



# **Determination of the 2015 Revaluation Pension Index**

## **Annex 3: Modelling and Forecasting Social security contributions**

This annex summarises the modelling of Social Security contributions series. It is estimated using total number of wage-earners, average wage per employee and maximum contribution base for the period 1995-2013. The sources are the National Statistical Institute and Social Security System (SSS).

The model shows that the elasticity of social contributions to a change in the number of wage-earners is almost one to one (as a 1% increase in the number of wage-earners implies an increase of 0.98% in social contributions), whereas the corresponding elasticity to average wage and to the maximum contribution base are only 0.72% and 0.49%, respectively.

### **I. DATA**

The series of total Social Security contributions modelled (see figure 1) includes revenues for common contingencies, industrial accidents and cessation of employment.

Social Security contributions depend on both the number of contributors and the contribution base and rates. Taking this into account, the total number of wage-earners, their average wage and the maximum contribution base are entered in annual frequency into the model as explanatory variables. These are shown in figure 1.

### **II. THE MODEL**

After testing for the existence of a stable long-term relationship between the variables (based on Johansen's criterion as well as correlation with the canonical components of Box and Tiao), a log-level model is calculated according to equation [1]:

$$\ln(\text{contributions})_t = c + \beta_1 \ln(\text{w\_earners})_t + \beta_2 \ln(\text{ave\_wage})_t + \beta_3 \ln(\text{Max base})_t + e_t \quad [1]$$

The Independent Authority for Fiscal Responsibility (AIReF) was founded with the mission of overseeing strict compliance of the budget stability and financial sustainability principles provided for in article 135 of the Spanish Constitution.

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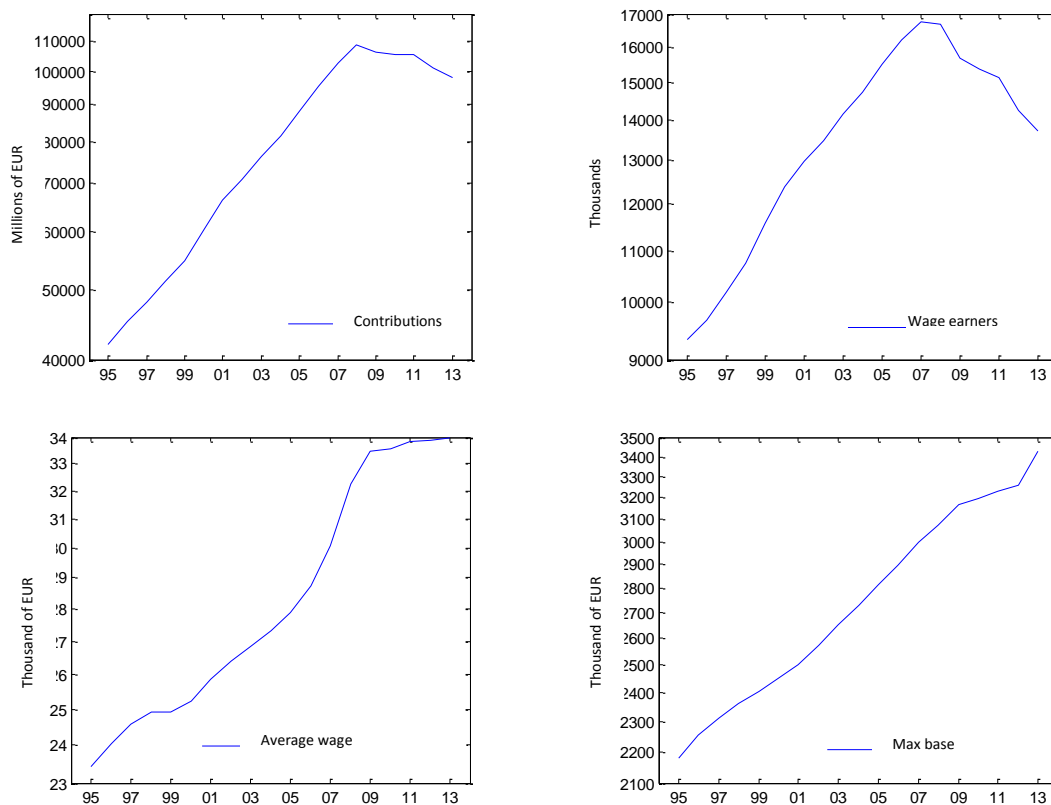
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Elasticities or percentage reactions of contributions to unitary percentage variations in explanatory factors are shown by their estimated coefficients,  $\beta$ . All t-ratios show a level of significance above 95% (see table 1). Likewise, the LM tests for serial autocorrelation and the Jarque-Bera normality test applied to the residuals show that the model achieves a suitable accuracy (shown in figure 2, which represents the rates of variation in the observed and estimated series).<sup>1</sup> As a robustness check, we look at the joint elasticity of the quotas with respect to the bases proxy and contributions which stands at approximately 1.<sup>2</sup>

Figure 1. Quotas and their explanatory variables, 1995-2013



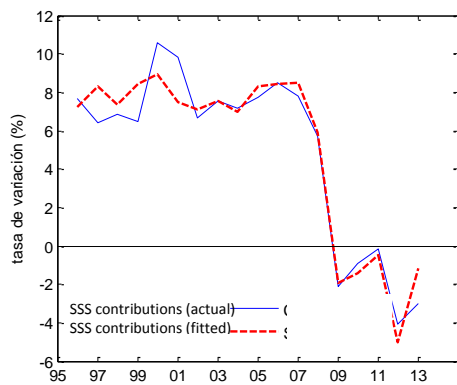
Source: SSS, INE.

Note: Ordinates on a logarithmic scale

<sup>1</sup> Taking into account the interpretation of Variance Inflation Factors (VIF) for regressors, there seems to be a high level of correlation between the salaries of wage earners and the maximum base. This effect may be corrected simply by introducing an interaction term between both factors. Nevertheless, the specification shown is selected, given its closeness to the determination of the quotas in practice and its greater predictive power.

<sup>2</sup> The result of adding wage-earner elasticity (0.26) and average wages (0.72). The first of these is obtained by a two-steps procedure. First, wage-earner salary is broken down into its components to separate the response to changes in wage levels and number of wage-earners ( $0.72 \cdot \log(\text{wage level}) - 0.72 \cdot \log(\text{wage earners})$ ). Second, the final elasticity regarding wage-earners, 0.26, is the result of adding both of the coefficients involved ( $0.98 - 0.72$ ).

**Figure 2.** Model fit



Source: AIReF

**Table 1.** Calculation results

Variable	Coefficient	Std. Error
LOG(wage-earners)	0.98	0.03
LOG(avewage)	0.72	0.12
LOG(maxbase)	0.49	0.13
C	-4.37	0.50
R-squared		0.9991
Adjusted R-squared		0.9989
S.E. of regression		0.0109
Sum squared resid		0.00
Log likelihood		61.20
F-statistic		5478.18
Durbin-Watson stat		1.11