The Role of Revaluation and Adjustment Factors in Pay-As-You-Go Pension Systems

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This study examines the role of revaluation and adjustment factors in pension systems. The first part sheds light on the determination of revaluation and adjustment factors according to the General Social Security Act (Allgemeines Sozialversicherungsgesetz – ASVG) and how these factors have evolved over time. The analysis shows that since the mid-1980s the revaluation factors have been set more or less in line with the inflation rate; in other words, contributions have not, in fact, been revalued in real terms.

The author then demonstrates that such a system eventually conflicts with principles of intragenerational and intergenerational fairness. In such case, the mere extension of the assessment period may entail substantial reductions in pension benefits. When we consider the Austrian situation, extending the assessment period from 15 to 40 years may cause the average pension to drop by 11% to 36% (depending on the underlying assumptions). Capping maximum losses at 10% certainly is a solution for persons aged 35+ at the cutoff date, but anyone younger than that would have to bear the brunt of such a pension reform measure. In the light of the problematic fairness aspects of the current revaluation regime, relating the necessary reform of the Austrian pension system and the concomitant paring of benefits too closely to the effects of this revaluation regime does not seem to be the right approach. In a new (harmonized) system, the revaluation factors should at any rate be linked to wage growth.

The last section of this paper focuses on issues which are crucial in wage-based revaluation regimes and which are mainly related to the emergence of demographic shifts. Some of the questions tackled are: Should revaluation be based on the growth rate of average earnings or of the total wage bill? Is the 80-45-65 formula frequently cited in the pension reform debate in Austria consistent in itself? Should automatic adjustment factors (sustainability factors) be built into the pension system, and if so, which ones? Does it make any difference then whether we are dealing with a traditional pay-as-you-go pension model or a notional account system?

1 Introduction

The political and public debate of the past few months revolved to a considerable degree around the Austrian pension reform adopted in 2003 and the forthcoming harmonization of pension systems. The intensity of the debate also reflects the significance of the old-age provision (sub)system under the General Social Security Act (Allgemeines Sozialversicherungsgesetz – ASVG). As it is nearly impossible to explore all the intricacies of the pension system and conceivable reform measures in a short paper, this study deals only with one particular aspect and explores it from the perspective of fiscal solidity and structural solidarity (intra- and intergenerational fairness).

The focus is on issues of revaluation and adjustment. At first glance, this may seem to be an insignificant aspect, but upon closer inspection, we see that revaluation and adjustment are crucial to any pay-as-you-go pension system. When compared to marketable financial products, the revaluation factor would essentially correspond to the interest on contributions and the adjustment factors to the indexing of annuities, both central provisions of the respective contracts.

Chapter 2 sheds light on the determination of revaluation and adjustment factors according to the ASVG and how these factors have evolved over time.

Chapter 3 then continues to explore in how far such a system conflicts with principles of intragenerational and intergenerational fairness. Furthermore, we see that the mere extension of the assessment period may

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entail substantial reductions in pension benefits. Chapter 4 is dedicated to the quantification of these effects within a framework reflecting the Austrian situation. In the light of the problematic fairness aspects of the current regime, in an overhauled system the factors of revaluation should follow the growth rate of wages.

Chapter 5 highlights issues which are relevant for wage-based revaluation and which should be taken into account in a new system. Among others, the following questions are tackled: Should the growth rate of the average wage or of the total wage bill be used for revaluation purposes? Is the 80-45-65 formula frequently cited in the Austrian pension reform debate (80% replacement rate at the age of 65 following 45 years of contributory service) consistent in itself? Should automatic adjustment factors be built into the pension system, and if so, which ones?

The results are summarized in the final chapter.

2 Revaluation and Adjustment in Austria

2.1 Definitions

According to Austrian pension law, a person's initial pension benefit, i.e. the benefit as at the time of retirement, is determined as follows:

initial pension = accrual rate × pension assessment base (1).

The accrual rate essentially depends on a person's employment history (e.g. period of actual and credited service, premiums and discounts depending on the actual retirement age); under the statutory scheme provided for by the ASVG, it amounts to 80% for the "benchmark" pensioner. The assessment base corresponds to the revalued annual earnings averaged out over the assessment period. The assessment period (AP) reflects how many of the "best" earnings figures are used to calculate the pension benefits, and the revaluation factors determine how past earnings are translated into current purchasing power units. Such adjustment is necessary because otherwise the relative amount (i.e. the "relative real income sacrifice") of contributions made a long time ago would be grossly undervalued. For this reason, it is often argued that the adjustment of previous annual earnings should be linked to wage growth.

Current pensions are adjusted as follows on an annual basis:

pension = pension of the previous period × adjustment factor (2).

In most countries, the adjustment factor equals the inflation rate or nominal wage growth.

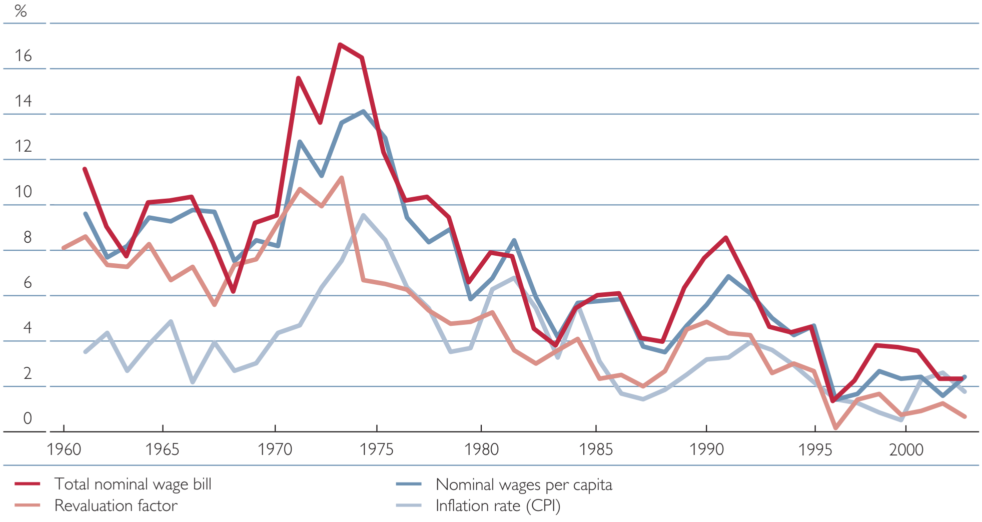
2.2 Revaluation Factor Developments of the Past Decades

As is evident from chart 1, the annual revaluation factor falls short of the growth rate of the total nominal wage bill or the per capita nominal wages nearly every year. At the same time, we see that the revaluation factors and the inflation rate have been developing almost in sync since the mid-1980s. In other words, past annual earnings are not adjusted at all for productivity gains or real economic growth.

When we look at the annual gaps of the revaluation factors, the differences seem to be minor. The effect of compound interest mounts up over the years, however, causing small amounts to increase substantially. Table 1 highlights that the current scheme leads to considerable cumulative effects. While the average nominal total wage bill has increased almost

Chart 1

Revaluation Factors and Macroeconomic Indicators



Source: Total nominal wage bill: AMECO (Compensation of employees, total economy; UWCD); nominal wages: AMECO (Nominal compensation per employee, total economy; HWCDW); inflation rate: OECD – Economic Outlook (AUT"CPI"]); revaluation factor: calculations based on Federal Law Gazette II No. 611/2003.

twentyfold since 1960 and more than eightfold since 1970, annual earnings of those years are revalued merely by a factor of 6.65 and 3.29, respectively. Even for the relatively short period since 1990 the cumulative effects of incomplete revaluation are quite substantial. Again, we find that the cumulated revaluation factor (123.7) is close to the cumulated inflation factor (130.87) and that, on the other hand, real gains are left completely unaccounted for.

This gross disparity is ascribable to the legal provisions laid down in paragraph 108 of the Austrian Social Security Act, according to which existing pensions must be adjusted such that the average net pension grows at about the same pace as average net annual earnings. However, the average net pension also increases when current pension payouts remain unadjusted because every year some of the (relatively low) pensions expire whereas (relatively high) new pension payouts become effective. This structural effect was estimated to amount to 1% to 2% per year. In a somewhat illogical move, the amount of the revaluation factors was linked to these adjustment factors (with a time lag), causing the revaluation factors to systematically lag behind wage increases. At the same time, this coupling mechanism results in a recursive, dynamic system since the assessment bases of the (distant) future are likely to be smaller given incomplete revaluation. Initial pensions are therefore likely to be lowered as

Table 1

Cumulated Effects until 2002

Base year (= 100)	Revaluation factor	Total nominal wage bill	Nominal wages per capita	Inflation rate
1960	664.5	1,959.19	1,443.75	479.07
1970	328.8	818.36	635.05	337.03
1980	168.4	266.87	241.88	184.96
1990	123.7	157.25	146.84	130.87

Source: OeNB (data see chart 1).

well, which might eventually dampen the structural effect.[2] As decided in the course of the 2003 pension reform, in the years 2004 and 2005, pensions will not be adjusted in line with paragraph 108 of the Austrian Social Security Act; the provisions on the revaluation factors have, however, remained unchanged.

To summarize, under the Austrian revaluation regime, previous contributions are de facto indexed to the inflation rate only and are therefore decoupled from real economic developments.

3 Reasons for Linking Revaluation Factors to Wage Development

In this chapter a numerical example is presented to show in how far an "incomplete" revaluation method, i.e. one that does not factor in wage growth, is problematic and why "complete," i.e. wage-based, revaluation is preferable.

3.1 Revaluation with Wage Growth

Table 2 depicts the schematic life cycle of a fictitious birth cohort consisting of two persons, A and B. Both work for two periods and, in the subsequent period, receive a pension. Let us assume that one period spans 20 years, and that A and B enter the labor force at the age of 20. The average (wage-based) income $\bar{\omega}$ grows at a rate of 50% ($\gamma = 0.5$),[3] and the pension insurance contribution rate (τ) is assumed to equal 25%. In the example, we assume intragenerational differences in the wage profile, which is increasing for A and declining for B. The accrual rate is set at s = 0.5 and revaluation is based on the growth rate.[4] If we use two assessment periods to calculate the pension (columns 7 and 8 of table 2), we arrive at a pension of 112.5 for both A and B – see equation (1) – which amounts to 50% of the then current average income of 225.[5]

Table 2

Pension Account of a Cohort – Revaluation with Wage Growth[1]

	Employment				Pension revaluation: growth AP: 1 period		Pension revaluation: growth AP: 2 periods	
	Period 1 (earnings)		Period 2 (earnings)		Period 3 (pension)		Period 3 (pension)	
	absolute	relative	absolute	relative	absolute	relative	absolute	relative
Person A	50	0.5	225	1.5	168.75	0.75	112.5	0.5
Person B	150	1.5	75	0.5	56.25	0.25	112.5	0.5
Average earnings	100	×	150	×	225	×	225	×
Average pension	×	×	×	×	112.5	0.5	112.5	0.5

Source: OeNB.

[1] The growth rate γ is assumed to be 0.5; average earnings thus increase from 100 to 150 in period 2. The relative amount of both earnings and pensions refers to the ratio to the average earnings accrued in the respective period. Pensions were calculated on the assumption that the contribution rate equals 25% and the accrual rate is 50%; thus the pension system posts a balanced budget.

[2] *For an extensive discussion of this topic, see Stefanits (2003). Knell (2003) demonstrates how the legal framework can be translated into a formal, dynamic system.*

[3] *This is a realistic assumption given that a period spans 20 years.*

[4] *Inflation is left unaccounted for in the example, which is why nominal growth corresponds to real growth and no revaluation is implicitly tantamount to a revaluation with the inflation rate.*

[5] *The pension (in period 3) is calculated as follows:* $p_3 = s\frac{1}{2}(AWF_2 w_2 + AWF_1 w_1)$, *with* AWF_t *the revaluation factor,* w_t *the individual wage and* p_t *the pension in period* t. *For person A, we arrive, for instance, at:* $p_3 = 0.5\frac{1}{2}\left[(1+0.5)225 + (1+0.5)^2 50\right] = 112.5.$

In case this life income cycle is the same for every birth cohort, the pension system in this example is in balance in every period. This becomes immediately evident when we take a look at the budget equation underlying any pay-as-you-go pension system (see box "Budget Equation of a Pay-As-You-Go Pension System").[6]

Budget Equation of a Pay-As-You-Go Pension System

The following condition must hold for a pension system to have a balanced budget, i.e. to not require any funding from the general government budget:

$$\tau_t \bar{\omega}_t L_t = \bar{p}_t R_t$$

(contribution rate × average income × number of employed persons
= average pension × number of pensioners) (3).

Should the size of the cohort remain constant over time, a simplified equation applies:

$$\tau_t \bar{\omega}_t G = \bar{p}_t H \quad (4),$$

where G denotes the number of employment periods and H the number of pension periods. For the example presented in the text, we thus arrive at: 0.25 × 225 × 2 = 112.5 × 1.

It is possible to rearrange equations (3) and (4), respectively:

$$\underbrace{\tau_t}_{\text{Contribution rate}} = \underbrace{\frac{\bar{p}_t}{\bar{\omega}_t}}_{\text{relative pension level}} \times \underbrace{\frac{\bar{R}_t}{\bar{L}_t}}_{\text{old age dependency ratio}} \quad (5).$$

The old-age dependency ratio equals the ratio of the number of pensioners to the number of persons of working age. The average relative pension level, hereinafter denoted as $q_t = \bar{p}_t / \bar{\omega}_t$, reflects the percentage of the average income the average pension amounts to. In the literature, we sometimes encounter the expression "replacement rate" for the relative pension level. This is somewhat misleading because the term replacement rate sometimes also refers to the ratio of the initial pension to final pre-retirement earnings or to the average income (see section 5.2).

3.1.1 Long Assessment Periods Increase the Degree of Intragenerational Fairness

A shortened assessment period yields a different result (columns 5 and 6 in table 2). While the *average* pension payout still amounts to 50% of the average earnings, the relative pension levels now diverge between the individual periods. Person A receives 75% of the average income, whereas B has to make do with 25%. This "inequality" is traceable to the fact that the assessment period comprises only one period. This is why A's relatively meager income years are not counted, while vice versa B's good income years are not factored into the calculation either. Most people would consider such a situation as unfair. It follows that a long assessment period (covering a person's entire employment history) raises the degree of intragenerational fairness.

3.1.2 Possible Solutions to Financing Problems

Should a pay-as-you-go pension system encounter financing difficulties (e.g. in the face of demographic pressures), a balanced budget may be restored essentially via three parameters, as shown in equation (5). It is possible to increase the contribution rate, reduce the relative pension level or lower the old-age dependency ratio

[6] *In the following "balanced budget" always refers to a balanced budget of the pension insurance system, i.e. equation (3) is fulfilled.*

(e.g. by raising the retirement eligibility age).[7] Let us assume for the above-mentioned example that at a given point in time, life expectancy soars and that any cohort consequently spends two periods in retirement.[8] Using equation (4), one can calculate how the three suggested solutions would work out in practice:

– The contribution rate τ is raised from 25% to 50%.
– The relative pension level q is lowered from 0.5 to 0.25.
– The old-age dependency ratio is maintained at 0.5 instead of allowing it to increase to 1. This means that the employment period must be extended to 2.667 periods and that the pension period accordingly amounts to a shortened 1.33 periods.

In addition to these solutions, each of which rests on only one instrument, it is possible to combine the three measures provided equation (4) is fulfilled.

3.2 Incomplete Revaluation

Let us now turn to the case that previous contributions are not revalued in real terms. As outlined before, this corresponds to the situation in Austria. Table 3 illustrates this case, again for the variants with two (AP = 2) and one (AP = 1) assessment period(s). Such incomplete revaluation would result in an assessment base which is much lower than that of the complete revaluation scenario; under such circumstances, a 50% accrual rate would yield a budget surplus. To ensure comparability, we set the accrual rate for both variants such that it likewise leads to a balanced budget under the given assumptions. It follows that $s = 0.9$ for the variant AP = 2 and that $s = 0.75$ for AP = 1.

Table 3

Pension Account of a Cohort – No Real Revaluation[1]

	Employment				Pension revaluation: growth AP: 1 period		Pension revaluation: growth AP: 2 periods	
	Period 1 (earnings)		Period 2 (earnings)		Period 3 (pension)		Period 3 (pension)	
	absolute	relative	absolute	relative	absolute	relative	absolute	relative
Person A	50	0.5	225	1.5	168.75	0.75	123.75	0.55
Person B	150	1.5	75	0.5	56.25	0.25	101.25	0.45
Average earnings	100	×	150	×	225	×	225	×
Average pension	×	×	×	×	112.5	0.5	112.5	0.5

Source: OeNB.

[1] The growth rate γ is again assumed to be 0.5 and the contribution rate 25%. The accrual rate leading to a balanced budget can then be calculated: 90% (AP = 2), 75% (AP = 1).

In both scenarios, individual inequalities ensue. Even in the two-period scenario persons with a steeper wage profile (person A) reach a higher relative pension level. This is ascribable to the fact that for them the best income years occur at the end of their employment record and that these years are affected less by incomplete revaluation.[9] Furthermore, we find

[7] *Naturally, it is additionally possible to tap other financing sources, e.g. funds from the general government budget. In the simple example such "revenue-side" measures are included in the contribution rate, though.*

[8] *The overall life span thus mounts to $G + H = 4$.*

[9] *In the scenario with only one assessment period, the example is construed such that the pension calculation is based on the final, and not on the best, income years. Granted, this is for demonstration purposes only. Given incomplete revaluation, the final years are in general also the best years.*

that extending the assessment period, ceteris paribus, reduces the sum of pension payouts.

3.2.1 Extending the Assessment Period Entails Pension Cuts

Again, we can analyze what the response to an increase in life expectancy (H increases from one to two periods) could look like in this model. Let us assume that the current pension – see equation (2) – is not adjusted in real terms (by analogy to the revaluation provision) and that we are dealing with incomplete revaluation and an assessment period of one period (20 years); this corresponds to columns 5 and 6 of table 3, where $s = 0.75$. To balance the resulting deficit, the following solutions are available:

– The contribution rate τ is raised from 25% to 41.67%.
– The accrual rate is reduced from 75% to 45%.
– The assessment period is extended to two periods and, at the same time, either the contribution rate is raised to (a lower) 34.72% or the accrual rate is cut to (a higher) 54% (or a combination of both).

Thus, in the case of incomplete revaluation, the pension level may be reduced simply by extending the assessment period. This drives down both the assessment base and pension claims, and it is not necessary to change the "observed" accrual rate (or it has to be cut to a lesser extent, as in our example).[10]

3.2.2 Incomplete Revaluation Conflicts with Intragenerational and Intergenerational Fairness

The most important properties and problems of a system with incomplete revaluation may be summarized as follows.

Conflict with intragenerational fairness principles. As is evident from the example in table 3, persons with identical relative income positions during their employment history are allocated different pensions. Incomplete revaluation (implicitly) benefits rising wage profiles (exemplified by person A). Such inequality runs contrary to the general understanding of "fair consideration" of contribution periods spread over the life cycle. Even using the complete assessment period does not eliminate this inequality.

Conflict with intergenerational fairness principles. The examples given in tables 2 and 3 consider only one generation each. It would, of course, also be interesting to investigate how different cohorts are treated in one and the same pension system. In contrast to the intragenerational analysis, to this end we use the contributions and pension benefits of the representative (average) members of different cohorts and examine whether burden sharing between these generations meets the commonly understood notion of fairness. This intergenerational perspective touches on a key aspect of pay-as-you-go pension systems, whose raison d'être lies in the intertemporal and intergenerational redistribution of income flows. At the same time, it is related to fundamental issues of equity and fairness theories (Konow, 2003), which will not be dealt with in

[10] *In the case of complete revaluation – as in table 2 – this is not possible. Here, extending the assessment period entails shifts in the intragenerational distribution but leaves the average pension level and thus the expenditure burden unchanged.*

detail here. As discussed at greater length in Knell (2004), a generally accepted principle of intergenerational fairness states that two generations which differ only with respect to when they live should be treated the same, so that the resulting payment flows result in identical "proportionality measures."[11] The proportionality measure is defined as follows:

$$\text{Proportionality measure} = \frac{\text{sum of relative outcomes}}{\text{sum of relative inputs.}}$$

If for instance – in an example with two employment periods and one pension period – one cohort pays a contribution rate of 10% (relative input) and another one of 20%, the cohort with the twofold contribution rate should attain a twofold pension level as well (i.e. the ratio of the relative pension levels q should also equal 0.5).

Incomplete revaluation violates this fairness principle, though. Of two identical cohorts – with identical contribution rates – that cohort will attain a higher relative pension level which worked in times of *lower* growth rates.[12] By contrast, such problems are nonexistent in wage-based revaluation regimes.

4 Assessment of Individual Measures of the 2003 Pension Reform

So far, only fictitious examples have been discussed. In the light of the above findings, let us therefore now assess and quantify the respective measures of the Austrian pension reform adopted on June 11, 2003, as part of the budget trailer bills.

In this context, the focus will be on the measures related to the topic of this study, i.e. the change of the assessment period and concomitant maintenance of the revaluation and adjustment provisions as laid down in paragraph 108 of the Austrian Social Security Act. Drawing up a precise assessment of the effects is a complex and daunting – and, with the exception of a few isolated calculations, unprecedented – endeavor. Table 4 shows the changes (in the initial pension benefit) resulting for the average cohort member upon an extension of the assessment period from 15 to 40 years if (i) no real revaluation is carried out,[13] (ii) the growth rate amounts to 2% and 1%, respectively, and (iii) three different assumptions about the seniority profile are used.

Table 4

Average Loss in Pensions for an Assessment Period Extension from 15 to 40 Years

Average growth rate	Seniority-based remuneration – annual increase		
	0%	1.5%	2.5%
	%		
2%	–20.2	–30.6	–36.0
1%	–11.2	–24.1	–30.6

Source: OeNB calculations.

[11] *Similar concepts are "Teilhabeäquivalenz" (Breyer, 2000) and "quasi-actuarial fairness" (Lindbeck and Persson, 2003).*

[12] *It is shown in Knell (2003) that the magnitude of the resulting intergenerational fluctuations is not negligible.*

[13] *Revalued at the inflation rate only.*

The examples presented in tables 2 and 3 do not account for seniority-based remuneration (i.e. rising wage profiles throughout the employment history). To capture reality, seniority-based remuneration must be taken into account, however, since a steeper wage profile amplifies the effects induced by an extended assessment period. For simplicity, we start from a linearly rising wage profile and assume that each additional employment year translates into 2.5% or 1.5% higher income.[14]

As borne out by these back-of-the-envelope calculations, the mere extension of the assessment period (while all the other adopted reform measures are excluded) entails noticeable pension cuts in the neighborhood of between 11% and 36% (depending on the assumptions about the growth rates and the underlying seniority profile). Note that the loss relates to the *average* cohort member.

The figures shown in table 4 do not reflect the eventual loss actually incurred by persons aged 35 years and above since in their case a capping provision takes effect which limits the maximum loss to 10%. As the average cohort member is expected to reach this 10% ceiling rather quickly, this provision de facto means that all persons aged 35 years and above must take a 10% pension cut. The problematic intragenerational and intergenerational fairness features of the current system described above are therefore prolonged. It goes without saying that the switch from "capped" to "noncapped" pension cohorts represents a gross inequity hardly justifiable from an intergenerational perspective.

Without a doubt, reforms were and are necessary to guarantee the fiscal sustainability of the Austrian pension system. Nevertheless combining the current revaluation regime with individual reform measures (especially the extension of the assessment period) generates effects which are considered problematic and worthy of improvement.[15] Finally, even if the new harmonized system were to be built on wage-based revaluation, appropriate transitional provisions would have to be drawn up.[16]

5 Issues Related to Wage-Based Revaluation and to Pension Adjustment

Wage-based revaluation helps avoid most of the aforementioned conflicts with intragenerational and intergenerational fairness principles. The difficulties of wage-based revaluation are different and are, above all, associated with demographic shifts, which have largely been excluded so far. Roughly speaking, there are three types of demographic processes that play a significant role in this context.

– **Fluctuations in the size of birth and work cohorts.** In Austria, the birth rate has been on a steady decline over the past decades.[17] While migration and stepped-up

[14] *In addition, the results in case of nonexistent seniority-based remuneration (zero growth rate) are presented. The 1.5% and 2.5% rates are basically in line with empirical estimates for Austria (Festerer and Winter-Ebmer, 1999, tables 1 and 2). All three assumptions are debatable, particularly the assumption about the development of the revaluation factors, as the latter are linked to the adjustment factors, which in turn depend on the structural effect. The results are, however, useful as a first approximation of the effects.*

[15] *The pension reform commission (PRK) itself almost unanimously arrived at the conclusion that the provisions on the revaluation factors and net adjustment were no longer effective; and a case was made for wage-based revaluation (PRK, 2002, p. 55).*

[16] *It could, for instance, be stipulated that each additional credited year be fully revalued.*

[17] *More than 130,000 births a year in the 1960s contrast with a current 80,000 a year.*

labor force participation have helped to somewhat constrain the effects of this downward trend on the size of the work cohorts, the fluctuations in the cohort size nevertheless cause problems for fiscal solidity and intergenerational solidarity.

- **Life expectancy** has been on a steady rise over the past decades, and it is assumed to increase by one year every six to eight years. This means that – given a constant pension eligibility age – the ratio of the employment period to the pension period will likewise shift steadily, again generating fiscal and intergenerational distribution problems.
- Economic fluctuations traditionally give rise to **variations in the employment ratio** (unemployment and labor force participation), which eventually results in variable contributions.[18] The sensitivity of a pension system to sharp cyclical movements should be kept to a minimum.

According to calculations based on conditions before the 2003 reform, in Austria the aggregate impact of these demographic fluctuations might drive up the old-age dependency ratio[19] from 22.9% (2000) to 40.7% (2030) (PRK, 2002, p. 72).

The challenge therefore lies in designing a rule-based structure for a pay-as-you-go pension system that accounts for these demographic trends and is at the same time sustainable in fiscal terms and intergenerationally equitable. In the following we will elaborate on several aspects of this issue.

5.1 Should the Growth Rate of Average Earnings or of the Total Wage Bill Be Used for Revaluation?

This question is not only key to any pay-as-you-go pension system, but it also plays a pivotal role in designing a notional account system and setting the "notional interest rate."[20] Undoubtedly, any revaluation rule based in some way on wage growth (or on real growth) is preferable to the current revaluation method. In a next step, the question arises which measure should be at the center of such wage-based revaluation. In the absence of demographic changes this distinction would be irrelevant because in that case the total wage bill $\bar{w}_t L_t$ would grow at the same rate as average earnings $\bar{w}_t$. This distinction, however, becomes crucial in the face of varying cohort sizes and cyclical employment fluctuations, which result in a variable employment figure L_t over time.[21] Country-specific practices differ widely in this respect. For instance, revaluation is based on wage growth in Germany and Sweden, and on total wage bill growth in Poland and Latvia.

Pension systems fulfill two core functions. They provide for both intertemporal consumption smoothing over time and risk sharing at a given point in time.[22] The principles of intragenerationally and intergeneration-

18 And – with a greater time lag – also to fluctuations in the setting of individual assessment bases for determining the pension level.

19 Old-age dependency ratio = persons aged over 65 / persons aged between 15 and 64.

20 The "notional interest rate" refers to the interest rate paid on contributions credited to an individual notional account.

21 For a discussion of the issue of a rising life expectancy, see section 5.2.

22 For more information on risk sharing, see Gordon and Varian (1988) as well as Shiller (1998).

ally fair consumption sharing may conflict with the principles of optimal risk sharing. It is possible to demonstrate that wage growth-based revaluation ensures compliance with the principle of an intergenerationally constant "proportionality measure" (section 3.2.2). If, by contrast, total wage bill growth is used for revaluation (and if current pensions are adjusted accordingly), this principle may be violated ex post; on the other hand, greater risk sharing ensues between pensioners and persons in the labor force. These considerations should at any rate be taken into account in choosing a revaluation regime, and, importantly, attention should also be paid to how times of nonemployment (credited service) are factored into pension calculations.

Furthermore, note has to be taken of the fact that given varying cohort sizes, neither of the two revaluation variants automatically balances the budget. At first glance, one could be led to believe that revaluation with total wage bill growth accounts for demographic shifts insofar as they are also reflected in the fluctuations of L_t. It can be shown, though, that this holds true only for the simplest two-period model $(G = 1, H = 1)$ and not in general.[23] Amid fluctuating fertility rates and cohort sizes a pay-as-you-go pension system requires explicit demographic adjustment measures to remain fiscally sustainable. A discussion of some aspects of automatic adjustment factors follows below.

5.2 Increase in Life Expectancy and the 80-45-65 Formula

The current debate frequently refers to one consensual cornerstone: The new harmonized pension system is meant to be in line with the 80-45-65 formula – 80% pension after 45 years of contributory service at the age of 65. In the light of an ever-rising life expectancy, it is but a question of time when such a formula will cease to be applicable. If the contribution rate is to remain constant (and this is almost always the explicit or implicit assumption), this formula does not provide any flexible adjustment parameter, which means that the financing gap would eventually have to be covered by tax revenues. Nevertheless, such a formula may serve as a useful reference point during a pension reform. This would, however, by extension imply that it – at least roughly – complies with a balanced pension system based on the current demographic framework conditions.

Let us now investigate whether an average pensioner who retires at the age of 65 with 45 years of contributory service is indeed eligible for an 80% replacement rate on the condition of a constant contribution rate and a balanced budget. Revaluation is assumed to be based on wage growth and the average life expectancy to stand at 80 years (at present: 75 years for men and 81.5 years for women).[24] No immediate answer can be given to the question whether an 80% replacement rate is feasible under these conditions without previously clarifying the following issues: Which income concept (gross or net earnings, etc.) at which point in time

23 *Lindbeck and Persson (2003, p. 86f.).*

24 *In line with the notation introduced in chapter 3, the central parts of the formula are as follows: $G = 45$, $H = 15$ and $t = 0.228$.*

(final earnings, average life income) does the replacement rate refer to? Are we dealing with the replacement rate of the initial pension only or with the average replacement rate over the entire pension period?

In the current debate, the replacement rate usually relates to the average life income and the focus is exclusively on the initial replacement rate (referring to the initial pension). As to the income concept, a distinction has to be drawn between the replacement rate related to gross earnings and the replacement rate related to gross earnings after deduction of pension insurance contributions; the latter is sometimes also called net replacement rate, which is somewhat misleading (see box "Definitions of Initial Replacement Rates").

Definitions of Initial Replacement Rates

Initial replacement rates are the replacement rates indicating the ratio of the initial pension $p_{1,t}$ to previous annual earnings. The initial replacement rate related to gross earnings (EER_t^B) and the initial replacement rate related to gross earnings after deduction of pension insurance contributions (EER_t^N) are defined as follows:

$$EER_t^B = \frac{p_{1,t}}{LE_t}$$

$$EER_t^N = \frac{p_{1,t}}{(1-\tau_{AN})LE_t}$$

where τ_{AN} denotes the employee's contribution to the pension insurance (in Austria $\tau_{AN} = 0.125$) and LE_t the average previous annual earnings revalued with the wage growth of pensioners at time t. Under the given assumptions, this corresponds exactly to current average earnings $\bar{\omega}_t$. The replacement rate EER_t^B corresponds (under an assumed "stationary state") exactly to the pension level q_t.

In addition, it is possible to define an initial replacement rate related to net earnings:

$$EER_t^{NE} = \frac{(1-\bar{\theta}_p)p_{1,t}}{(1-\bar{\theta}_\omega)(1-\tau_{AN})LE_t},$$

where $\bar{\theta}_\omega(\bar{\theta}_p)$ is the average tax rate of wage earners (pensioners). In the light of tax progressivity, one can assume that $\bar{\theta}_\omega > \bar{\theta}_p$ and that: $EER^{NE} > EER^N$. The estimates provided in this paper, however, relate only to the replacement rates EER^B and EER^N.

From the perspective of a "living standard concept," the net replacement rate is more adequate as for pensioners (employees') contributions are no longer due. The current proposals incorporate all the various approaches.[25]

So far this study has dealt primarily with the setting of the revaluation factors. At this point, it is, however, necessary to also look at pension adjustment methods, which figure prominently in tackling the issue at hand and play an important role in general. If the pension is indexed to wage growth, the relative pension level remains constant over the pension period, whereas with a lower adjustment factor, the pension level decreases steadily over time, which,

25 *The pension reform commission seems to favor EER^N, the Social Democratic Party (SPÖ) EER^{NE} and the Austrian Trade Union Federation (ÖGB) EER^B. According to the pension reform commission, the new, actuarially fair pension calculation formula is to yield a net replacement rate of 80% for a pension eligibility age of 65 after 45 years of contributory service (PRK, 2002, p. 81); the SPÖ states that after 45 years of contributory service, a net replacement rate of 80% (i.e. 80% of the life income) is reached (SPÖ, 2003, p. 10); finally, according to the ÖGB, following 45 years of contributory service, a person attains a pension claim at the full retirement age of 65 to the tune of 80% of the assessment base (ÖGB, 2003, p. 7).*

ceteris paribus, naturally allows for a higher initial replacement rate. The exact amount of an initial replacement rate that is compatible with a balanced budget depends on the expected (or average) growth rate. Table 5 reflects the values for three assumptions: a pension adjustment with wage growth and an adjustment with the inflation rate at an average wage growth of 1% and 2%, respectively. Interestingly, all the available proposals appear to favor inflation indexation.[26]

Table 5

Different Replacement Rates[1]

	Pension adjusted with		
	wage growth	inflation rate ($\gamma = 0.01$)	inflation rate ($\gamma = 0.02$)
Gross replacement rate (EER^B – initial replacement rate related to gross earnings)	0.684	0.733	0.783
Net replacement rate (EER^N initial replacement rate related to gross earnings less contributions)	0.762	0.816	0.872

Source: OeNB calculations.

[1] *Average life expectancy is assumed to equal 80 years; furthermore, it is assumed that retirement occurs at the age of 65 after 45 years of pensionable service and that the contribution rate remains constant at $\tau = 0.228$. The figures in the table show (under different initial replacement rate concepts and pension adjustment regimes) which initial replacement rates are compatible with a balanced budget under these assumptions.*

The values in table 5 show that the 80% target is compatible with a balanced budget given the current structural parameters, provided reference is made to the net concept and that pensions are indexed to the inflation rate. Even when we take into account any exceptions (e.g. concerning blue-collar workers and pension credit provisions), the 80-45-65 formula still appears realistic and feasible.[27]

Whether keeping pensions indexed to the inflation rate is the optimal choice for a long-term system is open to debate. For one thing, intergenerational fairness is once again an issue (less so intragenerational fairness), as discussed in chapter 3 in connection with the revaluation factors. For another, this method implies that over a long pension period real purchasing power could diminish steadily, possibly pushing some groups of the population below the poverty line.

The following two arguments are commonly put forth to validate inflation indexation: (i) In times in which the budget of the pension system is not balanced, this practice implies that the pension cohorts help cofinance the system; (ii) furthermore, inflation indexation implicitly leads to a more equitable distribution of pension benefits between individuals with different life spans. Both arguments are also controversial, though. Should all

[26] *The majority of the pension reform commission members are strongly in favor of switching to a pension adjustment based on consumer price developments (PRK, 2002, p. 80); the pensions are adjusted at least with the inflation rate so that the purchasing power of the pensions does not diminish. (SPÖ, 2003, p. 10); a crucial element of a predictable and secure pension promise is guaranteed ongoing adjustment with a view to avoiding a loss of real purchasing power. The future model thus envisages yearly adjustments with the inflation rate. (ÖGB, 2003, p. 11).*

[27] *In this context, it would, of course, also be conceivable that pension credit provisions are funded by the general budget or by earmarked budgets to which such benefits are assignable. Stefanits and Mayer-Schulz (2001) tried to assess the credited contributions of the year 1999. The costs amount to some 10% of total pension expenditures, which accounts for a considerable part – about half – of the federal subsidy for pensions (p. 31).*

cohorts and individuals really be required to fund such a financing gap to the same (proportional) extent, or would not a system be preferable in which persons who receive higher pensions make a larger contribution (for such a transitional period)? As regards item (ii), the question is whether inflation indexation is a suitable principle in the long run. Given people's risk aversion when buying insurance, it is safe to assume that people would prefer a lower, yet constant replacement rate to a rate that continuously decreases from an initially higher value.

In any case, chances are that the formula will have to be adapted to changes in life expectancy from time to time (e.g. 80-45-67, 75-45-65), either discretionarily or according to a fixed mechanism tracking life expectancy development. A pension system must respond not only to changes in life expectancy, but also to other demographic fluctuations, though. For this reason, a "pension period factor" geared exclusively towards changes in life expectancy was again dropped from Germany's recent pension reform since any employment period fluctuations would have been neglected (Börsch-Supan et al., 2003, p. 27).

5.3 Absolute or Relative Concepts

In the public debate, we occasionally hear the argument that there is in fact no pension crisis because in an expanding economy the additional output gains (or parts thereof) could be channeled into retirement provisions. To illustrate this argument, let us recall the example given in table 2. Average earnings in period 3 (225) clearly exceed those of period 2. The newly retired only achieved average real gross earnings of 150 and net earnings of $150(1-0.25)=112.5$ during their active years. So, one could in principle "trim" the currently employed persons' earnings by 112.5 without putting them at a disadvantage in absolute terms relative to the new pensioners' previous earnings. Following such a "diversion of the growth dividend," the contribution rate would, however, have to be raised to 50%. *In absolute terms,* the employed would then be on an equal footing with the retired, bearing, however, double the *relative* burden of their predecessor generation.

Similar switching between absolute and relative concepts is also observable in respect of pension adjustment. Here, experts always emphasize that inflation indexation maintains the purchasing power of pensions (i.e. real disposable income). At the same time, it has to be borne in mind that as a result, the relative pension level contracts steadily over the pension period. And this is certainly not inconsequential – as pointed out in section 5.2 – in a long-term pension system.

In a nutshell, whenever contributions and benefits are discussed, it should always be clear whether talk is of relative or absolute values. Which perspective to choose will depend on the issue at hand, but in general it is safe to assume that in an intergenerational context the relative concept is preferable (Settergren, 2001; Knell, 2004).

5.4 Demographic Adjustment Factors and the German "Sustainability Factor"

The extension of life expectancy is one reason for the anticipated increase in the old-age dependency ratio (section 5.3). Another reason is the steady decline in the size of birth and work cohorts, which is frequently regarded as the primary demographic challenge.[28] For this reason, the 2004 German pension reform incorporated a demographic adjustment factor (sustainability factor) into the pension system. Should the pensioner dependency ratio change over time, the sustainability factor stipulates that a share α of the necessary adjustment be brought about by reducing the relative pension level (or the replacement rate) and a share (1-α) by raising the contribution rate. The parameter α was set at 0.25.[29] By 2030 the contribution rate is forecast to advance from about 19.5% to 23% and the gross pension level is expected to fall from 48.5% to around 40% (Börsch-Supan et al., 2003).

While the rationale for introducing such an automatic adjustment factor is conclusive (section 5.2), note should also be taken of several complicating factors. First, fiscal criteria frequently seem to predominate in this context. In Germany, setting α at 0.25 is mainly due to the existence of a target capping at 22% contributions until the year 2030. Though this is frequently overlooked, variations of α would entail disparate effects on intergenerational burden sharing. As a case in point, a chiefly contribution-oriented adjustment (low α) places greater demands on the young than an adjustment of the pension level (high α). Which of these principles is considered fairer depends to a great extent on which generations are to be held responsible for the drop in the fertility rate. Knell (2004) discusses this issue at length and argues that from the perspective of intergenerational fairness the second variant (high α) would be preferable.

Second, it has to be clear that the quality of the implementation of such a sustainability factor may differ depending on the given framework conditions. Knell (2004) provides evidence for the incompatibility of such a formula with a conventional notional account system since the ever-changing contribution rate would counteract the automatic balancing of the budget (Valdés-Prieto, 2000).[30]

6 Summary and Outlook

This study has explored various aspects of revaluation and adjustment factors in pay-as-you-go pension systems. Following evidence indicating that under the current pension regime in Austria, previous contributions are not revalued in real terms, the paper continued to examine in how far such a situation conflicts with principles of intragenerational and intergenerational fairness. Furthermore, it was shown that extending the assessment period while keeping the revaluation provisions in place would lead to substantial pension cuts of between 11% and 36%. A capping provision, while allowing several pension cohorts to avoid such losses, creates new fairness problems.

At any rate, a harmonized system should rely on a wage-based revalua-

28 *A contraction in the size of the working age population is more critical for financing a pension scheme than an increase in life expectancy. (PRK, 2002, p. 76).*

29 *Adjusted to the notation of this paper, the sustainability factor may be expressed as follows:* $q_{t+1} = q_t \frac{1-\tau_{t+1}}{1-\tau_t} \left[\left(1 - \frac{R_{t+1}}{L_{t+1}} / \frac{R_t}{L_t} \right) \alpha + 1 \right]$. *Here, we do not account for specificities of the German system (e.g. the phased increase in private supplementary pensions also referred to as "Riester ladder," time lags).*

30 *The Swedish notional account system has an alternative automatic adjustment mechanism, the "automatic balance mechanism," which is meant to provide for fiscal balancing irrespective of demographic fluctuations. For a detailed description of this mechanism, see Settergren (2001) as well as Settergren and Mikula (2003).*

tion method. Note that this calls for principal decisions to be made at the very beginning of reform efforts, as highlighted in this paper. First, it is necessary to decide whether to revalue with the growth rate of average earnings or of the total wage bill. Neither of the two variants seems to be preferable to the other on all counts. While revaluation with the former index is more in line with the "equity principle," the latter method provides for better risk sharing. Moreover, none of the two methods guarantees a balanced budget in the long run. Besides, additional demographic adjustment factors are required to address demographic fluctuations.

A related question is whether current pensions should likewise be indexed to wage growth or rather to inflation. Inflation indexing seems to be more popular these days even though there are credible objections against applying such an adjustment method also to long-term systems and not just to transitional periods.

Finally, it has to be determined whether to build automatic demographic adjustment factors ("sustainability factors") into the pension system. The challenge lies in designing a structure which safeguards fiscal stability amid demographic shifts and at the same time complies with commonly accepted fairness principles. One option would for instance be to regularly align the concept of the average pensioner, i.e. the 80-45-65 formula, with changes in life expectancy. In this context, this paper examined whether it was at all possible, given the current demographic structure, to offer an 80% replacement rate at the age of 65 after 45 years of contributory service as well as to meet the requirement of a balanced budget. This question was answered in the affirmative provided (a) a net replacement rate concept is used, (b) current pensions are indexed to inflation and (c) credited contributions are funded primarily from alternative sources. On the other hand, more broadly based demographic adjustment factors exist as well, such as the sustainability factor recently introduced in Germany. It was stressed that fiscal necessity should not be the only determinant in choosing such a factor; rather, intergenerational burden sharing should be factored into the decision as well. Last, but not least, it was pointed out that not all factors are equally suited for a conventional model or a notional account system.[31]

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[31] *To economize on space, I did not deal with detailed aspects of notional account systems in this study. For in-depth descriptions of their workings, their strengths and weaknesses, see: Disney (1999), Palmer (2000), Börsch-Supan (2003). Türk (2002) and Rudda (2004) focus on the situation in Austria.*

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