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An Actuarial Model for Basic Income Benefit

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AIMS

- To calculate the lump sum (cost) of a basic benefit for the whole population and financial cost of this measure for Spain in 2010 and its projection for the next twelve years.
- To design an actuarial model for financing the Basic Income Benefit. This model has to redistribute the existing benefits (retirement, disability, mortality) and the Basic Income benefit.



THE COST OF A UNIVERSAL BASIC BENEFIT

- Once the results from the sample are extrapolated to the whole population, the **financial cost of this proposal for whole population** of Spain can be obtained as we show:

$$BBT_{2010} = \sum_{h=1}^S I_{X_h:2010}^{RB} \cdot BB_{h:2010}$$

$$= 172,485,757,349.54 \text{ €}$$



THE COST OF A UNIVERSAL BASIC BENEFIT: HYPOTHESIS

- The factor of elevation associated with each record in the survey will vary over time in the same way as the proportion of the total population represented by each age bracket.
 - The factor of elevation of the sample takes into account the households surveyed as part of the whole population and permits us to extrapolate the result to the population of the entire country, i.e. 45,147,618 people (INE, 2010).



THE COST OF A UNIVERSAL BASIC BENEFIT:
HYPOTHESIS

- The fertility rate and the clear balance of migration in 2010 are held constant for the following twelve years.
- A forecast of population for the next twelve years is made using the General Spanish Population mortality tables (PE2000NP) (Prieto and Fernandez, 1995)
- The different factors of consumption (Peña-Miguel et al, 2013) and the consumer price index set for 2010 (Table 1).

Table 1: Differentiated inflation in 2010

Food Price Inflation	0.70%
Clothing and footwear inflation	0.60%
Household inflation	2.85%
Transport inflation	9.20%

Source: INE (National Statistics Office;
<http://www.ine.es>)



THE COST OF A UNIVERSAL BASIC BENEFIT:
HYPOTHESIS

- The establishment of this basic benefit must entail the disappearance of all local, regional and national benefits that could serve to similar purposes because the needs which those benefits cover will in fact be covered by this universal benefit. Thus, taking into account the cost of pensions, unemployment and non-contributive benefits (Table 2), in the case considered here the financial cost of a universal basic social benefit for 2010 would be as follows:



THE COST OF A UNIVERSAL BASIC BENEFIT

Year	Cost	Cost taking into account the rest of the benefit that currently exist
2010	172,485,757,349.54	116,978,763,035.24
2011	178,234,995,954.96	120,877,860,739.25
2012	183,667,227,755.79	124,561,966,408.88
2013	188,987,641,472.07	128,170,237,752.15
2014	194,192,337,262.47	131,700,029,921.03
2015	199,594,312,158.04	135,363,615,546.54
2016	204,750,320,287.48	138,860,388,047.93
2017	209,755,567,384.81	142,254,915,359.22
2018	214,745,552,086.70	145,639,091,809.27
2019	221,001,005,432.29	149,881,501,187.51
2020	226,630,898,344.75	153,699,659,388.17
2021	232,977,196,697.40	158,003,679,282.64



Table 2: Estimated cost of a universal basic benefit.
Source: Own work with micro-data from the 2010 HBS

THE COST OF A UNIVERSAL BASIC BENEFIT

- All this gives the **present value** for the reference twelve years of the total cost corresponding to universal basic aid paid to the Spanish population (B (12)), which would be:

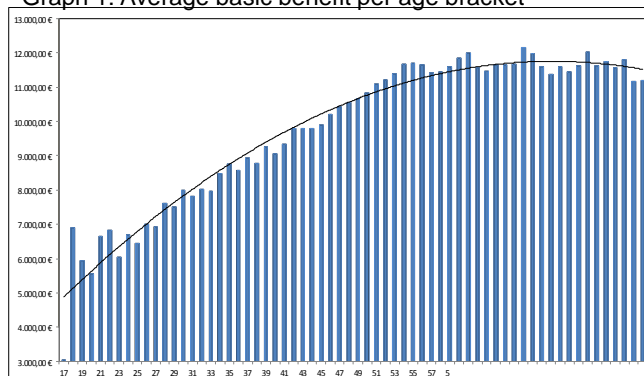
$$B(12) = \sum_{t=1}^{12} \sum_{h=1}^5 [i_{x_{t-1}}^{RB} \cdot (t-1)^{[h]}] p_{x_t} \cdot RB_{h,1} \cdot (1+irb)^{t-1} \cdot v^{(t-1)/2}$$

$$= \text{€}2,146,586,758,209.99$$



THE COST OF A UNIVERSAL BASIC BENEFIT

Graph 1: Average basic benefit per age bracket



the total amount of basic benefit follows a concave distribution, the quantity increases for the highest age brackets (between 50 and 60) where growth is reduced due to the lower level of influence of factors such as the number of dependents.



THE COST OF A PARTIAL BASIC BENEFIT

Year	Cost	Cost taking into account the rest of the benefits already existing
2010	74,862,618,089.43	19,355,623,775.13
2011	78,159,801,843.58	20,208,105,960.39
2012	81,071,612,575.18	20,960,950,497.00
2013	83,881,999,268.39	21,687,571,992.27
2014	86,601,025,180.46	22,390,572,287.11
2015	89,529,007,671.73	23,147,598,009.26
2016	92,238,720,457.50	23,848,190,408.49
2017	94,830,369,948.51	24,518,257,710.24
2018	97,463,506,625.20	25,199,051,465.03
2019	101,419,875,576.67	26,221,965,048.53
2020	104,825,291,507.82	27,102,430,509.71
2021	109,030,319,501.07	28,189,634,535.94

Table 3: Estimated cost of a partial basic benefit.
Source: Own work with micro-data from the 2010 HBS



THE COST OF A PARTIAL BASIC BENEFIT

- The present value of the total cost of a universal partial basic benefit for the Spanish population (BP (12)), for the next twelve years is:

$$BP(12) = \sum_{t=1}^2 \sum_{h=1}^5 \left(\frac{RB_{h:1}}{1+i} \right)^t \cdot p_{x_h} \cdot RB_{h:1} \cdot (1+irb)^{t-1} \cdot v^{(t-1)/2}$$

$$= \text{€ } 966,129,904,277.93$$



THE COST OF A PARTIAL BASIC BENEFIT

Graph 2: Average basic benefit per age bracket



the amount of the partial basic benefit follows an exponential, convex distribution. This is due to the fact that most of the working population is to be found in the intermediate age bracket (from 25 to 45) where the number of survivals of the aid is notably lower than in the over 45 bracket, where the percentage of the working population decreases progressively.

ACTUARIAL MODEL: PAY-AS-YOU-GO SYSTEM

The International Labour Organization (ILO) proposes an actuarial model (Plamondon et al, 2000) for the financing of the public aid's pension-system, where apart from the contributions of the government, ILO proposes a price(quote) for contributor.



ACTUARIAL MODEL: PAY-AS-YOU-GO SYSTEM for a universal basic benefit

- Establishing the equivalence for the fiscal year 2010, there is obtained the average percentage of price(quote) that on the salary it finances the expense for BI.

$$k_{2010} = \frac{\sum_{h=1}^s l_{x+h/2010}^{RB} \cdot RB_{h/2010}}{\sum_{t=x}^{xj-1} l_{t/2010} \cdot S_{t/2010}} = 33,3042417\%$$

The workers must dedicate this percentage of the salary to finance the RB. On the other hand, every worker also receives an identical RB to the minimal vital needs.



ACTUARIAL MODEL: PAY-AS-YOU-GO SYSTEM for a universal basic benefit

With Contributions of the State

Concept	Contribution of State (€) 2010
Unemployment: Assistencial level	4,732,000,000.00
Non- contributory pensions	3,403,030,000.00
Contributory pensions (33%)	34,916,887,494.30
Unemployment : Contributory level (50%)	12,312,500,000.00
Non-contributory pensions quota	142,576,820.00
Contributions of State: AE_{2010}	55,506,994,314.30



ACTUARIAL MODEL: PAY-AS-YOU-GO SYSTEM for a universal basic benefit

With Contributions of the State

The purpose of the RB is to reorganize the minimal monetary aids that exist along the whole country. This substitution does not imply that the State stops contributing the above mentioned quantities, by what they must be born in mind on having determined the percentage of contribution for the financing of the RB.

$$k_z = \frac{\sum_{t=1}^g l_{t|2010}^{RB} \cdot RB_{t|2010} - AE_{2010}}{\sum_{t=x}^{X-1} l_{t|2010} \cdot S_{t|2010}} = 22,5867287\%$$



ACTUARIAL MODEL: PAY-AS-YOU-GO SYSTEM for a universal basic benefit

- **With Contributions of the State and the creation of a Reserve Fund**

Besides the financing on the basis of the contributions of the State, it is necessary to create a reserve fund to generate resources in a few epochs that avoid lacks of coordination or deficits of others. If a value estimates the reserve fund 2 monthly payments of the annual payments, the percentage of contribution for the financing of the presentation(service) proves,

$$k_x = \frac{\sum_{t=1}^p l_{x+t|2010}^{RB} \cdot RB_{t|2010} + FR_{2010} - AE_{2010}}{\sum_{t=x}^{x+1} l_{t|2010} \cdot S_{t|2010}} = 28,1374356\%$$



ACTUARIAL MODEL: PAY-AS-YOU-GO SYSTEM for a partial basic benefit

- **Case 1= Without External Financing**

14.4547745%

- **Caso 2= With contribution of State**

3.7372615%

- **Caso 3= With contribution of State and a Reserve Fund**

6.1463905%



CONCLUSIONS

- The current crisis is likely to lead to a thorough revision of minimum income schemes in Spain. To meet the challenge of providing a basic benefit capable of becoming an efficient tool, helping to place most of the population within the economic and production system. In this sense BB could become the basic national social protection system (ILO, 2012).



CONCLUSIONS

- The average financial cost for a universal basic benefit for 2010 is €172,485,757,349.54. The establishment of this basic benefit would entail the disappearance of all those local, regional and national benefits that could serve similar purposes.



CONCLUSIONS

- a partial basic benefit for the unemployed could be considered. In this case, the total amount would be €74,862,618,089.43. As with the universal basic benefit, the establishment of this basic benefit must entail the disappearance of all those local, regional and national aids that could serve similar purposes.



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