Mind the pension gap
On the relationship between future pensions and pre-retirement consumption in Poland

Executive Summary

Aging process triggers sweeping pension reform
Poland, the biggest country in Central Eastern Europe, will be confronted with an exceptionally fast pace of aging in the coming decades. No other EU country (except Slovakia) will experience such a rapid rise of the number of elderly people relative to the working population. In view of this development the Polish government adopted profound changes of the pension system in 1999. Based on a multi-pillar approach a new mandatory funded pension scheme (FDC) was introduced. Furthermore, the former defined benefit system was converted into a notional defined contribution scheme (NDC). In contrast to the old system, pension benefits are now adjusted to changes in life expectancy. As a consequence, future pensions will be cut significantly.

Indicating the need for additional old-age provision: pension gaps
Against this background, the study at hand quantifies the extent to which the Polish general pension system will be sufficient to cover consumptive needs during retirement. More specifically, it is analyzed whether future NDC and FDC pensions can guarantee the pre-retirement level of consumption. If pension benefits fall short of prior consumption, individuals are confronted with a pension gap. In order to bridge these gaps additional savings during working life are necessary.

Two concepts of pension gaps are used to quantify the average extent of such supplementary old-age provision: (1) relative pension gaps indicate the percentage of pre-retirement consumption not covered by mandatory pension benefits, and (2) absolute pension gaps reveal the respective amount of money to be set aside today to guarantee a sufficient retirement income tomorrow.
The results: future pensions cover only half of prior consumption
The study's simulations have a clear-cut result: Poles are confronted with substantial pension gaps. On average, only half of the pre-retirement consumption level will be covered by future mandatory pensions.

A gender gap in pension gaps: women are worse off
From a gender perspective, pension gaps turn out more dramatic for women than for men. Figure A illustrates that females are confronted with a relative pension gap which is roughly 16 percentage points larger than that of their male counterparts. The main explanation for this gender differential is straightforward: on average, women retire about five years earlier than men. According to the benefit formula this shorter period of contributions leads to lower pension benefits and as a result also to bigger pension gaps.

Birth cohorts between 1965 and 1985 are the most affected
The outcomes depicted in Figure A vary not only between genders but also between different age groups. Especially the cohorts born between 1965 and 1985 face extensive pension gaps. While e.g. an average female born in 1955 has a pension gap of 50 percent (which means that she will be able to maintain 50 percent of her
pre-retirement consumption), the gap of a representative female born in 1976 is about 15 percentage points higher. This increase is mainly caused by a rise in life expectancy which will significantly reduce future pension levels.

**Absolute pension gaps: six-digit savings amounts necessary**

As Figure B shows, women (men) have absolute pension gaps of about 285,000 (190,000) PLN on average. This is the amount that has to be invested today (at a real interest rate of 3.0 percent) in order to maintain previous consumption during retirement, or equivalently, it exhibits the volume of an annuity contract entered today.

![Figure B: Absolute pension gaps](image)

**Postponing retirement reduces pension gaps significantly**

These findings reflect average retirement behavior, i.e. it is taken into account that individuals retire at different ages with respective probabilities. From the individual perspective, however, deliberately postponing retirement has significant effects on the pension gap. Taking the example of a female born in 1970, her pension gap will lessen drastically from roughly 335,000 PLN to 200,000 PLN if she retires at the age of 65 instead of 60. As a rule of thumb, a one-year delay of retirement reduces the absolute pension gap by roughly 8 percent.
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Discussion of recent pension reform proposals

Financing gap brings "reform of the reform"
The Polish pension system is presently undergoing an extensive transformation process from the old pay-as-you-go (PAYG) to a multi-pillar pension system with a strong funded component (FDC). This conversion of the Polish pension system goes along with substantial transformation costs since entitlements from the voluminous old PAYG system (before 1999) cannot be paid by lowered pension contribution rates—to the new PAYG-system (NDC)—which decreased from 19.56 to 12.22 percent. The resulting temporary financing gap is, therefore, bridged by the state budget or in other words by considerable tax money transfers to the general pension system (ZUS). Facing a tight state budget the Polish government proposed two incisive reforms of the pension system in December 2009.

Proposal No. 1: Axe the FDC scheme to less than half its original scale
The first proposal is to lower the contribution rate of the FDC system from 7.3 to 3.0 percent and increase the NDC contributions from 12.22 to 16.52 percent in turn. Such a modification represents nothing else than a partial abolishment of the recent pension reform. From the perspective of the government the intention behind this proposal is clear: increasing contributions to the NDC scheme will alleviate state budget financing. As a result, the Polish government could lower short term budget deficits and new indebtedness, which will be crucial to become a member to the Euro area. Of course, this polishing of government statistics is merely a shift of burdens from present to future generations. By the logic of the pension system higher present pension contributions to the PAYG-system result in higher public pension entitlements—and subsequently higher public pension expenditures in the coming
decades. As a consequence, the lower state budget deficits today correspond to higher contribution rates and/or budget deficits tomorrow.

**An additional burden, especially for younger cohorts**

Moreover, it can be expected that this partial abolishment of the funded scheme will further increase the inadequacy of future pensions, i.e. it will further increase pension gaps as calculated in this study. This estimation is based on the common assumption that the NDC system will show significantly lower rates of return than the FDC system due to a shrinking population. As a result, especially younger cohorts—which accrue most of their pension entitlements under the new multi-pillar pension system—would be strongly affected by a lower contribution rate to the FDC scheme. As depicted in Figure A the pension gap of a person born in 1960 would be almost unchanged, a person born in 1980, however, could cover between 1.5 and 3 percent less of the pre-retirement consumption level if the proposed reform were enacted (from 2010 onwards). It is interesting that men are losing considerably more than their female counterparts by this reform proposal. This is due to the fact that males retire on average about 5 years later. Hence, they can generally profit longer from the higher FDC interest rates. Of course, with the proposed lower FDC contribution rate men can gain less from this advantage.

**Figure A: Lowering contributions to the funded pillar – a burden for younger cohorts**
Putting all eggs in one basket
Another weak point of this reform proposal concerns the diversification of risks. An old saying advises not to put all eggs in one basket. This counsel has been closely followed with the multi-pillar approach of the pension reform in 1999—appropriately titled “Security through Diversity”. With the new reform proposal, however, pensioners would have to put most of their contributions in the PAYG-basket. Diversification of risks, i.e. of the demographic risk inherent in the PAYG system and the market risk of the funded system, would be considerably restricted as a consequence.

A step backwards from diversification
Summing up, the envisaged shift of contributions from the FDC to the NDC system is clearly a retrograde move. Not only would the Polish old age provision’s risk diversification be impaired, future pensions would also be even more insufficient to cover pre-retirement consumption levels—especially for younger birth cohorts. Moreover, will the younger cohorts have to pay the higher entitlements accrued today in the NDC system in the coming decades. Somebody has to pay the bill – the coming generations.

Proposal No. 2: Align legal retirement ages until 2035
The second reform proposal by the Polish government concerns the gradual increase of the female retirement age from 60 to 65 between 2026 and 2035. As presented in the study at hand later effective retirement ages significantly lower pension gaps. The main explanation for this effect lies in the benefit formula of the NDC system which rewards later retirement with higher pension benefits.

Easing the burden on women born after 1965
Since this reform step is phased in not until 2026 and thereafter, of course, only cohorts which retire after 2026, i.e. the birth years of 1965 and later are affected. As shown in Figure B the impact for these birth cohorts is, however, rather substantial. Especially cohorts born after 1969 can expect to cover about 17 percent more of their pre-retirement consumption level due the increase of the legal retirement age to 65.
Why stipulate retirement ages at all?

While the impact of the increased retirement age on pension gaps is straightforward, it is, however, worthy of discussion whether a mandatory minimum pension age is necessary at all. Why should it be decided by the state and not by the individual itself at which age to retire? Some individuals might well be willing to put up with a smaller pension if they can retire earlier while others would choose individually to retire later when being faced with substantial pension gaps. Apart from this question, it is important to mention that even with this sharp increase of the legal retirement age female pension gaps would not vanish but merely level with their male counterparts (see Figure C).
Both proposals are highly debatable

In conclusion, both new reform proposals are highly debatable. A cut of contributions to the FDC system can be expected to increase further pension gaps—especially for younger cohorts. Raising female retirement ages to 65 could indeed more than compensate this increase of pension gaps—but of course only for women born after 1965. It is, however, rather discussable whether such an increase of retirement ages should be on a mandatory basis.
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Arne Leifels
Christoph Müller
Bernd Raffelhüschen

Study of the
Research Center for Generational Contracts

on behalf of
ERGO Versicherungsgruppe AG

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1 Introduction

Poland, the biggest country in Central Eastern Europe, will be confronted with an exceptionally fast pace of aging in the coming decades. In view of this development the Polish government adopted profound changes of the pension system in 1999. Being based on a multi-pillar approach, the reform marked a drastic paradigm shift in Polish pension policy. Most importantly, an all-new pillar was created: a mandatory funded pension scheme. Furthermore, the former pay-as-you-go system was converted into a notional defined contribution scheme. In contrast to the old system, pension benefits are now adjusted to changes in life expectancy—with the consequence of future pensions being cut significantly.

Against this background, the study at hand aims to quantify the future adequacy of mandatory pensions in Poland. Using the concept of pension gaps, it is analyzed to what extent future pension levels of the general pension system are sufficient to cover the individual pre-retirement levels of consumption. These pension gaps are calculated not only for different cohorts, but also gender specific as well as for heterogeneous retirement ages. With this approach, the need for additional old-age provision on the individual level becomes apparent. In a further step, the amount to put aside today to secure an “adequate” retirement income is quantified—cohort and gender specific.

The study is organized as follows: Section 2 gives an overview of Poland’s demographic situation and its future development. A description of the reformed Polish pension system—which constitutes the institutional framework of our simulations—follows in Section 3. The methodology applied to calculate the adequacy of future pensions—i.e. the concept of pension gaps—is outlined in Section 4. Following, in Section 5, the simulation results are presented and discussed. Section 6 concludes this survey with a short summary of the main findings.
2 Poland’s demography

Demography reflects to a great extent the history of the respective country. This becomes apparent when looking at Poland’s age specific population structure (see Figure 1). First of all, one can clearly identify the impact of World War II on the cohorts born between 1941 and 1946. As commonly observed during periods of war and unrest, birth rates were relatively low, resulting in relatively small cohorts aged around 60 in 2006. After the end of World War II the fertility rate recovered quite rapidly which led to strong cohorts aged 45 to 60. During the 1960s and 1970s the total fertility rate decreased from nearly 3.0 to 2.2 children per woman. This explains the drop in the birthrate which can be observed around the age group of 40 in 2006. The subsequent gains in birth numbers can be traced back to the fact that the respective cohorts have been born by those aged 45 to 55 in 2006. Due to the fact that these are quite large in numbers, their children are numerous as well.\(^1\) The considerable size of the age groups 15 to 30 plays an important role for the results of this study. After the opening of the Iron Curtain in 1989, however, Poland displayed a steep fall in natality—as in most formerly communist countries.

In order to project Poland’s demographic future, assumptions about fertility rates and life expectancy for the coming decades are needed. In accordance with most other population projections such as EUROPOP (conducted by Eurostat) we assume that the fertility rate will remain on its low present level of roughly 1.3 children per woman.\(^2\)

The assumed evolution of life expectancy in Poland is broadly similar to the rest of Europe. While an average male (female) born in 1990 could expect to live for 66.3 (75.3) years, this value is assumed to rise to 70.9 (79.7) for a male (female) born in 2006.\(^3\) In comparison to most other EU countries this increase in life expectancy by almost four months per year is particularly fast. According to Eurostat (2009) life expectancy of a male (female) newborn will further increase by around eight (five) years until 2050. As to be shown in Section 3, the specific design of the Polish pension system implicates that increased life expectancy has a significant impact on future pension benefits.

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\(^1\) This is sometimes referred to as the “echo-effect”.

\(^2\) See Eurostat (2009a).

\(^3\) See Eurostat (2009a).
Both declining fertility rates and the ongoing and rather steep increase in life expectancy lead to a bold double aging process in Poland. As a result, the Polish population pyramid’s appearance will considerably change in the coming decades (see Figure 2). The pace of this aging process is exceptional—compared with other European countries. This can be illustrated by the old-age dependency ratio, defined as the number of persons aged 65 and older, relative to those between 15 and 64. This indicator will rise from about 19 percent in 2009 to 69 percent in 2050, which is a steeper increase than in any other EU country except Slovakia. A demographic development of this kind puts substantial pressure on a pay-as-you-go (PAYG) pension system and can thus be understood as the main reason for the sweeping pension reforms that are described in detail in the following Section 3.

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4 Of course migration plays a role for the future demographic development, too. In the case of Poland, however, future net-migration is comparably low. See European Commission (2009a), p. 111.

Figure 2: Future development of Poland's demography
3 The reformed Polish pension system

3.1 Overview of the mandatory and voluntary pensions systems

The Polish pension system underwent a considerable transformation during the past decade. With the far-reaching reform of 1999, the mandatory PAYG pension system—which still represents the main pillar of the Polish old-age provision—was redesigned as a notional defined contribution (NDC) system. Additionally, a funded second pillar—mandatory as well—is being phased in to complement the first. Voluntary, state subsidized occupational pension funds (in operation since 1999) as well as personal pension schemes (since 2004) form the third and forth pillar. Yet with a volume of about 5.2 billion PLN in 2008, the voluntary pension schemes play only a minor role for the old-age provision in Poland so far. The following passages describe the Polish pension system and its recent reforms in greater detail. Since this study focuses on the coverage gaps of the general public pension system, the latter system will be devoted more weight to in the following.

Looking upon the mandatory public pension systems in Poland one comes across three main branches: a general system covering employees and the self-employed, a separate pension system for farmers, as well as a security provision system for military forces, police, judges and similar services. Each of these branches operates under separate rules and for marked-off occupational groups. Fundusz Ubezpieczeń Społecznych (FUS), the general system, represents by far the largest scheme with about 88 percent of all contributors (see Figure 3). The other two branches, the farmers’ pension scheme (10.5 percent), and the security provision system for state employees (1.7 percent) cover the remaining 12 percent of contributors. This proportion is predicted to decrease in the coming decades due to an ongoing restructuring of the Polish agricultural sector. We confine the analysis of this study (and the following description) to the FUS system due to its overwhelming and upward trending size.
3.2 The general public pension system and its reform in 1999

Until 1999 the Polish general pension system was structured as most traditional systems in Europe: based on a PAYG system and operating on the foundation of a defined benefit formula. However, with tremendous budget deficits in the 1990s it became increasingly apparent that this pension system was not financeable—much less considering the demographic momentum described in Section 2. The Polish government adopted a sweeping pension reform in 1999, and as implied by its slogan “Security through Diversity” this overhaul was based on a multi-pillar approach. This reform represented a clear change of paradigm in Polish pension policy: old-age income would not be guaranteed by a solitary pillar anymore, i.e. the old PAYG pension system. Instead two complementary mandatory schemes were put forth—the notional defined contribution scheme (NDC) and the privately managed defined contribution scheme (FDC)—as well as voluntary fully funded defined contribution schemes.

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7 The pre-1999 pension formula consisted of a flat component, equal to 24 percent of the average wage, an earnings related component, based on the wage of 10 consecutive years out of the last 20 before retirement, as well as a supplement for non-contributory periods.
8 For a more detailed description see Holzmann and Guven (2009) or OECD (2009).
With 12.2 percent of gross wage the majority of mandatory contributions (19.52 percent paid equally by employees and employers) are still spent for the PAYG system, the first pillar of the Polish pension system. The new PAYG system in Poland, the so-called NDC system, however, differs significantly from the old one. Like in funded pension systems every contributor has a pension account in which his entire accrued-to-date contributions are collected. This account, though, is purely notional. In other words it is nothing else than an administrative record of contributions and credited interest, but without any underlying funds. As contributions to this system started in 1999, there was an account value set for all people employed at that time which is to represent their contributions up to 1998. Upon retirement account balances are converted into an annuity which is based on unisex life expectancy of the respective cohort at the age of retirement. The NDC accounts are managed by the Polish Social Insurance Institution (ZUS).

The rest of the mandatory contributions (7.3 percent of gross wage) are converted into open pension funds. They represent the second pillar of the Polish pension system and are fully funded. Similarly to the NDC scheme an account is kept for each individual, but managed by private institutions. As in most EU countries, the government set a number of restrictions to manage the open pension funds such as a rule concerning the portfolio mix and minimum return guarantees. Furthermore, fees deducted from contributions must not exceed seven percent. In addition, a maximum of 0.6 percent of the total FDC account can be charged annually as a management fee.

Due to perceived immediate necessity of reform there was only a relatively short phasing in of the reform measures. While the cohorts born before 1 January 1949 still retire according to the old pension rules, all those born after 1968 have to participate.

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9 When assessing pension systems, it is common to use the so-called pillar concept. However, there are rather different definitions of this concept. In this study we classify the Polish pension system as a four pillar system, as commonly done.

10 This initial capital at the beginning of 1999 is based on the old pension formula, with adjustment for the age and working period. The amount of pension calculated for the end of 1998 is multiplied by life expectancy of a person aged 62 in 1998. The result is then registered on the notional accounts. See European Commission (2007), p. 272.

11 The portfolio share of bonds was 75.1 percent (at the end of 2008); 21.4 percent of total assets were invested in equities, the remaining 3.5 percent in T-Bills, NFI shares, and bank securities (see Polish Financial Supervision Authority (2009b)).

12 The rate of return guarantee is defined in relative terms: if a pension fund yields less than fifty percent of the average rate of return across all pension funds (or more than four percentage points less, whichever is lower), returns have to be topped up to this benchmark (see Chlon et al., pp. 29f.).

13 This value will be reduced to 3.5 percent until 2014.
in the new pension system. Age groups born after 1948 and before 1969 have to take part in the NDC scheme, too. They could, however, choose in 1999 whether to join both the NDC and the FDC scheme or only the former.

In comparison to other EU countries the average actual retirement age in Poland was rather low in recent years.\textsuperscript{14} With the reform of 1999 it was envisaged to increase the effective retirement age significantly. One step in this direction was the increase of the legal retirement age from 55 (60) to 60 (65) years for women (men) born after 1949. Furthermore, various forms of early retirement for groups such as teachers, railway workers and women have been phased out until 2009. Nevertheless, there are still plenty early retirement options for specific occupational groups.\textsuperscript{15} Looking at the present political debate, it is quite questionable whether early retirement will be sufficiently restricted in Poland to increase effective retirement age.

When quantifying the future average pension level one should not neglect minimum pensions. It defines nothing else than the lowest possible amount of a pension. If pension benefits fall below this level there is a supplement paid out of tax accounts. Presently the minimum pension under the PAYG scheme amounts to 636.29 PLN per month, equivalent to 24 percent of average earnings in Poland.\textsuperscript{16} This threshold is adjusted annually according to the same indexation rules as general pension benefits.

The indexation of pension benefits in the Polish general pension system is relatively modest, compared to most other European pension systems. Every year pensions are rated up in line with 80 percent of prices and 20 percent of average earnings in the past year. It will be shown (in Section 5) that this indexation rule plays a significant role in the calculation of pension gaps.

### 3.3 Subsidized voluntary pension schemes

The Polish state encourages employees to participate in voluntary employee pension funds (PPE) by deducting the seven percent contributed to the voluntary pillar from the wage base for the payment of social security contributions to the first pillar.


\textsuperscript{15} Exceptions from this abolishment of early retirement pensions are made for miners as well as the so-called group of people working under special conditions (about 270 000 workers). The latter will receive a bridging pension up to five years before the legal retirement age financed by the state budget; see OECD (2009), p. 2.

\textsuperscript{16} See European Commission (2009b).
Employees can make their own contributions, which are then deducted from their wages and transferred to their accounts. One is eligible to receive benefits from the PPE by the age of 60. At the beginning of 2008 a total of 1,040 plans registered with the Financial Supervision Commission were active. The overall participation in PPE is still quite low with about 59,000 members participating in 2008.

First individual retirement accounts were established in 2004. They can be held with open-ended investments funds, banks, insurance companies, and similar institutions. Participants must contribute for at least five years and—similarly to PPE—can withdraw benefits aged 60 at the earliest. In order to qualify for tax exemptions, contributions may not exceed 150 percent of the average monthly wage. They are free of capital gains tax, if the account is maintained until retirement age. By the end of 2008, around 853,000 individuals (i.e. about four percent of Poland’s working-age population) had individual retirement accounts.

17 See Holzmann and Guven (2009), p. 191
18 See Polish Financial Supervision Authority (2009a).
19 See Polish Financial Supervision Authority (2009b).
4 Conception and Method

4.1 The concept of pension gaps in a nutshell
This study quantifies pension gaps in the Polish pension scheme. As the term “gap” is a comparative concept, it needs clarification as to which values are compared: we compare projected net pension benefits with consumption levels before retirement. The extent to which pension benefits fall short of prior consumption is the pension gap as it is defined throughout this study.20

The idea behind this approach is that, in economic theory, individuals tend to smoothen their consumption paths over the life cycle. The vehicle for consumption smoothing is saving. A compulsory pension scheme forces contributors to save from their wage income, yet modern pension systems are not designed to accomplish full wage replacement and therefore necessitate additional private saving. Having this in common, pension schemes differ not only in the overall magnitude of pension gaps, but also in respect to how these gaps differ across generations, genders, and for heterogeneous retirement choices. This is why we investigate the gaps produced by the Polish pension system differentiated by gender, birth cohort, and retirement age.

The following passages explain the crucial steps of our simulations in detail. Section 4.2 deals with the derivation of the consumption level, whereas Section 4.3 describes the calculation of pension benefits for the NDC and FDC components, respectively. Section 4.4 gives an account of the pension gap calculation, followed by an explanation of the implementation of specific retirement probabilities in Section 4.5.

4.2 Consumption level
Consumption is equal to disposable income less savings. In default of (reliable) age and gender specific data on disposable income or net wages—a close proxy of the former variable—our strategy is to derive consumption levels from gross wages. These were obtained as gender specific averages for age groups of five years from the Polish Household Survey21 and interpolated for single ages between 18 and 68. This age specific gross wage has to be reduced in four ways in order to arrive at the consumption level.

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20 Note that there is no universal definition for the term “pension gap”. It is frequently used as a synonym for “replacement rate”, as well.
Firstly, the data represent average wages for all employed and self-employed. We are however interested in the wages of all contributors to social security, and the latter include the unemployed. We thus have to adjust for the fact that a certain share of contributors receives unemployment benefits, not wage. In other words, a new gross wage has to be calculated, because the given is valid only for a subpopulation (albeit the majority). The adjustment requires unemployment rates, the level of unemployment benefits (monthly 551.80 PLN in 2008), and the average duration of unemployment (roughly one year). Obviously, this results in a lower gross wage profile.

Secondly and thirdly, income tax and contributions to social security are deducted from gross wage, which yields net wage. The contribution ratio amounts to 22.71 percent. The income tax rate is calculated as follows: the general rate of 18 percent is reduced by most of the health care contributions (7.75 of 9.00 percent) and is assumed to be roughly 10 percent. Fourthly, net wages are reduced by an average savings rate of 13 percent. As reference value for any retiree we choose his (or her) consumption level right before the average retirement age. The resulting composition of average gross wages for 64 years old men and women aged 59 in 2008 is illustrated in Figure 4. According to this, roughly 60 percent of gross wage is available for consumption.

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22 The total is composed of contributions to the following social insurance schemes: sickness/unemployment (2.45 percent), invalidity and survivorship (1.50), old-age (9.76), health (9.00).
23 It should be noted that the new tax reform of 2009 has not been included in these calculations.
24 Age specific savings rates were not available for Poland, just the average across all ages. The missing values are derived by scaling numbers for Germany according to the ratio of average savings rates.
25 This is to render pension gaps comparable, as described in Section 4.4 below.
26 It should be noted that the derived consumption levels do not reflect the fact that larger households benefit from scale economies in consumption.


4.3 Pension contributions and benefits

In both mandatory pillars of the Polish pension system, benefits are generally computed as annuities from an individual account upon retirement. These accounts are built up by contributions during working life. In 2008, the base year of the simulation, the balances of these accounts have not only been accumulated since the implementation of the new system. In addition, benefit claims from the old system have been transferred to the NDC accounts.

Age and gender specific data on NDC accounts have been provided by ZUS.27 Concerning FDC accounts, only an aggregate is available.28 This can be assigned across cohorts, however, by simulating the accumulation from 1999 to 2008 and scale the cohorts' accounts according to the ratio of aggregates. The share of individuals participating in the FDC scheme has to be factored in for all birth cohorts between 1968 and 1949, of course (see Figure 5).29

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27 The data are confidential and cannot be reproduced here.
28 See Polish Financial Supervision Authority (2009c).
29 Since the data on NDC accounts comprise retirees (who have already started to deplete their accounts), too, it is only useful for ages before the youngest common retirement age. The omitted ages are then extrapolated.
Future contributions are defined as the product of gross wage and the contribution rate. The contribution rate is the total, not only the contributor's part. Furthermore, it is not uniform, but—being a cohort average—varies from 19.35 to 13.13 percent across birth cohorts between 1949 and 1968 due to the aforementioned FDC participation shares (NDC and FDC contribution rates vary inversely, of course).

The gross wages need explaining. The profiles presented in Section 4.2 are adjusted for our purposes; they are continuously trending upwards, i.e. also for ages above 60. In these age groups the average wage is actually affected by a large proportion of the population leaving into retirement. Imagine for instance that highly paid top managers retire very late, say because they are workaholics, while everyone else retires relatively early. Then average wage would rise sharply. The reverse would happen if only those work longer who really need it to make ends meet. This means that the original wage profile is likely to be distorted in higher age groups, since people of different productivity and wage levels do not leave the work force in equal measure. If the effects do not cancel out coincidentally, that is a problem from this study's perspective, as we are interested in the wage profile of a representative
individual, given that he (or she) works. The remedy is not far-fetched: we extrapolate the trend from younger ages onto these probably distorted age groups.\textsuperscript{30}

Contributions to the NDC component are indexed in line with 75 percent of the real wage bill growth which is thus the NDC system’s rate of return. Real wage bill growth is the sum of the growth rates of real wages and employment. Since wages move in line with labor productivity in the long run, we assume identity in any given year.\textsuperscript{31}

The assumed time paths of the respective variables are depicted in Figure 6.

\textbf{Figure 6: Growth rates of employment, real wages, and the real wage bill}

The FDC pillar features a more common accumulation: the account balances are increased by portfolio returns of the insurance company managing the account. For this rate of return (which obviously varies across companies), we assume an average of 4.0 percent, constant over time. It exceeds our assumed risk free real interest rate by one percentage point.\textsuperscript{32} Two types of fees are also taken into account: a time-

\textsuperscript{30} The trend is below linear though, which means that wages still grow in older ages, but at decreasing pace.

\textsuperscript{31} The assumptions on employment and real labour productivity growth base upon estimates of the European Commission.

\textsuperscript{32} In comparison to recent FDC rates of return our assumption of 4.0 percent (real) is a relatively conservative assumption since between 2000 and 2009 the average real rate of gross return exceeded 6.0 percent (see IGTE (2007), Sierhej (2008) and G0Warsaw (2010). However, similar to the convergence of productivity growth it can be assumed that the average real rate of return will not stay on the high growth path of the last decade. Nevertheless, we will show the impact of a varying FDC rate of return on pension gaps in the sensitivity analysis (Section 5.3).
varying pre-deducted “contribution charge”\textsuperscript{33} and an “asset management charge” (after interest) that is assumed to be constant at 0.6 percent.

The benefits from the NDC and FDC accounts, respectively, are calculated as a straightforward annuity, i.e. by dividing the assets at retirement by remaining life expectancy.\textsuperscript{34} This computation is based on unisex life tables. There is no return on remaining balances once withdrawal has started; the benefits are indexed in line with 20 percent of real wage growth, though. In contrast to the benefit’s calculation, their projection until the death of the retiree relies on gender specific life tables.

In order to avoid comparing oranges and apples these gross pensions (of both pillars combined) have to be corrected for income tax and health care contributions, too. The latter amount to 9.0 percent. The average tax rate is calculated income-dependently, i.e. considering the exempt amount of 3,089 PLN (in 2008, indexed with wage growth thereafter) and the aforementioned tax rate of 10 percent. Comparing these net benefits with consumption levels implicitly assumes that savings from pension benefits are zero. This is in line with life cycle theory, but not with reality. Retirees do save, be it out of bequest motives or due to seemingly irrational reasons. The point of disregarding old-age savings anyway, is that they can and will be reduced if pension benefits become less and less sufficient to satisfy consumptive needs.

Optimally, the derived pensions should be adjusted further, considering that a certain share of retirees can be expected to receive supplements up to the minimum pension. Unfortunately, this is impossible without any data on the distribution of pensions within each age group. However, given that the payments of minimum pension supplements will presumably decline significantly in the future due to indexation rules, omitting this aspect in the simulation is unproblematic.\textsuperscript{35}

\subsection*{4.4 Pension gaps}

Given consumption and net pensions, finally the pension gaps are determined as “unity minus the ratio of net pensions to consumption”. In addition to these \textit{relative}...
gaps—our main indicator—we provide absolute gaps as well, i.e. the PLN difference between pension benefits and consumption.

A retiree has as many yearly pension gaps as he has years of his life left when he retires. Each of these gaps relates the respective pension benefit to pre-retirement consumption. Thus, every cohort has one such trace of yearly pension gaps for each retirement age. Cumulating the above-mentioned yearly gaps of such a “retirement path” and dividing the sum by remaining life expectancy yields a contingent life cycle pension gap for each cohort at a given retirement age, i.e. the average yearly gap dependent on the retirement age.

There are two ways in which we facilitate these contingent life cycle pension gaps for more illustrative purposes. On the one hand they are summed up across cohorts for a single retirement age in order to show the significance of the retirement decision’s timing. On the other hand we reduce them to a single life cycle pension gap for every cohort. This is done by taking the average of the contingent gaps, weighted by the respective retirement probabilities—explained in Section 4.5 below.

As pre-retirement consumption we take the level at age 64 for men and at 59 for women. Two aspects need explaining. Firstly, why is consumption referred to at a fixed age and not right before actual retirement? The explanation is short: in order to achieve comparability across retirement ages. Or more lengthily, take a person retiring at 65 instead of 60. Of course, this person’s yearly pension gaps would shrink as pension benefits increase, but a 65 year old earns and thus consumes more, which would in turn widen the gap. While the former effect would regularly dominate, this ambiguousness is to be avoided in designing a meaningful indicator. Secondly, why 64 and 59 of all ages? These are simply the consumption levels right before the earliest retirement age (of the relevant cohorts), i.e. the best proxy for old-age consumption that still tolerates comparisons.

Furthermore, pre-retirement (and retirement) consumption is indexed in line with productivity growth, so that subsequent pensions are compared with ever-increasing consumption levels. At first sight, it stands to reason that the consumptive needs are only to be increased by inflation, i.e. kept constant in real terms. Yet, considering that the working part of society partakes in productivity growth (through wages, technology-induced changes of consumer baskets, and so on), this notion is judged short sighted. Interlinking reference consumption and productivity growth calls
attention to the broader concept of relative consumption positions, i.e. the participation of the old in a society’s prospering. Put differently, pension gaps defined in this way do not capture whether retirees can sustain consumption of an unaltered basket, but to what extent they can sustain their original consumption relative to society.

4.5 Legal retirement ages and retirement probabilities

The age specific retirement probabilities are derived from relative retirement frequencies in 2007, made available by the Polish social insurance institution (ZUS). We exclude ages below 55 because the data indicate that most individuals retiring this young draw invalidity, and not old-age pensions. The oldest retirement age in the data is 68. The probabilities are normalized to sum to unity, so that we could interpret them as ex ante retirement probabilities for all cohorts below the youngest retirement age. For cohorts aged 55 and older in 2009, further modification is necessary: the remaining probabilities until the age of 68 are normalized to sum to unity, again.

This derivation of retirement probabilities implicitly assumes time invariance of retirement behavior as it imputes the same ex ante probabilities for all cohorts. This would be an extreme assumption, considering the uplift in legal retirement ages by the pension reform of 1999—that has already shown effects and can duly be expected to increase average retirement age even after ten years have passed.

More specifically, rather than by the mere increase in legal retirement ages, the major effect will most probably be seen in 2009, caused by the abolition of many exemption clauses for cohorts born after 1948 (as mentioned in Section 3). It is thus not justified to assume the 2007 ex ante probabilities for 2009 and thereafter. Accordingly, our assumptions are that only individuals over 59 in 2009 retire as described above. All other cohorts’ retirement is postponed until the age of 65 (60 for women). This implies that any pull-forward effects of the age groups between 55 and 59 must have happened before 2009, which may not be perfectly realistic, but is still the best guess for want of better data. This assumption produces a structural break in retirement behavior: only until 2013 will there be men (women) retiring before the age of 65 (60), and from 2018 on, the retirement probabilities are constant for all cohorts. The ex ante probability for a man to retire at 65 is then 88 percent, the remaining 12 percent

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36 On top of that, it should be suspected that the 2007 data include pull-forward effects in anticipation of the changes two years ahead.
are split between the ages of 66 (7 percent), 67 (3 percent), and 68 (2 percent). Women’s retirement probabilities are distributed even more unevenly: retirement at 60 has a probability of 95 percent—any other age group’s probability is insignificantly low. These assumptions concerning retirement behavior are used in our standard scenario.

There is, of course, reason to believe that actual retirement ages will increase further over time. Firstly, a corresponding reform could be made inevitable by fiscal constraints; secondly, and more importantly, the very pension gaps that result from still relatively early retirement—as to be described in Section 5—could force people to postpone retirement (due to personal financial constraints, that is). Our simulations therefore include an alternative scenario in which the average retirement age of 65.2 (60.2) years for men (women) gradually increases to 67 (63) during the period 2018 until 2030. The corresponding probability profiles for 2030 are depicted in Figure 7.

**Figure 7: Ex ante retirement probabilities as of 2030**
5 Results and Discussion

5.1 Preliminary remarks
Will future mandatory pensions in Poland be sufficient to cover the pre-retirement levels of consumption? The answer to this question is given in the following passages. As described in the previous Section, pension gaps are quantified not only for different cohorts born between 1955 and 2000, but also gender specific as well as for heterogeneous retirement ages. Additionally to the exposition of relative pension gaps, their absolute counterparts, i.e. pension gaps in PLN, will be illustrated. The latter indicate how much a representative individual of a specific cohort and gender would have to put aside today to secure an adequate retirement income. Finally, as the future is uncertain by nature, several variations of the assumptions underlying our projections —and their impact on the results—shall be discussed.

As outlined in Section 3, the Polish pension system underwent a profound reform in 1999. The impact of this reform on future pension levels is, however, not perfectly obvious. Rather opposed effects can be observed when looking at the various reform steps. The significant increase of the legal retirement age by five years clearly leads to a rise of pension levels, other things being equal. Based on the principle of equivalence, a longer contribution period until the age of 65 or 60, respectively, enhances pension entitlements and thus results in higher pensions. The new second pillar, the FDC system, may increase or decrease future pensions—depending on its rate of return in comparison to the NDC scheme. Apart from that, one aspect of the new pension system will necessarily lead to a decrease in pensions: higher (unisex) life expectancy is always accompanied by a reduction of pension levels by the mathematical logic of annuity calculation.

5.2 Life cycle pension gaps
Considering these factors jointly, the development of pension levels and resulting pension gaps over the coming decades can be quantified. Looking at the relative life cycle pension gaps of the birth cohorts from 1955 to 2000 in Figure 8, two general facts become clear. Firstly, all cohorts have a positive gap, i.e. none can attain

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37 Cohorts born before 1955 are omitted due to a conceptual and a technical reason. First and foremost, cohorts close to retirement are hardly relevant for this study’s analysis of future savings. Furthermore, the phasing out of early retirement possibilities in 2009 would necessitate specific retirement probabilities for these cohorts—that could only be guessed.
previous consumption. For males, these gaps range from about 42 percent to 49 percent. Women show pension gaps between 51 and 65 percent. Secondly, these gaps widen further in the short and medium term, as pensions increasingly fall back behind consumption.\textsuperscript{38} While e.g. an average male individual born in 1955 has a life cycle pension gap of 42 percent (which means that he will be able to cover roughly 58 percent of his pre-retirement consumption), the gap of a representative male born in 1976 is seven percentage points higher.

\textbf{Figure 8: Cohort specific relative pension gaps}

From Figure 8 the large discrepancy between the pension gaps of women and men becomes obvious. Females are confronted with a pension gap roughly 16 percentage points higher than that of their male counterparts. The main explanation for this differential is straightforward: women retire considerably earlier than men. According to the benefit formula of the NDC system this results in lower pension benefits since a shorter period of contribution leads to lower NDC and FDC accounts.\textsuperscript{39}

\textsuperscript{38} The decrease in life cycle gaps for cohorts born in the mid-1970s and later can be mainly explained by a slower increase in life expectancy in the years from 2030 to 2050. As of 2050 mortality is assumed to be constant. As a result, pension gaps for cohorts born in the 1990s are relatively similar in magnitude.

\textsuperscript{39} It should be noted that female pensions would be much lower if pensions were based on gender specific, instead of unisex life-tables.
Not surprisingly, the life cycle pension gaps in absolute terms (see Figure 9), show a similar picture: the gender differential is apparent here as well. Besides lower pension benefits, another factor determines the discrepancy between women and men: gender specific life expectancies. Women simply live much longer and therefore accumulate more yearly pension gaps. As a result a woman born in 1980 would have to set aside about 300,000 PLN in order to secure a “consumption-neutral” retirement income. For a man born in the same year a significantly lower amount of 200,000 PLN would close the pension gap. The third factor inducing the gender differential in pension gaps is the indexation of pensions. Compared to most other European countries the yearly adjustment of pensions in line with 20 percent of real wage growth is relatively low. As a result, the level of pensions grows considerably slower than consumption possibilities of the economy as a whole—and therefore falls back behind the benchmark, namely pre-retirement consumption.

The future pension gaps shown above are of course based on a set of assumptions about the future behavior of individuals as well as the economic development of the decades to come. To get a better grasp of the results, it is useful to analyze how the outcomes are affected by a variation of assumptions. The following passages demonstrate the sensitivity of outcomes due to alterations of the retirement behavior, life expectancy, and the internal rates of return of the FDC and NDC systems, respectively.

40 For an overview on the design of European public pension systems see Müller et al. (2009).
5.3 Sensitivity of the results

Our approach of life cycle pension gaps takes into account that individuals have heterogeneous retirement ages. In other words, an individual of a certain cohort has a certain probability to retire with 60, 61, 62, and so on. In our base scenario, we hold these retirement probabilities constant for all cohorts. Figure 10 illustrates the relative pension gap for different retirement ages of a female born in 1970. This is clearly the picture one would expect when looking at NDC and FDC pension systems: the later an individual retires, the more contributions have been accrued and the higher are the respective pension benefits. Also lower contingent life expectancy at higher ages results in a higher annuity. Taking the example of a female born 1970, her relative pension gap will shrink drastically from 64 to 48 percent if she retires at the age of 65 instead of 60.

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41 The calculation of the present value is based on a discount rate of three percent.
42 A detailed description of this concept is given in Section 4, along with the imputed data.
Nevertheless, even in the extreme case of retiring at 68 the pension gap would not disappear. In this case she would still have to put aside today 130,000 PLN to secure her pre-retirement consumption level. Choosing the other extreme of a possible retirement at age 60, a lottery win of 335,000 PLN would just be enough to cover the resulting pension gap.

Against the backdrop of the relatively large pension gaps indicated in this study, there is some reason to believe that future actual retirement ages will further increase. Therefore, Figure 11 and Figure 12 outline a scenario in which the average retirement age of 65.2 (60.2) years for men (women) gradually increases to 67 (63) during the period 2018 to 2030. As can be easily seen, pension gaps turn out to be considerably smaller—but are still well above zero, both in relative and absolute terms. For instance, a woman born in 1980 would have to set aside about 700,000 PLN less today if she retired three years later than in the standard scenario. Summing up, the pension gap hinges on retirement age, which might be obvious, but is still very important from the individual perspective.
The projected pension gaps are also strongly affected by the assumption on future rates of return of the two pension schemes. Concerning the FDC system, a higher
rate of return results in lower pension gaps by design, and vice versa. Figure 13 shows male cohorts’ life cycle gaps for three different rates of return. Obviously, the cohorts born after 1968 would gain most from an increase in FDC returns (see optimistic scenario\textsuperscript{43}). Accordingly, a lowered rate of return (see pessimistic scenario\textsuperscript{44}) would—especially for these age groups—result in larger pension gaps than in the standard scenario. The explanation of this phenomenon is simple: cohorts born after 1968 participate fully in the new FDC pension scheme, devoting about one third of their contributions to this new second pillar. Older age groups, however, have lower FDC participation rates and therefore draw smaller proportions of their pensions from this scheme. As a consequence, they are also less affected by an alteration of the rates of return in the second pillar.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure13}
\caption{Variation of the FDC rate of return}
\end{figure}

Close inspection of the development of pension gaps over cohorts calls attention to a kink at 1968/1969 interrupting the otherwise smooth progression. This is due to discrete changes in FDC participation, e.g. between the male cohorts born 1968 and 1969. The former have an obligatory FDC share of 100 percent, the latter are the

\textsuperscript{43} In the optimistic scenario the FDC rate of return is assumed to be two percentage points higher than in the standard scenario.
\textsuperscript{44} The pessimistic scenario is based on a FDC rate of return which is two percentage points lower than in the standard scenario.
youngest cohorts to choose and have a share of 75.5 percent.\textsuperscript{45} The pension portfolios of these cohorts have a very different composition, and this produces a “jump” in pension gaps as long as the NDC and FDC schemes have diverging rates of return.\textsuperscript{46}

Examination of the NDC rate of return reveals a mirror image. Higher (lower) internal rates of return can lead to an increase (decrease) of pension gaps in our simulation. The respective relative pension gaps for male cohorts are shown in Figure 14 (see pessimistic (optimistic) scenario).\textsuperscript{47} This result might be counterintuitive at first sight. Therefore, this specific sensitivity analysis suits very well to get a better understanding of the concept of pension gaps employed in this study.

\textbf{Figure 14: Variation of the NDC rate of return}

Note that the NDC system’s rate of return is the real wage bill growth or, more precisely, 75 percent thereof. For the following experiment it should be assumed that

\textsuperscript{45} The differential in FDC shares is smaller for women, so that the kink is less evident.

\textsuperscript{46} Any other kinks are due to a technicality in connection with our simulation method. Assuming discrete periods of one year constrains the projection to use of whole-numbered life expectancies. As a consequence, whenever a cohort with a one year higher life expectancy than the cohort before reaches a frequent retirement age, there is a significant increase in this cohort’s pension gaps relative to the one before. In contrast to the kinks produced by differential FDC shares, these are not realistic and should thus be disregarded.

\textsuperscript{47} In the pessimistic (optimistic) scenario the yearly wage growth is assumed to be one percentage point higher (lower) than in the standard scenario.
the higher rate of return of the NDC system is caused only by higher wage growth—employment growth being constant. Then why should higher rates of return increase pension gaps? Do not pension accounts and therefore benefits increase in line with the NDC interest rate? This is clearly the case. A higher wage growth, therefore, would lead to higher future pension benefits. However, despite the pension increase, the pension gap widens. This is due to the relative concept of pension gaps. To calculate these gaps each pension is compared to a benchmark, the level of pre-retirement consumption. Of course, the benchmark grows faster, namely with the rate of real wage growth—which is higher than 75 percent of real wage bill growth by assumption. This differential alone leads to increasing pension gaps when real wages accelerate. Pension gaps are increased, moreover, due to the fact that actual pensions are only indexed by 20 percent of wage growth while the benchmark—the pre-retirement level of consumption—is fully indexed in line with real wages, as explained in Section 4. Summing up, a higher wage growth results—ceteris paribus—in faster growth of the benchmark than of the NDC pensions. As a consequence pension gaps would increase over time.

Apart from retirement behavior and the rates of return, the assumptions on life expectancy play a significant role for the results of the simulation. Higher life expectancy leads unambiguously to a higher pension gap. The impact of future mortality assumptions shall be illustrated by an example: imagine the unrealistic scenario that men have a significantly higher life expectancy—equal to that of women. In comparison to the standard scenario, male pension gaps would be increased by roughly 12 percent (see Figure 15).
Figure 15: Variation of life expectancy

Yet, men would still have a smaller pension gap than women. This can be traced back to the fact that women retire five years earlier on average and therefore receive significantly lower pension benefits. The importance of the actual retirement age becomes apparent once again. Furthermore, in the given example, not only male life expectancy is increased, but—indirectly—also unisex life expectancy which is used to calculate women’s annuities, too. As an interesting side-effect, this would decrease women’s pensions—leading to higher pension gaps for them as well.

Summing up the sensitivity analysis, it has been demonstrated that the results change significantly if certain assumptions are varied. Especially the choice of future retirement ages and the rate of return affect the outcomes. In this context it is worth noticing that even in case of extreme scenarios, such as very high rates of return or very low life expectancies, pension gaps do not vanish. Only a combination of extremely optimistic assumptions would lead to such a result. The sensitivity analysis demonstrates that especially in the far future results would change more significantly with alternative assumptions. Here, the rate of return in the FDC system is a good example. The results for the long run should therefore be interpreted with caution.
6 Short Summary

By means of simulating (specially conceived) pension gaps in the Polish general pension system, it has been shown that future retirement benefits from the mandatory pillars will not be sufficient to cover the pre-retirement levels of consumption.

Differentiating by gender, it has been outlined that pension gaps are considerably higher for women than for men. The former lie within the span of 50 to 65 percent, while the latter range from “only” 40 to 50 percent. A main factor for this gender differential is the earlier retirement of women.

The results vary not only between genders, but also for different birth cohorts. Especially the cohorts born between 1965 and 1985 face extensive pension gaps. In our base scenario, men (women) of these age groups would have to put aside roughly 210,000 (310,000) PLN today to sustain previous consumption during retirement. This widening of pension gaps is to a high degree caused by an increase in life expectancy which will significantly reduce future pension levels.
7 References


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