office buildings in the Auckland CBD since 1996. The recent steep decline (to the left of the dotted line) is attributed to rising employment in the area and strong demand for prime office space. Colliers notes that "*Auckland CBD office employment has increased by more than 20% in the past five years. The result of such rapid growth is the overall vacancy rate reducing to 6.2% - a record low. Since 2010, vacant space has halved and net supply has reduced by almost 30,000 sqm.*"[62]

Figure 22 illustrates Wellington CBD's vacancy rate which rose significantly after 2008. Westpac suggests that significant factors in the overall change in demand are modest employment growth and the reduced Government footprint; it intends to cut its space utilisation by up to one-third[63] in a market in which Government accounts for 50% of all office space.[64]

Trends in business land and commercial property occupancy provide some insight into supply and demand dynamics in this market, but they must be interpreted in context with other data. For instance, if vacancy rates are falling with little evidence of a subsequent increase in consenting or construction, it may indicate the presence of supply-side constraints.

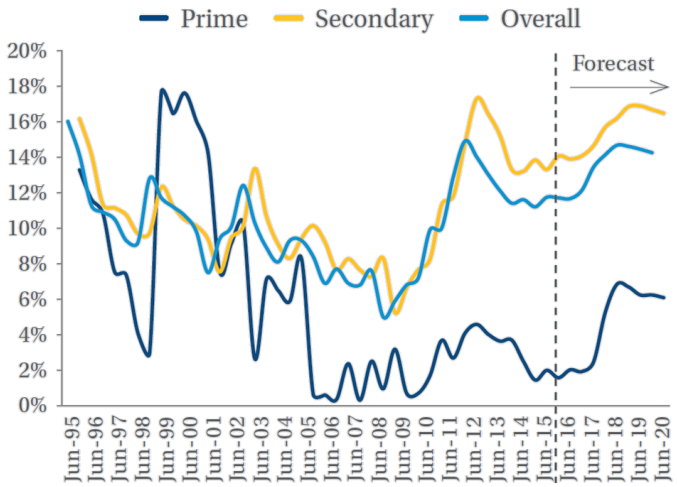
[62] Colliers International (2015) NZ CBD Office Report 2015
[63] See Minister of State Services (2011) Property Management Guidelines For Office Space
[64] Westpac (2016) Industry Insights: Commercial Property June 2016

Figure 21 Auckland CBD office vacancy rate by grade



Source: Colliers International (2015) NZ CBD Office Report 2015

Figure 22 Wellington CBD office vacancy rate by grade



Source: Colliers International (2015) NZ CBD Office Report 2015

4.8 Business Land Indicators

Business land indicators provide useful information about the supply-demand balance for business land. A recent MfE report[65] analysed councils' forecasting and monitoring practices for business land demand and capacity. MfE found data relating to GDP, population, employment and floor space are commonly used to forecast demand by economic sector. Resource and/or building consents granted, and the vacant land register are used to monitor market activity.

In general, councils were found to use fewer resources in analysis of business land than residential land. This may reflect forecasting difficulties because of data gaps and the diversity of demands for businesses. Below we outline indicators to assist councils' monitoring and foresight of market activity and quantification of supply and demand.

[65] Ministry for the Environment, 2016. How Councils Estimate Demand and Supply of Development Capacity for Housing and Business. Ministry for the Environment: Wellington

4.8.1 Business floorspace supply

The number of non-residential building consents provides insight into growth of business floorspace supply. MfE's survey of high-growth areas found only Queenstown, Christchurch City, Hamilton City, Tauranga City and Auckland Council to be monitoring this indicator.[66] Non-residential building consents by territorial authority can be retrieved from Statistics NZ and disaggregated by land use (eg new buildings for accommodation, education, retail, office, factories and industrial purposes). Figure 23 shows non-residential building consents for Auckland and Wellington[67] areas since 2000. Auckland's growth of new non-residential buildings has increased significantly since 2010 while Wellington's new supply has declined since 2004.

Figure 23 Auckland and Wellington non-residential building consents 2000 – 2015

Source: Statistics NZ

4.8.2 Business land demand

Business land demand can be monitored through changes to business units (ie individual businesses or branches of a business operating from multiple locations) and number of employees in a given area. These data are available by ANZSIC code at the territorial authority and area unit level from Statistics NZ's 'Business demography statistics' database.[68] As observed in the MfE report[69] we adopt a similar approach to high growth councils and allocate ANZSIC sectors data into 'office, retail or industrial' categories. Net percentage growth in business units and employees since 2000 for Auckland and Wellington areas is illustrated in Figure 24 and Figure 25 respectively.

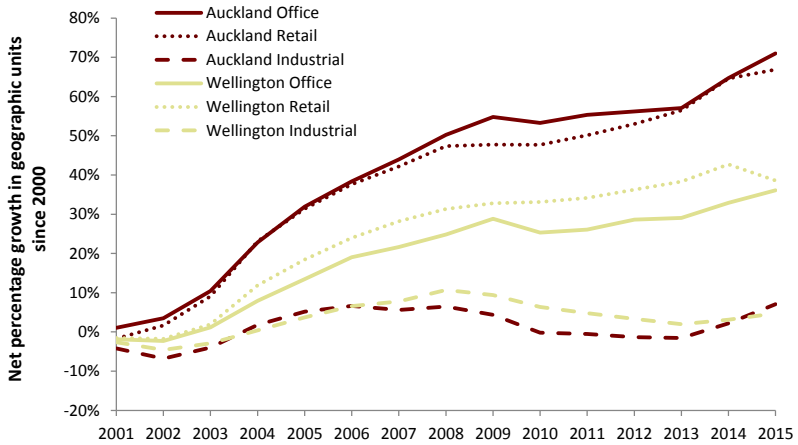
[66] ibid

[67] Wellington area is represented by the territorial authorities of Porirua City, Upper Hutt City, Lower Hutt City and Wellington City.

[68] http://nzdotstat.stats.govt.nz/wbos/Index.asp

[69] Ministry for the Environment, 2016. How Councils Estimate Demand and Supply of Development Capacity for Housing and Business. Ministry for the Environment: Wellington

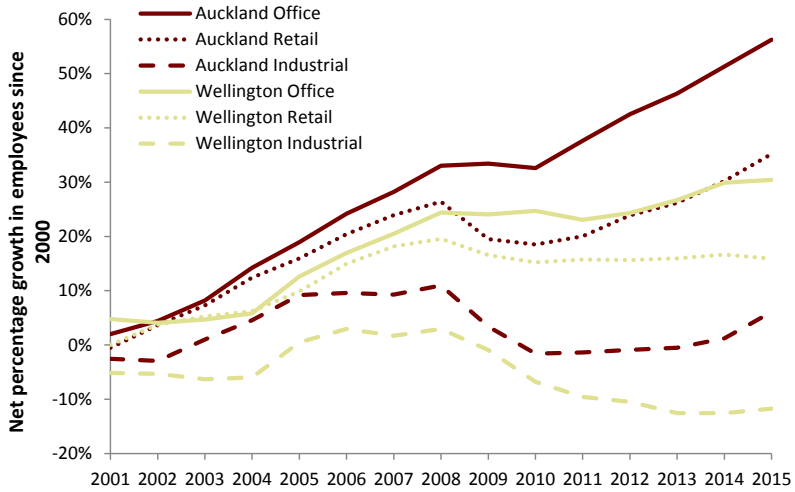
Figure 24 Net percentage growth in business units since 2000



Source: Statistics NZ

Figure 24 shows strong growth in the number of office and retail business units, particularly in Auckland, which is likely to have implications for space demand. The number of industrial geographic units has remained constant however in both cities. Figure 25 shows similar trends for employee count.

Figure 25 Net percentage growth in employee count since 2000



Source: Statistics NZ

Data on business units and employment can assist in understanding growth in demand for business land and floorspace. However, it is a useful but incomplete indicator, as it does not account for other factors influencing demand for business land, such as productivity trends that result in the substitution of land for labour (or vice versa). For instance, a manufacturing or warehousing firm may be able to increase its output and space requirements while reducing employment if it invests in new plant and machinery. Employment levels are most likely to be a meaningful measure of demand for business floorspace in office-based industries which tend to be more labour-intensive.

4.9 Conclusions

This section has examined approaches to modelling supply and demand and a number of indicators which might be used to provide information to councils. We make the following comments about useful data and indicators.

- Modelling demand for housing should be undertaken on the assumption of efficient prices that reflect the costs if supply rather than current inflated prices. Modelling should also account for a number of expected changes in demography and income which will influence total demand and demand by building type.

- Ratios of new build consents to population increase can be monitored as a simple assessment of whether new supply is matching demand increases. However, it should take account of the factors that influence demand and should include an assessment of changes in housing size.

- Monitoring of land and property prices in real terms can provide information to identify emerging problems, especially when price trends are compared between cities. Usefully prices on a per square metre basis can be used to isolate some of the influence of changes in property size.

- Models of housing supply have been developed by a number of councils, particularly to better understand commercial viability by geographical location. These can provide a better understanding of geographic limits to total supply.

- Vacancy rates indicators for residential properties are unlikely to be useful. The data are difficult to collect, apart from via the three-yearly census, and the results are ambiguous reflecting different ways in which residential property is used, eg for holiday homes.

- Vacancy rate indicators are more useful for businesses and these are collected and published by a number of private companies. To understand these data, it is useful to have additional information relating to demand and supply, eg sectoral economic activity levels, trends in numbers of geographic units and employment (demand), and building consent numbers (supply).

5 Competitiveness Indicators

5.1 Introduction

The discussion of competitiveness in Section 2.2 noted that competitive (wellbeing-maximising) markets for urban land and development would have the following characteristics:

1. no barriers to entry;
2. many buyers and sellers;
3. uniform products (or comparable development opportunities);
4. no externalities, ie unpriced effects on those other than the buyers and sellers;
5. perfect information; and
6. zero transaction costs.

Indicators can be developed to measure most of these characteristics. These may be useful to assist in assessing regulatory and non-regulatory barriers to achieving more competitive land and development markets. As discussed in Section 2.2, uncompetitive market outcomes may arise for reasons other than planning regulations and infrastructure supply. Measures of non-regulatory constraints on competition can assist in interpreting the indicators of efficient pricing that we discuss in Section 6, by helping understand whether there are factors *other* than planning and infrastructure that constrain competition.

In this section we focus on indicators related to market concentration, information problems, and transaction costs. While externalities associated with urban development are important, they are currently dealt with via the planning system, rather than through prices. More targeted analysis of particular rules that aim to manage these externalities is required to understand whether (and where) it is working efficiently.[70]

5.2 Market Concentration

Markets are more competitive if there are many buyers and sellers. In highly concentrated markets it is more likely that firms or individuals can exercise market power and increase prices above the cost of supply. Submissions on the draft NPS-UDC raised this as a significant problem in some local areas, particularly in greenfield areas where plans have allocated most of the future development capacity.

One widely used indicator of market concentration is the Herfindahl–Hirschman Index (HHI).[71] It measures the degree to which markets are dominated by a small number of

[70] Section 32 of the RMA requires local governments to publish evaluation reports assessing the costs and benefits of proposed planning regulations. These evaluation reports are an appropriate point to undertake an analysis of the efficiency of rules. The cost benefit analysis of the proposed NPS-UDC compiled some recent research and also undertook a high-level assessment of two specific planning regulations in the Auckland context (MRCagney *et al*, 2016).

[71] See Stevens P (2011) Competition in New Zealand: An analysis using micro data. New Zealand Association of Economists Annual Conference 2011 for a discussion of alternative measures of competition.

firms. It is calculated as the sum of the squares of market shares of each firm competing in the market. For example, for a market consisting of five firms with shares of 50, 30, 10, 5 and 5 percent, the HHI is $50^2 + 30^2 + 10^2 + 5^2 + 5^2 = 3,550$; in contrast if there are ten firms, each with 10% market share, the HHI is 1,000.

The HHI has a minimum of close to zero (numerous small firms with tiny market shares) and has a maximum of 10,000 (1 firm with 100% market share). According to the US Department of Justice, and representing a widely-held interpretation of the HHI, markets in which the HHI is between 1,500 and 2,500 points are considered to be moderately concentrated, and markets in which the HHI is in excess of 2,500 points to be highly concentrated.[72]

Measuring an HHI for development capacity would require the following information.

1. Identification of the market for development capacity, ie is it all property in an urban area or a more narrowly defined sub-set of new capacity in a specific location or locations?
2. The total number of owners of "development capacity";
3. The share of development capacity controlled by each owner.

The analysis could be simplified. For example:

- if no single person owned more than 10% of the developable land on the fringe of the city, the maximum HHI would be 1,000, which is not regarded as concentrated (see above). The analysis could simply record an HHI of less than 1,000; and

- if there were a few landowners with significant market shares, the analysis could be truncated to exclude people who owned a small share of developable land. For instance, people with less than 3% market share could be excluded as they would add a maximum of 9 to the total HHI.

It would be possible to use land title data and company ownership data to estimate an HHI measure for particular land markets. This could assist in understanding the extent of non-regulatory constraints on the competitiveness of land and development markets. For example, measuring the concentration of ownership of greenfield land on the city fringe would provide an indicator of the degree to which greenfield development may be limited by land-banking.

For smaller councils the information the HHI provides might be known and understood, but the HHI could provide a means for communicating the problem. For larger councils, the HHI could be used to analyse whether there is a concentrated market problem. This might be combined with market definition work to isolate separate markets, ie is there a single market for business land or are there separate markets defined by geography or other factors, each of which might be monopolised?

[72] https://www.justice.gov/atr/herfindahl-hirschman-index

The HHI is a useful indicator and one that is widely understood by competition economists. It could be a useful addition to the suite of indicators used by councils.

5.3 Information Problems

Markets are made more competitive by better quality information relating to price, supply and demand. With more complete information, market participants have greater certainty over the value of what they are buying or selling. This drives price towards the marginal cost of supply and reduces the opportunities for speculative purchasing and profitable holding of land (land banking). Greater certainty increases the likelihood that developers will invest.[73]

Councils affect the quality of available information through their plans and consenting processes. These can provide more or less information about factors that include what development is allowed now and in the future at a specific location, and when infrastructure will be in place.

The quality of available information is not straightforward to measure because some of the problem relates to the changeability of information rather than its current status, ie if the list of activities that are allowed changes over time. Information quality might be measurable in the form of the timeframe of infrastructure planning, eg how far in advance are plans in place, but this is a limited component of the total problem.

An alternative approach might be based on surveys of developers. This would be subjective, but if repeated over time it might provide an idea of whether or not business certainty is improving over time.

An information quality indicator is a possibility for the set of council indicators, but it is not a priority indicator.

5.4 Transaction Costs

Land and development markets would be more efficient if there was no (or low) transaction costs associated with buying or selling properties or undertaking development. If property could be exchanged and (re)developed more quickly and cheaply, it would be more likely that people would make exchanges when their circumstances changed.

The costs to buy or sell properties include time to search for an appropriate property and costs of sales. Real estate agent fees currently range from 3% to 5% of the sales price of a $500,000 property.[74] However, absent a very different trading model, fees will continue to be a barrier to a more competitive market.

Transaction costs of property development include the costs to acquire land for development, the holding costs associated with the time lag between land acquisition

[73] Grimes A and Mitchell I (2015) Impacts of Planning Rules, Regulations, Uncertainty and Delay on Residential Property Development. Motu Working Paper 15-02

[74] http://www.hometopia.co.nz/help-me-sell/agency-fees-at-a-glance

and receipt of development revenues (eg from sales of new dwellings), and the costs of designing and consenting new buildings. In principle, these transaction costs can be measured through surveys of:

- developers to understand the costs that they face, including financial costs, delays, and uncertainty associated with consenting requirements;[75] and

- local authorities to understand resource consent and building consent fees and timeframes for consent decisions,[76] including that required under the National Monitoring System (NMS).[77]

Such surveys would be good practice.

Interpreting data on transaction costs can be difficult because the costs include land acquisition costs and holding costs for redevelopment projects which may be increased by planning rules (it is the marginal costs attributable to planning rules that are of interest), and other costs, eg architectural design costs, may be partially influenced by planning rules but will be required anyway. However, good survey design might deal with many of these potential problems.

5.5 Conclusions

We recommend the use of the HHI to measure concentration in specific land markets.

[75] Grimes A and Mitchell I (2015) Impacts of Planning Rules, Regulations, Uncertainty and Delay on Residential Property Development. Motu Working Paper 15-02.
[76] Ministry for the Environment (2014) Resource Management Act: Two-yearly Survey of Local Authorities 2012/13. Wellington: Ministry for the Environment. Available online at http://www.mfe.govt.nz/publications/rma/resource-management-act-two-yearly-survey-local-authorities-20122013
[77] http://www.mfe.govt.nz/rma/rma-monitoring-and-reporting/information-requirements

6 Indicators of Efficient Pricing

6.1 Theory

In Section 2.3 we discussed pricing in competitive markets. This analysis suggests that, in a competitive (wellbeing-maximising) market for urban land and development, prices for housing and business floorspace would be no higher than the marginal social cost of supply. The marginal social cost of development can in turn be decomposed into:

- marginal private costs, ie the opportunity cost of land if used for its next-best use plus land development costs; plus
- marginal external costs, including costs of network infrastructure that are not borne by the developer, external impacts on neighbours, and environmental impacts.

Where observed prices diverge significantly from marginal social costs, it suggests that there are constraints to competitive markets, which may include insufficient development capacity in plans, as well as non-regulatory constraints such as concentrated market power (Section 5.2).

Identifying cases where prices diverge significantly from marginal social costs can be challenging. Competitive markets do not imply that prices for land, housing or business floorspace will be equal across all locations. Within cities (and between cities) there are variations in access to employment and amenities that result in higher prices in some locations than others. Consequently, evidence of variations in prices within cities is not sufficient evidence of inefficient pricing.

It is possible to identify whether or not prices are efficient by comparing:

- prices for parcels of land (or residential properties) that are essentially the same but which have different development capacity due to differences in zoning or infrastructure supply; or
- market prices for dwellings or business floorspace with a 'bottom-up' estimate of the marginal social cost to supply comparable goods, including development costs and external costs.

Large differences in prices for similar goods (land, housing, or business floorspace) that cannot be explained by differences in their underlying characteristics are evidence of inefficient pricing. If it is possible to link observed discontinuities in prices to urban planning policies, eg by observing them at the edges of spatially-based zones that allow urban development in some locations but not in others, then it is reasonable to infer that a lack of development capacity is increasing prices.

The overall problem identified by inefficient prices is that a lack of sufficient development capacity is distorting urban land and development markets and increasing prices above the optimal (wellbeing-maximising) level. This could include inefficient

allocation between uses (eg residential vs commercial or industrial), inefficient densities of development and inefficient city size in total.

However, if an analysis of prices suggests a price discontinuity in land prices between, areas zoned for, say, residential (high price) and industrial use (low price), this cannot be used to conclude that there is too much area zoned for industrial use. On the contrary, it may be the case that demand for industrial land is being adequately catered for, while opportunities for residential development are excessively constrained. If rules were changed to enable a more efficient allocation of land across the city as a whole, there would be an increase in total housing development, eg through further intensification or extensions of urban boundaries, but no reduction in the total industrial land area.

In other words, prices can provide evidence of uncompetitive markets, but the decision to how best to address this inefficiency requires further analysis.

6.2 Discontinuities in Land Prices Across Zoning Boundaries

Urban planning policies often permit development on one side of a boundary, but not on the other side. For example:

- urban growth boundaries (eg Auckland's former Metropolitan Urban Limit) allow urban development to occur within the boundary but only allow rural uses outside the boundary; and

- zoning policies allow specific uses in one location but not in others, eg industrial zones may allow manufacturing and warehousing activities but not retail or housing.

Urban growth boundaries and zoning policies do not necessarily distort prices. If plans enable a sufficient quantity of development capacity to meet all demands for urban development, then they may alter the *distribution* of activities throughout the city but not affect prices at zone boundaries. However, if urban growth boundaries or zoning policies are excessively restrictive, limiting the amount of land that is available for a given use, then they will raise land prices in areas where that use is allowed, relative to adjacent areas where it is not.

Here, we examine three specific instances where land price discontinuities might be observed:

- discontinuities in land prices immediately inside and outside the urban boundary;

- discontinuities in land prices across zone boundaries within urban areas, eg between industrial and residential zones or between residential zones that allow different intensity of development; and

- discontinuities in section prices between similar residential properties with or without capacity to be subdivided.

Before doing so we discuss some empirical issues in measuring and interpreting price discontinuities.

6.2.1 Measuring and Interpreting Price Discontinuities

Price discontinuities are observed when the market prices for goods differ in ways that cannot be explained by differences in their characteristics or qualities. To identify them, it is necessary to undertake a "like-for-like" comparison, eg between land values in adjacent sites that are zoned for different uses.

Identifying discontinuities in prices

To identify discontinuities in land or property prices, it is necessary to have some insight into the underlying factors driving prices. This includes:

- localised amenities that may increase land / property values in particular locations, such as proximity to employment, environmental amenities like coastlines, and artificial amenities like school zones; and

- the potential for positive or negative externalities ("spillovers") between adjacent land uses that may be factored into land prices. For instance, McCann observes that urban boundaries may enhance amenity for people living just inside the boundary due to improved access to open space, while industrial zones may lower neighbouring property values.[78]

Failing to properly account for these drivers of property values may make it difficult to accurately identify price discontinuities. For instance, Angrist and Pischke observe that nonlinear relationships can easily be mistaken for discontinuities.[79] This is illustrated in Figure 26. The explanation of the panels is as follows.

- In the first panel, there is a linear relationship between the variable on the X axis and an outcome variable (Y axis), plus a discontinuity that manifests itself as a sudden "jump" up in value.

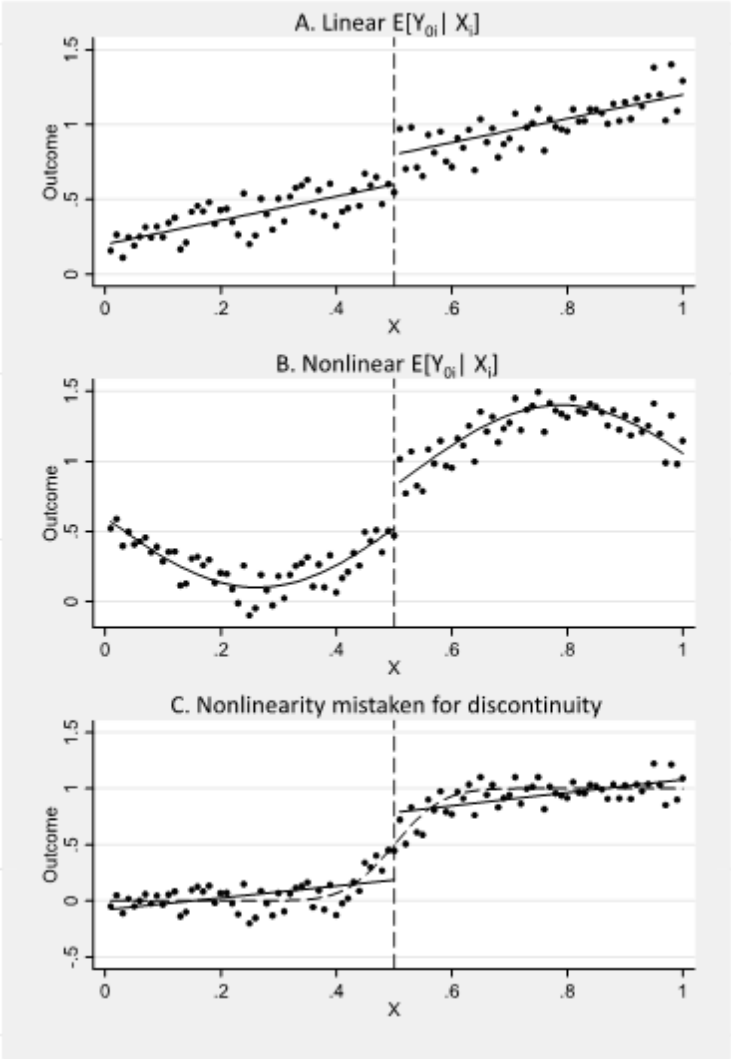
- In the second panel, there is a nonlinear relationship between the variable on the X axis and the outcome variable, plus a sharp discontinuity at the same point.

- In the third panel, the scatterplot shows that there is a nonlinear relationship between the two variables, *without* any sharp discontinuity. However, if this was modelled as a linear relationship, it would indicate – inaccurately – the presence of a discontinuity.

[78] McCann P (2001) Urban and Regional Economics.

[79] Angrist JD and Pischke J-S (2009) Mostly Harmless Econometrics: An Empiricist's Companion

Figure 26: Measuring discontinuities in empirical data (Source: Angrist and Pischke, 2009)



Price indicators can be challenging to estimate or interpret during periods when cities are undergoing periods of significant economic or regulatory change which may change the structure of demand for land and housing. This could include, for example:

- significant economic "shocks" such as rapid in-migration or closure of major industries. This may result in a period of "disequilibrium" as prices adjust towards new stable levels;

- major re-planning exercises or plan reviews, which may result in a period of regulatory uncertainty while the details of new rules are being worked through. During this period, prices may change in anticipation of announced changes or market expectations about potential further changes, rather than reflecting the impact of operative rules; and

- natural disasters, which can have temporary and permanent effects on prices. For example, the Canterbury earthquake resulted in significant destruction of housing and business premises, causing prices to rise in the short run until losses could be

made good. It also increased awareness of and information about natural hazards such as liquefaction, which were subsequently reflected in lower land prices in liquefaction-prone areas.

Approaches to measuring price discontinuities

Following NZIER (2015), there are two robust approaches to identifying price discontinuities: the sophisticated and focussed approaches (see Section 1.2.2). We provide examples of both approaches in Box 3.

Box 3 Spatial hedonic analysis

Housing (and land for housing) is not homogenous. Dwellings differ on a wide range of attributes, such as:

- Location, eg their proximity to the city centre, other major employment centres, and regional amenities such as coastlines
- Neighbourhood characteristics, eg the presence of parks, historic buildings, or popular schools
- Dwelling characteristics, eg size, views, and condition.

The prices that people pay for housing implicitly reflect the value that they place on these attributes. However, all of these attributes are "bundled" together, which can make it difficult to disentangle the individual value that people place on different attributes. Econometric techniques such as ordinary least squares (OLS) regression or spatial regression can be used to identify the contribution of various attributes to home prices. This is often described as "hedonic analysis", as it attempts to measure the "pleasure" that people obtain from individual characteristics of goods. OLS regression typically models an outcome variable (in this case, home prices) as a function of various other attributes. For example, a typical hedonic analysis may take on the form:

$$Price_i = \beta_0 + \beta_1 LandArea_i + \beta_2 FloorArea_i + \beta_3 View_i + \cdots + \varepsilon_i$$

The terms β_1, β_2, etc are coefficients (estimated in the model) that reflect the relative impact of different dwelling attributes on prices, while ε_i is an error term reflecting unobserved characteristics.

Spatial hedonic regression is similar, except that it explicitly addresses localised correlations between the value and attributes of nearby properties that cannot easily be identified in the data. The insight underpinning spatial regression is that "everything is related to everything else, but near things are more related than distant things."[80] Failing to account for spatial effects can lead to biased or misleading results.

When modelling residential property sales, spatial error models are often most appropriate for controlling for unobserved localised correlations (see Nunns et al, 2014 for a discussion). These models are similar to OLS regressions, except that the error term is decomposed as follows:

$$\varepsilon_i = \lambda W_{ij} \varepsilon_j + \xi_i$$

Where ε_j is a vector of error terms for $j \neq i$, weighted using spatial weights matrix W_{ij} (based on a selected definition of "neighbouring" properties – a common approach is to define neighbours as properties accessible within a short walking distance), λ is the spatial error coefficient, ξ_i is a vector of uncorrelated error terms, and $j=1,2,\ldots,n$, $j \neq i$ are index values for property sales records.

Data on land and property prices

There are two main sources of data on land and property prices:

- district valuation rolls compiled for council rating purposes on a three-yearly cycle; and

[80] Tobler W., (1970) "A computer movie simulating urban growth in the Detroit region". *Economic Geography*, 46(2): 234-240.

- property sales records collected on an ongoing basis by councils or private data providers such as CoreLogic or REINZ as an input into valuations.

Table 6 summarises the characteristics of these data sources, as well as the key advantages and disadvantages of each source.

Table 6 Overview of valuation and sales databases

	District valuation roll	Property sales dataset
Coverage	All residential, business, and rural properties in the district	All residential, business and rural properties that have been bought or sold (in a typical year, less than 5-10% of total properties)
Timeliness	Updated on a three-yearly cycle	Updated continuously with data on new sales
Details of valuation	Professional valuers estimate land values and capital values (land+improvement value) for each property	Property values are determined by the prices actually paid by buyers No split between land and improvement values
Other data on properties	Includes information on property type (eg residential, industrial, or commercial buildings), location and characteristics (eg lot size, building size, building features, etc)	Includes information on property type (eg residential, industrial, or commercial buildings), location and characteristics (eg lot size, building size, building features, etc)
Key advantages	• Most comprehensive source of information on property values • Availability of land valuation data allows for easy comparison between different types of zones – it is not necessary to adjust for building characteristics on sites	• Most timely source of information on property values • Property values reflect the price buyers are willing to pay, rather than valuers' estimates
Key disadvantages	• Three-yearly updates mean that this may not provide timely data on rapidly changing markets • Valuations may depend upon assumptions in valuation models – this is mitigated to an extent by calibrating models against observed sales	• Lack of land valuations makes it more challenging to compare between different property types, eg residential and industrial • Sophisticated econometric models may be needed to conduct a "like-for-like" comparison between different properties.

Although valuations data are comprehensive, covering all properties, the valuations are only undertaken periodically (typically every three years). Using these data, emerging problems can only be identified after new valuation data have been collected. By contrast, property sales data are more timely but also require adjustment to separate out the value of the land from the value of the property as a whole including the building(s).[81]

A further complication is that valuation models may not accurately reflect all influences on land prices. Valuations are modelled estimates of prices rather than those observed. Consequently, it is desirable to cross-check results from a focussed analysis of land valuations against sales data, eg with a more sophisticated, regression-based analysis of property sales. For example, if a comparison of average land values on either side of a

[81] As an example of this analysis, see Nunns P, Hitchins H and Balderston K (2015) The value of land, floorspace and amenities: a hedonic price analysis of property sales in Auckland 2011-2014. Auckland Council technical report, TR2015/012

zoning boundary reveals evidence of a discontinuity, a spatial hedonic analysis of property sales data could be used to confirm it. (See above for a description of hedonic analysis.)

6.2.2 Discontinuities in land prices at the urban boundary

Auckland Council previously established a Metropolitan Urban Limit (MUL) which defines a hard boundary between land that can be used for urban development and land that cannot.[82] The notified version of the Unitary Plan envisaged an MUL that would move outwards over time to enable further development on the fringe of the city, at least within a more expansive Rural-Urban Boundary (RUB).[83]

Other councils in New Zealand have not declared a hard MUL, although many have a de-facto urban boundary as land zoned for residential purposes (or with plot sizes typical of an urban area rather than lifestyle blocks) extends only to a certain distance from the city/town centre. The effect is similar, although councils that have not declared an MUL may be more open to extending urban zoning, eg through private plan changes.

A number of studies have examined discontinuities in land prices around the (former) Auckland MUL. This is a useful indicator that provides information on:

- the expected relativity of price, ie the smoothness of the land price curve relative to the expected gradient; and

- absolute prices, ie the difference between urban land and the opportunity cost of supply, assumed to be the price of land just outside the urban area, adjusted for infrastructure and land development costs.

Grimes and Liang (2009) found that land just inside the MUL is valued (per hectare) at approximately ten times land that is just outside the boundary.[84] Similarly, the Productivity Commission (2012) found a differential of close to nine times in 2010.[85] This boundary discontinuity reflects both the effect of the MUL as well as other regulations that distort the demand for land within the city. More recently, Zheng assessed that the price differential for land either side of the MUL was 5-6 times, and that the impact is uneven, with a much larger impact on land at the lower end of the price distribution.[86]

We extend this analysis to estimate discontinuities in land values around the urban boundary of six New Zealand cities: Auckland, Wellington (including Kapiti Coast),

[82] Housing can still be developed in rural areas, albeit at a much lower density.
[83] The Independent Hearings Panel's report on the Auckland Unitary Plan, which was publicly released on 27 July 2016, recommended a flexible RUB that could be amended through both public and private plan changes.
[84] Grimes, A. and Liang, Y. 2009. Spatial Determinants of Land Prices: Does Auckland's Metropolitan Urban Limit Have an Effect? Appl. Spatial Analysis (2009) 2:23–45.
[85] Productivity Commission. 2012. Housing affordability inquiry: Final report. Wellington: Productivity Commission.
[86] Zheng G (2013) The effect of Auckland's Metropolitan Urban Limit on land prices. New Zealand Productivity Commission.

Tauranga, Hamilton, Nelson, and Palmerston North. In Auckland, we used the Metropolitan Urban Limit set out in the notified version of the Auckland Unitary Plan, while in other cities we estimated an urban boundary based on the extent of current urban zoning.

Following the previous research, we estimate land price discontinuities by applying spatial regression models to land valuation data from CoreLogic/QVNZ, grouped at the level of Census meshblocks. These are estimated as capital values less the value of improvements, which includes the costs of the buildings on the land but does not include the costs of infrastructure and land development. Hence, to estimate the true magnitude of the discontinuity, we also consider how prices can be corrected for the value of infrastructure and of land development, both of which will be capitalised in land prices.

To begin, we provide descriptive statistics on average land values inside and outside these cities' urban boundaries. This allows us to identify the difference in average land values (in dollar terms) across the urban boundary. In addition, we also summarise data on average section sizes immediately inside and outside the urban boundary. This enables us to estimate differences in land development costs – for instance, per-hectare land values in an area with average section sizes of 500m^2 (20 sections/ha) would include land development costs for 20 sections.

Land development costs are typically estimated on a per-section basis. Based on our review of the available evidence of land development costs (see Annex A8), we suggest that a conservative approach would be to use:

- the weighted Auckland land development costs of $120,000 per site as a baseline for estimating costs in locations with high development contributions, such as Auckland and Tauranga; and

- the range observed in other locations ($80,000-$100,000 per site) for estimating costs in locations with low development contributions.

The analysis in Table 7 indicates that, on average, land immediately inside each city's urban boundary is more valuable than land outside it. These discontinuities are large in some cases, in the range of $1-3 million per hectare. However, in all cases, a significant share of the difference, although not necessary all, can be explained by land development costs. Land development costs make up the largest share of the difference in Hamilton (70%) and the smallest in Auckland (37%).

However, the figures in the above table only refer to average effects and do not control for localised factors that may affect prices, such as proximity to amenities such as employment centres or coastlines, or spatial correlations between prices in different locations. Consequently, econometric analysis of land valuation data is a more robust way of assessing the existence and magnitude of price discontinuities at urban boundaries. Our analytical methodology is set out in Appendix A8, and key results from our analysis are summarised in Table 8. The top rows report ordinary least squares

(OLS) estimates, while the lower rows report estimates from spatial error regression models that better address localised spatial correlations in land values.

Table 7 Descriptive statistics on average land values and section sizes inside and outside urban boundaries

City	Auckland	Wellington	Tauranga	Hamilton	Nelson	Palmerston North
Weighted average land values ($m/ha)						
Inside urban boundary (2km distance)	$2.90	$2.92	$3.07	$1.40	$2.40	$1.82
Outside urban boundary (2km distance)	$0.34	$0.17	$0.26	$0.19	$0.20	$0.13
Difference	$2.56	$2.75	$2.81	$1.21	$2.20	$1.69
Weighted average lot size (m^2/section)						
Inside urban boundary (2km distance)	1,165	754	753	1,101	840	862
Outside urban boundary (2km distance)	16,266	13,866	12,750	14,758	14,192	14,253
Estimated land development costs						
Costs per site ($'000)	$120	$100	$120	$100	$100	$100
Total costs ($m/ha)	$0.96	$1.25	$1.50	$0.84	$1.12	$1.09
Share of price discontinuity "explained" by land development costs	37%	46%	53%	70%	51%	65%

This analysis shows that, even after controlling for several other determinants of land values, such as distance to the centre, land immediately outside the urban boundary in all cities is valued at a discount. The differences in average land values observed in the above table appear to reflect a genuine discontinuity rather than varying proximity to urban and natural amenities. However, the magnitude of the discontinuities estimated in these models is smaller than the difference in average land values reported above. Failing to account for other factors affecting land values, either through 'focussed' or 'sophisticated' methods, is therefore likely to bias estimates of urban boundary discontinuities upwards.

A second finding that bears further investigation is the quantitative difference in results between the OLS and spatial error models. While the literature on hedonic analysis of property values generally supports the use of spatial error models, previous research on Auckland's MUL boundary discontinuity did not find such large differences between results these two types of models.[87] It is unclear whether this reflects the impact of modelling choices (eg about how to define 'neighbourhoods' for meshblocks) or subsequent policy changes.

[87] Grimes A and Liang Y (2009) Spatial determinants of land prices: Does Auckland's metropolitan urban limit have an effect? *Applied Spatial Analysis and Policy*, *2*(1), 23-45.

Table 8 Econometric estimates of discontinuities in land values inside and outside of urban boundaries

	Auckland	Wellington	Tauranga	Hamilton	Nelson	Palmerston North
OLS regression outputs (1)						
Dist_boundary_2 (2km inside boundary)	-0.244	-0.098	-0.862	-0.285	0	0.129
Dist_boundary_3 (2km outside boundary)	-2.335	-1.63	-2.721	-1.83	-2.027	-1.756
Estimated ratio of land prices (2)	8.1	4.6	6.4	4.7	7.6	6.6
Spatial error regression outputs (1)						
Dist_boundary_2 (2km inside boundary)	-0.128	0.018	-0.562	-0.101	0	0.179
Dist_boundary_3 (2km outside boundary)	-1.404	-1.087	-1.83	-1.409	-1.641	-1.258
Estimated ratio of land prices (2)	3.6	3.0	3.6	3.7	5.2	4.2
Control variables included in models (3)						
Distance to CBD	Y	Y	Y	Y	Y	Y
Distance to coast	Y	Y	Y		Y	
Distance to sub-regional centres	Y	Y				
Territorial authority		Y	Y	Y	Y	Y

Notes: (1) All coefficients were statistically significant at the 1% level except for the Dist_boundary_2 variable for Palmerston North and Wellington, and the Dist_boundary_2 variable for Hamilton in the spatial error model. This indicates that, in all cases, land immediately outside the urban boundary was valued at a discount relative to land immediately inside.
(2) As land values were log-transformed, this ratio was calculated by taking the exponent of the difference between the coefficients on the Dist_boundary_2 and Dist_boundary_3 variables – eg for Auckland it was calculated as exp(-0.244-(-2.335)).
(3) Demographic controls were not included in this version of the model. Consistent with Grimes and Liang (2009), we find that they did not have a large impact on the results.

Following our discussion of the pros and cons of using land valuation data (Section 6.2.1), we recommend undertaking a further robustness check by modelling the presence of discontinuities in observed sale prices for dwellings bought and sold inside and outside of cities' urban boundaries. While we do not expect the exact magnitude of estimates from this alternative modelling approach to be the same, as we are analysing finished dwellings rather than land prices, we would expect the sign and statistical significance of the estimates to be the same. If they are not, it may indicate that land valuation data provides a biased estimate of the underlying relationship.

Lastly, we note that data on land values and land development costs does not address external costs of land development, such as negative impacts on water quality and loss of amenity from foregone access to peri-urban open space. Nor do they explicitly consider the availability of land outside urban boundaries – in some cases, especially around Wellington, steep hillsides or coastlines may mean that there is little developable land at the fringe. Some degree of local knowledge is required to assess these constraints and costs.

MRCagney *et al* (2016) reviewed some evidence on external costs of land development, focusing on the Auckland context. Their findings, which are summarised in the following table, can be used to estimate the marginal external costs associated with developing land at the urban fringe.

Table 9 Environmental and amenity impacts of developing land at the city fringe in Auckland

Attribute	External cost per 600m^2 section
Reduced freshwater quality	$1,783 to $3,566
Reduced coastal water quality	$1,914 to $3,829
Loss of peri-urban open space	$2,664 to $4,657 (or $44,400 to $77,600 per hectare)

Source: MRCagney, Covec and Beca (2016)

These estimates were developed using data from willingness-to-pay (WTP) surveys that asked people about their preference for better environmental quality, plus some high-level about the impact of new development on environmental quality. They were based on conservative assumptions about the impact of new developments on environmental quality, ie assuming that attempts to mitigate impacts on water quality are only partly successful. On the whole, these estimates suggest that developing fringe land results in external costs of approximately $6,400 to $12,100 per section. This is equal to less than 10% of land development costs.

However, we caution that costs associated with network infrastructure not paid for by development contributions or users may be larger. In the Auckland context, MRCagney *et al* estimated that external costs for network infrastructure for greenfield developments may range from $12,100 to $36,500 per dwelling – a significantly larger share of overall land development costs.

To conclude, this measure is feasible to calculate, with established methodologies for modelling land price discontinuities around urban boundaries and conducting robustness checks to ensure that bias is not introduced through use of rating valuation data. It also appears to provide useful information on how different cities vary in terms of sufficient development capacity. Consequently, it is a good candidate for inclusion in the NPS-UDC or supporting guidance as a price indicator to guide planning.

6.2.3 Discontinuities in land values across zone boundaries within urban areas

Most district plans include spatial zones that permit some activities to occur but exclude others. For instance, industrial zones typically allow manufacturing, warehousing, and trade supply businesses to locate within them as a permitted ("by-right") activity but may require offices or retail facilities to obtain resource consent to establish within them. They also generally exclude residential dwellings.

If there is a shortfall in development capacity for one type of activity, this may be reflected in price discontinuities at boundaries between different zones within an urban area. These differences reflect the relative sufficiency of land zoned for different types of activities (eg residential, commercial, industrial) as well as the efficiency of controls on the intensity of development, eg building height limits, site cover ratios, and minimum lot size / density controls.

These discontinuities can be estimated using the 'focussed' or 'sophisticated' approaches identified by NZIER (2015). However, we note that the choice of approach should be informed by the characteristics of zones.

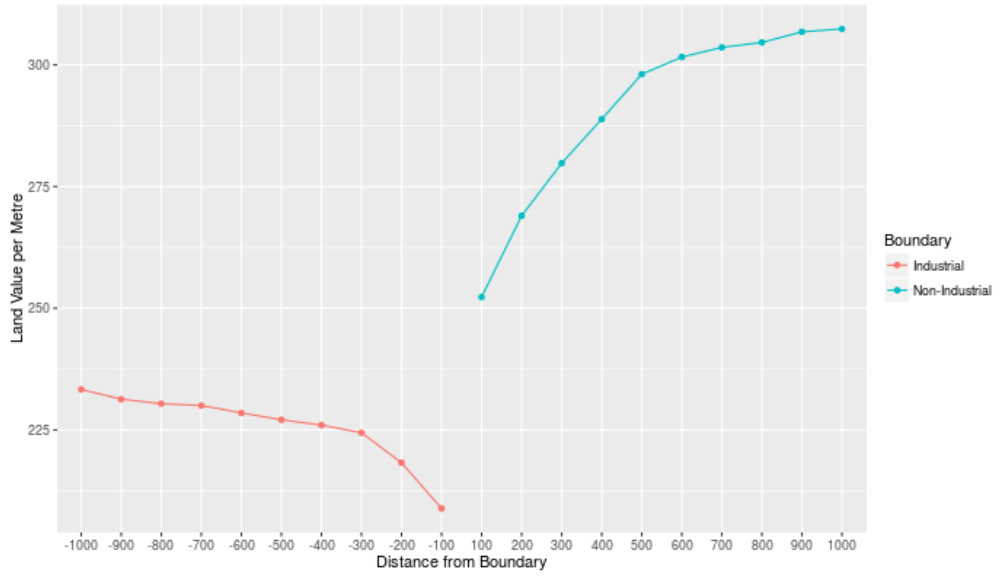
- When comparing between adjacent residential zones, spatial hedonic analysis of residential property sales is likely to be the most appropriate approach. Because residential properties have similar drivers of value (eg proximity to amenities and dwelling characteristics like views and dwelling size), it is possible to develop a model that controls for these effects and robustly estimates discontinuities arising from zoning.

- When comparing between residential and non-residential zones (eg industrial zones) a focussed approach based on comparisons of land valuations across the zoning boundary is more likely to be appropriate. The drivers of property values are different for residential and non-residential properties, making it challenging to incorporate both property types into a spatial hedonic model.

To illustrate the feasibility and utility of this measure, we estimated discontinuities in land valuations around industrial zone boundaries in the Auckland context. We used parcel-level rating valuations data from 2011 (sourced from Auckland Council) to estimate average rateable land values within small 'bands' inside and outside industrial zones.[88] These calculations follow NZIER's 'focussed' approach, also drawing upon additional guidance on assessing boundary discontinuities from Angrist and Pischke (2009).[89]

Figure 27 shows results for the Onehunga – Penrose – Mount Wellington industrial area.

Figure 27: Land values around the boundary of the Onehunga-Penrose-Mt Wellington industrial area



Source: Analysis of 2011 Auckland Council valuation data

The X axis shows distance (in metres) around the industrial zone boundary, with negative numbers reflecting locations inside the industrial zones and positive numbers

[88] MRCagney (2013) The Economic Impact of Minimum Parking Requirements in Auckland. A report for Auckland Council.
[89] Angrist JD and Pischke J-S (2009) Mostly Harmless Econometrics: An Empiricist's Companion

reflecting locations immediately outside the industrial zone. The Y axis shows average land prices within increasing distance bands, eg 0-300 metres inside the industrial zone.

On average, land within a 100m band immediately outside the industrial zone boundary is approximately $40/m^2$ more valuable than land immediately inside the industrial zone boundary. However, this difference rises as we increase the size of the bands inside and outside the industrial zone boundary. This may reflect negative spillovers that industrial zones create for adjacent residential areas, or, alternatively, that the industrial zone is located next to another land use, eg a major road, that generates negative spillovers.[90]

Table 10 shows average land values within small (200 metre) buffers immediately inside and outside the edge of Auckland's ten largest industrial zones by land area. This illustrates how discontinuities in land prices at the edge of industrial zones may differ significantly between locations. At Glenbrook and Takanini, industrial land is valued more highly than adjacent non-industrial land. By contrast, nearby non-industrial land is valued over $200/m^2$ more than industrial land in two locations – East Tamaki and Albany-Rosedale.

Table 10 Land values in 200m buffers inside and outside industrial zone boundaries

Industrial zone location	Mean inside industrial zone ($/m2)	Mean outside industrial zone ($/m2)	Difference ($/m2)	Ratio
Glenbrook Steel Mill	$37.92	$9.29	-$28.63	0.24
Takanini	$359.14	$216.37	-$142.76	0.60
Manukau	$138.15	$218.93	$80.78	1.58
Airport	$167.04	$230.68	$63.64	1.38
East Tamaki	$114.81	$370.69	$255.88	3.23
Onehunga-Penrose-Mt Wellington	$218.28	$269.01	$50.73	1.23
Te Atatu	$183.68	$330.54	$146.86	1.80
Lincoln Road	$159.23	$268.91	$109.68	1.69
Wairau	$202.01	$294.08	$92.07	1.46
Albany-Rosedale	$103.31	$327.91	$224.59	3.17

Source: Analysis of 2011 Auckland Council valuation data

One potential interpretation of this analysis is that, in some locations but not others, industrial land is in lower demand than land for alternative uses. However, accurately interpreting this measure is likely to require additional analysis to control for the impact of localised negative externalities associated with industrial activities (or other land uses that are co-located with industrial areas) on surrounding residential zones, as well as

[90] For some evidence on the impact of industrial zones on residential property values, see Van Duijn, M., Rouwendal J and Boersema R (2014) Transformations of industrial heritage: insights into external effects on house prices. Tindbergen Institute Discussion Paper 2014-122; De Vor, F. and de Groot, H. 2011. The impact of industrial sites on residential property values: a hedonic pricing exercise from the Netherlands. *Regional Studies*, 45(5).

the potential for reverse sensitivities from non-industrial uses locating in industrial zones.

To conclude, this measure is feasible to calculate using established methodologies. It also provides useful information on the relative balance between demands for residential and business land within cities, which may be helpful in assisting councils to draw linkages between residential demand and capacity assessments and business demand and capacity assessments. Consequently, it is a good candidate for inclusion in the NPS-UDC or supporting guidance as a price indicator to guide planning.

6.2.4 Discontinuities in section prices around minimum lot size / density controls

If planning regulations result in a situation in which similar residential lots (which are not necessarily adjacent to each other) have considerably different development potential, they may result in significant differences in the price for those lots. However, this is only likely to occur if development capacity is insufficient to meet demands for housing.

Brueckner et al (2015) investigate the impact of floor area ratio (FAR) restrictions on land prices in Chinese cities.[91] They use data on land transactions in 200 Chinese cities over the period 2002 to 2011 to estimate the relationship between FAR restrictions and land prices. After controlling for observed and unobserved characteristics of land parcels, they find evidence of discontinuities in land values between similar parcels with different FAR restrictions. This relationship is stronger in some locations than others, indicating that development capacity is more constrained in those places. For example, FAR restrictions have a stronger impact on land prices near the centre of Beijing, where there is greater demand for tall buildings.

In New Zealand, there is generally less variation in building height limits across residential zones. Minimum lot sizes and dwelling density controls, which require each new house to have a specified minimum amount of land, are the primary means of regulating the intensity of development.

For example, in the proposed Hamilton District Plan (notified November 2012), the General Residential Zone establishes a minimum lot size of 400m^2 per detached dwelling or duplex.[92] The Residential Intensification Zone, by contrast, establishes a *maximum* lot size of 350m^2 per detached dwelling, minimum lot size of 300m^2 for duplexes, and a minimum land area of 150m^2 per unit for apartment buildings.

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[91] Brueckner JK, Fu S, Gu Y and Zhang J (2015) Measuring the Stringency of Land-Use Regulation and Its Determinants: The Case of China's Building-Height Limits. Working paper. FAR restrictions can be calculated as a combination of maximum building height and maximum site coverage – i.e. a zone that allowed property owners to build a 2-storey building on 40% of the site would have a maximum FAR of 0.8.

[92] Hamilton City Council (2012) Proposed District Plan. Available online at http://www.hamilton.govt.nz/our-council/council-publications/districtplans/proposeddistrictplan/Documents/Proposed%20District%20Plan%20Volume%201.pdf.

The practical consequence of this is that, in the General Residential Zone, it is necessary to have a parcel of at least 800m^2 before subdivision to two lots is enabled by the plan. A property with 805m^2 of land would have potential for subdivision, while an otherwise identical property with 795m^2 of land would not. If properties with subdivision capacity are worth significantly more than properties without, it may indicate that there is unmet demand for subdivision and infill development.

Some district plans establish no minimum lot size / density controls in some residential zones. The Auckland Unitary Plan, as notified in September 2013, included minimum lot size requirements in most residential zones, eg a minimum of 300m^2 of land per dwelling in the Mixed Housing Urban zone. However, in its report on the plan, the Independent Hearings Plan recommended removing density controls entirely from most urban and suburban residential zones.

Price discontinuities related to minimum lot size and density rules can be complex to measure and interpret. We discuss some potential approaches to measuring their impact in Annex A6, and attempt to demonstrate their implementation using property sales data from Auckland during the period immediately after the Unitary Plan was notified (end 2013-end 2014). This analysis did not reveal any clear evidence of price discontinuities related to minimum lot sizes or alternative residential zones. However, there are several alternative explanations for this:

- it was difficult to measure price discontinuities around the Unitary Plan's minimum lot size / density controls due to flexibility or ambiguity about what minimum would apply. The notified version of the Proposed Auckland Unitary Plan allows for higher dwelling densities on sites with wider frontages, which we were unable to identify based on property sales data. This creates a potential source of bias in analysis;

- People buying residential property during the 2013-2014 period did not factor the development controls in the notified Unitary Plan into their price expectations, either because they were not fully aware of the rules or because they expected them to be amended as a result of hearings processes. In this case, we would not expect to find sharp discontinuities; or

- there were no discontinuities in section prices because there is no unmet demand for more intensive development in Auckland. This is an unlikely scenario given the city's rapidly rising home prices.

To conclude, this measure is feasible to calculate using existing techniques, ie the application of spatial hedonic regression models to residential property sales. However, there are practical barriers to implementing it, including difficulty in precisely identifying the subdivision potential of individual sites. The example we have provided suggests that there are also likely to be challenges in interpreting the results of analysis. Consequently, while this indicator is of theoretical interest and may bear monitoring in the future, especially in contexts where minimum lot size rules are more well-established, it is not recommended for inclusion in the NPS-UDC or supporting guidance.

6.3 Comparison of Market Prices with Marginal Costs of Supply

In a competitive market with no barriers to entry, market prices would be expected to equal the marginal social cost of supply. In this case, in a competitive market we would expect the price of new dwellings to be similar to the marginal cost to construct them.

In urban development, we can compare:

- the marginal cost to construct additional high-rise apartments (or offices) with the market price for apartments (or offices); and
- the marginal cost to construct additional houses with their market prices.

This comparison is more straightforward for high-rise apartments / offices, as land makes up a smaller share of overall development costs. To estimate the marginal cost of constructing houses, it is necessary to obtain an estimate of land prices in the absence of constraints on the availability of urban land. Glaeser and Gyourko (2002) demonstrate a method for estimating a "free-market" price of land; however, this is more applicable to comparisons between cities than estimation within cities.[93]

In their analysis of the impact of Manhattan's development controls on apartment prices, Glaeser et al (2005) demonstrate that the impact of regulations limiting building heights can be observed as large, persistent gaps between market prices for high-rise apartments (or offices) and the marginal cost to build additional storeys.[94] Cheshire and Hilber (2008) build on their analysis, including providing a microeconomic analysis of prices with and without height limits (see Box 4).[95]

Because of significant fixed costs in construction (that do not vary with building height), average costs per apartment follow a 'U-shaped' pattern. Up to a certain point, they fall as more storeys are added because fixed costs are spread over a larger number of units. Past that point, they rise again, because rising construction costs outweigh reductions in fixed costs per unit.

In a competitive market, price-taking developers will seek to maximise their profits by minimising development costs. This means building up until marginal construction costs are equal to average costs. Consequently, large, persistent deviations from marginal construction costs indicate that building height limits are constraining development and distorting prices.

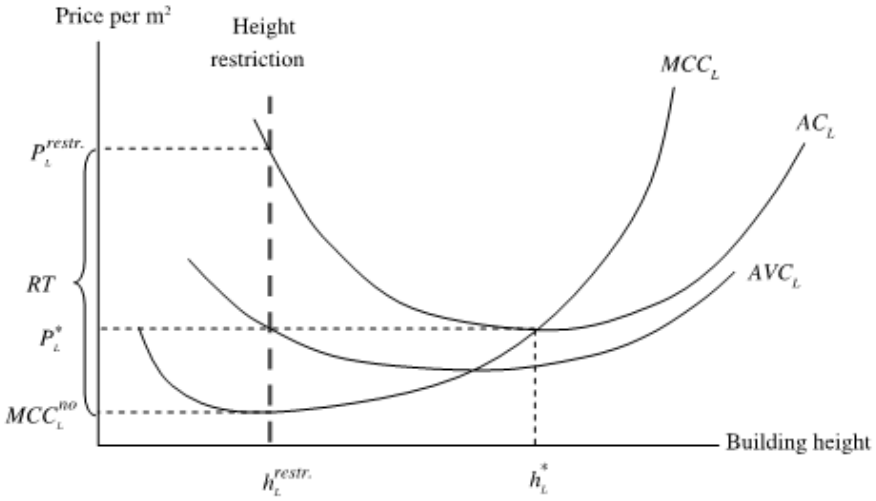
[93] Glaeser EL & Gyourko J (2002) The impact of zoning on housing affordability National Bureau of Economic Research Working Paper No. w8835.
[94] Glaeser EL, Gyourko J and Saks R (2005) Why Is Manhattan So Expensive? Regulation and the Rise in Housing Prices. Journal of Law and Economics, 48(2), pp.331-369.
[95] Cheshire PC and Hilber CA (2008) Office Space Supply Restrictions in Britain: The Political Economy of Market Revenge. The Economic Journal, 118(529), F185-F221.

Box 4 Impacts of building height limits on apartment price

The X axis is building height (in storeys), while the Y axis is price per square metre. The three curves on the chart are:

MCC = marginal construction cost for an additional storey
AC = average cost per storey
AVC = average variable cost (excluding fixed costs) per storey.

Figure: Costs to construct high-rise buildings



In the absence of building height limits, a profit-maximising developer would seek to minimise average costs per storey.[96] In order to do so, they would seek to build up to the point at which MCC=AC, indicated by h* on the X axis. Up to this point, marginal construction costs are lower than average development costs, indicating that it would be possible to reduce average costs by building up. Past this point, marginal construction costs are higher than average costs, indicating that costs will tend to rise.

Consequently, in an unconstrained market, prices for new apartments would tend to be roughly equivalent to marginal costs to construct additional storeys on high-rise buildings.

The impact of building height limits is also shown in this diagram. Limiting building heights to a lower level than is economically optimal for the developer – $h^{restr.}$ – can result in a situation in which average costs are substantially higher than marginal construction costs. In this case, developers would not develop apartments unless they could sell them for a price that covered average costs – i.e. $P^{restr.}$.

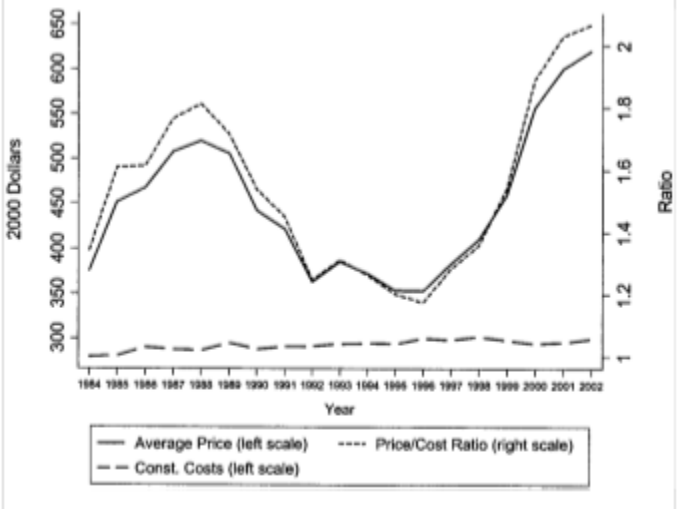
Source: Adapted from Cheshire PC and Hilber CA (2008) Office Space Supply Restrictions in Britain: The Political Economy of Market Revenge. The Economic Journal, 118(529), F185-F221.

Glaser *et al* used this analysis in Manhattan (Figure 28), measuring the gap between market price and marginal cost as a 'regulatory tax' that approached 100% of construction costs in the early 2000s. Cheshire and Hilber undertook a similar analysis in the UK, finding that office space in London's West End cost 809% more than construction costs in 1999-2005. Luen (2014) applied Glaeser et al's approach to investigate the relationship between sale prices and marginal construction costs for

[96] This assumes that the developer is a price-taker – ie that they cannot directly influence the prices people are willing to pay for apartments.

taller (3+ storey) residential buildings in Auckland, tentatively concluding that prices were substantially higher than marginal construction costs for these buildings.[97]

Figure 28: Apartment sale prices and marginal construction costs (US$/sq ft) in



Source: Glaeser EL, Gyourko J and Saks R (2005) Why Is Manhattan So Expensive? Regulation and the Rise in Housing Prices. Journal of Law and Economics, 48(2), pp.331-369.

This indicator is relatively simple to calculate. It can be estimated based on the ratio of the average sale price per square metre for high-rise apartments (or offices) to the marginal cost of construction for tall buildings. However, it is only valid in places where there is sufficient density of high-rise buildings (ie buildings over 5-10 storeys), as land costs and other fixed costs of development make up a relatively small share of the marginal cost to construct another floor of apartments or offices in these locations.

Furthermore, it is also necessary to consider the impact of building quality, building features, and depreciation on this indicator. For example, data on apartment sales will typically include sales of both new apartments and old apartments that are of lower quality. Depreciation can be inferred (roughly) from construction date, but that cannot take account of renovations. In addition, higher-quality apartments or apartments with more features like decks and garages will be more expensive to construct.

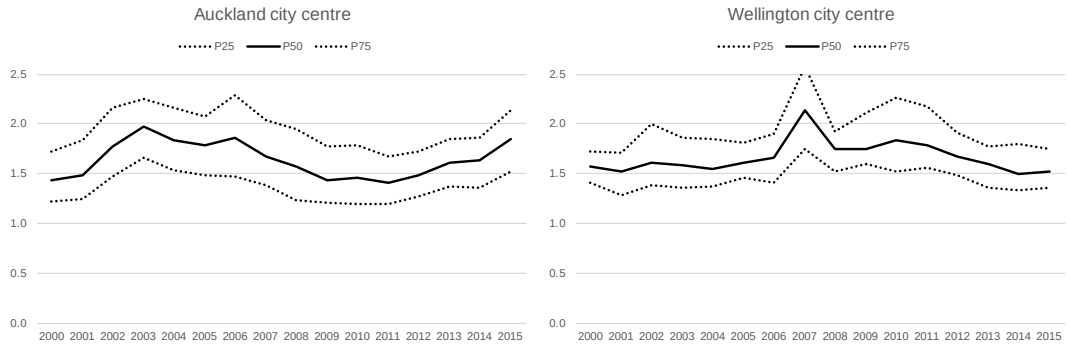
We estimate a measure of sale prices to marginal construction costs for residential apartments sold in the Auckland and Wellington city centres over the 2000-2015 period. We selected these locations as they are the only two places in New Zealand with a sufficient density of high-rise apartments. Our approach to estimating prices and marginal construction costs is set out in Annex A7 – wherever possible, we have adopted a conservative approach.

Figure 29 shows that apartment prices have consistently been above marginal construction costs in both cities throughout the entire time period. However, there is a

[97] Luen M (2014) Up or out? Residential building height regulations in Auckland - understanding the effects and implications. Paper presented at New Zealand Association of Economists Annual Conference 2014, Auckland.

marked difference in the trend. In Wellington, apartment prices have fallen relative to build costs over the last five years, while in Auckland they have risen significantly.

Figure 29 Ratio of apartment sale prices to marginal construction costs



Source: Consultants' analysis of CoreLogic property sales data; Luen (2014); Statistics NZ CGPI

Furthermore, the dotted lines that show the distribution of prices indicate that less than one in four apartments sells for less than marginal construction costs – a surprising finding given that we would expect apartments to depreciate over time.

This analysis provides potential evidence that regulations constraining building heights or the amount of land available for constructing tall buildings may be driving up prices. However, other contextual information is needed to fully evaluate this. This may include evidence on:

- other development costs that we have missed in our analysis, eg if adding additional floors to a high-rise apartment building raises consenting costs or results in 'lumpy' costs for earthquake strengthening or foundations, then marginal construction costs may be higher than our estimate;

- time lags in apartment development, ie if rising prices provoke a supply response, albeit with a slight lag due to the time required to get apartment development underway, then they may be self-correcting; and

- the marginal external costs of added floors on tall buildings, eg as a result of blocked views and sunlight for neighbouring properties, that may create a rationale to limit building heights.

On the last subject, MRCagney *et al* (2016) reviewed Auckland-specific evidence on the impact of access to views and sunlight on residential property prices. Their findings, which are summarised in the following table, can be used to estimate the marginal external costs associated with high-rise apartments.

If we assume, pessimistically, that every apartment in a high-rise building blocks water views and sunlight from of 0.5 similar dwellings on neighbouring sites, then the external costs associated with each apartment would be in the range of 13% to 19% of their value. Consequently, if building height limits were efficient in controlling the external costs of development, we would expect observed prices for high-rise apartments to be no more than 13-19% above marginal construction costs in Auckland.

As Auckland apartment prices are currently 1.81 times as high as marginal construction costs, and have never been lower than 1.45 times marginal construction costs, it is unlikely that external costs of development are sufficient to explain this difference.

Table 11 Impact of access to views and sunlight on Auckland residential property prices

Attribute	Impact on property values
Views of water	+8.3% to +20%
Views of land	+0% to +6%
Access to sunlight (proxied by north-facing apartments)	+17.3%

Source: MRCagney, Covec and Beca (2016)

To conclude, this measure is feasible to estimate using existing methodologies and data. It can be relatively straightforward to interpret, provided that appropriate contextual information is gathered. The main shortcoming of this measure is that it is only feasible to estimate in a small number of locations, principally city centres with a sufficient density of high-rise apartments. At present, this only includes the Auckland and Wellington city centres. However, Cheshire and Hilber's analysis suggests that this approach could be extended to multi-storey offices, which are more common, or multi-storey hotels, which are an important consideration in tourism hotspots, eg Queenstown. As a result, it is a potential candidate for inclusion as a price indicator in the NPS-UDC or supporting guidance.

6.4 Conclusions

Possible indicators or signals of efficient prices and their data requirements are listed in Table 12. These use price comparisons to understand whether prices are close to efficient levels.

Table 12 Possible price signals

Indicator	Proposed in NPS-UDC	Data required
Land price discontinuity at the urban boundary (The ratio of the value of land between rural and urban zoned land)	✓	• GIS data on city boundaries • Land values close to the urban boundary (possibly grouped by meshblock) • Estimated cost of converting bare land for residential use plus cost of infrastructure provision
Minimum lot size discontinuity		• Zoning maps • Land values (or sales data adjusted to produce land values) either side of zones.
Land price discontinuity at zoning boundaries within the city, eg industrial zones (= Ratio of land value to that of best alternative use)		• Zoning maps • Land value inside and outside zone boundaries
Ratio of sale price to marginal construction cost for apartments		• Zoning maps of where high-rise apartments are allowed • Sales data on apartment sales adjusted for explanatory variables (age, size, location, view, balconies etc) • Estimated marginal cost of construction for high-rise apartments

Where land and development markets are efficient, prices would be expected to reflect the opportunity costs of supply. This would mean that differences in land prices between zones would be explainable by differences in supply costs, rather than differences in their value in the alternative uses. These indicators are used to better understand these differences, but in all cases they need additional analysis.

For example, if land price differences between zones are large this begs the question of whether other costs of development explain this difference: are absolute (dollar value rather than percentage) differences across the MUL explained by the costs of land development per land parcel? These are useful indicators of the overall efficiency of the market, when combined with estimates of the costs of land development.

7 Affordability Indicators

7.1 Introduction

Housing affordability can be defined as being able to pay for the cost of housing without incurring financial difficulty.[98] Affordability is not an absolute concept. Rather, it is best seen as a continuum, with 'easily affordable' at one end and 'definitely not affordable' at the other. The relationship between the ongoing cost of housing and available income determines the position on this continuum.

Indicators used by a number of New Zealand authors include the following.

- Residual income measures, eg the proportion of households spending more than a given percentage of household income on housing. [99]

- Housing costs to income ratios, eg
    - the prospective mortgage payments as a proportion of average household income for would-be homeowners;[100]
    - the median rent and median mortgage payments as a proportion of household disposable income, by disposable income quintiles.[101]

- Home price to to income ratios, eg
    - the ratio of average home prices to average household income; [102]
    - ratio of median home prices to gross annual median household income.[103]

- Affordability indices based on combinations of average income, average monthly mortgage interest rates and home prices. [104]

- Number or proportion of intermediate renters (at least one member in paid employment) who are unable to purchase[105] a lower-quartile priced home.[106]

- Household crowding levels.[107]

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[98] Robinson M, Scobie GM, & Hallinan B (2006) Affordability of housing: concepts, measurement and evidence. New Zealand Treasury working paper 06/03. Wellington, New Zealand.
[99] ibid
[100] ibid
[101] Law D & Meehan L (2013) Housing affordability in New Zealand: Evidence from household surveys. New Zealand Treasury Working Paper 13/14. Wellington: The Treasury.
[102] Robinson *et al* (*op cist*)
[103] NZ Productivity Commission (2012) Housing affordability inquiry
[104] Massey University (2016) The Massey University Real Estate Analysis Unit. Retrieved from http://www.massey.ac.nz/massey/learning/colleges/college-business/school-of-economics-and-finance/research/mureau.cfm; and NZ Productivity Commission (*op cit*)
[105] Based on normal lending criteria and a maximum debt servicing ratio of 30% of gross household income; a 25-year mortgage term using market interest rates; and a 10% deposit.
[106] NZ Productivity Commission (op cit)
[107] Ministry of Health (2014) Analysis of Household Crowding based on Census 2013 data.

The most common indicators are housing costs to income ratios and residual income (RI) measures (household income left after housing costs).[108] On their own, these measures only provide information on the distribution of affordability along the continuum, not whether any particular location on the continuum is affordable or not. However, they can be used to provide indicators of whether affordability is changing over time, and in what direction.

Household crowding measures provide some indication of housing affordability, eg using the Canadian National Occupancy Standard,[109] but the data are only available from the census every three years.

To form an 'absolute' measurement of affordability the definition requires a benchmark of 'financial difficulty', eg housing costs exceeding 25-30% of household income are deemed unaffordable.[110] This benchmark is often focused on the bottom four deciles (40%) of household income.[111] Such threshold estimates of affordability have been criticised for their lack of objectivity,[112] but Robinson *et al* (2006) believe that they are still useful.[113]

7.1.1 Summary of the three key indicators

Affordability indicators are generally calculated for three different groups:

- renters;
- would-be home owners; and
- existing homeowners.[114]

Table 13 shows three different indicators which could be used to analyse affordability issues from their perspectives.

The measures can use average values, however for income data especially, median values are often preferred because income distributions tend to be positively skewed, ie the mean is higher than the median, such that 'ratios to mean income' are prone to understating unaffordability. Further insight can be gained when measures are presented by income group (quartile/quintile/decile) given that lower income groups are the most affected by unaffordable housing.

No single measure outlined above gives a complete picture. Using all of these indictors together can provide a fuller picture of the different elements of affordability at the aggregate level.

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[108] Robinson et al (*op cit*)
[109] Ministry of Health (2014) Analysis of Household Crowding based on Census 2013 data.
[110] Housing New Zealand Corporation (2005) "Building the future: The New Zealand housing strategy." Wellington.
[111] Robinson *et al* (*op cit*)
[112] Bramley, G (1994) "An affordability crisis in British housing; dimensions, causes and policy impact." Housing Studies 9(1): 103-125
[113] Robinson *et al* (op cit)
[114] DTZ New Zealand (2004) "Housing costs and affordability in New Zealand." Wellington, Centre for Housing Research Aotearoa New Zealand - Kainga Tipu.

Table 13 Affordability indicators by housing group

	Housing costs to income ratio	Residual income (RI) measure	Home price to income ratio
Renters	Rental payments divided by household income	Household income less rental payments	Not applicable
Home owners	Mortgage payments divided by household income	Household income less mortgage payments	Home price divided by household income
Would-be home owners	Prospective mortgage payments (given an assumed deposit and current interest rate) divided by household income	Household income less prospective mortgage payments (given a specified deposit and current interest rate)	Home price divided by household income
Strengths	Easy to calculate and understand Although this ratio does not directly describe a household's ability to cover expenses after housing payments, we can gain a better idea of this by focusing on low income households	Easy to calculate and understand Accurately describes a household's ability to cover housing and then other costs Can "equivalise"[115] the RI measure so it represents the same thing for any household composition	Easy to calculate and understand
Weaknesses	Does not accurately describe a household's ability to cover housing and other costs Does not control for the number of dependants in a household Does not account for differences in the quality of the housing No indication of how long a particular home will remain at a given housing cost to income ratio	Does not account for differences in the quality of the housing No indication of how long a particular home will remain at a given residual income	Does not directly consider the prevailing interest rate (although this is somewhat reflected in home prices) Does not consider deposit put towards a house, bank lending rules, and rates

Source: Summarised from Robinson M, Scobie GM, & Hallinan B (2006) Affordability of housing: concepts, measurement and evidence. New Zealand Treasury working paper 06/03. Wellington, New Zealand

7.1.2 Household or individual income

Whether individual or household income is used can make a significant difference to affordability outcomes. On the one hand, household income is the appropriate measure for affordability calculations as it is the whole household that pays the housing costs, and a household may easily be able to afford a home that they could not afford alone. On the other hand, household income hides changes in household composition in response to income shortfalls, eg low income may encourage people to live with others to share housing costs. Robinson *et al* (2006) use household income where possible for their investigation of housing affordability in New Zealand, and specifically net household income, which includes the Accommodation Supplement.

[115] Statistics NZ "equivalises" income by dividing annual household income by the Revised Jensen Scale (RJS). The RJS gives a two-adult household a rating of 1, and households with fewer or greater members a score above and below 1, respectively. The scale also accounts for children being likely to require less income than adults to maintain an acceptable standard of living.

7.1.3 Other considerations

A number of issues need to be taken into account.

- 'Ability to pay' measures can conflate low incomes with high home prices. Low income households will always find housing less affordable than other households.

- A household may be able to 'afford' a given home because of its lower quality or relative inaccessibility. However, living there may result in some other costs, such as poor health due to damp or mouldy housing or higher transport costs to access employment.

- Different housing cost to income ratios or residual income levels may reflect different preferences rather than differing levels of affordability. For example, people may move to a relatively high-cost location to take advantage of better amenities there.

- Relatively unaffordable housing may be out of choice given a person's perceived life cycle position. For example, young and other first-time buyers may not be earning very much currently but would expect to increase future income so that housing will be (more) affordable in the future.

7.2 Government Indicator Projects

7.2.1 MBIE's Housing Affordability Measure (HAM)

MBIE is developing new high quality measures of housing affordability which should help councils to better understand housing affordability within their respective areas. Recognising that housing can be an 'asset' (ie an investment) and a 'service' (eg for shelter), the Housing Affordability Measure (HAM) project contains a collection of measures, including:

- HAM-S (Housing Service Affordability Measure), which is a measure how affordable it is for New Zealand households to live in their current home. The HAM-S is measured separately for renters (HAM-SR) and for owner-occupiers (HAM-SO); and

- HAM-FB (First Home Buyer Housing Asset Affordability Measure), which measures the proportion of New Zealand households who are currently renting yet able to afford the housing service costs associated with buying a modest home in their current territorial authority.

MBIE uses administrative data sets to create the HAM. These include:

- income data from the Integrated Data Infrastructure (IDI) which originate from the tax system;

- rent data from the Tenancy Bond Database; and

- data on property sales prices and values from CoreLogic.

Other data are also used in the HAM, such as:

- interest rate data from the Reserve Bank of New Zealand; and
- data from the Household Economic Survey (used as a calibration sample).

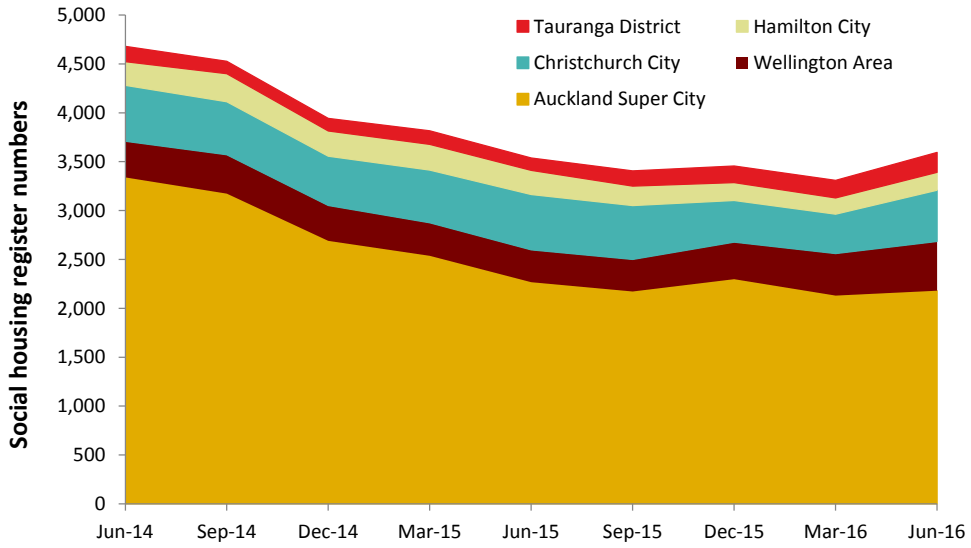
The HAM is created by using street addresses to match household level data. This enables better comparisons of income with rent payments and assumed housing costs.

The HAM is currently being peer reviewed, with the intention of releasing it as an experimental series in 2017 and making it a "Tier one" statistic in 2018.[116] It would appear to be a good source for councils to meet the NPS-UDC requirement to monitor housing affordability.

7.2.2 MSD Social Housing Register

The Social Housing Register is managed by Ministry of Social Development (MSD) and is divided into the Housing Register and the Transfer Register. The former includes eligible applicants ready to be matched to a suitable property, while the latter is made up of people already in social housing but who have requested and are eligible for a transfer to another property. Register numbers are reported quarterly (since 2014) and include data by territorial authority (or local board for Auckland) and household demographics. Figure 30 shows the quarterly changes in 'new demand for social housing' (ie the number of social housing register applications) in selected major urban areas.

Figure 30 Number of new Social Housing Register applications by major urban area



Source: MSD

[116] Tier 1 statistics are key official statistics identified as performance measures of New Zealand. They need to be produced, analysed, and released to high statistical standards.

The number of new applications for Social Housing in Auckland has reduced by 34% over the last two years. Numbers in Hamilton and Christchurch have also fallen, however the Tauranga and Wellington areas have increased 30% and 170% respectively over the same time period. Some commentators have suggested that these trends may present a false picture however, eg with applicants increasingly being persuaded not to apply formally when supply is very limited.[117]

MSD's data are specific to social housing. This provides some data of interest to councils but would be secondary to the other indicators discussed here, particularly given the questions over data quality.

7.3 Possible Indicators

A number of possible affordability indicators are shown in Table 14 which build off those discussed by Robinson *et al* (Table 13). The residual income after housing costs indicator is possible using Household Economic Survey (HES) data, but this is only undertaken every three years with data available at the Regional Council level. This is inadequate for the purposes here. The crowding index and numbers in temporary accommodation are similarly restricted by data availability. Of the indicators listed in Table 14, 'home price to income' and 'housing costs to income' are the most feasible to develop.

Table 14 Possible affordability indicators

Indicator	Proposed in NPS-UDC	Data required
Home price to income ratio (average, median, quartile etc)	✓	Sales data (all properties) Annual income
Housing cost to income ratio		Rent payments (TA median/average) or mortgage payments (or home costs and mortgage rates) Annual income
Residual income after housing costs		Rent payments (TA median/average) or mortgage payments (or home costs and mortgage rates) Annual/weekly income
Crowding index		Possible only using census data every three years Population growth:consents ratio might provide a proxy indicator of expected change in crowding
Temporary accommodation		Data not collected currently but may be in the future

7.3.1 Home price to income

This indicator is most relevant to would-be homeowners and first home buyers. However, there are limitations to the availability of income data; the only regularly-updated source of income data at the territorial authority level is the Linked Employer-Employee Data (LEED) published via NZ-Stat. It uses administrative data drawn from the taxation system, together with business data from Statistics NZ's Business Frame. Two measures feasible using these data are:

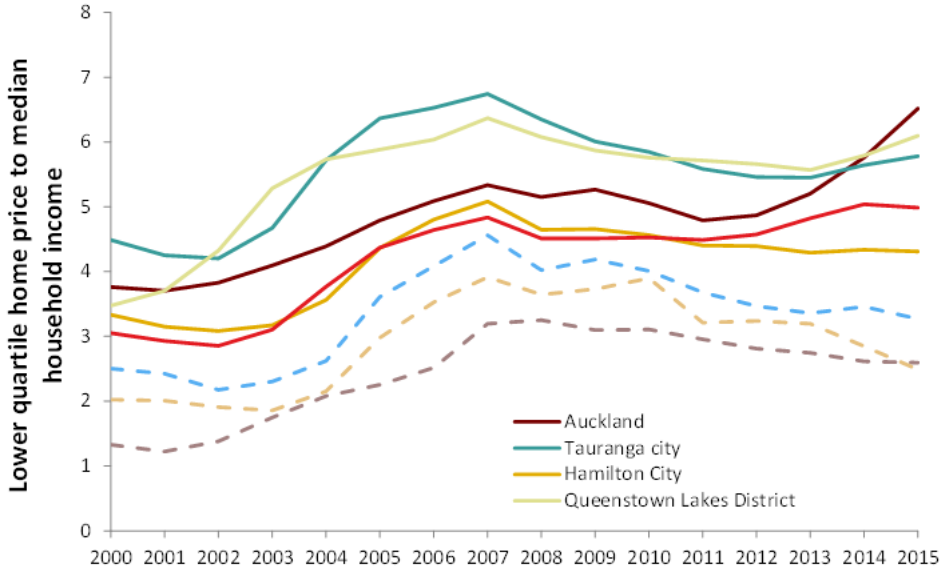
[117] Personal communication, Alan Johnson, Social Policy & Parliamentary Unit, Salvation Army. See also Johnson A (2016) Drawing the Line. How many state houses do we need? Paper Presented to Australasian Housing Institute Seminar - Auckland 21st July 2016.

- median home price to median income ratio; and
- the lower quartile home price to median income ratio.

The preferred method is to use lower quartile home price matched with median income values as this would best reflect home price affordability for whom it is most relevant: would-be homeowners and/or first homebuyers with limited access to capital.

Figure 31 shows lower quartile home price to median household income in selected high growth areas (solid lines) and non-high growth areas (dotted lines). Lower quartile priced homes are less affordable in high growth areas with affordability worsening (ie price to income ratio has increased) in recent years. However, housing affordability has been steadily improving (ie declining ratio) since 2008 for those non-high growth areas represented in Figure 31.

Figure 31 Lower quartile home price to median household income 2000-2015



Source: QVNZ and LEED (Statistics NZ)

This indicator does not take into account the current mortgage interest rates, which are regarded as important determinants of housing affordability in the short run. Interest rates, and other factors influencing housing affordability, are considered in the following measures.

7.3.2 Housing costs to income

Housing costs to income can be calculated from the perspective of homeowners and renters.

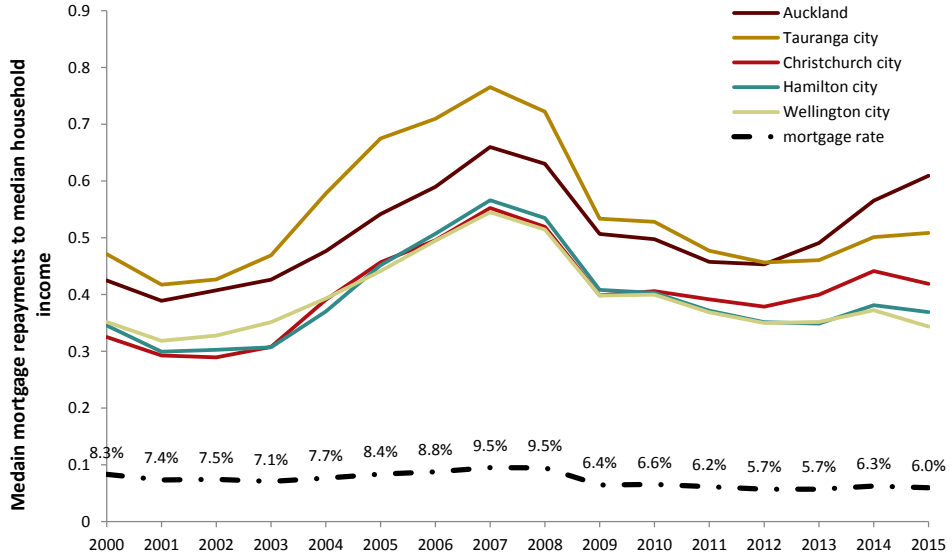
For homeowners, the costs of housing are directly determined by the purchase price, the prevailing interest rates, and their chosen loan repayment period. However, it is also determined by the deposit. Existing homeowners are likely to have higher levels of equity but they may also have a more valuable/expensive home.

The suggested indicator simplifies the analysis by ignoring the potential equity level, equivalent to assuming any equity has an opportunity cost. The suggested assumptions are:

- a 100% mortgage (zero deposit);
- a 30 year loan repayment period; and
- the average of the 2 year fixed and floating mortgage rate (data are available from the Reserve Bank).

Figure 32 illustrates changes in mortgage repayments to income over time for a select number of areas. Although current home prices are at an all-time high in most of these areas, low mortgage rates have improved home price affordability relative to previous years.

Figure 32 Annual mortgage repayments annual household income 2000-2015

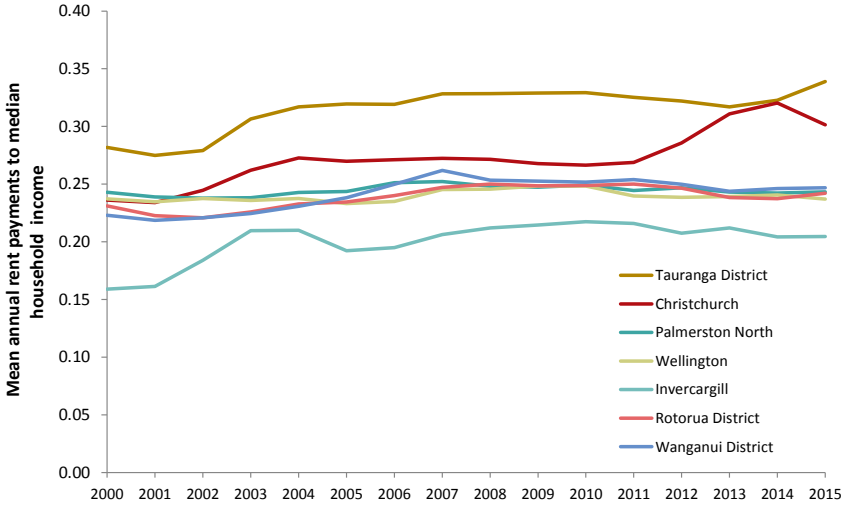


Source: QVNZ, Reserve Bank of New Zealand and Statistics NZ

Housing costs to income ratios are more straight-forward when calculated from a renter's perspective. For this indicator we use mean annual rent payments divided by median annual household income. Although median rent values may be preferred to mean rent values, particularly when there are large outliers of rent prices within a given area, median rent data are not currently available.

Figure 33 shows that mean rental payments to annual household income ratios have been relatively constant for a number of New Zealand territorial authorities over the 2000 to 2015 period. The recent increase in the ratio for Christchurch can be explained by price increases reflecting reduced supply of rentals after the Canterbury earthquakes. In contrast, incomes have not changed from the pre-earthquake trend.

Figure 33 Mean annual rent payments to annual household income 2000-2015



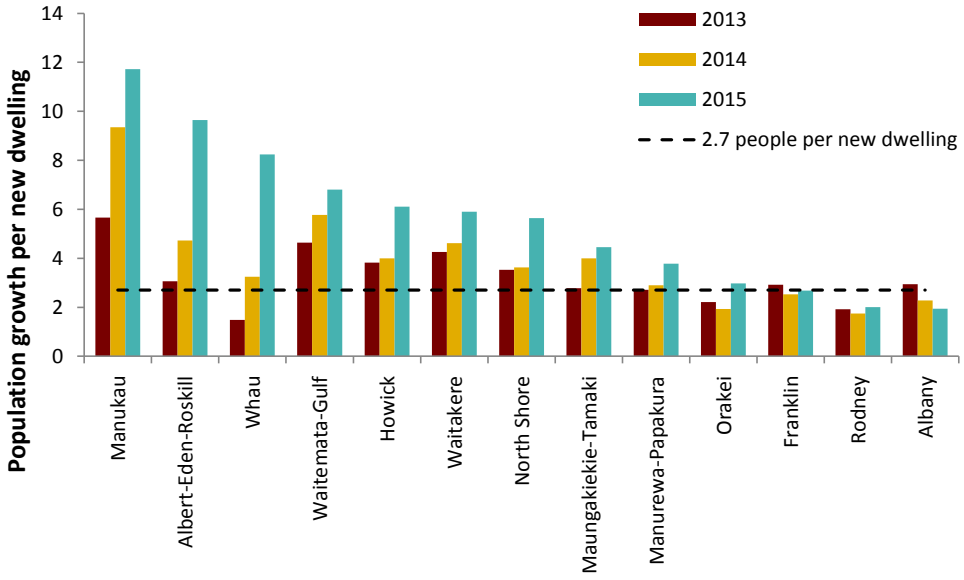
Source: MBIE and Statistics NZ

7.3.3 Crowding Index

One response to increased costs of housing is for people to crowd into homes to limit the costs per person. Overcrowding is a sign of under-supply of housing or of high costs. However, comprehensive and reliable data, eg number of people in homes in proportion to home size or number of bedrooms, are currently only available via the census which is produced every three years. This is a useful measure, but it is too infrequent to be a useful indicator for the purposes of the NPS-UDC.

One alternative approach is to measure the change in the ratio of the number of consented dwellings to the estimated population increase at a disaggregated level (see Section 4.3 for a more aggregated version). The numbers are shown in Figure 34 relative to the average New Zealand household size of 2.7.

Figure 34 Ratio of Population increase to consented new dwellings



Source: Data retrieved from Infoshare and NZ.Stat, Statistics NZ

While not providing evidence of over-crowding, the numbers suggest that there is more likely to be over-crowding in locations with a high ratio of population growth to new consented dwelling. The numbers have some uncertainties: the population data are estimates rather than actual measurements and the consented dwellings are not actual builds. However, this could provide some suggestion of where problems might be emerging, to be confirmed periodically using census data (or direct surveys).

7.3.4 Temporary Accommodation

As with the crowding index, the number of people in temporary accommodation, such as motels, is an additional measure of housing shortages, particularly for low income households. These data are not available currently but are planned for inclusion in the next census.

7.4 Suggested Indicators

The two indicators developed here are:

- The ratio of home price to income; and
- The ratio of housing costs to income for home buyers/potential home buyers and renters.

These can be developed using data published by Statistics NZ but MBIE has access to better and more detailed data that it is compiling for the HAM. We suggest that the HAM is used as the basis for housing affordability indicators.

8 Implementation Requirements and Capabilities

8.1 Data Requirements

Table 15 summarises the data required to calculate each price indicator considered in this report, and describes sources and access arrangements. Data on prices for land, housing, and business floorspace underpin all of the recommended price signals. These data include:

- property valuations;
- property sales records; and
- rental property data.

The availability and ownership of the data varies. In particular, individual councils will usually have access to property valuations from their district valuation roll. They may also have access to property sales records, which are an input into property valuations but which are often collected on councils' behalf by CoreLogic/QVNZ. In addition, two private providers, CoreLogic/QVNZ and REINZ, maintain databases of property sales and, in CoreLogic's case, property valuations.

Most of New Zealand's urban areas include multiple district councils, or at any rate they abut other council areas. As a consequence, for purposes of analysis it may not be sufficient to have data from a single council area. Local or central government may seek to overcome this by:

- collaborating and sharing data between all councils in an urban area; or
- purchasing consistent city-wide data from private providers.

To calculate housing affordability measures, data on incomes are required in addition to data on property values. These data are publicly available from Statistics New Zealand. The HAM project is likely to provide a comprehensive source of these data and indicators. To calculate and interpret indicators of efficient pricing, data on construction costs and land development costs are required. These data are available from private providers, such as construction cost estimators, quantity surveying firms, or subdivision companies.

Table 15 Data requirements by indicator

Problem component	Indicator	What data are needed?	Where can it be retrieved?	Availability
General market information	1. Home price trends: Inflation-adjusted median home prices	• Annual median home price by TA • CPI values for Q2 each year	Home prices: QVNZ or REINZ, or TLAs if they collect data themselves CPI: Statistics NZ (or RBNZ)	Home price data: purchased from private providers CPI: public, free
	2. Changes in land values by suburb	• Land values ($/m^2) by location	QVNZ, or TLAs if they collect data themselves	Valuation data: purchased from private providers
	3. Trends in rents: Inflation-adjusted mean rent values	• Mean weekly rent prices by TA • CPI	Rents: MBIE CPI: Statistics NZ (or RBNZ)	Rents: MBIE[118] CPI: public, free
Demand, supply and supply-demand balance	4. Population growth to building consents	• Building consents for new dwellings by territorial authority • Annual population estimates by territorial authority (TA)	Statistics NZ Infoshare.	Public, free
	5. Consented floor space to population growth	• Floor space of new building consents by TA • Population estimates by TA	Statistics NZ Infoshare.	Public, free
	6. Land leverage ratio	• Land and overall property values	Valuation data: QVNZ, or TLAs if they collect data themselves	Valuation data: purchased from private providers
	7. Home price to rent ratio	• Annual average home prices and average rent prices by territorial authority.	Sales data: QVNZ or REINZ, or TLAs if they collect data themselves Rents: MBIE (bond data)	Sales data: purchased from private providers Rent data: MBIE
	8. Residential vacancy rates	• Housing vacancy rates	Census only	Census
	9. Vacancy rates	• Business land vacancy rates	Business: real estate agency databases.	Business: some data are published free

[118] www.mbie.govt.nz/info-services/housing-property/sector-information-and-statistics/rental-bond-data

Problem component	Indicator	What data are needed?	Where can it be retrieved?	Availability
				by real estate agencies; more detailed data are available to purchase
Competitiveness	10. Market concentration: Herfindahl–Hirschman Index (HHI)	• Definition of area of development capacity • The total number of owners of "development capacity". • Each owner's market share.	Data on ownership and land area are available from Land Information New Zealand's data service. However, identifying ultimate owners may require Companies Office search.	Base ownership data can be licensed from LINZ[119] Companies Office data: public, free (likely to require significant analysis)
Price indicators (Price discontinuities)	11. Discontinuities in land values between zones or at the urban fringe	• Land valuation data • Zoning maps • GIS analysis of property parcel location • Land development costs	Land valuation data: QVNZ, or TLAs if they collect data themselves Zoning maps: councils Land development costs: Surveying companies or subdivision companies	Valuation data: purchased from private providers Land development cost data: purchased from private providers Statistical software is required to analyse the location of zone boundaries and properties
	12. Ratio of rateable value to market value of land at its best alternative use	• Rateable land values • Alternative use values	Land valuation data: QVNZ, or TLAs if they collect data themselves Alternative use values require a "counterfactual analysis"	Valuation data: purchased from private providers Counterfactual analysis might use discontinuity data or require additional analysis and data
(Price comparisons)	13. High-rise apartment sale prices against marginal construction costs	• Apartment sales data. • Construction cost data	Sales data: QVNZ or REINZ, or TLAs if they collect data themselves Construction costs: Rawlinsons Construction Cost Handbook (or equivalent)	Sales data: purchased from private providers Construction costs: private providers
	14. Construction costs for residential or commercial buildings	• Construction cost data	Construction costs: Rawlinsons Construction Cost Handbook (or equivalent)	Construction costs: private providers
	15. Land development costs for new	• Development costs data	Private suppliers	Data available from private suppliers at cost

[119] https://data.linz.govt.nz/layer/804-nz-property-titles/

Problem component	Indicator	What data are needed?	Where can it be retrieved?	Availability
	subdivisions			
	16. Public infrastructure costs for new dwellings	• Infrastructure cost data	Infrastructure providers, including transport agencies, councils, and infrastructure CCOs	Some data available from public (council) source. May require engineering estimates
Affordability			**All data may be available from MBIE's HAM analysis**	
	17. Home price to income: lower quartile home price to median household income	• Lower quartile home price by TA • Median individual & household income by TA	Sales data: QVNZ or REINZ, or TLAs if they collect data themselves Individual income data: Linked Employer-Employee Data (LEED) - NZ.stat[120] Median household income: Census data	Sales data: purchased from private providers LEED: public, free Census: public, free
	18. Mortgage repayments to income	• Median home price by TA • Average of 2 year fixed and floating mortgage rates • Median individual & household income by TA	Sales data: QVNZ or REINZ, or TLAs if they collect data themselves Mortgage rates: RBNZ Individual income data: Linked Employer-Employee Data (LEED) - NZ.stat Median household income: Census data	Sales data: purchased from private providers Mortgage data: public, free LEED: public, free Census: public, free
	19. Rent payments to income	• Mean weekly rents by TA • Median individual & household income by TA	Rents: MBIE (bond data) Individual income data: Linked Employer-Employee Data (LEED) - NZ.stat Median household income: Census data.	Rent data: MBIE LEED: public, free Census: public, free
	20. Crowding index	• Proportion of households within a territorial authority living in crowded conditions • Potentially measured as ratio of population growth by suburb to building consents	Census (every three years) Statistics NZ	Census: public, free
	21. Households in temporary accommodation	• Proportion of people in TA in temporary housing	Not available but next census intends to record this measure.	

[120] Provides data for people in paid employment but not for whole population.

8.2 Capability Requirements

8.2.1 GIS and Econometric Analysis

To measure price indicators, and indicators of efficient pricing in particular, technical capabilities are required in both geographical information systems (GIS) and statistics (econometrics). Annex A5 describes in detail the calculations and processes underpinning our analysis of price discontinuities at rural-urban boundaries.

Practical and theoretical understanding of economics and statistics is necessary to undertake this analysis. There are considerable 'fixed costs' in developing appropriate GIS and econometric methods, consisting of the time required to gather data and develop appropriate procedures for cleaning and processing it. However, once methods and models have been developed, other cities can be analysed at a relatively low additional cost.

GIS analysis is required to identify:

- the location of properties that are being sold or valued;
- the location of zoning and amenities such as city centres, coastlines, etc; and
- properties' zoning and the distance to zone boundaries and amenities.

This requires well-defined variables such as:

- the rural-urban boundaries defined by current zoning boundaries; and
- less complex, but more computationally-intensive calculations such as distances to amenities and zoning boundaries.

After creating key spatial variables, econometric analysis is required to implement 'sophisticated' methodologies for assessing boundary discontinuities. Spatial econometrics methods are reasonably well-understood in the literature but require a degree of experience to apply correctly. In our analysis, we estimated spatial neighbourhood matrices which were input to spatial linear regression modelling using the R package *spdep*.

A free and open-source combination of software tools were used including PostgreSQL/PostGIS for spatial analysis, QGIS for map-making and visualisation, and R for spatial and econometric analysis. The combination of these toolkits made it easy to automate and generate results for each urban area in this study. These tools are widely available and free to use; however, they do require a relatively high level of technical capability by the analyst.

8.2.2 The importance of visualising data

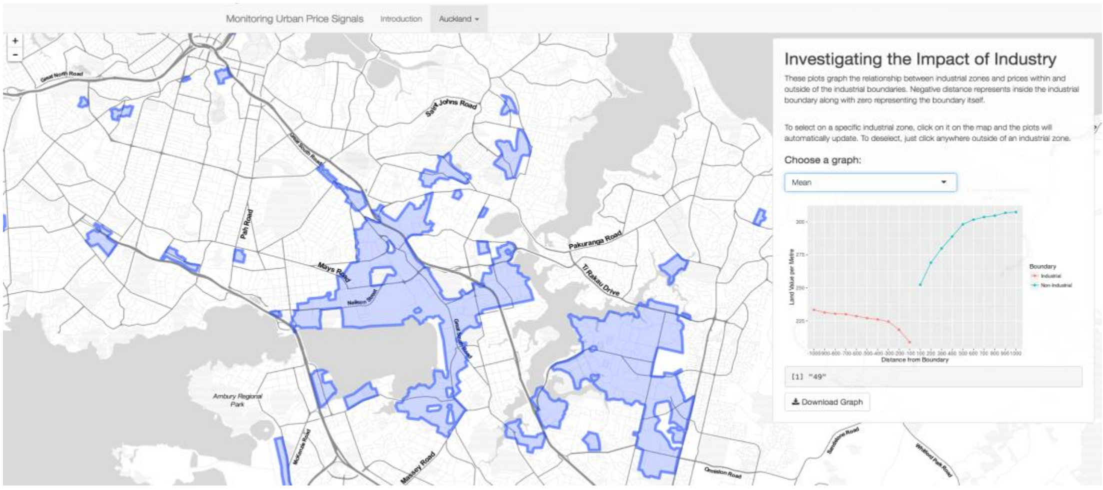
A key insight from this study was that it is frequently necessary to understand the localised determinants of land values and residential sale prices. For example, the behaviour of property prices can vary significantly at different industrial zone boundaries and at different parts of urban boundaries within urban areas. This reflects the numerous local, context-specific drivers of urban prices. Aggregated summaries of

these data, whether descriptive statistics presented in tables and graphs or outputs from sophisticated econometric model of entire regions, can omit some relevant detail.

Visualisation and mapping of these data can be important for understanding local relationships and enabling people with greater 'on the ground' knowledge to provide targeted information on other determinants of prices.

To analyse the effects of industrial zone boundaries on land prices, we developed a web-based visual toolkit in the 'Shiny' package for R. It provides an easy-to-deploy web application framework. Figure 35 presents a screenshot from this web application. In this picture, the user has selected the large industrial zone in Onehunga-Penrose-Mt Wellington, Auckland and, the web application has plotted land values inside and outside of the boundary. This application not only makes local analysis possible, it enables anyone to use the data, regardless of technical ability.

Figure 35 A visualisation of land values in and around industrial zones in Auckland



8.3 Current capability

We gathered information on capacity in central and local government to implement these requirements through a workshop with local government, an online survey, and discussions with members of MBIE's data analysis team.

8.3.1 Local government capability

We circulated an online survey to 27 councils in high- and medium-growth urban areas to investigate councils' capability and perceptions of barriers to estimating measures of price signals, followed by a workshop with local government representatives on 4 July 2016.

Based on responses received from 13 participants in the online survey and from the workshop, we identified the following key insights:

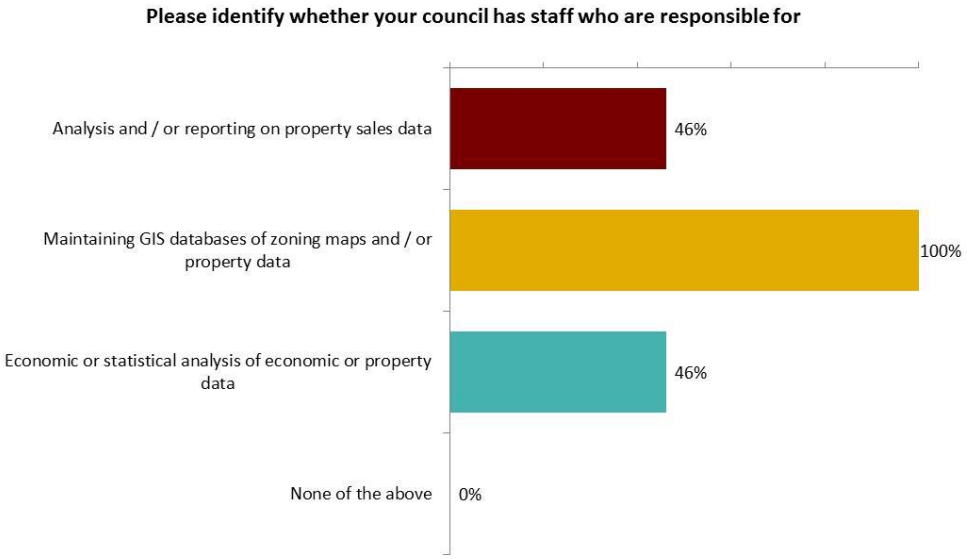
1. As shown in Figure 36, all councils responding to the survey had staff members responsible for maintaining GIS databases of zoning maps and / or property data. This indicates at least some capability for spatial analysis. However, less

than half of respondents had staff responsible for analysis of property data or other economic data. This suggests that councils may have less existing capability to implement the more detailed analysis required for several price indicators.

2. A number of councils considered access to data, including data that are consistent between council areas, as a barrier to implementing price measures. They saw a role for central government in providing or publishing basic data on property prices to enable them to undertake their own analysis or interpretation.

3. Several smaller councils stated that it would be challenging for them to monitor indicators without partnering or collaborating with other councils, as they did not necessarily have staff with the capability or capacity to monitor price signals.

Figure 36 Councils' self-reported assessment of existing capability



Despite some limitations in the availability of experienced analysts (economics and statistics), many councils will have local knowledge which may provide good insights into the level of emerging problems. However, the data analysis skills will be useful in communicating this and in confirming whether local understanding is consistent with the analysed data.

8.3.2 Central government capability

MBIE has existing resources devoted to data analysis and reporting, including capabilities in econometric analysis. MBIE has been investing in developing the following analytical capabilities in its staff:

- data analysis in R, an open-source software package;
- SQL for storing and accessing large datasets;
- development of web graphics and visualisation tools; and
- fundamentals of statistical and econometric analysis, including regression analysis and time series analysis.

MBIE is also developing a housing affordability measure (HAM) programme which is collecting and processing data to better understand trends. It has access to a number of data sets that are not available to councils. This would provide a very useful source of data and indicators under the NPS-UDC.

MBIE and/or other government agencies could also work with other data suppliers, such as Statistics New Zealand and CoreLogic, to ensure that the data necessary for monitoring indicators can be made available to local authorities.

9 Conclusions and Indicator Options

9.1 Long List of Indicators

In this paper we have examined possible indictors or price signals that could be used under the NPS-UDC. These have been divided into indicators of:

- Supply-demand balance;
- Market competitiveness;
- Efficient price; and
- Affordability.

Table 16 is a long list of possible indicators; it summarises the results of the analysis above. In the table we analyse these indicators against four criteria.

- **Usefulness:** Does the proposed indicator help decision makers to understand the problem, including the issues of supply-demand balance, competitiveness, price and affordability?

- **Understandability:** Is the proposed indicator *interpretable* by users, including urban planners, infrastructure providers, and policy analysts?

- **Data availability:** Are the necessary data available to local and/or central government to calculate the indicator on a regular basis?

- **Feasibility:** Is it *feasible to estimate* based on the capabilities and econometric techniques available to local and/or central government?

The preferred indicators are highlighted in the table. We provide brief explanations of them in Annexes. Below we note a number of issues relating to the individual indicator categories.

9.2 General Market Indicators

There is regular reporting in the media on changes in property prices, but these can suggest different conclusions depending on the way in which the data are disaggregated or the time period over which changes are measured. Councils can usefully analyse and present data on a consistent basis over time. These general market indicators include:

- trends in home prices, including median home prices and prices per square metre of property to take account of changing preferences for property size and type;

- land values, including indicators at a disaggregated (suburb) level. These indicators can be used to better understand relative price trends and emerging problems, and differences in levels of supply and demand by suburb within cities; and

Table 16 Long list of potential indicators

Problem component	Indicator	Interpretation and use	Useful	Under-standable	Data available	Feasible
General market information	1. Home price trends: Inflation-adjusted median home prices	This indicator provides a simple indicator of the rate of increase in median home prices (in real terms, ie adjusted for inflation). Very rapid increases would lead to more questions and analysis of the causes.	Yes – with additional analysis	Yes	Yes – home price data from QV; CPI from StatsNZ	Yes
	2. Changes in land values by suburb	Can be used to provide insights into emerging problems, eg rapidly rising prices, and if analysed at a disaggregated level, can provide insights into the location of residential demand.	Yes	Yes	Yes	Yes
	3. Trends in rents: Inflation-adjusted mean rent values	This indicator provides a simple indicator of the rate of increase in median (real) rents. Very rapid increases would lead to more questions and analysis of the causes.	Yes – with additional analysis	Yes	Yes via MBIE (tenancy bonds data)	Yes
Supply-demand balance	4. Population growth to building consents	Indicator of sufficiency of development relative to population increase: a lower number suggests that there are more dwellings per person. Interpretation requires some understanding of the types of dwellings being built, eg sufficiency will depend on whether new dwellings are apartments or family homes. Data on trends in the size of new consents should be used to supplement this indicator. It is presented as population growth to homes built as this is more easily understandable, eg compared to the average household size.	Partly – it does not measure total supply-demand balance	Yes	Yes (although consents data are not actual builds and population data are estimates only)	Yes
	5. Consented floor space to population growth	As for indicator 4	ditto	ditto	ditto	ditto
	6. Land leverage ratio	A ratio representing the land value proportion of a property's overall value (similar to the land value to improvement ratio). Useful in explaining causes of home price movements and the relativities of supply-demand balance in land and property markets.	Yes	Maybe	Yes	Yes
	7. Home price to rent ratio	Indicator of substitutability of renting for buying a home. Also used to predict future trends in housing market, ie if rising prices move these ratios above their long-run averages, then either incomes or rents are likely to rise, or home prices to fall.	Maybe	Maybe	Yes	Yes

Problem component	Indicator	Interpretation and use	Useful	Under-standable	Data available	Feasible
	8. Vacancy rates - residential	Vacancy rates for residential properties might be used, in theory, as an estimate of levels of excess supply. However, it can be difficult to measure vacancy, eg because of second homes or other reasons for part-time occupancy. Even then, accurate data are only available from the census.	No	No	Only from census	Yes
	9. Vacancy rates - business	Might be used as an estimate of levels of excess supply. Business vacancy rates measured using customer surveys. These may be limited by customer bases of individual property companies.	Yes	Yes	Partially	Yes (via surveys)
Competitiveness	10. Market concentration: Herfindahl–Hirschman Index (HHI)	This indicator is a measure of the competitiveness of the development capacity market based on the level of market concentration. This suggests how likely it is that a large land-owner could exercise market power and raise prices.	Partly	Yes - with some explanation	May require identification of ultimate owners of properties	Yes via interaction with Companies Office data
Efficient prices (Price discontinuities)	11. Discontinuities in land values between zones or at the urban fringe	A discontinuity in price not explainable by the cost to convert land between alternative uses suggests a less than fully competitive market and under-supply of one form of development capacity. Note it cannot be used to suggest misallocation of land at the specific site of the discontinuity.	Yes (although needs to be carefully interpreted with explanators)[121]	Yes (but with explanators analysed)	Price data available but explanatory factors may not be	Yes
	12. Ratio of rateable value to market value of land in best alternative use	This is equivalent to the price discontinuity indicator, but explicitly analyses the opportunity cost of land supply. Measuring this would require a "counterfactual" valuation exercise across all land types. It is likely to be prohibitively expensive.	Yes (more useful than price discontinuity alone)	Yes	Some data available. Some will require new analysis	No
(Price comparisons)	13. High-rise apartment sale prices against marginal construction costs	In a competitive market the cost of property should reflect the marginal cost of supply (MCS). This indicator would analyse MCS and compare with market prices. The analysis is simpler for multi-storey apartments, offices, or hotels where land costs make up a negligible proportion of MCS (ie adding another storey to an apartment building does not require a larger lot).	Yes	Yes (with explanations)	For apartments	Yes (for apartments)
	14. Construction costs for	This indicator would be a simple analysis of trends in costs of construction and would provide an indicator of changes in one key	Yes – this is useful for	Yes	Yes – data can be	Yes

[121] For example, a price differential at the urban boundary is best considered in absolute (dollar value) terms in comparison with estimates of the costs of land conversion and infrastructure provision.

Problem component	Indicator	Interpretation and use	Useful	Under-standable	Data available	Feasible
	residential or commercial buildings	input cost for housing supply. Construction cost data are needed to estimate measures of sale prices relative to marginal construction costs.	understanding the market		sourced from cost estimators	
	15. Land development costs for new subdivisions	This indicator would be a simple analysis of trends in private costs of land supply and would provide an indicator of changes in one key input cost for housing supply. Land development cost data are needed to estimate the "efficient" level of price discontinuities at the urban fringe.	Yes – this is useful for understanding the market	Maybe	Yes– data can be sourced from cost estimators	Yes
	16. Public infrastructure costs for new dwellings	This indicator would be a simple analysis of trends in public costs to provide development capacity and would provide an indicator of financial constraints facing councils. Public infrastructure cost data are needed to estimate the "efficient" level of price discontinuities at the urban fringe.	Maybe	Maybe	Yes– data can be sourced from agencies	Yes
Affordability	17. Home price to income: lower quartile home price to median household income	An indicator of housing affordability that is particularly relevant for first homebuyers or would-be homeowners. It does not take account of costs of ownership that will differ with equity in a home and mortgage interest rates.	Yes	Yes (although it has clear limitations)	Yes (HAM)	Yes
	18. Mortgage repayments to income ratio	Similar to price to income ratio yet controls for interest rates – an important determinant of affordability for homeowners. For simplicity we assume a 100% mortgage.	Yes	Yes (requires assumptions about equity)	Yes (HAM)	Yes
	19. Rent payments to income	As for mortgage payment to income ratio, but for renters.	Yes	Yes	Yes (HAM)	Yes
	20. Crowding index	An indicator of one outcome of unaffordability: crowding to reduce individual housing costs. Statistics NZ already use a variety of crowding indices. This can be measured based on Census data but this is only updated periodically.	Yes	Yes	Infrequently	Only from census
	21. Households in temporary accommodation	Measures unmet housing need by analysing distribution of households in temporary accommodation (motel accommodation and emergency accommodation) from census data).	Yes	Yes	No	No

- trends in rents by property type, size and location, and changes in rent:property price ratios. These data can be used to identify rapidly increasing prices and differences between trends in purchase prices and rents as indicators of relative supply and demand.

9.3 Supply-Demand Indicators

The supply-demand indicators suggested are those that show the extent to which development is keeping pace with demand from population growth, in addition to overall trends in prices. We note a number of issues:

- the overall supply-demand balance differs with price in addition to population. Given the concern with affordability and competitive markets for development capacity, the main interest is in defining the level of demand at a price equal to the marginal social cost of supply, ie the price which would result in an optimal level of supply and demand of land and development opportunities. This requires detailed analysis of that price and the elasticity of demand with respect to price; and

- indicators of the increase in demand with population growth ignore other factors that will increase demand, eg income which results in a demand for more floor space and changes in age structure of the population.

However, despite these limitations, the ratio of population growth to new consents, when combined with data on the size of new consents, can provide some information on whether levels of supply are improving or not.

Inflation-adjusted property prices and rents data provide background information and a better understanding of emerging problems, especially where these data are compared between council areas.

9.4 Competitiveness Indicators

Market competition is the result of many factors, although our main interest is in the impacts of reductions in supply and of market concentration from small numbers of market participants.

The HHI is a useful indicator of market concentration. It analyses whether there is a concentrated market problem and is a means for communicating the size of the problem. It is widely understood by competition economists and would be a useful addition to the suite of indicators used by councils.

9.5 Indicators of Efficient Price

The efficient pricing indicators are the most important indicators in identifying whether prices of land and development opportunities are higher than is optimal because of uncompetitive markets. They are the key indicators that would trigger an analysis of whether current zoning controls are a significant factor.

The indicators examined are price differences between adjacent zones, and differences between market prices and marginal costs of development. We noted a number of issues:

1. Price discontinuities are best observed at specific locations. However, the existence of a price discontinuity in a specific location does not mean that the market or regulatory failure is located there also. Rather, it should be considered as evidence of a city-wide shortfall in development opportunities. Addressing the problem still requires careful consideration of where plans shou;d provide more development capacity most efficiently, taking into account demand for housing (or business floorspace) at different locations as well as development costs, infrastructure costs, and other external costs such as environmental externalities.

2. There are limited data that can be used to update indicators of price discontinuities on a regular basis. Valuation data, which separate prices into land and improvement value components, are comprehensive but are only produced every three years. Sales data are available more frequently but are not comprehensive and require additional work to separate out the different elements of price.

3. Discontinuities need to be examined carefully to ensure that they are not simply different shapes of curves rather than genuine discontinuities—nonlinear relationships can easily be mistaken for discontinuities.

4. Comparisons of market prices with the marginal costs of construction (or supply) are a useful indicator of market efficiency. These are most easily developed for apartments or offices in multi-storey buildings where land value is insignificant in the value of each individual unit. Marginal construction cost data are not collected systematically and would need to be updated periodically or adjusted from existing data using price indices.

5. Efficient price indicators can be difficult to interpret during periods of disequilibrium, eg as a result of economic shocks, major plan changes or natural disasters.

9.6 Affordability Indicators

Affordability indicators are measuring something closer to the real issues of concern to policy makers. In contrast, indicators of efficient prices are measuring a proxy: market un-competitiveness as an indicator of likely unaffordability problems. Affordability indicators include those that:

- measure home prices and or rentals, and compare these with some measures of income; and

- those that measure actual expenditure on housing in comparison with total income.

We make the following comments:

1. Affordability indicators do not necessarily produce a reliable absolute measure of unaffordability. They are better at measuring changes in affordability over time or making comparisons across or between cities.

2. The home price to income ratio measures cannot take account of different circumstances which include:
   - the differences in equity in homes which determine costs of ownership;
   - life circumstances and people's ability to face short-term "unaffordability" when there is the prospect of higher future income (and greater future affordability).

3. Indicators that measure actual housing expenditure, eg amounts spent on rent or mortgages, for individual households are useful. However, until now, data are only available from surveys. Because of the limited numbers of respondents, they have provided data at a regional level but not at a more disaggregated level, such as TLA. In addition, the surveys, eg the HES, are only undertaken every three years. This does not allow up-to-date assessments of affordability.

4. The conclusions of the Treasury's 2006 paper are useful, ie that "*There is no single measure of affordability that can tell us everything, and different measures reveal different movements over time. A basket of measures needs to be considered to obtain a complete picture of affordability trends.*"[122]

MBIE is developing a series of indicators in the context of the housing affordability measure (HAM) programme, which will address many of these issues. MBIE has access to more data than is available to councils and is measuring the same indicators as we recommend in this report. It would be a useful source of data and indicators for councils.

9.7 Recommendations

9.7.1 Indicators

The review above shows the potential usefulness of a wide range of indicators. Ideally a *package* of indicators would be developed covering:

- Trends in home prices and rents, plus the ratio of new capacity to population increase as background information on the emerging problem;

- Housing affordability indicators, making use of the HAM being developed by MBIE; and

[122] Robinson M, Scobie GM, & Hallinan B (2006) Affordability of housing: concepts, measurement and evidence. New Zealand Treasury working paper 06/03. Wellington, New Zealand

- Indicators of the extent of price inefficiency that might be used as the basis for investigating whether current zoning controls are limiting market entry.

Different indicators may be more appropriate in some places than others, eg apartment sale price to marginal construction cost ratio is only feasible to estimate in Auckland and Wellington (at present). Indicators of competitiveness, eg using the HHI, may be useful in some areas, but they may involve more effort than is justified by the information provided.

It is recommended that price discontinuities should be measured using a mix of "sophisticated" and "focussed" methodologies (see Section 1.2.2) depending on the particular price signal being measured (Box 5).

Box 5 Key sophisticated and focussed approaches

Key "sophisticated" approaches include:

- Spatial regression models of property values;
- Propensity score matching models to compare like with like. These are "parametric" approaches – they require the analyst to identify an underlying economic relationship and include variables to control for other influences on prices (eg proximity to the coast, school zones).

Key "focused" approaches include:

- Comparison of average rateable land values on either side of a (short) zoning boundary
- Comparison of average apartment sale prices with marginal construction costs
- These are non-parametric approaches – by averaging prices within a small "window" they require less information on other determinants of prices, underlying economic relationships etc

The preferred set of indicators is shown in Table 17.

Table 17 Suggested indicators

Component	Preferred indicators	Description
General market information	1. Home price trends	Trends in home prices over time (inflation adjusted)
	2. Trends in land values	Changes in land values by suburb
	3. Trends in rents	Inflation-adjusted average rents by size category (1-bedroom, 3-bedroom)
Supply-demand balance	4. New build to population growth ratio	Ratio of population growth to: number of new build consents (supplemented by data on average size of new builds and number of buildings in different size categories
Competitiveness	5. HHI	Sum of the squares of market shares (% of development land available) of each landowner in the market
Price efficiency	6. Price discontinuities	Discontinuities in land values: (1) either side of urban limit; (2) adjacent uses zones, eg residential & industrial; (3) adjacent zones with different density potentials
	7. Price:market price ratio	Ratio of estimated marginal costs of building to market price, eg for one more floor on an apartment building
Affordability	8. Home price to income ratio	Ratio of lower quartile home price to median household income
	9. Housing costs (owners) to income ratio	Ratio of mortgage payments (100% mortgage, 30-year term, average 2-year fixed & floating interest rate) for median home price to median household income
	10. Housing costs (renters) to income ratio	Ratio of average rent payments to median household income

To the extent possible, data should be published in spatial form, eg as a map of price discontinuities at different locations within the city and the edge of the city. This makes it easier for council staff to interpret the information and provides appropriate local context. Mapped data may be supplementary to numerical analysis.

9.7.2 Interpretation

Figure 37 illustrates how the indicators might be used to analyse and interpret the problem, and to provide a trigger for release of development capacity.

Figure 37 Use of indicators to diagnose the problem

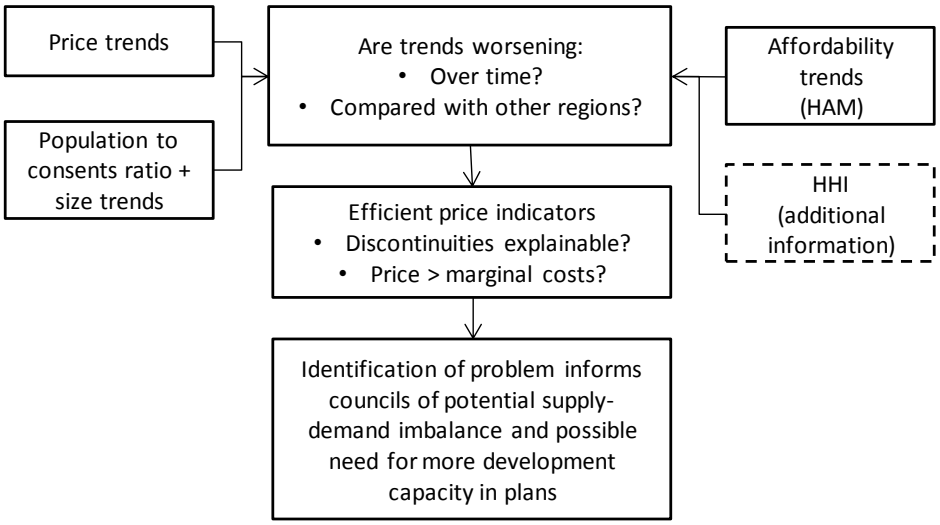


Table 18 provides more detail relating to the individual recommended indicators and how they might be interpreted to assist decisions.

The way in which the different groups of indicators function is as follows:

- The supply-demand indicators (price trends + population to consents ratio) provide background information that helps to identify if there is an emerging problem that requires further investigation.

- The competitiveness indicator (HHI) can provide information on whether market concentration is a problem.

- The affordability indicators provide information on whether the identified trends are matched by increasing signs of unaffordability. They are best interpreted through comparisons over time and between cities. This may include NZ cities and international examples.

- The efficient price indicators are the chief indicators to provide evidence of a problem of uncompetitive markets leading to elevated prices. They require additional information to interpret them, and specifically the costs of development and of building.

Table 18 Interpretation of recommended indicators

Category	Indicator	Interpretation
General market information	1. Home price trends: Inflation-adjusted median home prices	Significantly increasing prices relative to those in other locations should signal a potential for uncompetitive land and development markets, requiring further analysis.
	2. Trends in land values	Significantly increasing prices can be used to identify emerging problems, as can divergence of land and property values.
	3. Trends in rents: Inflation-adjusted mean rent values	Significant differences between changes in price trends for rents and home prices can provide further suggestions on which parts of the market are least competitive.
Supply-demand	4. Population growth to building consents	If ratio of population growth to new building consents is greater than average household size, it suggests that there is insufficient new building.
		Average building size for new consents and number of buildings in different size categories should be used to supplement the analysis and interpret whether: (1) there is a shift to different size categories that might provide more or less total residential space, or (2) if there is a shift to more or less affordable housing types, eg bigger houses.
Competitiveness	5. HHI	1,500 - 2,500: moderately concentrated; >2,500: highly concentrated. If moderate to high concentration is combined with high prices, planning rules should be investigated to see if they can enable greater market entry and more competition.
Efficient prices	6. Discontinuities in land values between zones or at the urban fringe	If there are significant absolute differences in land values across zones which cannot be explained by an analysis of the costs of development of land, it suggests that there is a lack of competitiveness in development markets. Planning rules should be investigated to see if they are providing significant barriers to market entry.
	7. High-rise apartment sale prices against marginal construction costs	If there are significant absolute differences between the price of high-rise apartments (or offices, hotels, etc) and marginal construction costs that cannot be explained by quantifiable factors, such as 'lumpiness' related to earthquake strengthening or building infrastructure costs, it suggests that there is a lack of competitiveness in development markets. Planning rules should be investigated to see if they are providing significant barriers to market entry.
Affordability	8. Home price to income: lower quartile home price to median household income	If the ratio of price to income is increasing it suggests an increasing affordability problem. This should be further investigated by examining trends in housing costs ratio (see below) and by comparing trends between cities to see if the problem is location-specific.
	9. Mortgage repayments to income ratio	If the ratio is increasing it suggests an increasing affordability problem. This should be further investigated by separating the effects of prices versus interest rates. Additional information to assist interpretation would include trends in prices and in incomes, including by age category.
	10. Rent payments to income ratio	If the ratio is increasing it suggests an increasing affordability problem. This should be further investigated by comparing trends in rents with trends in home prices.

Where the efficient price indicators suggest that there are significant price differences that are not explainable by other factors, this information indicates plans should provide additional development capacity. The indicators cannot, by themselves, lead to

conclusions about exactly what kind of capacity or the location, but they are the starting point for that analysis as a matter of urgency.

9.7.3 Institutional Arrangements

National direction and non-statutory guidance

There are three main options.

1. Include all specific price signal measures in the NPS-UDC, and provide additional explanation on how to calculate and interpret them in guidance.

2. Include *some* specific price signal measures in the NPS-UDC, and provide guidance that includes additional price signals that are optional to measure.

3. Provide guidance on the *type* of price signals to measure in the NPS-UDC, and provide guidance that sets out options for a range of price signals that councils could choose to measure.

Our recommendation would be to opt for option 2. Having a small set of indicators measured across all councils would provide the ability to make comparisons. It is also likely that a small set of indicators would be useful in most circumstances.

Of the indicators listed above (Table 17), we suggest that:

- the price trend indicators (house prices and rents) are collected by all councils;

- the ratio of population growth to new consents plus data on the size of new consented dwellings are collected by all councils; and

- affordability indicators are published for all council areas using data from the HAM.

Efficient price indicators should be developed where these indicators suggest that:

- prices are rising significantly faster than inflation rates;

- new consents are not keeping pace with population growth or buildings are only meeting the requirements of certain segments of the population; or

- the HAM indicators suggest that affordability is becoming significantly worse.

The role of central and local government:

Central government has better access to consistent data, eg through purchase arrangement with CoreLogic and access to administrative data through Statistics New Zealand's Integrated Data Infrastructure, eg tax data. At a minimum there is a role for central government in providing data to councils.

Central government may have better ability to:

- develop and implement consistent and sophisticated methodologies, and interpret indicators; and/or

- purchase skills without duplicating effort.

Local government potentially has better local information on determinants of prices, development costs, and so on. However, local government capability to develop indicators is mixed, reflecting council size and skill levels of staff. Therefore, partnership approaches between councils, or between councils and central government, should be encouraged.

It is recommended that:

- central government
    - compiles a consistent set of data on house prices and rents which it provides to councils;
    - continues to develop the HAM and provides housing affordability indicator results to councils;
    - provides advice to councils on: (1) the development of models to analyse price discontinuities across zones and (2) the analysis of the differences between prices and marginal construction costs; and
    - provides other technical advice as required.

- local government
    - develops and publishes indicators of price trends, and the ratio of population increase to new building consents with building size data;
    - analyses these data and the HAM indicators;
    - develops efficient price indicators, as required, in response to the initial problem identification; and
    - responds to a significant price problem if identified.

Annex: General Market Indicators

A1 Inflation-adjusted Median House Prices

A1.1 Description

Annual median house prices for a given territorial authority, adjusted by annual inflation in the consumer price index (CPI).

A1.2 Interpretation

This simple indicator allows a local area to track or compare annual median house prices over time or between different areas. Adjusting for inflation allows for a better comparison of past and present prices through controlling for changes to the purchasing power of the dollar. Prices adjusted for inflation are often referred to as 'real' prices and un-adjusted prices are known as 'nominal' prices. Median values are used instead of average values to mitigate against potential biases caused by price outliers. For example, median values will give a better interpretation of the market when a small number of houses sold within a given period are drastically higher (or lower) than the typical sale price.

A1.3 Data availability

House price data by territorial authority can be purchased from QVNZ. CPI values are publicly available from the Reserve Bank of New Zealand (Table 19).

Table 19: Data sources

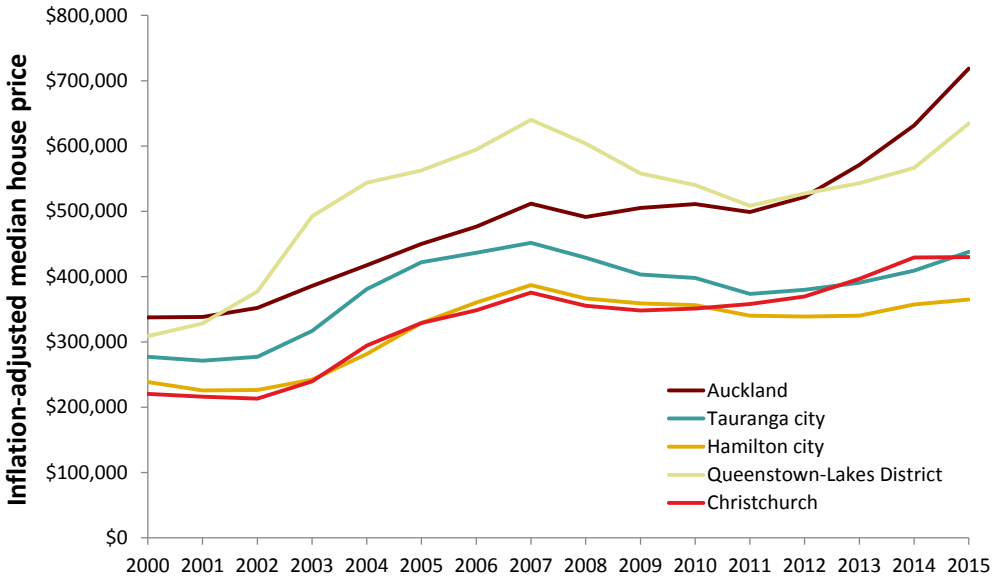
Data	Source	Location
Median house price	QVNZ	QVNZ
CPI	RBNZ	RBNZ Statistics[123] *Economic Indicators > M1(1988-current)*

A1.4 Examples of Use

Figure 38 shows that real median house prices were steadily increasing until the 2008 global financial crisis which subdued house price growth over the following years. Auckland has experienced the sharpest increase in prices in recent years whilst other fast growth areas have only just recently reached pre-2007 'real' price levels.

[123] http://www.rbnz.govt.nz/statistics/key-graphs/key-graph-mortgage-rates

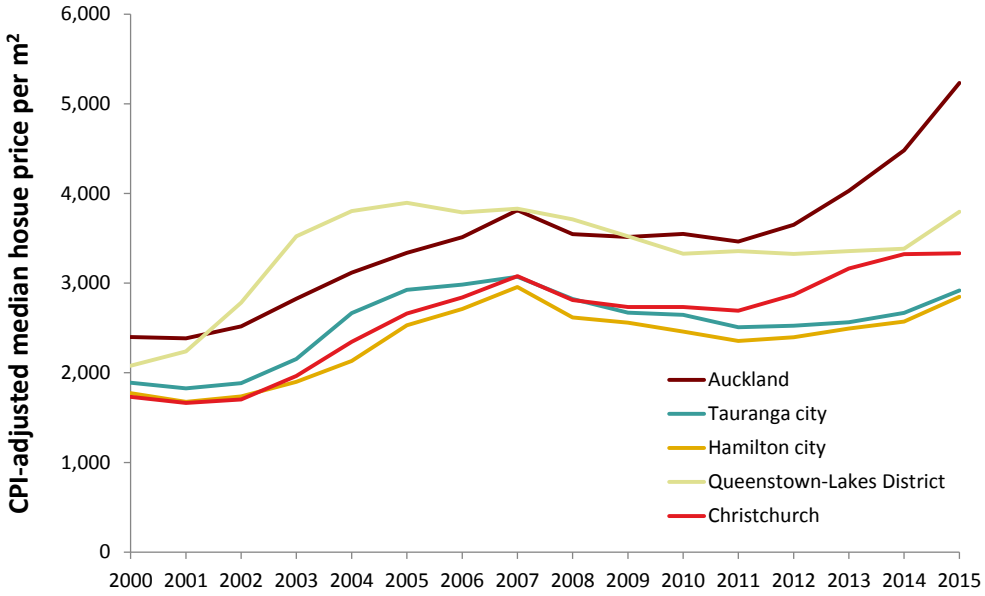
Figure 38 Inflation-adjusted median house prices for high growth areas 2000-2015



Source: QVNZ and RBNZ

If the average house size is known or suspected to be changing over time, a preferred indicator would be the inflation-adjusted median house price per square metre (Figure 39).

Figure 39 Inflation-adjusted median house price per m^2 for high growth areas 2000-2015 (2015$ values)



Source: QVNZ and RBNZ

A2 Land Values

A2.1 Description

Trends in average land values ($/m^2$) by territorial area and at a more disaggregated level, eg by suburb. To be presented as a heat map or using charts.

A2.2 Interpretation

Data on changes in land values over time can be used to identify emerging, eg if there are rapidly increasing values or values which diverge significantly from other locations. The data can also be used, in association with data on property values, eg as a land leverage ratio, to identify divergence of trends, suggesting the markets in which there is emerging scarcity of supply.

A2.3 Data availability

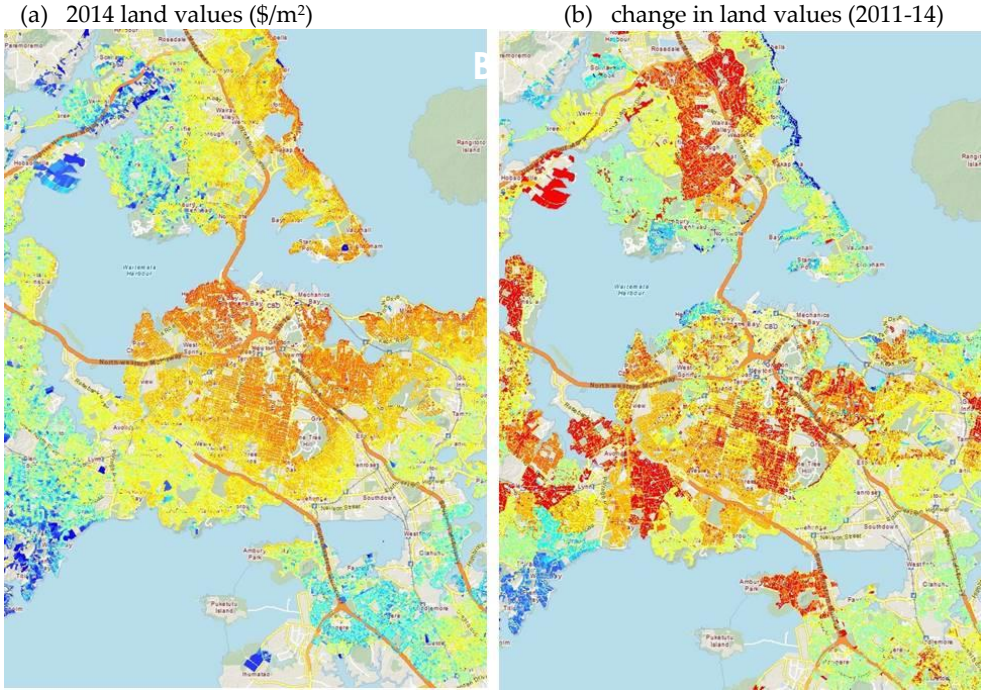
Land values are estimated by CoreLogic, often for councils. These values are estimated only and only periodically, eg every three years. Alternative sources of data would be from statistical analysis of sales data. If there are sufficient data, this can be used to identify the contributing factors to total value, eg the contribution of land (by location), property type, size and so on.

A2.4 Examples of use

Figure 40 is an example using Auckland data. It shows absolute land value estimates and changes in value from 2011 to 2014. These need to be interpreted with caution because they are modelled estimates only.

Figure 40 Auckland land values ($/m^2$)

(a) 2014 land values ($/m^2$) (b) change in land values (2011-14)



Source: Auckland Council's GIS viewer via http://transportblog.co.nz/2014/11/11/new-auckland-valuation-maps/

A3 Inflation-adjusted Mean Rent Values

A3.1 Description

Average weekly rent values by month and territorial authority, adjusted by annual inflation in the consumer price index (CPI).

A3.2 Interpretation

This simple indicator allows a local area to track or compare average rent values over time or between different areas. Adjusting for inflation allows for a better comparison of past and present prices through controlling for changes to the purchasing power of the dollar. Prices adjusted for inflation are often referred to as 'real' prices and un-adjusted prices are known as 'nominal' prices. Although median values will give a better representation of rental price movements when large outliers exist, median rent values were readily available.

A3.3 Data availability

Average rental data by territorial authority was obtained from the bond tenancy services database and is administered by MBIE. CPI vales are publicly available from the Reserve Bank of New Zealand (Table 20).

Table 20: Data sources

Data	Source	Location
Mean rents	Tenancy Bond Database	MBIE
CPI	RBNZ	RBNZ Statistics[124] *Economic Indicators > M1(1988-current)*

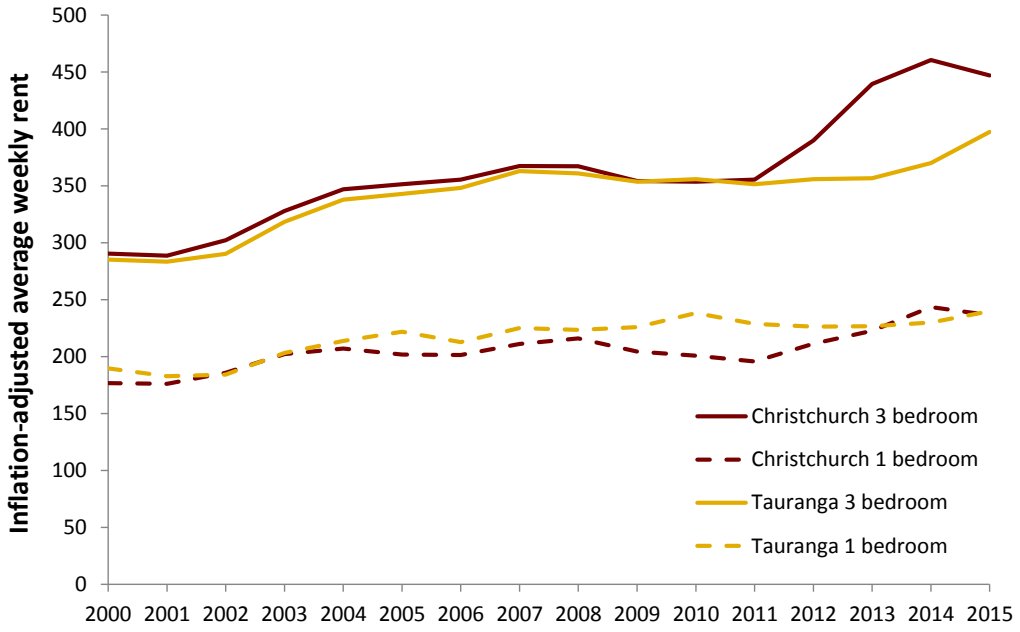
A3.4 Examples of use

Figure 41 shows that real rent prices for 1 and 3 bedroom homes in Tauranga and Christchurch since 2000. By restricting the indicator to 1 and 3 bedroom homes, we are able to control for potential changes in the size that influence rent price.

Separating trends by bedroom number is useful given that levels of supply and demand can be specific to the number of bedrooms in a home (ie house size). For example, the post-earthquake spike in 1 bedroom rental prices in Christchurch is far less pronounced for that of 3 bedroom houses. This may indicate that either the surplus in demand or supply shortage of 1 bedroom houses in Christchurch following the earthquake was less substantial than that of 3 bedroom houses.

[124] http://www.rbnz.govt.nz/statistics/key-graphs/key-graph-mortgage-rates

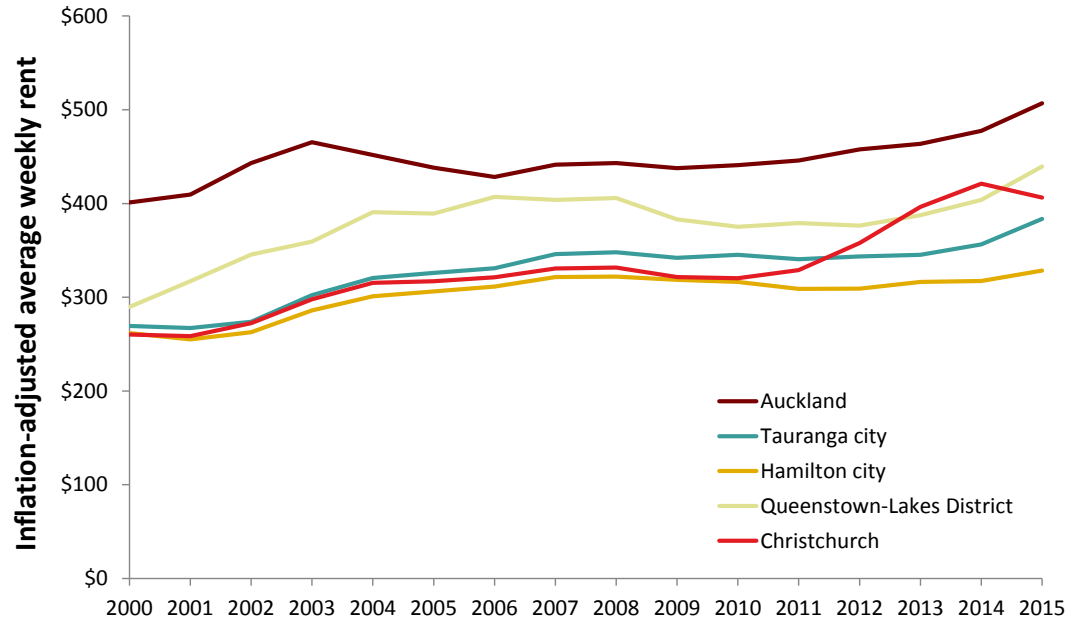
Figure 41 Inflation-adjusted mean rents for 1 and 3 bedroom homes in Christchurch and Tauranga 2000-2015 (2015$ values)



Source: MBIE and RBNZ

Figure 42 shows that real rent prices have been increasing at a slower rate than that of real house prices in Figure 38. Although Auckland has had the highest proportionate increase in real house prices since 2000 of 113%, its real rent price has only increased by 26% in real terms; this is substantially lower than rent price increases of other high growth areas, such as Christchurch (56%) and Queenstown (52%).

Figure 42 Inflation-adjusted mean rents for high growth areas 2000-2015



Source: MBIE and RBNZ

Annex: Supply-Demand Indicators

A4 Population growth to building consents

A4.1 Description

Annual population growth divided by the annual number of building consents issued for new dwellings.

A4.2 Interpretation

This indicator measures whether the rate of residential development is keeping pace with population growth. It might be measured over time or between territorial authorities. Higher values indicate that an area's population is increasing at a greater rate than that of new dwelling building consents.

The indicators should always be used alongside additional analysis of changes in the average size of new dwellings and/or the number of new dwellings in different size categories: small (<100m^2), medium (100-200m^2) or large (>200m^2). This provides additional information on whether sufficient capacity is being provided or if the new capacity is meeting the demands of only certain parts of the market.

A4.3 Data availability

Monthly building consent and population data are available by territorial authority from Statistics NZ Infoshare as described in Table 21.

Table 21: Data sources

Data	Source	Location
Building consents	Statistics NZ	Infoshare[125] *Industry sectors* > *Building consents*
Population	Statistics NZ	Infoshare *Population* > *Population Estimates*

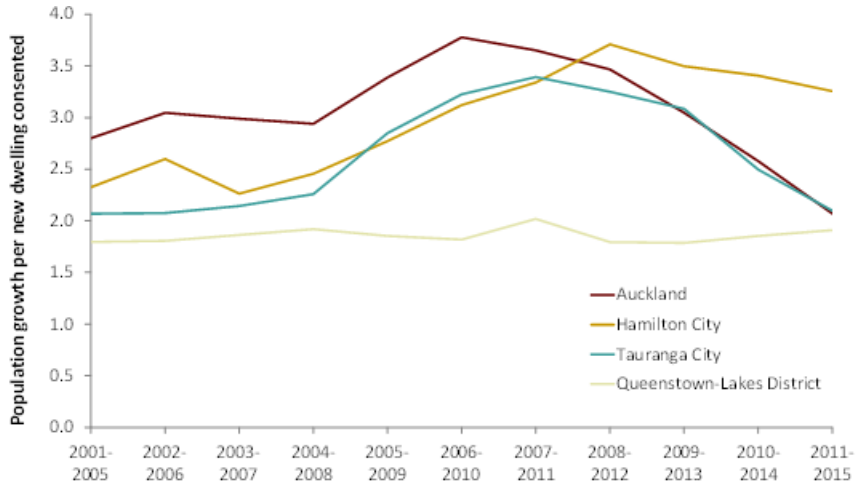
A4.4 Examples of Use

Figure 43 illustrates a time series of the '5 year moving average' of annual population growth per new dwelling building consents for a selected number of high growth areas. The recent downward trend for Auckland, Hamilton and Tauranga may indicate increased effort to catch up with their fast growing populations, however Hamilton's population growth to new residential building consents has remained relatively high.

Figure 44 provides additional information to help interpret these trends. It shows the shift in the proportion of new buildings that fall in different size categories. The example provided is for Tauranga City.

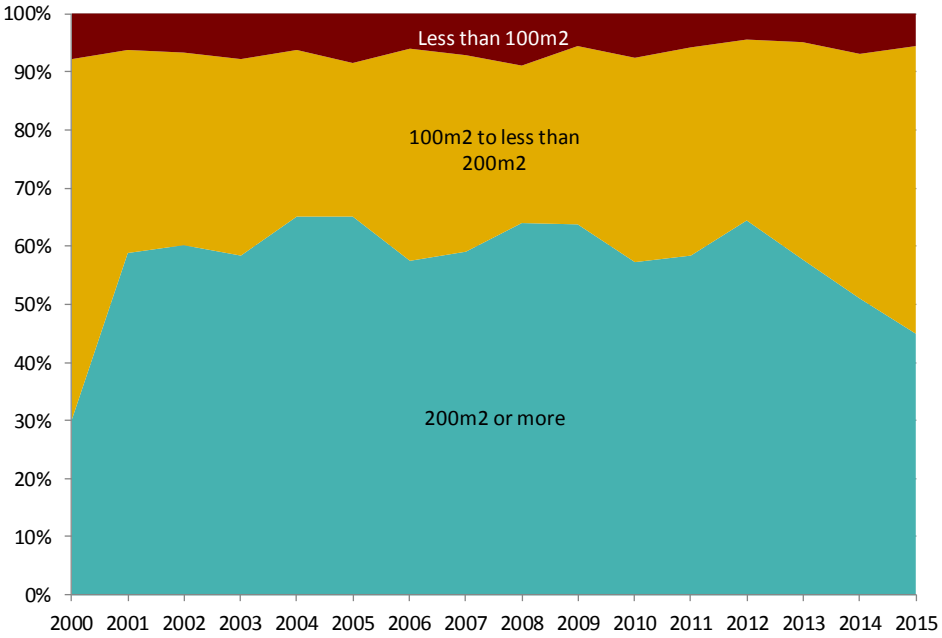
[125] http://www.stats.govt.nz/infoshare

Figure 43 Five year moving average of population growth per building consent for a new dwelling



Source: Data retrieved from Infoshare, Statistics NZ

Figure 44 Percentage share of new dwellings consented by size in Tauranga City 2000-2015



Source: Statistics NZ

Annex: Competitiveness Indicators

A5 Market Concentration: HHI

A5.1 Description

The Herfindahl–Hirschman Index (HHI) is a measure of market concentration. It is calculated as the sum of the squares of market shares of each firm competing in the market. For example, for a market consisting of five firms with shares of 50, 30, 10, 5 and 5 percent, the HHI is 3,550 ($50^2 + 30^2 + 10^2 + 5^2 + 5^2 = 3,550$); in contrast if there are ten firms, each with 10% market share, the HHI is 1,000.

A5.2 Interpretation

According to the US Department of Justice, markets in which the HHI is between 1,500 and 2,500 points are considered to be moderately concentrated, and markets in which the HHI is in excess of 2,500 points to be highly concentrated.

A5.3 Data Availability

Measuring an HHI for development capacity would require the following information:

- Identification of the market for development capacity, ie is it all property in an urban area or a more narrowly defined sub-set of new capacity?
- The total number of owners of "development capacity";
- The market share of each owner.

The analysis could be simplified. For example:

- if no one had more than 10% market share, the maximum HHI would be 1,000, which is not regarded as concentrated. The analysis could simply record an HHI of less than 1,000;
- if there were a few landowners with significant market shares, the analysis could be truncated below a certain level, eg not counting below those with 3% market share. They would add a maximum of 9 to the total HHI.

Data on ownership and land area is available to councils via ratings databases. The more complicated analysis would be to identify ultimate owners of property, eg if there are layers of share ownerships. This would require analysis of data held by the Companies Office.

Annex: Indicators of Efficient Prices

A6 Land price discontinuity at zoning boundaries

A6.1 Description

The difference in rateable land values for residential or commercial properties *just inside* and *just outside* a zoning boundary.

A6.2 Interpretation

This indicator measures whether urban planning policies result in an artificial scarcity of development capacity for one purpose relative to another purpose. It can be measured:

- at different zone boundaries within the city, eg to estimate whether discontinuities are greater in one location or another; and
- over time, eg to estimate if development capacity is keeping up with growing demand or falling behind demand.

In principle, land price discontinuities at zoning boundaries can result from both limits on the supply of land for particular purposes *and* limits on more intensive development within the city. Interpreting this measure can be challenging, as it requires contextual information on:

- Underlying growth in demand for different activities, eg the degree to which demand for industrial floorspace or residential floorspace is increasing;
- Recent trends in property prices – when housing and business floorspace prices are rising rapidly, land valuation data can become outdated;
- Localised externalities associated with activities that occur in or around particular zones – eg noise and poor air quality associated with industrial activities that may reduce neighbouring residential property values; and
- Other non-regulatory constraints, such as land-banking by major property owners, which may result in an artificial scarcity that cannot be attributed to urban planning rules alone.

A6.3 Data availability

Calculating this measure requires information on land valuations and district plan zoning maps, as well as GIS analysis of property parcel locations. These data are briefly described in Table 22.

Land valuation data is available from three-yearly rating valuations conducted by territorial local authorities. Other data on the location of properties inside or outside the urban boundary can be estimated using GIS analysis of zoning maps.

Table 22: Data sources

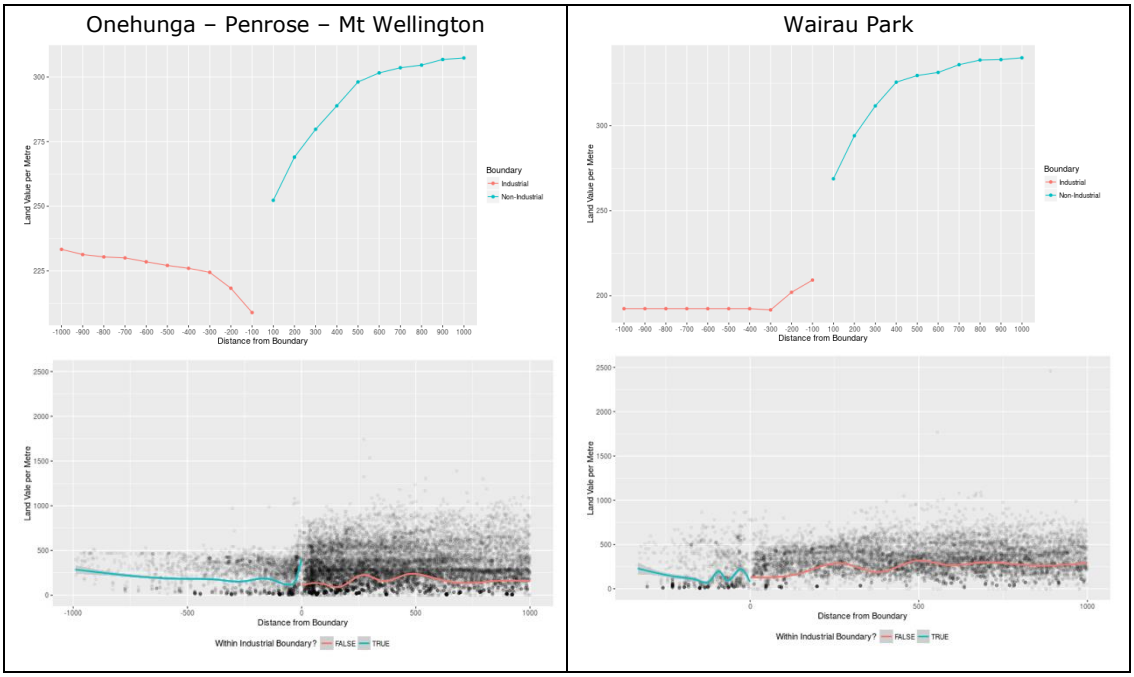
Data	Source	Location
Land valuation data	TLAs / Corelogic	CoreLogic and councils; MBIE has purchased CoreLogic valuation data for residential properties
District plan zoning maps	TLAs	District councils hold this data
GIS analysis of property parcel location	Custom analysis	Must be undertaken on a case-by-case basis

A6.4 Examples of Use

Figure 45 shows data on land values just inside and outside two industrial zones in Auckland. The top panel shows average land values in buffers ranging from 0-100m to 0-1000m immediately inside and outside the industrial zone boundaries. The bottom panel shows a scatterplot of land valuations inside and outside the industrial zones to better understand the distribution of values. In 2011, the median difference in land values in 100 metre buffers immediately inside and outside the industrial zone boundaries was in the range of \$40-\$60/m^2.

This is a simple comparison of average land prices inside and outside zoning boundaries. In principle, more sophisticated econometric techniques could be applied, as Grimes and Liang (2009) and Zheng (2013) use to identify the MUL boundary discontinuity in land prices.

Figure 45 Land values around two industrial zones in Auckland



Note: Land valuation data sourced from 2011 district valuation roll obtained for an analysis of the economic impact of minimum parking requirements (MRCagney, 2013)

Table 23 summarises the results of this analysis for the ten largest industrial zones in Auckland, focusing on average land values within 200m buffers inside and outside of the zone boundaries. This shows large variations in price discontinuities. In some locations, such as Takanini and Glenbrook, industrial land is valued higher than

adjacent non-industrial areas. In other cases, such as the Albany-Rosedale industrial area, adjacent non-industrial land is considerably more valuable.

Table 23 Land values in 200m buffers inside and outside industrial zone boundaries

Industrial zone location	Mean inside industrial zone ($/m2)	Mean outside industrial zone ($/m2)	Difference ($/m2)	Ratio
Glenbrook Steel Mill	$37.92	$9.29	-$28.63	0.24
Takanini	$359.14	$216.37	-$142.76	0.60
Manukau	$138.15	$218.93	$80.78	1.58
Airport	$167.04	$230.68	$63.64	1.38
East Tamaki	$114.81	$370.69	$255.88	3.23
Onehunga-Penrose-Mt Wellington	$218.28	$269.01	$50.73	1.23
Te Atatu	$183.68	$330.54	$146.86	1.80
Lincoln Road	$159.23	$268.91	$109.68	1.69
Wairau	$202.01	$294.08	$92.07	1.46
Albany-Rosedale	$103.31	$327.91	$224.59	3.17

A significant challenge in assessing the existence and magnitude of land price discontinuities around industrial zone boundaries is understanding the impact of localised negative externalities arising from industrial activities. The charts above indicate that average residential land prices fall with increased proximity to industrial zones.

If this is due to negative external effects arising from activities taking place in the industrial zone, then a comparison of land values immediately inside and outside the boundary will under-state the magnitude of the price discontinuity. However, if it is due to other land uses that are adjacent to the industrial zone, such as major roads, then this will be a more accurate reflection of the discontinuity. Assessing which is the case requires a degree of local knowledge.

A7 Section price discontinuities arising from minimum lot sizes / density controls

A7.1 Description

The difference in property sale prices for comparable residential lots that can be subdivided or intensified to different extents, either due to variations in residential zoning or minimum lot size rules that allow some sites to be subdivided, while other sites that are slightly smaller cannot be subdivided.

A7.2 Interpretation

This indicator measures whether urban planning policies result in an artificial scarcity of development opportunities for higher-density residential dwellings. It can be measured:

- between different types of residential zones, or between residential properties of different sizes within one residential zone; and
- over time, eg to estimate if development is keeping up with growing demand or falling behind demand.

In principle, price discontinuities between comparable residential properties with different potential for subdivision or intensification can result from both limits on the supply of land for particular purposes *and* limits on more intensive development within the city. Interpreting this measure can be challenging, as it requires contextual information on:

- Infrastructure costs associated with subdividing or intensifying sites, such as development contributions levied on new lots
- Externalities associated with different residential development forms, if any
- Other non-regulatory constraints, such as land-banking by major property owners, which may result in an artificial scarcity that cannot be attributed to urban planning rules alone.

A7.3 Data availability

Calculating this measure requires information on residential property sales (and in particular sales of standalone houses without cross-lease arrangements) and district plan zoning maps, as well as GIS analysis of property parcel locations. This data is briefly described in Table 24.

Property sales data is available on an annual basis. Other data on the location of properties inside or outside the urban boundary can be estimated using GIS analysis of zoning maps.

In addition, econometric analysis (eg spatial regression models or propensity score matching) is required in order to estimate the magnitude of discontinuities in prices for comparable dwellings with different residential zoning or subdivision potential.

Table 24 Data sources

Data	Source	Location
Residential property sales	TLAs / Corelogic	CoreLogic and councils; MBIE has purchased CoreLogic valuation data for residential properties
District plan zoning maps	TLAs	District councils hold this data
GIS analysis of property parcel location	Custom analysis	Must be undertaken on a case-by-case basis

A7.4 Examples of Use

This measure has not previously been estimated for New Zealand cities. Initial analysis suggests that it is feasible to estimate, provided that:

- Data on residential property sales can be sourced
- Zoning maps are available in an appropriate format to enable identification of the zoning of individual residential properties
- Minimum lot size / density controls are stated in a way that would allow subdivision potential for individual sites to be assessed.

Spatial hedonic regression techniques can be used to measure whether density controls result in discontinuities in property values. It would be most appropriate to apply these techniques to analyse prices for standalone houses without cross-leases or similar barriers to redevelopment. There are three approaches to measurement that could be tested. However, we note that preliminary testing of these measures in Auckland did not find consistent evidence of price discontinuities. This may be due to the fact that, during the period in which we examined prices (end 2013-end 2014), the city's future zoning rules were under review by an Independent Hearings Panel, making it difficult to determine what future rules would apply to individual sites.

Approach 1: Impact of different residential zoning on property values

This approach takes advantage of the fact that different residential zones allow sites to be developed to different extents. For example, in the notified version of the Auckland Unitary Plan, the Mixed Housing Urban zone allowed three-storey buildings and less land per dwelling, while the Mixed Housing Suburban zone allowed two-storey buildings and required more land per dwelling.

A regression model could be specified as follows:

$$Price_i = \beta_0 + \beta_1 Zoning_i + \beta_2 Other\ characteristics_i + \varepsilon_i$$

If the model coefficient β_1 was positive and statistically significant, indicating that higher-density zoning was associated with higher sale prices after controlling for other characteristics of the dwelling (including its location within the city), then it would suggest that there was a price discontinuity between similar residential properties located in different zones.

Approach 2: Impact of different subdivision potential

This approach takes advantage of the fact that minimum lot size / density controls allow some sites to be subdivided or developed for multiple dwellings, but not others. If the subdivision potential of individual residential lots can be estimated, eg by analysing the relationship between site area and density controls, then the following regression model could be tested:

$$Price_i = \beta_0 + \beta_1 Subdivision\ potential_i + \beta_2 Other\ characteristics_i + \varepsilon_i$$

If the model coefficient β_1 was positive and statistically significant, indicating that greater subdivision potential was associated with higher sale prices after controlling for other characteristics of the dwelling (including its location within the city), then it would suggest that there was a price discontinuity arising from minimum lot size / density controls.

Approach 3: Marginal value of land in different residential zones

This approach takes advantage of the fact that different zoning rules may result in different marginal value of land in different zones. There may be some countervailing effects. For instance, if one zone allows subdivision to smaller lot sizes, larger lots may not be as valued due to the fact that they are not needed for subdivision. Conversely, zones that allow land to be developed more intensely may be worth more due to greater development potential.

A regression model could be specified as follows:

$$Price_i = \beta_0 + \beta_1 Zoning_i * Land\ area_i + \beta_2 Other\ characteristics_i + \varepsilon_i$$

If the model coefficients β_1 differ between zones, it may suggest that zoning rules result in similar residential lots being valued differently. This may suggest the presence of a price discontinuity arising from minimum lot size / density controls.

A8 High-rise apartment sale prices against marginal construction costs

A8.1 Description

The ratio of average apartment sale prices against marginal construction costs associated with adding an additional storey.

A8.2 Interpretation

This indicator measures whether building height limits and other rules limiting high-rise development are limiting development opportunities. It can be measured:

- within areas with a sufficient density of tall apartment buildings; and
- over time, eg to estimate if development is keeping up with growing demand or falling behind demand.

Interpreting this measure can be challenging, as it requires contextual information on:

- Marginal construction costs, which may rise in a "lumpy" fashion if buildings over a certain height require more internal services or earthquake strengthening;
- Non-regulatory constraints on high-rise development, such as limited availability of development finance or construction labour, which may result in scarcity that cannot be attributed to urban planning rules alone;
- Building consent trends – because high-rise buildings are time-consuming to develop, there may be a "lag" between when prices rise and when new supply enters the market. Comparing this ratio against building consent applications for apartments (or dwellings in general) can provide valuable insight into whether

A8.3 Data availability

Calculating this measure requires information on apartment sales, as well as GIS analysis of apartment locations. This data, which is briefly described in Table 25, is available from property sales datasets maintained by councils (or private data providers like CoreLogic) as an input into ratings valuations. Property sales data is available on an annual basis.

Table 25: Data sources

Data	Source	Location
Apartment sales data	TLAs / CoreLogic	CoreLogic and councils; MBIE has purchased CoreLogic valuation data for residential properties
GIS analysis of apartment sale location	Custom analysis	Must be undertaken on a case-by-case basis, with reference to zoning maps and existing land uses
Marginal cost of construction	Quantity surveyors or cost estimators	Held by private data suppliers; some relevant data is summarised in this report

A8.4 Examples of Use

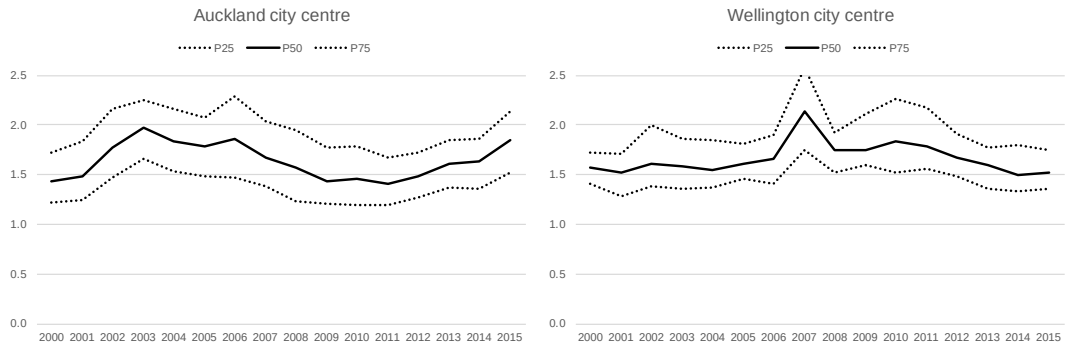
Table 26 summarises data on average apartment sale prices in the Auckland and Wellington city centres over the 2000-2015 period. This data covers the areas of the city where high-rise apartments are most likely to be found. To avoid biasing the results, it has been filtered to exclude apartments that are at high risk of being leaky buildings, as well as apartments sold with a significant amount of land. The floor area of apartments has been calculated as including balconies (assuming an average of 8m per balcony).

Table 26 Average apartment sale prices (nominal) in the Auckland and Wellington city centres

	Auckland		Wellington	
Year	Number of sales	Average sale price ($/m2)	Number of sales	Average sale price ($/m2)
2000	244	$3,228	205	$3,018
2001	500	$3,344	261	$2,999
2002	946	$3,903	398	$3,441
2003	2024	$4,518	322	$3,526
2004	1682	$4,670	339	$3,817
2005	1597	$4,869	285	$4,261
2006	1926	$5,303	257	$4,620
2007	1260	$5,197	521	$6,099
2008	781	$5,127	168	$5,497
2009	1031	$4,622	166	$5,494
2010	852	$4,635	250	$6,443
2011	1032	$4,502	155	$5,632
2012	1234	$4,750	222	$5,237
2013	1398	$5,239	147	$5,081
2014	1210	$5,505	167	$5,156
2015	1143	$6,581	140	$5,407

Figure 46 compares observed sale prices against marginal construction costs for high-rise apartments (8-24 storeys; medium size; high quality finish). Construction costs have been deflated to nominal NZD using the Capital Goods Price Index for Residential Construction, and adjusted downwards slightly for Wellington.

Figure 46 Ratio of apartment sale prices to marginal construction costs



Source: Consultants' analysis of CoreLogic property sales data; Luen (2014); Statistics NZ CGPI

Figure 46 shows that apartment prices have consistently been above marginal construction costs in both cities throughout the entire time period. However, there is a

marked difference in the trend. In Wellington, apartment prices have fallen relative to build costs over the last five years, while in Auckland they have risen markedly.

Furthermore, the dotted lines that show the distribution of prices indicate that less than one in four apartments sells for less than marginal construction costs – a surprising finding given that we would expect apartments to depreciate over time.

While these data suggest that apartment sale prices have consistently exceeded marginal construction costs in both cities, they do not provide conclusive evidence of a problem with planning regulations. For example, rising prices may provoke a supply response, albeit with a slight lag due to the time required to get apartment development underway.

A8.5 Estimating Marginal Construction Costs

We employ a conservative approach to estimating marginal construction costs to ensure the robustness of our results. In particular, we:

- Compare apartment sale prices against the highest available construction cost estimates – ie construction costs for high-quality apartments – although some apartments are built to a lower standard and at a lower cost;
- Include decks in our estimate of building floorspace – assuming that the average deck takes up 8m^2 of space and costs the same to construct as the equivalent area of floorspace; and
- Ignore depreciation for older dwellings – ie not adjusting construction costs downward for older apartments that are likely to require renovation to bring them up to the same standard as a new apartment.

Table 27 summarises some data on construction costs for apartments and office buildings in Auckland and Wellington. Note that Wellington construction costs are generally similar to, but slightly lower than, Auckland construction costs.

Luen (2014) provides estimated construction costs for low-rise, mid-rise, and high-rise apartments of varying size and quality (Table 28). These costs are in the same approximate range as those in Table 27; however, they provide additional detail about how construction costs vary with building height. They show that construction costs rise as building height increases.

It is possible that Luen's data underestimate marginal construction costs for some locations, eg where earthquake risks or challenging soil require additional strengthening for tall buildings. It may be necessary to obtain site-specific information on construction costs and techniques to assess whether this is likely to be the case.

Table 27: Construction cost estimates ($/m2) for high-rise buildings (Source: Rawlinsons, 2013)

	Auckland		Wellington		Ratio of Wgtn to Akl	
Building type	Low	High	Low	High	Low	High

Building type	Auckland		Wellington		Ratio of Wgtn to Akl	
Multi-Storey Apartments	2,400	2,700	2,350	2,650	97.9%	98.1%
2 or 3 bedrooms. Medium quality fittings						
2 or 3 bedrooms. Ensuite. High quality fittings	2,800	3,100	2,600	2,900	92.9%	93.5%
Low Rise Offices						
Up to 2 storeys, no lifts	1,475	1,675	1,425	1,625	96.6%	97.0%
3 to 5 storeys, with lifts	1,750	1,950	1,675	1,875	95.7%	96.2%
High Rise Offices						
6 to 15 storeys	2,500	2,800	2,400	2,700	96.0%	96.4%

Source: Rawlinsons Construction Cost Handbook, 2013

Table 28: Construction cost estimates ($/m^2) for apartments in Auckland

Apartment size	Building height	Low-average quality	Medium quality	High quality
Small (20-35m2)	1 to 3 storeys	$2,604	$3,100	$3,348
	4 to 7 storeys	$2,695	$3,209	$3,468
	8 to 24 storeys	$2,976	$3,472	$3,720
Medium (50-70m2)	1 to 3 storeys	$2,108	$2,852	$3,100
	4 to 7 storeys	$2,171	$2,938	$3,209
	8 to 24 storeys	$2,480	$3,224	$3,472[1]
Large (90+m2)	1 to 3 storeys	$1,860	$2,356	$2,604
	4 to 7 storeys	$1,916	$2,427	$2,682
	8 to 24 storeys	$2,232	$2,604	$2,976

Source: Luen M (2014) Up or out? Residential building height regulations in Auckland - understanding the effects and implications. Paper presented at New Zealand Association of Economists Annual Conference 2014, Auckland

Note: [1] this figure (costs for high-quality, medium-sized apartments in the 8-24 storey range) is used as a basis for marginal construction costs.

Marginal construction costs can be "back-casted" using Statistics New Zealand's Capital Goods Price Index for Residential Construction. The following table shows the estimates of marginal construction cost that we used in our analysis. We used prices for a medium-sized, high-quality apartment in an 8-24 storey building as a baseline for Auckland, and a multiple of 0.96 to convert this figure to the Wellington context.

Table 29 Estimated marginal construction costs (in nominal NZD)

Year	Construction price inflator (rebased to 2014)	Auckland MCC ($/m2)	Wellington MCC ($/m2)
2000	0.583	$2,023	$1,942
2001	0.596	$2,068	$1,986
2002	0.615	$2,134	$2,049
2003	0.652	$2,263	$2,173
2004	0.713	$2,474	$2,375
2005	0.763	$2,649	$2,543
2006	0.804	$2,793	$2,681
2007	0.845	$2,933	$2,816
2008	0.880	$3,055	$2,933
2009	0.883	$3,064	$2,942
2010	0.886	$3,075	$2,952
2011	0.897	$3,115	$2,990
2012	0.919	$3,192	$3,064
2013	0.954	$3,313	$3,180
2014	1.000	$3,472	$3,333
2015	1.049	$3,643	$3,497

A9 Land price discontinuity at the urban boundary

A9.1 Description

The difference in rateable land values for comparable residential properties *just inside* and *just outside* the urban boundary, net of land conversion and infrastructure costs.

A9.2 Interpretation

This indicator measures whether urban planning policies result in an artificial scarcity of development opportunities. It can be measured:

- at different locations on the urban boundary, eg to estimate whether discontinuities are greater in one location or another; and
- over time, eg to estimate if development is keeping up with growing demand or falling behind demand.

In principle, land price discontinuities at the urban boundary can result from both limits on the supply of land for development *and* limits on more intensive development within the city. Interpreting this measure can be challenging, as it requires contextual information on:

- Recent trends in property prices – when housing prices are rising rapidly, land valuation data can become outdated
- Infrastructure provision, eg locations that are served by network infrastructure
- Topographical constraints, eg steep hillsides or flood plains that are unusually costly to develop
- Other non-regulatory constraints, such as land-banking by major property owners, which may result in an artificial scarcity that cannot be attributed to urban planning rules alone

A9.3 Data availability

Calculating this measure requires information on land valuations and district plan zoning maps, as well as GIS analysis of property parcel locations. This data is briefly described in Table 30.

Land valuation data is available from three-yearly rating valuations conducted by territorial local authorities. Other data on the location of properties inside or outside the urban boundary can be estimated using GIS analysis of zoning maps.

Table 30: Data sources

Data	Source	Location
Land valuation data	TLAs / Corelogic	CoreLogic and councils; MBIE has purchased CoreLogic valuation data for residential properties
District plan zoning maps	TLAs	District councils hold this data
GIS analysis of zoning maps and property parcel location	Custom analysis	GIS analysis is required to identify the location of urban boundaries (see below) and identify how close properties are to the boundary. This analysis must be undertaken on a case-by-case basis
Land development costs	Surveying or land development companies	Held by private data suppliers; some relevant data is summarised in this report.

A9.4 Examples of Use

Several previous papers have investigated the impact of Auckland's Metropolitan Urban Limit (MUL) on land values at the city fringe. Grimes and Liang (2009) and Zheng (2013) apply several econometric models to identify the MUL boundary discontinuity in land prices, taking into account other factors such as distance to the coast, distance to employment centres, and local demographics.

In this paper, we replicate their analysis for six New Zealand cities: Auckland, Wellington (including Kapiti Coast), Tauranga, Hamilton, Nelson, and Palmerston North. We also take into account land development and infrastructure costs, which are important as land located within the urban boundary is more likely to be subdivided for residential use and / or served by public infrastructure.

Table 31 provides descriptive statistics on average land values inside and outside these cities' urban boundaries.

Table 31 Descriptive statistics on average land values and section sizes inside and outside urban boundaries

City	Auckland	Wellington	Tauranga	Hamilton	Nelson	Palmerston North
Weighted average land values ($m/ha)						
Inside urban boundary (2km distance)	$2.90	$2.92	$3.07	$1.40	$2.40	$1.82
Outside urban boundary (2km distance)	$0.34	$0.17	$0.26	$0.19	$0.20	$0.13
Difference	$2.56	$2.75	$2.81	$1.21	$2.20	$1.69
Weighted average lot size (m^2/section)						
Inside urban boundary (2km distance)	1,165	754	753	1,101	840	862
Outside urban boundary (2km distance)	16,266	13,866	12,750	14,758	14,192	14,253
Estimated land development costs						
Costs per site ($'000)	$120	$100	$120	$100	$100	$100
Total costs ($m/ha)	$0.96	$1.25	$1.50	$0.84	$1.12	$1.09
Share of price discontinuity "explained" by land development costs	37%	46%	53%	70%	51%	65%

This allows us to identify the difference in average land values (in dollar terms) across the urban boundary. In addition, we also summarise data on average section sizes immediately inside and outside the urban boundary. This enables us to estimate differences in land development costs – for instance, per-hectare land values in an area with average section sizes of 500m^2 (20 sections/ha) would include land development costs for 20 sections. We discuss our approach to estimating land development costs below.

This analysis indicates that, on average, land immediately inside each city's urban boundary is more valuable than land outside it. These discontinuities are large in some cases, in the range of $1-3 million per hectare. However, in all cases, a significant share of the difference, although not necessary all, can be explained by land development costs. Land development costs make up the largest share of the difference in Hamilton (70%) and the smallest in Auckland (37%).

Econometric analysis of land valuation data is a more robust way of assessing the existence and magnitude of price discontinuities at urban boundaries. Our methodology for this analysis is set out below, and key results are summarised in Table 32. The top rows report OLS estimates, while the lower rows report estimates from spatial error regression models that better address localised spatial correlations in land values.

Table 32 Econometric estimates of discontinuities in land values inside and outside of urban boundaries

	Auckland	Wellington	Tauranga	Hamilton	Nelson	Palmerston North
OLS regression outputs (1)						
Dist_boundary_2 (2km inside boundary)	-0.244	-0.098	-0.862	-0.285	0	0.129
Dist_boundary_3 (2km outside boundary)	-2.335	-1.63	-2.721	-1.83	-2.027	-1.756
Estimated ratio of land prices (2)	8.1	4.6	6.4	4.7	7.6	6.6
Spatial error regression outputs (1)						
Dist_boundary_2 (2km inside boundary)	-0.128	0.018	-0.562	-0.101	0	0.179
Dist_boundary_3 (2km outside boundary)	-1.404	-1.087	-1.83	-1.409	-1.641	-1.258
Estimated ratio of land prices (2)	3.6	3.0	3.6	3.7	5.2	4.2
Control variables included in models (3)						
Distance to CBD	Y	Y	Y	Y	Y	Y
Distance to coast	Y	Y	Y		Y	
Distance to sub-regional centres	Y	Y				
Territorial authority		Y	Y	Y	Y	Y

Notes: (1) All coefficients were statistically significant at the 1% level except for the Dist_boundary_2 variable for Palmerston North and Wellington, and the Dist_boundary_2 variable for Hamilton in the spatial error model. This indicates that, in all cases, land immediately outside the urban boundary was valued at a discount relative to land immediately inside.
(2) As land values were log-transformed, this ratio was calculated by taking the exponent of the difference between the coefficients on the Dist_boundary_2 and Dist_boundary_3 variables – eg for Auckland it was calculated as exp(-0.244-(-2.335)).
(3) Demographic controls were not included in this version of the model. Consistent with Grimes and Liang (2009), we find that they did not have a large impact on the results.

This analysis shows that, even after controlling for several other determinants of land values, such as distance to the centre, land immediately outside the urban boundary in all cities was valued at a discount. This indicates that the differences in average land values observed in the above table may reflect a genuine discontinuity rather than varying proximity to urban and natural amenities. However, the magnitude of the discontinuities estimated in these models is smaller than the simple averages reported above.

The quantitative difference in results between the OLS and spatial error models bears further investigation. While the literature on hedonic analysis of property values generally supports the use of spatial error models, previous research on Auckland's MUL boundary discontinuity did not find such large differences between results these two types of models.[126] It is unclear whether this reflects the impact of modelling choices (eg about how to define 'neighbourhoods' for meshblocks) or subsequent policy changes.

A9.5 Modelling land price discontinuities

Here, we describe in detail our methodology for modelling land price discontinuities at these cities' urban boundaries.

A9.5.1 Land valuation data

This analysis is based on the most recently available land valuation data for six New Zealand urban areas: Auckland, Wellington, Tauranga, Hamilton, Nelson, and Palmerston North. All but one of these urban areas extends into (or abuts) multiple district councils, and as a result it has been necessary to combine valuation data across multiple councils, as summarised in Table 33.

Table 33 Urban area descriptions

Urban area	District councils included in urban area (and fringe of urban area)
Auckland	Auckland
Wellington	Wellington City, Lower Hutt City, Upper Hutt City, Porirua City, Kapiti Coast District
Tauranga	Tauranga City, Western Bay of Plenty District
Hamilton	Hamilton City, Waikato District, Waipa District
Nelson	Nelson City, Tasman District
Palmerston North	Palmerston North City, Manawatu District, Tararua District

Land valuation data for two types of residential properties – standalone dwellings (property type RD) and lifestyle blocks (property type LI) was sourced from CoreLogic (via MBIE). We then aggregated this data by Census meshblock and calculated the following summary measures:

- the number of residential properties in each meshblock;
- the average area of those properties (in hectares); and
- the average land value (in nominal dollars per hectare).

[126] Grimes and Liang (2009)

Valuations take place on a three-yearly cycle, but councils are not in sync with each other. The dates of the most recent valuations varied between 2013 and 2015. A small number of properties were also subsequently revalued – eg due to objections from land-owners. Rather than attempting to adjust valuations to account for land price inflation in different locations, we have controlled for differences in valuation years by including indicator variables for district councils.

A9.5.2 Measuring urban boundaries

In order to estimate the land price discontinuity at the rural-urban boundary, it is first necessary to establish *what* that boundary is. In Auckland, this is relatively straightforward, as the Auckland Unitary Plan establishes a rural-urban boundary that is intended to form the future edge of the city. In other cities, it is less straightforward as they have not established fixed rural-urban boundaries. Instead, urban boundaries are established by the extent of the existing urban-zoned land.

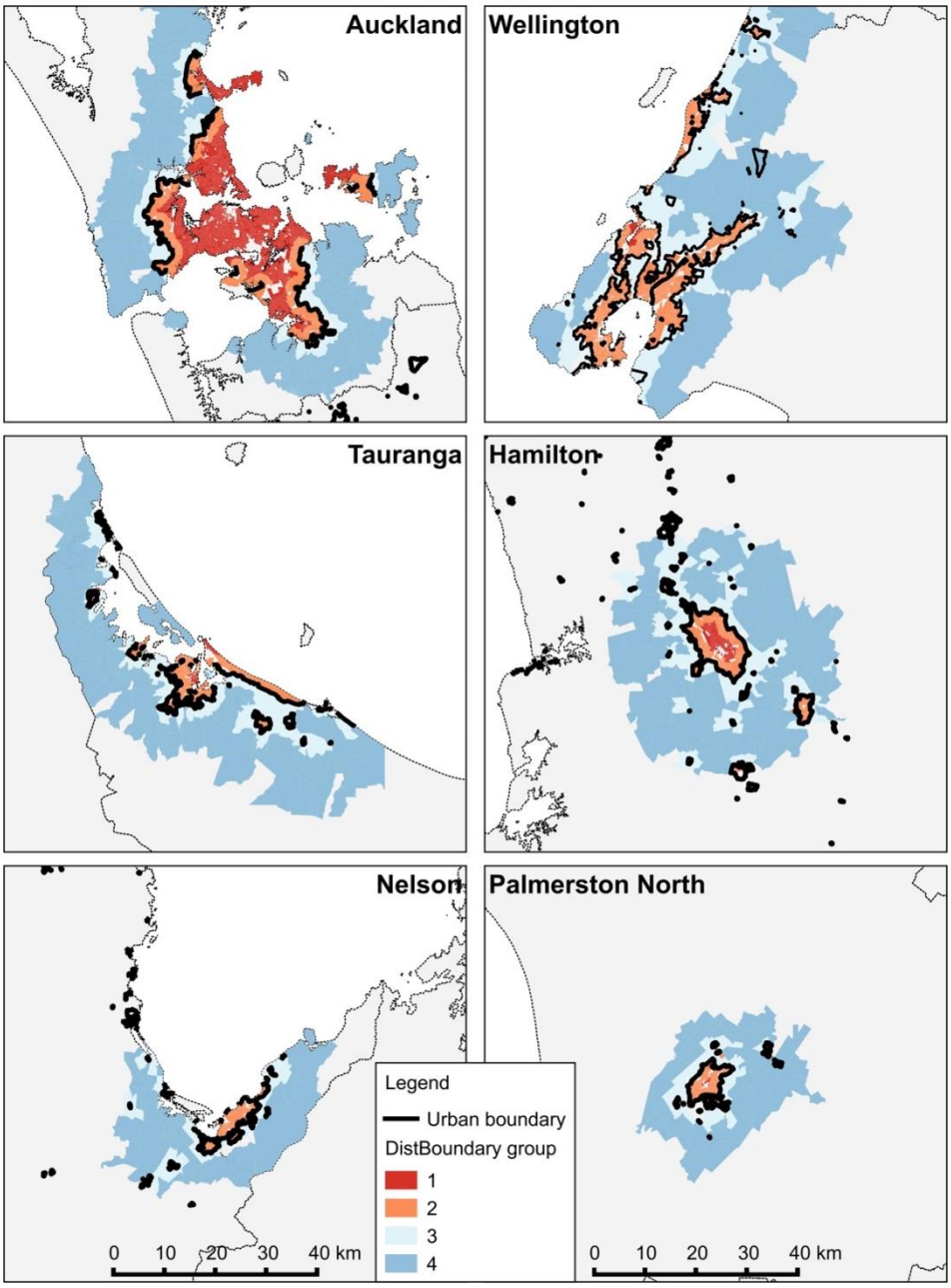
We identified the location of current rural-urban boundaries using district plans sourced from the sixteen councils included in the analysis. We used the most recent available district plans, accepting that in some cases aspects of these plans are still under review by RMA commissioners. We developed new spatial analysis tools (in R) to convert zoning maps into analytically tractable rural-urban boundaries, smoothing and simplifying zone boundaries to account for roads, rail reserves, and coastlines. The resulting urban boundaries are mapped in Figure 47.

After identifying current urban boundaries, we followed Zheng (2013)'s approach to categorising meshblocks according to the straight-line distance between the meshblock centroid (or property parcel centroid for sales records) and the urban boundary. After measuring this distance, we created a series of dummy (indicator) variables that reflect whether the meshblock is inside or outside the urban boundary, as summarised in Table 34.

Table 34 Variable descriptions – distance from boundary

Variable	Description
DistBoundary1	Land *inside* the urban boundary and located *more than 2km* away from the boundary
DistBoundary2	Land *inside* the urban boundary and located *less than 2km* away from the boundary
DistBoundary3	Land *outside* the urban boundary and located *less than 2km* away from the boundary
DistBoundary4	Land *outside* the urban boundary and located *more than 2km* away from the boundary

Figure 47 Urban boundaries in six New Zealand cities



In doing so, we note that some small cities have no land more than 2km from their urban boundary. This is unlikely to create any issues for analysis.

A9.5.3 Other control variables

It is also necessary to control for other determinants of land values, to the extent possible. Table 35 describes the key control variables to measure, and the rationale for adopting them. This selection of variables is informed by the approaches of Grimes and Liang (2009) and Zheng (2013).

Table 35 Control variables and rationale

Variable	Description and rationale
DistCBD	Distance in metres to the centre of the urban area – proxied by town hall location. Can be measured either for meshblock centroids or individual property sales records. This variable controls for locations' accessibility to employment and amenities, which tend to be higher near the middle of the city.
DistCentres	In Auckland and Wellington, which are large polycentric cities, we also measured the straight-line distance in metres to a number of sub-regional centres. In Auckland, we measured the distance to ten metropolitan centres designated in the Auckland Unitary Plan – Takapuna, Albany, Westgate, Henderson, New Lynn, Newmarket, Sylvia Park, Botany, Manukau, and Papakura – as well as three rural centres that were within a reasonable distance of the main urban area – Orewa, Kumeu, and Beachlands. In Wellington, we measured the distance to the two sub-regional centres designated in the Wellington City District Plan – Kilbirnie and Johnsonville – as well as the main commercial centres of Hutt City, Upper Hutt, Porirua City, and Kapiti Coast (Paraparaumu).
DistCoast	Distance in metres to the nearest coastline (or major lake, where applicable). Can be measured either for meshblock centroids or individual property sales records. This variable controls for locations' accessibility to natural amenities in the form of beaches and coastlines
TA	Dummy variables for the territorial authority that the meshblock (or property sale) is located in This variable controls for variations in local property taxes (rates), infrastructure provision, regulatory approaches, and also different valuation dates between adjacent councils. In Hamilton, the urban boundary exactly coincides with the edge of TA boundaries. In this case, it may be necessary to estimate alternative models with and without the TA variables, with the understanding that the true value of the price discontinuity will lie between the values from the alternative models.
Income01	Median household income within the Census meshblock, measured at the 2001 Census This controls for areas' amenity levels and demographic characteristics – eg the fact that higher-income households will tend to "sort" themselves into higher-amenity areas. Following Grimes and Liang (2009), we measure it in an earlier year to minimise endogeneity problems.
PopDen01	Population density in within the Census meshblock, measured at the 2001 Census. This controls for areas' pre-existing level of development and demographics. Following Grimes and Liang (2009), we measure it in an earlier year to minimise endogeneity problems.

A9.5.4 Modelling the impact of urban boundaries on land valuations

In the first stage, we model land valuations, aggregated to 2013 Census meshblocks, as a function of distance to urban boundaries and the control variables specified above. The model described here is estimated on a city-by-city basis. It provides more robust evidence of boundary discontinuities than descriptive statistics alone.

This model allows us to determine whether land immediately inside a city's urban boundary (DistBoundary2) is valued more highly than land immediately outside the boundary (DistBoundary3), after other determinants of value (eg distance to the centre or coast) are taken into account.

We adapt the approaches of Grimes and Liang (2009) and Zheng (2013), testing two regression models with and without demographic controls. The purpose of the demographic controls is to control for the influence of localised amenities and other determinants of prices – eg areas with better amenities may attract higher-income people, all else being equal.

Equation 1: OLS Model 1: Without demographic controls

$$\log(LV_i) = \beta_0 + \beta_1 * DistBoundary1_i + \beta_2 * DistBoundary2_i + \beta_3 * DistBoundary3_i + \beta_4 * DistBoundary4_i + \beta_5 * \log(DistCBD_i) + \beta_6 * \log(DistCoast_i) + \sum_k \delta_k * TLA_i^k + \varepsilon_i$$

Equation 2: OLS Model 2: With demographic controls

$$\log(LV_i) = \beta_0 + \beta_1 * DistBoundary1_i + \beta_2 * DistBoundary2_i + \beta_3 * DistBoundary3_i + \beta_4 * DistBoundary4_i + \beta_5 * \log(DistCBD_i) + \beta_6 * \log(DistCoast_i) + \beta_6 * \log(Income01_i) + \beta_7 * \log(PopDen01_i) + \sum_k \delta_k * TLA_i^k + \varepsilon_i$$

Where LV_i is the average land value ($/ha) in meshblock i, and all other variables are as described above. Note that many variables have been log-transformed to normalise them. The β and δ terms are coefficients to be estimated in the model, and ε_i is a random error term with mean zero.

In Auckland and Wellington, we also included controls for distance to sub-regional centres, specified using the same approach as the DistCBD variables. Conversely, in Hamilton and Palmerston North, which are both inland cities, we excluded the DistCoast variable.

We began by estimating these models using an ordinary least squares (OLS) model with heteroscedasticity-robust standard errors. After testing these models for spatial dependence (correlations between the error terms in neighbouring meshblocks, which violate OLS modelling assumptions) using Moran's I, we re-estimated them using spatial error models, which decompose the error term as follows:

Equation 3: Decomposition of error terms in a spatial error model

$$\varepsilon_i = \lambda W_{ij} \varepsilon_j + \xi_i$$

where ε_j is a vector of error terms for $j \neq i$, weighted using spatial weights matrix W_{ij} based on a selected definition of neighbouring meshblocks, λ is the spatial error coefficient, ξ_i is a vector of uncorrelated error terms, and $j=1,2,\ldots,n$, $j \neq i$ are index values for meshblocks. As we are undertaking this analysis at the meshblock level, we have defined the "neighbourhood" for each individual meshblock as all meshblocks that share a boundary with a given meshblock.[127]

The first approach is probably more appropriate given the format of the data.

[127] Another approach, which is demonstrated in Grimes and Liang (2009), is to measure the distance between all meshblocks and weight neighbours based on their proximity.

A9.5.5 Using property sale data as a robustness check

As a robustness check on results based on land valuations, we recommend also modelling the impact of urban boundaries on prices for residential properties that are actually bought or sold. The aim of this analysis is to ensure that the results from the first model (of land values) do not simply reflect the assumptions made by valuers.

If the coefficients on the DistBoundary variables in this model exhibit the same sign and statistical significance as the coefficients from the previous model, then it suggests that the observed boundary discontinuity is a "real" phenomenon rather than an artefact of valuation methodologies.

The model used to test this is similar to the one used above, except that it includes additional control variables for dwelling characteristics. This model should be applied to sales of detached houses (property type RD) and lifestyle blocks (property type LI) that were sold in the same calendar year as the ratings valuation was conducted.

Equation 4: Proposed OLS model for robustness checks using property sales data

$$\begin{aligned}\log(Price_i) = {} & \delta_0 + \delta_1 * DistBoundary1_i + \delta_2 * DistBoundary2_i + \delta_3 * DistBoundary3_i \\ & + \delta_4 * DistBoundary4_i + \delta_5 * \log(DistCBD_i) + \delta_6 * \log(DistCoast_i) + \delta_6 \\ & * \log(Income01_i) + \delta_7 * \log(PopDen01_i) + \delta_8 * \log(Land_i) + \delta_8 \\ & * \log(Floorspace_i) + \delta_9 * \text{Age}_i + \delta_{10} * \text{Condition}_i + \delta_{11} * \text{Garage}_i + \delta_{12} \\ & * \text{View}_i + \delta_{13} * \text{Type}_i + \sum_k \delta_{13+k} * TLA_i^k + \varepsilon_i\end{aligned}$$

Where Price_i is the sale price for dwelling i, and all other variables are as described above. Note that many variables have been log-transformed to normalise them. The δ terms are coefficients to be estimated in the model, and ε_i is a random error term with mean zero.

Note that this model also includes the following variables controlling for dwelling characteristics (Table 36).

Table 36 Variable descriptions

Variable	Description
Land	Land area (either in hectares or square metres) of the residential property
Floorspace	Floor area (in square metres) of the residential property
Age	An indicator variable for the decade that the building was constructed
Condition	An indicator variable for the condition of the building's walls and roof
Garage	An indicator of whether or not the dwelling has a garage. May be expressed as two separate variables – one for freestanding garages and one for garages under the main roof.
View	An indicator variable of whether the dwelling has a sea view, land view, or no view at all.
Type	An indicator of the property type – ie detached house (RD) or lifestyle block (LI).

As above, this model can be extended to include variables for distance to sub-regional centres in Auckland and Wellington, and simplified to exclude the DistCoast variable in inland cities Hamilton and Palmerston North.

Begin by estimating this model using an ordinary least squares (OLS) model with heteroscedasticity-robust standard errors. Then estimate it using a spatial error model, which decomposes the error term as follows:

$$\varepsilon_i = \lambda W_{ij}\varepsilon_j + \xi_i$$

where ε_j is a vector of error terms for $j \neq i$, weighted using spatial weights matrix W_{ij} based on a selected definition of neighbouring properties, λ is the spatial error coefficient, ξ_i is a vector of uncorrelated error terms, and $j=1,2,\ldots,n$, $j \neq i$ are index values for property sales.

The recommended approach to defining a neighbourhood for residential property sales is to define neighbours as those within a short straight-line distance of the property, approximating the walking catchment around each property. Following Nunns et al (2015), we recommend using a distance of 1.25km, which roughly approximates a 15-minute walk.

A9.6 Estimating land development costs

To estimate land development costs, we drew on two BRANZ reports on the cost of new house construction, which provide data on costs in a number of locations around New Zealand.[128] We supplemented this with information on three subdivisions in south Auckland and the northern Waikato from a subdivision company.[129] According to these sources, land development costs include:

- Siteworks and infrastructure, eg earthworks, electrical infrastructure, landscaping;
- Professional fees, eg infrastructure design and quantity surveying;
- Subdivision resource consents; and
- Development and financial contributions for network infrastructure – in principle, these should reflect a large share of network infrastructure costs, but in practice the degree to which they do so will depend upon individual councils' pricing policies, especially for water and wastewater infrastructure where there are large variations in council practices.

Table 37 summarises this data on land development costs. On a per-section basis, land development costs range from $63,525 (Northland) to $386,608 (Queenstown). Average subdivision costs were highest in Queenstown by a considerable margin. They were also higher, on average, in Auckland than in the Waikato, Hawkes Bay, or Wellington.

[128] Page I (2008) New house price modelling. BRANZ Study Report 196(2008); Page I and Curtis M (2013) New house price model update at April 2013. BRANZ Project Report E626.
[129] The Surveying Company (2016) Personal communication with John Gasson. 1 August 2016.

According to a personal communication with John Gasson (The Subdivision Company), variations in land development costs per section are more likely to reflect councils' development contributions policies and local terrain, rather than variations in lot size:

> "Construction costs, engineering design, engineering observation and engineering completion varies from location to location. These can be considerably higher where topographical restraints are limiting and the land is steeper. The earthworks volumes in these areas significantly increase… Another limiting factor is areas prone to flooding or areas within a 1 in 100 year storm event area. These areas require full stormwater catchment analysis and hydraulic analysis which adds time and cost to the subdivision… Furthermore, deeper top soil depths within the Pukekohe area can often mean that the foundations for building houses can be $5,000 to $10,000 more expensive than other areas.
>
> "The main difference [between council areas] is purely the financial contributions and development contributions. For example, the development contributions in the Waikato District Council area are approximately $15,000 plus GST cheaper per additional lot than they are in the Auckland Council area.
>
> "Generally speaking the costs for subdivision of lots between 300sqm to 1,000sqm are very similar. This means that the price per lot is approximately the same. However, once you get lots less than 300sqm then the cost to subdivide each additional lot can decrease by up to 10 to 20%. Furthermore at the other end of the spectrum rural residential lots in excess of 2,500sqm can also be increased by 20 to 30% per lot. The reason for this is the distance for infrastructure is reduced for small lots and in turn increased for larger lots."

In light of this, it is more appropriate to address land development costs on a per-site basis rather than a per-square metre basis. This could be done by estimating the average land area of residential parcels immediately inside cities urban boundaries. For instance, if residential parcels within 2km of the edge of a city had an average size of 500m^2, then it would indicate that converting 1 hectare of rural land to residential land would require developers to incur land development costs for twenty sections.

There is significant variation in per-section costs between different regions. We suggest that a conservative approach would be to use the weighted Auckland land development costs of $120,000 per site as a baseline for estimating costs in locations with high development contributions, and the range observed in locations – $80,000-$100,000 per site – for estimating costs in locations with low development contributions.[130]

Table 37 Land development costs for 17 subdivisions

Location	Dwellings	Average site area (m^2)	Land development costs ($)	Average land development costs ($/m^2)

[130] The Productivity Commission (2012) provides some data on development contributions in some urban councils, suggesting that contributions are generally higher in Tauranga and Auckland than in Hamilton and Christchurch.

Location	Dwellings	Average site area (m^2)	Land development costs ($)	Average land development costs ($/$m^2$)
Auckland - North Shore (1)	24	2152	$113,753	$53
Auckland - North Shore (2)	22	230	$98,973	$430
Auckland - Pukekohe (3)	41	1000	$124,154	$124
Auckland - Pukekohe (3)	33	1000	$130,584	$131
Hawkes Bay (1)	149	500	$74,388	$149
Hawkes Bay (1)	128	500	$65,887	$132
Hawkes Bay (2)	26	338	$75,784	$224
Northland (1)	56	761	$63,525	$83
Queenstown (1)	89	900	$149,044	$166
Queenstown (1)	15	1400	$268,368	$192
Queenstown (1)	18	2500	$286,594	$115
Queenstown (1)	10	1200	$386,608	$322
Queenstown (1)	95	800	$89,070	$111
Southland (1)	70	800	$67,154	$84
Waikato - Tuakau (3)	21	650	$95,565	$147
Waikato (2)	71	162	$75,952	$469
Wellington (1)	170	500	$63,909	$128
Weighted average		**694**	**$93,539**	**$135**

Source: (1) Page (2008); (2) Page and Curtis (2013); (3) The Surveying Company (2016). All costs inflated to 2015Q4 dollars using Statistics New Zealand's Capital Goods Price Index for Land Improvements.

Annex: Affordability Indicators

A10 House price to income

A10.1 Description

The annual lower quartile house price within a given territorial authority divided by the median household income for that area.

A10.2 Interpretation

This indicator measures the affordability of purchasing a house at the 'lower end' of the market for those households on 'middle level' incomes. This would best reflect house price affordability for would-be home owners and/or first home buyers with limited access to capital. It could be measured over time or across territorial authorities.

A10.3 Data Availability

House price data can be retrieved from a QVNZ and median incomes by territorial authority can be found from Statistics NZ (Table 38). Time series income data by territorial authority are available from the Linked Employer-Employee Data (LEED) and only at the individual level, rather than by household. Other sources of income data include the Household Economic Survey (HES), but to convert LEED data into household income, we divide 2013 household income (from the 2013 Census) by the 2013 median individual income for each individual area. The resulting values represent an 'individual income to household income multiplier' and can then be applied to each respective area's annual individual income to yield an estimate of annual household income. MBIE's access to IRD data may be helpful in order to obtain more reliable household income data by territorial authority.

Table 38 Data sources

Data	Source	Location
Lower quartile house price	QVNZ	QVNZ
Individual earnings	Statistics NZ	NZ.stat[131] *LEED > 1-way > LEED by territorial authority > Median earnings of continuing jobs*
Household income	Statistics NZ	Statistics NZ Quickstats about income[132] *> 2013 Census QuickStats about income – tables > Table 32*

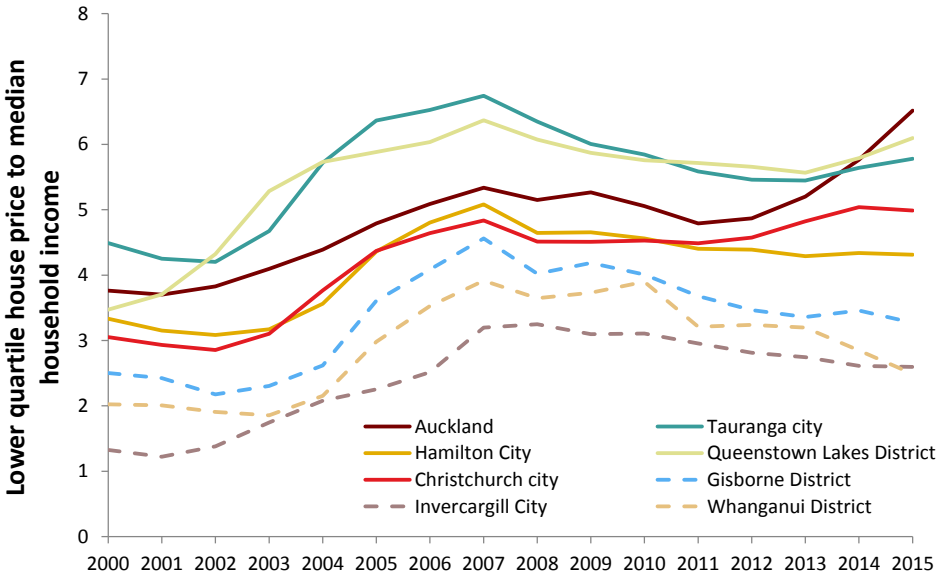
A10.4 Examples of use

Figure 48 shows lower quartile house price to median household income in selected high growth areas (solid line) and non-high growth areas (dotted line). From 2000 to 2010, lower quartile house prices to household income were much the same for all areas represented in the figure: worsening affordability (ie increasing ratio) until 2007-08 when affordability began to improve (ie declining ratio). Recently, however, high growth areas have experienced a noticeable worsening in affordability, whereas non-high growth areas have continued their steady improvement in lower quartile housing affordability.

[131] http://nzdotstat.stats.govt.nz/wbos/Index.aspx

[132] http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-income.aspx

Figure 48 Lower quartile house price to median household income 2000-2015



Source: QVNZ & LEED

A11 Mortgage payments to income

A11.1 Description

The annual mortgage repayments on a median priced house divided by the median household income. Annual mortgage repayments might be estimated on the following assumptions:

- a 100% mortgage (zero deposit);
- a 30 year loan repayment period; and
- average of the 2 year fixed and floating mortgage rate.

A11.2 Interpretation

This indicator measures the affordability of purchasing a house given two key contributing factors: household income and the prevailing interest rate. This indicator is most relevant to first home buyers who tend to use a relatively small deposit and a longer repayment period to ease the financial burden of purchasing a home. Although the assumption of a 100% mortgage is unrealistic currently, it provides a means of measurement consistency.

A11.3 Data availability

Data are retrieved from a variety of sources as shown in Table 39. House price data by territorial authority can be purchased from QVNZ. Time series income data by territorial authority are available from the Linked Employer-Employee Data (LEED) and only at the individual level, rather than by household. Other sources of income data include the Household Economic Survey (HES), but to convert LEED data into household income, we divide 2013 household income (from the 2013 Census) by the 2013 median individual income for each individual area. The resulting values represent an 'individual income to household income multiplier' and can then be applied to each respective area's annual individual income to yield an estimate of annual household income. MBIE's access to IRD data may be helpful in order to obtain more reliable household income data by territorial authority.

Table 39: Data sources

Data	Source	Location
Median house price	QVNZ	QVNZ
Mortgage rates	RBNZ	RBNZ Statistics[133] *Key graphs > Mortgage rates > Average of 2 year fixed and floating rates*
Individual earnings	Statistics NZ	NZ.stat[134] *LEED > 1-way > LEED by territorial authority > Median earnings of continuing jobs*
Household income	Statistics NZ	Statistics NZ Quickstats about income[135] *> 2013 Census QuickStats about income – tables > Table 32*

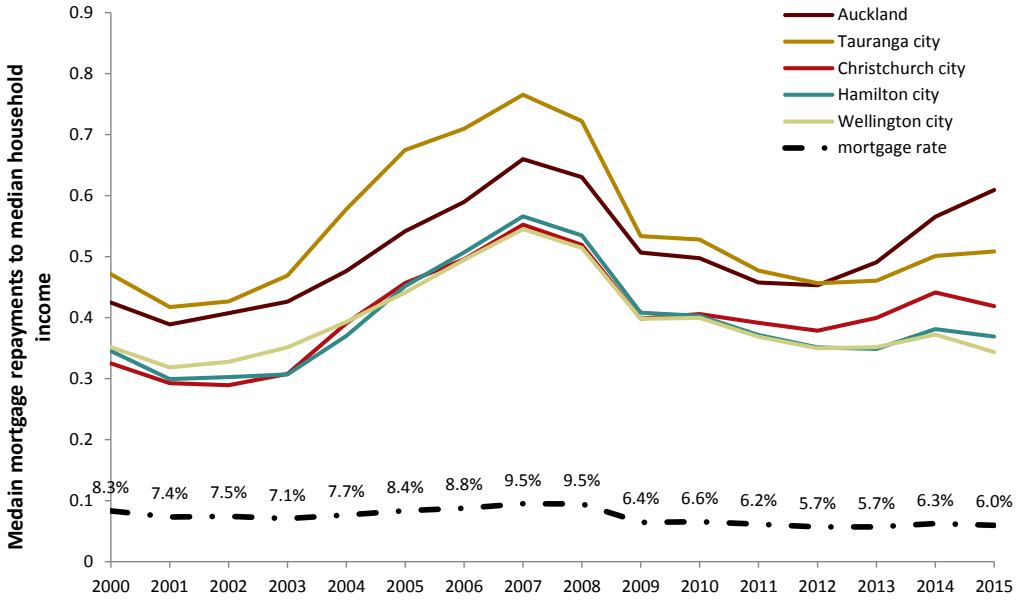
[133] http://www.rbnz.govt.nz/statistics/key-graphs/key-graph-mortgage-rates
[134] http://nzdotstat.stats.govt.nz/wbos/Index.aspx
[135] http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-income.aspx

A11.4 Examples of Use

Indicator values can be used to monitor the relative affordability over time or between areas. However, there are insufficient data for an absolute measure of affordability. The suggested indicator uses a 0% deposit assumption, for example, whereas many purchases will have at least some deposit.

Figure 49 illustrates changes in the ratio of mortgage repayments to income over time for a select number of areas. Although current house prices are at an all-time high in most of these areas, low mortgage rates have improved house price affordability relative to previous years.

Figure 49 Ratio of annual mortgage repayments to annual household income 2000-2015



Source: QVNZ, Reserve Bank of New Zealand and Statistics NZ

A12 Rent payments to income

A12.1 Description

Mean annual rent payments divided by median annual household income.

A12.2 Interpretation

This indicator measures the affordability of renting a home. It might be measured over time or across territorial authorities. For comparability reasons, median rent values may be preferred to mean rent values, however median rent data is not available. Despite this, a Statistics NZ[136] rental affordability report shows little difference between median and mean rent values and that both have tracked identically over time.

A12.3 Data availability

Rent data by territorial authority are held by the MBIE whereas income data are publicly available through Statistics NZ (Table 40).

Time series income data by territorial authority are only available from the Linked Employer-Employee Data (LEED) and only at the individual level rather than by household. Other sources of income data include the Household Economic Survey (HES), but to convert LEED data into household income, we divide 2013 household income (from the 2013 Census) by the 2013 median individual income for each individual area. The resulting values represent an 'individual income to household income multiplier' and can then be applied to each respective area's annual individual income to yield an estimate of annual household income. MBIE's access to IRD data may be helpful in order to obtain more reliable household income data by territorial authority.

Table 40: Data sources

Data	Source	Location
Mean rent	MBIE	MBIE database (acquired through Tenancy Services)
Individual earnings	Statistics NZ	NZ.stat[137] *LEED > 1-way > LEED by territorial authority > Median earnings of continuing jobs*
Household income	Statistics NZ	Statistics NZ Quickstats about income[138] *> 2013 Census QuickStats about income – tables > Table 32*

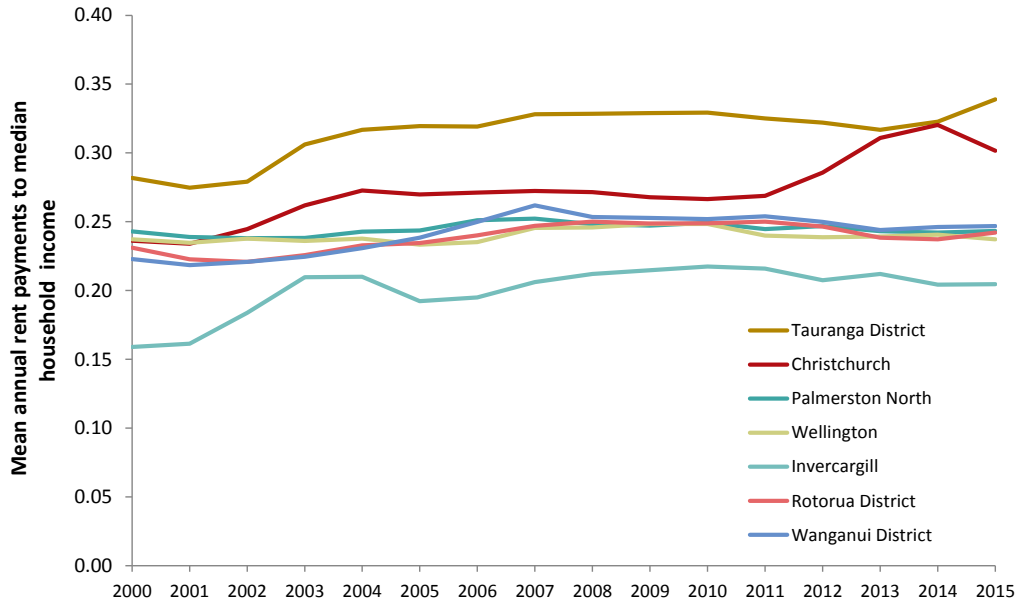
A12.4 Examples of Use

Figure 50 shows that mean rental payments to annual household income have been relatively constant for a number of New Zealand territorial authorities over the 2000 to 2015 period. The recent increase in rent payments to household income ratio for Christchurch can be explained by a reduced supply of rentals after the Canterbury Earthquakes; this resulted in rent price inflation. Canterbury incomes have remained

[136] Statistics New Zealand (2013). Rental affordability1998–2012: Regional distributions.
[137] http://nzdotstat.stats.govt.nz/wbos/Index.aspx
[138] http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-income.aspx

relatively unaffected by this shock and have not wavered from the pre-earthquake trend.

Figure 50 Ratio of mean annual rent payments to annual household income 2000-2015



Source: MBIE and Statistics NZ