Measuring adequacy
and facing longevity risk in social security

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ABSTRACT

Labour markets are undergoing major transformations mostly due to ageing population. Actuaries can play a fundamental role to ensure that social security systems continue to meet their objectives of adequacy of benefits and financing constraints.
Adequacy of benefits and financial sustainability are two sides of the same matter and must be jointly considered. In the medium to long term, unsustainable pension systems may not be able to guarantee enough level of the benefits. At the same time, the financial sustainability, pursued through a compression of the benefits, may be not socially sustainable.
Although it seems hard to define uniquely the Adequacy of Pensions, we can certainly state that the main objective of a system is to provide an adequate income during retirement.
To measure adequacy we can consider the so-called Pension Wealth indicator (PW).
PW is the ratio between the actual value, on pensionable age, of all the pension payments that are expected to be paid (generally for the entire life) and the last salary received.
PW is highly related to the future mortality trends and its study may give useful information to face the longevity risk. PW can be thought as the lump-sum needed to buy an annuity giving the same cash flow as that of the old age pension.
The PW is generally referred to old age pensioners, but the aim of this study is to present a redefinition of PW with reference to specific vulnerable workers: the Italian injured worker broken down by accidents and occupational diseases and by impairment level. In this sense, the indicator will also include the pension income coming from the Workers Compensation system. The old age generic PW will be compared with the injured worker's PWs.

Keywords: social security, adequacy, pension systems, workers' compensation programs, injured workers, pensions benefit.

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FOREWORD

The overall success of the retirement income system is often measured by whether it meets the income replacement objectives on average. However, even under a successful system, significant disadvantaged minorities with particular characteristics still can be at risk of inadequate income replacement as they enter retirement. These often include those workers who have lost employment and cannot find work for reasons of sickness or lack of relevant skills. In this case study we consider Pension Wealth Indicator for injured workers.

1. VULNERABLE GROUPS.

Tomorrow's vulnerable groups will be shaped in large part by future economic situation, particularly employment growth and the outcome of reforms being implemented in the last years. The ones, most likely to be at risk, are people with intermittent or weak job history during their working years and, accordingly, with weak contribution histories.

The topic of vulnerable groups was widely discussed in Marcelloni (2018[3]), where all injured workers were treated as vulnerable as long as they have experienced at least one job interruption during their career due to a work injury. An employee work injury is a mental or physical harm caused by accident or disease occurred during the course of his work. An injury or illness is considered to be work-related if an event or exposure in the work environment either caused or contributed to the resulting condition or significantly aggravated a pre-existing injury or illness. In Italy, such situations entitle the employee to compensation and/or a benefit either for disability or for treatment. If this compensation/benefit are considered the same

[3] "Theoretical Replacement Rates And Vulnerable Groups: The Italian Experience On Injured Workers", Raffaello Marcelloni (Inail, Italy), International Congress of Actuaries, Berlin, June 2018.

way as an income from work (as it is somehow strongly related to the working activity of the employee), it can then be seen how this additional income could affect the economic wellness of a worker (injured worker) once he/she retires.

2. INJURED WORKERS IN ITALY.

A public non-profit administration (INAIL[4]) manages the compulsory insurance against accidents at work and occupational diseases. INAIL protects injured workers and workers affected by occupational diseases through a wide range of activities ranging from preventive actions at the workplace, to medical services and financial assistance, rehabilitation and reintegration of victims of workplace accidents or occupational diseases to social life and work. INAIL also provides a large number of economic benefits depending on the type of injury or disease and on their consequences (even benefit to survivors are provided). In this case study we will focus on the life annuity benefit as regulated by the recent reform introduced by the Law (Legislative Decree no. 38 enforced in 2000 (LD 38/2000)). This reform redefined the overall role of INAIL focusing the system also on the "physical and psychological integrity" of the worker, considered as a violation of the basic right to health. Besides the reduced capacity of the worker to generate an income, this kind of consequences of an injury (or occupational disease) called "biological damage" are independent of income, since the impairment in itself produces the same prejudice to health. What is special about the life annuity paid by INAIL is that it is not subject to taxation, while other kinds of wage compensation are subject both to the income tax and to the social security contribution. The Life Annuity for Permanent Disability is an economic benefit to compensate the decreased ability to work due to the effects reported following a work accident or an occupational disease. It is paid from the first day after clinical recovery of the injured worker until complete recovery or death. The eligibility requirement needed to be entitled to this benefit is basically to have an assessed Impairment Degree from 16% upwards as a result of the consequences reported after a work injury.

The calculation of the annual amount of the annuity is based on this degree of impairment and on the earnings received by the injured person in the last year preceding the date of the work accident (or the date of first notification of the occupational disease). These earnings are subject to the minimum and maximum limits established by law each year.

[4] INAIL – Italian national institute for insurance against accidents at work.

3. MEASURING ADEQUACY FOR AN INJURED WORKER.

Although it seems to be hard to define uniquely the principle of Adequacy of Pensions we can certainly state that the main objective of a pension system is to provide an adequate income during retirement. As we already mentioned the adequacy of pension benefits may be defined in two main ways: satisfying basic needs and trying to allow retirees maintaining the same standard of living they experienced before retirement.

Marcelloni (2019[5]) used the replacement rate as an adequacy indicator and it turned out to be quite good to monitor the functioning of a pension system at time of retirement. If someone wants to take into account benefit payment period and to see how benefit's value evolves over time, the so-called Pension Wealth (PW) indicator may be useful. The PW takes into account benefit payment period and indexation of benefits in payment. PW can be thought of as the lump-sum needed to buy an annuity, however assumptions about life expectancy and indexation of benefits are needed.

In Italy, the law requires INAIL to review and, if needed, to update PW indicator, specifically related only to the injured workers population, at least every five years. To take into account the recent changes in mortality and in the modified exposure to risk of injury at work, the INAIL Statistical and Actuarial Department has lately carried out a study focused at monitoring mortality of injured workers. In 2016 it was decided to update Pension Wealth indicators. The current Pension Wealth indicators are now calculated using mortality of the Italian injured workers in 2013, which is the most recent experience year. Specifically, Pension Wealth indicators are calculated on the basis of a lifetime steady income flow of 1 unit per year. For the purpose of this case study these indicators have been redesigned to consider the average salary of an injured worker at the age of retirement, and then linking it to the price index. It must be noted that these modified indicators consider both the generic mortality and the probability of death as a result of the injury.

4. INJURED WORKERS PENSION WEALTH: METHODOLOGY AND ASSUMPTIONS.

The features of the pension scheme presented here are those one currently legislated in Italy and the values used are in respect to 2016.

[5] "Theoretical Replacement Rates And Injured Workers In Italy", Raffaello Marcelloni (Inail, Italy), IIA Section Colloquium 2019, Cape Town, April 2019.

- WORKING CAREER:

  In this study a retirement age of 67 is assumed both for males and females. Considering an average entry age of 26, the resulting career length is 41 years.

- COVERAGE:

  This study is focused on the Italian injured workers included in the mandatory compensation program regardless of whether they are in the public or in the private sector.

- ECONOMIC VARIABLES:

  Price inflation is assumed to be 2% per year. Real earnings are assumed to grow by 1.25% per year on average. This implies a nominal wage growth of 3.275%. The real discount rate adopted for actuarial calculation is 2.5%.

- TAXES AND SOCIAL SECURITY CONTRIBUTIONS:

  Income taxes and social security contributions used for the purposes of this work are those provided by the Italian law in 2016. Pensioners do not pay social security contributions.

- DEFINITION AND METHODOLOGY:

  The pension wealth indicator (PW) measures the discounted value of a lifetime flow of all the retirement incomes of a pensioner at retirement age.

  The methodological background is that one presented in the OECD "Pension at a Glance 2017" (see references). Its assumptions are common to the analysis of all OECD's countries, allowing the design of pension systems to be compared directly. This enables the comparison of future entitlements under today's parameters and rules.

If we want to calculate this specific indicator for an injured worker (PW_{inj}) receiving both the old age pension and the invalidity pension, we could then consider these two incomes together. Under this assumption the specific indicator will result as the sum of two components:

$$PW_{inj} = PW_{inj,old} + PW_{inj,inv}$$

where PW_{inj} = total pension wealth for an injured worker; $PW_{inj,old}$ = old age pension wealth of an injured worker; $PW_{inj,inv}$ invalidity pension wealth of an injured worker. The invalidity benefit, in general, can start before retirement. In this case study only payments after the pensionable age are considered. These indicators are measured as a multiple of annual gross (or net) earnings. To calculate these values we used the available data in the INAIL archives updated to December 2016.

As it is known, the PW is strictly related to the expectancy of life. The particular behavior of the mortality of the injured workers suggested some further considerations. Baradel and Martini (2017[6]) showed that mortality of the injured worker population is highly affected by the claim age[7], by the type of event and, of course, by the level of impairment (see Table 1).

Table 1. Average Italian injured workers crude[8] mortality rates disregarding age (per 1000 of workers)

CLAIM AGE	>15 YEARS			<=15 YEARS					
Type of event	Accidents and Occupational Diseases			Accidents			Occupational Diseases		
Impairment degree	up to 60% (A)	61%-100% (B)	Variation (B / A)	up to 60% (A)	61%-100% (B)	Variation (B / A)	up to 60% (A)	61%-100% (B)	Variation (B / A)
Mortality rate	35.58	44.03	24%	4.07	14.70	261%	31.59	449.56	1,323%

Source: prepared by authors based on data from INAIL

Data in Table 1 show that, in case of claim ages over 15 years, after the stabilization of impairments after-effects, the impairment degree doesn't affect the level of mortality significantly as it happens for shorter claim ages. For claim ages up to 15 years, indeed, impairment degree plays an important role, especially for occupational diseases where 60% is a threshold of worsening. High level of mortality for occupational diseases is mainly due to the high age of those exposed to risk because usually occupational diseases occur after a long latent period. The fact that claim age is less than 15 years indicates that occupational disease was diagnosed for individuals aged 52 or more but in fact beginning of disease taking into account possible latent period might be significantly earlier.

It could be also interesting to compare the Italian injured worker's life expectancy with that of the Italian population.

[6] "Inail Life Tables For Work-Related Injured Or Ill People", Laura Baradel (Inail, Italy), Daniela Martini (Inail, Italy), ASTIN and AFIR/ERM Colloquia, Panama City, August 2017.

[7] In this case study let's define "Claim age" as the number of years from the starting date of the invalidity benefit to the pensionable age.

[8] Number of deaths among the population in the statistical period of observation (2000-2013).

Table 2. Life expectancy at some ages of INAIL permanent disability annuitants (disregarding gender) compared to Italian population (ISTAT[9] – weighted on INAIL gender distribution)

Age	ANNUITANTS WITH CLAIM AGE >15 YEARS		ANNUITANTS WITH CLAIM AGE <=15 YEARS				ISTAT 2013 sex weighted
	Accidents and Occupational Diseases		Accidents		Occupational Diseases		
	up to 60% (VS Istat)	61%-100% (VS Istat)	up to 60% (VS Istat)	61%-100% (VS Istat)	up to 60% (VS Istat)	61%-100% (VS Istat)	
20	59.57 (-2%)	55.55 (-9%)	62.68 (+3%)	47.98 (-21%)	51.12 (-16%)	8.97 (-85%)	60.88
40	40.53 (-2%)	37.68 (-9%)	43.50 (+5%)	31.05 (-25%)	32.12 (-22%)	4.00 (-90%)	41.44
60	22.54(-2%)	20.61 (-11%)	25.34 (+10%)	17.24 (-25%)	15.76 (-32%)	2.03 (-91%)	23.09
80	8.32 (-1%)	7.60 (-9%)	10.20 (+22%)	7.62 (-9%)	5.55 (-34%)	1.25 (-85%)	8.38

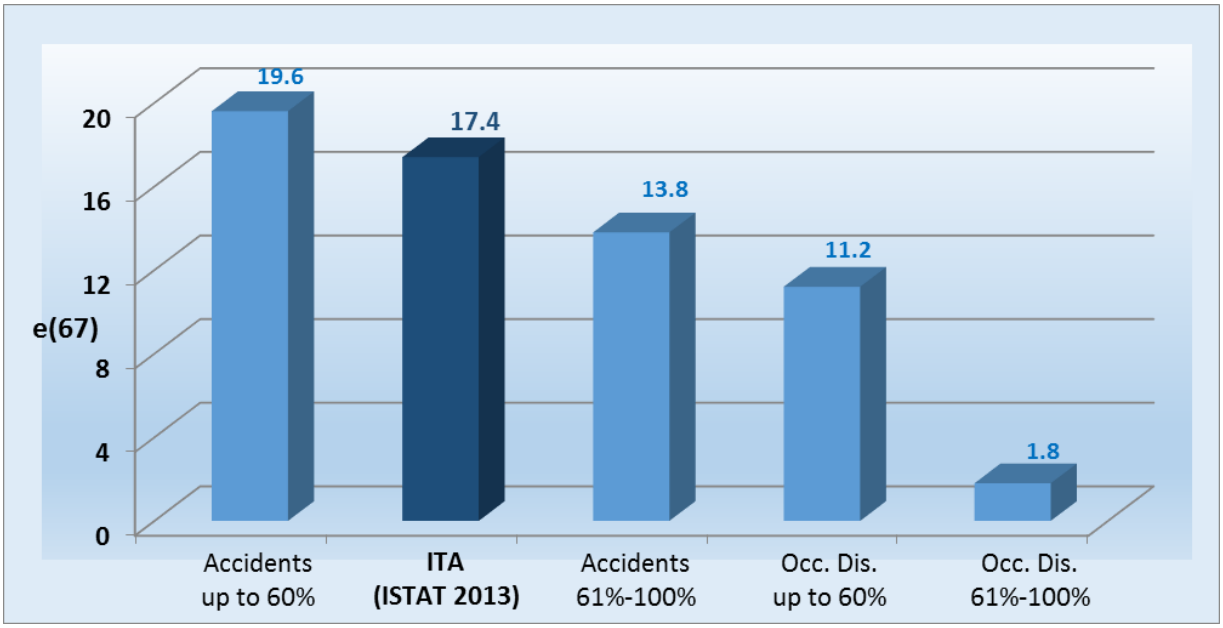
Source: prepared by authors based on data from INAIL

The data in Table 2 show that, for higher claim ages (> 15 years) and low to mid impairment degree, mortality of injured workers is overall similar to mortality of the Italian population. For lower claim ages there is a substantial difference between accidents and occupational diseases, with particular emphasis on the most serious diseases, including all forms of cancer (even those related with asbestos), that cause a very low life expectancy.

In this case study only injured workers attaining the pensionable age in 2016 and with a claim age up to 15 years have been considered. At last, because the age of interest of the PWs is the retirement age, it could be also interesting to focus the attention on the life expectancy at pensionable age.

[9] ISTAT (Italian National Institute of Statistics) is a public research organization and the main producer of official statistics in the service of citizens and policy-makers. It operates in complete independence and continuous interaction with the academic and scientific communities.

Figure 1. Life expectancy at age 67



Source: prepared by authors based on data from INAIL

Because of the particular behavior of the mortality of the population of injured workers shown above, it seemed to be appropriate to calculate Pension Wealth indicators by type of event (injury or occupational disease) and level of impairment (up to 60% and from 61% onwards) considering an average claim age for each one of them. Thus, we define four PWs:

1. $PW_{inj(16\text{-}60)}$ = pension wealth for an injured worker with a degree of impairment between 16% and 60%;
2. $PW_{inj(61\text{-}100)}$ = pension wealth for an injured worker with a degree of impairment between 61% and 100%;
3. $PW_{OD(16\text{-}60)}$ = pension wealth for an ill (occupational disease) worker with a degree of impairment between 16% and 60%;
4. $PW_{OD(61\text{-}100)}$ = pension wealth for an ill worker with a degree of impairment between 61% and 100%;

The annual amount of the invalidity pension (B) is composed of two elements:

$$B = FD + BD$$

where FD = Financial Damage and BD = Biological Damage.

FD parameter has the aim to restore the presumed reduced capacity to produce an income because of the consequences of the accident (or occupational disease). It is calculated by multiplying the annual Salary (S) by the Degree of Impairment (DI) and by a further specific factor (G), which depends on the degree of impairment itself, i.e.

$$FD = S \times DI \times G.$$

BD aims to restore the so called "biological damage" defined above. Its value is a variable amount depending only on the degree if impairment (DI).

It is clear that the higher the salary (or the higher the degree of impairment as well) the higher will be the benefit. The benefit is not subject to taxation in Italy similar to many other countries where a compensation programs exist. The salaries considered to calculate the PWs are those extracted from the INAIL database updated to December 2016.

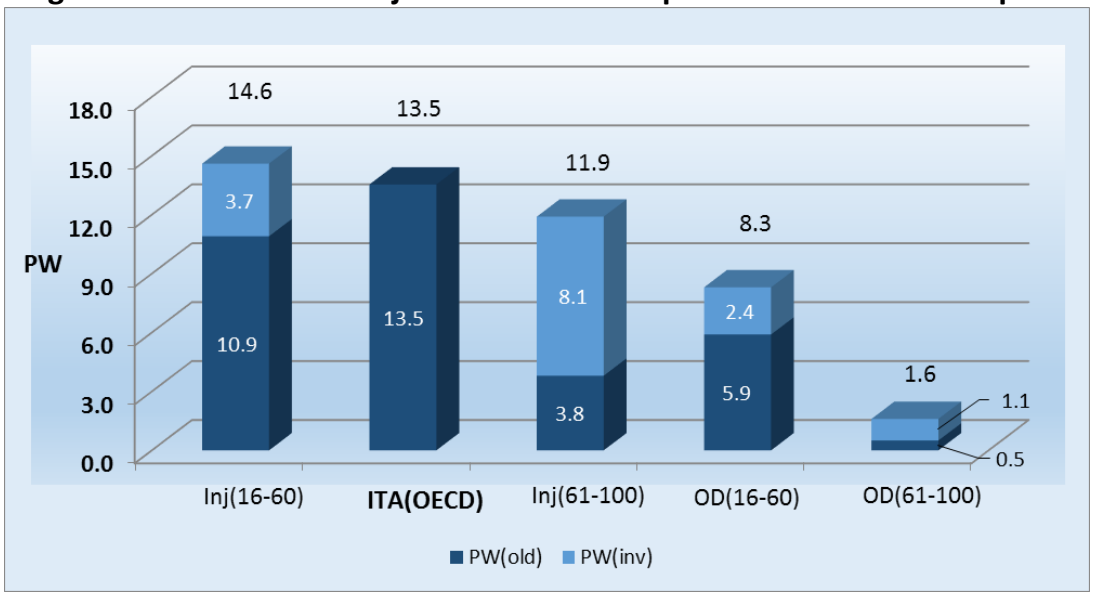
5. Pension Wealth Indicators.

The PW_{inj} values for Italian injured workers are compared with the PW values for a generic Italian pensioner (PW_{ITA}) (see OECD 2017). The PW_{inj} were calculated adopting the same assumptions and methodology as OECD.

5.1 Gross Pension Wealth.

Figure 2 shows the obtained values of the PW_{inj} compared with PW_{ITA}.

Figure 2. Gross PWs for injured workers compared to PW for Italian pensioners



Source: prepared by authors

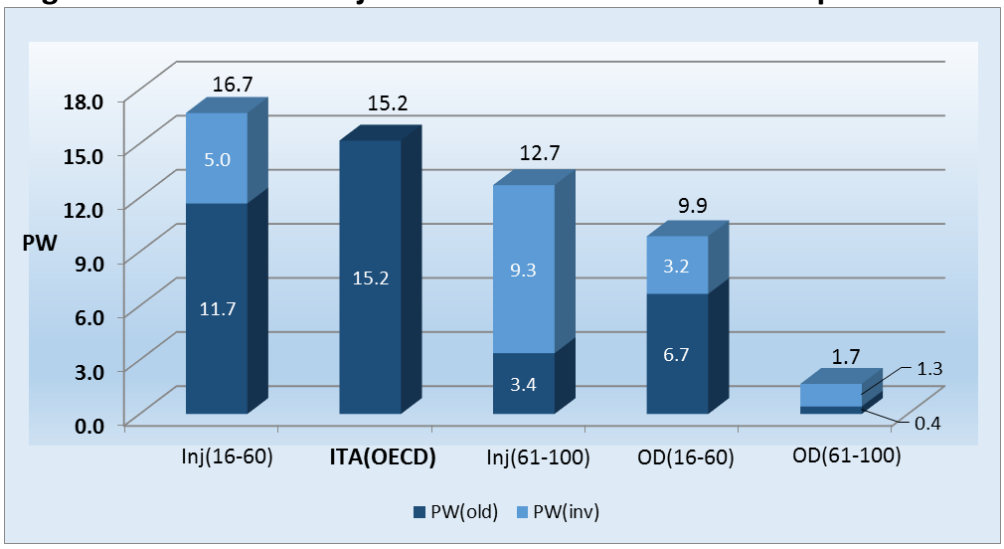
The first important observation that can be made is that the value of Pension Wealth indicator for injured workers with low to mid degree of impairment (i.e. 16% and 60%) is higher than the Pension Wealth indicator for overall Italian population. This is mainly because, as already mentioned, the Italian injured workers with a relatively low impairment (up to 60%) have a better life expectancy than the Italian general population. On the opposite Pension Wealth indicators for injured workers with high degree of impairment or those suffering from occupational diseases are lower than indicator for general population. In the extreme case (occupational diseases with high degree of impairment) $PW_{OD(61-100)}$ is only about 12% of PW_{ITA}. This is because of the very short life expectancy for such type of workers even if they receive higher benefits.

It may be seen from Figure 2 how final value of Pension Wealth for injured workers is affected by the Pension Wealth indicator related to old age pension (PW_{old}) and by the same indicator related to the invalidity benefits (PW_{inv}). It is evident that compensation program benefits have different impact on the four groups of impaired workers since the invalidity benefits are strongly related to the degree of impairment. This effect is less evident for the occupational disease with degrees form 61% upwards. This is again because of the high mortality of this group.

5.2 Net Pension Wealth.

If we consider the net PWs, the component regarding the invalidity benefits has a significant impact on the resulting total values because of the advantage coming from their exempt from taxation, which was less evident in terms of Gross values (see Figure 3).

Figure 3. Net PWs for injured workers VS PW for Italian pensioners



Source: prepared by authors

6. CONCLUSIONS.

The reported results of PWs values, showed as a combination of the two components of old-age and invalidity, point out how the Italian workers compensation program seems to be well functioning in restoring the workers' reduced capacity to generate an income after the occurrence of a work accident or after an occupational disease. This case study showed how it is important to refer to the Pension Wealth indicator to measure the adequacy of the benefit when considering both an old age pension scheme and a compensation program. Furthermore, PW is also useful to assess the obligations arising from such schemes. From this point of view, this indicator offers good information in order to verify the financial sustainability. At last this case study has pointed out that, when measuring adequacy and sustainability, is very important to split out the whole population of protected people in different groups having the same features that affect the level of mortality.

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