STUDY REPORT

SR 247 (2011)

Cost Efficiencies of Standardised New Housing

I C Page and J Fung

The work reported here was funded by BRANZ from the Building Research Levy.

ISSN: 1179-6197

Preface

The New Zealand house building industry is characterised by quite small-scale builders, with an estimated 60% of all new housing being built by builders constructing less than seven houses per year. Most of these small builder houses are one-offs i.e. designed to incorporate specific requirements of the owner. Larger builders tend to erect more “standardised” designs, which can be “customerised” to a great or lesser extent. These group builder homes tend to have a lower cost than one-offs. This report identifies the costs savings with standard design and the design features to be avoided that can increase costs.

Acknowledgments

This work was funded by the Building Research Levy.

Note

This report is intended for new house owners, designers and builders. The various types of housing firms are discussed, and the variations in costs between firms and regions. A survey of builders identified design features that add to costs and hence give a guide about which specific features should be avoided if possible.

Cost Efficiencies of Standardised New Housing

BRANZ Study Report SR 247

I C Page and J Fung

Reference

Page IC and Fung J. 'Cost Efficiencies of Standardised New Housing'. *BRANZ Study Report 247.* BRANZ Ltd, Judgeford, New Zealand.

Abstract

This report examines the efficiencies involved in the use of "standardised" designs compared to "one-off" designs for new detached housing. The firm size structure of the house building industry is analysed and compared to the types of house the different groups build and their prices in $ per square metre ($/sqm) of floor area. Housing features that add to cost are identified via a survey of builders.

Contents Page

Figures Page

Tables Page

1. INTRODUCTION

This report examines the cost savings associated with standardisation in new housing, comparing construction costs with one-off designs. These savings arise in design and approval costs, reduced material waste and more efficient use of labour arising from construction repetition on adjacent sites.

Approximately 45% of detached new houses are believed to be one-off designs and built by small-scale builders. The other 55% are built by builders erecting more than one house per year and most have some measure of repetition. This project examines the cost differences between the two broad groups. It considers which features in typical houses add most to costs, thereby indicating how to design to save on costs.

2. MAIN RESULTS

Medium-sized house builders (arbitrarily defined as between eight to over 30 houses per year) were found to construct the cheapest houses on average. Their houses are approximately 8% cheaper than one-off designs, over a period covering mid-2009 to early 2010.

Large houses builders (>30 per year) have a slightly higher $/sqm rate than the medium-scale builders, possibly because of the costs and marketing advantages associated with having a national franchise and the ability to target a higher quality market. Their prices are approximately 3% higher than the medium-sized builder.

The savings in the medium and large builder groups arise though a combination of factors including repetition, material discounts for bulk purchase, well-organised sub-contractors, and selective design aspects.

The design aspect savings relate to using flat sites with good soil conditions, and wherever possible keeping to single storey and simple roof-lines.

The larger the builder the more standard plans they offer, on average. Within the standard plan limitations most builders allow significant client input, not only into fixtures (kitchen, bathroom fittings), but also interior layouts, and minor changes to external walls, as desired by the client. These changes do not appear to have significant cost penalties except at the bottom end of the market (i.e. for cheaper housing any changes may add a significant percentage to costs).

Variations after signing the contract are common and average about 4% on the original house price. This increase was near identical across all building firm sizes, both large-scale and small-scale builders. The changes mainly relate to fittings, floor coverings, kitchens and landscaping.

3. LITERATURE REVIEW

The literature on housing markets includes research into sub-markets, mostly for existing housing. In the wider economic literature an individual market is one where a “standard” product trades at a common price over a given time period. So for new housing a sub-market could be defined as a group of similar houses (in size and materials) that sell for a similar price (Watkins 2001). However there is no single

consistent definition of a sub-market in housing. Initial housing research (Palm 1978) identified sub-markets solely on the basis of location i.e. all houses within a particular area that look similar in appearance and sell for similar prices. Later authors (e.g. Watkins 2001; Bourassa and Hoesli 2003) have concluded that spatial and structural factors influence the definition of sub-markets. The first author finds that both factors need to be considered simultaneously for houses analysed in Scotland.

The second author undertook regression type analyses for the existing house market in Auckland using the Quotable Value database, which records a variety of characteristics affecting value. The paper used regression analysis and concludes that location at a quite detailed level is important for explaining sales prices, as well as other factors such as cladding type and condition, age, garaging, access, water views and a number of other factors. It is likely similar results would hold for new housing, namely location and structural characteristics of the house should affect the price but no research was found on this for New Zealand. This is briefly examined later using new housing characteristics and contract prices obtained from the BRANZ New Dwellings Survey.

Housing firm structure is often related to the type of new housing undertaken. It is believed in New Zealand smaller firms tend to undertake the one-off designed houses, while larger firms mostly build a limited range of house layouts, as discussed later. In many western countries, including New Zealand, the average firm size in the house building sector is low. An analysis (Buzzelli, 2001) for the North American market finds that there is no long-term trend toward market concentration, i.e. no trend toward larger firms.

While market concentration has occurred in other industries in North America there is no similar trend in house building. The paper postulated that market fragmentation may enable alternative firm sizes for the various sub-markets in the building sector. He asks the question: “Is the housing market fragmented such that different segments sustain alternative firm sizes?” However the paper does not answer this question and instead proposes further research on this and related questions.

Housing firm size trends for New Zealand are examined shortly and show similar results as in North America, namely no long-term trend toward firm concentration.

4. APPROACH

Three main methods were used for analysing the types of housing built by different firm sizes in New Zealand:

- building consent analysis
- postal surveys of builders
- case study interviews with selected builders.

Individual building consent data is available for value, floor area, location and builder’s name for most new detached houses. This was analysed to determine the distribution of costs and floor areas within and between firms. The aim is to determine if builders specialise within a narrow cost and floor area range, and how large builders differ from small-scale builders.

The postal survey covered cost factors for new housing, looking at the use of standard plans versus one-offs, material and sub-contractor arrangements, and what design aspects have most effect on costs.

The case studies interviewed a small number of the medium-sized builders on aspects identified in the postal survey, including how important firm size is in achieving cost

savings or market position, and what design features have a significant effect on building costs.

First, a brief analysis was done on firm size data from the Business Demographic Survey, and industry censuses (Statistics NZ).

5. DETAILED RESULTS

5.1 Firm size numbers

Statistics NZ has carried carry out an annual demographic survey of enterprises since 2000 and the results of industry employment by firm size are shown in Figure 1 and Figure 2. The 1979 and 1985 data are from construction industry censuses at the time. The lines in each pair of charts add to 100% for each year.

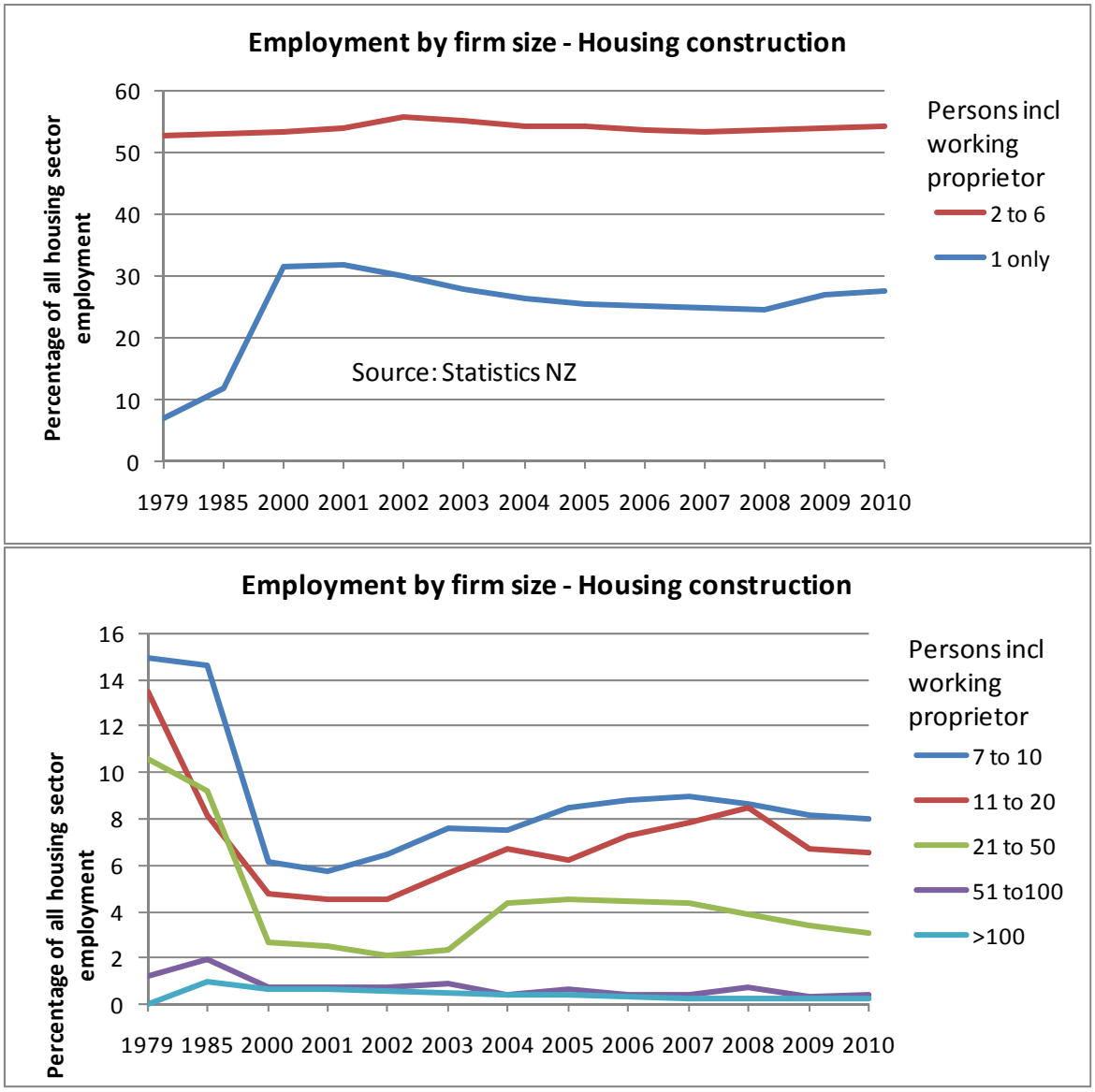


Figure 1. Housing construction employment by firm size

Figure 1 shows the distribution of persons engaged in house building by numbers of persons per firm. The vertical axis is the percentage of total employment in the sector. At present about 80% of employment is in firms six persons or less in size. During the upturn in new housing in the mid-2000s there was a slight decline in percentage employment in small firms and an increase in percentage employment in medium-sized firms i.e. in firms between seven to 20 persons. But this trend reversed as workloads declined in the late-2000s.

The main changes occur between 1979 and 2000. The all-time high for house building was in the mid-1970s and it appears that the industry was differently organised then with more medium to large firms (firms employing more than six persons) doing a greater proportion of the work. Over the next two decades there was a significant rise in one-person firms in the house building sector, and a drop in the proportion of medium-sized firms.

A similar trend is evident looking at numbers of firms by firm size. Figure 2 shows small firms (six or less persons engaged) are now over 96% of all firms in the sector, but in the 1970s and 1980s there were more medium-sized firms as a percentage of all firms.

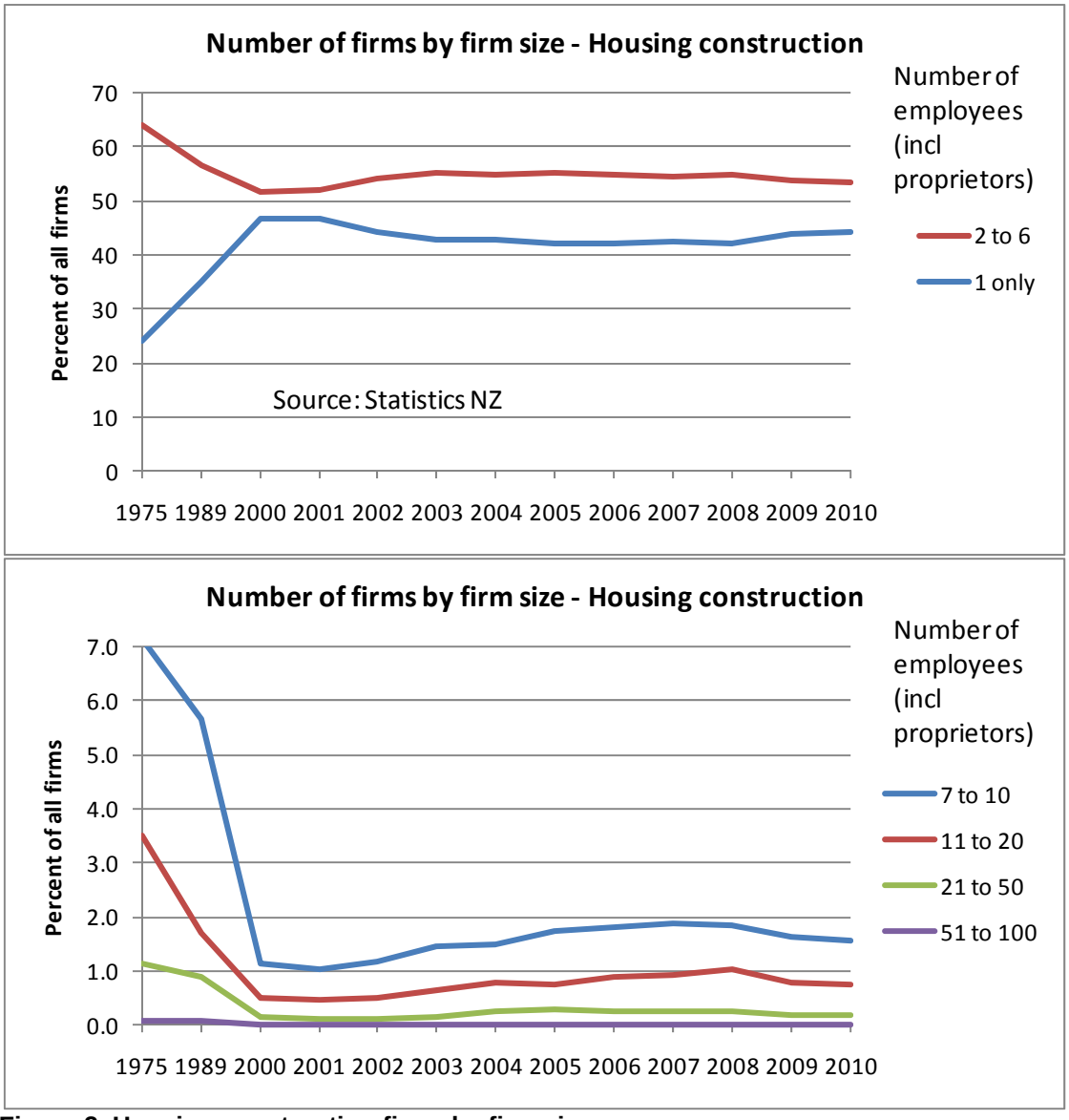


Figure 2. Housing construction firms by firm size

The average number of persons engaged in house building firms is low at around 1.50 persons and this includes working proprietors (see Figure 3).

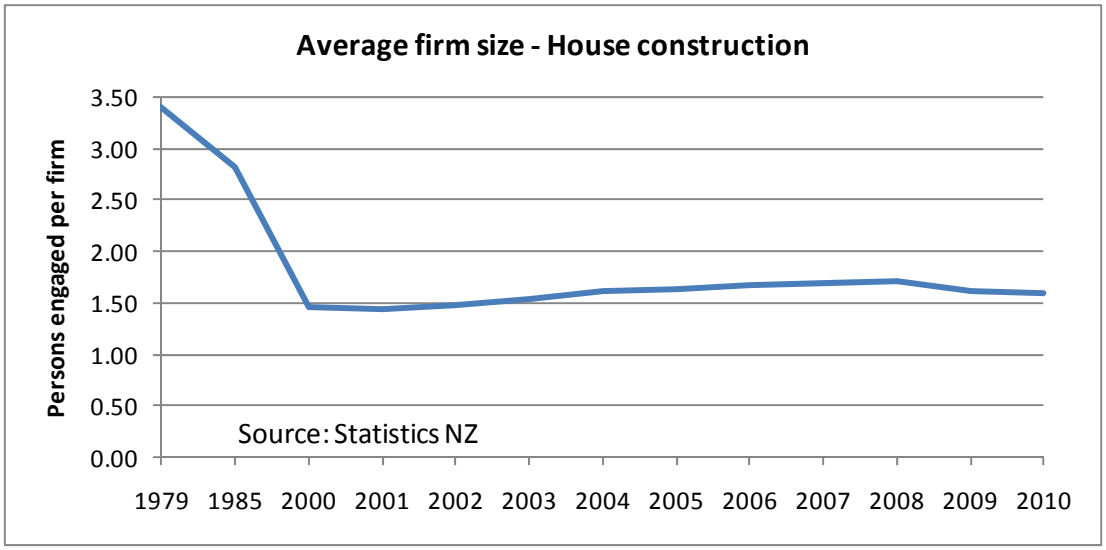


Figure 3. Average number of persons engaged per firm

The current small size of the typical house construction firm is due to a number of factors. The two main ones are ease of entry, and the cyclical nature of workloads. Entry and exit from the building industry is quite easy, in part because capital requirements are low and qualification barriers to entry are basically non-existent (shortly to change with the Licensed Building Practioners regime to be introduced in 2012).

Figure 4 shows the death rates of firms in the overall construction industry (i.e. all building and civil engineering). The rate is among the highest for all industry groups and is currently trending upward as workloads have declined in the last three years. In the same period one-person firms have increased as a percentage of all firms in the housing sector, indicating that as larger firms die some of the people from those firms form single-person operations.

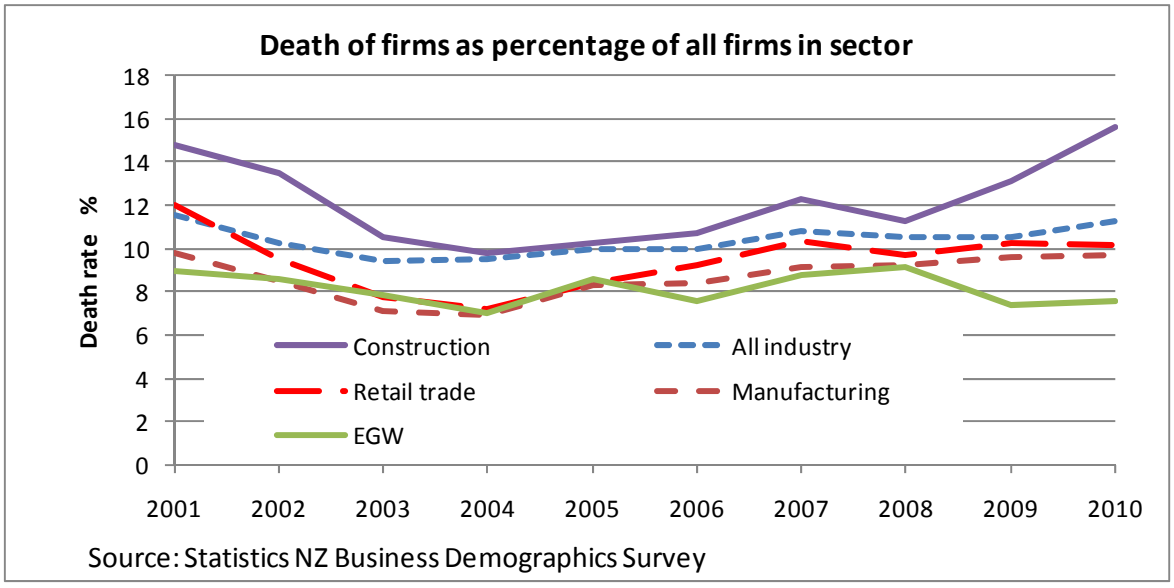


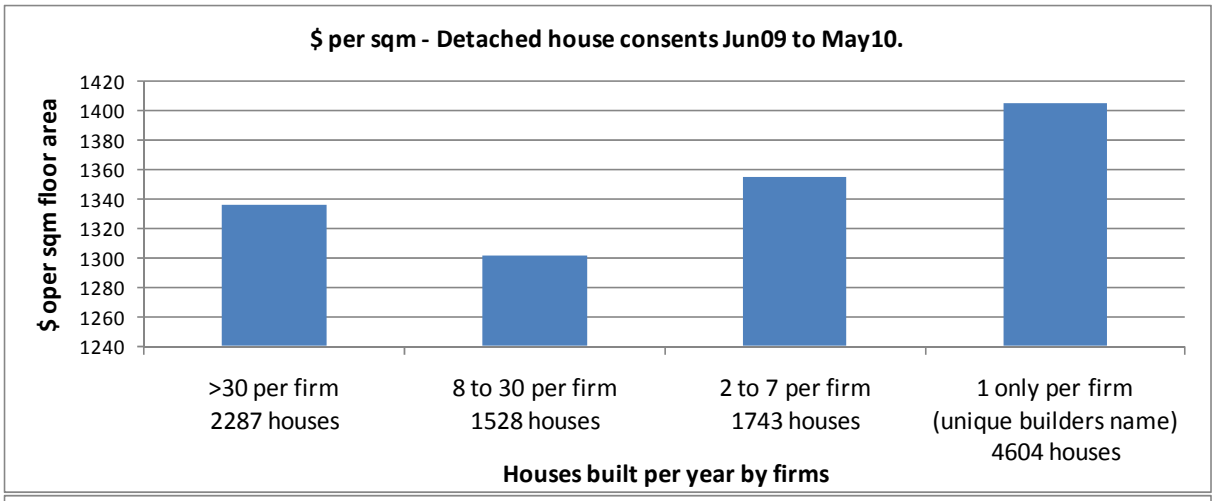
Figure 4. Firm death rates for selected industries

Figure 1 and Figure 2 suggest that most new housing is constructed by small firms of six persons or less. These firms account for about 80% of total employment in the house construction sector and approximately 80% of new housing. This is true as far as individual financial entities are concerned, but it is somewhat misleading. It does not allow for the prevalence of franchising, which is where financially independent small firms operate under a franchise banner in different regions. Franchises allow for more marketing power and economies of scale than is implied by the firm size analysis. The prevalence of franchising can be identified from building consent analysis.

5.2 Consent analysis

Annual numbers of houses constructed by building firms were examined using building consent data. The Whats-On dataset was used, which records consent values and floor areas as entered on the building consent application to the Territorial Authority (TA). The period covered was June 2009 to May 2010 and a total of 10,162 consents were analysed. Their coverage, and how representative they are of all consents, is discussed in the Appendix.

Figure 5 shows a summary of results by four firm size groups using houses per year as the metric. Regional franchises under the same banner were added together and are represented as one firm in the chart. About 23% of the houses in the dataset were built by "large" firms, arbitrarily defined as firms building more than 30 or more houses per year.



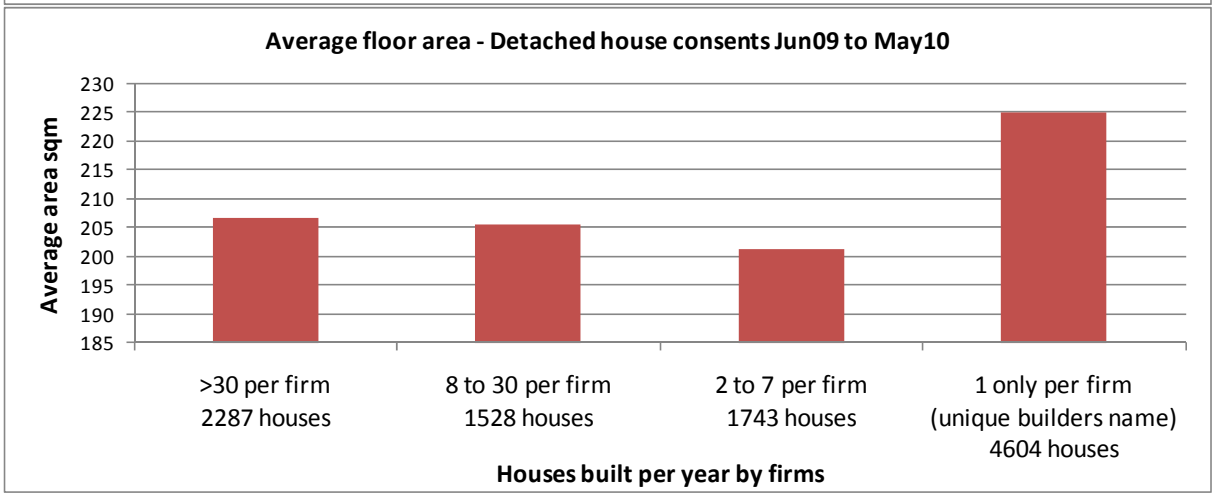


Figure 5. House sizes and $/sqm by firm size (houses per year)

The largest group in number are the one house per year firms. However, this is slightly confusing because it covers cases where owners have had the house designed but have not yet obtained a builder and the owner's name is entered in the builder field instead. About 85% of the one house per year group has the same builder's and owner's name. About 12% of the latter are "spec" houses where the builder has entered his/her name as the owner, so most are owners still looking for a builder.

It is believed most of these consents are for houses that have had significant design input and are mainly "one-off" designs rather than adaptations from standard plans used by the larger firms. Most of these are built by small-scale builders and they have quite high $/sqm rates.

The difference between the high and low values in Figure 5 for $/sqm is about 8% i.e. between a medium-sized firm of 8-30 houses per year and the small firm one-off designs.

The scatter plot of houses by cost ($/sqm) and floor area are shown in Figure 6 for the top 20 largest house builders, and in Figure 7 for the small-scale builders (i.e. one or two houses per year). It indicates a large range in $/sqm for similar-sized houses reflecting quality and regional cost differences. There is some concentration across the $1,500/sqm line, suggesting that some large builders base their pricing on this figure and owners choose a house size based on their budget and this $/sqm rate. Also in Tauranga most builders put in a rate very close to $1,500/sqm on their consent forms, suggesting they are using a standard rate mandated by the council.

The Appendix has similar charts for selected housing firms showing less variation within a firm, particularly those operating in one region.

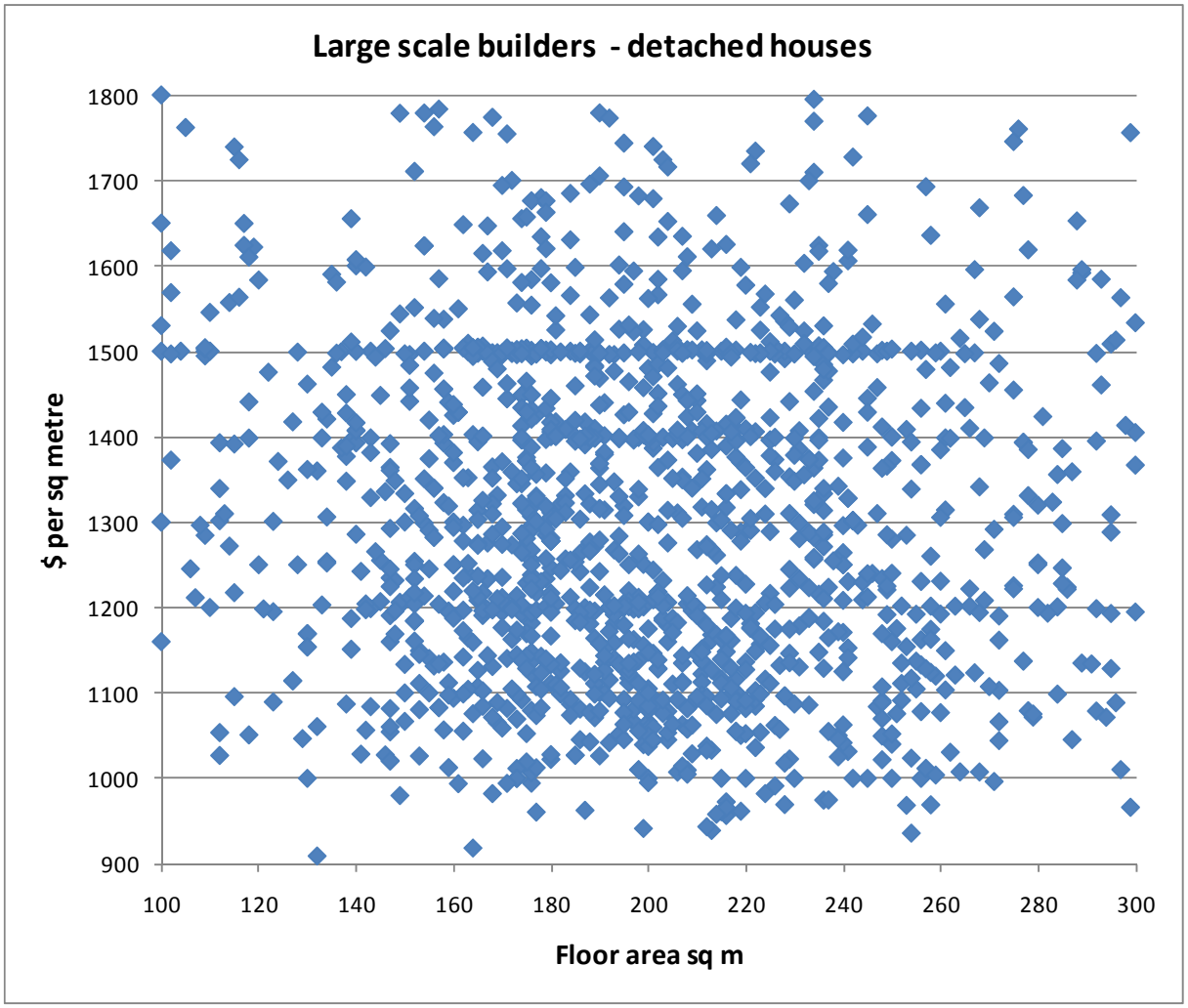


Figure 6. Top 20 builders scatter chart

Figure 7 (for small-scale builders) has a number of bands curving diagonally from top left to bottom right, which represent different house prices. The main bands, going from left to right are $150K, $200K, $250K, $300K, $350K and $400K. These are believed to be for consents where the owner/designer has applied for the consent based on the owner's budget (commonly rounded to $50,000), but the actual contract cost is not known. More often than not the consent estimate is below the final contract price after variations, so the actual percentage difference between one-off designs and the houses from the larger builders may be larger than the 8% estimated earlier.

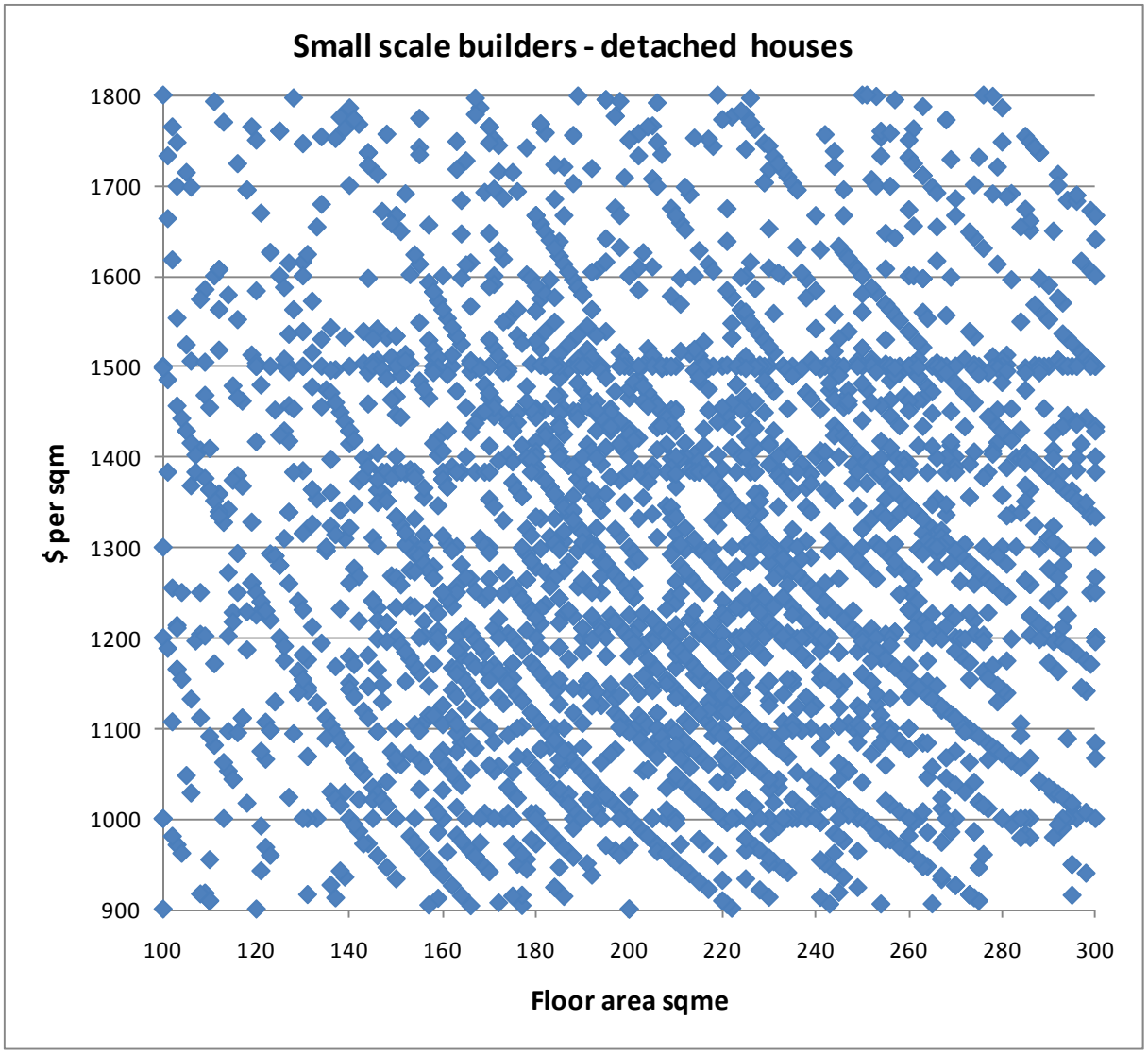


Figure 7. Small-scale builders scatter chart

5.3 Design and supply chain factors affecting house costs

Builders were surveyed on characteristics of their firm and design aspects affecting the cost of new housing. The postal survey form is the Appendix. The three main parts to the survey were:

- firm size and use of standard plans
- supply chain arrangements for materials and sub-contractors
- design aspects affecting costs.

Responses were received from 135 firms and most built more than one house per year (see Figure 8).

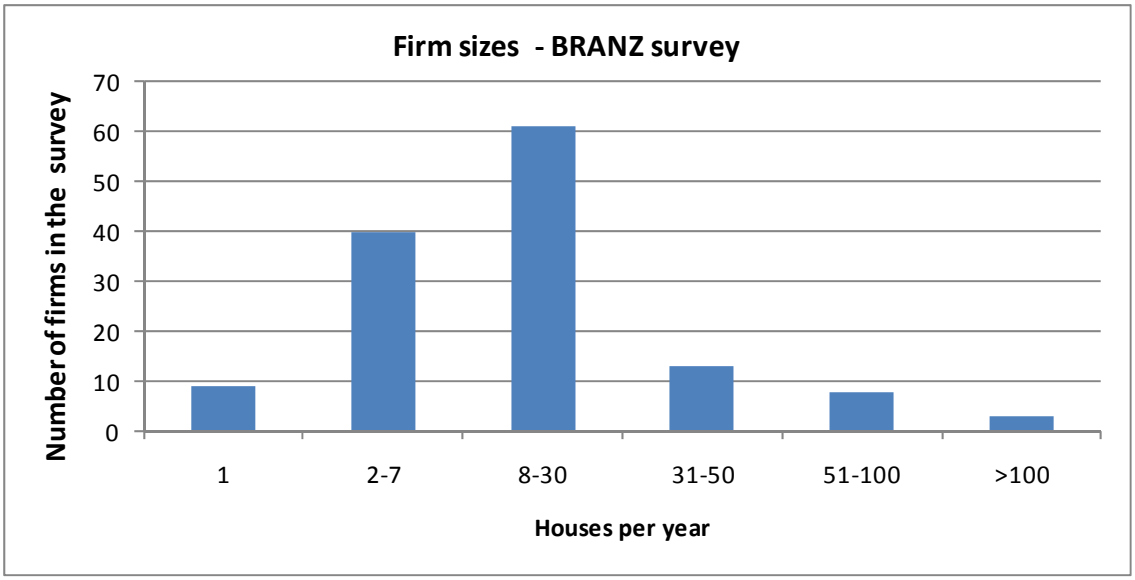


Figure 8. BRANZ survey of builders – number of responses by firm size

Table 1. Firm size by houses per year from BRANZ survey

FIRM SIZE Number of houses built per year by firm size		
# houses built per yr	% of firms in category	
1	14%	
2 to 7	35%	
8 to 30	29%	
30+	22%	
	100%	

5.3.1 Standard plans and cost variations

A significant proportion of builders have standard plans to show clients (see Table 2). Builders who have standard plans offer a large number on average (see Figure 9). There is no particular pattern between firm size and plans offered, except the small builders (less than eight houses per year) have few standard plans, presumably because they concentrate on off-offs. About 62% of small builders do not have standard plans.

Table 2. Standard plans used

Standard plans		
% firms which have standard floor plans to show clients		
	%	
Have plans to show	64%	
None	36%	
	100%	

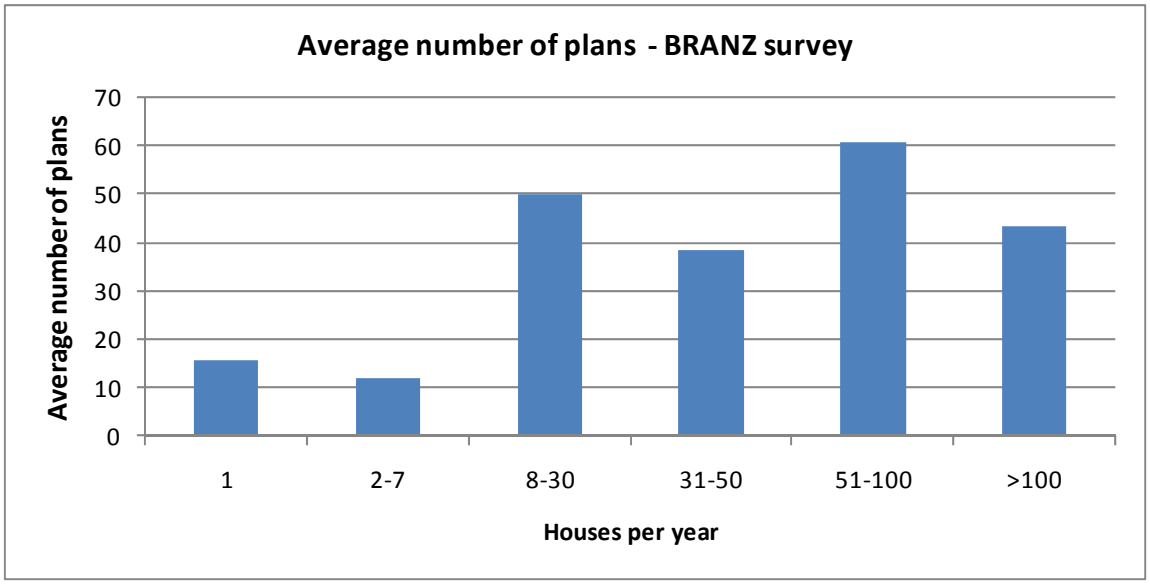


Figure 9. Number of standard plans by firm size

Despite the standardisation clients can make significant changes to these houses (see Table 3). As expected changes are permitted for kitchen and bathroom fittings and layout, but somewhat surprisingly changes to the external wall layouts are also permitted with these "standard" plans. The latter are believed to be minor shifting of an exterior wall rather than extensive changes to the building footprint.

The implication is that standard plans are used to show to clients to give them ideas about layouts and approximate costs, but that builders probably do not use exact repetition of layouts to achieve economies of production.

Table 3. Input by clients into standard plan houses

Inputs from clients into standard designs				
	Changes allowed from clients			
	None	Minor	Major	
		Percentage of firms		
External wall layout	9%	25%	67%	100%
Internal wall layout	8%	25%	68%	100%
Roof & Wall Claddings	11%	22%	67%	100%
Kitchen layout & appliances	7%	16%	77%	100%
Bathroom layout & fittings	9%	21%	70%	100%

Cost variations occur in most projects with only 11% having no change during the contract. The majority of the variations are below 5% (see Figure 10). It was postulated that one-off designs built by small firms would have higher cost escalation, but Figure 11 shows that the percentage variation is similar across all firm sizes.

Table 4. Cost variations by % increase

Cost Variations				
Contract variations after client contract sign-off				
	None	Minor	Major	
% of firms	11%	78%	12%	100%
How much are the total contract variations				
	under 5%	6 to 10%	11% or more	
% of firms	67%	30%	2%	100%

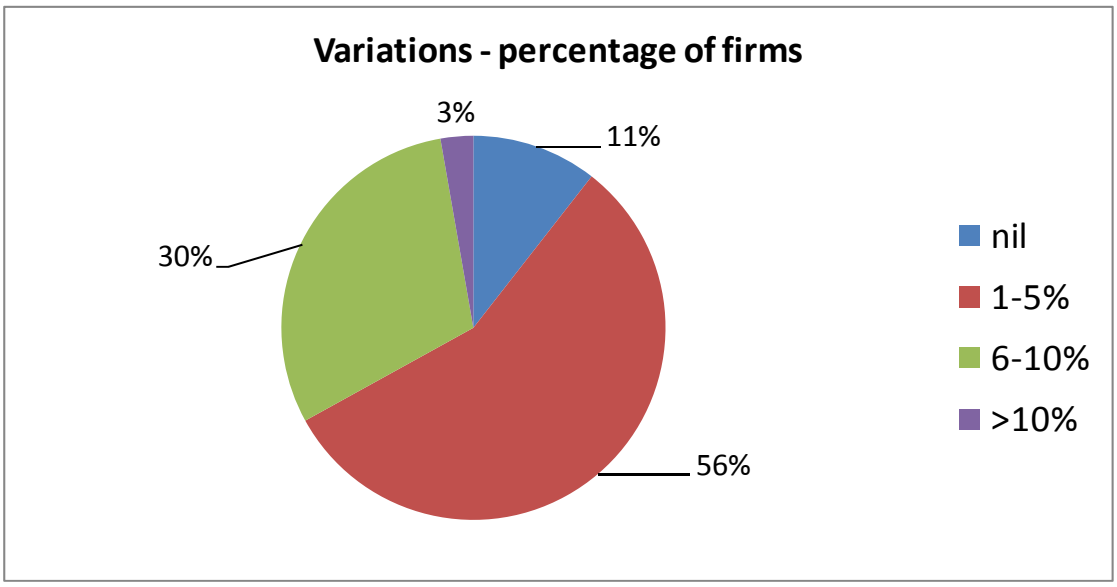


Figure 10. Cost variations by percentage increase

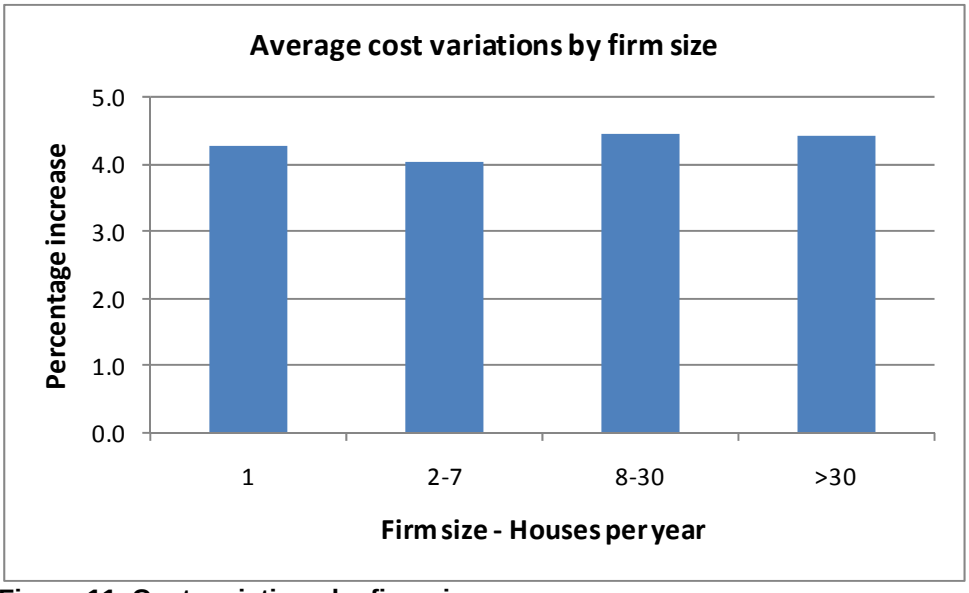


Figure 11. Cost variations by firm size

Builders were asked about the types of cost variations, and these are shown in Figure 12 below. Kitchen, floor coverings, appliances and fittings, and electrical fittings are the most common extras. Some variations involve significant alterations to the design such as a change to windows (size and location) and to the floor plan layout. Foundation variations are quite common and occur because foundation conditions are often undetermined until excavation begins. Others changes are related to finishing details (e.g. landscaping, appliances/fittings and painting) and represent either originally omitted items (landscaping) or aesthetic changes (e.g. painting).

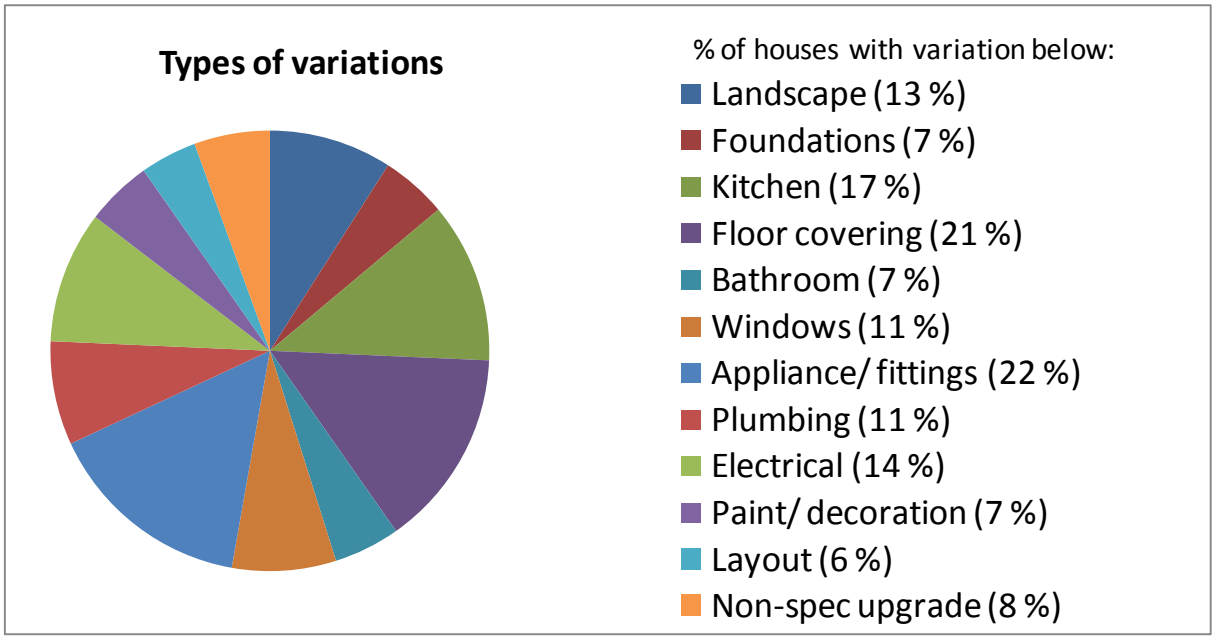


Figure 12. Types of cost variations in new housing

From the above it is concluded the use of standard plans does not significantly reduce the likelihood of increased cost variation.

5.3.2 Supply chain aspects

Builders were asked about the number of sub-contractors they use and the main results are in Table 5 and Figure 13. Builders are likely to used more than one sub-contract in the painting and roofing sub-trades than in other trades. The chart indicates that firms building less than 30 houses per year tend to have one or two sub-contractors for each trade. It is only the large firms that use more than two sub-contractors on average, probably as result of their regional spread and because sub-contractors do not generally operate outside their base region.

Table 5. Sub-contractors used by trade

SUB-CONTRACTORS USED					
	number of sub-contractor firms used last year				
	none	one	two	three or more	
	(1)	% of firms			
Foundation/slab placing	16%	45%	31%	9%	100%
pre-nail wall frames	11%	62%	19%	8%	100%
pre-nail roof trusses	7%	65%	21%	7%	100%
linings	26%	51%	18%	6%	100%
painters	4%	55%	26%	16%	100%
electricians	0%	72%	21%	6%	100%
scafolders	29%	60%	9%	2%	100%
roofers	6%	43%	34%	17%	100%
insulators	17%	68%	14%	1%	100%
plumbers	1%	67%	25%	7%	100%
brick/block layer	9%	56%	27%	9%	100%
kitchen	6%	60%	25%	10%	100%
(1) firms do work themselves, this % is a maximum with few not stating number					

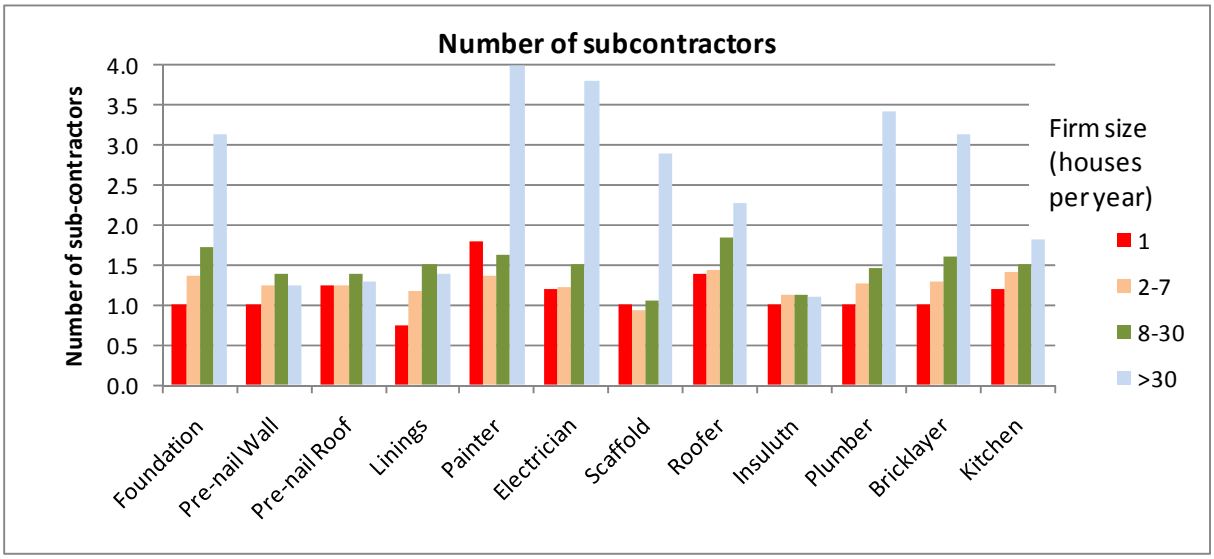


Figure 13. Number of sub-contractors used by firms

The number of material suppliers typically used by builders is also fairly small with only one supplier used for most products for the majority of firms. The exceptions are wall claddings and windows, which are often sourced from two or more suppliers during the year.

Table 6. Material suppliers used

MATERIAL SUPPLIERS USED				
	number of material suppliers used last year			
	one	two	three or more	
		% of firms		
Loose framing timber, finishing timber/mouldings	70%	25%	5%	100%
Engineered floor joists	80%	19%	1%	100%
Wall claddings	53%	22%	25%	100%
Windows	64%	30%	6%	100%
Insulation	80%	19%	1%	100%
Linings	83%	14%	3%	100%

The small builders tend to use one main sub-contractor for most trades, and even the large builders tend to remain with one or two sub-contractors and material suppliers. It is likely that it is simpler for builders to use one or two sub-contractors per trade, thereby reducing transaction costs. Because of their greater purchases the large builders are probably able to achieve better discounts for materials than the smaller builders, helping reduce their sale prices and/or increasing their profit margins.

5.3.3 Design factors affecting costs

The main design and site factors affecting the cost of new houses from the builders' responses are in Figure 14 and Table 7.

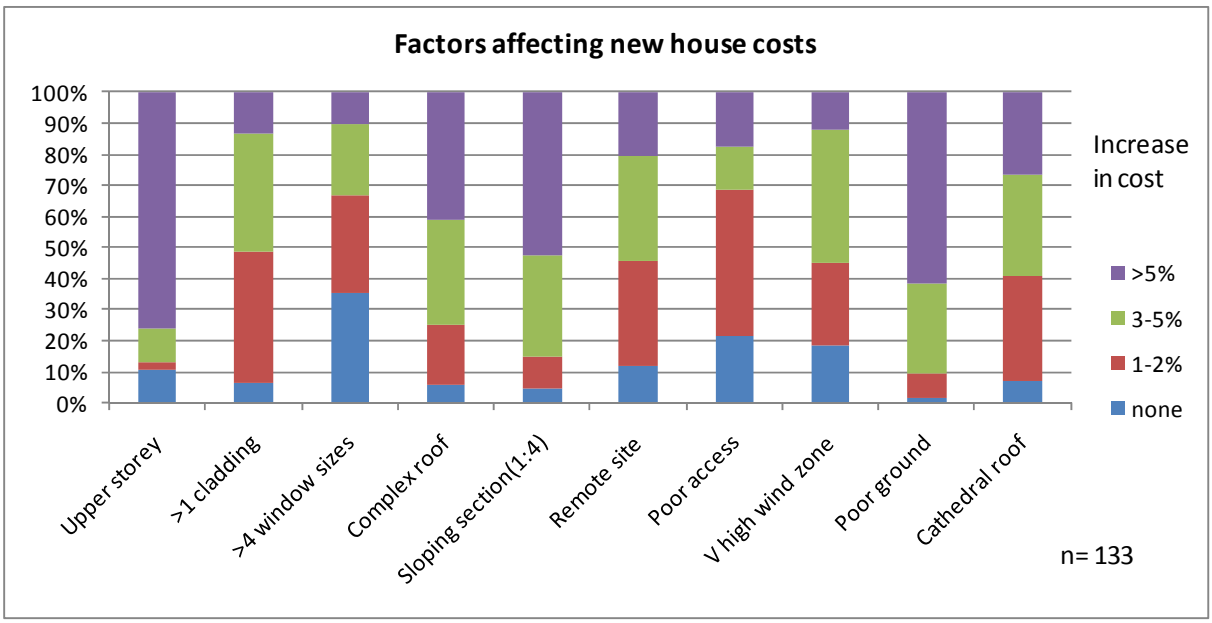


Figure 14. Factors affecting costs

Table 7. Design and site factors affecting new house cost

Design features adding to the cost of a new house							
		More cost ---------->					
	None	1 to 2 %	3 to 5%	Over 5%		Average %	Number of
		% of firms				incr in costs	responses
An upper storey	10%	2%	13%	75%	100%	5.5	127
More than one type of wall cladding	8%	38%	38%	15%	100%	3.0	130
More than 4 different window sizes	34%	31%	25%	10%	100%	1.8	131
Complex roof line (1)	4%	21%	31%	44%	100%	4.3	129
Sloping section (more than 1 in 4)	5%	11%	26%	59%	100%	4.9	133
Remote site (2)	12%	27%	31%	29%	100%	3.3	131
Poor access (3)	23%	41%	16%	20%	100%	2.3	129
Very high wind zone	16%	39%	34%	11%	100%	2.5	70
Unstable/poor ground	3%	15%	26%	56%	100%	4.9	68
Monopitch/cathedral ceilings	8%	25%	35%	32%	100%	3.8	75
High stud over 2.4m (4)	0%	100%	0%	0%	100%	1.5	3
Foundations, retaining walls, earthworks (4)	0%	25%	25%	50%	100%	4.0	4
Raking ceilings (4)	0%	33%	33%	33%	100%	4.0	3

(1) e.g. dormers & valleys, internal gutters
(2) e.g. farm/ holiday home, more than 20km from town
(3) e.g. difficult driveway, back site, restricted parking, ect
(4) Small sample of 3 or 4. Picked up in "other design features which may affect cost of new house"

The factors having the largest impact on costs include an upper storey, a sloping section, complex roofs, and poor ground conditions. Some other features which were thought to have cost implications have quite low effects. These include many different window sizes, poor site access, and very high wind zones.

The implications are that new housing costs can be reduced by building on flat sites with good ground conditions and with enough section size to fit the required floor space at ground level, and the use of simple roof-lines.

5.4 Case studies of selected builders

Two builders were interviewed in a structured series of questions. The main aim was to gain their views on the perceived advantages of “standardised” housing in comparison to one-off designs.

5.4.1 Builder A

The builder is a medium-sized operation, not part of a franchise, and is doing about 15 houses a year at present. Standard plans are shown to clients but are a starting point for discussion with potential owners and in almost all cases the layouts are changed slightly. The builder argued that “standard” homes do not exist because of these changes and also because with software-driven design and pre-cutting of framing and joinery there is very little additional cost in “customerisation”. The cost efficiencies arise in having the sub-contractors working in the same area on a number of houses at the same time, so that travelling time and set-up times are minimised.

The larger builders do not necessarily obtain significant material cost discounts compared to smaller or one-off builders. In normal or high demand times their main advantage is priority in delivery of materials. During low periods of activity many small-

scale builders actively seek out best supply deals and probably achieve similar discounts as the larger builders.

The builder agreed with the general findings of Table 7, namely that upper storeys, sloping sites and poor foundation conditions have significant cost implications. The reason upper storeys have high cost penalties is that although they have a reduced roofing area per sqm of floor area (compared to single storey) these savings are more than off-set by a number of additional costs. These costs include scaffolding ($5-8K), larger windows in upper levels need to be site glazed (extra $2K), flashings at the lower roof-upper wall junction are needed (extra $2K), steel beams are needed to support upper walls and/or slab thickenings ($2K), upper level bathrooms need an extra floor substrate when tiled ($1K), and there is extra time to build because some trades come back twice (e.g. roofers).

For the majority of new house buyers (about 80%) the main consideration is getting maximum floor space. The other 20% are more interested in quality and will trade-off floor space for better quality in the bathrooms and kitchens. For example, “quality” products and fittings in bathrooms and kitchens can easily add $20,000 above more normal fittings.

As a general comment new houses within a few streets of one another can have quite different $/sqm rates due to quality of finish, foundation conditions, roof types and profit margins. Hence regional location will not always be a good indicator of overall cost.

5.4.2 Builder B

His firm, part of a franchise, has over 60 standard plans and about 60% of clients make minor changes to these. Changes counted as minor include replacing normal windows with sliding windows, and small changes in wall positions including external walls. In another 30% of cases the changes are major, with large changes to room sizes and external walls. For these it appears owners have a need to have significant input into the design (i.e. put their “mark” on the new house), even though it might be thought one of the large range of standard plans would closely meet their needs and at a lower cost.

The builder acts mainly as a project manager and has a small team of four people for the region (another project manager, sales and accounts), with only one person being full-time. This number of permanent staff is sufficient for about 20 houses per year. They will undertake almost any type of home and do not restrict their work to particular styles or sizes of house. Material waste is not a major cost factor and designs are not usually laid-out to minimise sheet off-cuts, except for the low cost “basic” house designs.

Resource and building consent processes are usually straightforward because they are building in “bulk” and the council develops confidence in the designs and the builder’s competency.

Material price discounts are received through the franchise, which amounts to several thousand dollars per house. The main constraint for potential owners is increasing land prices. A basic section in the main cities is around $300,000, leaving the owner with less money to spend on the house and having to compromise on the house design.

6. DISCUSSION

Firm size by employment over the last decade shown in Figure 1 and Figure 2 suggests a slight trend to large housing firms with about 2.5% of the workforce now in firms seven persons or larger compared to 1.5% a decade earlier. Over the long-term firm size has reduced with an apparent drop in the proportion of employment in the medium-sized firms since 1979 (see Figure 3).

It is possible that the early censuses (1979 and 1985) were biased toward the medium-sized firms because of the difficulty of identifying one-person firms. If that is the case then the apparent small proportion of one-person firms at that time may be a sampling error. Alternatively it could represent a real trend where the firm principal(s) have increasingly over time acted mainly as project managers and have farmed-out most work to a variety of sub-contractors. In any case there does not appear to be a long-term trend to larger firm size in the house construction industry.

The literature indicates that in the existing house market prices can be explained by a variety of location and physical characteristics of the house. The regression analysis undertaken in Table 10 in the Appendix explored this for new housing. It used contract values and physical characteristics obtained from the BRANZ New Dwellings Survey for over 1,100 new houses. The result was the explanatory variables did not explain much of the variation in contract prices, and the conclusion was the method was not very useful for new housing. It is likely the hard to quantify variables such as quality of finishes and fittings, market power of the firm, and location and views at a detailed level, are major influences on the selling price. These were not included in the regressions, although they did confirm a second storey as having a major effect on price, as was found in the cost factor survey of builders.

Major builders tended to operate within a fairly narrow market, often characterised by location (e.g. within a new land sub-division), with fairly similar houses constructed by the franchise holder, one or more at a time, depending on level of demand. This enables continuity of work for the trades and provides familiarity of the layouts for the workers, reducing overheads and waste. Within the major builder groups are various sub-markets, from basic houses with simple layouts and single storey, to more complex layouts with two-storey construction. The most basic arrangements allow for very little or nil changes by the client and are generally the lowest cost housing. The more complex two-storey layouts usually allow some variations, which can amount to many thousands of dollars when the changes involve kitchen and bathroom finishes and fittings. These more complex houses from the group builders are similar to many one-off designs built by the smaller builders where the client requires something different than the “standard” offering.

The overall size of the one-off individual design market (defined here as builders constructing less than seven houses per year) is somewhat surprising at 62% of all detached houses. It is surprising because, as just noted, the major builders allow significant customerisation to their large number of standard layouts. Unless the site conditions and customer needs are extreme it could be expected that adaptation of standard layouts would satisfy most owners, and have a lower price.

Figure 5 indicates that one-offs are about 8% more expensive than the medium-sized group builders (8-30 houses per year), and the two to seven houses per year group is about 4% more expensive. There may be some quality differences in the one-offs but the lesson, from a cost viewpoint, is to use a group builder. In particular, first home buyers with constrained budgets should choose a basic no-frills design with minimal or nil design changes.

7. CONCLUSIONS

One-off designs are approximately 40% of the market. The medium-sized builders (8-30 houses per year) appear to have the cheapest prices, approximately 8% below that of average one-off designs.

About 64% of firms have standard plans and most allow changes to these including amendment to wall layouts. Only about 10% of builders with standard plans allow no changes, and these tend to be the lower cost houses.

Cost variations are common and average about 4% of the original contract price. The main areas for escalation are kitchens, fittings and floor coverings. Often these are not changes but additions omitted from the original contract. So it appears that most builders have a fairly tight control on costs and are able to deliver to a pre-agreed price.

Design factors adding to costs are upper storeys, complex roofs, sloping sections and poor foundation conditions. Significant savings can be made by avoiding these features where possible.

The cost efficiencies of group builders appear to arise from efficient organisation of the trades, arising from established agreements with a few sub-contractors, and working on several houses in the same location in a sequential operation. The savings are in reduced downtime. The actual layout of individual houses is a less important influence on cost, in part because computer controlled pre-cutting of frames and trusses tends to optimise material use and reduce waste.

8. APPENDIX

8.1 References

Bourassa S and Hoesli M. (2003). 'Do Housing Sub-markets Really Matter?' *Journal of Housing Economics* (12):12-28.

Buzzelli M. (2001), 'Firm Size and Structure in North American House Building: Persistent Deconcentration 1945-98'. *Environment and Planning A* (33): 533-550.

Page I. (2008). 'New House Price Modelling'. *BRANZ Study Report 196*. BRANZ Ltd, Judgeford, New Zealand.

Palm R. (1978). 'Spatial Segmentation of the Urban Housing Market'. *Economic Geography* (54): 210-221.

Watkins C. (2001). The Definition and Identification of Housing Sub-markets. *Environment and Planning A* (33): 2235-2253.

Whats-On Report (Monthly). TF Stevens & Co Ltd, Auckland, New Zealand.

8.2 Detailed consent analysis results

The analysis used the Whats-On dataset. Total consents issued in that period for detached houses was about 14,800, and the Whats-On dataset was short by about 3,000 consents or about 17% omissions. The latter include consents issued by delegated authorities, builders' names not provided, non-returns from some TAs, and houses outside the 30-500 sqm range, i.e. very small and very large houses are omitted (about 900 houses).

A count was made by the builder's name entered on the consent application. The largest firms are shown in Table 8 by the number of houses in the database. Note that as the Whats-On dataset is not complete and the house numbers and firm rankings are approximate. However, the houses in the dataset are assumed to be representative of all houses constructed by each firm. Three of the top four firms are nation-wide and several further down in the ranking are also New Zealand wide. The other large firms are mainly in the housing growth areas of the Auckland region, Bay of Plenty and Canterbury.

All consents over the period (June 2009 to May 2010) had an average value of $283,000 and an average floor area of 207 sqm. It is noteworthy that this corresponds almost exactly with the average for the top 30 builders in Table 8. These top 30 builders account for about 20% of new detached housing, based on the Whats-On database.

Table 8. Large firms by house numbers per year

Firm characteristics from What-On database June09 to May 2010.												
		Count	Average	Average	Std Dev	Std Dev	Average	Std Dev	Min	Max	Range	
		detached	$K	Sq m	$K	Sq m	$/sqm	$/sqm	Sq m	Sq m	Sq m	Where ?
		houses only										
1	G J Gardner	423	280	208	98	59	1350	253	48	496	448	All NZ
2	Jennian Homes	198	307	216	109	62	1425	293	60	460	400	All NZ
3	Stonewood Homes	180	282	216	100	58	1293	221	107	439	332	Canterbury mainly
4	A1 Homes	109	207	168	69	57	1266	291	50	380	330	All NZ
5	Classic Homes	104	240	194	70	49	1241	199	104	350	246	BOP mainly
6	Mike Greer Homes	99	268	202	89	57	1348	371	86	490	404	Chch
7	Generation Homes	95	240	177	42	25	1357	158	109	234	125	BOP, Waikato
8	Versatile Buildings	84	141	110	59	55	1365	425	33	288	255	All NZ
9	Fletcher Residential	73	316	220	50	43	1478	308	129	406	277	Auck/N Shore
10	Signature Homes	65	347	219	151	76	1585	348	69	420	351	All NZ except Cant.
11	Peter Ray Homes	64	278	231	69	43	1199	145	138	356	218	Upper SI
12	Peak Construction	64	269	218	76	60	1233	177	102	441	339	South Island
13	Milestone Homes	59	242	187	55	43	1317	208	98	332	234	All NZ
14	Universal Homes	59	278	199	30	21	1400	69	164	254	90	North Sh/Papakura
15	QBT Homes	50	283	240	62	55	1187	132	138	365	227	Waikato/ Rodney
16	David Reid Homes	46	443	252	188	80	1726	397	117	445	328	All NZ
17	Enterprise Homes	44	218	211	37	35	1035	62	128	289	161	Chch
18	Downey Designer Homes	43	288	249	83	47	1158	144	92	373	281	Waikato
19	Today Homes Ltd	40	283	230	101	54	1230	195	84	362	278	Canterbury
20	Horncastle Homes Ltd	39	290	232	95	41	1248	148	165	378	213	Canterbury
21	Homes by Parkway Ltd	39	229	207	77	59	1107	155	106	354	248	Selwyn, U Hutt
22	Golden Homes	38	298	247	99	76	1207	164	86	452	366	Waikato
23	Baywide Construction	38	309	231	78	43	1338	218	152	347	195	BOP
24	DGL Construction	36	176	160	8	4	1096	34	159	170	11	Inverc
25	Gillies Construction	36	252	184	54	52	1371	258	105	320	215	Upper Hutt
26	Cavalier Homes	35	347	231	148	63	1504	415	100	350	250	Rural NZ
27	Landmark Homes	34	426	247	200	68	1727	391	90	412	322	Rural NZ
28	Highmark Homes	32	222	178	53	40	1245	243	77	276	199	C Otago, Well
29	Penny Homes	31	403	237	178	70	1698	254	116	465	349	Taupo
30	Hassall Homes	31	320	236	74	58	1357	106	112	338	226	New Plymouth
	Average		276	207	109	61	1337	289				
Other Fletcher Group firms												
	Spaceline Homes	18	250	237	28	51	1119	369	124	332	208	Manukau/Papakura
	Fyfe Homes	22	241	252	29	27	963	133	202	302	100	Manukau/Papakura
	Dempsey Morton	10	250	221	0	47	1182	259	167	273	106	Auck/N Shore
	Sierra Homes	10	360	231	28	50	1629	397	165	290	125	N. Shore/ Rodney
	Aston Marsh	13	221	221	44	21	999	193	197	247	50	Manukau/Papakura

Notes: The first column, the count, is the number of detached houses in the database. It is not necessarily the complete number for the period.

St Dev = standard derivation of all the firm's houses. It is a measure of the variation in value, size and floor area of houses produced by the firm.

= high variance in floor areas and/or $ per sqm.

= low variance in floor areas and/or $ per sqm.

The Range is the diifference in sq metres between the smallest and largest detached house produced by the firm.

The scatter plot for selected major builders is shown in Figure 15 for the major builders covering all New Zealand and indicate a quite large scatter in $/sqm. The two largest, GJ Gardner and Jennian, average between $1,350/sqm and $1,420/sqm.

The next sets of charts are for consents issued by selected TAs. Figure 16 is for Christchurch which indicates a scatter between $1,000-$1,500/sqm for most houses. The Enterprise Homes Ltd houses are mostly close to the average $1,035/sqm for all floor area sizes. The other two builders shown have more scatter and the bottom panel is for all small-scale builders in Christchurch and has a large range in rates. The average for one-off builders (i.e. one house per year) at $1,341/ sqm is from $50-$300/sqm larger than for the other three builders in Christchurch.

In Manukau City (see Figure 17) the larger-sized builders have rates about $970-$1,170/sqm, compared to the small one-off builders at about $1,360/sqm.

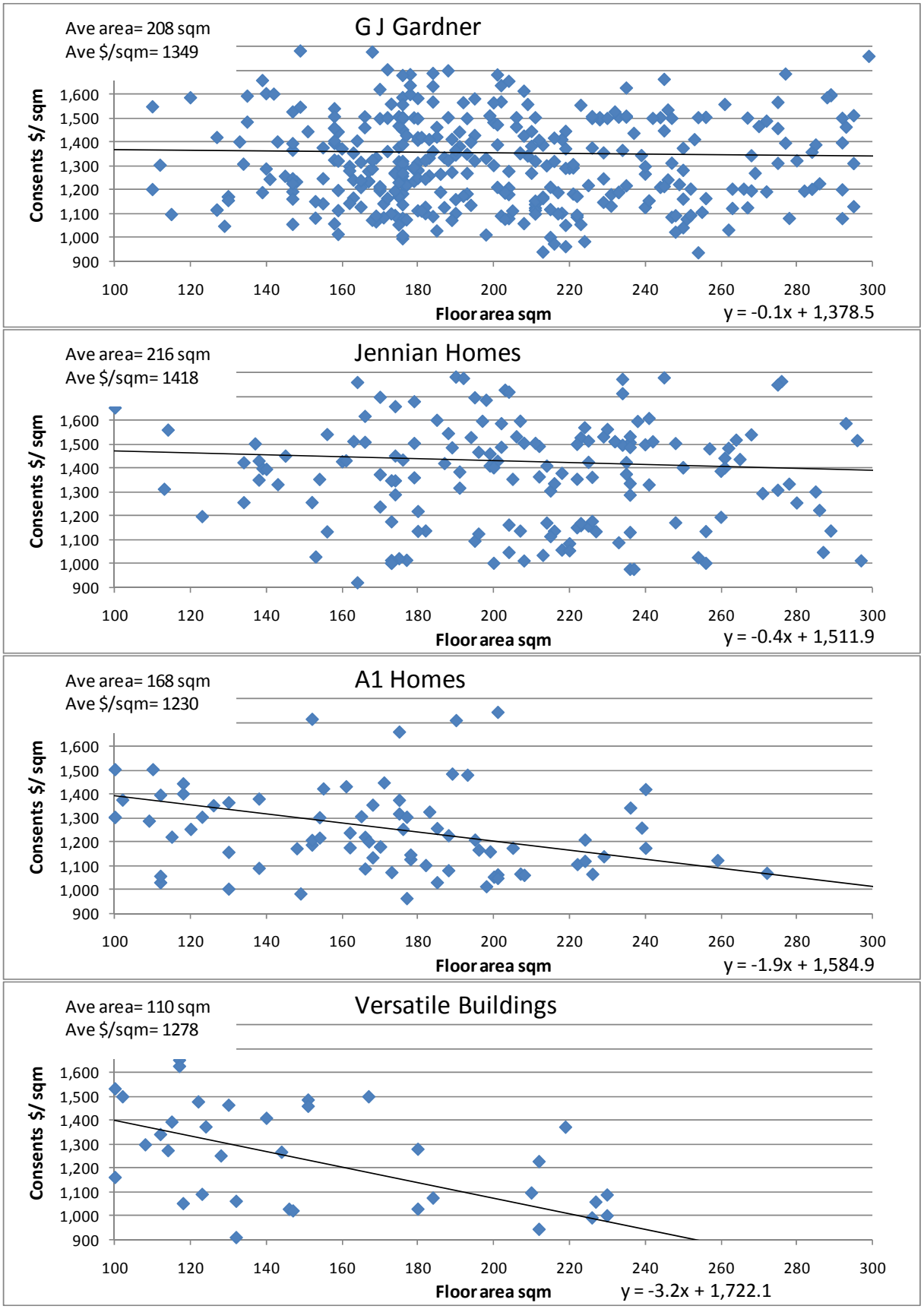
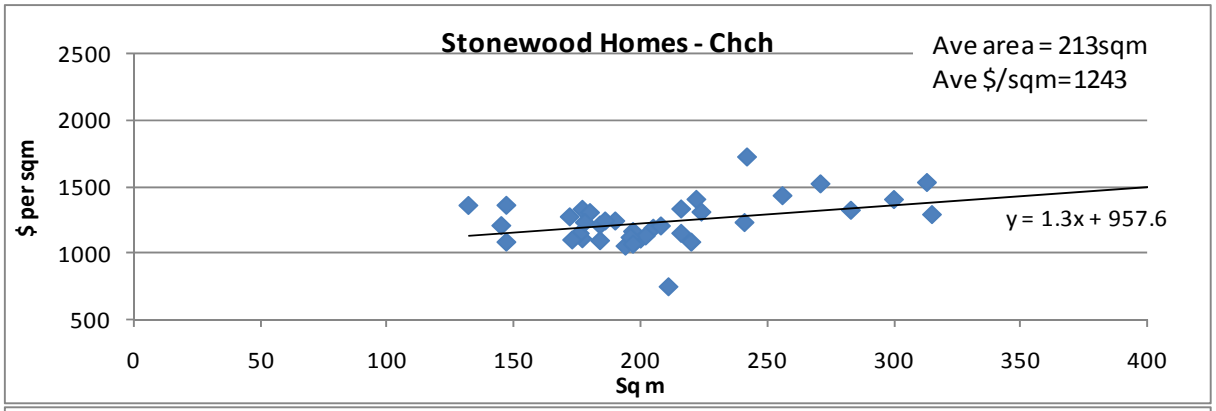
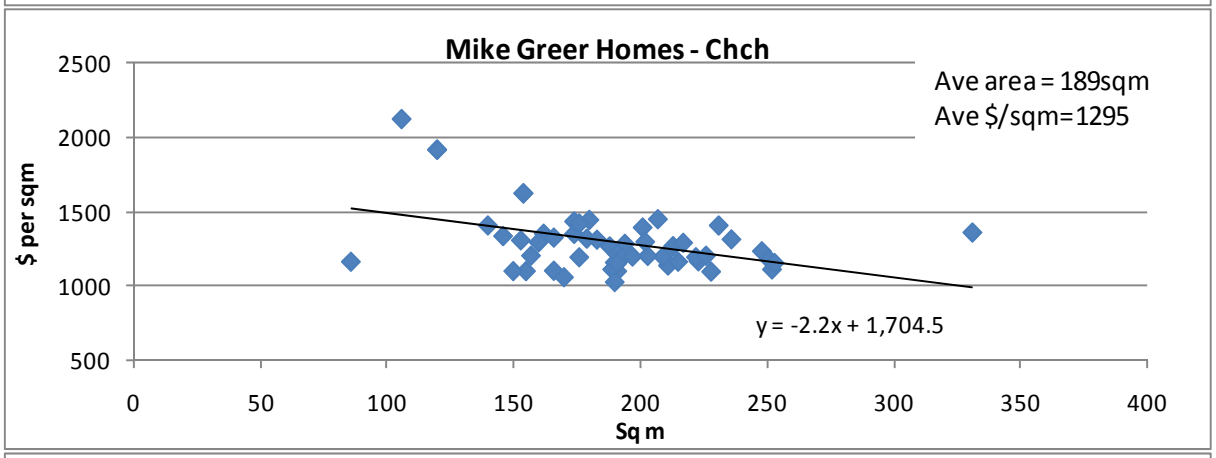
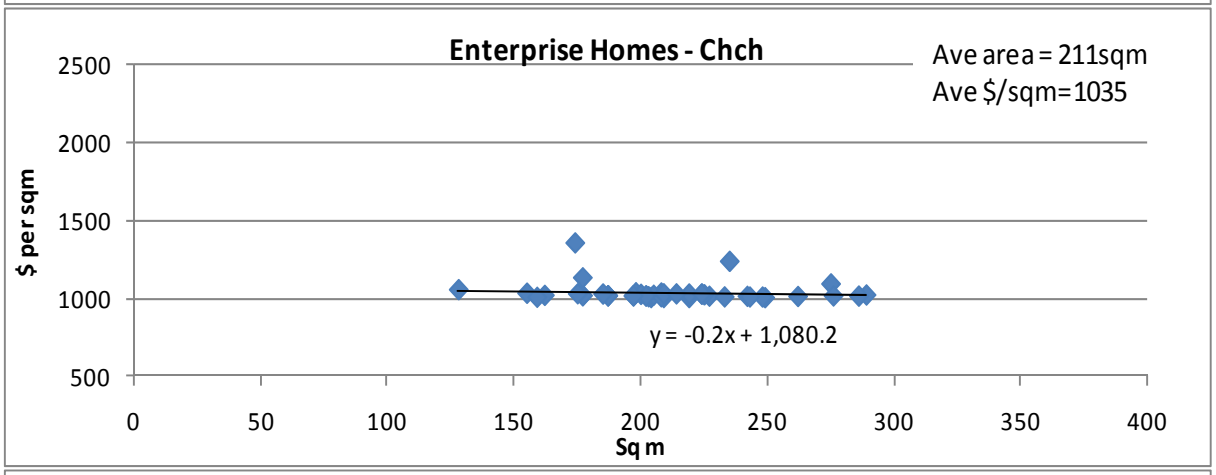


Figure 15. Major builders – all New Zealand







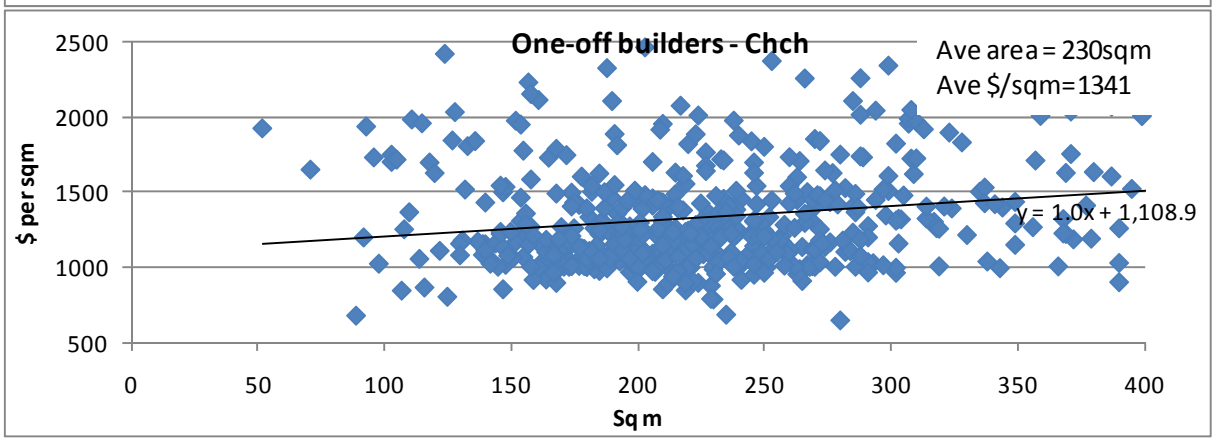


Figure 16. Major builders – Christchurch

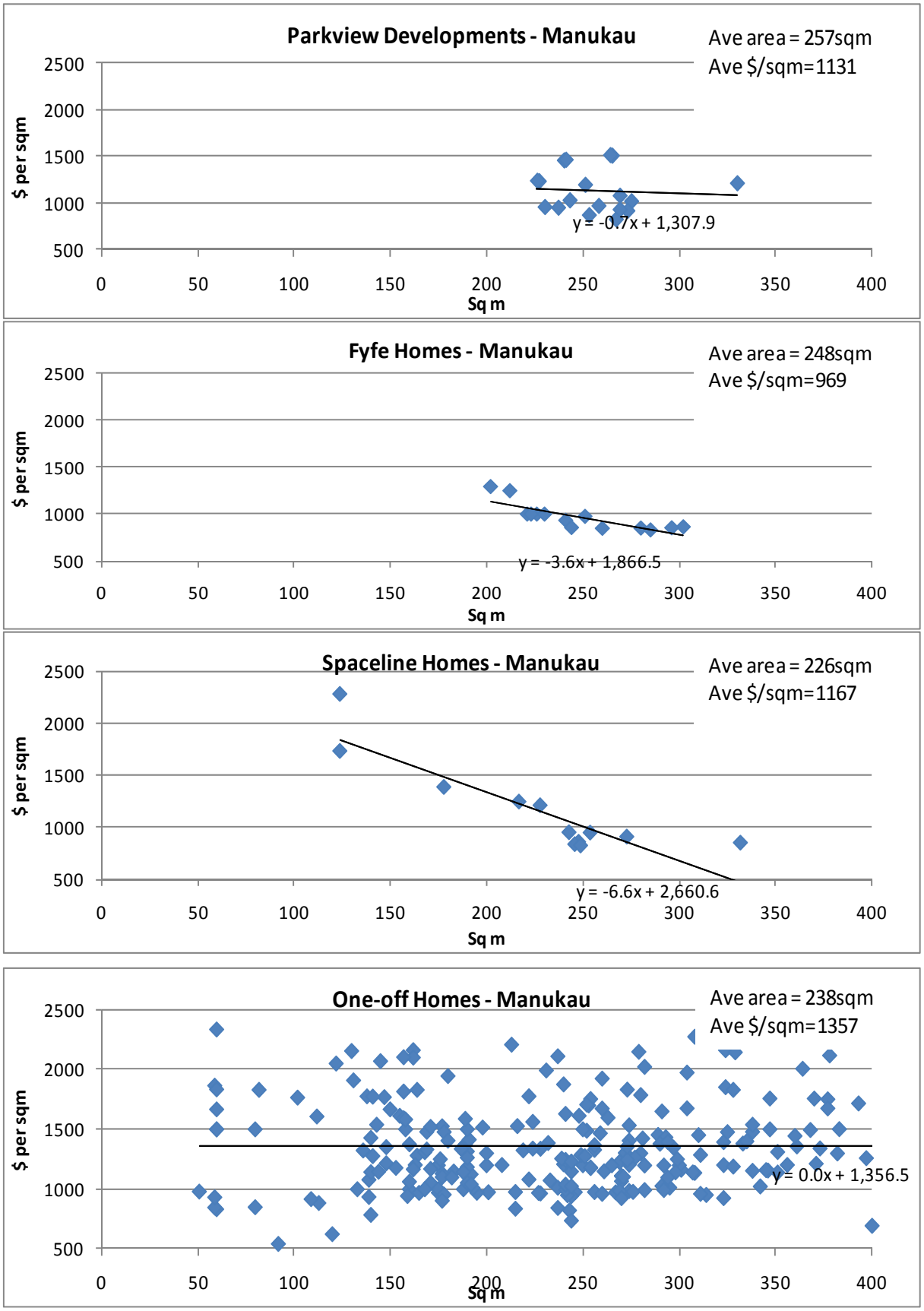


Figure 17. Major builders – Manukau

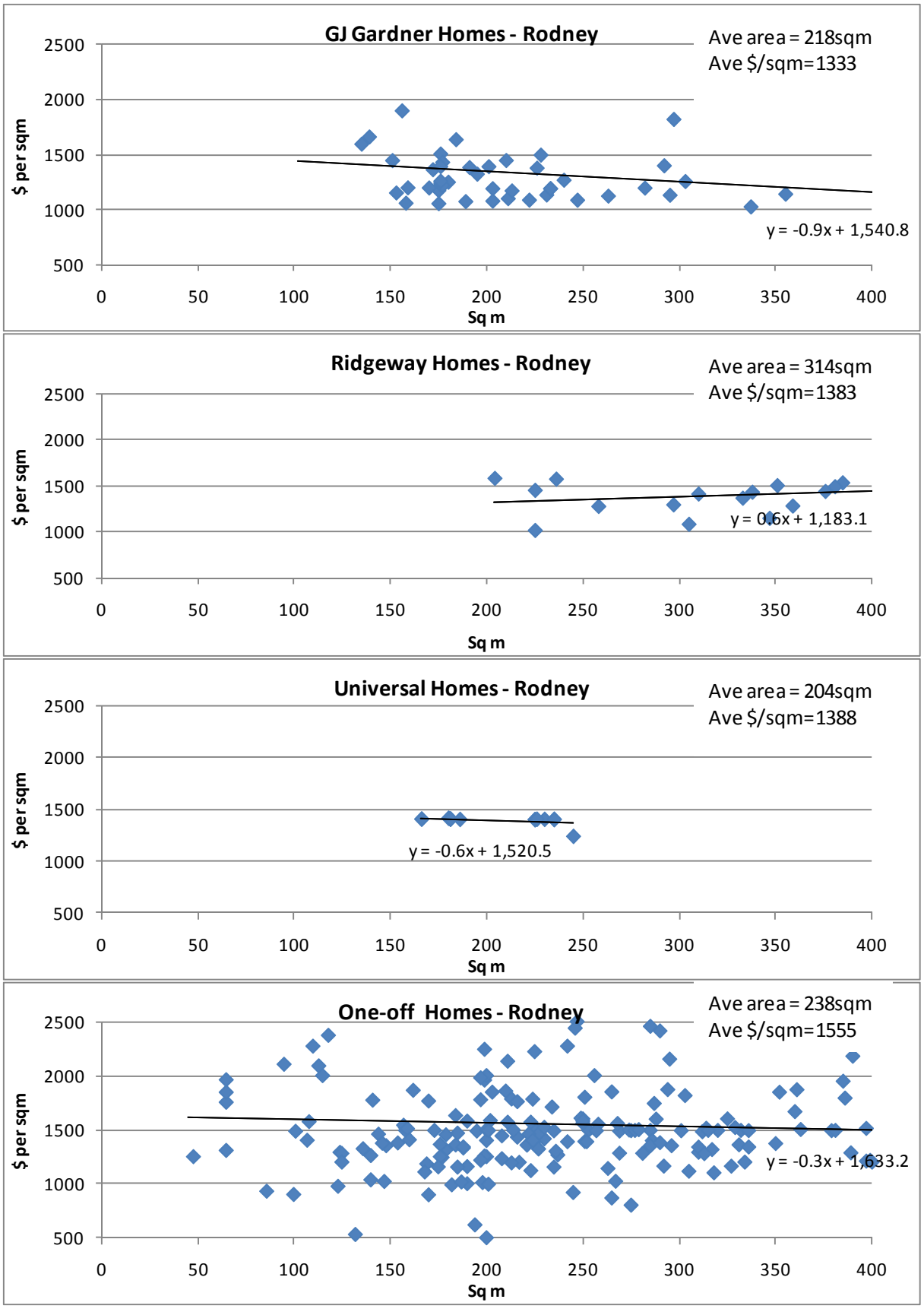


Figure 18. Major builders – Rodney

For Rodney District (see Figure 18) there is again a difference between the larger builders and the one-offs of about $200/sqm.

Cost comparisons within a TA are useful because material and labour costs and design influences such as topology and structural loading are likely to be fairly constant across the region. So the cost differences reflect builder scale economies and the different quality niches. One house per year builders are between 5% and 40% more expensive than the cheapest group builder in the region. How much of this reflects quality differences, or economies of scale, is not known from the consent data.

8.3 BRANZ New Dwellings Survey

The BRANZ new house survey was analysed for two reasons:

- Can differences in $/sqm rates within TAs be related to cladding types and the presence of upper floors?
- Are consent values under-estimated?

The first of these is an attempt to measure quality effects on the $/sqm rate. The second analysis is to check how valid the previous consent analysis is likely to be. The period covered was the year to June 2010, with 1,204 new housing returns.

8.3.1 Quality measurement

This section examines the variation in $/sqm rates by region, cladding types, existence of upper floors, whether the house is multi-unit or detached, and more than one wall cladding. The method used was regression analysis on approximately 1,200 returns from the survey. The aim was to explain the contract $/sqm for each house in the survey in terms of some of the house characteristics recorded in the survey. The best fit with the data was found using a cost region, presence or absences of an upper floor, existence or not of weatherboard and long-run steel roofing, whether the house was multi-unit or detached, and if the house had more than one wall cladding. A brief explanation of each variable follows:

- $/sqm is the contract value divided by the floor area.
- Cost region: the BRANZ survey covers 30 TAs and these were allocated into five cost groups with equal increments ranging between the lowest and highest cost TAs. The cost groups were based on all detached house building consents for the year and the results are shown below in Table 9.
- Upper floor: the BRANZ survey records if the house has an upper floor.
- Weatherboard (including, timber, fibre cement and PVC) and long-run roofing were found to have a greater cost effect than other materials. Also more than one wall cladding type appears to increase costs.
- Multi-units have a higher cost per $/sqm.

Table 9. Allocation of TAs into cost groups for regression analysis

Average new house consent values for selected TAs		
	Ave $/sqm	**Cost group**
Far North	1525	4
Whangarei	1359	3
North Shore	1465	4
Waitakere	1554	4
Auckland	1606	5
Manukau	1291	2
Franklin	1277	2
Thames Coromandel	1515	4
Waikato	1334	3
Hamilton	1195	1
Waipa	1291	2
Western BOP	1310	2
Tauranga	1573	4
Rotorua	1191	1
Gisborne	1415	3
Napier	1451	4
New Plymouth	1342	3
Palmerston North	1358	3
Kapiti	1347	3
Porirua	1350	3
Hutt City	1371	3
Wellington	1577	5
Tasman	1387	3
Marlborough	1355	3
Waimakariri	1335	3
Christchurch	1319	2
Queenstown Lakes	1701	5
Dunedin	1332	3
Southland	1379	3
Invercargill	1265	2
	$/sqm	
	less than	Cost groups
	1196	1
	1322	2
	1448	3
	1574	4
	1701	5

The results of the regression analysis are shown in Table 10 below. Here an attempt is made to explain the house costs as a function of region, cladding types, existence or absence of an upper floor and whether the house is detached or a multi-unit.

Unfortunately the R sq value at 0.12 is low indicating the model does not explain very much of the variation in individual housing costs. The cost region and upper floor variables have t statistics well above 2, which indicates they are highly significant (95% confidence level). But the other variables have a t-stat of 1.3 to 1.7, which has significance at about the 80% level i.e. we can be certain with only 80% confidence that the coefficients on those variables are non-zero.

Table 10. $/sqm rate as a function of house characteristics – regression results

SUMMARY OUTPUT

$/sqm = c1 +c2CostReg+ c3UpperFl + c4WB + c5Longrun+c6Multiunits+c7>1clad.

Regression Statistics	
Multiple F	0.342077
R Square	0.117017
Adjusted I	0.112418
Standard E	326.2231
Observati	1159

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressio	6	16247184	2707864	25.4447	1.73E-28
Residual	1152	1.23E+08	106421.5		
Total	1158	1.39E+08			

		Coefficients	*tandard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Upper 95.0%*
	Intercept	1143.64	29.29	39.0	0.000	1086.2	1201.1	1086.2	1201.1
Cost Region	X Variable	68.98	8.59	8.0	0.000	52.1	85.8	52.1	85.8
Upper floor	X Variable	135.43	22.50	6.0	0.000	91.3	179.6	91.3	179.6
Wboard	X Variable	0.49	0.33	1.5	0.142	-0.2	1.1	-0.2	1.1
Longrun roof	X Variable	0.33	0.20	1.7	0.094	-0.1	0.7	-0.1	0.7
Multiunits	X Variable	70.13	44.72	1.6	0.117	-17.6	157.9	-17.6	157.9
More1 clad	X Variable	27.28	20.42	1.3	0.182	-12.8	67.3	-12.8	67.3

The interpretation of the coefficients is that the base cost of a house is $1,144/sqm. Then add $69/sqm for each cost region level i.e. in Wellington add 5 x $69/sqm, whereas in Rotorua add only $69/sqm. The existence of an upper floor adds $135/sqm to the cost. If the house has weatherboard claddings add $49/sqm, and another $33/sqm for long-run roofing. Multi-units cost an extra $70/sqm compared to a detached house. Last, more than one cladding adds about $27/sqm.

As the R sq value is well below 1.0 there must be other explanatory variables that are not included. It is unknown what these may be but will include marketing power (ability to attract extra superior profits), site factors (such as site slope and ground conditions), quality of fittings and fixtures (kitchen, bathroom etc), and adjacent house values. None of these variables are easily quantified so they have not been included in the survey.

8.3.2 Consents versus contract values

There is anecdotal evidence that consent values are under-estimated. This could be for two reasons: first, builders may have an incentive to under-estimate at application time because consent fees are based on values for some TAs; and, second, there is often a cost variation after the contract is signed.

The BRANZ New Dwellings Survey was used to see how consent values differ from contract values. Table 11 shows the results for a sample of large and small builders. For the larger builders, the variation between consent and survey values was about 4% on average, although some builders were somewhat higher. For the small builders, i.e. one or two houses per year, the variation was a lot higher i.e. about 16%. This suggests the major builders are able to offer fixed price contracts, whereas the smaller builders tend to have more escalation in their work. Also, the small builders work on larger houses than the group builders, and their $/sqm rate is about 8% higher than the group builders. For this table the contract values, rather than consent values, have been used and the analysis confirms the results from the consent analysis that group builders are about 8% cheaper than one-off builders.

The firms' names in Table 8 have been kept confidential as a condition of the agreement BRANZ has with the builders. However it is a good cross-section of the industry, including large, medium and small-scale house builders.

Table 11. Consent versus contract values for new housing

Consent versus Contract values BRANZ Materials survey June 2010 year.						
	Count	Average area sqm	Ratio of Contract $ to Consents $	Max ratio	Min ratio	$/sqm Contract $
Firm 1	85	211	1.02	1.40	0.73	1346
Firm 2	30	229	1.04	1.42	0.77	1532
Firm 3	24	172	0.90	1.00	0.76	1217
Firm 4	19	208	1.10	1.63	0.67	1160
Firm 5	17	100	1.01	1.46	0.78	1382
Firm 6	15	227	1.03	1.61	0.94	1330
Firm 7	14	242	0.96	1.00	0.74	1227
Firm 8	13	230	0.99	1.04	0.93	1319
Firm 9	10	188	1.03	1.12	1.00	1214
Firm 10	10	209	1.24	1.68	1.01	1445
Firm 11	9	115	1.05	1.67	0.85	1210
Firm 12	9	262	0.91	1.00	0.71	1368
Firm 13	9	241	1.06	1.22	0.74	1427
Firm 14	9	255	1.09	1.43	0.99	2143
Firm 15	9	190	1.19	1.61	1.00	1573
Firm 16	8	171	1.04	1.25	0.73	1257
Firm 17	8	239	1.04	1.14	1.00	1074
Firm 18	8	197	1.04	1.26	1.00	1206
Firm 19	8	197	0.94	1.16	0.71	1141
Firm 20	8	279	1.22	2.47	0.90	1477
Firm 21	7	227	1.05	1.31	0.87	1406
Firm 22	7	262	1.46	1.53	1.38	1451
Average		211	1.04			1353
Small builders only i.e.1 or 2 houses per year.						
	380	245	1.16			1464

8.4 Factors affecting new house costs survey form

The survey form used to identify the factors affecting costs of new housing is shown in Table 12. It was sent to builders as an insert in the BRANZ New Dwellings Survey and 135 returns of the form were received. The results are shown in Section 5.3.

Table 12. New house cost factors survey

COST FACTORS FOR NEW HOUSES SURVEY.

Please dis-regard this form if your firm has already filled in

It would be appreciated if respondants could also fill out this form **once** for your firm, and include with the New Dwelling form.
All responses are added together and no individual firm is identified in reports produced by BRANZ.

FIRM SIZE

How many houses did your firm build in the last 12 months ? _____

STANDARD PLANS

Tick one

	Yes	No	
Do you have standard sets of house floorplan layouts to show clients?	☐	☐	If Yes how many layouts? .....

How much input do clients have into your standard designs?	Nothing allowed	Minor allowed	Major allowed
For external wall layouts :	☐	☐	☐
For internal wall layouts :	☐	☐	☐
For roof and wall claddings :	☐	☐	☐
Kitchen layout and appliances :	☐	☐	☐
Bathroom layout and fittings :	☐	☐	☐

COST VARIATIONS

Tick one

Do you have contract variations after the client contract agreement sign-off ?	None	Some	Many
	☐	☐	☐

Tick one

Typically how much are the total contract variations ?	0-5%	6 to 10%	Greater than 10%
	☐	☐	☐

Describe work type variations below

What types of variations ? _____

SUB-CONTRACTORS

How many sub- contractor firms did you use in the last year?

Write the number of firms

Foundation/ slab placing : _____	Linings : _____	Scafolders : _____	Plumber : _____
Pre-nailed wall frames : _____	Painters : _____	Roofer : _____	Brick/ blocklayer : _____
Pre-nailed roof trusses : _____	Electrician : _____	Insulation : _____	Kitchen : _____

MATERIAL SUPPLIERS

Did you use one supplier or several in the last year ? Write the number of suppliers used

For loose framing timber and finishing timber/ mouldings :	_____	Windows :	_____
Engineered floor joists :	_____	Insulation :	_____
Wall claddings :	_____	Linings :	_____

DESIGN FEATURE COST IMPACTS

Tick one

What design features add to the cost of a new house?	None	1 to 2% more cost	3 to 5% more cost	Over 5% more cost
An upper storey :	☐	☐	☐	☐
More than one type of wall cladding :	☐	☐	☐	☐
More than 4 different window sizes :	☐	☐	☐	☐
Complex roof line (e.g. Dormers and valleys, internal gutters) :	☐	☐	☐	☐
Sloping section (more than 1 in 4) :	☐	☐	☐	☐
Remote site (e.g.farm /holiday home, more than 20 km from town) :	☐	☐	☐	☐
Poor access (e.g.difficult driveway,back site, restricted parking, etc) :	☐	☐	☐	☐
Very high wind zone :	☐	☐	☐	☐
Unstable/poor ground :	☐	☐	☐	☐
Monopitch or cathedral ceilings :	☐	☐	☐	☐

What other design features may adversely affect the cost of a new house (and by how much) ? _____

WORK TYPES

What type(s) of work does your firm do? State percentage for each work type category below, must total to 100%

Write percentage, must total to 100%

New Housing	Additions to houses	Renovate/alter houses	New Non-Residential	Add/renovate/alter Non-Residential	Other	**Accumulated Total =100%**
☐	☐	☐	☐	☐	☐	

Thank you. Please fold, and send back to BRANZ with the New dwelling form in the attached reply paid envelope. Oct-10