

# Reasonable Pensions: for Whom?

Bo Larsson<sup>§</sup>

Edward Palmer<sup>§</sup>

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**Abstract:** The aging populations in middle and high income countries are posing a growing problem for governments around the world. Generous defined benefit pension schemes embody promises that cannot be kept. This has increased the attractiveness of non-financial (or notional) defined contribution schemes (NDC), a pay-as-you-go pension scheme, perhaps with buffer funds. NDC is financially sustainable at a constant contribution rate, if set up correctly, and is fair in the sense that all individual contributions constitute individual rights, enhanced over time with an internal rate of return. This rate of return also contributes to maintaining financial stability.

Though NDC is in principle intra and inter-generationally fair, the absence of individual contributions can lead to only a minimal pension in old age. In Sweden, this is the guarantee benefit. Sweden, an NDC pioneer, has created non-contributory rights for periods surrounding child birth, education and military service, paid for by the general budget, and in addition, general-budget financed rights for insured periods of sickness, disability and unemployment gaps in earnings careers can arise due to other circumstances. This article investigates which groups are at risk to have insufficient pensions due to gaps in earnings and, thus, contributions, including those with already covered gaps. It also addresses potential policy changes to circumvent the problem of irregular contribution histories.

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<sup>§</sup> Department of Economics, Stockholm University, 106 91 Stockholm,  
[bl@ne.su.se](mailto:bl@ne.su.se) +46 (0)8-674 7122

<sup>§</sup> Department of Economics, Uppsala University, Uppsala Center for Labor Studies and Swedish Social Insurance Agency, 103 51 Stockholm,  
[edward.palmer@forsakringskassan.se](mailto:edward.palmer@forsakringskassan.se), +46 (0)10-116 92 40

## Introduction

In most middle and high-income countries with predominantly non-financial define benefit (NDB) pension schemes, pension-driven government “debt” is growing steadily, and, what’s most troublesome, often faster than the contribution base and GDP, due to an aging population and generous, but in the long run unaffordable defined benefits. To counter this some countries have gradually changed to or implemented financial defined contribution (FDC) personal account schemes, where contributions on lifetime earnings and the financial market rate of return determine pension amounts. Others, among them Sweden, Poland and Italy have replaced their NDB pay-as-you-go schemes with non-financial (notional) defined contribution (NDC) schemes.

From the point of view of the contributor, NDC is like an FDC personal account scheme during the accumulation phase, albeit the rate of return on personal accounts is determined by the economic determinants of the rate of economic growth.<sup>1</sup> NDC (and FDC) schemes by themselves are not adequate as protection of old age poverty because pensions are determined by contributions, i.e., there is no built in within system redistribution of system revenues (Barr 2006; Palmer 2006). If your lifetime earnings are low your pension is low, so NDC and FDC schemes need to be supplemented with a minimum guarantee level, with external financing with general state revenues.

In a non-financial defined benefit (NDB) scheme the pension levels can be set with anywhere from a strong to no relation to the worker’s lifetime contributions. Hence, redistribution in NDB schemes can be explicit and

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<sup>1</sup> See e.g. Palmer 2006 and 2012 for detailed presentations of NDC.

intentional but it can also be unintentional. For example, consider a tax-based scheme that requires only thirty years of participation to receive a full lifetime benefit in a setting where a normal working career entails forty or more years with contributions. This obviously transfers lifetime earnings from those in a birth cohort who work more than thirty years to those who work fewer years. In addition, unless an NDB pension system has a constantly growing working-age population, which also work and pay contributions many years on average, the scheme is likely to cost increasingly more to sustain as the longevity of the retired population increases. In fact, this is a problem that many developed countries have today where many communities, national governments and other organizations have rapidly growing pension debts that are not sufficiently pre-financed.

To counter this problem some countries have converted to, or implemented from the outset – e.g., as in many Latin American countries in the 1990's - a pre-funded FDC scheme. Some other countries predominantly in Europe – have converted existing NDB schemes to NDC schemes, e.g., Sweden, Italy, Latvia and Poland. In Sweden, the financial long-run unsustainability of the too generous public NDB and non-pre-funded occupational schemes together with the financial crises in the early 1990's led to the introduction of mandatory public NDC and FDC schemes<sup>2</sup> and conversion to FDC personal account supplementary schemes for private and public sector workers, with various occupational-based variants.

Sweden, an NDC pioneer, has created non-contributory rights for periods surrounding child birth, education and military service, paid for by the general

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<sup>2</sup> Discussed in considerable detail in e.g. Könberg, Palmer & Sundén (2006).

budget, and in addition, general-budget financed rights for insured periods of sickness, disability and unemployment gaps in earnings careers can arise due to other circumstances. In this paper and using historical earnings data for Sweden we identify groups that are at risk of receiving poor pensions due to broken or sporadic earnings careers in the pure DC setting. The question is, does the new NDC pension system with the social policy add-ins provide sufficient pension levels and for whom? What do the earnings profiles of those who can only expect a minimum pension look like and what are the characteristics of these groups?

Forteza and Rossi (2012) develop an earnings simulation model for Uruguay where they compare Uruguay's current NDB distributional outcomes for individuals with a hypothetical NDC scheme, in a cost-neutral setting. Their focus is to determine which system is best in a country with many workers that have frequent long duration gaps in their earnings careers and contribution careers –the answer in their case being that NDC actually does a better job. We perform the opposite exercise in the Swedish context, and ask what are the effects generated by gaps in earnings careers in a developed country with an NDC scheme? The likely candidates for not faring so well are immigrants, who may not have a long working career in in their new country, native born late entrants into the labor force, for example due to low demand for new employees during recessions, and native born women. Klerby, Larsson and Palmer (2012) show that women who separate from their spouse/co-habitant or become a widow have substantially lower pensions than do their male equivalents.

This paper will deepen and broaden this analysis to include expected outcomes for current and future workers with simulation methods as well as a horse race experiment between NDC and the previous NDB scheme. The study

begins by identifying risk groups in terms of frequent gaps or late starting earning careers using historical data. We then use this information to produce projected earnings paths. We have a – to our knowledge relatively unique - simulation model that is very robust and builds on the Lorenz curve so we can adopt different growth rates and income inequalities. Given the estimated earnings careers we calculate pension results for the given system.

The remainder of the paper is organized as follows. First we describe the Swedish pension system. Thereafter we present a background on earnings and dynamics in the Swedish labor market. Finally we analyze the length of careers in the data with respect to characteristics of the individuals. The study ends with conclusions.

## **The Swedish Pension System**

In the midst of the financial crisis 1990-1994 and in the wake of a rapidly increasing government debt, Sweden converted its NDB-scheme to a combination of mandatory NDC and FDC schemes with a guarantee financed out of general tax revenues as a minimum benefit floor. The guarantee is constructed as a top-up of the combined NDC and FDC benefits, which can be claimed first at age 65. Following a long implementation process, in 1999 the new system replaced the combination of a flat rate “demogrant” and an earnings-related DB scheme called ATP – with a full benefit requiring 30 years of contributions above a certain floor, with the actual benefit based on the best 15 years of earnings. Following the first legislation in 1994, the four major occupational supplementary schemes, which provide both a supplement under the earnings’

ceiling for contributions to the public schemes and the entire benefit above the ceiling, followed suit and introduced FDC schemes, beginning with the blue-collar workers in 1996.

Basically contributions on all taxable income – at a rate of 16 percent for the NDC scheme and 2.5 percent for the mandatory public FDC scheme - whether the source is work (as an employee or self-employed, including farmers) or social security replacing income from work in various situations (e.g., parental benefits, sickness benefits, unemployment benefits) generate pension contribution rights. Capital income is, however, an exception. About 90 percent of all employees are covered by an occupational scheme pension supplement, and pay around another four percent contribution rate for this increment below the ceiling. The occupational supplement above the ceiling for the public scheme varies among occupational groups, but generally speaking is intended to provide an income replacement rate of around 60-70 percent on the first echelon above the ceiling, but then decreases with higher income.

Benefits that compensate workers for income loss also give rise to contributions to NDC accounts. The most important of these are unemployment insurance, sickness and disability insurance, and benefits paid during parental leave. The national government's contributions to the individual's old age benefit for these periods of insurance compensation are paid into the individual's account from *general tax revenues*, i.e., from the central government budget.<sup>3</sup> Also, non-contributory credits are given for military service, higher education and to parents (one at a time) for up to

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<sup>3</sup> Contributions have an employee and an employer component. The employee component of sickness, parental leave and unemployment compensation is paid by the individual.

four years after the birth of a child. These too are financed from the central government budget and give rise to contributions to the NDC and FDC schemes.

This means that the gaps in Swedish careers should be expected to be relatively short and few. However, there are situations in which they can and do occur. The sort of situation we expect to find is a continuation for women of time at home with young children after the period with parental benefits and situations with neither work nor unemployment. These may arise for anyone but are certainly prevalent among immigrants, prior to a strong enough start in the labor force to qualify for unemployment benefits; and especially those who work as self-employed. We also expect to find people with longer periods with low earnings for various reasons – which appear thus as low-earnings gaps in the earnings career.

In the empirical analysis we define low earnings as taxable (and contribution-based) yearly income below the minimum standard set by the National Board of Health and Welfare. A person with a lifetime earnings' career at this level of income would thus risk being in absolute poverty in old age – and would qualify for the guarantee.

## **Background**

In an NDC system the idea is that lifetime contribution to the pension system is the base from which the pension is calculated. The idea with a non-financial system is that money is not funded but still a pay-go system where current pension contributions are distributed to today's pensioners according to their claim to the system.

If there are gaps in the working career this will lead to lower contribution-based pension rights for the individual. In fact, most may have a relatively steady income depending on the country, which is certainly true of Sweden, so in this context an important determinant of pensions in a DC scheme is how often individuals contribute to the scheme. Sporadic contributions, i.e., gaps in earnings' careers, have thus the potential to lead to very low pensions. It has been argued that therefore NDB system is more suitable to sustain reasonable income at old age. Forteza et. al. (2012) test this assumption using Uruguayan pension earnings histories and pension rules and show that this does not seem to be the case for Uruguay, at least not with the present Uruguayan NDB rules. They find that an NDC/FDC schemes with a minimum guarantee provides better coverage of the poor and higher pensions for persons with stronger earnings careers. The more generous pensions are due to the fact that NDC does not need to have a qualification period for coverage, whereas with the Uruguayan rules workers must contribute for a minimum of 30 years with a 10 year minimum of full time work to be eligible for pension. In the NDC system all contributions lead to pension rights and if your pension nevertheless falls below the floor it is topped up with the guarantee.

So, how does one go about identifying and studying broken careers in a country like Sweden where the labor force is largely formal and there are laws and regulations guaranteeing job security? Largely, we expect broken careers to be a result of individual situations. And, we also expect that the individuals affected are frequently unaware of the consequences for their future pensions. That is, they do not have or do not search for the information that is necessary to see all the consequences of their actions. In other cases people, for example



young first-time labor force entrants and immigrants can be the victim of economic circumstances, e.g., they may be confronted by a recession when it comes time to seek employment.

One possibility to detect variations in individual's income generating process is to look at their income-rank relative their peers, or all income earners in an economy. It turns out that income rank can be modeled fairly well using a beta distribution given last years income rank. The formal estimation is as follows:

$$f(y; \mu, \phi) = \frac{\Gamma(\phi)}{\Gamma(\mu\phi)\Gamma((1-\mu)\phi)} y^{\mu\phi-1} (1-y)^{(1-\mu)\phi-1} \quad (1)$$

where  $\mu$  is expected rank tomorrow,  $\phi$  is the dispersion parameter,  $\Gamma$  the gamma distribution and  $y$  is the observed rank. The distribution is defined for the range zero to one. The expected rank parameter  $\mu$  is estimated via Logit Link:

$$\mu_{t+1} = \frac{e^{X_t\beta}}{1 + e^{X_t\beta}} \quad (2)$$

where we have used only previous year rank as data ( $X_t$ ), it would of course make sense to use more information about individuals if the goal was to forecast next years income. At this stage this is only used to illustrate the potential problem to rig a fair and robust pension system where individuals are insured both against bad luck and poor judgment.

However, it turns out that even if the beta distribution is very flexible it does not contain enough parameters to capture the kurtosis and skewedness in data. For this reason Friedmann and Sanddorf-Köhle, (2007) suggest using a mixed beta distribution. That type of modeling makes sense on income data as one can imagine that there is a portion of the workforce that desires job stability

and a portion that desires career improvements. We can capture this through a mixed beta distribution with one part is “stayers”, the portion preferring stability, and “movers”, who are the individuals that prefer career.

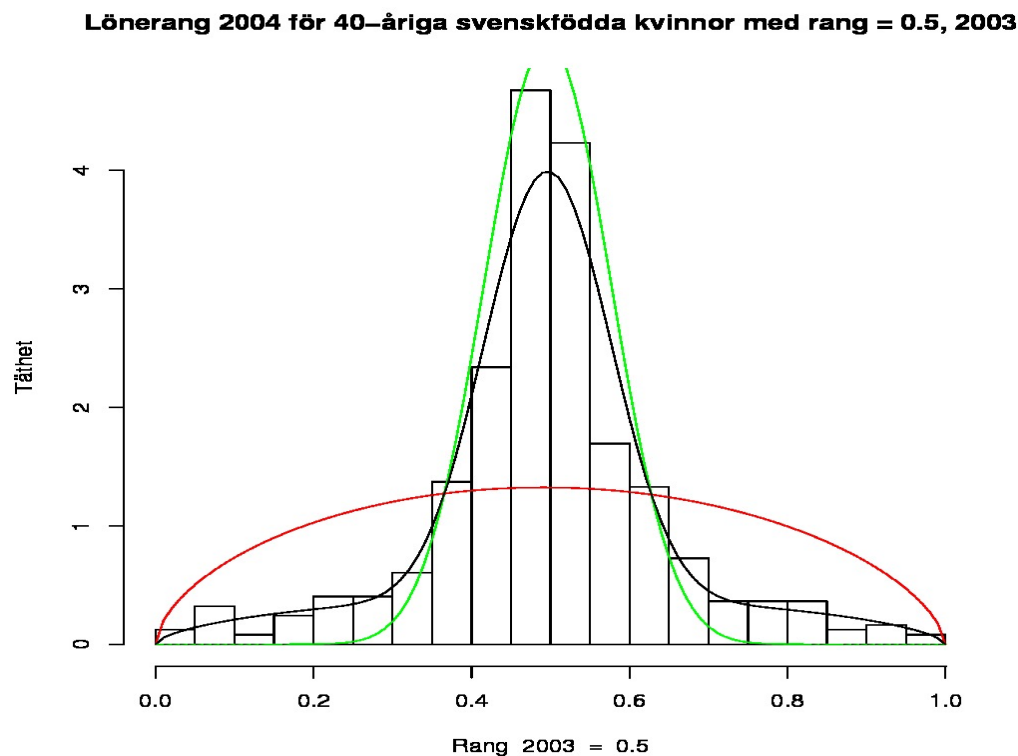
$$f(y; \mu_1, \mu_2, \phi_1, \phi_2) = (1 - \pi)f_1(y; \mu_1, \phi_1) + \pi f_2(y; \mu_2, \phi_2) \quad (3)$$

where

$$f_1(y; \mu_1, \phi_1) = \frac{\Gamma(\phi_1)}{\Gamma(\mu_1\phi_1)\Gamma((1-\mu_1)\phi_1)} y^{\mu_1\phi_1-1} (1-y)^{(1-\mu_1)\phi_1-1}$$

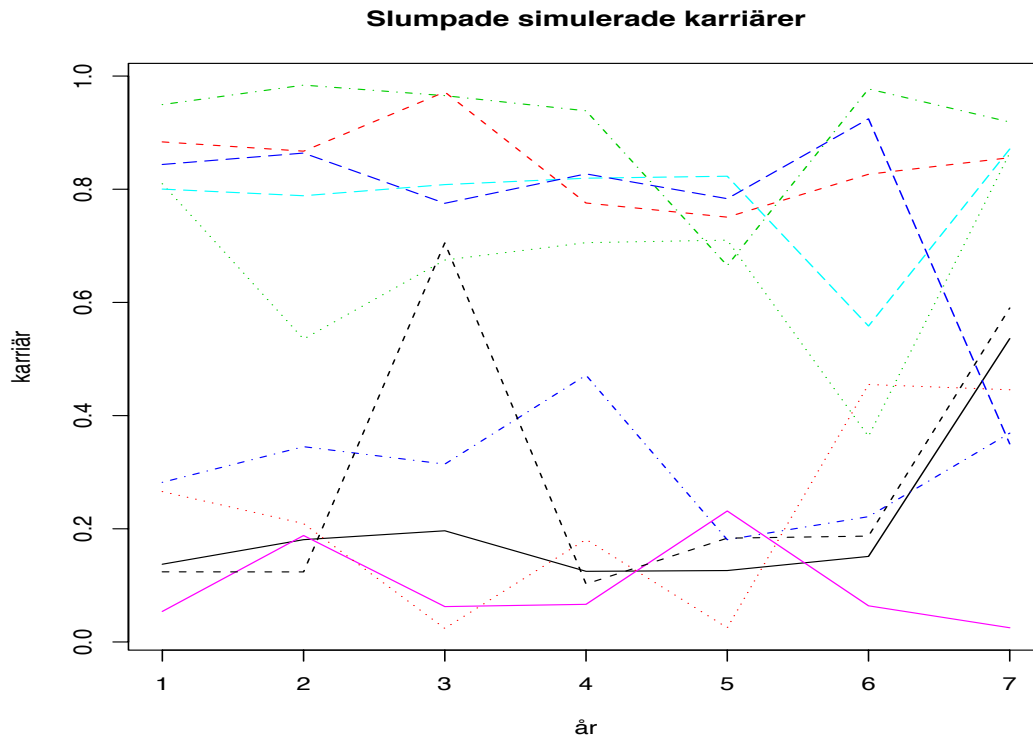
$$f_2(y; \mu_2, \phi_2) = \frac{\Gamma(\phi_2)}{\Gamma(\mu_2\phi_2)\Gamma((1-\mu_2)\phi_2)} y^{\mu_2\phi_2-1} (1-y)^{(1-\mu_2)\phi_2-1}$$

To illustrate the estimated distribution using a sample of country data Figure 1 shows the 2004 estimated distribution for a sample of 600 women born in Sweden who were 40 years of age and had an income rank 2003 between percentiles 49.5 and 50.5.



**Figure 1:** Empirical and estimated distributions for the income rank 2004 of 40 year old women born in Sweden given that they had a rank in 2003 between 0.495 and 0.505.

The green line represents the “stayers” and the red line the “movers”, when they are weighted together to form the estimated mixed beta distribution the result is the black line following the histogram of the data fairly close. Note that since each birth cohort consists of roughly 120 thousand individuals and women are roughly half the cohort, this graph is of roughly 600 women born in Sweden. What does this mean in terms of the relationship between income and earned pension rights? It is obvious that there are quite a few women who fall drastically in income rank. If the group of 40-year-old women born in Sweden is very homogenous this might not matter, as lowest and highest income would be fairly similar. However, even though Sweden has a very compressed income distribution the lower tail of the income rank in 2004 means that almost 6 percent of the women with median income in 2003 have less than half their income the previous year. In fact 3.5 percent of the women in the sample have less than a quarter of their earnings the previous year.



**Figure 2:** Simulated careers for 40-year-old men 1999.

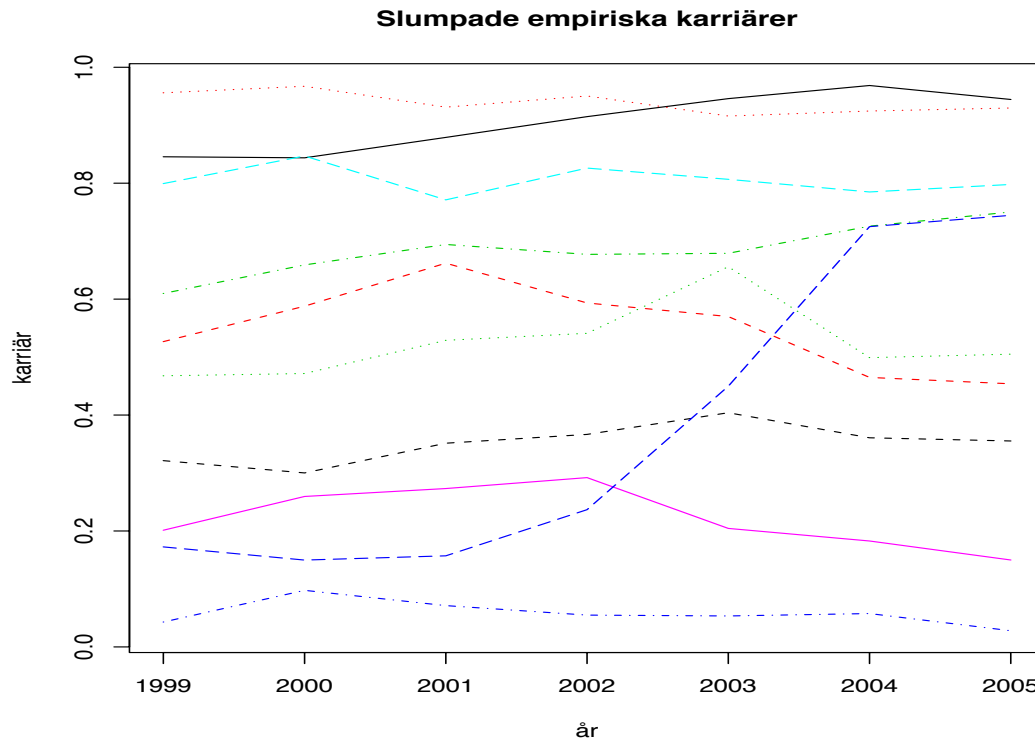
The fall in income with such a large percent of the cohort might not be a problem if individuals “jump” back up to their previous career. Simulating some careers from the model results in a picture that could support the view that there is not much to worry about. Figure 2 show simulated careers for 40-year-old men 1999 for seven years forward. It is clear that individual careers are very stochastic with both large upward jumps in income rank that mean a large increase in income, as well as large drops in income. Some transitional careers are generated as well where the individual have “a good year” and then are back to where they started.

This picture is of course not what is commonly believed to be the empirical picture of Swedish careers, where strong Unions and a lot of job security for persons with seniority are dominant features. Instead, one might

believe that this picture is more typical for young individuals just entering the labor market. With the careers shown in Figure 2 individuals would mix years with high contribution rate to their future pension with years with lower contributions and the result can very well be a pension that can sustain a sufficient standard of living.

Contribution payments are split between employer contributions and employee contributions in the Swedish framework. The Swedish pension system has a redistribution tax in that income above a ceiling does not render any pension rights but employers still have to pay contributions – and it is likely that the cost is passed to workers. The employee contribution for earnings below the ceiling is not paid though. An effect of this framework is that low earning years cannot be readily compensated with high-income years, as income above the ceiling does not yield any pension rights.

Figure 3 shows 10 random empirical careers for different income ranks. In contrast to the simulated careers the empirical careers do not show large jumps in income rank over the sample period. This suggests that large jumps in income could normally be to a new “career” level, which is beneficial if jump is positive but erodes future pension rights if the jump is negative. Our aim is, among other things, to identify and analyze more extreme jumps in both directions. These gaps in the income career that consists of lower income needs to be compensated in order to secure a sufficient standard of living at old age.



**Figure 3:** Empirical careers for randomly selected 40-year-old men 1999.

In this paper we identify and analyze the gaps in income and identifies groups at risk incurring these gaps. This is important information for policy makers in order to be able to correct possible structural problems. Some policies to counter structural problems are made in the Swedish pension system, as mentioned above, e.g. compensation to parents for absence from labor.

## Data

We use two sources of data: the official research/policy database LISA supplied by Statistics Sweden (SCB), and internal data from Swedish Pensions Agency on actual pension contributions. LISA contains various data on income,

unemployment, education and so forth<sup>4</sup> but does only have information on pensions paid out and not pension contributions earned. Therefore we impute pension contributions from the different income sources that are documented. However, we have recycled results from an earlier project performed at the Swedish Pensions Agency that we also use. All calculations in of ranks in the previous section were based on the actual data form the pension system on income that is eligible for calculation of pension contributions.

Some pension contributions can only be approximated with a very crude method: “dichotomous” type compensation where a status yields contributions that are based on something else. An example is rights in connection with childbirth. LISA only contains individuals of age 16 and older, which means that we cannot determine the first four years of child’s life to connect rights to parents. Instead we allocate this compensation to women that uphold maternity compensation. Another problem, but of minor importance, is military conscription, where compensation is based on number of days of service but LISA only contains income received. Since the compensation received for army service varies with the length of service and service can start and end in different calendar years, the correct number of days is impossible to determine. Some conscripted also receive compensation for rent if they have their own apartment, which is included in the total payment but is not base for pension contributions and rights.

The data range of LISA is 1991–2007 which gives us 17 years of data to study the individual distributions of contributions and especially the gaps in

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<sup>4</sup> [http://www.scb.se/en\\_/Finding-statistics/Publishing-calendar/Show-detailed-information/?PublObjId=16129](http://www.scb.se/en_/Finding-statistics/Publishing-calendar/Show-detailed-information/?PublObjId=16129)

contributions. Included in the data set are 9,6 million individuals in total and each birth cohort is roughly 125 thousand individuals.

## Analysis

First some basic statistics are presented for one birth cohort, the 1975 one whom are turning 16 during the first year of the database 1991, to set the stage for the analysis. After that the formal analysis of the accumulation of pension contributions is done.

## Earnings

As an introduction to the data and the Swedish labor market Table 1 displays the earnings distribution for the birth cohort from 1975 that turned 16 in 1991. The figures in the last two columns are calculated the percentage with income that had a value of at least a hundred Skr (column four), income high enough to obtain pension credits (column five). The lower bound total income in a given year below which pension credit is not granted was SKr 13,620 in 1991. This amount can be comprised of income of at least SKr 1,000 from each employer if earnings come from two or more employers.<sup>5</sup> Note that that level (13,620) is roughly 40 percent of the Swedish welfare norm excluding rent in 1991. Total welfare norm is roughly two base amounts, compared to this pension credits were awarded for incomes larger than roughly 20% of the welfare norm.

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<sup>5</sup> Note that this is 42.3 % of the price base amount of 1991 which is the rule from 2003 which is applied retrospectively since we are interested in how an NDC system for a developed country is behaving rather than the special case of Sweden.



	Mean	Median	Max	income	pgi
1991	7 910	6 300	130 700	0,53	0,06
1992	11 813	9 100	233 200	0,55	0,14
1993	15 585	11 100	244 000	0,56	0,19
1994	30 635	20 600	283 000	0,63	0,38
1995	52 804	37 100	519 500	0,68	0,50
1996	69 606	50 400	585 300	0,68	0,54
1997	83 423	63 200	730 000	0,69	0,57
1998	101 257	88 500	879 800	0,72	0,62
1999	119 408	117 000	1 934 400	0,74	0,66
2000	141 963	148 500	4 699 100	0,76	0,69
2001	163 574	174 900	4 890 000	0,76	0,71
2002	176 513	188 600	3 257 900	0,77	0,71
2003	187 224	199 900	2 484 100	0,76	0,72
2004	196 765	207 700	2 314 500	0,76	0,71
2005	207 941	216 000	2 652 000	0,76	0,72
2006	221 999	226 000	6 415 100	0,77	0,73
2007	238 787	239 100	5 751 000	0,79	0,75

**Table 1:** Yearly earnings from age 16 for persons born in 1975. Income is the fraction that have non-zero annual income in the specified year, and pgi is the fraction that are above the threshold to obtain pension rights. Based on a sample of all persons born 1975 who were still alive 2007.

It is notable from the “pgi” column that 25 percent of the cohort born 1975 does not have an annual income greater than 42.3 percent of the price base amount when they turned 32 in 2007. Already this is an indication that there might be many individuals with less than sufficient pension contributions to expect to earn a pension that can sustain a reasonable standard of living when they claim a pension at age 65, the age at which a guarantee can be claimed. Most likely they will receive full guarantee pension or a top up from the guarantee to strengthen their purchasing power.

By age 25 the median income is larger than the mean for the cohort born in 1975, which means that more than half of the cohort makes more than the mean income. For the cohort born in 1970 this occurs already at the age of 21 which is an indication that labor-market entry costs have gone up.

## Earnings Career

The first question for the size of pension in an NDC system is how many years does an individual work. The second question is how large were contributions in these years, i.e. what is the individual's level of income. The birth cohort of 1975 is only 16 years old in 1991 and therefore few will have 17 years of earnings in excess of two basis amounts.<sup>6</sup>

	1942	1945	1950	1955	1960	1965	1970	1975
c	12.36	13.58	14.05	14.03	14.01	13.92	12.88	9.12
	408.24	513.23	550.8	588.66	604.43	688.14	495.51	391.46
gender	-0.97	-0.83	-0.68	-0.83	-1.52	-2.25	-1.64	-0.89
	-28.86	-27.15	-22.76	-28.98	-55.69	-95.35	-61.01	-39.94
for 1	-0.6	-0.65	-0.63	-0.64	-0.62	-0.63	-0.92	-0.76
	-5.34	-6.97	-8.93	-10.61	-11.26	-13.53	-19.21	-20.49
for 2	0.85	-1.26	-0.96	-0.7	-0.75	-0.94	-1.35	-1.14
	2.11	-4.9	-6.13	-6.32	-7.98	-12.22	-20.25	-20.96
for 3	-4.45	-4.8	-5.26	-4.91	-5.28	-5.41	-5.51	-3.52
	-76.69	-84.91	-103.93	-99.64	-120.81	-140.6	-153.28	-130.67
edu <9	-1.54	-1.67	-2.6	-5.77	-6.19	-6.26	-5.9	-4.85
	-36.92	-40.93	-48.92	-86.2	-111.73	-135.17	-142.53	-158.79
edu 9	1.51	1.4	1.38	1.22	0.92	0.68	-0.28	-1.41
	27.96	30.35	34.83	32.55	24.91	21.14	-8.2	-45.7
edu Uni	2.19	1.89	1.82	1.35	0.66	-0.05	-1.46	-1.85
	47.97	49.61	51.43	38.55	18.93	-1.48	-53.5	-89.89
edu Post G	3.46	2.75	2.41	2,00	1.65	0.59	-1.74	-2.06
	31.00	27.23	24.29	18.55	16.01	6.38	-20.72	-29.82
vpl	-	-	-	-	-	-	0.58	0.47
	-	-	-	-	-	-	21.06	31.27
R2	0.13	0.13	0.2	0.29	0.36	0.4	0.44	0.41
R-adj	0.13	0.13	0.2	0.29	0.36	0.4	0.44	0.41

**Table 2:** Dummy regression of years of earnings in excess of two base amounts for Birth cohorts between 1991 – 2007. The independent dummy categories are: for1 = born abroad with non-Swedish born parents, for 2 = born in Sweden with non-Swedish born parents, for 3 = born abroad with at least one Swedish born parent, edu<9 = less than 9 years of school, edu9 = 9 years of schooling (mandatory in Sweden), edu Uni = university education, edu Post G = post graduate studies, vpl = military conscription. T-stat is in small print.

We argued above that to obtain a substantial pension it is important to have a many years with pension contributions. The dummy regression presented in Table 2 shows the expected: women, especially in younger cohorts have lower

<sup>6</sup> This is roughly the norm for eligibility for welfare benefit.

expected number of years with a pension base larger than 2 base amounts, where the reference individual is a male with 11-12 years of schooling who is born in Sweden with at least one Swedish born parent. For this cohort the expected number of years with a pension base of at least 2 base amounts increases up until the cohort born in 1950. A possible reason for why expected number of years with 2 base amounts of earning is lower for the 1945 and 1942 cohorts could be the downsizing of many business after the financial crisis in Sweden in the early 1990's, when many older workers were offered golden handshakes in the form of early pensions in order to for employers to retain younger employees. Individuals born in 1944 and earlier are also entitled to retire with public pension from age 61.

It is noteworthy that the gender dummy effect, 1 for women, is largest for birth cohorts when they are more likely to be on maternity leave from employment. But it also seems that women choose to retire slightly earlier than men since the effect then is larger once again when women are in their 60's. Another noteworthy effect is that for individuals born abroad with two foreign born parents. They have an expected number of years with earnings above our threshold that is a little less than a year shorter than for the base individual. The effect we find is a clear indication of labor market discrimination based on origin. Note that this effect lowers the expected number of contribution years with 30 percent for all birth cohorts we study.

Being born in Sweden with foreign-born parents (for 2) shortens the number of years with our minimum decided pension base with roughly one year. This could point to discrimination to some extent is related to a network effect rather than a pure discrimination effect on origin. Being born in, grown up in and

having gone to school in Sweden puts these individuals on an almost equal status with persons with two Swedish born parents, and gives them the all the opportunities of children born to native Swedes. Still there is a negative effect from two foreign born parents. But since the parents could be suspected to have a smaller or no network in terms of “opening doors” to entry jobs in the labor market, this could be the effect rather than “pure” discrimination on origin.

Note that worst-case scenario for an individual in terms of earning contribution-based pension rights is to be a female born abroad with two foreign born parents and less than 9 years of education. This leads to a reduction of expected number of years of contributions by 7 to 14 years. For this group the expected number years of obtaining our pension base income of 2 base amounts (the welfare norm) is virtually zero, for the three youngest cohorts. For the older cohorts the number of years are increasing with age which could be a sign of them staying home raising their children before entering the labor force.

For the two youngest cohorts we add in a dummy for conscription. It should be noted that although mandatory conscription has been less than a total cohort and the actual numbers conscripted fell over the sample period. Even though service eliminates the possibility to work for half a year to a year and a half (depending on the type of service) this effect is positive.

### **Pension base compensation**

As we have discussed above, the Swedish government pays pension contributions for insured period of absence from the labor force (e.g., sick leave, disability status, unemployment, compensated parental leave and compensated absence from work to care for a sick child) and non-contributory rights in

conjunction with childbirth, higher education and, as already discussed, military conscription. Child year credits are, for example, distributed the first four years of a child's life to the parent with the lowest current contributions, which is usually the mother – unless the parents choose otherwise.<sup>7</sup> An interesting question is whether this helps to fully compensate for earnings gaps associated with childbirth or if it is more of a gesture of “good faith”.

Since our data set does not allow us to replicate the Swedish pension system exactly this analysis has to be interpreted more as an indication of effects from compensations that are in the “spirit” of the Swedish pension system. The most important effects are from the compensation at childbirth and army service. Note that the effect from military service only impacts the results for the two youngest cohorts.

The differences in the results when the pension base also includes contributions for these social security add-ons are as follows:

- i. Higher education: Rights are granted to individual accounts equivalent to 138 percent of subsidy for university studies (not including borrowed money) which in 2007 was Skr 12,640 per semester ( €1,400 per semester). This amount constitutes imputed income for persons receiving student financial aid according to the database.
- ii. Unemployment insurance: In 2014 the maximum amount of unemployment insurance that can be received is Skr 680 per day, which is equivalent to Skr 18,700 per month. In the calculations total unemployment compensation is assumed. and included in the income base.

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<sup>7</sup> If there are two children under four, there is only compensation for one.

- iii. Sick leave compensated by social insurance: Sick leave is compensated in a way similar to unemployment insurance. The compensation rate is 80 percent below a ceiling of Skr 19,470 per month in 2014.
- iv. Permanent disability: Income is imputed for individuals with permanent disability. This compensation is included in the pension base.
- v. Parental Benefits: Contributions for parents are of three types: those based on replacement of income due to parental leave, those based on leave in connection with care of a sick child, and child year credits of up to four years (see above). Both parents are entitled to claim parental leave income, but the majority of benefits are drawn by women. Thirteen months of full parental leave income can be claimed but at least one month must be withdrawn by the other partner, popularly called the “daddy month”. An additional 3 months are available but with lower compensation. The daddy month was introduced in 1995. Compensation for lost income of 80 percent can be claimed for time at home for care of a sick child younger than 12 years old. These two forms of compensation are included in full in the pension base. Finally, the child year rights are granted for up to four years per child as already discussed. This can be calculated in three different ways. In this paper we only consider a top up to equivalent to 75 percent of the average pension base and a fixed amount that is one price base amount. The larger of the two is used. Further our database does not contain information on dates when children are born so we allocate these credits only to women for years when parental leave compensation is paid out (note that half days can be

used to calendar time can extend outside of 16 months).

	1942	1945	1950	1955	1960	1965	1970	1975
c	13.13	14.24	14.7	14.71	14.77	14.79	13.68	9.13
	475.7	601.17	645.89	691.09	696.87	789.07	547.91	391.61
gender	-0.71	-0.63	-0.32	-0.05	0.05	-0.45	-0.76	-0.87
	-22.55	-22.37	-11.64	-1.9	1.91	-19.44	-28.05	-39.00
for 1	-0.39	-0.5	-0.54	-0.43	-0.53	-0.57	-0.83	-0.76
	-3.81	-5.9	-8.53	-8.24	-10.73	-13.02	-17.71	-20.33
for 2	0.51	-1.04	-0.72	-0.61	-0.57	-0.66	-1.13	-1.12
	1.28	-4.47	-5.17	-6.24	-6.87	-9.17	-16.94	-20.57
for 3	-3.18	-3.89	-4.58	-4.53	-5.23	-5.61	-5.81	-3.52
	-53.94	-69.61	-91.78	-91.75	-113.62	-132.9	-147.97	-130.3
edu <9	-1.27	-1.46	-2.48	-5.86	-6.52	-7.02	-6.53	-4.85
	-32.53	-38.76	-48.26	-81.23	-100.63	-129.71	-138.36	-156.98
edu 9	1.00	0.97	0.94	0.83	0.4	-0.08	-0.97	-1.41
	20.24	23.21	26.5	25.00	11.77	-2.67	-29.27	-45.73
edu Uni	1.52	1.34	1.23	0.82	0.08	-0.8	-2.19	-1.86
	36.38	38.81	38.39	25.6	2.42	-26.24	-79.11	-90.53
edu Post G	2.61	2.01	1.66	1.19	0.69	-0.58	-2.54	-2.07
	24.68	20.89	17.28	11.35	6.68	-6.22	-30.15	-30.02
vpl	-	-	-	-	-	-	0.45	0.47
	-	-	-	-	-	-	16.74	31.16
R2	0.08	0.1	0.18	0.3	0.38	0.42	0.46	0.41
R-adj	0.08	0.1	0.18	0.3	0.38	0.42	0.46	0.41

**Table 3:** Dummy regression of years of earnings in excess of two base amounts for Birth cohorts between 1991 – 2007. The independent dummy categories are: for1 = born abroad with non-Swedish born parents, for 2 = born in Sweden with non-Swedish born parents, for 3 = born abroad with at least one Swedish born parent, edu<9 = less than 9 years of school, edu9 = 9 years of schooling (mandatory in Sweden), edu Uni = university education, edu Post G = post graduate studies, vpl = military conscription. T-stat is in small print.

When earnings histories including social security income are included in the income base there are two main changes: the negative gender effect with only earnings is lowered substantially and the effect from university studies decreases. It is also noteworthy that adding the different compensations for parental leave have an impact on the gender effect that is less pronounced for the youngest and two oldest cohorts. A suspicion is that this is due to compensations related to parenting are generous and have the intended effect,

but in the youngest cohort many might not have started a family yet and in the older cohorts the children are grown, which is why we believe these cohorts are not affected by contributions from parenting. Chłon-Dominczak, Franco and Palmer (2012) present a similar result from the OECD pension model for Sweden, where the parental compensation is shown to almost cover the career change following childbirth, when the absence from the labor market is one year. The effect is diminishing with time as the absence from labor market is extended due to longer parental leave.

The structural problem that leads to a high entry cost for individuals with foreign parents (variable “for 2” for born abroad with parents that both were born outside Sweden, and “for 3” which is born in Sweden with both parents born abroad) appears to be less severe with the addition of the various supplements for periods covered by social insurance, child years, etc. Especially the older cohorts have a smaller effect from being both born abroad and with both parents born abroad. This could probably be explained by the fact that older cohorts of individuals with foreign background came due to the shortage of workforce in the growing Swedish industry starting the 1960's. This means that they became established almost immediately on the labor market and also qualified for full social insurance. Adding on social insurance then raises income and more individuals move above our earnings threshold. For the younger cohorts, whether born abroad with foreign parents or born in Sweden with foreign parents, with the deep recession in the beginning of the 1990's, it was tough to enter and get a foothold in the labor market. Together with the increased number of refugee immigrants, which are more likely to have fewer years of education than other immigrants, this could have had the effect on



reducing the impact from social insurance income on the younger cohorts with foreign background.

University education has a lower impact across all cohorts when social insurance-, parental leave-, and higher education compensation are added to labor income. Since the lion's share of student financing is in terms of a loan that is not included in determining the size of the pension contribution, the marginal effect is very low. For postgraduate studies the effect is smaller across the cohorts, but the difference is very small for the youngest cohort. When you are older the postgraduate education raises income as it is not "endogenous" to obtain it, i.e. you are likely to have obtained the education before our sample so we only see the individuals reaping the benefits. The same is true for regular university education. For the younger cohorts the time devoted to education decreases the possibility to earn enough to climb above our earnings threshold, which lowers the maximum possible years of the earnings.

Really low education is low across all cohorts but low education consisting of 9 years actually is positive for the older cohorts. Maybe this is due to the fact that the overall formal educational level was lower historically. For cohorts born for example in 1945, nine years of schooling could be quite long as mandatory schooling consisted of only seven years. The youngest cohorts have negative effects from longer schooling, which is expected since years in university could otherwise been used working. This illustrates one of the dangers of long term studies, the opportunity cost is that years that could have been earning income to be included into the pension base is instead used for studies with a low contribution rate. Finally it is important to note that if as in Sweden a ceiling that is rather low is put on the earnings giving contributions for

pensions it is harder to compensate shorter careers due to studies with higher income.

The expected number of years with earnings above our threshold for the baseline group, males with eleven to twelve years of schooling, also increases for all cohorts. For the youngest cohort the increase in expected years with labor- and social security income above our determined threshold is only marginal. This is probably partly related to the effects analyzed above: the generous parental income compensation does not apply to many in this cohort since few in this cohort might have started families yet, the pension contribution is very low and many in this cohort have probably studied at university between the analyzed years 1991–2007. Above we also discussed the effect on this birth cohort from entering the labor market during the deep recession of the early 1990s.

## **Conclusion**

This is the first stage in a larger project aiming to fully analyze and disentangle all parts of the pension system and earnings possibilities to evaluate the differences and similarities between NDC and NDB systems. Here we have established that there are structural features even in a country like Sweden with very low income inequalities and high gender equality. These features will be reflected in NDC pensions. The Swedish system therefore have included pension fees on social insurances and unemployment payments in order to generate pension contributions even when bad luck keeps you outside the labor market. We have found, as we expected, that the two main markers for a lower expected number of years earning at least two base amounts (the welfare norm) are

gender and foreign origin. To lessen the gender effect associated with child birth the Swedish pension system has included subsidized pension contributions not only for actual social security payments associated with parental leave, but also a contribution for the first four years of a child's life. This treatment is found to remove much of the gender effect in our dataset.

However, including social security compensation for income loss due to temporary or permanent inability to work does not remove the negative effects of foreign origin. This could be due to the higher entry cost to the labor market in Sweden for individuals with foreign origin. Adding contributions based on income would then not help as the unemployment rate is higher which spills over to the pension contributions due to lower income overall. Education has a positive effect on the number of years with income above the threshold except for the youngest cohorts due to fact that there is an opportunity cost in terms of losing possible working years for studies.

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