

Pensions, Benefits and Social Security  
**4TH PBSS Colloquium**

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**Models of the actuarial balance of  
pay-as-you-go pension system:  
A review and some lessons**



**by**

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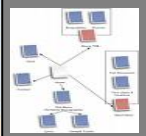




# Aim of this paper

To show the **advisability** of making it **compulsory** to draw up an **actuarial balance** in **pay-as-you-go** pension systems so as to **improve their transparency, credibility and solvency**. (Actuarial analysis methodology).

To shed some light on the **two main methods** used by government Social Security departments to draw up the actuarial balance, **focusing on their results, methodology and actuarial issues**.



# Structure of this paper

Models of the actuarial balance of pay-as-you-go pension system

1

**Introduction**

2

**The Swedish model**

3

**The US and the Japanese models**

4

**Concluding comments**

5

**Appendixes**

# Introduction

Models of the actuarial balance of pay-as-you-go pension system

One possibly useful way of reaching the objective of better designed and managed public pension systems would be to **provide better information** on the financial development and status of the systems.



How pension system interacts with demography and economy



Informed public debate



Longevity of old misunderstanding

Actuarial  
Balance

Mismatch between the planning horizons of politicians and the system itself.  
(Political risk)

American actuarial balance  
Japanese actuarial balance  
(stochastic methodology)

Swedish actuarial balance  
SHEET

The most commonly used methodologies for making aggregate projections of spending on pensions or for analysing the sustainability of pension system are:

1. **Aggregate or growth accounting models.** Making projections of spending on pensions (making assumptions of economy as a whole, such as future trends in demography, economic conditions...). Actuarial models

2. **Micro simulation models.** The working lives of a group of individuals are used to project how their pensions will evolve. (Variants: dynamic, static..)

3. **General equilibrium models.** The pension system is placed within an economic environment of general equilibrium with endogenous prices which generates explicit models.

4. **Indirect models.** Based mainly on the internal rate of return or the transfer component.



## Actuarial Balance sheet

**Financial statement listing the pension system's obligations towards contributors and pensioners at a particular date, with the amounts of various assets which back up these commitments. (2001)**

- ➔ **It does not fit into any of the methods described. No projections.**
- ➔ **It has now attracted little attention from academics.**



(millions of SEK)	2008	2007	2006	2005
Financial Asset	707,087	898,472	857,937	769,190
<b>Contribution asset</b>	4 Turnover Duration x Contributions (t)			5,720,678
Actuarial losses	261,327	81,607	-	-
<b>ASSETS</b>	7,445,765	7,096,049	6,802,575	6,489,868
Liabilities to Contributors	5,156,684	4,909,569	4,750,749	4,612,959
Liabilities to Pensioners	2,271,123	2,086,915	1,952,261	1,848,157
Accumulated surplus	17		28,392	8,783
Actuarial profits	-		71,173	19,609
<b>LIABILITIES</b>	7,445,765	7,096,049	6,802,575	6,489,868
<b>SOLVENCY RATIO</b>	<b>0.9672</b>	<b>1.0026</b>	<b>1.0149</b>	<b>1.0044</b>
<b>DEGREE OF FUNDING</b>	<b>9.52</b>	<b>12.84</b>	<b>12.80</b>	<b>11.90</b>

Assets  
-----  
Liabilities



ACTUARIAL INCOME STATEMENT Dec. 31 2008			
Fund Assets (changes)	-191,385	431,323	Pension Liabilities (changes)
Contributions	203,140	217,680	New pension credit and ATP points
Pension disbursements	-199,206	385,378	Indexation
Return on funded capital	-193,931	27,044	Longevity
Administrative costs	-1,388	1,345	Inheritance gains
Contribution Asset (changes)	361,381	-942	Administrative costs
Contribution revenue	394,833		Pension disbursements
Turnover Duration	-33,452	-199,182	
<b>ACTUARIAL LOSSES</b>	<b>261,327</b>	0.0	<b>ACTUARIAL PROFITS</b>
Total	431,323	431,323	Total

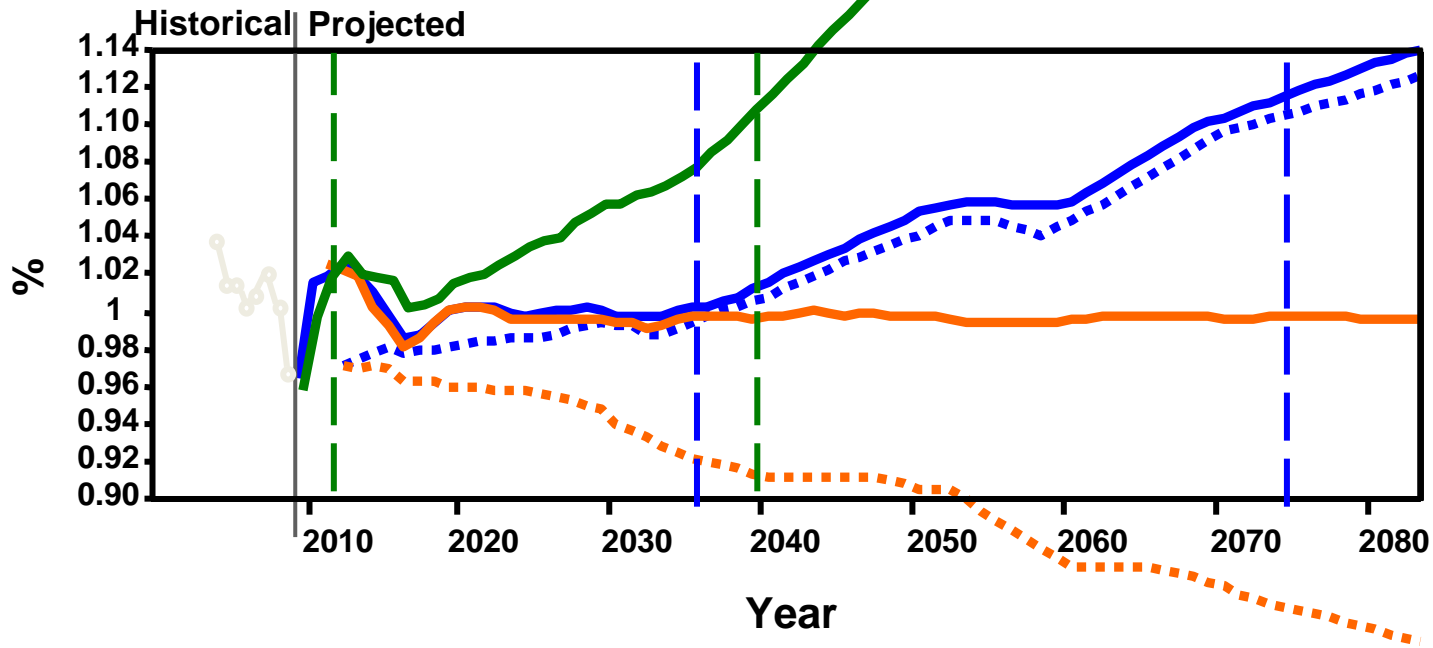
Millions of SEK





Models of the actuarial balance of pay-as-you-go pension system

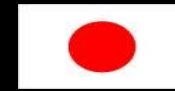
## Balance Ratio (Historical evolution and scenarios)



— Optimistic — Base ..... Base without ABM — Pessimistic ..... Pessimistic without ABM



### Actuarial Balance



- A projection model of aggregate accounting spending on pensions.
- It involves using the forecast demographic scenario to determine the future evolution of the number of contributors and pensioners according to the rules of the system.
- This paper reviews two model of actuarial balance: the American balance and the Japanese balance.



### Actuarial Balance

→ USA model report measures the system's financial solvency with a 75-year time horizon annually. (1941)


It measures the difference in present value, discounted by the projected yield, between spending on pensions and income from contributions, taking into account that the level of financial reserves at the end of the time horizon reaches a magnitude of one-year's expenditure.

→ The value summarises the system's financial deficit or surplus for the 75-year horizon.

**3**

# The US in comparison to the Japanese model

Models of the actuarial balance of pay-as-you-go pension system

USA BALANCE (2008)	 ITEM (in billion of dollars)	OASDI
1	Payroll tax revenue	35,041
2	Taxation of benefits revenue	2,175
3=1+2	Tax income	
4	Cost	
5=-4+3	Initial deficit	7,678
6	Trust fund assets at	
7=5+6	Open group unfunded obligations	7,678
8	Ending target trust fund	402
9=7-8	Results for the period	-5,661
10	Taxable payrolls	282,781
11=(3+6)/10%	Summarised income rate	<b>14.02</b>
12=(4+8)/10%	Summarised cost rate	<b>16.02</b>
13=(9/10)%	Deterministic Actuarial Balance	<b>-2.00</b>
Details in BOT (2008)	Deterministic Actuarial Balance ( $\infty$ )	-3.41%
	Stochastic Actuarial Balance (75 years)	-2.16%

**Tax income + trust fund at the start**  
**Payroll tax revenue (contribution bases)**

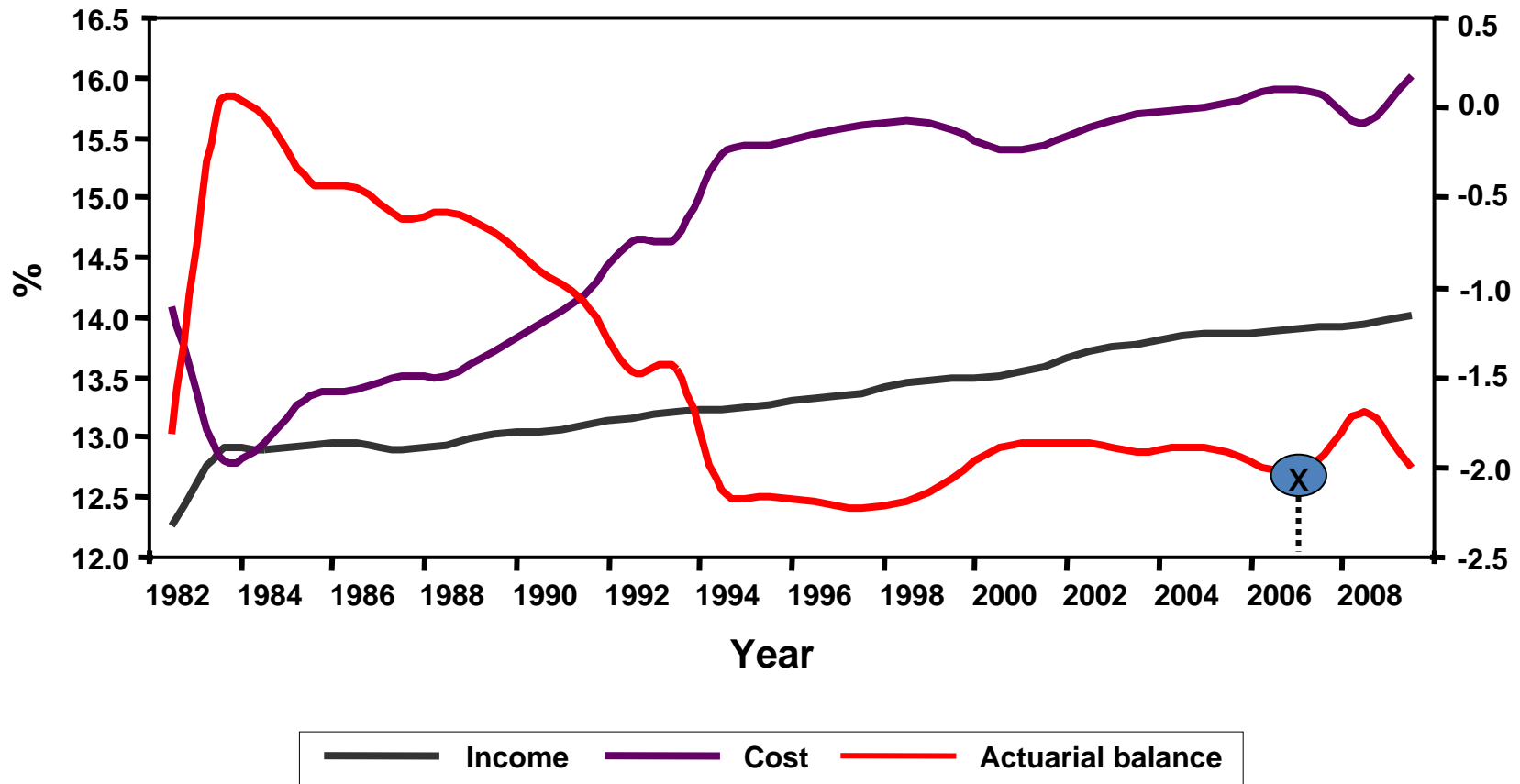
**Spending on pension + Ending trust fund**  
**Payroll tax revenue**



Models of the actuarial balance of pay-as-you-go pension system




## Historical evolution of OASDI Actuarial Balance estimates (1982-2009)



**3**

# The US in comparison to the Japanese model

Models of the actuarial balance of pay-as-you-go pension system

 Past figures and forecast evolution of some indicators					
Years	Income rate %	Cost rate %	Annual Balance %	Contributors/ Beneficiaries	Trust fund ratio (years)
1990	12.49	10.74	1.75	3.4	0.75
1995	12.59	11.67	0.92	3.3	1.28
2000	12.69	10.40	2.29	3.4	2.16
2005	12.71	11.16	1.55	3.3	3.18
2008	12.71	11.38	1.33	3.2	3.58
2010	12.71	11.38	0.37	3	3.60
2020	13.15	11.55	-1.46	2.5	3.15
2030	13.25	11.61	-3.56	2.2	1.53
2040	13.27	11.67	-3.74	2.1	-
2050	13.25	16.61	-3.36	2.1	-
2060	13.27	16.73	-3.46	2.1	-
2070	13.30	17.05	-3.75	2	-
2080	13.33	17.53	-4.20	2	-

**2016**  
 Cash deficit

**2037**  
 Trust fund exhausted



The



## Actuarial Balance

- Japanese model report is compiled at least every five years with a **95-year time horizon**. (resemblance US model).
- Japan applies what is known as the **“limited balance”** or **“closed period balancing”**. Period of financial equilibrium is finite and equal to 95.
- Method for financial balancing is carried out by the so-called **“modified indexation”**. Applied to revaluation of contribution bases and indexation in pensions in payments.



- Valuation on verifiable facts
- Contribution Asset derived from cross-section facts
- Not dependent on market interest rate
- Traditional structure of accounting balance sheet
- Immediate effect (MFA)



- Projections for 75 (95) -year period
- Contributions are estimated
- Dependent on market interest rate
- More a financial profile
- No immediate effect  
Informative effect (USA)  $\neq$   
Immediate effect (Japan)





## Transparency

Compiling actuarial balances should “oblige” politicians to be much more careful about what they say and minimize the use of populism in pensions.



## Credibility

Contributors and pensioners have a reliable idea as to how far promises made to them regarding the payment of their pensions are kept.



## Solvency

The obligation to compile an actuarial balance periodically makes people more interested and this may make it easier to introduce automatic balance mechanisms (ABMs).



## Sweden

It seems more appropriate for the Swedish actuarial balance sheet to be applied to the NDC system, especially if measures that immediately affect current pensioners and contributors can be derived from the solvency indicator.



## USA

It has a different mission from the Swedish one. Its aim is to provide information to the “interested public” and legislators. It is largely concerned with the future.



## Japan

It includes elements that can be found in the two models: highlights future challenges to the system and it incorporates automatic measures.



## Proposal

It would be interesting and politically productive to get official yearly information on these type of actuarial balances for all public pension systems.

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