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Investing into Land Lease Structures

An Alternative for Index Linked Bonds

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Investing into land lease structures: an alternative for index linked bonds

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Abstract

Index linked bonds attached to Dutch inflation have been a subject of interest for pension funds in The Netherlands for a long time. Such bonds are very convenient to protect the pension funds' clients from long term inflation risks; however, the Dutch government's reluctance to issue the above mentioned financial instruments forces the country's pension industry to look for alternatives.

Land lease structures are already common in The Netherlands and the risk return structure of these financial contracts resembles the one of government issued bonds. This is our motivation to research whether land lease structures in which the land rent payments are linked to inflation can be an alternative for indexed bonds.

We used past data to create Dutch indexed bonds and inflation linked land lease structures as if they existed before in The Netherlands. The risk and return results of the historical analysis showed that inflation linked land lease structures can be an alternative to inflation linked bonds. The observation of legal and tax issues leads us to the same conclusion.

The results of our research add more empirical validity to the idea that land lease structures can be an alternative for index linked bonds and can give more confidence to the newly developing market for inflation linked land leases.

Our work also has some interesting implications. The data on land prices observed and the current behavior of land lease markets gives us ideas for a product which, while it is not an alternative for an indexed bonds, can be a subject of interest for pension funds.

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Chapter 1: Introduction

1.1 Motivation

For a variety of reasons which we will not discuss in this paper the Dutch government does not issue inflation linked bonds and remains reluctant to do so in the future. This position of the state is not well accepted by pension funds in The Netherlands which see index linked bonds tied to Dutch inflation as a great financial instrument to protect their clients' savings from long term inflation. The strategic importance of Dutch indexed bonds for pension funds and the unwillingness of the government to issue them leave a large gap which has not yet been filled.

Pension funds have looked for alternatives such as foreign issued bonds linked to European or other country's inflation; however, nothing yet has given the protection against Dutch inflation which indexed bonds issued by the government of The Netherlands would have provided.

In many ways the risk return structure of land lease structures resembles the one of government bonds. This has lead to the idea that if land lease structures are linked to inflation they can be an alternative to inflation linked bonds. Our goal is to further investigate both land lease structures and indexed bonds and to determine whether the first can be an alternative to the second.

1.2 Research question

With this research we want to address the following question:

Can inflation linked land lease structures be an alternative for indexed linked bonds?

To address the question we first examine in detail land lease structures and indexed bonds. Then, using past Dutch financial data, we artificially create inflation linked land lease structures and indexed linked bonds as if they existed in The Netherlands in the past.

Following that we compare the returns of both and the risks associated with these returns. We also take into account all other considerations such as legal and tax ones, which could play a role in determining the answer to the research question.

1.3 Structure of the document

The document is organized in the following order. After the introduction, in Chapter 2, background information is provided on index linked bonds and land lease structures. First, each one of them is described in detail and then the similarities and differences between them are discussed in a separate section.

In Chapter 3, the term inflation linked land lease structure is introduced. We define it and describe it in detail and then contrast it with an index linked bond. The new element in this chapter is that we add a linkage to inflation to a land lease structure.

In Chapter 4, one of the major issues we faced during our research, the availability of data is faced. The methods used to derive suitable data on land prices are showed, followed by a discussion on the land price tendencies in the recent past.

Chapter 5 is dedicated to the historical analysis of the risks and returns of inflation linked land lease structures and index linked bonds in The Netherlands. As neither one of them has a history in this country, we used financial data to simulate the existence of such financial products in the past. The empirical results of this chapter provide the answer to the research question.

In Chapter 6 the marketing of inflation linked land lease structure is discussed. Following is the conclusion which includes some very interesting implications and ideas for further research.

Chapter 2: Background information on index linked bonds and land lease structures

2.1 Index linked bonds and their alternatives

The term index linked bond refers to a bond whose coupons and principal are tied to a specific index. The index used (the consumer price index or another one) is used to represent the inflation changes. The cash flows coming from the bond are adjusted to make sure that the holder of the bond receives a known real rate of return. The difference between conventional bonds and index linked bonds is that conventional bonds make payments which are fixed in nominal terms while index linked bonds make payments which are fixed in real terms. The cash flow and nominal yield of a nominal bond are adjusted by the expected inflation when the bond is being issued while the cash flow and maturity value of an index linked bond are being adjusted throughout the whole life of the bond. In the case of a nominal bond, if inflation rises above the expected levels, the real rate goes down; if inflation declines unexpectedly, the real rate goes up. The idea of index linked bonds is to protect both the lender and the borrower from the uncertainty of inflation over the life of the bond. Index linked bonds are attractive to investors because they guard their purchasing power.

The benefits from owning index linked bonds are greater for long term bonds than for short term bonds as inflation for long term bonds can be significant and have a large impact while inflation for short term bonds is usually minor and as a rule much easier to forecast. Also, inflation variations affect much more long term bonds than short term bonds due to the effect of compounding. Nominal bonds are subject to inflation risk and therefore some of their returns should be considered an inflation risk premium. It would make sense for the nominal yield of a nominal bond to be a sum of the real return, the expected average inflation over the bond's life, and the inflation risk premium. If we assume that on average expected inflation and actual inflation are the same, nominal bonds would be more expensive than indexed bonds by the size of the inflation risk premium (the yield of an indexed bond would be the sum of the real return and the actual inflation over the bond's life). From the perspective of the issuer index linked bonds can be used to reduce borrowing costs. This happens due to the fact that the inflation risk premium is saved.

Since the benefits of indexed bonds are much more related to long term bonds, both borrowers and lenders are rather interested in long term index linked bonds than in short term ones. The main benefit to a purchaser of a bond is that he would get a long term asset with a fixed long term real return free of inflation risk. Logically, index linked bonds appeal the most to investors for whom real value uncertainty is a major problem. Investors with such interests would be pension funds and life insurance companies because they try to preserve the real value of their liabilities to their clients.

Index linked bonds are a small but growing portion of the European bond market. They were first introduced by the French government in 1998, followed by the Italian, Greek, and Austrian governments. Also, German and Swedish governments have issued index linked bonds. The United Kingdom has issued the greatest amount of index linked bonds; however, they use different calculation method and seem less popular on Continental Europe. World wide, Australian and Canadian governments have issued index linked bonds. Privately issued index linked bonds are practically impossible to find.

Some of the major issues related to index linked bonds are their availability and liquidity. There are not Dutch government index linked bonds. Foreign issued indexed bonds are linked either to the issuing country specific inflation or to the Euro zone inflation. Either way, Dutch companies (pension funds for example) cannot use index linked bonds to protect themselves against Dutch specific inflation. Index linked bonds are less liquid than nominal bonds and this might be the reason why most companies have much more nominal bonds. The low liquidity forces investors to require liquidity premium to hold index linked bonds. This liquidity premium required can overwhelm the benefits issuers may have gotten from saving the inflation risk premium. In the case of Cordares, only ten percent of fixed income assets can be inflation linked bonds. This percentage is set by the asset allocation strategy currently being used by the company. This allocation can go up if availability and liquidity of index linked bonds go up.

Another issue is that bond payments are tied to a lagged value of a price index. A three month lag would mean that each semiannual coupon payment from an indexed bond is determined three months in advance. Logically, as it is the case with nominal bonds, the predetermined nominal payment creates inflation risk. This is not a significant problem though; because

there is a very small risk of differences in inflation between overlapping-six month periods and any potential differences will be compensated in the next coupon payment. The only period during which investors would be exposed to inflation is the three months before the maturity date. However, this is a very short period compared to the bond's entire life and the inflation risk is negligible (Wrase 1997).

A possible issue related to inflation linked bonds is how accurately indexes, no matter if domestic or international, represent inflation changes. For example, some economists state that the CPI overstates the true inflation. This should not be a problem, as participants in the bond market take into consideration their perception of any bias in the index's measurement of inflation when they price securities (Wrase 1997).

The liquidity and availability risk, the accurateness of index risk, and the lag risk sum up the downsides related to index linked bonds. While the last two are negligible the liquidity and availability risk remain an issue today.

In the next paragraph we will discuss the differences between linking inflation bonds to domestic or to international indices. France has issued both inflation linked bonds linked to French inflation and inflation linked bonds linked to eurozone inflation. However, recent issuers have been linking their bonds to eurozone inflation. Typically they use a European index – a harmonized index of consumer prices excluding tobacco (Arnold 2006). In the last years, the share of index linked bonds tied to the European index has become bigger than the share of index linked bonds tied to country specific price indices. Some authors (Wolwijk and De Haan 2005) believe that tying index linked bonds to the European index increases their attractiveness, widens the investor base, makes them more tradable, and lowers the liquidity premium. For example, in the case of the first French index linked bonds tied to the European index 75% were sold to non residents (so linking to the European index indeed widens the investor base).

Still, there are significant differences between bonds linked to a country specific and to Euro zone inflation. They provide different protection to their purchasers. According to Arnold 2006, index linked bonds tied to the European index are less useful for diversification purposes compared to the ones linked to national price indices. From the investors' point of view, the dilemma between euro linked and nationally indexed inflation linked bonds can be

seen as a trade-off between inflation hedging and liquidity. Index linked bonds tied to European inflation are more liquid but do not provide protection against a country specific inflation. From the perspective of most pension funds, protection at the national level is more important and they would prefer nationally indexed inflation bonds. However, in real life, the benefit nationally indexed bonds have as better hedges of inflation risk can be destroyed by their lower liquidity. Bonds linked to national consumer price indices permit better ALM management for local investors but the price for this is the lower overall number of investors. Of course, we can say that the lower liquidity of nationally indexed bonds is a result of market incompleteness.

Authors such as Ceccacci, Marchesiani, and Pecchi (2005) find it strange that index linked bonds have emerged and are taking a growing share of the market at a time when the European Central Bank has strongly committed to maintain price stability. One explanation can be that financial instruments are becoming more complex and serve human needs better. Investors want to be protected against insurance risk and even thought the European Central Bank is putting solid effort to decrease the inflation risk itself the desire of investors to be insured especially in the long run remains. Obviously, the efforts of the ECB, while being successful in controlling inflation at a low level, cannot wipe out the fear of the impact inflation changes can have on real returns.

J.A. Garcia and A. van Rixtel in their 2007 paper *Inflation linked bonds form a central bank perspective* state that the eurozone inflation linked bond market seems very promising. According to them, with the rising number of sovereign issuers and available maturities, the liquidity and availability of bonds will increase significantly. They mention that there is a lot of potential for additional supply of inflation bonds from the private sector which is currently issuing a negligible amount. The authors also recognize the fact that as index linked bonds are a relatively new asset class and investors need to get accustomed to it, entry cost for private issuers can be high.

If we look at the economy as a whole, the growth of the numbers of government issued index linked bonds issued can have a positive impact as it would remove an incentive to create inflation. When predominantly nominal bonds are in place, governments can significantly decrease public debt by creating unexpected inflation (Arnold 2006). If private entities start issuing more index linked bonds, this might increase the liquidity of such bonds (along with

the low availability, the low liquidity is one of the main reasons many companies avoid investing in index linked bonds). The increased liquidity can put further pressure on governments to issue index linked bonds (as they could no longer use the low liquidity as an excuse not to do so) and this will result in greater good for society. In their paper from 2005, *Managing Debt Stability*, Bacchoicci and Missale suggest that according to their empirical evidence a large share of public debt should be linked to the price level. On the other hand, an increase in the liquidity of privately issued index linked bonds can result in a decrease of the liquidity of other bonds including government issued nominal bonds. This would result in an increased cost of financing public debt.

As the Dutch government has not issued index linked bonds, we are not aware if index linked bonds would be subject to a tax treatment any different from the tax treatment nominal bonds are subjected to. The issue that could arise from this is whether a possible increase of the nominal value of the indexed bond (due to an increase in inflation) would be taxed and whether this taxation would make index linked bonds less attractive. In the Netherlands, coupon income is taxed at the marginal tax rate of the investor while capital gains are tax exempt. The increase of the value of the bond due to its indexation would be considered capital gain and will be tax exempt. Therefore, we can assume in our further discussion of the tax treatment of bonds in the Netherlands that index linked bonds and nominal bonds would be subjects to the same tax regulations.

2.2 Land lease structures

Due to the low availability of index linked bonds, historically, there have been various attempts to create suitable alternatives. Some of the options have been real estate, infrastructure, and energy networks. The safety of these investments strongly relates to the idea of risk free bonds. Still, organizing such investments into structures that would resemble index linked bonds has not been successful so far as it turned out to be very complex and the similarity was not as big as originally thought.

Another alternative, land lease structures, appears to be a much more suitable substitute for index linked bonds and will be researched in detail in this thesis.

Land lease is an arrangement between an owner of the ground and the lessee in which the owner gives up some of his rights regarding the use of the property to the lessee; however, the property rights of the owner are not transferred. Usually, ground leases are property transfers limited in time; however, there are also perpetual ground leases. When the land lease has expired the owner receives back the property of the land and it is his right to expect from the lessee that the land was maintained according to the contract and not harmed. A ground lease is a property right, and by being that it is tied to the land and not to the person or company occupying the land (The Development Corporation Amsterdam).

The Dutch legal system which is based on the Napoleonic Code allows for land leases. According to the Dutch Civil Code, book 5, title 7, article 85, Erfpacht or land lease is the right to hold and to use land property owned by someone else. The land lease can be traded and it has monetary value. Municipalities have the right to grant building permits, therefore, they can be part of the relationship between the owner and lessee. The leaseholder can sell the ground lease rights to a third party without the permission of the owner of the ground. In other words, a land lease can be transferred from one lessee to another lessee without the need for approval by the owner of the ground (The Development Corporation of Amsterdam).

In the past two centuries some Dutch municipalities have chosen to grant ground leases instead of freehold rights for a number of reasons. By remaining the owner of the land the city can keep the control over the use of the ground. Financially, the municipalities and consecutively the whole communities have benefited from the increases of the land values. If freehold rights were issued instead of leases the increases of the land value would be lucrative only for the owners. The municipalities revise the ground rent at the end of the lease period to make sure it reflects the changes of land values. Some municipalities have implemented index linked ground rents. The index linked ground rates are adjusted every five years according to the changes in inflation (The Development Corporation of Amsterdam).

From municipal point of view there are various forms of ground leases in The Netherlands. One option is to have a ground lease right for an indefinite time span. In this case, after a premium is paid at the moment of granting the lease, the contract is valid as long as the use of the ground remains the same. Another option is a land lease that applies for an indefinite period of time but is separated into administrative periods of 50 to 75 years. If changes in regulation occur during the period they are included in the contract at the end of the 50 or 75

years. The third option consists of a definite period of 99 years and administrative periods of 50 years. Once the 99 years are over the ground lease is terminated (The Development Corporation of Amsterdam).

What kind of public leases are in place can be interesting for private parties willing to lease the use of a land they own. While the approval of the municipality is always needed, private parties can structure the land lease in different ways and are not constrained by the three options used by the city government. Also, the fact that municipalities have already indexed some ground rents is a very good sign for private entities willing to do so and an indication that they will be allowed to implement yearly indexation.

Legally, there have been various acts of Parliament and provisions of local authorities which regulated the use of real estate. The statutory provisions on ground lease are listed the Civil Code (Burgerlijk Wetboek) in sections 5:85 to 5:100. According to the legislation, the lessee and the lessor have a lot of freedom in how they negotiate the terms of the lease as long as they satisfy the mandatory rules of the law. Ground lease rights are very difficult to terminate. Usually, if the lessee wants to terminate the lease, he or she has to wait for the expiration of the period of the lease and not accept a new one (The Development Corporation of Amsterdam).

In the case of public land leases, various financial and political forces drive the rents in a not completely transparent way. The city of Amsterdam has stated the following formula to calculate the ground rate:

Ground rate = Land value x Ground rent rate

The land value is based on the market value which may depend on the location of the land, the designated or permitted use of the land, and the size of the building (if any) existing on the land. The ground rent rate is linked to the interest rate on the capital market. Currently, the municipalities in Amsterdam are giving lessees the choice among an annually indexed ground rent, a 10 year fixed ground rate, a 25 year fixed ground rate, or paying a premium for the whole remaining lease. Logically, the rate is different for each type. The general rule is that the higher the fixed period is the higher the ground rate is. The annually indexed ground rate is adjusted annually using the inflation minus 1% The Municipal Executive of the City of

Amsterdam each quarter calculates the ground rates using as a basis the actual return on government loans plus an increment depending on the kind of ground rent selected (The Development Corporation of Amsterdam). From the perspective of private parties, there are not legal restrictions on how a private land lease structure is financially organized.

Helsinki ground lease experts have noted that ground lease structures are interesting to investors because such structures do not require them to buy the land on which they build their premises and prevent them from freezing money, they would otherwise invest in their core activities, in land (The Development Corporation of Amsterdam).

Land lease structures appear a very solid contract. From the prospective of the issuer, he or she remains in possession of the land and is practically sure that the rent payments due will be received. The lessee cannot use the land or transfer the right to use the land to a third party when the payments are not made. From the perspective of the lessee, once the lessor has entered into the agreement he is legally obligated to follow it till the expiration of the lease. Historically, land lease structures have proven to be a very stable contract in which both parties practically always meet their responsibilities.

Ground rent payments are deductable for income tax purposes. However, if a lessee chooses to pay a premium (pay the rent for the whole period of the lease at once), the rent is not deductable.

2.3 Similarities and differences in the structure, characteristics, legal status, and tax treatments of index linked bonds and land lease structures

So far, we have discussed index linked bonds and land lease structures. This section of the thesis is dedicated to the comparison of the two.

We will begin with the similarities between index linked bonds and land lease structures. The first one is the security of both investments. The risk of a government defaulting on its bonds is very low and so is the probability that one of the sides in a land lease agreements will not receive what the contract has promised. While recent history has proven that actually it is possible that governments default on their bond promises, government issued bonds remain

the safest investment on the market for securities. On the other hand, as already discussed, land lease structures are a very solid contract. Once the lessor has entered the agreement, he is obligated to follow it till the expiration of the lease with practically no possibilities to break the contract. The lessee cannot use the land or transfer the right to use it unless the required by the agreement payments are made. The issuer remains in possession of the land and the existence of this underlying asset makes land lease structures possibly even safer than bonds. Historically, land leases have showed to be a very solid agreement in which practically always both sides meet their responsibilities.

An interesting question that arises from the comparison of the safety of index linked bonds and land lease structures is what impact would the index linkage have on the security of both investments. In the case of bonds, it is frequently assumed that a government can always create inflation to decrease its obligations to a level at which it can pay them. If the obligations are linked to inflation, this method would no longer work. The only thing the government would be able to do to pay its debts is to increase taxes. In the case of land lease structures, there is no guarantee that the income of lessees is going to be linked to inflation and if an increase in inflation would not make it more difficult for them to pay their rents. For index linked bond issuers and for land lessees, indexation can potentially increase their obligations in real terms if their income is not indexed for inflation. While this is a potential danger, and therefore is mentioned, it does not have much significance for the core topic of the thesis. The thesis focuses on whether land lease structures can be an alternative for index linked bonds. The potential risks for governments issuing index linked bonds are not part of our main interests. Also, logically, people whose income is not linked to inflation should not be interested in being lessees in structures indexed to inflation. Logically, most people's incomes are linked to inflation and the exceptions of the rule will not be a group so large to significantly reduce the target market for the product discussed. The product of this thesis is guided toward those interested in protecting themselves against inflation (issuers of land leases) and those who can benefit from this interest (buyers of buildings or parts of buildings, apartments etc. who would prefer not to buy the land under the building).

In conclusion of the topic about the security of bonds and lands, we believe that both are as close to risk free investments as we can get currently. Also, the indexation of both will not make one riskier than the other.

The next aspect of both types of investments which will be discussed is their illiquidity. At first sight, one might worry that the market for bonds is much more liquid than the market for land leases. It should not be forgotten, though, that we are in search for an alternative of index linked bonds, not the regular bonds so popular on today's financial markets. Currently, there is not a market for Dutch index linked bonds because these are not existent. The market for Euro area index linked bonds is illiquid. Conversations with specialists in bond trade have shown that the reason most companies have very small allocations in their portfolios for index linked bonds is their low availability. Also, many of the potential purchasers of such bonds (such as pension companies) intend to hold them for a long term. It seems logical to conclude that since currently there is not a well established index linked bond market; an alternative such as land lease structure could only do better in terms of liquidity.

Indeed, the biggest clients who would want the land on their balance sheets (pension funds, insurance companies, etc.) intend to hold the asset for a long time and the low liquidity is not a matter of concern for them. However, many others would still compare the liquidity premium and the inflation premium and if the liquidity premium remains high it will keep the market for alternatives for index linked bonds a niche exciting only for pension companies (such a niche would still be lucrative enough to make the alternative worthwhile developing!).

There is confidence on the market that there is demand for index linked bonds in the Netherlands and the reason for the illiquidity is their low availability. As alternatives for index linked bonds are developed and marketed their liquidity will only be increasing. To summarize everything written above, the current low liquidity of the index linked bonds market allows us to develop a valid alternative. The confidence of the market in the demand for such (especially on behalf of pension and companies) can be a guarantee for the existing potential. However, the long run success and growth of index linked land lease structures will strongly depend on their liquidity. If they remain illiquid, they will always be used only by pension companies and maybe few others. However, if we develop a product which has a potential for a higher liquidity, this could create new opportunities as the liquidity premium goes down. More investors, apart from the pension companies, will choose index linked bonds to avoid the inflation risk premium and decrease the variability of their real returns. The condition of this is that the liquidity premium should be lower than the inflation risk premium. In other words, we have to design land lease structures whose liquidity will be as high as possible

The rents for land leases are usually paid annually while coupon payments for bonds are most frequently payable semiannually. This difference is minor as we can easily structure the rents for land leases in a semiannual manner.

As mentioned earlier in the thesis, the liquidity and availability risk, the accurateness of index risk, and lag risk sum up the downsides of index linked bonds. The same downsides would apply for land leases linked to inflation. In the beginning, until a market is well developed, liquidity will be an issue for index linked land leases. The accurateness of index risk and the lag risk are inherent to indexation and will remain existent independently of whether bonds or land leases are indexed. Also, the dilemma whether indexation to Eurozone or Dutch inflation is more proper applies in the same way to both index linked bonds and land lease structures.

We can wonder why would index linked bonds and index linked land leases emerge at a time when the European Central Bank is so committed to keeping inflation low. The fact is that despite the efforts of European Central Bank, inflation risk remains existent and financial institutions and individuals are seeking protection from it especially when they are seeking protection for their long term investments.

In many ways we discuss index linked land lease structures as a product for pension funds. As pension funds are tax exempt, from their perspective taxes are not an issue and should not be a matter for future discussion. However, we have to consider the possibility that financial organizations other than pension funds could be interested. Also, we should take a look into the impact taxes can have on the lessees.

In the Netherlands, annual ground rent payments are deductable from income tax (The Development Corporation Amsterdam). We can presume the same is the situation if we structure land leases with semiannual ground rent payments. So from the perspective of the lessees there are not tax considerations. The more interesting part is how the entity in possession of the land (in case it is not a pension fund) will be taxed for the ground rates received. While we are going to structure the ground rents as coupon payments they will technically remain ground rents and will be taxed as such. Also from the perspective of the entity owning the land (in case it is not a pension fund), it is important to know what is difference in terms of taxes between owning a bond and owning land.

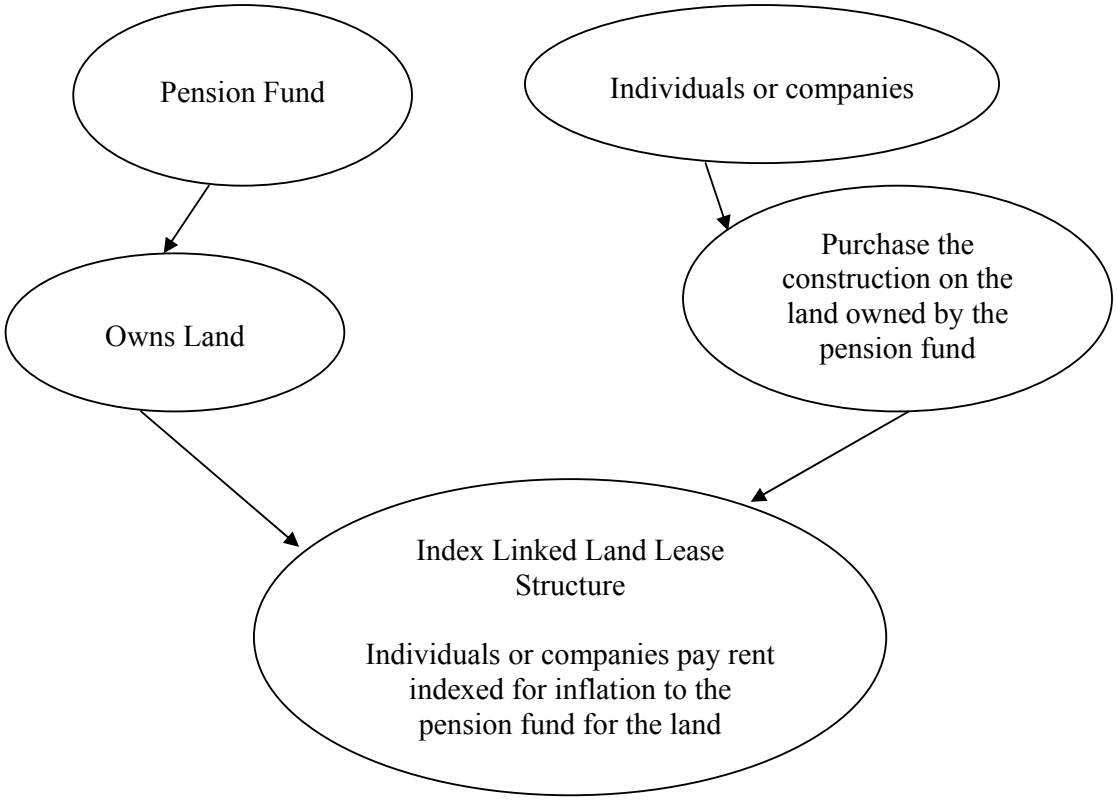
Selling immovable property is usually tax exempt in the Netherlands. The same is the tax treatment of letting immovable property. The local authorities in the Netherland charge a property tax which is based on the market value of the property and applies to both the owner and the user of the property. Usually the rates are between 0.1% and 0.3%. Real estate transfer tax is charged on the acquisition of property. The rate is 6% on the higher of the market value and the purchase price of the real estate. Following is a summary of the tax treatments which are relevant to the thesis:

Buying land	Taxable at 6%
Selling land	Tax exempt
Renting land	Tax exempt
Rent payments	Tax deductible
Owning/Using property	Taxable at the local level at 0.1%-0.3%

Chapter 3: Inflation linked land lease structure

3.1 The structure of an Inflation linked land lease[1]

Index linked bonds and land lease structure have already been described and compared in detail. In this section it will be illustrated what is inflation linked land lease structure.



From the diagram above the structure of an index linked land lease can be observed. On one hand there is a pension fund[2] which is interested in protecting its clients' assets from inflation.

[1] Inflation linked land lease structure and index linked land lease structure have exactly the same meaning and are used interchangeably throughout the thesis

[2] There is no requirement that the financial entity which will be the owner of the land to be rented has to be a pension fund. Any financial organization which seeks protection from inflation and has assets to invest can be on this side of an index linked land lease structure. Pension funds are used as an example throughout the thesis because of their desire to protect their assets for inflation and long investment horizon. These investment objectives motivate Dutch pension funds to search for alternatives of index linked bonds.

On the other hand there are individuals/organizations who would find it much more convenient to purchase apartments, building, factories, etc. without having to buy the land under them[3]. The interests of the two groups meet in an index linked land lease structure. The pension fund can purchase a parcel of land with a construction on it. The individuals/organization can purchase only the construction and not the land from the pension fund[4]. Then the pension fund will rent the land to the purchasers of the construction for periodic payments. These payments will be determined after the land lease rate is multiplied by the value of the land. The term "land lease rate" has just been introduced. In essence it has exactly the same meaning as ground rent rate but it refers to the ground rent rate that will be used in the land lease structure. As in most of the cases the rate used in an index linked land lease will be different from the ground rent rate used by the municipality, the new term has been introduced to help differentiate between the two.

The owners of the construction have the buyback option. This means that at the end of the lease they can purchase the land at the initial price[5] indexed for inflation. By this way, they can benefit from all improvements they might have done to the land or from the general increase of the land prices. This is an option, so the owners of the construction do not have to exercise it if they do not wish to or if for example land prices went down during the period. In other words, the owner of the land bears all the downside risk related to the movement of land prices and the owners of the construction get all the upside risk .

In the structure of an index linked land lease we always talk about land with construction on it. The question remains why such a structure could not be based on land without construction. The reason land with construction is required for this product is the safety that the construction adds to it. Put another way, there can be an index linked land lease structure based on land without construction; however, such structure will not resemble an inflation linked bond. Renting land without construction on it resembles renting an apartment – there is a chance that the lessee can leave without making all the payments. This would add a lot more risk to an index linked land lease structure and will convert it into a riskier investment than

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[3] The motivations for individuals and companies to enter into an index linked land lease structure are discussed in more detail in the marketing section.

[4] In the case that the index linked land lease structure is already signed by the two parties before the land and construction are purchased, the pension fund should purchase only the land. By doing this transaction costs will be saved (the pension fund will not have to buy the construction and then sell it to the oher party in the index linked land lease structure).

[5] The price of the land as appraised at the beginning of the contract

inflation linked bond. However, construction on the land makes the structure a lot safer. There are strong legal restrictions on the use or sale of the construction if rent payments for the land are not made. This makes it extremely unlikely for rent payments to remain unpaid if there is construction on the land. The safety associated with the presence of construction on the land is the reason why construction is needed for an index linked land lease structure to resemble an index linked bond.

3.2 Structure of Index linked land leases vs. Structure of Index linked bonds

Further in the thesis, tables will be presented showing what the results would have been if index linked land leases and inflation linked bonds were introduced simultaneously in the past. Here, we will compare the structures of index linked land leases and index linked bonds so that it is logical where the results from the tables will be coming from and what the base for the conclusions made is.

Index linked land lease structures	**Index linked bonds**
Rent structure	Coupon structure
Change in land value	Change in nominal value of the principal

Land Value vs. Value of Principal

As it has already been discussed in the section describing index linked land lease structures, all the upside potential coming from the change in land value is given to the purchasers of the construction. So at the end of the 30 years the owner of the land will get the initial price of the land indexed to inflation. In the same way, a purchaser of an index linked bond will get the initial value of the principal indexed to inflation. Therefore, the owner of the land and the owner of the index linked bond will receive exactly the same amounts from land and the principal (if the initial investment amounts are the same of course)[6].

[6] As pointed in the section describing index linked land leases, there is the small possibility that land 30 years after the start of the contract will be cheaper than the initial price. In this case the owner of the land will receive a smaller value than the owner of the principal (or will keep an asset with a smaller value)

The conclusions made in the previous paragraph indicate that the difference in cash flows coming from index linked land lease structures and index linked bonds originates in the difference of cash flows coming from rent payments and coupon payments. Therefore the relationship between indexed rent payments and indexed coupon payments will be discussed in the following section.

Rent structure vs. Coupon structure

Rent payments and coupon payments are created by all the same elements but one. This is made very obvious by the following equations:

$$GR = (1+i)*(g * LV)$$

$$CP = (1+i)*(r * BV)$$ [7]

The land value and the bond value are equal by default[8]; inflation participates in both equations leaving ground rent rates and interest rates to be the only different parts. The difference in the values of ground rents and coupon payments will be determined by the difference between the ground rent rate and the interest rate and will be multiplied by the size of the initial investment and the duration of the contract (if we look at the sum of all cash flows from ground rents and coupon payments throughout the time period considered). So it is essential to further investigate ground rent rates and interest rates[9]. The best scenario is for the ground rent rates to be systematically higher than the risk free rate.

The City of Amsterdam Development Corporation which is responsible for setting the ground rent rates has indicated that the ground rent rates are related to the interest rates on the capital market and the ground rent rates rise and fall in line with the interest rate. This political

[7] CP-coupon payment; BV-bond value; GR-ground rent; LV-land value; r-interest rate; g-ground rent rate; i-inflation

[8] When comparing index linked land lease structures and inflation linked bonds, we assume the same initial investment amounts for both to make the comparison easier.

[9] The risk free rate (The Netherlands Interbank 3 month lending rate) is used, as the coupon payment for inflation linked bond is determined by the risk free rate plus inflation

promise is a positive sign indicating that there is intention for stability in the relationship between ground rent rates and the risk free rate.

In the following table historical data is presented on ground rent rates and the risk free rate:

[10]

Year	Ground rent rate	Risk Free Rate	Ground Rent Rate - Risk Free Rate
1985	8,90%	5,72%	3,18%
1986	8,90%	5,88%	3,02%
1987	8,80%	6,16%	2,64%
1988	8,80%	4,63%	4,17%
1989	8,80%	5,72%	3,08%
1990	8,80%	8,70%	0,10%
1991	8,00%	9,37%	-1,37%
1992	8,50%	9,68%	-1,18%
1993	8,50%	8,20%	0,30%
1994	8,20%	5,30%	2,90%
1995	7,90%	5,25%	2,65%
1996	7,70%	3,50%	4,20%
1997	7,50%	3,08%	4,42%
1998	7,30%	3,55%	3,75%
1999	7,30%	3,28%	4,02%
2000	6,40%	3,29%	3,11%
2001	5,49%	4,84%	0,65%
2002	5,00%	3,28%	1,72%
2003	4,69%	2,82%	1,87%
2004	4,38%	2,11%	2,27%
2005	4,01%	2,16%	1,85%
2006	3,56%	2,49%	1,07%
2007	3,83%	3,74%	0,09%
2008	4,47%	4,65%	-0,18%

The analysis of this historical data follows and is presented in table format for the purpose of an easier comparison:

[10] The risk free rate used is the 3 month Netherland interbank rate

Correlation b/w Ground Rent Rate and Risk Free Rate	0.66
Average Difference: Ground Rent Rate – Risk Free Rate	2.01%
Standard Deviation of the Difference	1.72%
Average Ground Rent Rate	6.91%
Standard Deviation Ground Rent Rate	1.92%
Average Risk Free Rate	4.89%
Standard Deviation Risk Free Rate	2.23%

The table confirms the statement of The Development Corporation of Amsterdam – the correlation between the ground rent rate and the interest rate is relatively high: 0,66. Also, the data presented indicates that in the majority of the time the ground rent rate is higher than the risk free rate. To be more precise, for the period observed – 24 years – on the average every year the ground rent rate was higher than the interest rate by 2,01%. This average number was achieved in a consistent manner – in 21 out of the 24 years the ground rent rates were higher than the risk free rate.

While market forces will determine land lease rate[11], it would be logical for it to be between the ground rent rate and the risk free rate. The reason is that customers buying the construction would not be willing to pay much more than the ground rent rate charged by the municipality and the owner of the land interested in having an alternative for index linked bond would not want to go much below the risk free rate. It is best for the product if ground rent rates exceed risk free rates. In this case a land lease rate between the two would be attractive for both sides: the purchaser of the construction would get a lower rate than the one the municipality is charging and the owner of the land would get a rate better than the risk free rate. In this context, it is good news for the index linked land leases that in 21 out of the 24 years between 1985 and 2008 ground rents exceeded rent free rates.

To conclude the analysis in the previous paragraphs, we would like to state the following: for index linked land leases the best relationship between ground rent rates and risk free rates is

[11] The term land lease rate refers to the ground rent rate which will be used in index linked land lease structures. As this rate will most likely be different from the municipality determined ground rent rate, the new term is introduced to help differentiate between the two.

one in which there is high correlation between the two and the ground rent rates are consistently higher. The past data observed shows that this is the case.

It is important to state again that market forces will be the final determinant of the land lease rate. While it would make sense for it to fall between the ground rent rate and the risk free rate, these forces could take it outside of these boundaries. In case various pension funds and insurance companies start implementing index linked land lease structures, the competition among them for customers will result in a land lease rate very close to the risk free rate or even lower than it. In the same time there could be forces that could lead the land lease rate higher than the ground rent rate – if the municipality does not give a buyback option and charges the ground rent rate it makes sense for those who give the buyback option to charge more than the ground rent rate.

Why ground rent rate is higher than risk free rate?

In this section the discussion focuses on explaining why the ground rent rate is higher than the risk free rate. Some would argue that there is not such a thing as a free lunch and the higher percentage accounts for additional risks associated with land lease structures. There might be some truth to this statement. The most likely suspect is the risk that the occupier of the land can leave and the rent payments would stop. However, this is more an irrational fear originating in the association with renting out an apartment where the tenant can just leave and the space can remain unoccupied by this way freezing the rental income of the owner. Land lease structure is very different from the scenario mentioned above. The tenants of the land own the construction above the land. As long as the tenants own the building they are legally obligated to keep paying the rent[12]. They cannot do anything with the building before their rent to the owner of the land underneath is paid. The only way for the tenant to stop owning the construction is to sell it. After this the new tenant assumes the same responsibilities. Still, we have to admit that there is some risk involved – payments can be delayed in time, there can be legal costs in the process of receiving money from delinquent tenants, and in some cases new tenants of the land receiving it from delinquent ones can try to negotiate past obligations. This risk accounts partially for the higher ground rent rates. The

[12] More detains on legal issues can be found in Chapter 2

other factor which drives ground rent rates higher than the risk free rates are political forces - ground rents are a source of income for the municipality. Being an owner of large amounts of strategically well situated land parcels, the municipality can afford to charge high rent rates to provide itself with a higher budget.

Chapter 4: Data issues and how they were dealt with

4.1 Obtaining data on historical land prices

Besides data on land prices all other data needed for our research is readily available. The NL CPI (the Dutch annual inflation rate) is used for inflation indexation purposes. The ground rent rates historically charged by the Municipality of Amsterdam are used to create index linked land lease structures as if they existed in the past. The Netherland interbank three month middle rate is used as a proxy for the risk free rate.

Still, the lack of proper data on historical land prices in the Netherlands creates a challenge for this research project. In the following paragraphs is explained how we deal with this challenge.

The only data which is provided on land prices is the following:

2001	1348
2002	1439
2003	1279
2004	1279
2005	1143
2006	1088
2007	1378
2008	1623
2009	1623

This is the land price for existing apartment building in Amsterdam. The prices are in euro and refer to the cost of a square meter of land. We choose not to use this data for a variety of reasons. The short observation period of 9 years is the first drawback of this information. While the source of the information: The Development Corporation of Amsterdam is credible and frequently referenced source across this thesis. However, in this particular case the price

per square meter in 2003 and 2004 stays the same to the last euro and the same can be seen if the years 2008 and 2009 are compared. This might mean that the price of only one building is observed and this suspicion along with the short observation period leads us to the decision not to use this set of data.

The unavailability of land data forces us to obtain it in an indirect way. The approach chosen is to derive land price data using the availability of information on transaction prices and construction prices. The equation below shows clearly how land prices can be obtained using transaction prices and construction prices.

Land Price + Construction Price = Transaction Price

The NVM makes available the average transaction prices on existing housing constructions in Amsterdam for the period between 1985 and 2008. The Central Bureau of Statistics of The Netherlands provides various indexes on construction prices in the country since 1990 till now[13]. One issue with the construction indexes created by the CBS is the fact that there is not a single index going from 1990[14] till 2008. Therefore three indexes have to be combined to create a complete data set for the period 1990-2008. This is complicated by the fact that the CBS changed its criteria for forming these indexes in the year 2000 leading to some inconsistencies between the different indexes. This is dealt with by using the most recent data available for each year[15]. By this way a single index for changes in construction prices in the period between 1990 and 2008 is created.

The next issue is that for transaction prices absolute numbers are available while for construction prices there is only an index. In this situation, the only way to obtain data on land prices is to introduce a ratio showing a relationship between land prices and construction prices. The ratio chosen is 30/70 (30% of the transaction price is the price of land and 70% of the land price is the price of construction). Having this ratio in mind the following formula is created to derive the changes of land prices for the period between 1990 and 2008.

[13] The data tables with the historical transaction prices by the NVM and the construction indexes by the CBS are included in the appendix
[14] 1990 is the first year for which the CBS provides information on the changes in construction prices
[15] The presumption is made that every change made in the criteria for forming the construction price index leads to improvement of the quality of the index

$$0.3*\Delta \text{ Land price} + 0.7*\Delta \text{ Construction price} = \Delta \text{ Transaction price}$$

$$\Delta \text{ Land price} = (\Delta \text{ Transaction price} - 0.7*\Delta \text{ Construction price})/0.3$$

This formula indicates that the change of land price accounts for 30% of the change in the transaction price while the change in construction price accounts for 70% of the change in transaction price. This formula is applied to the first year. After that the changes in land and construction prices are used to obtain the ratio for the next year. That way the ratio 30/70 changes every year depending on the changes that occurred to land and construction prices in the previous year. Due to that the values 0.3 and 0.7 in the formula are used only for the first year and then for each consecutive year are readjusted based on the changes in the ratio. The following table clarifies how the land value changes for each year are obtained.

Year	Land change	Land	Construction	Land	Construction	Transaction
1990		30,00%	70,00%	30	70	100
1991	**3,90%**	29,96%	70,04%	31,17	72,86	104,03
1992	**20,17%**	33,46%	66,54%	37,45	74,49	111,95
1993	**21,27%**	37,64%	62,36%	45,42	75,25	120,67
1994	**15,65%**	40,55%	59,45%	52,53	77,00	129,53
1995	**7,46%**	41,55%	58,45%	56,45	79,39	135,84
1996	**28,74%**	47,62%	52,38%	72,67	79,95	152,62
1997	**23,04%**	52,33%	47,67%	89,42	81,46	170,87
1998	**22,07%**	56,63%	43,37%	109,15	83,60	192,75
1999	**42,22%**	64,61%	35,39%	155,24	85,03	240,27
2000	**21,78%**	68,21%	31,79%	189,06	88,12	277,18
2001	**9,93%**	69,27%	30,73%	207,82	92,18	300,00
2002	**-0,69%**	68,46%	31,54%	206,39	95,09	301,48
2003	**-6,02%**	66,78%	33,22%	193,97	96,50	290,47
2004	**0,13%**	66,35%	33,65%	194,23	98,52	292,75
2005	**2,73%**	66,57%	33,43%	199,53	100,20	299,73
2006	**7,36%**	67,51%	32,49%	214,21	103,11	317,32
2007	**7,09%**	68,14%	31,86%	229,40	107,25	336,64
2008	**4,29%**	68,08%	31,92%	239,23	112,18	351,41

Technically, the values for land change can be obtained in a couple ways. The values for transaction and construction are obtained after the initial values (30 and 70) are indexed using the transaction data and construction indexes available:

Transaction prices on existing housing constructions in Amsterdam			Construction index Most recent data	
Year	Price	from previous year		
1985	55100		1990	
1986	56400	2,36%	1991	4,08%
1987	61500	9,04%	1992	2,24%
1988	68400	11,22%	1993	1,02%
1989	75100	9,80%	1994	2,33%
1990	74500	-0,80%	1995	3,11%
1991	77500	4,03%	1996	0,70%
1992	83400	7,61%	1997	1,89%
1993	89900	7,79%	1998	2,63%
1994	96500	7,34%	1999	1,71%
1995	101200	4,87%	2000	3,64%
1996	113700	12,35%	2001	4,60%
1997	127300	11,96%	2002	3,15%
1998	143600	12,80%	2003	1,48%
1999	179000	24,65%	2004	2,10%
2000	206500	15,36%	2005	1,70%
2001	223500	8,23%	2006	2,90%
2002	224600	0,49%	2007	4,02%
2003	216400	-3,65%	2008	4,60%
2004	218100	0,79%		
2005	223300	2,38%		
2006	236400	5,87%		
2007	250800	6,09%		
2008	261800	4,39%		

Following that step, there are two options. The first one is to use the formula listed on the previous page and to get the land change for 1991[16]. After the percentage for land change is obtained it is used to get the land value for 1991[17]. Then the ratio between land and construction for 1991 is obtained[18]. The ratio is used to readjust the formula for 1992[19]. Using the newly obtained formula the land change is derived with which the land value for 1992 is obtained (37.45) and then the new ratio is derived and applied to the formula for 1993. This process is continued until the values for 2008 are obtained.

The second and probably even simpler option is to use the values for transaction and construction to get the value for land[20]. After the values for land are obtained the changes in

[16] 1991 is the first year for which complete data is available
[17] 30 is indexed by 3.90% to obtain 31.17 for 1991
[18] Obtained trough Land/Transaction and Construction/Transaction expressed in percentage terms
[19] The results of Land/Transaction and Construction/Transaction for 1991 are used to replace the 0.3 and 0.7 respectively in the formula
[20] Land + Construction = Transaction

land prices can be derived. Both processes lead to completely the same results. As we can see it is essential for the results what the initial ratio between land and construction (the ratio for 1990) will be. In this context, it is necessary to explain how the 30/70 ratio was obtained.

To determine the most appropriate initial ratio all feasible scenarios (in increments of 10%) are developed. In other words, the first scenario starts with 30% of the transaction price allocated to land and 70% of the transaction place allocated to construction and the last scenario finishes with: 90% for land and 10% for construction[21]. Following that, all the results have been observed along with an expert in the field and it has been determined which ones were the most accurate[22]. Through this process the ratio 30/70 was chosen.

It is essential to both appreciate and make use of the limited data obtained but also to understand its limitations. In other words, we shall be careful "not to get too much out of the data". Finding the right balance will guarantee that the results obtained are valid and credible and will keep us away from misleading our readers.

In this context, in all situations where the results of the land changes are observed, besides the technical analysis which shows steep increase in land prices in the recent past, also fundamental analysis should be applied to reason whether this tendency will remain in the near future.

4.2 Land price tendencies

An essential part of the analysis in this thesis is the observation of land prices. This observation is done in the context of the major research question of this thesis: "can index linked land lease structures be an alternative for index linked bonds?" As it is explained in the section about the structure of index linked land lease structures, the owner of the land rents it to the owner of the construction for a rent amount indexed to inflation and also gives the owner of the construction the opportunity to buy the land at the end of the period at the initial price indexed for inflation. This structure gives the owners of the construction the opportunity

[21] All the tables can be found in the appendix
[22] While there is not exact and comprehensive data on historical land prices available, experts in the field have a very good idea how these prices changed especially in the near past.

to gain from the appreciation of land and from any improvements they might make to the land. However, if the land depreciates during that period they do not have to buy it and the loss will be incurred by the owner of the land. In other words, the owner of the land bears all the downside risk and the owner of the construction can enjoy all the upside risk. The data available on which an analysis can be made is the following:

Year	Land change
1990	
1991	**3,90%**
1992	**20,17%**
1993	**21,27%**
1994	**15,65%**
1995	**7,46%**
1996	**28,74%**
1997	**23,04%**
1998	**22,07%**
1999	**42,22%**
2000	**21,78%**
2001	**9,93%**
2002	**-0,69%**
2003	**-6,02%**
2004	**0,13%**
2005	**2,73%**
2006	**7,36%**
2007	**7,09%**
2008	**4,29%**

A technical analysis of this data of course would show very high upside risk and very low downside risk. The standard deviation of the returns is very high but this is due to the immense increases in the price of land. This data shows very low risk for the owner of the land and great profit potential for the owners of the construction[23] and can be used as a marketing tool for index linked land lease structures. However, the limitations of the data force us to use more reasoning and to go beyond just looking at the numbers. The short observation period makes disputable the idea that in any period of time longer than 18 years similar increases in land prices would be observed. Still, even without proper data available, experts in the field confirm that land prices have been growing throughout the modern history of the western world and declines in their level have usually lasted for a relatively shorter

[23] Since they can buy the land at the end of the lease at the initial price indexed for inflation and following that sell it for the much higher current price

periods of times and have been compensated by following increases. These declines have usually been caused by natural disasters or political problems, such us earthquakes and wars. A logical conclusion is that in the normal course of the development of the modern world land prices rise at levels higher than inflation (in other words are rising in real terms). It is important to note that events that tend to immediately drop land prices such us major wars, earthquakes, or floods are also very likely to affect a government's ability to meet its index linked bonds obligations. In this context, index linked land lease structures and inflation linked bonds share similar default risk. Still, we have to mention the scenario in which the prices of land can possibly decrease in the long run due to pure market forces without any tragic event occurring. While there is not data available to show such a danger and experts confirm that on the long run land prices have been increasing throughout modern history, there is still the small chance that in 30 years land will be cheaper than today. In this case the owner of the land can choose whether to sell the land and to incur the loss or to enter into a new land lease agreement in which the rent payments will be determined using the new lower value of the land. This choice will be influenced by the ground rent rate at that moment. If the ground rent rate is higher than it was when the initial agreement was signed, it could compensate for the lower value of the land[24]. However, if this is not the case, the choice is left to the subjective opinion of the owner of the land. A correlation analysis shows very small correlation between land prices and ground rent rates so nothing can be predicted on the future relationship between these two.

In conclusion, the data available shows very low risk for the owner of the land (who bears the downside risk of land prices) and great profit potential for the owner of the construction (who bears the upside risk of land prices). The limitations of the data imply that these conclusions might be exaggerated. In the future, the profits the owners of the construction get from the buyback option might not be as big as they would have been if the index linked land lease structure was in place in the past 20 years. Still, the most important for us and for the answer to our research question is the fact that both the data and the experts in the field indicate that the probability of land being cheaper in 30 years than what it is now without a major a disaster occurring is very low.

[24] Ground Rent = Ground Rent Rate x Land Value

Chapter 5: Historical analysis: what would be the returns of inflation linked land leases and indexed bonds if they existed in The Netherlands in the past

In this section of the thesis a historical analysis is going to be presented of what would have happened if index linked land lease structures and inflation linked bonds were introduced in the past. First, tables are going to be shown which will demonstrate the results and then the results are going to be analyzed. Due to the availability of historical data[25] the first year for which the scenarios are executed is 1991. The presumption is that in the beginning of 1991 100 000 Euros are invested an index linked land lease structure and the same amount is invested in an inflation linked bond.

Index linked land lease structure

Initial value	100000		
Starting year	1991	Total income	**231542.02**
Ground rent rate	8%		

Year	Inflation	Ground rent indexed to inflation	Initial land price indexed to inflation
1991	3.62%	8289.60	103620.00
1992	2.29%	8479.43	105992.90
1993	2.67%	8705.83	108822.91
1994	2.60%	8932.18	111652.30
1995	1.72%	9085.82	113572.72
1996	2.29%	9293.88	116173.54
1997	2.32%	9509.50	118868.77
1998	1.78%	9678.77	120984.63
1999	2.15%	9886.86	123585.80
2000	2.60%	10143.92	126799.03
2001	4.15%	10564.90	132061.19
2002	2.75%	10855.43	135692.87
2003	1.70%	11039.97	137999.65
2004	1.12%	11163.62	139545.25
2005	2.04%	11391.36	142391.97
2006	1.00%	11505.27	143815.89
2007	1.87%	11720.42	146505.25
2008	1.94%	11947.80	149347.45
		182194.57	

Index linked bond

Initial value	100000		
Starting year	1991	Total income	**262742.84**
Interest rate	9.37%		

Year	Inflation	Coupon payment indexed to inflation	New value of the principal indexed to inflation
1991	3.62%	9709.19	103620.00
1992	2.29%	9931.53	105992.90
1993	2.67%	10196.71	108822.91
1994	2.60%	10461.82	111652.30
1995	1.72%	10641.76	113572.72
1996	2.29%	10885.46	116173.54
1997	2.32%	11138.00	118868.77
1998	1.78%	11336.26	120984.63
1999	2.15%	11579.99	123585.80
2000	2.60%	11881.07	126799.03
2001	4.15%	12374.13	132061.19
2002	2.75%	12714.42	135692.87
2003	1.70%	12930.57	137999.65
2004	1.12%	13075.39	139545.25
2005	2.04%	13342.13	142391.97
2006	1.00%	13475.55	143815.89
2007	1.87%	13727.54	146505.25
2008	1.94%	13993.86	149347.45
		213395.39	

The index linked land lease structure starting in 1991 is constructed using the ground rent rate for 1991 and the inflation during the period between 1991 and 2008[26].

[25] The availability of data is discussed in detail in the section named: "Data issues and how they were dealt with"
[26] How inflation data is obtained can be found in "Data issues and how they were dealt with"

As we can see from "Initial land price indexed to inflation", the initial price of the land is indexed to the inflation rate every year to reach the value of 149347,45 in 2008. There are a couple of ways which can be used to obtain the annual inflation linked ground rents. The first is to multiply the initial value of the land (100 000) by the ground rent rate and then to index it to the inflation in 1991 (3.62%). To obtain the indexed ground rent for 1992, the rent from 1991 is indexed to the inflation in 1992. The same process is repeated for all the following years until 2008. Another way to obtain the indexed ground rent is to multiply the initial land price indexed to inflation for each year by the ground rent rate in 1991[27]. Of course, both techniques lead to exactly the same results. The total income (231 542) is the sum of all the ground rents indexed to inflation (182 194) plus the final value of the initial land price indexed to inflation (149 347) minus the initial investment (100 000). In other words, this is the sum of all the cash flows for the issuer of the index linked land lease.

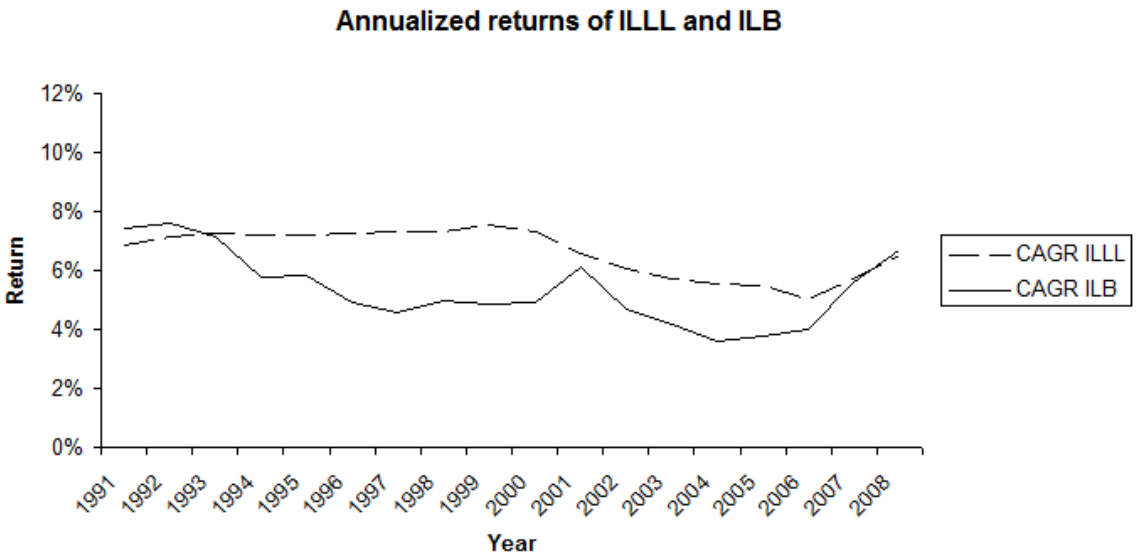
The inflation linked bond starting in 1991 is created using the risk free interest rate for 1991[28] and the inflation for each year between 1991 and 2008. The new value of the principal is obtained by indexing the initial value of the principal (100 000) to inflation. Then, the coupon payment indexed for inflation is determined by multiplying the interest rate for 1991 (9.37%) by the value of the principal for each year. Another way to obtain the coupon payments indexed for inflation is to multiply the initial value of the principal by the interest rate and index the product by the inflation for the period between 1991 and 2008. The results from using both methods are absolutely the same of course. The total income is calculated by adding the sum of the coupon payments indexed to inflation and the final value of the principal and subtracting the initial investment.

Using exactly the same process the results are derived for both index linked land lease structures and inflation linked bonds starting in each one of the years between 1991 and 2008. To save space all the tables are exported to the appendix while here a table with only the total incomes and annualized returns of both products for each one of the years is presented.

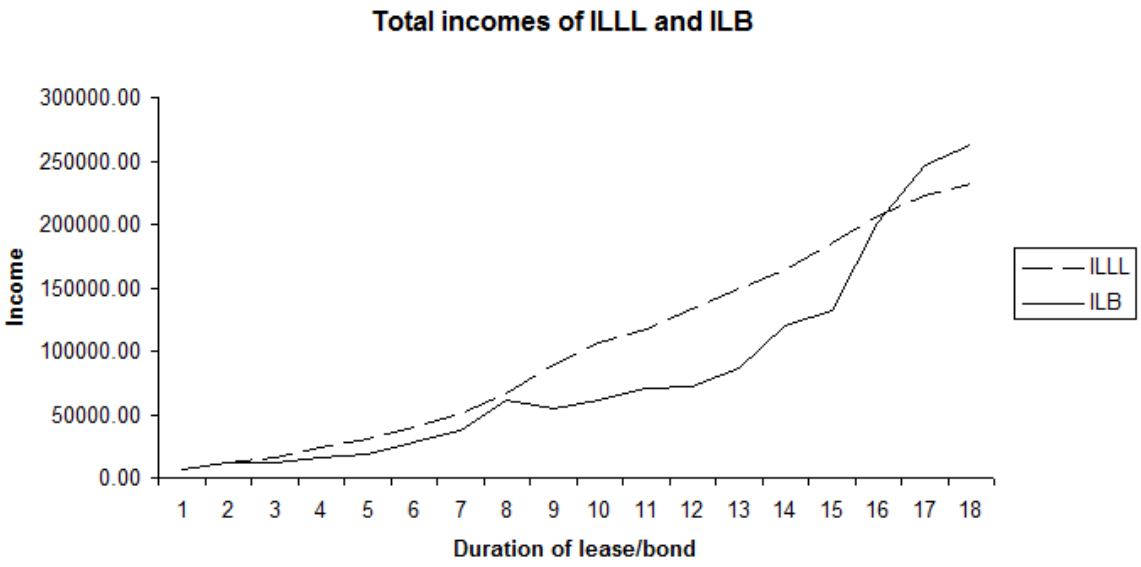
[27] The ground rent in 1991 is the one used when the contract has been created and therefore is the rate which determines the rents throughout the contract. In other words, the ground rent rate valid in 1999 for example has completely no influence on an index linked land lease structure started in 1991.
[28] The Netherland interbank 3 month lending rate is used

Year	ILB	CAGR ILB	ILLL	CAGR ILLL
1991	262742.84	7.42%	231542.02	6.89%
1992	247203.69	7.60%	222448.83	7.13%
1993	200877.35	7.13%	206730.06	7.26%
1994	132647.94	5.79%	184852.84	7.23%
1995	120625.10	5.81%	164470.69	7.19%
1996	87117.03	4.94%	149045.57	7.27%
1997	71441.33	4.59%	132985.31	7.30%
1998	70399.96	4.96%	117680.96	7.33%
1999	60795.19	4.86%	106574.00	7.52%
2000	54232.34	4.93%	88934.84	7.33%
2001	60814.83	6.12%	66593.93	6.59%
2002	37809.78	4.69%	50772.81	6.04%
2003	27927.37	4.19%	39773.70	5.74%
2004	19256.34	3.58%	31126.26	5.57%
2005	16034.02	3.79%	23750.60	5.47%
2006	12573.20	4.03%	15877.08	5.03%
2007	11540.07	5.61%	11725.21	5.70%
2008	6680.21	6.68%	6496.72	6.50%

Under inflation linked bond (ILB) and index linked land lease structures (ILLL) are listed the total incomes of the two products while CAGR refers to the compound annual growth rate[29]. To assist easier interpretation a graph with the annualized returns of index linked bonds and inflation linked land leases and another one with their total incomes are presented below.



[29] The formula of obtaining the CAGR is the following:
CAGR=((Ending Value-Beginning Value)^(1/# of years))-1

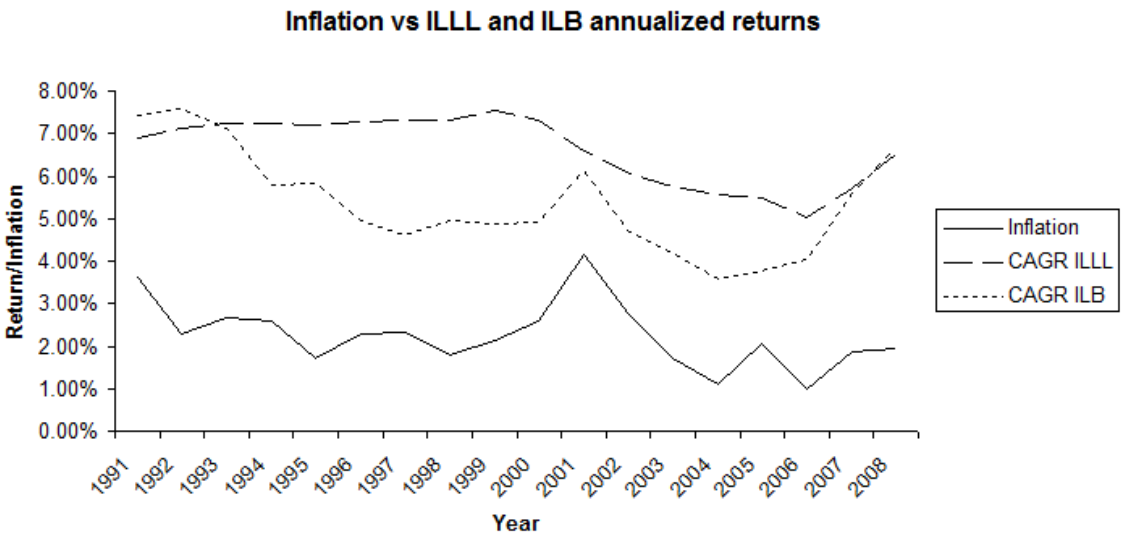


The most important result is that the correlation between the total incomes of the index linked bonds and index linked land leases is 0.94 (the high correlation can be predicted by looking at the construction of the two products). The standard deviation of the returns of inflation linked bonds is 1.23% while the one for index linked land lease structures is 0.81%. Also, the results of both are highly predictable – at the starting point of either product there is a high degree of certainty exactly what the returns in real terms will be - and this conclusion can be made just from looking at the structure of the two products (even if there is completely no data available). On top of all this, in the majority of the cases (15 out of 18) index linked land lease structures produce better results than inflation linked bonds.

In the following table and graph we observe a comparison of the returns obtained and inflation.

Correlations

	CAGR ILLL	Rate of return ILLL	CAGR ILB	Rate of return ILB
Inflation	0.415	0.421	0.547	0.465



From the table of correlations we can observe that the total incomes of both bonds and leases have similar correlations with inflation (0.465 and 0.421) which adds to the point that they provide similar protection to investors against inflation.

The analysis so far demonstrates very high correlation between the results of the two products. The next step is to discuss the risks associated with the returns. As mentioned earlier, the standard deviations of both are low and also identical: 1.23% for inflation linked bonds and 0.81% for index linked land lease structures. Still, there might be some risks that are harder to measure and fall out of the historical analysis made so far. Such are inflation risk, default risk, and depreciation of land risk.

Inflation risk refers to the fact that usually the coupon payments or rent payments are determined a month or more in advance. There is a possibility that inflation can change over that time. First, this risk applies exactly in the same way to both index linked land leases and inflation linked bonds so it does not change the relationship between them nor it makes the lease less or more of an alternative to the bond. Also, the risk is very minimal due to the fact that inflation is very predictable over such a short period of time. Still, in case, something exceptional happens, the payments can be adjusted during the next period. By this way, the only inflation risk remaining is the one from the last payment. It can be concluded that inflation risk is negligible in the cases of both index linked land lease structures and inflation linked bonds.

The default risk for index linked bonds is related to an eventual inability of the government to pay out its obligations. While this used to be considered almost impossible, the happenings in Russia and Iceland in the past two decades demonstrate that government bonds are not completely risk free. Also, inflation linked bonds are riskier than regular bonds because the government cannot just raise inflation to lower its debt.

The default risk related to index linked land leases is already discussed in chapter 3.2 under "Why ground rent rate is higher than risk free rate?" There, it is mentioned that there is some default risk involved: payments can be delayed, there can be legal costs in the process of receiving payments from delinquent payers or new tenants can negotiate obligations accumulated by old tenants.

The risk of depreciation of land is not confirmed by any data available; however, we have to mention the possibility that land can be cheaper in 30 years than it is now.

The historical analysis shows that usually the returns of index linked land leases are better than the returns of inflation linked bonds. In the same time, the standard deviation of the bonds is a little higher which is counterintuitive: it would make sense for the investment with the higher returns to have the higher risk. An explanation can be the fact that index linked land lease structures carry a little more default and depreciation of land risk than inflation linked bonds. These two risks do not find numerical representation in the data used to obtain the returns and the deviations and are likely to account for the mismatch discussed in the beginning of the paragraph. Still, as indicated by the small difference in the standard deviations of the two, they are both very safe and predictable investments.

The analysis done in this section demonstrates that index linked land lease structures and inflation linked bonds have highly correlated returns associated with similar levels of risks. The overall analysis done so far on the structure, returns, and risks of the two products clearly indicates that index linked land lease structures can be an alternative of inflation linked bonds.

Chapter 6: Marketing

As already explained in the thesis, an index linked land lease structure has two participating sides: one is the owner of the land, the other one is the owner of the construction. In this section, it will be discussed why these two sides would be interested in entering such a structure.

There is a long history of interest in inflation linked bonds especially on behalf of pension funds; however, the Dutch government is consistently reluctant to issue these. Therefore, pension funds are left without the opportunity to use inflation linked bonds as a long term protection from inflation instrument for their clients' savings. Pension funds in the Netherlands have expressed their interest in alternatives of Dutch index linked bonds. They even have history of buying indexed bonds issued from other governments (France, USA) even though these are indexed to inflation different from the Dutch one. For example APG has already allocated 8.3% of its total portfolio to foreign index linked bonds (17% of its global fixed income portfolio). Conversations with APG specialists indicate that this allocation can go up if the inflation linked bonds market increases its size.

In the context of the situation described in the paragraph above, pension funds are very interested in alternatives of inflation linked bonds and would eagerly be the owner of land on the index linked land lease market if this market can grow large enough to be a subject of their interest.

The bigger challenge is what will attract the other side of the product – the owners of the construction. The first and the most apparent reason is that entering the contract will decrease their initial cost – they do not have to come up with the money to purchase the land, they can just rent it at an attractive rate[30]. Also the owners of the construction do not assume any risk with land price movements. Due to the buyback option, they can make money if land appreciates during the 30 year period but cannot loose money if land depreciates.

[30] With only one company at the market, the rate is already below the ground rent rate charged by the municipality. With more companies entering the market that rate can get even lower and closer to the risk free rate. It has already been shown in the thesis that usually the ground rent rate is higher than the risk free rate.

The buyback option and the lower land lease rate applied are the reason index linked land leases are more attractive than purchasing construction on municipality land where the higher ground rate will be used and there would not be a buyback option.

To be attracted to index linked land leases potential owners of the construction also need a sense of security. They should be given the option to enter into another land lease agreement after the 30 years in case they want to keep the construction and not buy the land. Of course, the new rent payments would be based on the new value of the land. However, there should be a guarantee that the land lease rate will not exceed the ground rent rate used by the municipality by more than 1%[31].

While everything else is also important, the biggest marketing tool for index linked land leases is the land lease rate. The land lease rate should be low enough to compensate some of the drawbacks of index linked land leases from the perspective of the purchasers of the construction. One drawback is that ground rent payments to the municipality would decrease over time in real terms because they are not indexed to inflation[32]. Indeed in nominal terms, the index linked payments are initially cheaper and then get more expensive every year while the rent payments to the municipality remain constant. In real terms, the indexed payments stay the same while the ones to the municipality decrease[33].

The land lease rate should also be such that the product remains attractive compared to the alternative of getting a mortgage for the land. While municipality issued land leases are obviously less attractive than the index linked land leases that have been discussed in the thesis, the opportunity to get a loan from a bank presents a serious competitor for the new product. In the case of a mortgage paying for the land, the customers are buying the land so the only benefit of the buyback option in an ILLL[34] is that the owners of the construction do not assume any of the downside risk[35]. However, this is not a major benefit. As it has been

[31] A number of variations of this are possible; the bottom line is that customers should be guaranteed that the owner of the land cannot manipulate them after 30 years if they want to keep on living in the construction but prefer not to use the buyback option.
[32] This is under the presumption that there is inflation and not deflation
[33] This statement might change soon as the municipality has also started indexing ground rent payment to inflation
[34] ILLL – index linked land lease
[35] In the case of a mortgage a decrease of land prices results in a decrease of the value of the assets owned by the customers; in case of an index linked land lease, the buyback option allows the clients to choose whether to purchase the land at the end of the 30 years, so in the case of land depreciation the losses are for the issuer of the land lease

discussed previously in the thesis, the probability that land will be cheaper in 30 years than it is now is very small. Also, in The Netherlands, interest paid on mortgage payments is tax deductable, making mortgages attractive. Many customers get a mortgage to pay for the construction so using a bigger one to pay for the land would be convenient. Currently, the interest rates for 30 year mortgages with fixed interest for the whole 30 years vary around 6-7% depending on the bank and the provisions. Using that we have created various tables to compare mortgages and index linked land leases.

Mortgage	
Value	100000
Interest Rate	6%
Duration	30 years
Mortgage monthly payments	599,95
Mortgage annual payments	7199,4
Overall	215982

ILLL	
Value	100000
Land Lease Rate	3%
Duration	30 years
Inflation	2%
Overall	124138,32

ILLL	
Value	100000
Land Lease Rate	4%
Duration	30 years
Inflation	3%
Overall	196010,71

ILLL	
Value	100000
Land Lease Rate	2%
Duration	30 years
Inflation	1%
Overall	94275,50

	Year	Land Lease Payments	Mortgage Payments
1	2009	3060,00	7199,4
2	2010	3121,20	7199,4
3	2011	3183,62	7199,4
4	2012	3247,30	7199,4
5	2013	3312,24	7199,4
6	2014	3378,49	7199,4
7	2015	3446,06	7199,4
8	2016	3514,98	7199,4
9	2017	3585,28	7199,4
10	2018	3656,98	7199,4
11	2019	3730,12	7199,4
12	2020	3804,73	7199,4
13	2021	3880,82	7199,4
14	2022	3958,44	7199,4
15	2023	4037,61	7199,4
16	2024	4118,36	7199,4
17	2025	4200,72	7199,4
18	2026	4284,74	7199,4
19	2027	4370,43	7199,4
20	2028	4457,84	7199,4
21	2029	4547,00	7199,4
22	2030	4637,94	7199,4
23	2031	4730,70	7199,4
24	2032	4825,31	7199,4
25	2033	4921,82	7199,4
26	2034	5020,25	7199,4
27	2035	5120,66	7199,4
28	2036	5223,07	7199,4
29	2037	5327,53	7199,4
30	2038	5434,08	7199,4
		124138,32	215982

	Year	Land Lease Payments	Mortgage Payments
1	2009	4120,00	7199,4
2	2010	4243,60	7199,4
3	2011	4370,91	7199,4
4	2012	4502,04	7199,4
5	2013	4637,10	7199,4
6	2014	4776,21	7199,4
7	2015	4919,50	7199,4
8	2016	5067,08	7199,4
9	2017	5219,09	7199,4
10	2018	5375,67	7199,4
11	2019	5536,94	7199,4
12	2020	5703,04	7199,4
13	2021	5874,13	7199,4
14	2022	6050,36	7199,4
15	2023	6231,87	7199,4
16	2024	6418,83	7199,4
17	2025	6611,39	7199,4
18	2026	6809,73	7199,4
19	2027	7014,02	7199,4
20	2028	7224,44	7199,4
21	2029	7441,18	7199,4
22	2030	7664,41	7199,4
23	2031	7894,35	7199,4
24	2032	8131,18	7199,4
25	2033	8375,11	7199,4
26	2034	8626,37	7199,4
27	2035	8885,16	7199,4
28	2036	9151,71	7199,4
29	2037	9426,26	7199,4
30	2038	9709,05	7199,4
		196010,71	215982

	Year	Land Lease Payments	Mortgage Payments
1	2009	2020,00	7199,4
2	2010	2040,20	7199,4
3	2011	2101,41	7199,4
4	2012	2164,45	7199,4
5	2013	2229,38	7199,4
6	2014	2296,26	7199,4
7	2015	2365,15	7199,4
8	2016	2436,11	7199,4
9	2017	2509,19	7199,4
10	2018	2584,46	7199,4
11	2019	2662,00	7199,4
12	2020	2741,86	7199,4
13	2021	2824,11	7199,4
14	2022	2908,84	7199,4
15	2023	2996,10	7199,4
16	2024	3085,99	7199,4
17	2025	3178,57	7199,4
18	2026	3273,92	7199,4
19	2027	3372,14	7199,4
20	2028	3473,30	7199,4
21	2029	3577,50	7199,4
22	2030	3684,83	7199,4
23	2031	3795,37	7199,4
24	2032	3909,23	7199,4
25	2033	4026,51	7199,4
26	2034	4147,31	7199,4
27	2035	4271,73	7199,4
28	2036	4399,88	7199,4
29	2037	4531,87	7199,4
30	2038	4667,83	7199,4
		94275,50	215982

If we presume that during that period land appreciated by 100%, then the purchasers who used the mortgage paid 15982 for their land[36]. We presume that the buyback option is taken advantage of and observe the results for the three index linked land leases from the table above[37]. The three different scenarios indicate that index linked land leases can be a cheaper or a more expensive option to buy land depending on inflation, interest rates, and ground rent rates and their overall price does not position them ahead of the competing products.

What should be used for marketing purposes is the fact that in both nominal and real terms the indexed land lease payments are lower in the initial years of the contract than the mortgage payments. Due to inflation indexation[38] this relationship can reverse in the last years of the lease[39]. Especially for young families who need an own apartment or house but the spouses are just at the start of their careers; the structure with lower payments in the first years would seem very attractive. Some young couples may not be able to get a loan from a bank to purchase the land due to the high scrutiny which banks use before lending money[40]. This leads us to the conclusion that the advertising efforts should target young families (where the spouses are 20-35 years old). The ideal customer seems to be a young self employed couple looking for an own place.

[36] They can sell the land for 200000 and have paid overall 215 982
[37] The expenses paid in each of the cases can subtracted from the 100 000 profit from land to obtain the final balance
[38] High inflation can make the indexed rent payment higher than the mortgage payments
[39] In the case of long term deflation this would not be the case
[40] Example would be self employed people or people who cannot obtain a guarantee from their employer that they will be a long term employee

Chapter 7: Conclusion and new ideas

The research conducted points out that inflation linked land lease structures can be a substitute for the non existent Dutch indexed bonds. By this way the major research question of this thesis has been answered. While further marketing efforts are needed for the indexed land lease market to become large enough to be of significance for pension funds, the research performed can add to the analytical background giving sound basis for efforts and investments in this direction.

The conclusion will be extended to discuss an interesting idea coming out of the analysis performed. While this implication is not directly related to the research question, it is very close to the general topic of index linked land lease structures and long term investing.

We already demonstrated that an index linked land lease structures in which the owners of the construction retain the right to buy back the land at the end of the contract is an alternative for an inflation linked bond. However, it is interesting what would happen if the buyback option[41] is not given to the owners of the construction.

The table on the next page shows the results[42] of an index linked land lease structure when the buyback option is not given to the purchaser of the construction[43].

[41] Buyback option – the right of the owner of the construction to buy the land at the end of the land lease contract
[42] The results of the index linked land lease when the buyback option is not given to the owners of the construction are showed in the last three columns, the other columns are left in the table for comparison purposes.
[43] The assumption is the same as in the section "Historical analysis": the results show what the returns would be if an index linked land lease structure without a buyback option for the purchaser of the construction is started during each of the years. The initial investment amount is always 100 000.

Year	ILB	CAGR ILB	ILLL	CAGR ILLL	ILLL w/o buyback option	CAGR
1991	262742.8	7.42%	231542.02	6.89%	879616.53	13.52%
1992	247203.7	7.60%	222448.83	7.13%	845845.38	14.13%
1993	200877.4	7.13%	206730.06	7.26%	704536.92	13.92%
1994	132647.9	5.79%	184852.84	7.23%	574299.42	13.57%
1995	120625.1	5.81%	164470.69	7.19%	486117.22	13.46%
1996	87117.03	4.94%	149045.57	7.27%	354280.37	12.35%
1997	71441.33	4.59%	132985.31	7.30%	333625.45	13.00%
1998	70399.96	4.96%	117680.96	7.33%	259581.83	12.34%
1999	60795.19	4.86%	106574.00	7.52%	202298.47	11.70%
2000	54232.34	4.93%	88934.84	7.33%	119048.86	9.10%
2001	60814.83	6.12%	66593.93	6.59%	75348.24	7.27%
2002	37809.78	4.69%	50772.81	6.04%	52794.79	6.24%
2003	27927.37	4.19%	39773.70	5.74%	45620.87	6.46%
2004	19256.34	3.58%	31126.26	5.57%	46232.91	7.90%
2005	16034.02	3.79%	23750.60	5.47%	39894.00	8.76%
2006	12573.2	4.03%	15877.08	5.03%	30885.16	9.39%
2007	11540.07	5.61%	11725.21	5.70%	19557.74	9.34%
2008	6680.21	6.68%	6496.72	6.50%	8841.93	8.84%

Due to the increases of land prices during the period observed the rates of return of an index linked land lease without a buyback option are very high. Interestingly enough, the correlation with the rates of return of an index linked bond is very high: 0.98. However, the standard deviation of the annual rates of return of the newly introduced to the thesis product (2.75%) is more than twice higher than the one of the inflation linked bonds.

Land prices are essential in determining the returns of an index linked land lease without a buyback option. The table with land price returns[44] demonstrates how volatile these are with their standard deviation of 12.3%. The much higher returns of this specific type of an index linked land lease and the volatility of land prices are the reason why this product is not an alternative for an inflation linked bond.

Still, an index linked land lease without a buyback option can be a very interesting investment product. The analysis of past data demonstrates that on the long run there is indeed high risk related to prices of land; however, this is mostly upside risk and almost none downside risk. The structure of the product is appealing to the pension funds because in a way it matches the return structure required of a two pillar pension system: there is the first pillar which is relatively small and very safe, it is composed of the payments indexed to inflation; and there is the second pillar which is composed on the returns made from the appreciation of land and it involves higher risk but also much greater return potential.

[44] The table with the land price returns can be found in the section “Land price tendencies”

In the case of an index linked land lease structure without a buyback option, the land lease rate would be lower than the one for the regular indexed land lease due to the fact that the owners of the construction cannot make money from the appreciation of land.

An interesting observation can be made on the market right now. The only company who has launched a similar product to the index linked land lease structure and has given the buyback option is charging a land lease rate lower than the ground rent rate. While we have already discussed why it makes sense for the rate to be lower than the ground rent rate and higher than the risk free rate we can also ask the following question: why are they charging a land lease rate lower than the ground rent rate and giving the buyback option when the municipality is charging the ground rent rate and not giving the buyback option? There can be multiple explanations for this[45]; however, it still seems that the market is not appreciating the value of the buyback option. As explained by behavioral economics, people value current utility very high and future utility very low. In other words, the further in the future certain benefit is the less utility it brings right now. People are focused on what they have to pay right now and not as much on what they could potentially make profit of in 30 years. A pension fund and almost any organization for which it would make sense to issue an index linked land lease structure; however, is very interested in the profits its investments will be making in 30 years. If the above analysis (partly psychological) is correct, then the owner of the land can keep the buyback option away from the owners of the construction without sacrificing too much of the land lease rate.

Again, an index linked land lease without a buyback option for the purchaser of the construction is not an alternative of an inflation linked bond; therefore, it falls out of the core of this thesis and is just briefly discussed. Still, it could make an interesting topic for further research. Other interesting questions for further research are whether contracts can be signed in which the owner of the land and the owner of the construction can share the profits made on the appreciation of land and how should the buyback option be priced.

[45] One is that in real terms indexed land lease payments stay the same while the ground rent payments to the municipality are decreasing (the majority of the land leases issued by the municipality are not indexed to inflation)

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Appendix

Appendix A: Index linked land lease structures

Index linked land lease structure
Initial value 100000
starting year 1991

Year	Ground Rent Rate	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
1991	8.000%	8000	3.62%	8289.60	3.90%	103895.04	
1992			2.29%	8479.43	20.17%	124848.81	
1993			2.67%	8705.83	21.27%	151403.80	
1994			2.60%	8932.18	15.65%	175100.67	
1995			1.72%	9085.82	7.46%	188157.53	
1996			2.29%	9293.88	28.74%	242233.47	
1997			2.32%	9509.50	23.04%	298055.44	
1998			1.78%	9678.77	22.07%	363840.84	
1999			2.15%	9886.86	42.22%	517466.60	
2000			2.60%	10143.92	21.78%	630188.19	
2001			4.15%	10564.90	9.93%	692738.37	
2002			2.75%	10855.43	-0.69%	687966.35	
2003			1.70%	11039.97	-6.02%	646577.32	
2004			1.12%	11163.62	0.13%	647427.36	
2005			2.04%	11391.36	2.73%	665112.34	
2006			1%	11505.27	7.36%	714031.60	
2007			1.87%	11720.42	7.09%	764654.92	
2008			1.94%	11947.80	4.29%	797421.96	**879616.53**
				182194.57			

Year	Initial land price indexed to inflation
1991	103620.00
1992	105992.90
1993	108822.91
1994	111652.30
1995	113572.72
1996	116173.54
1997	118868.77
1998	120984.63
1999	123585.80
2000	126799.03
2001	132061.19
2002	135692.87
2003	137999.65
2004	139545.25
2005	142391.97
2006	143815.89
2007	146505.25
2008	149347.45

In case the buyback option is sold
Income from rent and sale of land **231542.02**

231542.02 is the amount used for the core to the thesis analysis in Chapter 5. This is the total income obtained by adding all the ground rents indexed to inflation the initial land price indexed to inflation and subtracting the initial land price. 879616.53 is the amount showing what the income would have been if the issuer of the land lease kept the buyback option and benefited from the appreciation of land. This amount is fundamental to the comments made in the chapter 7 of the thesis. The same applies to the next 17 tables showing the returns of inflation linked land leases.

Index linked land lease structure

Initial value	100000
starting year	1992

Year	Ground Rent	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
1992	8.500%	8500	2.29%	8694.65	20.17%	120168.21	
1993			2.67%	8926.80	21.27%	145727.65	
1994			2.60%	9158.89	15.65%	168536.12	
1995			1.72%	9316.43	7.46%	181103.48	
1996			2.29%	9529.77	28.74%	233152.10	
1997			2.32%	9750.86	23.04%	286881.30	
1998			1.78%	9924.43	22.07%	350200.39	
1999			2.15%	10137.80	42.22%	498066.70	
2000			2.60%	10401.39	21.78%	606562.34	
2001			4.15%	10833.04	9.93%	666767.50	
2002			2.75%	11130.95	-0.69%	662174.39	
2003			1.70%	11320.18	-6.02%	622337.04	
2004			1.12%	11446.97	0.13%	623155.21	
2005			2.04%	11680.48	2.73%	640177.18	
2006			1%	11797.29	7.36%	687262.44	
2007			1.87%	12017.90	7.09%	735987.89	
2008			1.94%	12251.05	4.29%	767526.49	**845845.38**
				178318.89			

In case the buyback option is sold

Income from rent and sale of land	**222448.83**

Year	Initial land price indexed to inflation
1992	102290.00
1993	105021.14
1994	107751.69
1995	109605.02
1996	112114.98
1997	114716.04
1998	116757.99
1999	119268.29
2000	122369.26
2001	127447.59
2002	130952.40
2003	133178.59
2004	134670.19
2005	137417.46
2006	138791.63
2007	141387.04
2008	144129.94

Index linked land lease structure

Initial value	100000
starting year	1993

Year	Ground Rent	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
1993	8.500%	8500	2.67%	8726.95	21.27%	121269.72	
1994			2.60%	8953.85	15.65%	140250.18	
1995			1.72%	9107.86	7.46%	150708.31	
1996			2.29%	9316.43	28.74%	194021.45	
1997			2.32%	9532.57	23.04%	238733.11	
1998			1.78%	9702.25	22.07%	291425.17	
1999			2.15%	9910.85	42.22%	414474.61	
2000			2.60%	10168.53	21.78%	504761.09	
2001			4.15%	10590.52	9.93%	554861.83	
2002			2.75%	10881.76	-0.69%	551039.59	
2003			1.70%	11066.75	-6.02%	517888.27	
2004			1.12%	11190.70	0.13%	518569.12	
2005			2.04%	11418.99	2.73%	532734.24	
2006			1%	11533.18	7.36%	571917.04	
2007			1.87%	11748.85	7.09%	612464.74	
2008			1.94%	11976.78	4.29%	638710.12	**704536.92**
				165826.80			

In case the buyback option is sold	
Income from rent and sale of land	**206730.06**

Year	Initial land price indexed to inflation
1993	102670.00
1994	105339.42
1995	107151.26
1996	109605.02
1997	112147.86
1998	114144.09
1999	116598.19
2000	119629.74
2001	124594.38
2002	128020.72
2003	130197.07
2004	131655.28
2005	134341.05
2006	135684.46
2007	138221.76
2008	140903.26

Index linked land lease structure

Initial value	100000
starting year	1994

Year	Ground Re	Ground Re	Inflation	Ground Rent Indexed for Inflation	Land Price	New Value of the Land	Income from rent and appreciation of land*
1994	8.200%	8200	2.60%	8413.20	15.65%	115651.44	
1995			1.72%	8557.91	7.46%	124275.30	
1996			2.29%	8753.88	28.74%	159991.67	
1997			2.32%	8956.97	23.04%	196861.27	
1998			1.78%	9116.41	22.07%	240311.56	
1999			2.15%	9312.41	42.22%	341779.13	
2000			2.60%	9554.53	21.78%	416230.09	
2001			4.15%	9951.05	9.93%	457543.57	
2002			2.75%	10224.70	-0.69%	454391.72	
2003			1.70%	10398.52	-6.02%	427054.88	
2004			1.12%	10514.98	0.13%	427616.31	
2005			2.04%	10729.49	2.73%	439296.99	
2006			1%	10836.78	7.36%	471607.44	
2007			1.87%	11039.43	7.09%	505043.40	
2008			1.94%	11253.60	4.29%	526685.56	**574299.42**
				147613.86			

In case the buyback option is sold	
Income from rent and sale of lanc	**184852.84**

Year	Initial land price indexed to inflation
1994	102600.00
1995	104364.72
1996	106754.67
1997	109231.38
1998	111175.70
1999	113565.98
2000	116518.69
2001	121354.22
2002	124691.46
2003	126811.21
2004	128231.50
2005	130847.42
2006	132155.90
2007	134627.21
2008	137238.98

Index linked land lease structure

Initial value	100000
starting year	1995

Year	Ground Rent	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price	New Value of the Land	Income from rent and appreciation of land*
1995	7.900%	7900	1.72%	8035.88	7.46%	107456.77	
1996			2.29%	8219.90	28.74%	138339.54	
1997			2.32%	8410.60	23.04%	170219.48	
1998			1.78%	8560.31	22.07%	207789.52	
1999			2.15%	8744.36	42.22%	295525.20	
2000			2.60%	8971.71	21.78%	359900.50	
2001			4.15%	9344.04	9.93%	395622.91	
2002			2.75%	9601.00	-0.69%	392897.61	
2003			1.70%	9764.22	-6.02%	369260.33	
2004			1.12%	9873.58	0.13%	369745.79	
2005			2.04%	10075.00	2.73%	379845.68	
2006			1%	10175.75	7.36%	407783.47	
2007			1.87%	10366.03	7.09%	436694.45	
2008			1.94%	10567.13	4.29%	455407.71	**486117.22**
				130709.51			

In case the buyback option is sold

Income from rent and sale of land	**164470.69**

Year	Initial land price indexed to inflation
1995	101720.00
1996	104049.39
1997	106463.33
1998	108358.38
1999	110688.09
2000	113565.98
2001	118278.96
2002	121531.64
2003	123597.67
2004	124981.97
2005	127531.60
2006	128806.92
2007	131215.61
2008	133761.19

Index linked land lease structure

Initial value	100000
starting year	1996

Year	Ground Rent Rate	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
1996	7.700%	7700	2.29%	7876.33	28.74%	102290.00	
1997			2.32%	8059.06	23.04%	125862.42	
1998			1.78%	8202.51	22.07%	153642.19	
1999			2.15%	8378.87	42.22%	218515.05	
2000			2.60%	8596.72	21.78%	266114.96	
2001			4.15%	8953.48	9.93%	292528.56	
2002			2.75%	9199.70	-0.69%	290513.44	
2003			1.70%	9356.10	-6.02%	273035.74	
2004			1.12%	9460.88	0.13%	273394.69	
2005			2.04%	9653.89	2.73%	280862.68	
2006			1%	9750.43	7.36%	301520.23	
2007			1.87%	9932.76	7.09%	322897.37	
2008			1.94%	10125.45	4.29%	336734.19	**354280.37**
				117546.17			

In case the buyback option is sold

Income from rent and sale of land	**149045.57**

Year	Initial land price indexed to inflation
1996	102290.00
1997	104663.13
1998	106526.13
1999	108816.44
2000	111645.67
2001	116278.97
2002	119476.64
2003	121507.74
2004	122868.63
2005	125375.15
2006	126628.90
2007	128996.86
2008	131499.40

Index linked land lease structure

Initial value	100000
starting year	1997

Year	Ground Rent Rate	Ground Ren	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
1997	7.500%	7500	2.32%	7674.00	23.04%	123044.70	
1998			1.78%	7810.60	22.07%	150202.55	
1999			2.15%	7978.53	42.22%	213623.08	
2000			2.60%	8185.97	21.78%	260157.36	
2001			4.15%	8525.68	9.93%	285979.62	
2002			2.75%	8760.14	-0.69%	284009.62	
2003			1.70%	8909.06	-6.02%	266923.20	
2004			1.12%	9008.84	0.13%	267274.11	
2005			2.04%	9192.62	2.73%	274574.91	
2006			1%	9284.55	7.36%	294770.00	
2007			1.87%	9458.17	7.09%	315668.56	
2008			1.94%	9641.66	4.29%	329195.61	**333625.45**
				104429.83			

In case the buyback option is sold

Income from rent and sale of land	**132985.31**

Year	Initial land price indexed to inflation
1997	102320.00
1998	104141.30
1999	106380.33
2000	109146.22
2001	113675.79
2002	116801.88
2003	118787.51
2004	120117.93
2005	122568.33
2006	123794.02
2007	126108.96
2008	128555.48

ndex linked land lease structure

nitial value	100000
starting year	1998

Year	Ground Rent Rate	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
1998	7.300%	7300	1.78%	7429.94	22.07%	122071.53	
1999			2.15%	7589.68	42.22%	173614.21	
2000			2.60%	7787.02	21.78%	211433.21	
2001			4.15%	8110.18	9.93%	232419.30	
2002			2.75%	8333.21	-0.69%	230818.25	
2003			1.70%	8474.87	-6.02%	216931.90	
2004			1.12%	8569.79	0.13%	217217.09	
2005			2.04%	8744.61	2.73%	223150.54	
2006			1%	8832.06	7.36%	239563.35	
2007			1.87%	8997.22	7.09%	256547.88	
2008			1.94%	9171.76	4.29%	267541.49	**259581.83**
				92040.34			

In case the buyback option is sold

Income from rent and sale of land	**117680.96**

Year	Initial land price indexed to inflation
1998	101780.00
1999	103968.27
2000	106671.45
2001	111098.31
2002	114153.51
2003	116094.12
2004	117394.38
2005	119789.22
2006	120987.11
2007	123249.57
2008	125640.62

Index linked land lease structure

Initial value	100000
starting year	1999

Year	Ground Rent Rate	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
1999	7.300%	7300	2.15%	7456.95	42.22%	142223.34	
2000			2.60%	7650.83	21.78%	173204.36	
2001			4.15%	7968.34	9.93%	190395.99	
2002			2.75%	8187.47	-0.69%	189084.42	
2003			1.70%	8326.66	-6.02%	177708.84	
2004			1.12%	8419.92	0.13%	177942.46	
2005			2.04%	8591.68	2.73%	182803.10	
2006			1%	8677.60	7.36%	196248.33	
2007			1.87%	8839.87	7.09%	210161.92	
2008			1.94%	9011.36	4.29%	219167.80	**202298.47**
				83130.67			

In case the buyback option is sold

Income from rent and sale of land **106574.00**

Year	Initial land price indexed to inflation
1999	102150.00
2000	104805.90
2001	109155.34
2002	112157.12
2003	114063.79
2004	115341.30
2005	117694.26
2006	118871.21
2007	121094.10
2008	123443.32

ndex linked land lease structure

nitial value	100000
starting year	2000

Year	Ground Rent Rate	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
2000	6.400%	6400	2.60%	6566.40	21.78%	121783.36	
2001			4.15%	6838.91	9.93%	133871.13	
2002			2.75%	7026.98	-0.69%	132948.94	
2003			1.70%	7146.43	-6.02%	124950.54	
2004			1.12%	7226.47	0.13%	125114.81	
2005			2.04%	7373.89	2.73%	128532.42	
2006			1%	7447.63	7.36%	137986.02	
2007			1.87%	7586.90	7.09%	147768.94	
2008			1.94%	7734.09	4.29%	154101.15	**119048.86**
				64947.71			

In case the buyback option is sold	
Income from rent and sale of land	**88934.84**

Year	Initial land price indexed to inflation
1999	102600.00
2000	105267.60
2001	109636.21
2002	112651.20
2003	114566.27
2004	115849.41
2005	118212.74
2006	119394.87
2007	121627.55
2008	123987.13

Index linked land lease structure

Initial value	100000
starting year	2001

Year	Ground Rent Rate	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
2001	5.490%	5490	4.15%	5717.84	9.93%	109925.63	
2002			2.75%	5875.08	-0.69%	109168.40	
2003			1.70%	5974.95	-6.02%	102600.67	
2004			1.12%	6041.87	0.13%	102735.56	
2005			2.04%	6165.13	2.73%	105541.86	
2006			1%	6226.78	7.36%	113304.50	
2007			1.87%	6343.22	7.09%	121337.55	
2008			1.94%	6466.28	4.29%	126537.12	**75348.24**
				48811.13			

In case the buyback option is sold	
Income from rent and sale of land	**66593.93**

Year	Initial land price indexed to inflation
2001	104150.00
2002	107014.13
2003	108833.37
2004	110052.30
2005	112297.37
2006	113420.34
2007	115541.30
2008	117782.80

Index linked land lease structure

Initial value	100000
starting year	2002

Year	Ground Rent Rate	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
2002	5.000%	5000	2.75%	5137.50	-0.69%	99311.14	
2003			1.70%	5224.84	-6.02%	93336.44	
2004			1.12%	5283.36	0.13%	93459.14	
2005			2.04%	5391.14	2.73%	96012.05	
2006			1%	5445.05	7.36%	103073.78	
2007			1.87%	5546.87	7.09%	110381.49	
2008			1.94%	5654.48	4.29%	115111.56	**52794.79**
				37683.23			

In case the buyback option is sold	
Income from rent and sale of land	**50772.81**

Year	Initial land price indexed to inflation
2002	102750.00
2003	104496.75
2004	105667.11
2005	107822.72
2006	108900.95
2007	110937.40
2008	113089.58

Index linked land lease structure

Initial value	100000
starting year	2003

Year	Ground Rent Rate	Ground Rent	Inflation	Ground Rent Indexed	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
2003	4.690%	4690	1.70%	4769.73	-6.02%	93983.86	
2004			1.12%	4823.15	0.13%	94107.42	
2005			2.04%	4921.54	2.73%	96678.03	
2006			1%	4970.76	7.36%	103788.74	
2007			1.87%	5063.71	7.09%	111147.14	
2008			1.94%	5161.95	4.29%	115910.02	**45620.87**
				29710.84			

In case the buyback option is sold	
Income from rent and sale of land	**39773.70**

Year	Initial land price indexed to inflation
2003	101700.00
2004	102839.04
2005	104936.96
2006	105986.33
2007	107968.27
2008	110062.85

Index linked land lease structure

Initial value	100000
starting year	2004

Year	Ground Rent Rate	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
2004	4.38%	4380	1.12%	4429.06	0.13%	100131.47	
2005			2.04%	4519.41	2.73%	102866.64	
2006			1%	4564.60	7.36%	110432.51	
2007			1.87%	4649.96	7.09%	118261.94	
2008			1.94%	4740.17	4.29%	123329.71	**46232.91**
				22903.20			

In case the buyback option is sold	
Income from rent and sale of land	**31126.26**

Year	Initial land price indexed to inflation
2004	101120.00
2005	103182.85
2006	104214.68
2007	106163.49
2008	108223.06

Index linked land lease structure

Initial value	100000
starting year	2005

Year	Ground Rent Rate	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
2005	4.01%	4010	2.04%	4091.80	2.73%	102731.58	
2006			1%	4132.72	7.36%	110287.52	
2007			1.87%	4210.00	7.09%	118106.67	
2008			1.94%	4291.68	4.29%	123167.79	**39894.00**
				16726.21			

In case the buyback option is sold	
Income from rent and sale of land	**23750.60**

Year	Initial land price indexed to inflation
2005	102040.00
2006	103060.40
2007	104987.63
2008	107024.39

Index linked land lease structure

Initial value	100000
starting year	2006

Year	Ground Rent Rate	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
2006	3.56%	3560	1%	3595.60	7.36%	107355.04	
2007			1.87%	3662.84	7.09%	114966.28	
2008			1.94%	3733.90	4.29%	119892.82	**30885.16**
				10992.33			

		Year	Initial land price indexed to inflation
In case the buyback option is sold			
Income from rent and sale of land	**15877.08**		
		2006	101000.00
		2007	102888.70
		2008	104884.74

Index linked land lease structure

Initial value	100000
starting year	2007

Year	Ground Rent Rate	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
2007	3.83%	3830	1.87%	3901.62	7.09%	107089.79	
2008			1.94%	3977.31	4.29%	111678.81	**19557.74**
				7878.93			

		Year	Initial land price indexed to inflation
In case the buyback option is sold			
Income from rent and sale of land	**11725.21**		
		2007	101870.00
		2008	103846.28

Index linked land lease structure

Initial value	100000
starting year	2008

Year	Ground Rent Rate	Ground Rent	Inflation	Ground Rent Indexed for Inflation	Land Price Change	New Value of the Land	Income from rent and appreciation of land*
2008	4.47%	4470	1.94%	4556.72	4.29%	104285.21	**8841.93**
				4556.72			

Year	Initial land price indexed to inflation
2008	101940.00

In case the buyback option is sold

Income from rent and sale of land	**6496.72**

Appendix B: Inflation linked bonds

Index linked bond
Initial value 100000
starting year 1991

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
1991	9.37%	103620.00	3.62%	9709.19	
1992		105992.90	2.29%	9931.53	
1993		108822.91	2.67%	10196.71	
1994		111652.30	2.60%	10461.82	
1995		113572.72	1.72%	10641.76	
1996		116173.54	2.29%	10885.46	
1997		118868.77	2.32%	11138.00	
1998		120984.63	1.78%	11336.26	
1999		123585.80	2.15%	11579.99	
2000		126799.03	2.60%	11881.07	
2001		132061.19	4.15%	12374.13	
2002		135692.87	2.75%	12714.42	
2003		137999.65	1.70%	12930.57	
2004		139545.25	1.12%	13075.39	
2005		142391.97	2.04%	13342.13	
2006		143815.89	1%	13475.55	
2007		146505.25	1.87%	13727.54	
2008		149347.45	1.94%	13993.86	
				213395.39	262742.84

Index linked bond
Initial value 100000
starting year 1992

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
1992	9.68%	102290.00	2.29%	9901.67	
1993		105021.14	2.67%	10166.05	
1994		107751.69	2.60%	10430.36	
1995		109605.02	1.72%	10609.77	
1996		112114.98	2.29%	10852.73	
1997		114716.04	2.32%	11104.51	
1998		116757.99	1.78%	11302.17	
1999		119268.29	2.15%	11545.17	
2000		122369.26	2.60%	11845.34	
2001		127447.59	4.15%	12336.93	
2002		130952.40	2.75%	12676.19	
2003		133178.59	1.70%	12891.69	
2004		134670.19	1.12%	13036.07	
2005		137417.46	2.04%	13302.01	
2006		138791.63	1%	13435.03	
2007		141387.04	1.87%	13686.27	
2008		144129.94	1.94%	13951.78	
				203073.74	247203.69

Index linked bond
Initial value 100000
starting year 1993

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
1993	8.20%	102670.00	2.67%	8418.94	
1994		105339.42	2.60%	8637.83	
1995		107151.26	1.72%	8786.40	
1996		109605.02	2.29%	8987.61	
1997		112147.86	2.32%	9196.12	
1998		114144.09	1.78%	9359.82	
1999		116598.19	2.15%	9561.05	
2000		119629.74	2.60%	9809.64	
2001		124594.38	4.15%	10216.74	
2002		128020.72	2.75%	10497.70	
2003		130197.07	1.70%	10676.16	
2004		131655.28	1.12%	10795.73	
2005		134341.05	2.04%	11015.97	
2006		135684.46	1%	11126.13	
2007		138221.76	1.87%	11334.18	
2008		140903.26	1.94%	11554.07	
				159974.09	200877.35

Index linked bond
Initial value 100000
starting year 1994

Year	Interest Rate	New value of the principal	Inflation	Indexed for Inflation	Income from coupon payments and appreciation of the principal
1994	5.30%	102600.00	2.60%	5437.80	
1995		104364.72	1.72%	5531.33	
1996		106754.67	2.29%	5658.00	
1997		109231.38	2.32%	5789.26	
1998		111175.70	1.78%	5892.31	
1999		113565.98	2.15%	6019.00	
2000		116518.69	2.60%	6175.49	
2001		121354.22	4.15%	6431.77	
2002		124691.46	2.75%	6608.65	
2003		126811.21	1.70%	6720.99	
2004		128231.50	1.12%	6796.27	
2005		130847.42	2.04%	6934.91	
2006		132155.90	1%	7004.26	
2007		134627.21	1.87%	7135.24	
2008		137238.98	1.94%	7273.67	
				95408.96	132647.94

Index linked bond
Initial value 100000
starting year 1995

Year	Interest Rate	the principal	Inflation	Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
1995	5.25%	101720.00	1.72%	5340.30	
1996		104049.39	2.29%	5462.59	
1997		106463.33	2.32%	5589.33	
1998		108358.38	1.78%	5688.82	
1999		110688.09	2.15%	5811.12	
2000		113565.98	2.60%	5962.21	
2001		118278.96	4.15%	6209.65	
2002		121531.64	2.75%	6380.41	
2003		123597.67	1.70%	6488.88	
2004		124981.97	1.12%	6561.55	
2005		127531.60	2.04%	6695.41	
2006		128806.92	1%	6762.36	
2007		131215.61	1.87%	6888.82	
2008		133761.19	1.94%	7022.46	
				86863.91	120625.10

Index linked bond
Initial value 100000
starting ye 1996

Year	Interest Rate	New value of the principal	Inflation	Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
1996	3.50%	103500.00	2.29%	3622.50	
1997		105901.20	2.32%	3706.54	
1998		107786.24	1.78%	3772.52	
1999		110103.65	2.15%	3853.63	
2000		112966.34	2.60%	3953.82	
2001		117654.44	4.15%	4117.91	
2002		120889.94	2.75%	4231.15	
2003		122945.07	1.70%	4303.08	
2004		124322.05	1.12%	4351.27	
2005		126858.22	2.04%	4440.04	
2006		128126.81	1%	4484.44	
2007		130522.78	1.87%	4568.30	
2008		133054.92	1.94%	4656.92	
				54062.11	87117.03

Index linked bond
Initial value 100000
starting year 1997

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
1997	3.08%	102320.00	2.32%	3151.46	
1998		104141.30	1.78%	3207.55	
1999		106380.33	2.15%	3276.51	
2000		109146.22	2.60%	3361.70	
2001		113675.79	4.15%	3501.21	
2002		116801.88	2.75%	3597.50	
2003		118787.51	1.70%	3658.66	
2004		120117.93	1.12%	3699.63	
2005		122568.33	2.04%	3775.10	
2006		123794.02	1%	3812.86	
2007		126108.96	1.87%	3884.16	
2008		128555.48	1.94%	3959.51	
				42885.85	71441.33

Index linked bond
Initial value 100000
starting year 1998

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
1998	3.55%	101780.00	1.78%	3613.19	
1999		103968.27	2.15%	3690.87	
2000		106671.45	2.60%	3786.84	
2001		111098.31	4.15%	3943.99	
2002		114153.51	2.75%	4052.45	
2003		116094.12	1.70%	4121.34	
2004		117394.38	1.12%	4167.50	
2005		119789.22	2.04%	4252.52	
2006		120987.11	1%	4295.04	
2007		123249.57	1.87%	4375.36	
2008		125640.62	1.94%	4460.24	
				44759.34	70399.96

Index linked bond
Initial value 100000
starting ye 1999

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
1999	3.28%	102150.00	2.15%	3350.52	
2000		104805.90	2.60%	3437.63	
2001		109155.34	4.15%	3580.30	
2002		112157.12	2.75%	3678.75	
2003		114063.79	1.70%	3741.29	
2004		115341.30	1.12%	3783.19	
2005		117694.26	2.04%	3860.37	
2006		118871.21	1%	3898.98	
2007		121094.10	1.87%	3971.89	
2008		123443.32	1.94%	4048.94	
				37351.86	60795.19

Index linked bond
Initial value 100000
starting year 2000

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
2000	3.29%	102600.00	2.60%	3375.54	
2001		106857.90	4.15%	3515.62	
2002		109796.49	2.75%	3612.30	
2003		111663.03	1.70%	3673.71	
2004		112913.66	1.12%	3714.86	
2005		115217.10	2.04%	3790.64	
2006		116369.27	1%	3828.55	
2007		118545.37	1.87%	3900.14	
2008		120845.15	1.94%	3975.81	
				33387.18	54232.34

Index linked bond
Initial value 100000
starting year 2001

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
2001	4.84%	104150.00	4.15%	5040.86	
2002		107014.13	2.75%	5179.48	
2003		108833.37	1.70%	5267.53	
2004		110052.30	1.12%	5326.53	
2005		112297.37	2.04%	5435.19	
2006		113420.34	1%	5489.54	
2007		115541.30	1.87%	5592.20	
2008		117782.80	1.94%	5700.69	
				43032.03	60814.83

Index linked bond
Initial value 100000
starting year 2002

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
2002	3.28%	102750.00	2.75%	3370.20	
2003		104496.75	1.70%	3427.49	
2004		105667.11	1.12%	3465.88	
2005		107822.72	2.04%	3536.59	
2006		108900.95	1%	3571.95	
2007		110937.40	1.87%	3638.75	
2008		113089.58	1.94%	3709.34	
				24720.20	37809.78

Index linked bond
Initial value 100000
starting year 2003

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
2003	2.82%	101700.00	1.70%	2867.94	
2004		102839.04	1.12%	2900.06	
2005		104936.96	2.04%	2959.22	
2006		105986.33	1%	2988.81	
2007		107968.27	1.87%	3044.71	
2008		110062.85	1.94%	3103.77	
				17864.52	27927.37

Index linked bond
Initial value 100000
starting year 2004

Year	Interest Rate	New value of the principal	Inflation	Indexed for Inflation	Income from coupon payments and appreciation of the principal
2004	2.11%	101120.00	1.12%	2133.63	
2005		103182.85	2.04%	2177.16	
2006		104214.68	1%	2198.93	
2007		106163.49	1.87%	2240.05	
2008		108223.06	1.94%	2283.51	
				11033.28	19256.34

Index linked bond
Initial value 100000
starting year 2005

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
2005	2.16%	102040.00	2.04%	2204.06	
2006		103060.40	1%	2226.10	
2007		104987.63	1.87%	2267.73	
2008		107024.39	1.94%	2311.73	
				9009.63	16034.02

Index linked bond
Initial value 100000
starting year 2006

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
2006	2.49%	101000.00	1%	2514.90	
2007		102888.70	1.87%	2561.93	
2008		104884.74	1.94%	2611.63	
				7688.46	12573.20

Index linked bond
Initial value 100000
starting year 2007

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
2007	3.74%	101870.00	1.87%	3809.94	
2008		103846.28	1.94%	3883.85	
				7693.79	11540.07

Index linked bond
Initial value 100000
starting year 2008

Year	Interest Rate	New value of the principal	Inflation	Coupon Payment Indexed for Inflation	Income from coupon payments and appreciation of the principal
2008	4.65%	101940.00	1.94%	4740.21	
				4740.21	6680.21

Appendix C: Obtaining data

Construction index

Most recent data

1990	
1991	4.08%
1992	2.24%
1993	1.02%
1994	2.33%
1995	3.11%
1996	0.70%
1997	1.89%
1998	2.63%
1999	1.71%
2000	3.64%
2001	4.60%
2002	3.15%
2003	1.48%
2004	2.10%
2005	1.70%
2006	2.90%
2007	4.02%
2008	4.60%

Source: CBS

Transaction prices on existing housing constructions in Amsterdam

Year	Price	Change from previous year
1985	55100	
1986	56400	2.36%
1987	61500	9.04%
1988	68400	11.22%
1989	75100	9.80%
1990	74500	-0.80%
1991	77500	4.03%
1992	83400	7.61%
1993	89900	7.79%
1994	96500	7.34%
1995	101200	4.87%
1996	113700	12.35%
1997	127300	11.96%
1998	143600	12.80%
1999	179000	24.65%
2000	206500	15.36%
2001	223500	8.23%
2002	224600	0.49%
2003	216400	-3.65%
2004	218100	0.79%
2005	223300	2.38%
2006	236400	5.87%
2007	250800	6.09%
2008	261800	4.39%

Source: NVM

Using the two data from the two tables above the following are constructed:

Using the formula: Change in Land price= (Change Transaction price - 0,7* Change Construction price)/0,3

and adjusting the ratio every year

		New ratio				
Year	**Land change**	Land	Construction	Land	Constructi	Transaction
1990		30.00%	70.00%	30	70	100
1991	**3.90%**	29.96%	70.04%	31.17	72.86	104.03
1992	**20.17%**	33.46%	66.54%	37.45	74.49	111.95
1993	**21.27%**	37.64%	62.36%	45.42	75.25	120.67
1994	**15.65%**	40.55%	59.45%	52.53	77.00	129.53
1995	**7.46%**	41.55%	58.45%	56.45	79.39	135.84
1996	**28.74%**	47.62%	52.38%	72.67	79.95	152.62
1997	**23.04%**	52.33%	47.67%	89.42	81.46	170.87
1998	**22.07%**	56.63%	43.37%	109.15	83.60	192.75
1999	**42.22%**	64.61%	35.39%	155.24	85.03	240.27
2000	**21.78%**	68.21%	31.79%	189.06	88.12	277.18
2001	**9.93%**	69.27%	30.73%	207.82	92.18	300.00
2002	**-0.69%**	68.46%	31.54%	206.39	95.09	301.48
2003	**-6.02%**	66.78%	33.22%	193.97	96.50	290.47
2004	**0.13%**	66.35%	33.65%	194.23	98.52	292.75
2005	**2.73%**	66.57%	33.43%	199.53	100.20	299.73
2006	**7.36%**	67.51%	32.49%	214.21	103.11	317.32
2007	**7.09%**	68.14%	31.86%	229.40	107.25	336.64
2008	**4.29%**	68.08%	31.92%	239.23	112.18	351.41

Using the formula: Change in Land price= (Change Transaction price - 0,6* Change Construction price)/0,4

and adjusting the ratio every year

Year	Land change	New ratio Land	Construction	Land	Constructi	Transaction
1990		40.00%	60.00%	40.00	60.00	100.00
1991	**3.94%**	39.97%	60.03%	41.58	62.45	104.03
1992	**15.68%**	42.96%	57.04%	48.10	63.85	111.95
1993	**16.79%**	46.55%	53.45%	56.17	64.50	120.67
1994	**13.10%**	49.05%	50.95%	63.53	66.00	129.53
1995	**6.70%**	49.90%	50.10%	67.79	68.05	135.84
1996	**24.05%**	55.10%	44.90%	84.09	68.53	152.62
1997	**20.17%**	59.14%	40.86%	101.05	69.82	170.87
1998	**19.83%**	62.82%	37.18%	121.10	71.66	192.75
1999	**38.23%**	69.67%	30.33%	167.39	72.88	240.27
2000	**20.47%**	72.75%	27.25%	201.65	75.54	277.18
2001	**9.59%**	73.66%	26.34%	220.99	79.01	300.00
2002	**-0.46%**	72.97%	27.03%	219.97	81.50	301.48
2003	**-5.55%**	71.52%	28.48%	207.76	82.71	290.47
2004	**0.26%**	71.15%	28.85%	208.30	84.45	292.75
2005	**2.66%**	71.35%	28.65%	213.85	85.88	299.73
2006	**7.06%**	72.15%	27.85%	228.94	88.38	317.32
2007	**6.89%**	72.69%	27.31%	244.72	91.93	336.64
2008	**4.31%**	72.64%	27.36%	255.25	96.16	351.41

Using the formula: Change in Land price= (Change Transaction price - 0,5* Change Construction price)/0,5

and adjusting the ratio every year

Year	Land change	New ratio Land	Construction	Land	Constructi	Transaction
1990		50.00%	50.00%	50.00	50.00	100.00
1991	**3.97%**	49.97%	50.03%	51.99	52.04	104.03
1992	**12.99%**	52.47%	47.53%	58.74	53.21	111.95
1993	**13.93%**	55.46%	44.54%	66.92	53.75	120.67
1994	**11.37%**	57.54%	42.46%	74.53	55.00	129.53
1995	**6.17%**	58.25%	41.75%	79.13	56.71	135.84
1996	**20.70%**	62.58%	37.42%	95.51	57.11	152.62
1997	**17.98%**	65.95%	34.05%	112.69	58.18	170.87
1998	**18.06%**	69.02%	30.98%	133.04	59.71	192.75
1999	**34.95%**	74.72%	25.28%	179.53	60.73	240.27
2000	**19.33%**	77.29%	22.71%	214.23	62.95	277.18
2001	**9.30%**	78.05%	21.95%	234.16	65.84	300.00
2002	**-0.26%**	77.47%	22.53%	233.56	67.92	301.48
2003	**-5.14%**	76.27%	23.73%	221.54	68.93	290.47
2004	**0.38%**	75.96%	24.04%	222.38	70.37	292.75
2005	**2.60%**	76.12%	23.88%	228.16	71.57	299.73
2006	**6.80%**	76.79%	23.21%	243.67	73.65	317.32
2007	**6.72%**	77.24%	22.76%	260.04	76.61	336.64
2008	**4.32%**	77.20%	22.80%	271.28	80.13	351.41

Using the formula: Change in Land price= (Change Transaction price - 0,4* Change Construction price)/0,6

and adjusting the ratio every year

Year	Land change	New ratio Land	Construction	Land	Constructi	Transaction
1990		60.00%	40.00%	60.00	40.00	100.00
1991	**3.99%**	59.98%	40.02%	62.39	41.63	104.03
1992	**11.20%**	61.98%	38.02%	69.38	42.57	111.95
1993	**11.95%**	64.37%	35.63%	77.67	43.00	120.67
1994	**10.12%**	66.03%	33.97%	85.53	44.00	129.53
1995	**5.78%**	66.60%	33.40%	90.47	45.37	135.84
1996	**18.19%**	70.07%	29.93%	106.93	45.68	152.62
1997	**16.27%**	72.76%	27.24%	124.33	46.55	170.87
1998	**16.61%**	75.22%	24.78%	144.98	47.77	192.75
1999	**32.21%**	79.78%	20.22%	191.68	48.59	240.27
2000	**18.33%**	81.83%	18.17%	226.82	50.36	277.18
2001	**9.04%**	82.44%	17.56%	247.33	52.67	300.00
2002	**-0.07%**	81.98%	18.02%	247.14	54.34	301.48
2003	**-4.78%**	81.02%	18.98%	235.33	55.14	290.47
2004	**0.48%**	80.77%	19.23%	236.45	56.30	292.75
2005	**2.55%**	80.90%	19.10%	242.48	57.26	299.73
2006	**6.57%**	81.43%	18.57%	258.40	58.92	317.32
2007	**6.56%**	81.80%	18.20%	275.36	61.28	336.64
2008	**4.34%**	81.76%	18.24%	287.30	64.10	351.41

Using the formula: Change in Land price= (Change Transaction price - 0,3* Change Construction price)/0,7

and adjusting the ratio every year

Year	Land change	New ratio Land	Construction	Land	Constructi	Transaction
1990		70.00%	30.00%	70.00	30.00	100.00
1991	**4.00%**	69.98%	30.02%	72.80	31.23	104.03
1992	**9.92%**	71.48%	28.52%	80.02	31.93	111.95
1993	**10.50%**	73.27%	26.73%	88.42	32.25	120.67
1994	**9.17%**	74.52%	25.48%	96.53	33.00	129.53
1995	**5.47%**	74.95%	25.05%	101.81	34.03	135.84
1996	**16.25%**	77.55%	22.45%	118.35	34.26	152.62
1997	**14.88%**	79.57%	20.43%	135.96	34.91	170.87
1998	**15.42%**	81.41%	18.59%	156.92	35.83	192.75
1999	**29.89%**	84.83%	15.17%	203.83	36.44	240.27
2000	**17.46%**	86.37%	13.63%	239.41	37.77	277.18
2001	**8.81%**	86.83%	13.17%	260.49	39.51	300.00
2002	**0.09%**	86.48%	13.52%	260.73	40.75	301.48
2003	**-4.45%**	85.76%	14.24%	249.11	41.36	290.47
2004	**0.57%**	85.58%	14.42%	250.53	42.22	292.75
2005	**2.50%**	85.67%	14.33%	256.79	42.94	299.73
2006	**6.36%**	86.07%	13.93%	273.13	44.19	317.32
2007	**6.43%**	86.35%	13.65%	290.68	45.96	336.64
2008	**4.35%**	86.32%	13.68%	303.33	48.08	351.41

Using the formula: Change in Land price= (Change Transaction price - 0,2* Change Construction price)/0,8

and adjusting the ratio every year

Year	Land change	New ratio Land	Construction	Land	Constructi	Transaction
1990		80.00%	20.00%	80.00	20.00	100.00
1991	**4.01%**	79.99%	20.01%	83.21	20.82	104.03
1992	**8.96%**	80.99%	19.01%	90.66	21.28	111.95
1993	**9.38%**	82.18%	17.82%	99.17	21.50	120.67
1994	**8.43%**	83.02%	16.98%	107.53	22.00	129.53
1995	**5.23%**	83.30%	16.70%	113.16	22.68	135.84
1996	**14.69%**	85.03%	14.97%	129.78	22.84	152.62
1997	**13.73%**	86.38%	13.62%	147.60	23.27	170.87
1998	**14.41%**	87.61%	12.39%	168.87	23.89	192.75
1999	**27.90%**	89.89%	10.11%	215.97	24.29	240.27
2000	**16.68%**	90.92%	9.08%	252.00	25.18	277.18
2001	**8.60%**	91.22%	8.78%	273.66	26.34	300.00
2002	**0.24%**	90.99%	9.01%	274.31	27.17	301.48
2003	**-4.16%**	90.51%	9.49%	262.90	27.57	290.47
2004	**0.65%**	90.38%	9.62%	264.60	28.15	292.75
2005	**2.46%**	90.45%	9.55%	271.10	28.63	299.73
2006	**6.18%**	90.72%	9.28%	287.86	29.46	317.32
2007	**6.30%**	90.90%	9.10%	306.00	30.64	336.64
2008	**4.36%**	90.88%	9.12%	319.36	32.05	351.41

Using the formula: Change in Land price= (Change Transaction price - 0,1* Change Construction price)/0,9

and adjusting the ratio every year

Year	Land change	New ratio Land	Construction	Land	Constructi	Transaction
1990		90.00%	10.00%	90.00	10.00	100.00
1991	**4.02%**	89.99%	10.01%	93.62	10.41	104.03
1992	**8.21%**	90.49%	9.51%	101.30	10.64	111.95
1993	**8.51%**	91.09%	8.91%	109.92	10.75	120.67
1994	**7.83%**	91.51%	8.49%	118.53	11.00	129.53
1995	**5.03%**	91.65%	8.35%	124.50	11.34	135.84
1996	**13.41%**	92.52%	7.48%	141.20	11.42	152.62
1997	**12.78%**	93.19%	6.81%	159.24	11.64	170.87
1998	**13.55%**	93.80%	6.20%	180.81	11.94	192.75
1999	**26.17%**	94.94%	5.06%	228.12	12.15	240.27
2000	**15.99%**	95.46%	4.54%	264.59	12.59	277.18
2001	**8.41%**	95.61%	4.39%	286.83	13.17	300.00
2002	**0.37%**	95.49%	4.51%	287.89	13.58	301.48
2003	**-3.89%**	95.25%	4.75%	276.68	13.79	290.47
2004	**0.72%**	95.19%	4.81%	278.68	14.07	292.75
2005	**2.42%**	95.22%	4.78%	285.42	14.31	299.73
2006	**6.02%**	95.36%	4.64%	302.59	14.73	317.32
2007	**6.19%**	95.45%	4.55%	321.32	15.32	336.64
2008	**4.38%**	95.44%	4.56%	335.38	16.03	351.41