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Towards a Better Understanding of Implicit Debts

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1 Introduction

Around the world, there is an increasing awareness of the size of the liabilities created by (public) pension schemes. These liabilities, also called Implicit Pension Debt (IPD), are created by unfunded or underfunded national and public sector workers pension schemes. IPD arises from a future obligation of the government to make payments in the future, just like explicit public debt. Although IPD is not fully comparable to explicit debt, the level of IPD is certainly relevant for economic policy. A high level of IPD is associated with large future pension obligations and therefore the level of IPD has implications for the sustainability of public finances in the future. This is especially the case in an aging world, as pension liabilities are dependent on life expectancy. The importance of IPD for the sustainability of public finances is increasingly recognized by authorities and investors. The international credit crisis followed by the European sovereign debt crisis has sparked new attention to the state of public finances of countries. Already, the European Commission has stressed the significance of future pension obligations for the sustainability of sovereign debt but they are not yet taken into account when formally assessing the sustainability of public finances within the EMU framework. Some rating agencies (see for example Credit Suisse 2010) already include indicators related to the size of pension liabilities in assessing the credit ratings of countries which suggests that a high level of IPD would lead to higher borrowing costs. There is limited empirical work available on the impact of IPD on borrowing costs of countries (e.g. Gonzalez et al. 2008), and a link between the IPD level and the credit rating and interest rate has not been established yet. However, empirical work on the level of US state pension funds (Munnell et al. 2010) and corporate pensions (McKillop and Pogue 2009) shows that underfunding and unfunded pension liabilities are reflected in market borrowing costs and credit ratings. A lack of good estimates of cross-country IPD levels might be a reason why empirical work failed to establish a link between the IPD level and borrowing costs at a country level.

The first goal of this thesis is to create a better understanding of the concept Implicit Pension Debt. This is necessary since the possibility of IPD influencing the (perception of) sustainability of public finances calls for a good and uniform way of measuring IPD. We argue that the existing literature on IPD lacks a complete overview of the concept and its use. Moreover, current cross-country IPD studies are inconclusive, and the IPD levels found in the studies differ substantially. The contribution of this thesis to the existing literature is that it gives an overview of IPD: the basics of the concept, methodologies in measurement, the use and the strengths and

weaknesses are discussed. The second goal of this thesis is to illustrate the use of IPD as a tool to measure the success of a reform. To achieve this goal, the level and future path of the IPD created by the Dutch first pillar pension plan is estimated, both when the retirement age is increased and when the retirement age is kept constant. The results indicate that increasing the retirement age will immediately have an impact on the IPD level of the Dutch first pillar pension plan, but it will take time for the reform to show up in expenditure figures. Furthermore, by increasing the retirement age, the IPD created by the Dutch first pillar pension plan could be reduced significantly.

The remainder of this thesis is structured as follows: Section 2 provides a complete theoretical overview of the concept IPD. Various studies that have measured IPD are compared and discussed, along with the basics of the concept, the relation between IPD and explicit debt, strategies to reduce IPD and the use of the concept. Section 3 explains that public pensions are not the only source that create IPD, and that next to implicit debts there are also implicit assets. Section 4 describes the model, data and assumptions used for estimating the IPD of the Dutch first pillar pension plan. Section 5 presents and discusses the results of this estimation. It also shows the impact of the assumptions made on the results. Section 6 concludes.

2 The basics of Implicit Pension Debt

This section will give an overview of the relevant literature on IPD. It will answer the following questions: What is IPD? How can IPD be measured? What is the relationship between IPD and public debt? How do financial markets react to IPD? How can IPD be reduced? And what is the use of IPD?

2.1 What is IPD?

Implicit Pension Debt is a concept that measures the obligation of governments with respect to pension promises from the past. These obligations can arise from different sources, for example from running a national unfunded scheme (either defined benefit or defined contribution) or from running a scheme for public sector workers (either unfunded or underfunded). The term 'debt' comes from the fact that the government is indebted towards its inhabitants as it has made promises to pay pensions in the future. While a funded system holds assets to cover future liabilities, a PAYG-type system holds no or little assets and is entirely dependent on the stream of contributions to pay for its current obligations. These pension promises are not officially on the government book, hence the term 'implicit'. Therefore, a formal definition of IPD could be: Public pension liabilities that are not directly covered by assets. The concept implicit debt can also be viewed upon a broader perspective and pension systems are not the only source which create implicit debts. See section 3 for an overview of other sources that can create implicit debts.

What does this definition exactly contain? There are many types of pension liabilities, but from a public finance perspective they are not all relevant for IPD as described by Holzmann (2014). He proposes that only liabilities that arise from contribution payments and liabilities that have a high level of certainty that the commitment has to be honored should be included in IPD. This excludes government guarantees on private pension schemes from IPD. Since IPD is a concept related to public finance, all liabilities in privately run systems are not relevant for IPD. Furthermore, next to liabilities, any assets in the system should also be taken into account because they need to be subtracted from the total liabilities in order to get to IPD. A scheme can contain explicit assets, but a scheme could also hold implicit assets. For example, a system that defers taxation of pensions (exempt-exempt-tax or EET) holds an implicit asset due to the tax revenues to be received in the future. According to Franco (1995), the concept of assets is to be looked upon in a broad sense and therefore expected future tax revenues on pensions should be subtracted

from pension liabilities.

IPD measures the stockpile of pension promises made by the government. A PAYG system actually operates quite similarly as a Ponzi scheme[1]: current contributions are used to pay off the promises made to past contributors, and the current contributors get promises of future payments in return for their contribution to the system. Due to population growth and due to indexation of pension benefits along with the growth of wages or prices, the added liabilities exceed the liabilities paid off by the contributions of a given cohort, and the stockpile of liabilities grows over time. In addition, IPD also captures the initial gift, received by the generations that were entitled with full pension benefits at the introduction of the PAYG system while not contributing fully or contributing anything at all to the system. In a running PAYG system this debt implicit in the system is not much of a problem, but the debt has to be paid off at some moment in the future. In this way, the mere size of IPD does not directly offer a measurement of the sustainability of the system. Rather, it offers a measure of how costly it is to pay off all past pension promises (Beltrametti and Della Valle 2011).

2.2 How can IPD be measured?

Measuring IPD is not easy and it requires a large number of choices and assumptions. There are multiple ways *how* to measure IPD and there are three main concepts that define *what* is measured. An overview and analysis is presented of different studies that have estimated cross-country IPD levels.

Total pension liabilities measure the stock value of the future commitment. There are three concepts that define the type of liability that is measured as described by Franco (1995): Accrued-to-date liabilities (ADL), Closed Group liabilities (CGL) and Open Group liabilities (OGL). The concept ADL is defined as the present value of pensions to be paid in the future based on the rights accrued to date. This concept only incorporates pensions accrued in the past and does not take into account future contributions or the accrual of new pension rights. Therefore, if a pension system would be closed down today and no more contributions would flow in and no more rights would be accrued, the ADL concept measures the total liabilities

[1]In fact, both Paul Samuelson and Milton Friedman have referred to PAYG systems as being a Ponzi scheme. The former one described PAYG systems as Ponzi schemes that work and the latter one was more critical. However, the difference between a PAYG system and a true Ponzi scheme is that the government can continuously force generations to take part in the scheme while a Ponzi scheme operates on a voluntary basis.

towards the participants that remain. CGL is a broader concept, because it also includes the future contributions and accrued rights of the current participants. This can be viewed as the liability that remains if the pension system does not allow any new participants and continues with the current group until the last participant dies. Even broader than CGL is OGL, which is defined as the present value of contributions and accrued rights towards infinity, where the contributions and accrued rights of new workers in the the future are also taken into account. The liability concept ADL fits best with respect to the concept IPD because it reflects the total accrued rights of the participants that need to be honored when the system is terminated. The CGL concept is more applicable in pension plans in the corporate sector as they are, unlike the government, possibly not allowed by law to close a scheme for current participants. The OGL concept represents a pension system that is continued until infinity, and therefore it is too broad with respect to the concept IPD which is aimed more at measuring the current pension liabilities.

In measuring the accrued-to-date liabilities an additional choice on the methodology should be made. The liabilities can be measured using the Accrued Benefit Obligation (ABO) or Projected Benefit Obligation (PBO). These two methodologies are quite similar but they can cause differences in estimates and therefore it is important to understand the differences in the methodologies. The choice for either ABO or PBO only affects the value of the liability towards individuals that are currently in the workforce because ABO and PBO deal with the question of how entitlements of individuals that are not yet retired are projected. Therefore, the value of the entitlements of those that are already retired is not affected by the choice for ABO or PBO because they are already entitled with full pension rights. The difference between ABO and PBO is that PBO takes wage increases into account while ABO keeps the wage level constant. It can also be the case that within the ABO methodology wages are kept constant in real terms which means that they are indexed for changes in prices. In this case, it is often referred to as Indexed Benefit Obligation (IBO). The wage increases that PBO takes into account can either be general wage growth (often linked to general economic growth) or the development of wages during an average career. The result is that liabilities estimated using PBO are generally larger than using ABO, because PBO allows for future wage increases. See Heidler, Müller, and Weddige (2009) and Bodie (1990) for more on ABO and PBO.

A number of studies have attempted to estimate IPD of multiple countries. The results from a selection of studies is shown in table 1 where the size of IPD rela-

tive to GDP is denoted. Early work on cross-country estimates of IPD is from the OECD (Van den Noord and Herd 1993) that estimated IPD for seven industrialized countries. This work was followed by the IMF (Chand and Jaeger 1996) that also estimated IPD for a number of industrialized countries. The World Bank (Holzmann, Palacios, and Zviniene 2004) estimated IPD for a much larger set of countries that mainly consisted of mid- and low-income countries by using the World Bank's PROST[2] toolkit. Recent work on estimations of IPD is by Heidler, Müller, and Weddige (2010) which estimates IPD for 19 European countries using the 'Freiburg Model'[3]. Furthermore, Beltrametti and Della Valle (2011) estimated pension liabilities for a number of countries, but only the liabilities towards current retirees are taken into account. Finally, Ponds, Severinson, and Yermo (2012) estimated the pension liabilities that arise from unfunded or underfunded public sector workers pension plans run by governments.

From table 1 it is clear that: 1) IPD estimates are often large compared to GDP and also large compared to public debt, 2) there is large variation in IPD across countries, 3) there is large variation in estimates of different studies for the same country. Not all the estimates are directly comparable, for example, the Beltrametti and Ponds estimates only cover part of the pension liabilities that a government has. Even though the other four studies should be more comparable, they still differ substantially from each other. There are a number of explanations why these estimates differ. Firstly, many simplifying assumptions need to be made to estimate IPD for different countries. IPD estimates are very sensitive to assumptions made and the choice of certain parameters and only small adjustments in the parameter values cause large changes in the IPD level. For example, applying a higher discount rate leads to lower estimates of IPD. Therefore, differences in the assumptions made and the parameters chosen can lead to large differences in IPD estimates. Secondly, the definition of IPD can also make a large difference. Including or excluding supplementary schemes run by the government (disability or survivor benefits) or public sector workers pension plans (which may be unfunded or the government acts as a sponsor) contribute to differences in estimations. For example, the Heidler estimates includes the liabilities from public sector workers pension plans which might explain why the Heidler estimates are relatively large. Choice of methodology (ABO/PBO) also contributes to differences. Thirdly, estimates over time are not directly comparable. The OECD estimates are from the beginning of the nineties while the Heidler

[2]For more on the PROST toolkit, see http://siteresources.worldbank.org/INTPENSIONS/Resources/395443-1121194657824/PRPNoteModeling.pdf

[3]For more on the Freiburg Model, see Heidler, Müller, and Weddige (2009)

Table 1: Cross-country IPD estimates (denoted as percentage of GDP)

Country	OECD	IMF	World Bank	Heidler	Beltrametti†	Ponds‡	Public debt*
Austria	-	-	-	360	-	-	85
Bulgaria	-	-	-	202	-	-	-
Canada	121	94	-	-	-	5	112
Czech Republic	-	-	-	201	-	-	56
Denmark	-	-	-	-	119	-	59
Finland	-	-	-	301	150	77	64
France	-	-	-	362	-	91	109
Germany	157	221	-	339	95	58	89
Greece	-	-	-	231	-	-	164
Hungary	-	-	203	258	-	-	90
Italy	242	357	-	323	197	-	142
Japan	162	266	-	-	-	-	228
Latvia	-	-	-	125	-	-	-
Lithuania	-	-	-	180	-	-	-
Malta	-	-	234	269	-	-	-
Netherlands	-	-	-	236	-	5	83
Poland	-	-	261	361	-	-	63
Portugal	-	-	233	298	-	-	128
Romania	-	-	256	-	-	-	-
Slovakia	-	-	210	211	-	-	57
Slovenia	-	-	298	-	-	-	61
Spain	-	-	-	204	-	-	92
Sweden	-	131	-	284	135	8	49
United Kingdom	156	117	-	91	136	63	101
United States	113	106	-	-	55	31	123

Sources:

OECD: Van den Noord and Herd (1993), IMF: Chand and Jaeger (1996), World Bank: Holzmann, Palacios, and Zviniene (2004), Heidler: Heidler, Müller, and Weddige (2010), Beltrametti: Beltrametti and Della Valle (2011) and Ponds: Ponds, Severinson, and Yermo (2012)

Year of estimates: OECD: 1990, IMF: 1995, World Bank: end 1990's-2000, Heidler: 2006, Beltrametti: 2007-2010 , Ponds: 2008

† Estimates resticted to pension liabilities towards current retired population

‡ Estimates restricted to unfunded pension liabilties created by public sector pension plans

∗ Public debt figures are of 2012 OECD. Source: OECD factbook 2014

- = data for the country is missing in this study

estimates are from 2006. In between there are 15 years in which pension liabilities could grow or they could have been reduced by pension reform. Other trends, such as rising life expectancy, might have also contributed to the large differences in IPD estimates over time. Heidler, Müller, and Weddige (2010) examined the main determining factors that explain differences in IPD across countries. They found that the main determinant of IPD is the initial level of pension expenditures. The initial level of pension expenditures is largely determined by the size of the unfunded pension scheme. A large unfunded pension scheme will cause a relatively high IPD in comparison to other countries that may have a significant funded pillar incorporated in their pension system. Other determinants of differences in IPD are population projections, generosity of pension indexation and whether there have been (major) reforms recently.

As stated above, the Ponds and Beltrametti estimates are not directly comparable to the other studies because they do not cover all the pension liabilities. Beltrametti and Della Valle (2011) limit their estimation to current retirees only because this makes measurement of IPD more accurate. The benefit levels of retirees are more certain and measuring the liability towards current retirees requires less assumptions to be made. Furthermore, a shorter time horizon makes the estimates less sensitive for the discount rate applied. However, this accuracy comes at a cost: abstracting from the rights accrued by current workers makes that these estimates cannot be used to say anything about the total pension liabilities of a government. The estimates by Ponds, Severinson, and Yermo (2012) show the implicit debt that is created by unfunded or underfunded public sector workers pension plans. Again, the differences between countries are large and these differences are mainly explained by the degree of funding. For example, a country like the Netherlands has a funded public sector workers scheme which makes that it only has some implicit liabilities as a result of underfunding. In contrast, in countries like France or Finland that operate an unfunded public sector workers scheme, the government has pension liabilities almost equal to GDP as a result of just the public sector workers scheme. This shows that the way in which in the public sector workers pension scheme is funded can significantly affect the level of IPD.

It is important to understand that ideally IPD is estimated at the national level where different pension schemes are modelled individually. However, this requires specific knowledge about the schemes and only few countries estimate their national IPD and publish it[4]. Furthermore, these national estimates might not be

[4]For example, Finland and Spain have national IPD estimates.

comparable across countries. On the other hand, cross-country estimates of IPD require simplifying assumptions. For example, they often use average benefit levels per cohort that are not differentiated by gender. The use of data which is not detailed enough is a serious caveat. Furthermore, the exclusion of unfunded separate schemes, like the public sector workers pension scheme is a caveat. Differences in the way the separate schemes are funded can have large impacts on the total IPD level of a country and therefore unfunded separate schemes should definitely be included when estimating IPD. The work in the early nineties does not include public sector workers schemes into the estimation and uses aggregate data. The PROST toolkit and the 'Freiburg Model' try to make a bridge between precision and cross-country comparability. Moreover, they use cohort and gender specific data and cover most of the supplementary schemes in a country which is an improvement compared to the initial pioneering work from the early nineties. In this way, the estimates by Heidler, Müller, and Weddige (2010) seem to be the most complete, as they use the 'Freiburg Model' and include the public sector workers scheme in their estimation. Another improvement in the international comparability of pension liabilities is the updated System of National Accounts (SNA). In the SNA 1993 standards, only funded pension liabilities are included and unfunded pension liabilities are missing. In the updated SNA 2008, countries are obliged to report unfunded pension liabilities in a supplementary table. According to Van der Wal (2014), this has improved the international comparability of pension liabilities. In addition, the EU also advocates for harmonizing the assumptions to be applied in estimating pension liabilities. The increased availability and harmonization of data on unfunded pension liabilities will certainly improve cross-country studies on IPD.

2.3 What is the relationship between IPD and public debt?

IPD is, just like explicit debt, a stock variable that measures the burden of future generations to honor all the current liabilities of the government. Furthermore, an individual is promised a stream of pension payments in the future in return for making a contribution to the pension system. Therefore, the pension obligations are quite similar to government bonds. In fact, whenever an individual makes a contribution towards the unfunded pension system, *de facto* he purchases an implicit government bond. According to Kotlikoff (1984), the government labels payments into the pension system 'contributions' and the retirement benefits are labeled as 'benefits'. However, economically speaking there is no difference between labelling payments 'contributions' or 'making a loan' to the government. Due to the link between contributions and benefits, contributing to an unfunded pension system is

similar to lending money to the government and earning a benefit is similar to the government paying back the principal loan plus interest. In this way, IPD can be viewed as being similar to explicit public debt.

However, there are also fundamental differences between IPD and explicit debt as described by Rizzo (1990), which makes that IPD is not one-to-one comparable with explicit debt. Firstly, an explicit bond is voluntarily purchased and can be freely traded on the market. In contrast, making contributions towards an unfunded pension system is mostly imposed by the legislation such that individuals do not acquire implicit bonds on a voluntary basis. Moreover, after acquiring these implicit bonds, they cannot be freely traded or be borrowed against. This feature makes IPD different from explicit public debt.

Another feature which makes IPD different from explicit public debt is that public debt is embodied in a formal contract in which the timing and amount to be paid to the bond holder is fixed in advance. Implicit liabilities are not embodied in formal contracts but are implicit in the legislation. This makes that implicit liabilities are a much weaker commitment compared to explicit debt, as in the case of implicit liabilities the debtor can unilaterally change the terms and conditions of the payments. For example, the government can alter the policy parameters (retirement age, indexation policy, size of the benefit) at any time. In fact, when changing the policy parameters comes down to paying out less towards the implicit bond holders than initially promised, the government partially defaults on its IPD. A partial default on the explicit debt of the government would spark an adverse reaction by financial markets and would have long-term effects as investors in the future want to be receiving a higher risk premium on debt from this state. Due to the mandatory nature of implicit debt, a partial default on IPD would have none of these consequences. Holders of implicit bonds cannot *en masse* sell them and the yield will not go up or down as a result of changes in policy parameters. In addition, the value of implicit liabilities is not fixed in advance, but conditional on a number of parameters such as life expectancy, dynamics of wages and prices and policy choices. In fact, pension liabilities are very sensitive to small changes in parameters due to the long-term scope of these liabilities. Therefore, small changes in parameters can have large effects on the level of IPD. As already discussed above, the government has the autohority to unilaterally alter the policy parameters which can significantly affect the level of IPD. However, other parameters that influence IPD are beyond the control of the government, for example life expectancy. The current trend in developed economies

of rising life expectancy on a macro scale means that over time, IPD is also rising[5]. The reaction of IPD towards rising life expectancy depends of course on the type of contract. An unfunded defined benefit system is much more vulnerable to rising life expectancy compared to a notional defined contribution (NDC) system which links the benefit and/or the retirement age to life expectancy.

From a government perspective, there are more important differences between IPD and common public debt. While IPD may be vulnerable to events, the government has a number of tools (reform) available to reduce IPD. Furthermore, IPD is less risky on the governments balance sheet compared to explicit debt. The government can force its inhabitants to purchase implicit bonds even in the case that it partially defaults on its implicit debt such that the IPD is easily refinanced. Therefore, a reform that transforms implicit debt into explicit debt (equivalent to a change from unfunded to funded), makes the government balance sheet more risky while leaving the total debt unchanged.

2.4 How do financial markets react to IPD?

As just established above, IPD does have its similarities with public debt but it is also fundamentally different. This raises a number of interesting questions: Do financial markets take IPD into account in determining the risk premium on explicit debt? Should financial markets take IPD into account? The empirical literature on the effect of pension liabilities on sovereign credit risk is not very broad. The limited empirical work on this topic (see Gonzalez et al. 2008) is unable to find a link between IPD and the credit risk rating and interest rates of a country. This is a remarkable result, as financial markets do take into account pension liabilities not covered by assets in corporations. According to Feldstein and Seligman (1981), Moody's (1998) and McKillop and Pogue (2009), unfunded pension liabilities and underfunding in corporate pension plans are reflected in the share prices and credit ratings of these corporations. Furthermore, Munnell et al. (2010) find a significant effect of unfunded pension liabilities on the spread of bond yields of US states. A possible explanation is that cross-country estimates of IPD are difficult to obtain and require many assumptions such that the quality of these estimates might not be sufficient to find an effect of IPD on interest rates or credit risk ratings at a country level. Another possibility is that this result is obtained due to myopic investors that do not take into account the obligations represented by IPD.

[5]See Holzmann (1998) for a simulation of how IPD reacts to rising life expectancy.

It is difficult to distinguish whether the lack of good quality IPD estimates on the country level or myopic investors produce the results found by Gonzalez et al. (2008). Therefore, it is not clear whether financial markets *do* take IPD into account when assessing public finances. However, *should* financial markets take IPD into account? Although the concept of IPD is in many aspects fundamentally different from common public debt, the basics are not: both measures represent the stock of future obligations that need to be honored by future generations. Paying off these obligations by higher future taxation (public debt) or by a partial default on pension rights (implicit debt) is not fundamentally different: in both cases a burden falls on future generations[6]. A high level of public debt is considered the most important variable[7] for financial markets to assess sovereign credit risk, because a high public debt now imposes a large burden on current and future generations which is a risk factor. Therefore, it is certain that the level of public debt is taken into account by financial markets. Due to the fact that IPD is different in many aspects from public debt, it would be reasonable if financial markets would judge IPD differently from public debt, but due to the similarities it would be unreasonable if financial markets would not take IPD into account at all. For example, consider a country with a public debt level of 50% of GDP that operates a PAYG pension system which creates IPD equal to approximately 100% of GDP. This country decides to reform its pension system and shifts from a PAYG system to a fully funded system. In order to honor all pension obligations the entire stock of IPD is transformed into explicit debt. This means that the level of public debt in this country suddenly jumps from 50% to 150%, while the total debt level, thus the total burden on future generations has remained unchanged. There are sound reasons why the credit risk rating of this country may have changed slightly as a result of the shift from an unfunded to a funded pension system[8], but there are no sound reasons why the credit risk rating should change radically as the burden on future generations has not changed. This is much like the Modigliani-Miller theorem, which states that the specific capital structure of a firm (or in this case of a government) is irrelevant because it does not change its value. If Modigliani-Miller is applied in this case, it would also state that it would be irrelevant whether the government debt is financed by explicit or implicit debt. Furthermore, according to Hochreiter, Winckler, and Brandner

[6]Of course, the timing matters to what extend specific cohorts are burdened.

[7]Many other variables play a role in assessing sovereign credit risk, but the size of public debt is the most important. See Powell and Martínez (2008).

[8]As discussed above, explicit debt is riskier on the government balance sheet. This justifies a higher credit risk rating of this country as a result from the increase of the explicit debt by 100% of GDP.

(1998), a given path of IPD without reform reduces the ability of a government to service the explicit pension debt. Therefore the level of IPD is a risk factor and financial markets might demand a risk premium on government debt of high IPD countries.

Not everyone agrees that IPD should be taken into account by financial markets. Franco (1995) argues that there are practical and theoretical reasons not to include IPD in debt measures. He considers the measurement of IPD to be too sensitive towards assumptions and parameter changes. Furthermore, he argues that IPD does not produce a direct effect on financial markets because of the mandatory nature of acquiring pension rights. Truglia (2002) also brings up the argument of the sensitivity of IPD estimates as a reason not to include IPD in credit risk ratings. Furthermore he argues that IPD does not take future policy actions into account. The sensitivity of IPD estimates with respect to assumptions and policy changes is indeed a valid argument to carefully assess IPD estimates and perhaps give them a smaller weight than explicit debt in assessing credit risk ratings. However, the second argument of Truglia is heavily dependent on the assumption that governments can reform pension systems easily. This might be a harsh assumption. In reality, governments find it hard to reform unfunded pension systems in terms of less generous benefits or increasing the retirement age. A great political risk is attached to reforming pensions, such that policy makers may be reluctant to seriously reform the pension system to reduce IPD. Within an aging society, the majority of the population is retired or near its retirement and is probably opposed to serious reforms which imply less generous pension benefits (Sinn 2005). Even though the government may successfully initiate reform, the dual nature of pension liabilities may partly shift the problem to social security. IPD enters the government's balance sheet as a liability, but at the same time it is an asset to its inhabitants. Reducing the value of the asset would deplete a major source of income for many such that the government might be forced to supply some other source of income, shifting the problem to the general government budget. IPD cannot be easily reduced and is therefore a risk factor.

All in all, unfunded and underfunded pension liabilities on the corporate level are taken into account by financial markets, but it is not clear whether they take pension liabilities into account when assessing the state of public finances of countries. Due to the similarities with explicit debt, IPD should be taken into account by financial markets. However, there are also important differences between IPD and explicit debt, which implies that the way in which a government finances its total debt not

completely irrelevant. Furthermore, the measurement of IPD is a serious caveat. Therefore it is reasonable that IPD is treated differently from explicit debt.

2.5 How can IPD be reduced?

If a government is interested in reducing the IPD, there are a number of strategies available to achieve this goal. As IPD is a result of promises in the past, reducing IPD often involves that current or future generations bear the burden in some way by higher future taxation or lower pension rights.

The first strategy to reduce IPD is to shift from an unfunded to a partially or fully funded system. The shift from an unfunded to a funded system does leave a transition burden, as the accrued-to-date pension rights of the old unfunded system need to be honored. These accrued pension rights are equal to IPD. Paying off this burden very quickly would put a heavy burden on current generations, therefore Holzmann (1998) argues that (partial) debt financing is justified, not only because of intergenerational fairness but also based on tax- and consumption-smoothing considerations. Basically this implies that the implicit debt is made explicit. In this way, while IPD is reduced, the total debt position (explicit and implicit debt) is unaffected as a result of the shift from funded to unfunded. Furthermore, due to the size of IPD compared to GDP and to explicit debt (see table 1) it may be impossible to make all the implicit debt explicit. Therefore, strategies are needed that reduce IPD without making it explicit, thus lowering the total debt position. A partial shift to a funded system may be an option for countries that run a very large unfunded pillar, as introducing a funded pillar would make the pension system more in line with the multi-pillar pension system advocated by the World Bank. An example of a successful case of shifting from unfunded to funded is Chile in 1981.

A reform strategy more aimed at reducing the pension liabilities without making implicit debt explicit is known in the literature as a 'parametric reform'. Literally, this type of reform alters the parameters of pension scheme. Different parameters of a pension scheme can be exploited to reduce IPD: the benefit level, the accrual rate, the indexation policy and the retirement age. Altering any of these parameters to reduce IPD basically comes down to a less generous pension and in fact the government is partially defaulting on its past pension promises. Therefore reducing IPD by means of a parametric reform means that the inhabitants (which hold the implicit assets) are burdened. A parametric reform can be an effective way of reducing IPD: Holzmann (1998) concludes on the basis of simulations of a stylized

model that simply moving from wage indexation to less generous price indexation could already get rid of 1/6th of the IPD. Similarly, increasing the retirement age also significantly reduces IPD, especially when combined with a decrease in the accrual rate. In addition, increasing the retirement age has a more long-term effect compared to adjusting the indexation policy. Evidence of the effectiveness of parametric reforms in practice comes from Italy. The 1992 reform in Italy decreased the (initially very high) IPD level by almost 100% of GDP (Franco, Marino, and Zotteri 2006). Moreover, as a result of several reforms in Germany, the IPD of Germany decreased by almost 50% between 1992 and 2004 even though life expectancy has risen in this period (Werding 2006). The success of parametric reforms with respect to reducing IPD depend on the political environment as there are great political costs involved for policy makers in proposing pension reforms. Therefore, policy makers might not be willing to propose reforms.

Other possibilities of reducing IPD are a shift from an unfunded defined benefit system to an NDC system or introducing assets into the existing scheme. An NDC system is more robust with respect to rising life expectancy, and often also has less generous benefits. However, moving to a (less generous) NDC system implies that there are transition costs which need to be measured and financed[9]. Furthermore, introducing assets into the system reduces IPD because these assets cover the pension liabilities. For example, several government assets such as state enterprises could be privatized such that the assets can be added to the pension scheme to reduce IPD.

All these tools described here that reduce IPD *and* the total debt level do imply that in some way the pension system becomes less generous and that some groups will be hurt by the reform. In the case of an increase of the retirement age, mostly the current workers are hurt because the current retirees are not affected by an increase in the retirement age. Reducing the pension benefits will hurt the current retirees and, provided that lower benefits result in lower taxes, will be of interest to the current workers that can anticipate the lower future benefits by increasing their private savings. However, reducing benefits might be relatively hard to accomplish. Next to the political risk for policy makers of proposing benefit cuts in an aging society, in many countries accrued benefits are well protected by the legislation such that policy makers are unable to reduce benefits. For example, in the US pension benefits are strongly protected by the constitution and policy makers have

[9]See Holzmann and Jousten (2012). They call the transition costs of moving from an NDB to an NDC system 'legacy costs'.

to be creative to reduce IPD. Furthermore, while reducing benefits will lower IPD, it might shift the problem partly to general revenue such that the effect on the total debt level is lower. As discussed in section 2.3, public pensions are a liability for the government but an asset for its inhabitants and reducing benefits might imply that some individuals are pushed below the poverty line such that they will have to rely on some other welfare program financed out of general revenue. Therefore, reducing IPD while also reducing the total debt level (implicit and explicit) might be a challenging task for policy makers.

The tools to reduce IPD have just been described, but a related question is: What should be the objective of the government with respect the level of IPD? Should it be fully paid off or rather be optimized? Barr and Diamond (2008) argue that it might be suboptimal to fully pay off the entire IPD. In analogy to public debt, it might be welfare improving for a country to roll over a reasonable amount of implicit debt in perpetuity. Therefore, according to them the proper objective for a government should be to search for the optimal debt level of implicit debt rather than to minimize it. For the government it could be beneficial to operate an unfunded pension system because implicit debt is less risky compared to explicit debt (see section 2.3). However, also from an individual perspective it can be beneficial if at least some component of the total pension income is financed by PAYG. From a portfolio approach, the lower yielding PAYG pension, which is also less risky, can be a valuable addition to the total portfolio of pension income (see Borgmann (2006) and Dutta, Kapur, and Orszag (2000)). Therefore, some form of an unfunded pension system, and therefore also some IPD, can be beneficial from both the perspective of the government as from the individual.

2.6 What is the use of IPD?

Published IPD estimates could be a valuable addition to public debt figures in assessing and comparing the state of public finances of different countries. The currently published public debt figures do not accurately disclose all the future obligations of governments because they do not include liabilities that are not listed on financial markets but that are implicit in the legislation. Differences in the design of the main pension system and its supplementary schemes, for example funded or unfunded, make that there are large differences in future obligations between countries, but these obligations are not reflected in the public debt figures. Furthermore, also other differences between countries have implications for the future obligations. Whether a country has a front loading or back loading nature in the taxation of

pensions also makes a difference. A country that taxes pensions according to the EET system defers taxation to the moment that the pension is paid out such that it has an implicit tax claim on the future, which lowers its net future obligations. The concept of IPD takes both implicit liabilities and implicit assets into account. Altogether, differences in the total future obligations that are implicit are quite large across countries, as reflected by the IPD estimates shown in table 1. Therefore, publishing IPD figures next to public debt figures would better reflect the actual position of countries towards each other with respect to public finances such that a better comparison of the true future obligations of countries can be made.

A possible application of IPD could be the inclusion of IPD by financial markets in their assessments of country credit risk. Already some financial analysts use pension liabilities as an indicator in the assessment of country credit risk (see Credit Suisse 2010). Moody's has used pension liabilities to rate US state bonds and justified it by stating that including pension liabilities gives a more complete comparison of states and their long-term obligations (Hampton, Kurtter, and Behr 2011). Within the Eurozone, pension liabilities could also be used to assess the sustainability of public finances. At the moment, within the framework of the Stability and Growth Pact (SGP), only the budget deficit and the public debt to GDP ratio are indicators. Therefore, only explicit debt is taken into account and the SGP actually holds back reform: shifting from unfunded to funded is not possible under the SGP regulation as the transformation of implicit debt into explicit debt would cause the public debt to GDP ratio to rise above the ceiling set by the SGP framework, even though the total debt position remains unchanged due to the reform. However, even though the inclusion of IPD would be a valuable addition to sustainability indicators, it should be stressed again that IPD should not be treated as a full equivalent of public debt following the arguments put forward in section 2.4.

IPD could not only allow for better international comparisons of the true state of the public finances, the methodology is also useful for evaluating the sustainability of domestic pension plans. A possible domestic application is to the IPD in evaluating the success of a pension reform. Holzmann (2014) reckons that the value of IPD lies especially in reform discussions. Estimates of IPD and its future path when the system is not reformed can give an indication of the need for reform. When a reform is initiated, the effect of the reform on IPD gives a better indication on the effect of the reform on long-term sustainability of the system compared to only looking at the effect of the reform on pension expenditure. The reason is that a reform has an immediate effect on IPD, but the effect on pension expenditures may only occur

in the long-run. Furthermore, he argues that the concept of IPD is very useful in measuring the transition costs of a reform (also see Holzmann and Jousten 2012) that need to be financed. Therefore, it is very useful for countries to measure their national IPD in order to guide discussions about reform and to measure the success of this reform.

3 Implicit debt in a broader perspective

The previous section gave an overview of the concept Implicit Pension Debt. The goal of measuring IPD was to improve the comparability between countries about the state of the public finances; therefore it is also relevant to look beyond implicit debt created by pension systems and study whether other public policies could create implicit debts.

3.1 Stretching the concept Implicit Pension Debt

In principal, besides pensions, many policies create future obligations that have the economic characteristics of debt while not being explicitly on the government balance sheet. Therefore, these policies also create implicit debt. Roughly, these policies that create implicit debt can be clustered in two groups: entitlement programs and guarantees.

Entitlement programs

Entitlement programs are programs in which some kind of right to future payments from the government is accrued. Therefore, pensions are an example of an entitlement program. It is obvious that entitlement programs that have made promises in excess of what they can pay for have an implicit debt equal to the excess promises. For example, the unpaid excess promises of the US health care social insurance program Medicare are estimated at 36.8 trillion dollars (Kaplan and Walker 2013). The reason for this is that the Medicare program uses the same financing method as unfunded pensions: PAYG financing. This also includes that rights to cover healthcare expenditures are accrued after making contributions. Therefore, the Medicare program works very similar as an unfunded public pension system[10]. In general, any entitlement program that uses PAYG financing or has underfunding and where strong rights are accrued or promises are made regarding the future will create an implicit debt, similarly to unfunded pension schemes.

Guarantees

Governments act as an insurer-of-last-resort in many cases. It is likely that large financial institutions have an implicit guarantee that they will be saved in case of a possible bankruptcy (see for example O'hara and Shaw 1990; Soussa 2000). Recall

[10]The Medicare program might be a special case of a health insurance program that creates implicit debt. This is caused by the unique way of financing of Medicare where only workers are required to make contributions. Therefore the Medicare system has the characteristics of a pension system. For more on the Medicare program, see Rettenmaier and Saving (2000).

from the recent global financial crisis that governments all over the world actually needed to bail out financial institutions at large costs. Furthermore, in case of natural disasters the government often ends up paying the bill. It is also possible that governments provide guarantees on private pension plans, student loans and mortgages. These guarantees do not directly cost money but create an implicit claim on the government in case of adverse events.

3.2 What is implicit debt and what is not?

In case of creating an indicator that measures the implicit debt of countries for the sake of comparing the true financial position amongst each other, which 'debts' should be included? The previous sections gave an overview of the implicit obligations and revenues there exist, however a relevant question is which ones are useful for cross-country comparison and which ones are not.

From the start it is clear that implicit debt is created by policies that imply some form of expected future payments. These payments are not formally embedded in contracts but are implicit in the legislation. Furthermore, to qualify as implicit debt, the obligation should be comparable to obligations embedded in formal debt instruments. A formal debt instrument, like a bond, has a high degree of certainty around the future stream of payments and therefore for an implicit stream of payments to qualify as a debt, it should also be more or less certain that this stream of payments will actually occur in the future.

With the criterion that in order to qualify as being implicit debt, it should be more or less certain that the promise that is made by the government is actually honored, it is clear that unfunded public pensions still qualify as a policy which creates implicit debt. Even though the accrued rights of pensions are not officially in the government books, they are often hard to avoid: there is a large political risk attached to reforming pensions and often these rights are well protected in the legislation and cannot easily be reduced or taken away. It is fairly certain that accrued pension rights imply future payments: everyone with accrued rights will receive a pension at the official retirement age provided that they make it until the retirement age. The same applies to other entitlement programs that are financed similarly to public pensions. The implicit debt created by entitlement programs is similar to the implicit debt created by public pension due to the fact that the implicit debt comes from the same source; the PAYG type financing of the program and the rights accrued by those who made contributions to the system.

Implicit guarantees are a different case because it is highly uncertain whether these guarantees will result in actual payments. The probability that the events covered by implicit guarantees occur is low and the damage of the event is not known in advance. The implicit debt of pension systems (or any other entitlement program) is already hard to estimate due to the need for assumptions. Valuing the guarantees on financial institutions, natural disasters and other events will be a harder task than valuing the liabilities created by entitlement programs. For valuing guarantees, more assumptions are needed and probabilities need to be attached to the adverse events that are guaranteed. This will lead to estimates that are even more uncertain and sensitive to assumptions compared to the estimates of IPD. Although it might be useful to include the value of implicit guarantees in the concept of implicit debt, due to the measurement issues it might not be a good idea to include them. Recall from the discussion about whether financial markets should or should not take into account IPD levels when assessing sovereign credit risk, that the sensitivity of IPD estimates with respect to assumptions and parameters was used as an argument against including IPD. This argument is much stronger when judging estimates of implicit guarantees.

3.3 The other side of implicit debt: implicit assets

Next to a government holding future obligations that are not explicitly on the government book, it is also possible that a government is entitled with future revenues. These can be viewed as an explicit asset to the government. In section 2.1, an example of an implicit asset is already discussed: deferred taxation of unfunded pensions creates an explicit asset for the government due to the cash flow that is generated in the future at the time when the benefits are paid out. This implicit asset is already captured by the definition of IPD because IPD is defined as public pension liabilities net of any (implicit) assets. However, in many countries there exists a funded second pillar in the pension system in which the benefits can also be subject to deferred taxation. In a funded system, no implicit debt exists[11] such that the implicit asset created by deferred taxation makes that these systems enter the government's implicit balance sheet as an implicit asset.

Implicit assets can be quite sizeable. To give an example from the Netherlands: Currently, there are more than 1,000 billion euros of assets in second pillar pension funds (De Nederlandsche Bank 2014). Assuming an average tax rate of approximately 30%, the Dutch government has a claim on these assets of about 300 billion euros

[11] Provided that the system is not underfunded in case the government is the plan's sponsor.

in future taxes. This is a sizable number given the Dutch GDP of approximately 650 billion euros in 2013 (Centraal Bureau voor de Statistiek 2014b). Therefore, in order to properly compare the true state of public finances of countries, also implicit assets that can arise from the taxation of pensions should be taken into account.

Not only pension systems create implicit assets. Any policy which is paid for today but which has a benefit also in the future can be viewed as an implicit asset. An example of a policy that creates an implicit asset is investment in infrastructure. The costs of infrastructure are often paid in advance, but the benefit of the improved infrastructure (lower transaction costs, higher efficiency) for the economy also materializes in the future. Therefore, the infrastructure of a country is an example of an implicit asset of the government because it can expect higher tax revenues in the future due to higher earnings as a result of the investment in infrastructure today. This asset can be valued, as is done for the Netherlands by the Dutch Bureau for Economic Policy Analysis. They value that the total stock of public capital for the Netherlands, of which infrastructure is a part, at 371 billion euros (see Smid et al. (2014)). That is more than 50% of GDP compared to GDP.

3.4 Implicit obligations and policy analysis

All implicit debts and assets have an impact on the sustainability of public finances in the long run. In the Netherlands, these implicit debts and assets (in a broad sense) are taken into account when the sustainability of public finances is evaluated. The Dutch Bureau for Economic Policy Analysis has evaluated the long-term sustainability of the Dutch public finances in two studies (see Smid et al. (2014) and Van der Horst et al. (2010)) while taking into account future expenditures and revenues from, amongst others, the pension and health care system including their reforms. Furthermore, the generational effects of these reforms are investigated. However, the final outcome is not presented as a stock variable like IPD, but as an annuity. The authors of the study conclude that in 2014, the Netherlands has a positive sustainability balance of 0.4% of GDP. This can be interpreted in the following way: government expenditures can be increased permanently or the government income can be reduced by this number in order for the long-term debt position to be sustainable. This number is a massive improvement compared to the outcome of the 2010 study, which came to the conclusion that the Netherlands had a negative sustainability balance equal to 4.5% of GDP. This outcome means that the government expenditures had to be permanently cut in order for the long-term debt position to be sustainable. The outcome of the 2010 study provided a motivation for austerity

and reforms in the pension and health care system. Therefore, the Netherlands is an excellent example of using also implicit obligations and revenues in evaluating the long-term sustainability of public finances. Furthermore, the outcome of this study is used as a motivation for reform, and the success of these reforms can be evaluated as shown by the difference between the 2010 and the 2014 study.

4 Measuring IPD of the Dutch first pillar pension system

This section describes the estimation of the IPD created by the Dutch first pillar pension system. Goal is to estimate the IPD and its future path under the old system, assuming that this would be continued. From 2012 on, the retirement age is raised in steps from the previous retirement age of 65 to 67. Therefore, IPD will also be estimated with the adjusted regulations. In this way, the level and path of IPD under the unreformed and the reformed system can be compared. Raising the retirement age should lower IPD. First, the Dutch first pillar pension system and its reform are introduced. Furthermore, the methodology, data and assumptions necessary for estimating the IPD created by the Dutch first pillar pension system are described.

4.1 The Dutch first pillar pension system and its reform

The Dutch pension system consists of three pillars, as summarized in table 2. The first pillar pension system is responsible for delivering a basic pension to all citizens of the Netherlands. The other pillars are responsible for supplementary pensions. As can be seen from table 2, only the first pillar of the Dutch system is unfunded. Therefore, the first pillar of the Dutch pension system is the main source of IPD for the Netherlands. The second pillar pension system for public sector workers is funded, but due to underfunding it also creates IPD (Ponds, Severinson, and Yermo 2012). However, the IPD created by the pension scheme for public sector workers is only small compared to the IPD created by the unfunded first pillar.

Table 2: Overview various pillars of the Dutch pension system

Pillar	What	Character	Funding
I	Basic state pension (AOW)	Mandatory	Unfunded
II	Supplementary pension (collective)	Mandatory	Funded
III	Supplementary pension (individual)	Voluntary	Funded

Every citizen in the Netherlands will receive a basic pension from the state after reaching the retirement age until death. The first pillar pension system is of a Beveridgian type: there is no link between contributions made by individuals and the benefit they receive since the benefit level is flat. However, the benefit level is

differentiated by marital status. Single persons receive a benefit equal to 70% of the minimum wage and persons married or living together receive a benefit equal to 50% of the minimum wage such that together they earn the minimum wage level. Under this system, each year 2% of the full benefit level is accrued, such that an individual accrues the full benefit after 50 years. Accrual of rights only occurs when the individual is living in the Netherlands. Therefore, (temporarily) migrating or immigrating will lower the benefit earned when reaching the retirement age. Under the old rules of the system, accrual of rights start at the age of 15, such that the full benefit is accrued by living in the Netherlands from the age of 15 until the retirement age of 65. Each year the benefit is indexed for the change in the wage level.

In 2012, legislation was passed which determined that the retirement age will be increased from 65 to 67. The retirement age will be increased in steps, such that in 2023 the retirement age is 67. After 2023, the retirement age is linked to life expectancy such that it is likely to increase even further. The accrual period of 50 years is not changed[12]. Therefore, the age at which the accrual of benefits starts will move along with the retirement age and will be 17 in 2023. Table 3 summarizes the increase of the retirement age.

Table 3: Overview of the stepwise increase in retirement age

Year	Retirement age	Start accrual
2013	65 + 1 month	15 + 1 month
2014	65 + 2 months	15 + 2 months
2015	65 + 3 months	15 + 3 months
2016	65 + 5 months	15 + 5 months
2017	65 + 7 months	15 + 7 months
2018	65 + 9 months	15 + 9 months
2019	66	16
2020	66 + 3 months	16 + 3 months
2021	66 + 6 months	16 + 6 months
2022	66 + 9 months	16 + 9 months
2023	67	17

[12]See http://wetten.overheid.nl/BWBR0002221/ for the legal framework of the reform.

4.2 Estimation of IPD of the Dutch first pillar pension system

The IPD of the Dutch first pillar pension system is estimated using the accrued-to-date liability concept (see section 2.2). The accrued-to-date liability concept measures liabilities as the present value of the future payments that have to be made to honor all accrued-to-date rights if the system would be terminated. This concept is an appropriate concept for measuring IPD. Furthermore, general wage growth will be taken into account when estimating the IPD level. This corresponds with the PBO methodology described in section 2.2, which takes into account that the benefit level increases over time along with general wage growth. In the case of the Dutch first pillar pension plan where indexation is linked to wage growth and this indexation is unconditional, using PBO is the right methodology.

Given the features of the Dutch first pillar pension system as described in section 4.1, the IPD of the system can be represented by the following equation, based on Franco (1995) but adjusted for the specific regulation of the Dutch first pillar pension system:

$$ADL_t = \sum_{s=1}^{2} \sum_{m=1}^{2} \sum_{i=RA}^{100} N_{i,s,m}\, A_i\, B_m \sum_{j=RR}^{100} S_{s,i,j} \left(\frac{1+g}{1+r} \right)^{j-i} \tag{1}$$

Four groups are distinguished here based on gender (denoted by s) and marital status (denoted by m). In turn, the liabilities of those four groups are evaluated for each specific cohort (denoted by the age of the members i). The accrued-to-date liabilities evaluated at time t are the sum of the liabilities of those four groups, which consist of the sum of the liabilities of each specific cohort belonging to the four groups. Each cohort has a size N, an accrual factor A and a benefit level B. The accrued-to-date liability of a cohort is the present value of all the expected future cash flows towards the cohort. These expected future cash flows take into account the chance of surviving (denoted by S) at least until retirement period j. The expected cash flows of all retirement periods j is discounted back to the current period, where $1 + r$ is the discount factor and $1 + g$ the benefit indexation factor of the future expected cash flows.

The accrual factor A measures the percentage of the full benefit that is accrued by a cohort. The accrual factor can be represented by:

$$A_i = \begin{cases} (i - RA)a_x \text{ if } i < RR \\ 1 \text{ if } i \geq RR \end{cases} \tag{2}$$

Where RR is the retirement age and RA is the age where the accrual of rights starts. a_x denotes the annual accrual rate. Full pension rights are accrued if the cohort reaches the retirement age, which is reflected by equation (2). Even though the retirement age is no longer predefined as a result of the reform of 2012, the accrual period is fixed in the legislations such that:

$$RR - RA = 50 \tag{3}$$

4.3 Data and assumptions

Estimation of the level and the path of IPD require both data and assumptions. The data sources and assumptions made are summarized here.

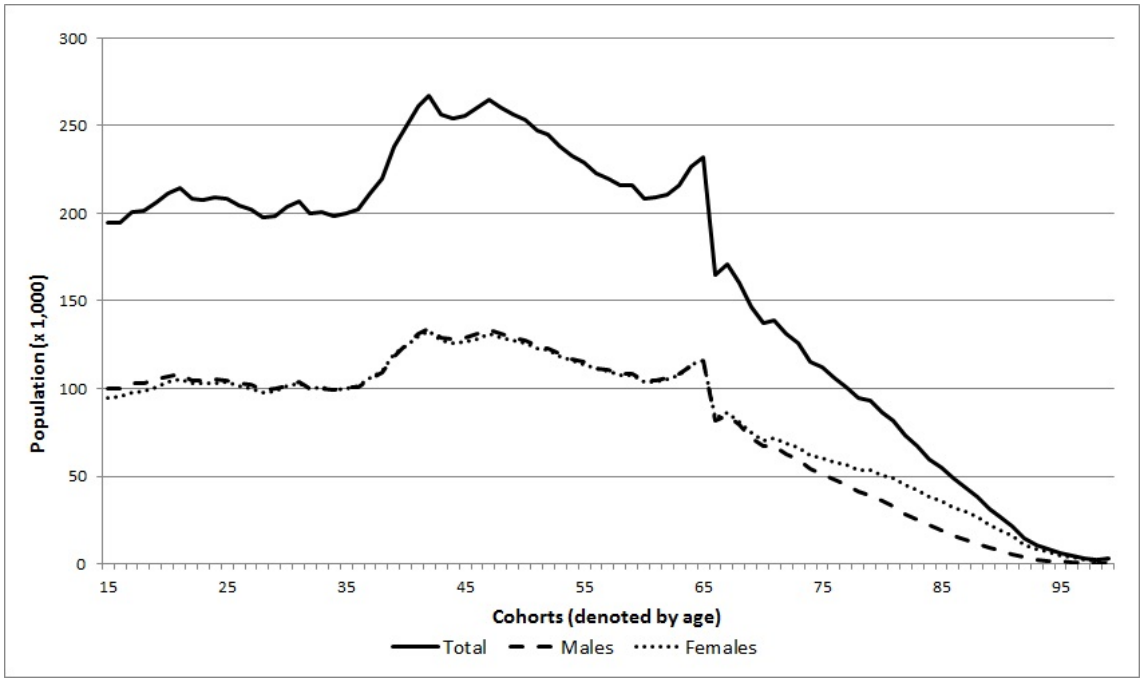
Population size

Data of the Dutch population is taken from the Centraal Bureau voor de Statistiek 2014a. For the base year 2012 and also for the years 2013 and 2014 actual population data is available. Only the cohorts with age 15 till 100 are evaluated. Evaluating cohorts that are under 15 is not necessary since these cohorts have not yet accrued any pension rights. Data for cohorts above 100 is not available such that it is assumed that all people die at age 100. This assumption is not problematic since the liability towards people of age 100 and older is only small due to the low expected continuation of life and the low number of people older than 100 years. For the years after 2014, a prognosis has to be made about the size of the cohorts.

Currently, the Dutch population has a very specific pattern due to the large 'baby-boom' generation that was born after the Second World War. Figure 1 shows a large hump in the population structure between cohorts 35 and 65. The population of the cohorts 15 to 35 is remarkably stable. In order to construct the population sizes of all the different cohorts, the current population size of a cohort is shifted to the next cohort in the following period, but the size of the population is multiplied by the survival rate:

$$N_{i+1,s,t+1} = N_{i,s,t}(1 - q_{i,s,t}) \tag{4}$$

Figure 1: Population of the Netherlands (2012)



This will give an approximation of the future Dutch population differentiated by age profile. A drawback of this methodology is that it does not take into account any migration or immigration as it assumes that the size of a cohort in a period is equal to the size of the lower cohort in the previous period minus the members of the cohort that have deceased. However, since this analysis is about the relative path of IPD in the future from an unreformed and a reformed system and not about the exact number of IPD this is not very problematic. For the years after 2028 there is no historic data available to approximate the size of the cohort with age 15. For the future, the prognosis is that the Dutch population as a whole will grow but that the group 0-20 year olds will become slightly smaller (Centraal Bureau voor de Statistiek 2012). It is unlikely that the cohort sizes will grow but uncertain whether the cohort sizes will become substantially smaller. Therefore, for the years after 2028 it is assumed that the cohort of age 15 is equal to the average size of the cohorts of age 15 of the five previous years.

Benefit level

The benefit size for the years 2012, 2013 and 2014 is known[13]. For the years after 2014, an assumption needs to be made on the growth of the benefit level. The benefit of the Dutch first pillar pension plan is indexed to match the nominal wage

[13]Information about the benefit level can be retrieved from the website of the Sociale Verzekeringsbank (www.svb.nl)

growth in the Netherlands. Assumed is that the benefit will grow by 2% per year after 2014. Table 4 shows the benefit level on a yearly basis including the vacation allowance for 2012, 2013 and 2014.

Table 4: Yearly benefit level Dutch first pillar pension system (incl. vacation allowance)

Year	Benefit couple	Benefit single
2012	€9547	€13690
2013	€9590	€13848
2014	€9721	€14040

Marital status

Since the benefit level is differentiated by marital status, an assumption needs to be made about the percentage of the cohort that is single or married/coupled. For each cohort, the five-year average percentage of the cohort that is married is calculated using data from 2010 until 2014 (Centraal Bureau voor de Statistiek 2014a). Future cohort sizes are multiplied by this number to determine the size of the single and the coupled cohort. It is assumed that the cohort specific marriage rate remains constant in the future.

Survival rates

Since a pension is paid out until death, survival probabilities are important in valuing pension liabilities. The Actuarieel Genootschap 2014 publishes mortality rates for the Netherlands including a prognosis of the changing life expectancy. The mortality rates are present until 2062. Therefore, it is assumed that for the years after 2062 the mortality rates remain constant. The survival rate is defined as the chance that someone will at least survive until a certain age, given his current age. The cohort and gender specific survival rates for each retirement period are calculated from the mortality rates supplied by the Actuarieel Genootschap.

Discount rate and benefit indexation

The future benefit payments need to be indexed and discounted. The discount rate is assumed to be equal to 4%. This is close to the Ultimate Forward Rate (UFR) used for discounting risk-free cash flows in long-term contracts. The UFR currently is equal to 4.2%. Since the benefits are linked to the wage growth in the Netherlands, the indexation rate is assumed to be equal to the long-term growth rate of the economy: 2%. A sensitivity analysis of these assumptions is provided

along with the results in the next section. The positive wage growth implies that the PBO methodology is used.

GDP

IPD figures will be presented relative to GDP, which requires data on the Dutch GDP. Data of the Dutch GDP is taken from the Dutch statistical office (Centraal Bureau voor de Statistiek 2014b). According to the Dutch statistical office, the GDP of the Netherlands was equal to EUR 640.6 billion in 2012 and EUR 642.9 billion in 2013. For the years after 2013, GDP is assumed to grow at 2%. This growth rate is equal to the rate of benefit indexation. The year 2014 is an exception since the benefit level is known and the benefit level between 2013 and 2014 only grew by 1.4%. Therefore the GDP growth rate between 2013 and 2014 is set equal to the growth rate of the benefit level.

4.4 Limitations of the model

A model to estimate the IPD of the Dutch first pillar pension system is presented here along with a set of assumptions. In this setting, the use of this model has a few caveats. First, the extensive list of assumptions that need to be made make the model weaker. All these assumptions can potentially be wrong or inaccurate. Furthermore, the model is set in a completely deterministic setting in which there is no uncertainty about the value of parameters such as GDP and population growth. In addition, the parameters are completely exogenous and do not respond to changes in policy. This is unrealistic since an increase in the retirement age could affect GDP growth through the labor market. As already concluded in section 2.3, IPD estimations are extremely sensitive to assumptions. Differences between studies in the assumptions made lead to large differences in the results. Due to the large number of assumptions, especially when talking about the future, the exact number of the IPD level that is estimated in this thesis is probably inaccurate. However, this study is not about estimating the correct IPD level. This empirical work attempts to illustrate the use of the concept IPD in measuring the success of a reform in pension systems. In measuring the IPD under the old and the reformed system, the same assumptions will be used. Therefore, the relative IPD levels are still interesting.

5 Results

This section presents the results of an estimation of the IPD created by the Dutch first pillar pension plan using the model described in section 4. The results are first presented for the base scenario in which the retirement age is kept at 65. Furthermore, results are presented for two alternative scenarios in which the retirement age is increased. Along with the results, a sensitivity analysis with respect to the assumptions is provided.

5.1 The base scenario

In the base scenario, the reform of 2012 is ignored and the retirement age is kept at 65. Figure 2 shows the path of the total liabilities (in billion euros) into the future for different benefit indexation rates. In the case of the benefit indexation rate being equal to 2%, the total implicit pension liabilities of the Netherlands are roughly equal to 1100 billion euros in 2012. These liabilities grow over time due to benefit indexation, longevity and population growth. In this setting, the liabilities grow to almost 2700 billion euros in 2051. As shown in figure 2, a higher benefit indexation rate increases the growth of the implicit pension liabilities while a lower benefit indexation rate leads to a lower growth of these liabilities.

Debt is usually evaluated in relative terms with respect to the GDP of a country, since the debt level relative to GDP is a better measure of the ability to pay off the debt compared to only the debt level in currency units. Therefore, figure 4 shows the IPD of the Netherlands relative to its GDP for multiple values of the discount rate. In this figure, the benefit indexation rate (and the GDP growth rate) is equal to 2%. Since the benefit indexation rate is equal to the GDP growth rate, the benefit indexation rate does not have an effect on the IPD level relative to GDP. Any developments in the IPD level over time are caused by longevity, population growth or changes in the population profile. Figure 4 clearly shows that the effect of the discount rate on the IPD level is huge, which is in line with the discussion in section 2.3 about the sensitivity of IPD estimates to changes in the discount rate. The IPD level in 2012 when evaluated at a discount rate equal to 2% is approximately 120 percentage points higher compared to the IPD level when evaluated at a discount rate equal to 5%. Over time, the IPD levels with different discount rates follow roughly the same path. Therefore, the choice of a discount rate does not matter a lot when evaluating relative levels of IPD in different scenarios. Evaluated at a discount rate of 4%, the IPD created by the Dutch first pillar pension plan is equal

to 173% of GDP in 2012.

Over time, the IPD level relative to GDP grows until it peaks around the year 2034. This indicates that the liabilities in this time period grow faster than the benefit indexation rate. After 2034, the IPD level relative to GDP slowly declines. This path is caused by the total population and the population profile used in the model. The total population (15-100 years) used as an input develops at a similar pattern: it first increases until it peaks around the year 2033 after which it declines. The population is an important driver for IPD: a larger population leads to more people accruing rights such that population growth causes the total liabilities to increase at a rate larger than the benefit indexation rate. Next to the total population, also the population profile is a driver for a larger IPD. The liability towards an individual at an age around 65 is relatively large because he has a full benefit accrual and still a relatively long life left (see figure 3). Therefore, a higher ratio of people in the age between 55 and 75 years old will increase IPD. In the model, the relative size of the group 55-75 year olds increases from 28% in 2012 to 32% in 2027, contributing to the increase in IPD relative to GDP in the period 2012-2033. After the peak in 2027, the share of 55-75 year olds slowly declines. Figures 6 and 7 show these specific developments of the population size and profile over time.

Note that in this setting where the benefit indexation rate is strictly linked to the GDP growth rate, the IPD level relative to GDP should remain constant in the case that there is no change in longevity, total population and the population profile. From figure 4 it seems that the total population and its profile are important for the development of IPD over time. To isolate the effect of population growth and changes in its profile, the model is also run with the population size and profile of 2012 used in each period. In this way, the population size and profile is constant for all periods. Figure 5 shows the results of keeping the population constant in terms of size and profile on IPD. With the effect of a changing population eliminated, figure 5 shows that IPD relative to GDP still grows, but only at a very low pace. This is the effect of an increase in the value of a pension due to the longevity trend in the mortality table.

The size and the profile of the population are an important driver for IPD. The Dutch statistical office (Centraal Bureau voor de Statistiek 2012) expects that the Dutch population will continue to rise until 2040 after which it will remain stable. Furthermore, the population is aging. This implies that the share of elderly people in the population will rise. Based on the results presented here and taking into

account the predictions of the Dutch statistical office, this population projection would result in the IPD level of the Netherlands to rise until at least 2040 after which it is likely to remain stable if the retirement age would be kept at 65.

Figure 2: IPD (in billion euros) of the Netherlands in the base scenario

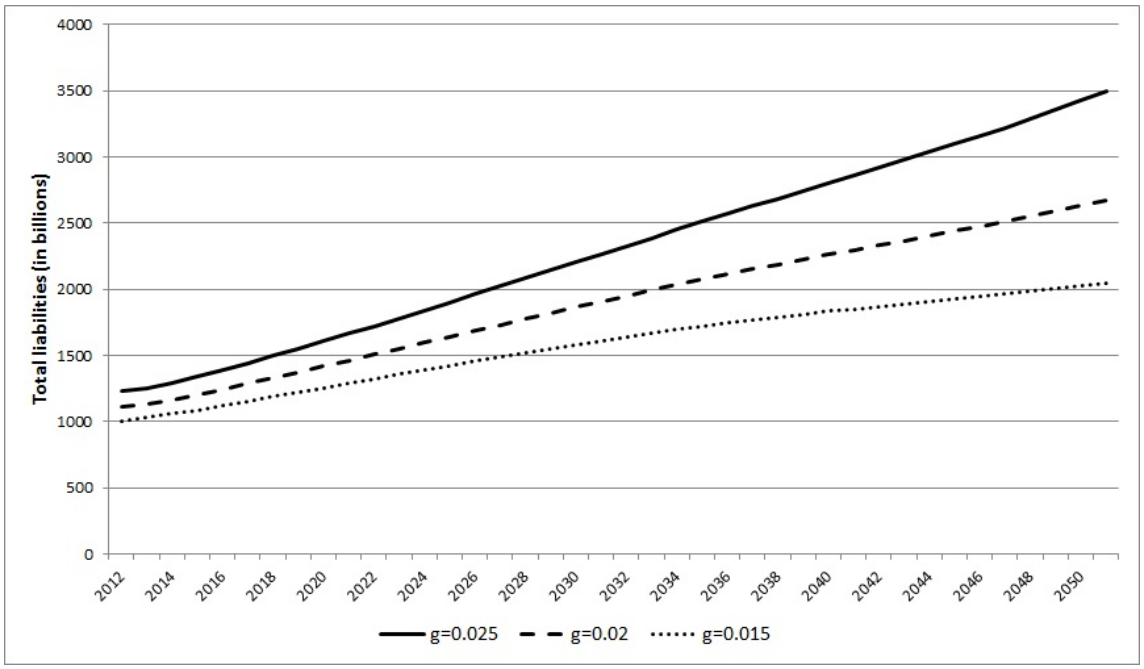
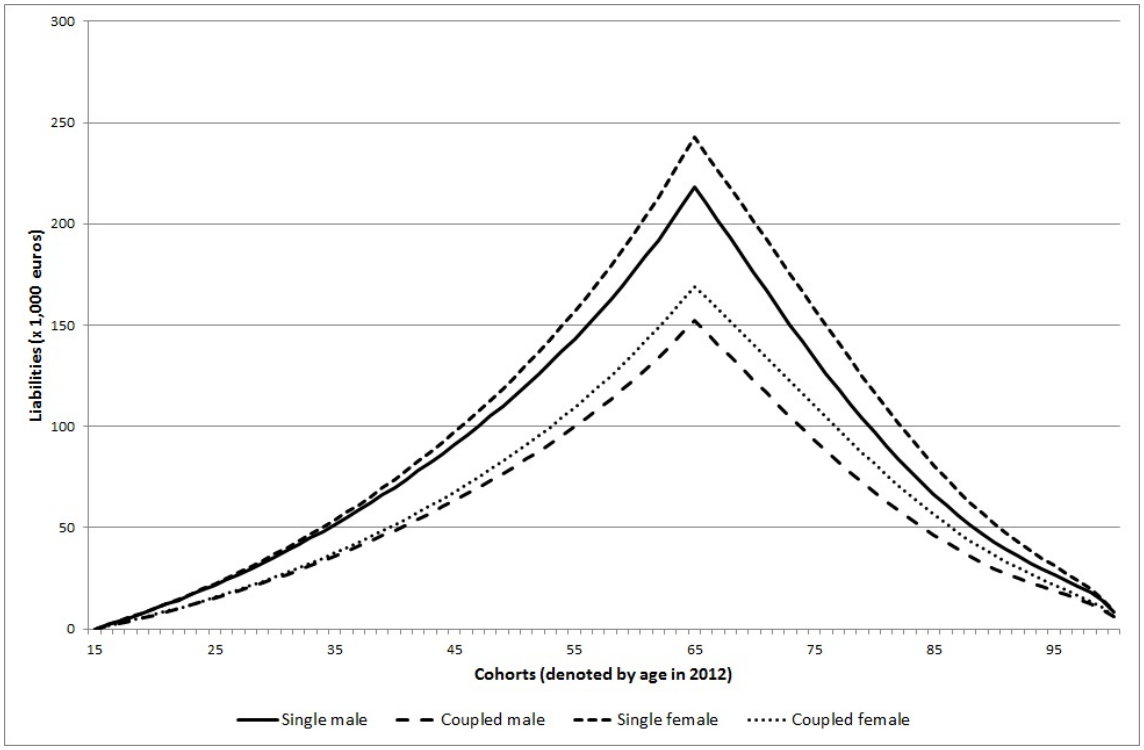


Figure 3: Liability profile of an individual in 2012



Parameters used to create figure 3: $R_A = 65$, $r = 0.04$ and $g = 0.02$

Figure 4: IPD (relative to GDP) of the Netherlands in the base scenario with population according to the model

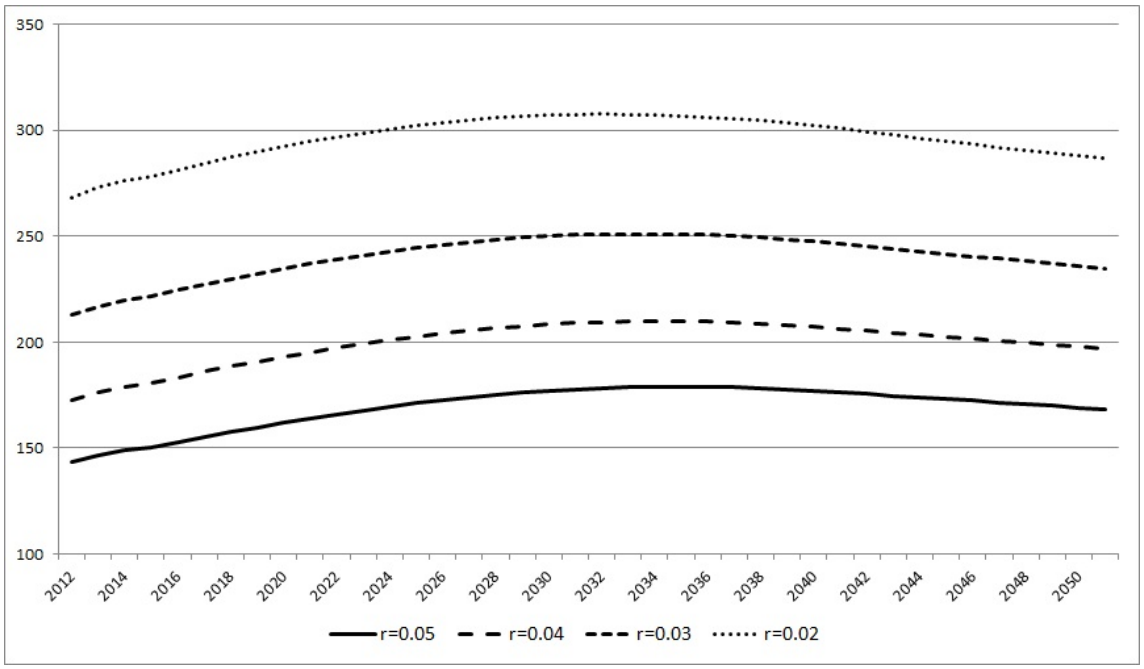


Figure 5: IPD (relative to GDP) of the Netherlands in the base scenario with constant population size and profile

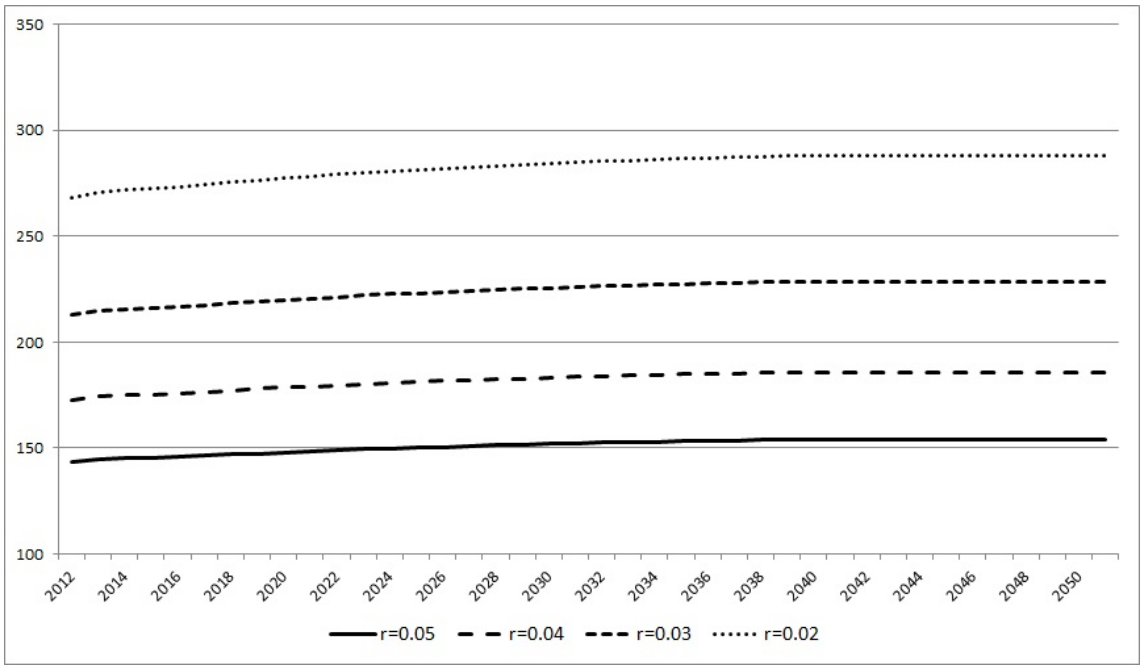


Figure 6: Development total population (in millions, total 15-100 year olds) over time as used in the model

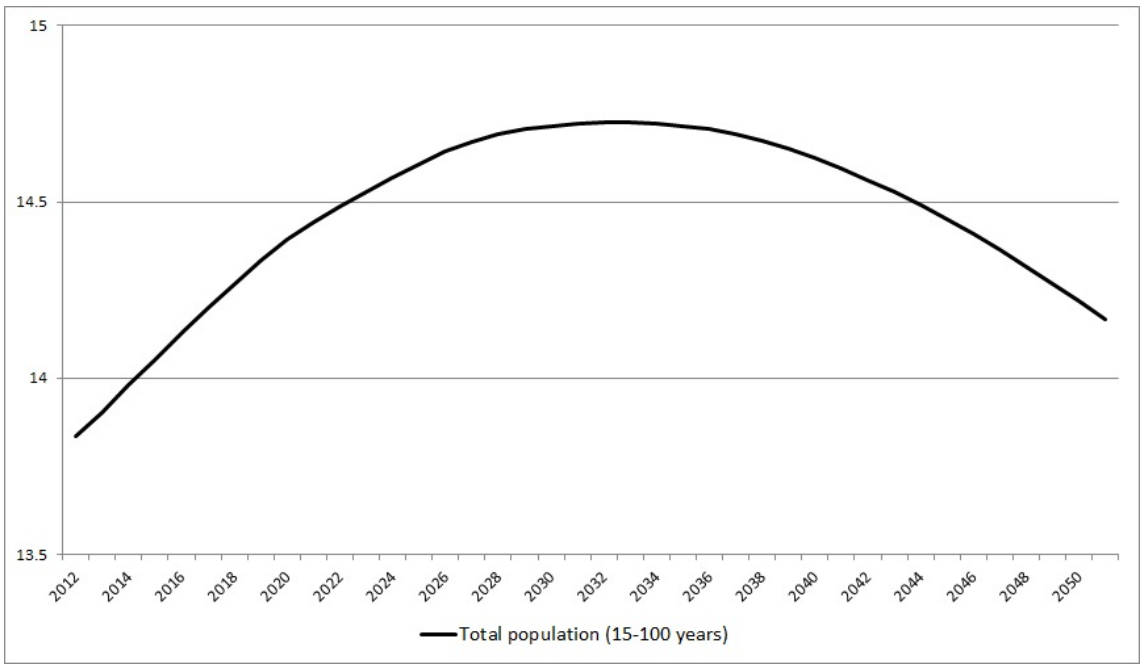
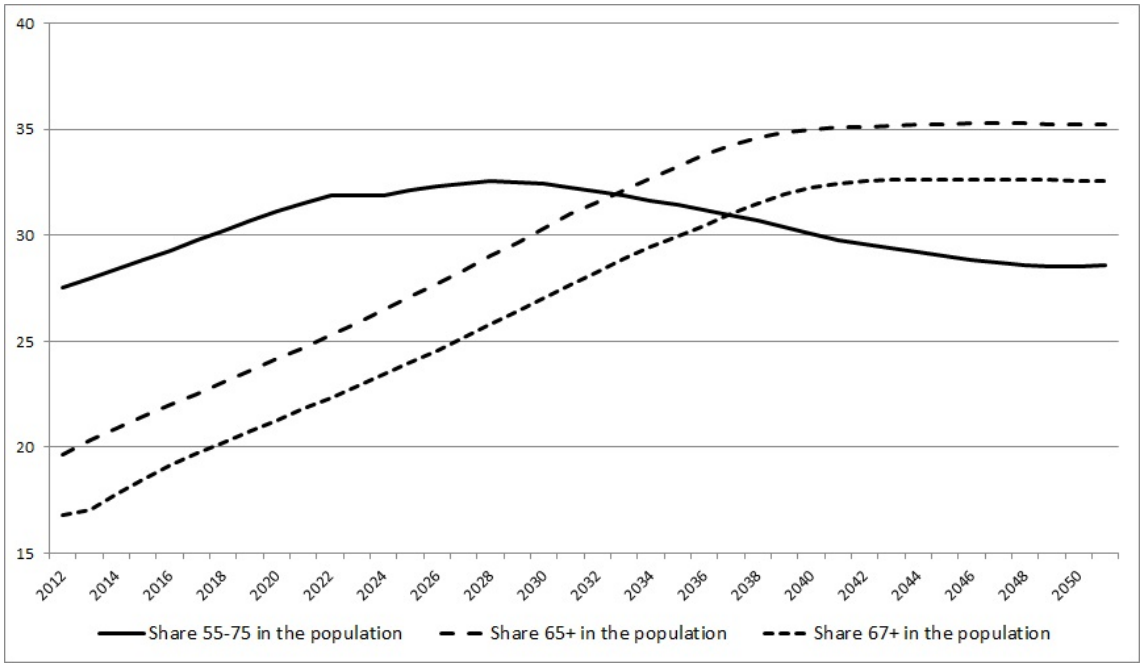


Figure 7: Development population profile as used in the model



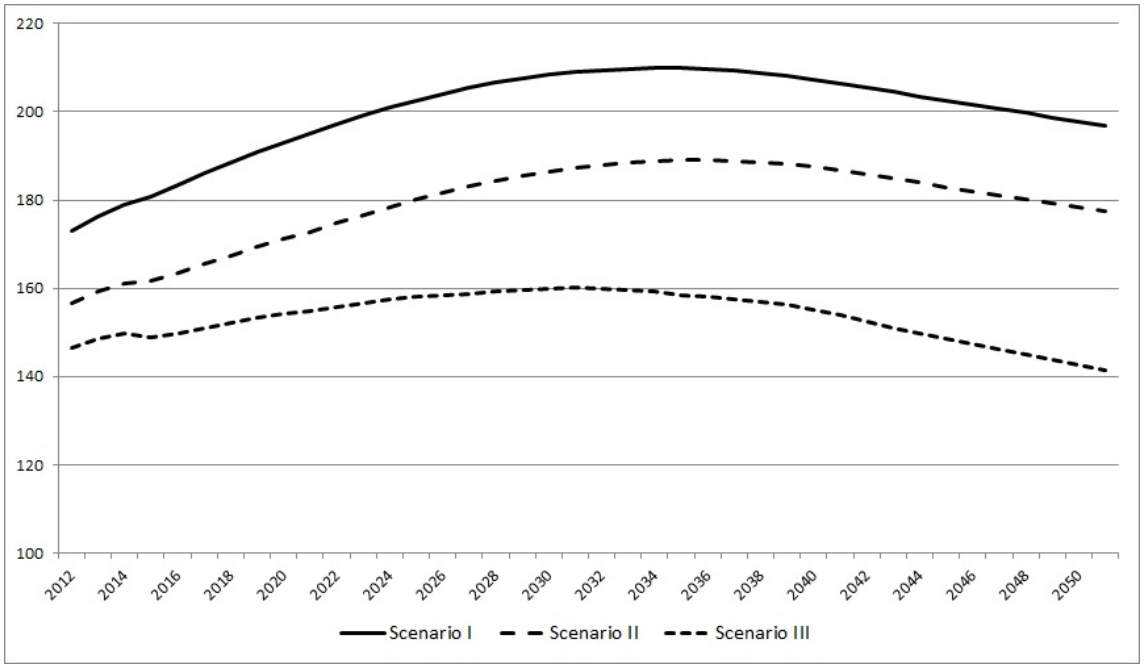
5.2 Increasing the retirement age

The results of the base scenario discussed above set the benchmark for two alternative scenarios in which the retirement age is increased. An increase in the retirement age should decrease IPD for two reasons. Firstly, an increase in the retirement age lowers the period between retirement age and death such that the total liability towards an individual at the start of its retirement is lower. Secondly, due to the fact that the accrual period remains fixed at 50 years, an increase in the retirement age will scrap the rights accrued in the early years for each individual which faces a higher retirement age. For example, an individual that faces a retirement age increase from 65 to 67 will lose his rights accrued in the years when he was 15 and 16 years old because the age at which the accrual of rights starts moves from 15 to 17 along with the increase of the retirement age.

In section 4.1 the 2012 reform of the Dutch first pillar pension plan is described. As a result of this reform, the retirement age is increased in steps such that the retirement age is equal to 67 in 2023. Furthermore, after 2023 the intention is to link the retirement age to the life expectancy such that it increases further after 2023 along with life expectancy. However, whether a link between the retirement age and life expectancy will be actually implemented is not certain. The two alternative scenarios in which the retirement age is increased take this into account. Scenario II captures an increase in the retirement age in steps from 65 to 67 but no further increase. In scenario III, the retirement age is linked to life expectancy such that it continues to increase after 67 until it eventually reaches 71. Scenario III should therefore have a larger impact on IPD compared to scenario II due to the further increase of the retirement age. See the appendix for an overview of the increase in the retirement age for both scenarios and a technical note on how the increase in the retirement age is incorporated into the model.

Figure 8 shows the development of IPD relative to GDP over time for the three scenarios and figure 9 shows the IPD in the two alternative scenarios in which the retirement age is increased relative to the IPD of the base scenario. As can be seen in figure 9, the liabilities in scenario II immediately drop by 10% compared to scenario I. All other parameters (discount rate, benefit indexation rate, population size and profile) apart from the retirement age are equal for the three different scenarios. IPD is a stock variable and therefore it is no wonder that an increase of the retirement age in the future already decreases liabilities today as it captures the decrease in liabilities of younger cohorts due to their increased retirement age. IPD of scenario

Figure 8: IPD (relative to GDP) for three different scenarios



II relative to scenario I continues to decrease over time until it increases again and stabilizes at a level of approximately 90% of the IPD in scenario I. Therefore, in this setting, increasing the retirement age from 65 to 67 will lower the IPD level by approximately 10% in the long run. Increasing the retirement age even further will also cause an immediate drop in IPD as reflected by scenario III in figure 9. The immediate drop in IPD in scenario III is bigger compared to the drop in scenario II as a result of the younger cohorts facing a retirement age up to 71 instead of 67. Moreover, in scenario III the IPD level relative to scenario I decreases even further over time as it takes time for more cohorts to face a higher retirement age. Eventually, in the long run, the IPD level in scenario III is just 73% of the IPD level in scenario I. A big difference between scenario II and scenario III is the long-term impact of both scenarios. Scenario II reduces IPD immediately compared to scenario I but the path of IPD in the long run is quite similar to scenario I. In contrast, in scenario III not only the IPD level is reduced immediately, the IPD level relative to scenario I will continue to decline in the long run. In absolute terms (see figure 8) all the three scenarios have the same pattern: an initial growth in IPD until it peaks, after which the IPD level declines. Scenario I and II have a trajectory over time which is almost parallel. In contrast, in scenario III the initial increase in IPD is slower, the peak is earlier and the IPD level declines faster afterwards.

The specific results derived here depend on the assumptions used. The choice of the

discount rate affects the size of the initial jump in relative IPD levels, but hardly affects the trajectory in the long run. A higher discount rate results in a smaller initial jump, and a lower discount rate increases the initial jump in relative IPD levels. The input of the population size and profile has an effect on the trajectory and the outcome in the long run of the relative IPD levels. This can be concluded from figure 10 which shows the relative IPD levels of the two alternative scenarios while keeping the population size and profile constant at a 2012 level. As a result, the relative IPD level does not increase over time for scenario II and the relative IPD level in scenario III decreases even further such that it in the long run it is only 65% of the IPD level in the base scenario. In fact, putting in any population size and profile produces slightly different results in terms of relative IPD of the reform scenarios in the long-term. Therefore, the total impact of the reform is dependent on the specific population size and profile.

The results here indicate that the IPD created by the Dutch first pillar pension plan can be reduced significantly. Furthermore, increasing the retirement age will reduce IPD directly, although the full reduction in case of an increase in steps is only achieved in the long run. The results in this section are derived under specific assumptions, and as described above these assumptions do influence the magnitude and trajectory of relative IPD levels.

Figure 9: Indexed IPD (Scenario I = 100) for two alternative scenarios with population according to model

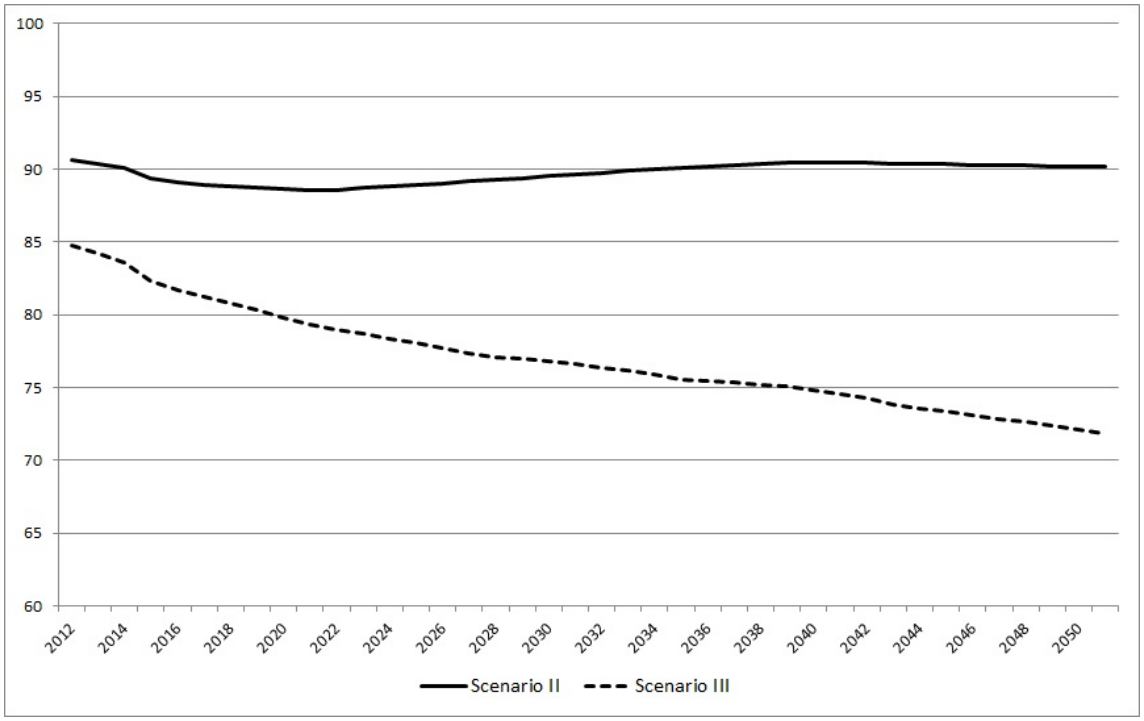
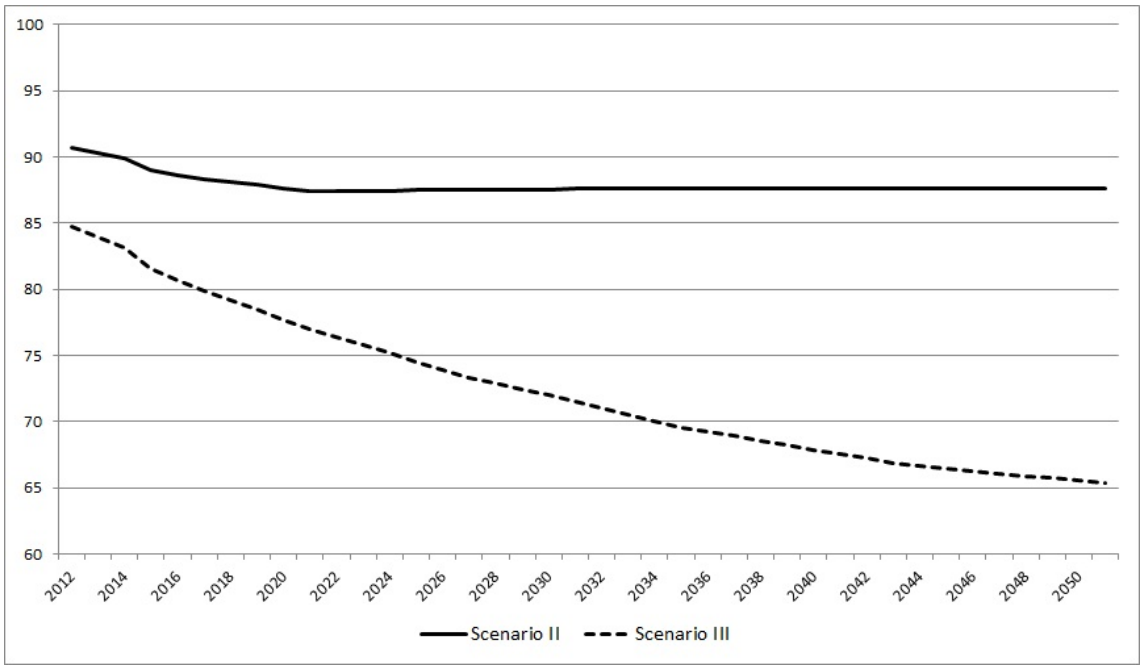


Figure 10: Indexed IPD (Scenario I = 100) for two alternative scenarios with a constant population size and profile



5.3 The effect of a reform on expenditure figures

In the previous section, the impact of an increase in the retirement age on the IPD created by the Dutch first pillar pension plan has been investigated. This section looks into the effect of the increase in the retirement age on expenditure figures. Expenditure figures are a conventional way of showing the cost of a pension system. Pension expenditures are defined as:

$$EXP_t = \sum_{m=1}^{2} \sum_{i=R_R}^{100} N_{i,m,t} B_{m,t} \tag{5}$$

In words: the pension expenditures evaluated at time t are equal to the total number of people eligible for a pension of all the cohorts i that are in retirement, multiplied with the benefit level B which depends on marital status m. This is the total flow of funds from the government towards retirees in a given year. The same input parameters (population, benefit level) are used as in the IPD calculations. Expenditure figures are presented relative to GDP.

Table 5: Pension expenditures relative to GDP for all scenarios

	2015	2020	2025	2030	2035	2040	2045	2050
Scenario I	5.2	5.9	6.6	7.2	7.8	8.0	7.8	7.5
Scenario II	5.2	5.6	5.9	6.5	7.1	7.4	7.2	7.0
Scenario III	5.2	5.6	5.9	6.1	6.7	6.7	6.4	6.2

Table 5 shows how calculated expenditure figures relative to GDP will evolve over time. The expenditure figures are presented for both the base scenario without reform and scenario II and III in which the retirement age is increased. In all scenarios pension expenditures relative to GDP will rise until they peak around 2040, but in the scenarios where the retirement age is increased they rise not by as much compared to the base scenario. Furthermore, the increase in the retirement age has a much smaller impact on expenditure figures compared to IPD. It takes time for the reform to show up in expenditure figures whereas the reform immediately caused a jump in IPD figures. The reason for the larger impact of an increase in the retirement age on IPD compared to expenditure figures is the forward looking nature of IPD. An increase in the retirement age immediately affects IPD due to the lower value of a pension and the scrapping of accrued rights. In contrast, an increase in the retirement age, especially when the increase is in steps, only slowly

decreases the number of people in retirement. In any case, the pension of current retirees is not affected by the reform, and current retirees are very dominant in the expenditure figures in the short run. In this way, IPD is a useful tool for evaluating the success of a reform because the reform immediately has its effect on IPD. On the other hand, IPD can be potentially misleading due to its forward looking nature: even though IPD is immediately affected, the effect in actual pension expenditures may only show up in the very long run. Therefore, a reduction in IPD does not automatically imply a reduction in the actual pension burden in the short run. However, other policies may have different effects on IPD and expenditure figures. For example, it is likely that a decrease in the benefit level will immediately show up in both IPD and expenditure figures because a decrease in the benefit level will have an immediate effect on the pensions of retirees.

Table 6: Comparing results of this study and the BEPA study

		2012	2015	2023	2040
Population eligible for pension (x 1,000)	BEPA	2827	not reported	3218	4044
	Thesis	2716	3015	3326	4267
Pension expenditures (as % of GDP)	BEPA	5.2	5.6	5.5	6.9
	Thesis	4.8	5.2	5.6	6.7

The calculated expenditure figures can be compared with other studies that have made predictions about the evolvement of pension expenditure over time for the Netherlands. An example of such a study is the study on the sustainability of Dutch public finances by the Dutch Bureau for Economic Policy Analysis (BEPA) already discussed in section 3.4. Table 6 compares the predictions of this study with the figures of the BEPA. For the sake of comparability, the results of this study presented in table 6 correspond to scenario III because like scenario III, the BEPA assumes that the retirement age is linked to life expectancy. Like this study, the BEPA also predicts that pension expenditures relative to GDP will rise until approximately 2040. The BEPA predicts that pension expenditures will decline afterwards to 6.1% in 2060. The reason that is mentioned for this initial rise in pension expenditures is the increase in the number of people that are eligible for a pension. Relatively large cohorts, including the 'baby-boom' generation born just after the Second World War, have just retired or are about to retire soon such that the population eligible for a pension will rise. The increase in the retirement age cannot prevent the increase in the population eligible for a pension. In the long

run however (after 2040), the increase in the retirement age will cause a decline in the population eligible for a pension such that expenditures relative to GDP will decline[14]. Table 6 shows that the expenditure figures of this study (based on scenario III) and of the BEPA study are relatively close and roughly follow a similar trend. Small differences in the expenditure figures can probably be explained by the slightly different population input and the way in which the increase in the retirement age in implemented in the calculations. The comparability of the figures of this study and the BEPA study show that the results of this study are realistic.

5.4 Stock versus flow figures

The results in this section are presented for both IPD and expenditure figures. IPD is a stock variable and it gives information about the long-term sustainability of a pension system. On the other hand, expenditure figures are a flow variable and give information about the short-term sustainability of the system. This section describes the impact of an increase in the retirement age on both IPD and expenditure figures. In this case, an increase in the retirement age mainly affects the long-term sustainability of the Dutch first pillar pension system because the reform immediately had an impact on the IPD level, but not directly on the share of pension expenditures. The reason is the forward looking nature of IPD: the concept takes into account the future obligations towards both the current retirees and the current working population. In contrast, pension expenditure figures only take into account the current expenditures and do not take into account the future obligations. This is a nice property of IPD but in this property is also a weakness as reductions in IPD do not per se imply an improvement in the short-term sustainability of the pension system. Another weakness of IPD compared to expenditure figures is the requirement for assumptions for IPD estimates and the sensitivity of the estimates towards changes in these assumptions. Expenditure figures require fewer assumptions and are less vulnerable to changes in these assumptions. However, the forward looking nature of IPD makes it a valuable addition in pension reform discussions. It can be used next to predictions of expenditure figures to assess the effects of a reform in both the short run and the long run.

[14]See table 3.1 and 3.2 in Smid et al. 2014.

6 Conclusion

This thesis has two goals: it aims at creating a better understanding of the concept of implicit debts, especially implicit debts created by unfunded pension systems. Moreover, the use of IPD as a tool to measure the success of a reform is illustrated.

IPD is created by governments having unfunded pension liabilities. Since IPD is a debt, it has to be repaid at some point and therefore high levels of IPD might be problematic for countries. Studies that have measured cross-country IPD levels all found that generally IPD is large compared to GDP and large compared to the explicit debt level. However, there are big differences in IPD levels between countries due to the different nature of pension schemes across countries. Moreover, there are large differences between estimated IPD levels for the same country in different studies. This is due to the requirement of making many simplifying assumptions to estimate IPD, and these estimates are highly sensitive to changes in assumptions and parameter values. However, these studies show that comparing explicit debt figures of countries does not give a complete picture of the state of the public finances. A large part of the total debt level of a country is implicit rather than explicit and taking into account IPD levels could help to improve the comparability of public finances across countries. Definitely, IPD shares similarities with explicit debt, but it is important to understand that there are also fundamental differences. These differences between IPD and explicit debt combined with the fact that IPD estimates are very hard to get right justify that IPD is treated differently from explicit debt. However, the similarities between IPD and explicit debt and the sheer size of IPD do not justify that IPD is not taken into account at all when public finances are evaluated. Reducing IPD might not be easy due to the protection of pension rights and the political risk involved in reforming pension schemes in an aging society. Furthermore, reducing IPD and also reducing the total debt level of a government requires that in some way its inhabitants are burdened because the value of the pension they are entitled to will be lower. They will either face lower benefits, a less generous indexation policy or a higher retirement age.

Pension schemes are not the only source of implicit debts. Other entitlement programs such as health care spending might also create implicit debts. Implicitly, the government acts as an insurer-of-last-resort in many cases which also creates a debt which is implicit rather than explicit. However, the obligations from implicit guarantees are uncertain, making the implicit debt created by guarantees more difficult to quantify than the implicit debt created by pension schemes and entitlement

programs. The opposite of implicit debts are implicit assets. They are created by a policy that creates future tax revenues for the government and this future tax income is an asset to the government.

To illustrate the use of the concept IPD in evaluating the success of a pension scheme reform, this thesis has estimated the level and future path of the IPD created by the Dutch first pillar pension scheme, both unreformed and in the case of an increase in the retirement age. The results show that the IPD level of the Netherlands can be significantly reduced when the retirement age is linked to life expectancy compared to when it remains at 65. Moreover, the empirical exercise confirms the sensitivity of IPD estimates to the input parameters. Comparing the effect of the reform on IPD and on expenditure figures shows that while a reform directly impacts IPD, it takes time for the reform to have an impact on expenditure figures. This is a nice property of IPD since it can show immediately the effect of a reform, but in can also be misleading as a successful reform in terms of IPD might not directly lower the burden in terms of pension expenditure. IPD could be a valuable addition in terms of evaluating the success of pension reform, but it should be used alongside predictions of pension expenditure figures.

All in all, IPD estimates could be a valuable addition in terms of improving cross-country comparability of the state of public finances, evaluating the success of pension reform and evaluating the long-term sustainability of the domestic public finances. However, measurement issues and sensitivity to assumptions are a serious caveat of IPD. Therefore, IPD estimates should always be used in addition to other indicators and never as a standalone indicator and policy makers should be aware of the weaknesses of IPD.

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A Appendix

A.1 Modelling an increase in the retirement age

The model used in this thesis is not capable of handling any other retirement ages than full years. This is problematic since the retirement age is increased in steps of months. Therefore, the following methodology is used for allocating a retirement age to a cohort: Retirement ages up to 6 months are rounded off downward (e.g. an actual retirement age of 66 years and 6 months becomes a retirement age of 66 in the model). Retirement ages from 7 months are rounded off upward (e.g. an actual retirement age of 66 years and 7 months becomes a retirement age of 67 in the model). There are multiple calculators available online which return the retirement age when the date of birth is entered[15]. For cohorts retiring after 2023, these calculators use predictions by the Dutch statistical office in calculating the expected retirement age. To calculate the retirement age for a cohort, January the first is entered as date of birth accompanied by the year in which this cohort is born. Table A1 shows the (expected) retirement age for each cohort in 2012 in the three scenarios. Note that for the years after 2012 the retirement age of the cohorts simply shifts along with the cohorts. In this way, in 2013 cohort 30 is the first cohort with retirement age 71 and so forth.

[15]The calculator used for this thesis can be found at: http://www.berekenhet.nl/pensioen/aow-leeftijd.html.

Table A1: Retirement age for the different cohorts used in the various scenarios

Cohort age in 2012	Born in:	Scenario I	Scenario II	Scenario III
65	1947	65	65	65
64	1948	65	65	65
63	1949	65	65	65
62	1950	65	65	65
61	1951	65	65	65
60	1952	65	66	66
59	1953	65	66	66
58	1954	65	66	66
57	1955	65	66	66
56	1956	65	67	67
55	1957	65	67	67
54	1958	65	67	67
53	1959	65	67	67
52	1960	65	67	67
51	1961	65	67	68
50	1962	65	67	68
49	1963	65	67	68
48	1964	65	67	68
47	1965	65	67	68
46	1966	65	67	68
45	1967	65	67	68
43	1968	65	67	69
42	1969	65	67	69
41	1970	65	67	69
40	1971	65	67	69
39	1972	65	67	69
38	1973	65	67	69
37	1974	65	67	69
36	1975	65	67	70
35	1976	65	67	70
34	1977	65	67	70
33	1978	65	67	70
32	1979	65	67	70
31	1980	65	67	70
30	1981	65	67	70
29	1982	65	67	71
≤ 28	≥ 1983	65	67	71