Rozprawy Ubezpieczeniowe. Konsument na rynku usług finansowych nr 29 (3/2018): 66-85
Journal of Insurance, Financial Markets and Consumer Protection No. 29 (3/2018): 66-85

Automatic Balance Mechanisms as instruments of maintaining pension scheme financial sustainability[1]

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Received: 25 April 2018; Accepted: 27 August 2018; Published: 21 December 2018

Abstract. Considering the challenges of modern pension schemes following the European Commission [2003] one can point out the three main fields which require particular attention: 1) adequacy; 2) financial sustainability and efficiency; 3) ability to respond to the changing needs of societies. This paper focuses mainly on the second of these issues – financial sustainability. Although this issue has been broadly discussed by academics, only a small number of studies takes up the topic of developing automatic mechanisms, independent from political decisions, which would be able to guarantee the long-term financial sustainability of pension schemes. Having noticed this research gap, the article poses the question whether automatic balance mechanisms (ABMs) are suitable instruments of ensuring sustainability of pension schemes. This question was the basis for the formulation of the main aims of this paper which are: 1) to introduce the issue of pension systems sustainability and to discuss possible policies and instruments that may be used to restore it; 2) to present, based on existing literature, automatic balance mechanisms that have already been applied in some countries; 3) to propose an appropriate framework of assessing the automatic mechanisms. Moreover, having treated this article as a preliminary study, another goal is to provide suggestions for further research in the area of automatic mechanisms.

Keywords: pension system, sustainability, financial stability, automatic adjustment mechanism, automatic balance mechanism.
JEL Codes: H55, H75.

[1] The publication was co-financed from the Ministry of Science and Higher Education Grant for the Young Researchers and Doctoral Students of the Faculty of Finance and Law of the Cracow University of Economics.
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1. Introduction

Pension schemes in developed countries are facing today a great number of challenges. Aside from the widely-discussed demographic changes [European Commission 2015], other substantial causes of problems with old-age security systems are their generosity, their vulnerability to political pressure and the heterogeneity of participation rules. Considering the challenges modern pension schemes face, one can point out three main areas which need particular attention. Following the European Commission [2003], these areas can be named as 1) adequacy; 2) financial sustainability and efficiency; and 3) the ability to respond to the changing needs of societies. Naturally these areas are closely related. In the simplest terms, the main goal of modern pension schemes is to ensure adequate pension benefits for all citizens. Achieving the adequacy of pensions is, however, impossible without the long-term financial stability of pension systems and assuring that pension schemes respond well to the needs of the changing labour market and people's expectations.

This paper focuses mainly on the second of the above mentioned issues – the financial sustainability of pension schemes. Admittedly, the matter of pension systems' financial stability is widely discussed in public debate and in academic studies, but the main emphasis is placed here on quantifying the current or predicted degree of the imbalance and applying one-off adjustments or reforms to restore the financial equilibrium of those systems. Only a small number of studies highlights the necessity of designing automatic mechanisms, independent from political decisions (Automatic Balance Mechanisms, ABM), which would be able to guarantee the long-term financial stability of the pension schemes together with their intergenerational fairness and without reducing their adequacy.

With this research gap in mind, this paper poses the question whether automatic balance mechanisms are suitable (i.e. efficient and effective) instruments of ensuring the long-term sustainability of pension schemes. This question was the basis for the formulation of the main aims of the study, which are: 1) to introduce the issue of pension systems sustainability and to discuss possible policies and instruments that may be used to restore it; 2) to present, based on existing literature, automatic balance mechanisms that have already been applied in some countries; 3) to propose an appropriate framework of assessing the automatic mechanisms. Moreover, having treated this article as a preliminary study, another goal is to provide suggestions for further research in the area automatic mechanisms.

Following this introduction, the paper is organised as follows. The next section discusses the issue of the financial stability and sustainability of pension systems. The third section focuses on discretionary policy and automatic mechanisms as instruments of maintaining the sustainability of pension schemes. In the fourth section, an analysis is undertaken of the four most notable automatic balance mechanisms that have been applied in Canada, Germany, Japan and Sweden. The paper ends with conclusion in which some final remarks are made.

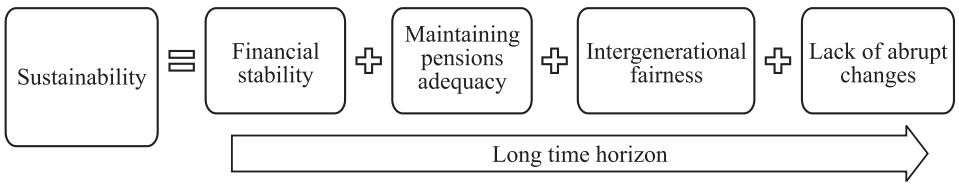
2. Sustainability of pension schemes

Financial stability is a broadly used term. It can be applied similarly for households, financial institutions (i.e. banks, insurance companies, investment funds etc.), financial systems as broadly understood and the whole economies or parts of them. In the recent years, especially after the subprime crisis, financial stability has been predominantly linked with systemic risk and the resilience of financial markets to external and internal stresses. Hence, the widely accepted definition of financial stability states that it is the absence of system-wide episodes in which the financial system fails to fulfil its primary functions [World Bank 2016]. In this study, however, the main focus is placed on pension systems. Therefore, financial stability is primarily understood as the ability of pension systems to deliver their functions properly without the necessity of additional external financing or abrupt changes in the system's main parameters. The proper delivery of pension system functions means above all the ability to pay out a specified level of pension benefits, the lack of the necessity of additional financing entails no need for any unplanned budget transfers, and abrupt changes in system's main parameters concerns mainly the level of contribution rates, the rules of benefit indexation and the retirement age.

The above-defined financial stability of pension system refers rather to short periods (of several years). In the long perspective, due to significant changes in the economic and socio-demographic factors, it is virtually impossible to guarantee the stability of a pension scheme without modifications of its principles and parameters. One could then even say that in the long-term, no financially stable pension system exists. Therefore, when referring to the long-term stability of pension schemes the term "sustainability" is rather used [Grech 2010; OECD 2012; GCAE 2012].

Generally, financial sustainability is a more extensive and complex term than financial stability. According to OECD [2012] financial sustainability is the capacity of a pension system to meet its long-term financial and social commitments. Similarly, Andrews [2016] claims that sustainability should be perceived from both an economic and social perspective and therefore he defines sustainable pension system as a "*one that delivers on its financial commitments in such a way that the financial burden is borne equitably by participants over the long term*".

Diagram 1. Financial sustainability of pension scheme



Source: Author's own elaboration.

This study proposes a wide definition of financial sustainability of pension schemes. This approach assumes that aside from short-term financial stability, which undoubtedly is one of the main constituents of pension scheme sustainability, it also consists of maintaining pension adequacy, intergenerational fairness and the absence of abrupt changes in the rules of participation. Moreover, financial sustainability is always concerned in long-time horizon (Diagram 1).

Considering the pension scheme sustainability, one can also distinguish several formal approaches to the issue. The most notable are the Aaron-Samuelson framework, pay-as-you-go equilibrium, and actuarial equilibrium. Without going into details: the Aaron-Samuelson framework assumes that a pension system is sustainable in the long-term if its internal rate of return is lower than the growth of the labour force in real efficiency units (i.e. labour force growth multiplied by wage growth). In the pay-as-you-go equilibrium approach, the pension system is sustainable when the amount of benefits received by retirees during a given year is equal to the total amount of contributions paid by the working generation in the same year. Actuarial equilibrium, similarly to pay-as-you-go equilibrium, takes into account the expenditures and revenues of a pension scheme, however this approach considers the long-term horizon. This means that a pension scheme is in actuarial equilibrium when the present value of the benefits to be paid in the future is equal to the present value of the contributions to be collected in the forecast horizon [OECD 2012, p. 49].

Undoubtedly, maintaining the long-term sustainability of pension schemes is one of the key challenges of the pension economy in developed countries today. Therefore, the following question arises: *how to maintain (or restore) the sustainability of pension schemes in the long time-horizon?* In other words: *What types of instruments can be applied by policymakers to guarantee pension scheme's sustainability*? The subsequent section tries to provide an answer to these questions.

2. Maintaining the sustainability of pension schemes – discretionary policy and automatic mechanisms

Generally, in order to restore the balance in an unsustainable pension system either its inflows should be raised or its outflows be decreased. Considering the primary tools of the pension economy, three basic instruments may be used to achieve these goals:

1. adjustments in contribution rates,
2. adjustments in benefit levels (either in form of changes in benefit indexation or in form of alterations to the future pension formula[3]),
3. adjustments in retirement age.

In the relative short-term, it is also possible to draw on a reserve fund, provided that one exists [OECD 2012]. These measures can be implemented either ad-hoc

[3] Note that these changes have different time impact – while benefit indexation affects mainly current pensions, modification of pension formulas has an influence on future pensions.

– by discretionary policy, or automatically – with the usage of automatic mechanisms. Some authors [Gannon, Legros, Touzé 2014] also point out a third possibility – delegating the management of pension systems to competent and independent authorities. It is, however, not clear how to guarantee the actual political independency of such authorities in the long term.

a. Discretionary policy

Discretionary policy is based on the ad hoc judgments of policymakers. It is one of the basic ways of making economic policy decisions. Omitting here the endless debate on the effectiveness of the discretionary policy between Monetarists and Keynesians, it should be noted that discretionary policy is definitely more useful in achieving short-term goals rather than long-term objectives. Considering the long time-horizon of pension systems, one cannot therefore expect a high efficacy of this type of policy. Furthermore, even in face of serious challenges faced by the contemporary pension systems, most governments make discretionary changes only reluctantly, as they are usually unpopular and induce high political risk. As a consequence, the policymakers frequently postpone implementing necessary measures, which inevitably leads to further weakening of the effectiveness of this policy[4] [Gannon, Legros, Touzé 2014]. In result, the main problem with ad hoc measures is that their timing and magnitude are unknown. As Turner [2007] rightly notes, discretionary policy adjustments are usually large, infrequent and unpredictable. They also tend to be made during periods of severe crisis and are put into force shortly after their enactment, which gives workers and labour market little time to adjust. Another risk for discretionary policy reforms is their vulnerability to reversal or erosion when changes on the political scene occur [Bosworth, Weaver 2011].

b. Automatic adjustment mechanisms and automatic balance mechanisms

According to Maneu et al. (2016), an automatic mechanism in pension schemes is a rule that "automatically regulates the value of one or more parameters of the pension system according to the level of some variables or indicator that is crucial for the sustainability or solvency of the pension system". Since the second half of the twentieth century, many countries have applied different versions of simple automatic mechanisms. For example, a widely used automatic mechanism is price indexation of the contribution base and/or benefit payments. The main aim of this solution is to maintain the real value of benefits without the necessity of frequent legislative changes. Moreover, automatic indexation reduces the risk of populist bidding during election years [Bosworth, Weaver 2011]. The more sophisticated Automatic Adjustment Mechanisms (AAMs) and Automatic Balance Mechanisms

[4] In the past, in face of serious solvency crises governments of course made reforms that were necessary and painful for the society, however most of them were only ad hoc solutions and did not take into account any long-term restorative forces.

(ABMs) are more recent. Their origin dates back to the 1970s when slower economic growth and adverse demographic changes forced authorities to find solutions to decrease the commitments of pension systems. It is thought that the first proposal of an automatic balance mechanism for a PAYG pension system was made by Robert J. Myers in 1982 while he was executive director of the National Commission for Social Security Reform in the United States [Vidal-Melia 2009, p. 289].

In the most basic concept, Automatic Adjustment Mechanisms are specific and mandatory rules which guarantee the solvency of pension systems without requiring any political intervention. This means that with AAMs, the institutional parameters of the pension system are adjusted independently from current policy, according to predefined rules [Gannon, Legros, Touzé 2016]. Importantly, the main idea of automatic mechanisms is to reduce the gap between revenues and expenditures in pension system, not to guarantee a perfectly balanced budget at any time [Turner 2009; Gannon, Legros, Touzé 2016].

The Automatic Balance Mechanism is a solution applied when AAMs are not able to stabilise the pension system. ABMs are stronger and more sophisticated then AAMs, as they have a built-in and clear obligation to restore the financial sustainability of a pension system within a finite time. In an ideal world, adjustments made through AAM are sufficient measures to guarantee the sustainability of the pension scheme. ABMs are designed as complementary mechanisms which are activated as the measure of last resort. As Gannon, Legros and Touzé [2014] note, they are "*an ultimate setting which should be expected to be marginal*".

Regarding ABMs, Sakamoto [2007] simply states that they are the mechanism used in social security pension schemes that "*automatically restores the financial equilibrium and keeps the scheme sustainable*". Andrews [2016] distinguishes between the self-adjusting mechanism and the automatic balancing mechanism. He claims that ABMs are self-adjusting mechanisms which are sustainable from a financial and equitable perspective (i.e. they ensure that a pension system shares its burdens equally among its participants). Subsequently in this study, ABMs are regarded similarly to Vidal-Meliá, Boado-Penas and Settergren [2009] definition which states that an ABM is a set of predetermined measures (rules) established by law to be applied immediately as required according to the given solvency or sustainability indicator.

According to Vidal-Meliá, Boado-Penas and Settergren [2009] the primary objectives of automatic mechanisms are:

1. gradual restoration of the long-term financial stability (sustainability) of the pension system;
2. automating the measures necessary to be taken and making them independent of the political arena;
3. ensuring that periodic monitoring of the pension system solvency parameters is performed;
4. building public confidence and pension awareness by informing citizens of the current state of the pension system and their pension rights.

When examining automatic mechanisms, Andrews [2016] notices that an effective ABM should be gradual (adjustments are spread over time, no sudden or significant changes are made), equitable (adjustments are distributed evenly among cohorts), sustainable (adjustments are made on the basis of reasonable assumptions and with respect to the long-term horizon) and transparent (the nature of adjustments are understandable for society). He also proposes a classification of ABMs according to their ability to maintain financial and equitable balance (Table 1). Summarising his study on automatic mechanisms in different countries, Andrews claims that according to the proposed definitions, currently none of the existing ABMs is robust[5].

Table 1. Classification of automatic balance mechanisms

Class of ABM		**Characteristics**
Completely robust		ABM allows achievement of both financial and equitable balance in the long run, regardless of any demographic or economic changes, however low the likelihood of such stresses may be.
Robust on financial dimension	Robust on equitable dimension	ABM allows achievement of either financial or equitable balance in the long run, regardless of any demographic or economic changes, however low the likelihood of such stresses may be.
Partial on financial dimension	Partial on equitable dimension	ABM allows to achieve partial financial or partial equitable balance in the long run in most circumstances other than those considered as extreme and highly unlikely.
Transitory on financial dimension	Transitory equitable dimension	ABM is not able to achieve even partial financial or partial equitable balance in the long run even in relatively likely circumstances

Source: Author's own elaboration based on [Andrews 2016].

An automatic balance mechanism, by definition, has to be linked with an independent, pre-existing solvency or sustainability indicator (triggering indicator). When the value of such an indicator reaches a specified value, the automatic mechanism is activated [Vidal-Meliá, Boado-Penas, Settergren 2009]. This means that the appropriate design of the triggering indicator is a key feature of the ABM as its efficiency and effectiveness depend on it. The triggering indicator may be based on the actuarial balance sheet, the actuarial report of system inflows and outflows (solvency indicators) or on the dependency rate or other demographic parameters (sustainability indicators). Examples of the triggering indicators introduced in some countries are discussed in detail in the following section of the paper.

Bosworth and Weaver [2011] notice that the triggering indicator for ABMs can be either certainty-based or projection-based. The former activates the ABM on the basis of the actual values of certain economic or demographic parameters, the latter takes into account the projected values of such parameters over a specified period. Another feature of the ABM's triggering indicator considered by Bosworth and Weaver is

[5] As the author notes, this is mainly due to a very high standard of robustness [Andrews 2016].

the frequency of review – pension system indicators may be reviewed systematically (annually, biannually) or infrequently (once-a-decade). Frequent reviews entail smaller adjustments to the system parameters and make them less visible, however they may also cause constant social tension and repeated political conflict.

Apart from the triggering indicator, designing the ABM requires also defining the adjustment parameters (i.e. parameters of the pension system which are modified). These parameters are closely related to basic instruments mentioned at the beginning of this section for achieving the primary goals of the pension system. Gannon, Legros and Touzé [2014] list the following most frequently applied adjustment parameters.

1. *Benefit indexation.* Pensions may be indexed according to inflation (CPI) or other economic parameters (e.g. GDP growth, wage growth). The main objective of benefit indexation is to maintain the purchasing power of pensions. Some types of benefit indexation (CPI indexation) may also have a positive effect on the solvency of the whole system.
2. *Retirement age and/or minimum contributory periods.* Nowadays, the adjustments in retirement age and contributory periods are made through discretionary policy[6]. However, this can also be done automatically on the basis of life expectancy. This solution makes it clearer who will bear the costs of the adjustments. On the other hand, it shifts the aggregate life expectancy risk to workers.
3. *Pension-earnings link.* In defined benefit (DB) systems, a relation between wages and pensions is usually defined by a replacement rate (like in Germany). With an ABM, the value of the replacement rate guaranteed by the system may be adjusted to the changes in other parameters (e.g. life expectancy, dependency ratio). The nature of defined contribution (DC) and non-financial defined contribution (NDC) pension schemes implies the existence of an automatic adjustment mechanism based on life expectancy. The only question here is how to establish the modification rules of the coefficient of conversion of the pension entitlements into an annuity[7]. In addition, in NDC schemes a specific type of automatic adjustment may be related to the indexation of individual accounts[8].

[6] Currently, the majority of developed countries are raising their statutory retirement age (see [OECD 2017, p. 94]). Some of them are also raising the number of contribution years required for full benefit indexing (e.g. France). Generally, adjustments are gradual and spread over time, however, they are introduced directly by policymakers. No examples of implementation of an automatic mechanism were found.

[7] It is worth noting here that there is a heated debate underway in the literature over how different approaches to calculating life expectancy (cross-sectional or cohort-based) affect the sustainability of pension schemes. Some of the most recent papers here include [Ayuso, Bravo, Holzmann 2017, 2018; Holzmann et al. 2017].

[8] Indexation in NDC schemes may be based on different economic parameters, e.g. the inflation index, real wage growth, productivity growth, wage bill growth etc. Naturally, various types of indexation have different consequences for the sustainability of the pension schemes. For a wider discussion about indexation see: [Alho et al. 2005]. A valuable application can also be drawn from an analysis of Swedish NDC pension scheme [Settergren 2001].

c. Advantages of automatic balance mechanisms

In contrast to discretionary policy, changes made through automatic mechanisms (both AAMs and ABMs) are generally slight, frequent, and predictable. The great advantage of automatic mechanisms is also their transparency – it is usually clear how and when (under what circumstances) adjustments are made and who bears their costs [Turner 2007]. Moreover, automatic mechanisms have an advantage over discretionary policy measures because they significantly reduce political risk, especially its most negative form which is "populism in pensions" [Vidal-Meliá, Boado-Penas, Settergren 2009][9]. Börsch-Supan [2007] also claims that automatic mechanisms are a rational solution as they allow establishment of reasonable rules for activating some measures in the future which would be difficult for politicians to apply *ad hoc.*

Diamond [2004] rightly points out that the main advantages of automatic mechanisms result from the basic rule of pension economy – *it is much easier to legislate future pain than current pain*. This means that implementing automatic mechanisms into pension schemes entails relatively low political risk, as average voters are likely to accept future and uncertain changes. As a result, automatic mechanisms have some undeniable advantages for politicians in power [Penner, Steuerle 2007; cited after: Vidal-Meliá, Boado-Penas, Settergren 2009]. Firstly, an automatic mechanism is not activated until the triggering indicator reaches the certain level. Assuming that the triggering level is correctly established, an ABM will be activated only when necessary, which means no-one should question it. Secondly, introduction of an automatic mechanism means that politicians do not have to make any direct and immediate reductions to a pension system (e.g. lowering benefits, raising retirement age). They only agree to incorporate the mechanism which would do so in the future automatically, independently of their will. Obviously, postponing unpopular changes into an unspecified future carries relatively low political risk. Thirdly, when the automatic mechanism has been triggered, politicians always may consider the eventuality of suspending application of the automatic mechanism and show their generosity to the public[10].

The three main flaws of traditional measures, which may be overcome by automatic mechanisms, are as follows [Vidal-Meliá, Boado-Penas, Settergren 2009]:

1. both due to the political game and legislative process, traditional measures are not taken as quickly as they should be. In many cases, this means that they are significantly more extreme when finally applied;
2. because of high political risk, in many countries with an unstable or undeveloped political scene, traditional measures are not taken until the pension system crisis can no longer be ignored,

[9] Vidal-Meliá, Boado-Penas and Settergren [2009] define populism in pensions as "*a form of competition between politicians in which voters are offered subsidies and benefits without the voters appreciating that it is they themselves who will pay through higher taxes, higher contributions, higher inflation and reduced economic growth*".

[10] Note that this point is also one of the greatest threats to the idea of ABMs.

3. even if implemented, traditional measures are often taken without the appropriate time perspective. This is due to the huge discrepancy between the election horizon seen by politicians and the effective time horizon of a pension system.

Due to the long-term planning horizon the automatic mechanisms can also be used to provide intergenerational fairness. However, this requires straightforward and clear choices about transfers between generations and strong public acceptance [Gannon, Legros, Touzé 2014].

Another argument in favour of automatic mechanisms focuses on the perspective of workers who are planning their own retirement. Undoubtedly, they would benefit from early knowledge about the expected retirement age and the level of their future pension, which can be provided only in the system with a correctly designed automatic mechanism. Moreover, awareness of future modifications to system parameters can induce a change in their behaviour and retirement plans (e.g. postponing their exit from the labour market) [Bosworth, Weaver 2011].

4. An overview of ABMs in selected countries – the case study analysis

This section consists of an analysis of ABMs which have been implemented in various countries. The performed survey of the pension schemes in developed countries allowed identification of at least 17 examples of AAMs and ABMs which are based on different indicators and adjustment parameters and have different degrees of automaticity[11]. Because of the constraints on length of an article, this section contains detailed analysis only of the most notable examples of ABMs in four countries: Canada, Germany, Japan and Sweden. Bearing in mind the main aim of this article, the description of the entire pension schemes in selected countries are omitted and the focus is placed on the most relevant features of analysed automatic mechanisms.

Automatic balance mechanisms are predominantly applied in DB pension schemes as they are vulnerable to ongoing demographic changes in most developed countries. The most characteristic examples of countries that have applied different types of ABM into their DB schemes, discussed further in this section, are the cases of Canada, Germany and Japan. Other examples of countries with DB schemes that have introduced some kind of automatic adjustments are Brazil, Finland, Iceland, the Netherlands and the United Kingdom.

According to Diamond [2004], well-designed NDC systems with decent reserve funds are financially sustainable in the long term as long as there is economic growth. This is mainly due to some kind of automatic adjustments incorporated to such schemes – the standard benefit formula in NDC takes past individual

[11] These are Brazil, Canada, Denmark, Finland, France, Germany, Iceland, Italy, Japan, Latvia, Poland, Portugal, the Netherlands, Norway, Sweden, the United Kingdom, and the United States. A complex analysis of automatic mechanisms in some of these countries was performed by Turner [2007]; however, this was made more than ten years ago and may already be out-of-date.

contributions and average life expectancy into account. However, in the short term the financial equilibrium in an NDC system may be achieved only with the usage of a buffer fund or under specific economic and demographic conditions. These include constant productivity growth, increase in the number of contributors and real wages, and changes in mortality patterns [Valdés-Prieto 2000]. Furthermore, some studies (Valdés-Prieto 2000) show that NDC schemes achieve short-term financial sustainability only in the unrealistic conditions of a steady economic and demographic state. Hence, as Vidal-Meliá, Boado-Penas and Settergren [2009] note, in practice NDC schemes, just like DB schemes, occasionally require some actions to restore their financial sustainability. The necessary measures may be taken in form of direct legislation (discretionary policy) or ABMs which are built-in to the scheme. The former is the most common approach employed in Italy, Norway and Poland. The latter is the case of Sweden, as described below.

a. Canada – the insufficient rate provision mechanism

Canada developed a complex multi pillar public pension system in which the most significant roles are played by a flat-rate pension tier (OAS – Old Age Security), an income-tested tier (GIS – Guaranteed Income Supplement), and a contributory social insurance plan (CPP – Canada Pension Plan)[12]. A specific automatic balance mechanism called the "insufficient rates provisions" is applied in the CPP [Brown 2008, Sakamoto 2013]. It was implemented in 1998 as part of the large rescue package aimed to prevent further deterioration of the financial condition of the CPP.

Under the insufficient rate provision mechanism, every three years the Chief Actuary performs an actuarial review of the CPP in which the long-term (75-year) financial sustainability of the system is evaluated. Together with other analyses, the Chief Actuary calculates the minimum contribution rate that will sustain the plan in a stationary state. If the computed minimum contribution rate is higher than the legislated contribution rate, in the first place the federal and provincial finance ministers are supposed to agree on implementing necessary changes to keep the CPP viable. The automatic mechanism is triggered as the measure of last resort when the ministers cannot reach an agreement. In this case, the insufficient rate provision mechanism activates two adjustments: the contribution rate is automatically increased by 50% of the difference between the minimum contribution rate and the legislated contribution rate (this increase is phased-in over three years) and the pension benefits indexation is suspended for three years until the next system review. During the next actuarial review, the minimum contribution rate is calculated again and if necessary, the whole adjustment process is repeated. Taking into account the two phases of introduction and the facultative nature of the insufficient rate provision mechanism, some authors claim that the Canadian ABM is in fact a semi-automatic balance mechanism [Vidal-Meliá, Boado-Penas, Settergren 2009].

[12] Formally, the province of Quebec has a distinct Quebec Pension Plan (QPP), although contribution rates, eligibility and benefit levels in QPP are harmonized with CPP [Bosworth, Weaver 2011]

It should be noted that the Canadian ABM does not guarantee the full financial stability of the CPP. Firstly, the finance ministers may reach an agreement and set the legislated contribution at a level lower than the calculated minimum contribution rate. Secondly, insufficient rate provision activation does not necessarily lead to balance between CPP expenditures and revenues. These reservations, however, do not undermine the main advantages of this mechanism, which are the ability to keep the CPP in better financial condition than without it and how it makes policymakers more conscious of intergenerational fairness, as they are aware of the consequences of maintaining contribution rates that are too low [Sakamoto 2013]. Another advantage of the Canadian ABM is that it also shares the necessary adjustments fairly between workers and pensioners.

b. Germany – the sustainability factor

Without going into details, the DB pension scheme in Germany is based on the point system in which the amount of pension benefits depends on the number of contribution years and the income in each of these years. More specifically, every year each active participant is given a point score equal to the ratio of his/her annual income to the average annual income of all active participants. When the particular participant ends his/her professional activity, the amount of pension is calculated by multiplying the accumulated points by the current pension unit value.

The pension unit value (PV_t) is computed yearly by indexing the pension unit value from the previous year (PV_{t-1}) to salary growth. Since 2004, the formula of revaluing pensions includes also the so-called sustainability factor, which plays the role of the automatic balance mechanism in the German pension system [Börsch-Supan and Wilke 2006]:

$$PV_t = PV_{t-1} \times \frac{I_{t-1}}{I_{t-2}} \times SF_t$$

where I_{t-1}, and I_{t-2} are the average net income of the whole body of contributors (excluding the contributions to the pension system), respectively in the previous year and two years before; SF_t is the sustainability factor defined as follows:

$$SF_t = 1 + \alpha\left(1 - \frac{R_{t-1}}{I_{t-2}}\right)$$

where R_{t-1} is the ratio of the number of beneficiaries to the sum of the number of contributors and the number of unemployed in the year $t-1$ and is a constant ($0 \leq \alpha \leq 1$).

The value of factor represents the degree to which any increase in the dependency ratio is reflected in reducing the indexation and is aimed to redistribute the adjustments between contributors and pensioners[13]. Its current value is set for 0.25.

[13] Note that if the value of SF is 1, and the entire cost of adjustments will fall on contributors (the currently working generation). Respectively, if all costs of adjustments will be borne by pensioners.

Note that the sustainability factor reflects changes in the ratio between the number of contributors and the number of pensioners (the dependency ratio)[14] which is the main determinant of the long-term sustainability of pension systems. Including this factor into the formula of pension unit value guarantees that together with the rise in the dependency ratio, the amount of pensions paid is reduced. In other words, the basic idea of the German ABM is to restore the financial equilibrium of the system by the gradual reduction of the replacement rate by lowering the indexation rate while the contribution rate is kept constant [Sakamoto 2013]. Some authors even claim that this feature makes the German PAYG pension scheme a quasi-NDC system [Börsch-Supan, Wilke 2006].

The main advantage of an ABM based on the sustainability factor is its ability to restore the full financial equilibrium of the pension system (providing that the value of is set properly). Moreover, the sustainability factor assures the participants that the contribution rate will not be raised significantly in the future. On the other hand, the sustainability factor, however, carries a threat of too deep reduction of pensions, which may ultimately lead to their inadequacy. It is also worth noting that an ABM based on the idea of the sustainability factor would be easy to apply in any other currently existing defined DB system [Sakamoto 2013].

c. Japan – the modified indexation mechanism

Since the 1980s, Japan's DB old-age security system has faced great challenges related to both the accelerating increase in life expectancy and the reduction of the working-age population (mainly due to the significant decline in the birth rate). After several earlier attempts to balance the system through traditional measures, in 2004 the Japanese authorities decided to develop their own automatic stabilising mechanism. The mechanism known as "modified indexation" was introduced in 2004[15] together with a fixed future contribution programme [Turner 2007; Fujisawa, Siu-Hang Li 2012].

The modified indexation mechanism is applied to both the revaluation of the contribution base used for calculating the initial pension and the revaluation of the pensions in payment. Under this mechanism, the normal indexation ratio is reduced by a modifier, which is defined as a sum of the decrease in the rate of the working generation participating in the pension system and the increase in the rate of life expectancy at age 65. For the purpose of calculation of the modifier, the rate of the increase in life expectancy is set for 0.3% per year. This value is based on long-term demographic projections and is applied as fixed value to avoid frequent fluctuations in benefit adjustments [Sakamoto 2008].

[14] The number of unemployed is included in the sustainability factor formula to exclude the effect of economic cycles.

[15] According to Turner [2007], the inspiration for the Japanese authorities were both German and Swedish experiences with automatic mechanisms.

With the modifier, the final formula used to revalue the contribution base until retirement is:

$$Max\{\beta + Min\{\delta, 0\} - 0.3\%, 0\%\}$$

where β is the net growth of salaries and δ is the growth rate of the contributing population.

Similarly, the final formula for indexation of pensions in payment is:

$$Max\{RPI + Min\{\delta, 0\} - 0.3\%, 0\%\}$$

where *RPI* is the retail price index.

The modified indexation mechanism is activated if the actuarial report which is made every five years reveals a long-term (a 95-year horizon is taken into account) financial imbalance. Other conditions for activation of the modified indexation are a positive CPI rate and a positive salary growth rate [Sakamoto 2008]. When triggered, the modified indexation mechanism gradually reduces the level of benefits until the pension system achieves financial equilibrium. As Vidal-Meliá, Boado-Penas and Settergren [2009] note, the main aim of the modified indexation mechanism in Japan is "to reduce spending on pensions to a particular level for a particular time and to adapt spending to the contribution rate".

The advantages of the Japanese ABM are similar to those in the German ABM: it is able to restore the pension system to full financial equilibrium, it guarantees that contribution rates will not be raised infinitely and it may be used in other DB pension systems. Like the sustainability factor, modified indexation may also cause too deep reduction in benefits. Moreover, due to the rules for activation of the modified indexation, this mechanism is not effective in a deflationary economy.

d. Sweden – the balance ratio and balance indexation

After a deep reform in 1999, the Swedish old-age security system has been a multi-pillar system in which the most significant role is played by the public, mandatory first pillar. It is constituted by three subsystems: a non-financial defined contribution tier, a defined contribution funded pension tier, and a guaranteed pension tier. A specific ABM is introduced in the NDC subsystem. It uses a complex formula to correct for the increase in life expectancy and slow wage growth by lowering the initial pension benefits and the indexation of benefits in payment [Settergren 2001].

In the Swedish NDC subsystem, each participant has an individual account with an account balance (A_t) which in time t is equal to the sum of the contributions credited to the account in the current period and the account balance in the previous year (A_{t-1}) multiplied by the accrual rate r:

$$A_t = C_t + (1 + r)\, A_{t-1}$$

Under normal conditions, the accrual rate r is equal to the growth rate of real per capita income. If the system is out of balance, the ABM is triggered and both the interest rate on individual accounts and indexation of benefits in payment are reduced.

To determine whether system is in balance in the year t, the balance ratio Br_t is used. It is defined as follows:

$$Br_t = \frac{CA_t + F_t}{L_t}$$

where: CA_t is contribution assets; F_t is a buffer fund accumulated from past surpluses; L_t is the liabilities of the scheme defined as a present value of the accrued benefits to date to be paid in the future. The contribution assets CA_t are calculated by multiplication of the annual system contributions and the expected turnover duration [Settergren 2001]. The expected turnover duration is the average length of time until the system must fully pay out benefits created in the year t[16].

If the balance ratio is higher or equal to one, no actions are taken. If the balance ratio is lower than one[17], the ABM is activated and the indexation of the NDC individual accounts and the indexation of pension benefits are reduced by switching the standard indexation to the balance index. The balance index is calculated by multiplying the income index which measures the growth of the average income by the balance ratio. The formula used for computing the balance index causes that the capital in NDC accounts and the pensions in payment grow together with the increase in the average income which is, however, corrected downward by the balance ratio.

What is noteworthy is that in contrast to other automatic mechanisms discussed above, the Swedish ABM rests on empirical data from the past, not on projections. Therefore, there is a lower likelihood that it will be eroded because of political discussion on the assumptions of this projections. However, it must be noted that this kind of ABM can be applied only in NDC schemes, as in DB schemes it is impossible to calculate the turnover duration. Moreover, the condition of a stationary population must be satisfied as Swedish ABM does not take into account a possible decrease in the annual contributions due to rapid ageing of the population. In addition, as Sakamoto [2013] notes, the balance ratio formula does not guarantee that the system is in financial equilibrium in the traditional sense, even if its value is higher than one. From the policymakers' point of view, the great advantage of the Swedish ABM is that it allows resolution of the problem of the smooth transition from PAYG scheme to fully funded one. Another important feature of Swedish ABM is that it shares the burden of necessary adjustments across the working generation and pensioners.

[16] Turnover duration can be also shown as a difference between expected income-weighted average age at which pension credit is received and expected pension-weighted average age at which pensions are disbursed [Settergren 2001].

[17] In order to smooth short-term variations, the three-year moving average of the solvency ratio is used.

e. Summary

As was shown in this section, ABMs can have numerous forms in terms of their degree of automaticity, frequency of adjustments and triggering indicator. They can be used both to reduce benefits and increase revenues. Moreover, they are quite easy to implement in the different frameworks of DB and NDC pension schemes. A brief summary of the key features of ABMs in the four analysed countries is presented in Table 2.

Table 2. Comparison of key features of ABMs in analysed countries.

	Canada	**Germany**	**Japan**	**Sweden**
Triggering of the mechanism				
Triggering indicator	Minimum contribution rate	Constantly active ABM based on current dependency ratio	Actuarial imbalance	Balance ratio
Source of data for triggering indicator	Actuarial report		Actuarial report	Current data from the pension system
Considered time horizon	75 years		95 years	Present situation, including liabilities accrued in the past
Degree of automaticity	Semi-automatic		Fully-automatic	Fully-automatic
Frequency of review	Every 3 years	Yearly	Every 5 years	Yearly
Intergenerational fairness and adjustment				
Sharing the costs between generations	Yes	To some extent (depends on parameter)	To some extent	Yes
Adjustments in contribution rates	Yes	No	Yes	No
Adjustments in amount of pension benefits	Yes	Yes	Yes	Yes
Adjustments in retirement / eligibility age	No	No	No	No
Equitable robustness[a]	Transitory	Transitory	Transitory	Partial
Ability to restore the financial equilibrium				
Ability to restore the full financial equilibrium	No	Yes	Yes	Yes[b]
Financial robustness[a]	Partial	Partial	Partial	Transitory
Applicability				
Applicable in other pension schemes	Yes	Yes	Yes	Only NDC
Degree of understandability for policymakers and system participants	High	Average	Average	Average

Source: Author's own elaboration.
Notes: [a]See Table 1. [b]When equilibrium is defined by the balance ratio.

Particular attention was placed on triggering rules, the ability to maintain intergenerational fairness, the ability to restore the financial equilibrium of the system and possible applicability in other systems.

5. Conclusions

With the growth rate of beneficiaries exceeding the growth rate of the workforce, policymakers in developed countries, in order to restore (or maintain) sustainability of pension schemes, are forced to reduce their generosity. In general, the long-term sustainability of pension schemes may be re-established only by applying one of three measures: cutting pension benefits, increasing contribution (tax) rates, or raising the retirement age. Any attempts to implement such measures are, however, extremely difficult, as they usually result in social anxieties which carry high political risk for the policymakers who are determined to introduce the necessary reforms. Another face of the political risk for pension schemes is also the so-called "populism in pensions". According to Besley and Prat [2005], a further serious problem of contemporary public pension schemes is their inability to develop a credible institutional framework which can guarantee contributors and pensioners that the promises of future payment will be respected. Indeed, frequent parametric ad hoc reforms substantially lower the credibility of pension systems and lead to the situation in which contributors reluctantly participate in the public pension system and seek other forms of securing the old-age risk [Vidal-Meliá, Boado-Penas, Settergren 2009].

In this situation, introduction of ABMs seems to be a solution which can addresses most of the discussed problems. First of all, when properly designed, ABMs may guarantee the financial equilibrium and the intergenerational fairness of the pension scheme. The assumed automaticity makes ABMs independent of politics and thus free of political risk. Moreover, thanks to their predictability, they can be used to cope with the pension systems' credibility issues. Adjustments made through an automatic mechanism are also less painful for the society than discretionary policy decisions as they tend to be smaller and more frequent.

When considering the introduction of ABMs, the authorities should however take into account that they are not an ultimate panacea for all diseases of the modern pension schemes. As was discussed in section four, not every ABM guarantees that pension systems will achieve and maintain financial balance. Similarly, not every ABM is able to provide full intergenerational fairness. Moreover, in most cases even if ABMs help to improve solvency of pension schemes, they usually also worsen benefit adequacy. From a broader perspective, ABMs in fact transfer some new risk to individuals. Besides the risk of pension inadequacy, it is also the risk of unemployment, particularly at an advanced age if workers decide to work longer to maintain the replacement rate of past generations. This transfer is more visible in DB schemes, as NDC schemes already incorporate the described shift. It should

be also noted that each type of ABM requires a proper triggering indicator which measures the solvency (or sustainability) of the pension system.

Another issue is that the sustainability of automatic mechanisms cannot be taken for granted, as they also face the risk of political erosion or reversal. This threat is particularly strong when they are introduced without wide political consensus. Experiences from the past show that ABMs or their triggering indicators may by over-ridden by governments under social pressure or during periods of crisis[18]. That is why an ABM should have vast social acceptance and should be viewed as an element of a broader pension system reform agreed upon among the main political forces. Therefore, ABMs can be successfully applied only in societies with an advanced democracy which fully supports the transparency of the pension scheme and where politicians do not take the opportunity to bypass the ABM to gain popularity.

This paper contributes to the research on pension systems by describing the concept of pension scheme sustainability and characterising the measures that can be used to restore it. In particular, the study provides an overview of the most notable ABMs and contains a summary of their advantages over traditional discretionary policy. Moreover, the important added value of the article is a proposal for the assessment framework of the ABMs, which shows that their key features refer to the following issues: how the mechanism is triggered, intergenerational fairness and adjustment, and the ability to restore the financial equilibrium and applicability

The article may also lay the groundwork for further, in-depth analyses. From a theoretical perspective, simulation of the optimal ABM construction in various pension schemes can be performed. Although for now automatic balance mechanisms in pension systems are too recent to make it possible to assess their performance, in the future it is desirable to evaluate their efficiency in real-world conditions. One can also consider how to incorporate automatic changes in retirement age through an ABM. Moreover, the issue of the proper sustainability indicator that triggers an ABM remains an open question.

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[18] Such situations occurred in Canada (although not directly), Germany and Sweden. For more details see [Bosworth, Weaver 2011].

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Abbreviations

AAM – Automatic Adjustment Mechanism; ABM – Automatic Balance Mechanism; DB – Defined Benefit; DC – Defined Contribution; NDC – Notional Defined Contribution.