

# Can green labels become the new normal?

German Molina<sup>1,\*</sup>, Michael Donn<sup>1</sup>, Micael-Lee Johnstone<sup>2</sup>, and Casimir MacGregor<sup>3</sup>

<sup>1</sup> School of Architecture, Victoria University of Wellington, Wellington, New Zealand

<sup>2</sup> School of Marketing & International Business, Victoria University of Wellington, Wellington, New Zealand

<sup>3</sup> Building Research Association New Zealand (BRANZ), Porirua, New Zealand

**Abstract** This study sought to review the effectiveness of green labels on the residential real estate market. As past studies revealed, green labels increased property prices, which motivated developers to build more green certified buildings. However, contradictory studies revealed that many developers did not use green labels due to a lack of consumer demand. Therefore, what impact do green labels have on the residential housing market? A meta-analysis of 36 articles presenting 52 different studies, published between 2008-2018, suggests that the price premium charged for green labels may have been systematically overestimated. Consumers' willingness-to-pay (derived from correlating green labels with purchase price) does not necessarily represent the average consumer but green consumers. The conclusion that follows from this analysis is that full market transformation via green labels is unlikely to take place because only a fraction of the population is willing to pay the premium. Therefore, full adoption is unlikely without other market "interventions".

## 1 Introduction

Since the 1990s, we have seen a rise in the use of green labels to promote energy efficient and sustainable buildings [1]. These building environmental assessment tools were introduced to improve knowledge on housing sustainability and to increase building performance by means of encouraging good building and design practices [1], [2]. However, how effective has this been? Can these labels be considered the solution to the environmental problems caused by buildings?

The effectiveness of these tools may be analysed from two complementary perspectives. First, it is possible to debate if the different labels indeed ensure sustainability. In this regard, it is acknowledged that creating a globally standardised tool for building performance is challenging, as green labels often do not take into account the local climates and industry practices that create housing [1], [3]. The second perspective is related to their market-based nature. Namely, green labels are voluntary standards [4] that rely on consumer demand for environmentally-friendly products. To be effective from this perspective, consumers must value green labels (i.e. there is perceived customer value) and be willing to pay for green certified products. In this case, perceived customer value is created by providing consumers with third-party information which can help them make more informed purchase decisions. This study is focused on the second perspective, particularly for the residential real estate market.

Several studies have shown that certified dwellings can command a price premium in the residential real estate market (e.g. [5]–[8]), which suggests that green

labels do indeed provide customer value. A price premium can be defined as 'the excess price paid over, and above the "fair" price that is justified by the "true" value of the product' [9]. However, there is also evidence of developers not adopting such labels due to a lack of demand [10], [11]; Christie, Donn, and Walton [12] conclude that consumers are not willing to pay more for sustainability options; and sustainability attributes are losing importance in some countries, which, for example, is the case in the Chilean residential real-estate market [13].

If developers perceive a lack of demand for Green Buildings and consumers do not appear to care enough about sustainability, how can a price premium be charged for certified dwellings? The purpose of this study is to explore this contradiction. Namely, this study reviews the results of 52 studies published in 36 articles to understand if green labels are capable of having a global effect on the residential housing market; or if they only affect certain segments in the market. In other words, are green labels becoming the new normal in the residential real estate market?

The results suggest that the premium attributed to green labels (which most studies conclude exists) may have been systematically overestimated. Namely, studies have been assessing "green" consumers willingness-to-pay a premium for green certified houses, not the average consumer's willingness-to-pay. A green consumer is a person who 'takes into account his or her impact on the physical environment when making product purchases', i.e. 'purchasing environmentally-friendly products to minimise the potentially negative impact of purchases' [14, p. 45]. The results from our study would therefore

\* Corresponding author: [german.molinalarrain@vuw.ac.nz](mailto:german.molinalarrain@vuw.ac.nz)

imply that the calculated premium applies to only a fraction of the population, thus making it impossible for green labels to have a global impact on the residential real estate market.

This paper begins with a brief discussion on how green labels can influence price; this includes examining the Hedonic Regression Analysis method. We then discuss how we used a systematic literature review to explore this phenomenon. Following on from this, we discuss our key findings, which leads us to conclude that green labels currently have limited reach within the residential market. This is something that needs to be addressed if we want to see an increase in the number of energy efficient and sustainable buildings in the residential real estate market.

## 2 Background

### 2.1 Residential price premium as an indicator of a green label's effectiveness

The effectiveness of a green label will be measured in terms of the higher price that can be charged for the green-certified dwelling. The rationale behind this decision is that, if developers perceive extra revenue when labelling their projects, they will freely choose to use them, and the real-estate industry will effectively adopt them [4]. Otherwise, governments would need to intervene, transforming green labels into mandatory regulations.

Four methods used to study the effect of green labels on real estate prices were found in the literature: Hedonic Regression Analysis, Customer Surveys, Discrete Choice Experiments, and Conjoint Analysis. As mentioned by Breidert, Hahsler, and Reutterer [15], these methods can be classified into two groups: Revealed Preference methods and Stated Preference methods. Revealed Preference methods obtain data from price-responses, such as market data analyses and experiments. Stated Preference methods obtain data via direct or indirect surveys. In direct surveys, customers or experts are asked directly about their willingness-to-pay for a certain product. In indirect surveys, like conjoint and discrete choice analyses, a rating procedure is applied for deriving willingness-to-pay [15].

One of the main weaknesses with surveys is response bias, in this case, some consumers may not truthfully answer the willingness-to-pay questions [15]. Likewise, with studies that focus on socially-responsible behaviours and environmental issues, social desirability bias may distort the findings [McDougall 1993 cited in 16]. However, even if consumers' responses do reflect their true willingness-to-pay, purchase intention does not necessarily translate into actual purchasing behaviour [17]. Indirect surveys can resolve some of these weaknesses by using a rating system to derive the premium for green labels. Discrete Choice Experiments and Conjoint Analysis have been widely utilized [18] but

they too have similar weaknesses to Direct Surveys, i.e. relying on purchase intention, which does not always reflect actual purchase behaviour [15].

Revealed Preference methods are preferable if market data is available because they represent consumers' real behaviour. Luckily, the Hedonic Regression Analysis is a Revealed Preference method widely used for estimating the premium associated with green labels (e.g. [19]–[21]). Accordingly, this paper will focus on studies that have used the Revealed Preference technique for estimating the effect of green labels on dwellings' prices. Because of its predominance, the Hedonic Regression Analysis method is explained briefly in the following section.

### 2.2 The Hedonic Regression Analysis method

Hedonic Regression Analysis is a particular type of market data analysis that decomposes the price of a product in the contributions added by each of its attributes by means of regressions [20]. This concept is based on Rosen's [22] statement that a product can be considered a vector of objectively measurable and observable characteristics. These characteristics can be continuous (e.g. annual energy consumption), discrete (e.g. the year the building was built or the number of bathrooms) or binary (e.g. does it have a garage?). Accordingly, if one of the characteristics is a green label, the value attributed to the label can be estimated.

A potential problem with the Hedonic Regression Analysis is that the calculated premium does not correspond to a specific consumer, but to the interactions in the whole market [23]. Thus, it is common to assume that all consumers have the same preferences [24]. This limitation becomes relevant because, in order to have a global influence, green labels need to be valued by most consumers. So, understanding who is (and who is not) paying for the price premium enables one to design interventions and target certain demographic sectors more precisely. In particular, it is expected that green consumers will be the first to demand green certified dwellings. In view of that, a low market penetration for green-labelled buildings would indicate that it is mainly the green consumers market who is paying this premium. Yet, if green labels are to be effective from a sustainability perspective, one needs to focus on other segments as well.

## 3 Method

A systematic literature review was used to identify the impact green labels have on pricing within the residential real estate market. This methodology was chosen because it is an analytical tool that can identify, evaluate, and synthesize the results and implications of many studies in order to address a specific research question [25]. Unlike traditional narrative reviews, the systematic literature review is a scientific approach that uses rigorous methods in order to minimize researcher bias [26]. This method

has been used widely within medical sciences but over time has been adopted in other disciplines due to its methodological rigor and ability to inform policy and practice [27]. This study followed the systematic literature review procedures as outlined in [28].

### 3.1 Search process

After performing a brief literature review, it was determined that most articles that were relevant for this research could be found in four databases: ScienceDirect, Scopus, SAGE Journals and JSTOR. Accordingly, these databases were used for this study.

Considering the multidisciplinary nature of this research (covering economics, finance, real estate management, and building science, among others), broad search terms were designed (identified as ‘A’ in Table 1) and used in the mentioned databases. The search was performed considering only the Title and the Abstract of the available articles. Google Scholar was also used (as a broader search engine) to ensure that no relevant article was left behind. However, due to the differences between that search engine and the others, a different search term was used. While this new search term is much more restrictive, the search was performed in the whole article.

The search was performed in English, as it is the language in which most literature in the field is written.

**Table 1.** Search terms used in the literature review

ID	Search term
A	(Buildings OR houses OR residential) AND (sustainability OR Green OR Sustainable OR “Energy Efficiency”) AND (certification OR label OR Rating) AND (value OR price OR valuation OR premium)
B	buildings AND houses AND residential AND sustainability AND green AND sustainable AND certification AND label AND rating AND value AND price AND valuation AND premium AND "energy efficiency" NOT commercial

### 3.2 Study selection

This study considered only peer-reviewed articles that used a Revealed Preference method for determining the impact of green labels on prices in the residential market. A first screening was completed by reading the article’s title as presented by the search engines and, in case of doubt, reading the abstract. All of the selected articles utilized the Hedonic Regression Analysis.

One out of 30 relevant documents was discarded because it analysed the market at a time when green labels had not yet been adopted in China, and accordingly the results were no longer considered relevant [29].

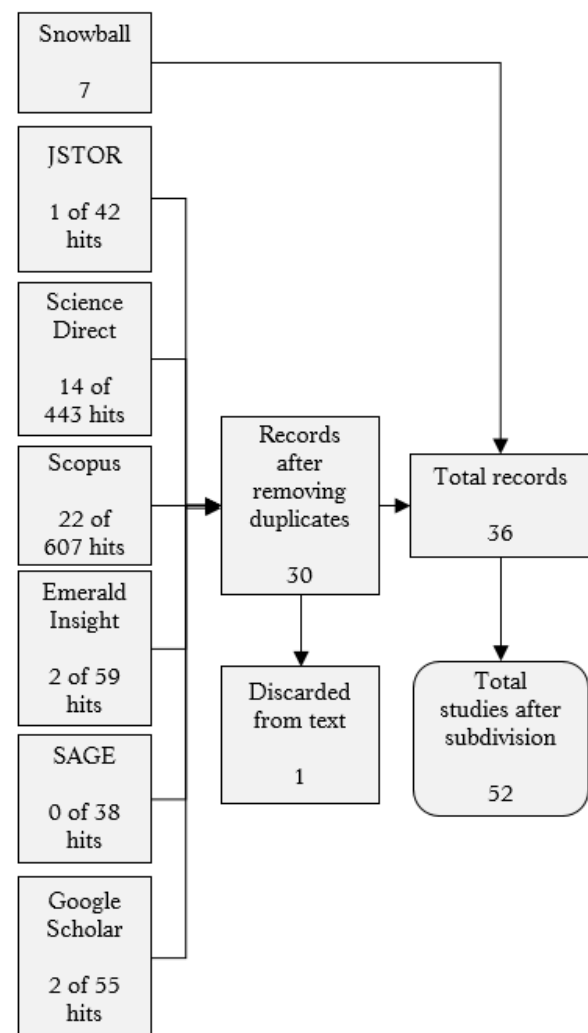
Additionally, seven documents were included in the database despite not having been found by the systematic

method previously explained. The decision was made because they were either official government reports [5], [30] or were widely referenced by the other documents [31]–[35]. A total of 36 documents published between 2008 and 2018 were reviewed. See Figure 1 for a representation of the selection procedure.

### 3.3 Data extraction

From the 36 reviewed documents, the following data were extracted:

- **Green Label name:** Different labels may have different impacts on price for various reasons.
- **Findings:** Positive, Negative or Neutral, depending on whether a price premium is charged for green labels.
- **Type of contract (sale or lease):** Different market segments choose different tenures, thus their willingness to pay may differ.
- **Location:** Allows identifying trends due to different countries, cities or cultures.
- **Market penetration:** Understanding the percentage of labelled or energy efficient dwellings in the market allows one to speculate about who is paying a premium for green labels (see section 2.2).



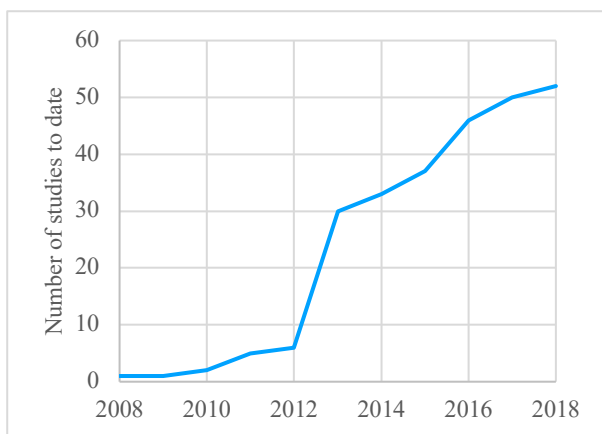
**Figure 1.** Hits and the final number of studies analysed

It should be mentioned that some articles contained information of more than one location (e.g. [30], [36]) and/or more than one kind of contract (e.g. [37]). In such cases, the studies' results were separated into their specific results, so each of them accounts for a single location and contract. After this process, the final number of studies was 52. Refer to Figure 2 for details about when the studies were published.

## 4 Results and discussion

The first noticeable trend is the dominance of the Hedonic Regression Analysis over others. In fact, all 52 studies in the 36 reviewed documents utilized this method.

Secondly, it was observed that most of the studies (60%) are focused on analysing the European Union's Energy Performance Certificates or its equivalents, followed by Green Mark (8%). This can be attributed to a report that was published in 2013; it reported 15 studies across 5 different countries in the European Union [30]. This is noticeable in Figure 2.



**Figure 2.** Cumulative number of reviewed studies by year

The studies are distributed in 22 countries, most of which have been classified by the World Bank as high-income. The only exception to this is China, which is classified as upper-middle income [38]. No studies were found for South America or Africa.

It should be noted that the majority of studies (87%) state that there is, indeed, a price premium for green labels. However, this fails to explain why developers see a lack of demand for green labels. The following subsections explore this contradiction further by studying the data within the reviewed studies.

### 4.1 Does the price premium actually come from green labels?

It is a challenge to estimate the value of green labels because it is often correlated with other characteristics of the property [39]. For instance, an energy efficient and/or certified dwelling will probably have double or triple glazing, a good heating and cooling system, modern luminaires and appliances, among other things. These

features, however, do not only increase the probability of getting a Green Label but also increase the perceived quality of the dwelling.

On the other hand, developers do not necessarily provide all their projects with sustainable attributes or labels. For example, sales prices and the number of certified dwellings can be clustered and not randomly distributed [40]. Namely, developers may choose to certify and label specific projects that are located in particular zones and price ranges. Likewise, newer dwellings are more likely to have a certification than older ones since many of them were built before the certifications existed.

The question discussed in this section, then, is whether the estimated price premium should be attributed to the green label itself, or whether it should be attributed to the perceived quality, the age of the property, or some other correlated attributes.

It is worth noting that researchers have already addressed the problem of non-random spatial and temporal distribution of certified dwellings. In fact, most studies include the location and age as a hedonic characteristic of the dwelling (e.g. [5], [30], [41], [42]).

The effect of the perceived quality, however, is more difficult to address. A survey conducted in Germany concludes that Energy Efficiency is a purchasing criterion of minor importance (9<sup>th</sup> place), below location (1<sup>st</sup>), price (2<sup>nd</sup>), the existence of a balcony/terrace/garden (3<sup>rd</sup>), condition of the building (4<sup>th</sup>) and other four characteristics [43]. This could explain, for instance, why energy retrofitted apartments (which enhances their "condition" considerably) are more valued by consumers than non-retrofitted ones [44], [45].

Two other studies have addressed this issue in particularly interesting ways. The first one applied the Hedonic Regression Analysis by using data from before and after the Energy Performance Certificates (EPC) were implemented in Norway [46]. Their results show that the premiums did not differ in both cases, suggesting that consumers were able to tell the difference between dwellings with different ratings even when the information was not available. This suggests that the value does not come from the label itself, but from other characteristics of the dwelling.

In contrast, Fesselmeyer [47] isolated the effect of the Green Mark certification in Singapore by analysing the sales price of a single building before and after the certification was awarded. This was possible because, in Singapore, developers can sell apartments before and after obtaining the Green Label. The results from this study indicate that apartments were sold with a 3% premium after the certification was obtained.

The contradictory results could be due to differences in how consumers perceive green labels, i.e. some labels may be deemed more or less trustworthy. Accordingly, some green labels may be valued more highly than other labels, or valued more in one location than in another, or simply not trusted at all. For instance, 'the premium

associated with the green, non-certified properties is substantially less than the LEED premium' in the United States [48, p. 138], evidencing the value created by LEED certification. Another example is documented by Limao Zhang et al. [40], who conclude that the regional certification program EarthCraft has a significantly higher premium than the national Energy Star certification program in Atlanta (US). Similarly, despite Energy Star being valued in Gainesville, Florida (US) [49], it does not seem to have any value in Austin, Texas (US) [50]. Finally, Chen, Peng, Liang, and Liang [51] conclude that consumers seem to value energy efficiency and "green features" but not the green labels themselves.

In summary, identifying whether the price premium actually comes from green labels may be an impossible task for two reasons. On the one hand, green labels are usually associated with other features that consumers value (e.g. recent renovations or state of the building). On the other hand, even if this association can be avoided (i.e. by having data from before and after labelling, or by finding two sets of similar properties with and without the label), the answer would highly depend on how consumers of a specific location perceive certain green labels.

#### 4.2 Is the average consumer paying a premium?

As mentioned earlier, the Hedonic Regression Analysis uses market data in order to decompose the price of a dwelling into constituent parts. One of the assumptions of this method, though, is that all consumers have the same preferences. This becomes an issue when comparing their environmental behaviour because consumers are known to have heterogeneous preferences. For example, 'occupants in green buildings are generally more willing to pay extra for such buildings' [52, p. 55] and 'labeled dwellings are mostly located in neighborhoods where density is higher, monthly household incomes are lower, and voting for "green" parties is more common' [6, p. 177]. Also, 'sales price and the number of green-certified home, are clustered and do not follow random spatial distribution across the study area' [40, p. 1232]. A clear example of consumer heterogeneity in the green building market was documented in [53]. In that study, a Hedonic Regression Analysis was performed for the condominium market in Tokyo, concluding that there is a premium for green labels. A more careful analysis, however, shows that the premium for such properties is primarily paid by higher-income households.

In addition, many of the reviewed papers assumed consumer homogeneity, which we know is not a true reflection of the residential real estate market. There was also low market penetration, i.e. green certified residential houses represented only a small percentage of the residential real estate market. This leads us to ask, who is buying green certified houses?

A survey performed in New Zealand (n=409 homeowners) shows that 79% of the consumers

displayed what was called *disconnected behaviour* related to sustainable building technologies [12]. That is, despite having all the information and actually wanting a certain product or solution, 79% of the people were not prepared to pay for it. More specifically, 21% of the population was willing to pay for green building technologies. In the absence of any other data sources, we will assume that only 20% of the population would be willing to purchase green certified houses in New Zealand. Although, further research would be required to confirm this.

While actual "market penetration" was not explicitly mentioned in a number of the reviewed studies, using other related information enabled us to estimate the magnitude of such penetration. For instance, in the case of the study conducted in Austria, it is mentioned that approximately 3,000 out of 54,000 (5.5%) properties listed provided EPC information [30]. Similarly, in the case of Belgium, the availability of EPC information applied to about one-quarter of the dwellings [30]. Even if this does not say much about the houses that obtained the score, it is safe to assume that houses that did not provide EPC information were not highly rated or were not available for rent or purchase. Likewise, even if information about the number of "sustainable" houses in Australia was not provided, [5], the corresponding study does mention that the average rating was 1.7 out of 6. It also mentioned that the standard dwelling (built before the rating was implemented) obtained less than two stars. Likewise, most dwellings in Belfast are labelled D and E [54]. Finally, a study made in California [55] refers to certified dwellings to be in the order of magnitude of thousands, while non-certified dwellings are mentioned to be more than a million.

Contrary to the examples mentioned in the previous paragraph, some studies did specify the amount of certified properties in the sample or market. For example, 10.2% of houses are labelled A, B or C in Stockholm [8] and 13.3% in Turin [56]. In Dublin, on its part, 13% of the dwellings are labelled A or B [57] (about 27% of Dublin's housing stock is labelled). In the case of Wales, 85% of the market is labelled C, D or E [58]. Similarly, about 10% of the market is labelled A, B or C in Spain [59] and almost 70% of the houses in Barcelona are rated E or G [60]. In Singapore, 11.5% of the resale market is labelled at all [34]. These data from Singapore will also apply to other studies in the same location [47], [61], [62]. The case of China is not better. Namely, despite being introduced in 2008, only 429 private projects have been labelled CGBL by 2013 [63]. Finally, while the two studies made in France did not report market penetration [30], a different article reported that about 84% of the dwellings in France are labelled D or lower [64]. It seems to be that the study which reported the highest market penetration (21.9%) was conducted in the US [49].

It should be noticed that there are 11 out of the 52 studies that offered no data about the market penetration of green labels [32], [36], [40], [41], [48], [51], [65]–[68]. The relevant information extracted from these studies, along with all the other previously mentioned, is



available to the reader in Table 2.

As mentioned earlier, Hedonic Regression Analysis utilizes market data in order to quantify the willingness-to-pay for, in this case, the availability of a green label. However, in a market with heterogeneous consumers, it is known that green consumers will be the first (or more likely) to purchase green properties. If, on top of that, there are few green properties in the market (i.e. low market penetration), then virtually all the certified dwellings will be purchased by green consumers. Thus the data with which the Hedonic Regression Analyses are fed does not account for the willingness-to-pay for certified dwellings by non-green consumers.

In summary, the willingness-to-pay for green labels calculated through Hedonic Regression Analysis cannot necessarily be attributed to the majority of consumers within that market, but to the most environmentally-concerned ones, i.e. the green consumer segment.

If only a fraction of the world's population is willing to pay a premium for certified buildings, developers will not see incentives in using them, and green labels will never reach full market penetration. In other words, they will not be able to cause a world-scale impact. This proposition is supported by two different sources of evidence, which will be explained below.

#### 4.2.1 *Stated preference methods do not show a clear premium*

Six studies that studied the impact of green labels in residential real estate prices were found during the systematic search. These are worth studying because their results are not affected by the mentioned bias [54]. That is, contrary to the Revealed Preference methods, Stated Preference methods allow one to identify who is paying price premiums in hypothetical choices where no scarcity of green buildings exists. Thus, they can identify how many and how much more consumers are willing to pay for green labels.

From these six studies, four conclude that there is no premium for green labels. To be precise, Amecke [43] and Murphy [69] conducted surveys in Germany and the Netherlands, respectively, concluding that the effectiveness of the EPC is limited. Similarly, a discrete choice experiment conducted in Ireland found that consumers are only willing to pay for energy efficiency improvements on the lower end of the spectrum [70]. From 'B' and above, on the contrary, willingness-to-pay is insignificant or even negative. Finally, the results from a survey conducted in Sweden suggest that consumers make a difference between low-energy buildings and certified buildings, valuing the former but not necessarily the latter [52].

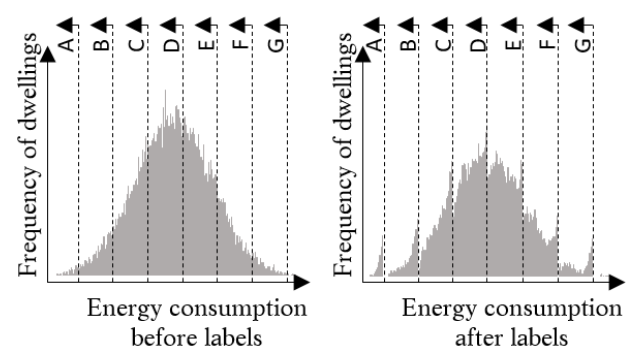
The other two studies, which concluded that there is a premium for green labels, were both conducted on the Singapore market [42], [61]. The study by [61] is of particular interest because it used two different methods for estimating the premium of the Green Mark label in Singapore. One of them was the Hedonic Regression

Analysis, affected by the mentioned bias, and the other was a survey, not affected by it. While the Hedonic Regression estimated a high premium of 9.6%, the survey estimated a considerably smaller one of 6.82%. This may be a reflection of the mentioned bias.

#### 4.2.2 *Investors and owners appear to only exploit low hanging fruits*

Bunching is the phenomenon caused by discrete scales (e.g. A, B, C, D, etc.). The public finance discipline were the first to use bunching analysis to investigate 'whether discontinuities in incentives elicit behavioural responses'; although it has now been used in other contexts as well [71, p. 663]. It was found that thresholds can drive bunching behaviour, i.e. behavioural responses may collectively bunch on one side of the threshold due to the discontinuity in the incentive [71]. However, to observe the phenomenon, large datasets are required because 'bunching usually occurs in close proximity to specific points' [71, p. 663]. A representation of Bunching is shown in Figure 3. The left side of the image shows a hypothetical normal distribution of dwellings' energy consumption, while the right side shows the effects of bunching. That is, 'an excess frequency of homes in the favourable side of a threshold accompanied by a much reduced frequency on the unfavourable side of that threshold' [72, pp. 2–3].

Only one of the studies found in this systematic literature review documented this phenomenon. In this case, an 'excess number of homes just in the right side of the notches' of the Austin Energy Green Building rating system was found in Austin, Texas (US) [50, p. 690]. The authors attributed this to developers engineering their projects to barely achieve certain ratings. That is, developers seem to be investing only in those points that have a relatively high return on investment.



**Figure 3.** Representation of the “Bunching” phenomenon.

This phenomenon was also reported in Ireland [72]. A subset of this data was studied two years later, concluding that Bunching appeared after houses had retrofits, and suggested that 'low energy lighting is the parameter most highly associated with bunching at the favourable of the BER thresholds' [71]. Such a study discarded that the bunching was caused by the behaviour of assessors or regional distribution.

## 5 Conclusions and implications

This study presented a review of 36 documents that reported 52 different estimations of the effect of green labels on the prices of the residential real estate market. All studies were performed using the Hedonic Regression Analysis, a Revealed Preference method that uses existing market data to assess the effect different attributes have on a dwelling's price. The studies were performed in 22 countries, all of which are considered high-income with the exception of China, which is considered upper-middle income. Accordingly, the following conclusions may be invalid in most middle- and all low-income countries.

Even if 87% of the studies conclude that there is a premium for green labels, a deeper analysis suggests that it is virtually impossible to generalize these results for all green labels in all locations. This is because the availability of a green label is often correlated with a dwelling's observed quality, thus attributing the premium to the certification is highly challenging. At the same time, even if the premium could be attributed to the label, its emitter can be more or less trusted by consumers.

The main conclusion of this study is that, due to the small market penetration under which the reviewed studies have been performed, there may have been a systematic overestimation of the price premium attributed to green labels. That is, studies based on Hedonic Regression Analysis have been attributing the willingness-to-pay to the most environmentally-concerned consumers, i.e. green consumers, not the average consumer. This would imply that the calculated premium applies to only a fraction of the population.

If this is true, green labels' reach is limited to the number of people who are willing to pay for them. Beyond that fraction, developers will see no incentives to certify their projects, effectively preventing green labels from solving the environmental problems attributed to the residential market.

It should be noticed that this result is independent of the capabilities of the different green labels to ensure a reduced environmental impact and energy consumption. Namely, even if labelled dwellings are more sustainable (a question not analysed in this article), the impact of such label is limited if consumers are not willing to buy them.

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## Appendix

**Table 2.** Studies reviewed

Reference	Location	Label	Contract	Premium / Findings	Market penetration
[5]	Australia	Australian star rating	Sale	1.23% premium for each half-star	Average rating was 1.7 stars out of 6
[30]	Austria (Lower Austria)	EPC	Sale	5% to 6% premium per letter	From almost 54,000 listing in total that were recorded, 3,000 contained EPC information
	Austria (Lower Austria)	EPC	Rental	4.4% premium per letter	
	Austria (Vienna)	EPC	Sale	10% to 11% premium per letter	
	Austria (Vienna)	EPC	Rental	4.4% premium per letter	
	Belgium (Brussels)	EPC	Sale	2.9% per 100 points	Information on the CPEB score is available for just over one quarter of the listing.
	Belgium (Brussels)	EPC	Rental	2.2% per 100 points	
	Belgium (Flanders)	EPC	Sale	4.3% per 100 points	
	Belgium (Flanders)	EPC	Rental	3.2% per 100 points	
	Belgium (Wallonia)	EPC	Sale	5.4% per 100 points	
	Belgium (Wallonia)	EPC	Sale	1.5% per 100 points	
[63]	China	CGBL	Sale	6.9% premium for labelled	429 housing projects had been CGBL-labelled in mainland China by April 2013. The label was introduced in 2008.
[8]	Finland (Helsinki)	EPC	Sale	Compared to D: 3.3% Price premium for apartments in A, B and C; and 1.5% when neighborhood is included	10.2% of houses are labelled A, B or C
[30]	France (Lille)	EPC	Sale	3.2% for each letter	According to [64], about 84% of the residential dwellings in France were labelled D or lower
	France (Marseille)	EPC	Sale	4.3% for each letter	
[32]	Germany	EPC	Lease	3.15% higher return and 0.76 more euros/m2 higher rent in efficient than in inefficient buildings.	
[36]	Hong Kong (Quarry Bay)	HK-GBC & HK-BEAM	Sale	6.4% premium for labelled dwellings	
	Hong Kong (Yuen Long)	HK-GBC & HK-BEAM	Sale	3.4% premium for labelled dwellings	

[57]	Ireland (Dublin)	EPC	Sale	3% per letter	13% of the houses with BER (which are 27% of the total) are in labels A or B
[30]	Ireland	EPC	Sale	2.8% per letter	Refer to [57]
	Ireland	EPC	Rental	1.4% per letter	
[37]	Ireland	EPC	Sale	Up to 9.3% in A vs D label	
	Ireland	EPC	Rental	1.1% per letter	
[56]	Italy (Turin)	EPC	Sale	No impact on prices	13.31% of the market is labelled C, B or A
[53]	Japan (Tokyo)	Tokyo green labeling	Sale	5% premium for labelled	It appears that eco-labelled condominiums in Tokyo are acquired primarily by higher income households
[7]	Japan (Tokyo)	Tokyo green labeling	Sale	5.8% premium is asked, 4.7% is payed	Refer to [53]
[33]	Japan (Tokyo)	Tokyo green labeling	Sale	There is a discount, associated (probably) to maintenance cost	
[6]	Netherlands	EPC	Sale	10% premium of A vs D	18% of the dwellings are labelled, and only 9% has label A or B
[54]	Northern Ireland (Belfast)	EPC	Sale	The results indicate a small but positive relationship between better energy performance and higher selling prices	“A large proportion of the housing stock rests in the middle of the EPC spectrum (Bands D and E)” (p. 310)
[46]	Norway (Oslo)	EPC	Sale	The apparent price premium of the energy labels clearly captures something else than an effect of the label themselves.	12% of the sample was labelled A, B or C
[34]	Singapore	Green Mark	Sale	4.7% premium	only 11.5% of the resale market has GM-label
[61]	Singapore	Green Mark	Sale	9.61% premium	Refer to [34]
[62]	Singapore	Green Mark	Sale	4% premium	

[47]	Singapore	Green Mark	Sale	3% premium	
[59]	Spain	EPC	Sale	5.4% for ABCD over others, and 9.8% for labels ABC over others	Homes labelled A, B and C account for less than 10% of the housing stock
[60]	Spain (Barcelona)	EPC	Sale	0.85% premium per letter	48.3% are rated E, and G is 21.8%
[65]	Sweden	EPC	Sale	No direct premium	
[66]	Sweden (Stockholm)	EPC	Sale	Energy performance effects selling prices positively	
[67]	Switzerland	Custom sustainability index	Lease	Positive relationship between environmental performance and price.	
[51]	Taiwan	EEWH	Sale	Premium exists for Green Features, but it is not significant for green labels	
[35]	UK	EPC	Sale	2.86% per letter	7.2% of properties in A or B rating
[39]	UK	EPC	Sale	Up to 5% for A/B dwellings vs D	93% of the dwellings are in band C, D and E
[30]	UK (Oxford)	EPC	Sale	Possible penalty	Refer to [35] and [39]
[48]	US	LEED	Sale	Up to 9.1% premium.	
[68]	US	LEED	Sale	No significant positive relationship between price and certification	
[55]	US (California)	LEED & Green Point	Sale	2.1% premium	Mention about 1.6 million non-certified houses, and talk about certified houses in the order of 5,000
[49]	US	Energy Star	Sale	1.2% premium	About 22% of the sample has label
[31]	US (Fort Collins, CO)	Energy Star	Sale	\$8.6 more per sq. foot	Energy-efficient houses account for 21% of the new home construction
[40]	US (Atlanta)	Energy Star & EarthCraft	Sale	11.7% premium	

[41]	US	Energy Consumption	Sale	2% increase price by \$1 per m <sup>2</sup> reduction in Energy bills	
[50]	US (Austin, TX)	Austin Energy Green Building (AEGB), Energy Star and Environments for Living (EFL)	Sale	5% average. Energy Star did not get any premium	6.9% of sample is labelled and 59% of those are in the "entry" level
[58]	Wales	EPC	Sale	Up to 12.8% for A/B dwellings compared to D	85% of the dwellings are in bands C, D or E