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A Decomposition of Multidimensional Economic Well-being: an application to Spanish regions

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A Decomposition of Multidimensional Economic Well-Being: an application to the Spanish regions

(Early draft version)

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Abstract

The aim of this paper is to analyse the evolution of well-being changes due to, on one side, the changes in the weighting scheme and, on the other, changes in the indicators along the time. An alternative methodology is proposed in this paper that allows one to decompose a multidimensional index of economic well-being by distinguishing such effects from some dimensions as adjusted consumption, real wealth, inequality and economic security. The analysis is performed between 2000 and 2010 for all the Spanish regions. The main results show the relevance of differentiating between both components of change.

1. -Introduction

(TO BE WRITTEN)

2. Estimating the Economic Well-Being Index

This estimation procedure follows Osberg and Sharpe's proposal. Four dimensions are considered: adjusted consumption, real wealth, equity and economic security. The first one is related to the factor with a clearest influence on the households' well being: consumption flow. Within it, the consumption of goods and services provided by the market as the public sector is considered. Besides, some matters related to consumption are not included in the analysis because to the difficulty to be measured as consumption of leisure, the shadow economy, the disability-free life expectancy, some costs like the ones related to commuting, the consumption of goods that damage health or illegal products that lead to crime and, therefore, produce more collateral costs.

The adjusted private consumption was calculated from monetary and non-monetary expenditure¹ (separately, to detect possible differences in the weightings), extracted from the Continuous Household Budget Survey (CHBS) for the year 2000 and from the Household Budget Survey (HBS) for the year 2006. In the former case, we employed the longitudinal file updated annually by the Spanish National Statistics Institute (INE) from the quarterly surveys.

¹ The expenditures registered in CHBS and HBS gather the monetary flow spent on paying some goods and services as well as the non-monetary flow related to self-consumption, self-supply, wages in kind, free or subsidised food and rent imputed to the household by its main housing.

Specifically, we employed in both cases the adjusted datum with a parametric equivalence scale, with k equal to 0.5 and multiplied by life expectancy.

Figure 1. Structure of the well-being index

DIMENSIONS	INDICATORS ²	VARIABLES
1. -ADJUSTED CONSUMPTION	1.1. - Adjusted private consumption	1.1.1. - Equivalent adjusted monetary expenditure (*) 1.1.2. - Equivalent adjusted non-monetary expenditure (*) 1.1.3. - Life expectancy index
	1.2. - Adjusted public consumption	1.2.1. - Total public consumption per capita
	1.3. -(-) Hours worked yearly per worker	1.3.1. - (-) Hours worked yearly per worker
2. -REAL WEALTH - INTERGENERATIONAL EQUITY	2.1. - Physical capital	2.1.1- Net capital stock p.c.
	2.2. - Human capital	2.2.1- Rate of postgraduates/population
	2.3. - R&D	2.3.1- Expenditure on R&D p.c.
	2.4. - Environment	2.4.1- Company expenditure on environmental protection
3. -EQUITY	3.1. - (-) Gini index	3.1.1. - (-) Gini index (*)
	3.2. - (-) Poverty index	3.2.1. - (-) FGT 1 index (*)
4. -ECONOMIC SECURITY	4.1. - (-) Risk of illness	4.1.1. - (-) % Expenditure on health
	4.2. - (-) Risk of over 65 poverty	4.2.1. - (-) Poverty rate over 65s (*)
	4.3. - (-) Risk of unemployment	4.3.1. - (-) Unemployment rate 4.3.2. - Unemployment benefit coverage

(*) Adjusted by the Purchasing Power Parities provided by Alcaide et al. (2008)

Another variable used by several authors, i.e. Osberg and Sharpe (2000), in measuring economic well-being is the life expectancy index. One should consider that a longer life is an important factor of well-being in a society. The “extra years” that people of some regions experience in relation to average life could have an economic value that should be included in the consumption flows. As Osberg and Sharpe (2000) said, “People care both about how much they consume per year, and how many years they get to consume it”. The data about it used in this paper was obtained from the Analysis and demographic studies (mortality data) done by INE.

The third indicator used to estimate adjusted consumption is the adjusted public consumption to express the relevance of public sector in goods and services market. Unfortunately, there are no official data of public consumption regionally disaggregated. Consequently, this information comes from an additional source: *Balance Económico Regional* (Regional Economic Balance Sheet, years 2000 to 2005, and *Cuadernos de Información Económica* No. 203, April 2008, published by FUNCAS.

² The negative sign in brackets before indicators means that a negative relation with the well-being index is assumed.

The last variable used in this study is the amount of working hours. Especially, the differences in hours worked yearly per worker must influence on the well-being level estimated for some regions with similar leisure activities. Even more, the increasing decentralization in Spain allows some differences in labour laws and regulation.

Furthermore, an important issue that it should be considered when well-being is estimated is economic equity, both in intra- and inter-generational terms. The former is usually computed by means of inequality indices or poverty indices. One can find a more exhaustive analysis of inequality in the regional sphere in Ayala (2006) or Jurado and Perez-Mayo (2015). In this paper, the Gini index and the Foster-Greer-Thorbecke index with a value of alpha equal to 1.³ Both indices are estimated for this paper from the HBS 2006 microdata and the longitudinal file 2000 obtained from the CHBS.

Regarding the other side of generational equity, the inter-generational equity, some variables are included in the analysis to the legacy which a society will foreseeably leave to the following generation, consisting of an accumulated capital that would serve as a productive structure in the future society. Nevertheless, this transfer should also include some level of environmental equity and a solid and fundamental research. Former analyses also consider a controlled public debt in order to avoid a damage of the future capacities of the economy. However, it is not been into account in this paper because of some reasons. First, the Regional Governments' debt is tightly controlled and regulated by the Central Treasury and, besides, it is mainly assigned to investment and it is, therefore, debatable that it subtracts real wealth from the next generation.

The first indicator listed above is the physical capital and, to estimate it, the nominal net capital stock is used. These data have been obtained by the Valencian Economic Research Institute (IVIE) for the period 1964-2005. Other dimension of capital is the human capital, which is estimated by the share of the working age population with a higher education degree. Besides, the expenditure on R&D is captured by internal expenditure on R&D by regions, provided by the INE. Finally, expenditure on environmental protection is taken from the same source, specifically from the survey of industrial companies' expenditure on environmental protection.

The last dimension, economic insecurity, is, from the authors' point of view, one of the main causes of a low of well-being in families. The economic problems that may accompany illness, divorce, old age and unemployment (especially in the absence of benefit coverage) reduce both current economic well-being and threaten the standard of living in the near future. Thus, the percentage of expenditure on health in relation to household income⁴ and the poverty rate

³ The FGT expression depends on a parameter denoted by alpha. When it is equal to 0, the FGT index measures the poverty incidence or extension. For a value of 1, the index approximates the level of poverty intensity and, finally, when the parameter is 2, it expresses the poverty severity, that is, how much inequality there is among poor people.

⁴ This variable is used as proxy for health status and its main economic effect on well-being. The health expenditure of the households in the HBS includes medicines, other pharmaceutical products, therapeutic materials, extra hospital medical and paramedical services and hospital services. Although the Spanish Health System has a universal coverage, medicines prices or some therapeutic materials and services are partially covered. Although there are some differences in certain expenditures (not very relevant) among the regional Health Systems, it is assumed in the analysis that the public health sectors are covering the same benefits (in cash or in kind) because the evaluation of Regional Health Systems is not the aim of this paper.

for older people are estimated as well as the unemployment rate and the unemployment benefit coverage, which is computed as the number of recipients with regards to the total number of unemployed people. Finally, to take into account the regional disparities in prices, the monetary expenditure, non-monetary expenditure, Gini index, FGT1 index and over-65s poverty rate variables have been adjusted by applying purchasing power parities (Alcaide et al., FUNCAS 2008).

Estimation

Once the indicators are collected or estimated, it is required to rescale them at the interval [0,1] in accordance with the methodology employed by the UNO in the elaboration of the Human Development Index (HDI). The maximum and minimum reference values are taken for each indicator in its regional distribution. Subsequently, using the expression (1), the value of each indicator in each of the regions is determined. These values will range between 0 for the region having the lowest value of the indicator and 1 for the region showing the highest value.

$$\text{indicator}_{ij} = \frac{\text{value of variable } i \text{ in region } j - \text{minimum reference value}}{\text{maximum reference value} - \text{minimum reference value}} \quad (1)$$

Thus, the influence of measure units is removed in the analysis because one could find proportions, percentages or millions of euros in the raw data. Having transformed the indicators in a [0,1] scale, it is possible to determine the values of each dimension of economic well-being for every region. In order to obtain them, Osberg and Sharpe proposed the application of uniform weightings scheme (i.e. an importance of 25% for each dimension) and equitable for each indicator within each dimension, taking into account the positive or negative sign corresponding to each indicator.

The main advantage of this procedure is its simplicity. It is very easy to be computed and understood. However, as Osberg and Sharpe (2000) state, different weightings may be considered, such as 40% for adjusted consumption, 10% for real wealth and 25% for each of the remaining dimensions. Similarly, analysing equity from a Rawlsian point of view, it is possible to pay more attention to poverty than to inequality, with the resulting changes in the weightings.

On the opposite, this simplicity involves a relevant degree of arbitrariness. To avoid this issue, Jurado and Perez-Mayo (2012) propose to apply multivariate statistical techniques. In the specialised literature, such models are known as latent variable models, and are differentiated by the measurement scale of the observed variables and the one assumed for the non-observed variable, as Figure 2 shows.

Figure 2. Latent variable models

	Observed variables	
Latent variables	Continuous	Categorical
Continuous	Factor analysis	Latent feature models
Categorical	Latent profile models	Latent class models

Source: Bartholomew *et al.* (2002)

Since a metric well-being index is estimated in this paper from some variables of the same type, factor analysis is the technique selected for the estimation. It is very similar to the standard regression model, with the sole difference that some of its variables are unknown. Therefore, as it is impossible to fix their value, this relationship is analysed indirectly.

Let p denote the observed variables and q the latent factors or variables. Thus, the general model is expressed as:

$$x_i = \alpha_{i0} + \alpha_{i1}y_1 + \alpha_{i2}y_2 + \dots + \alpha_{iq}y_q + e_i, i = 1, \dots, p \quad (2)$$

where y_1, y_2, \dots, y_q are the factors, e_i the residuals and $\alpha_{i0}, \alpha_{i1}, \dots, \alpha_{iq}$ the factor loads. Among the model assumptions, it should be emphasised that the factors are estimated as standardised variables⁵, i.e. with zero mean and unitary variance. In general, the number of underlying factors is unknown when applying this analysis. To decide the structure of the factors it is necessary to examine the proportion of the variance explained by each one⁶.

However, while equation (2) expresses the observed variables as linear combinations of the factors, the aim of this study involves the inversion of this relationship, that is, to express the factors as linear combinations of the observed variables.

It can be demonstrated that equation (2) can be transformed into another model, given in expression (3).⁷

$$y_i = c_{i1}x_1 + c_{i2}x_2 + \dots + c_{ip}x_p, i = 1, \dots, q \quad (3)$$

This system of equations allows one to estimate well-being from information contained in the set of selected variables.

Besides, some comments should be done about the estimation performed in this paper. Firstly, as the different dimensions of well-being have been established earlier based on economic theory, it is not necessary to explore further and decide how many factors exist. Additionally, in order to avoid a possible distortion from some variables in other dimensions different to those to which they are assigned, a dual process of estimation is undertaken⁸: firstly, an index for each dimension and, secondly, the joint well-being index from these indices.

Therefore, the equations to be estimated later are the following:

$$\text{Adjusted consumption} = c_1\text{AdjPubCon} + c_2\text{AdjMonExp} + c_3\text{AdjNonMonExp} + c_4\text{HoursWork}$$

$$\text{Real Wealth} = c_1\text{PhysCap} + c_2\text{HumanCap} + c_3\text{R\&DExp} + c_4\text{EnvExp}$$

$$\text{Equity} = c_1\text{Gini} + c_2\text{FGT1}$$

$$\text{Security} = c_1\text{Health} + c_2\text{Pov65} + c_3\text{Unemployr} + c_4\text{Unemployc}$$

⁵ Similarly, the indicators have been standardised to eliminate the possible effects of the distinct units of measurement units.

⁶ A common criterion in the literature consists of revising the eigenvalues of the correlation matrix and selecting those components whose eigenvalue is greater than one.

⁷ Although the punctuations c_{ij} must be estimated, if the principal components model is chosen to extract the factors (as in our case), the punctuations c are related with the coefficients α of equation (2).

⁸ It must be underlined that what is determined is not a structure of weightings, but instead the effect of each variable upon the factor.

(4)

Having estimated the partial indicators, the next step is to determine the model that allows one to compute the regional well-being index:

$$\text{Well Being} = c_1 \text{Adjusted Consumption} + c_2 \text{Wealth} + c_3 \text{Equity} + c_4 \text{Security} \quad (5)$$

3. Estimating changes in Well-Being

The advantage of factor analysis in estimating weightings becomes an objection. When well-being evolution is intended to be analysed, having a stable weighting scheme makes easier to understand and explain how and why well-being changes. In this case, all the increases (decreases) would be due to higher (lower) values in the indicators.

Nevertheless, avoiding arbitrariness keeps being important and, although one could assume that the relative importance of every dimension and indicator is the same along time, it is a very hard assumption. Even more, it is harder if the studied country or economy experience extreme changes in its situation. For instance, Spanish economy showed one of the highest GDP growth rates and unemployment decreases in EU countries before the crisis and the opposite after the crisis started.

Therefore, a variable weighting scheme could help one to reflect changes in economic and social conditions but it conveys an underlying issue: what is the role that weighting scheme does in explaining changes. One could wonder if the observed changes in the well-being index would be due to variations in indicators or only in their relative positions.

To sort out this problem, a tool used in Labour Economics is proposed and adapted. In the context of gender discrimination, the decomposition technique of wage differentials was initially proposed by Blinder (1973) and Oaxaca (1973). This widely known technique allows for the difference in average earnings between two groups to be decomposed into a component due to average differences in characteristics, and a component due to the way such attributes are rewarded in the labour market. Specifically, a contrafactual wage distribution is built by estimating the wages that women would earn if they were paid as the men with the same features than them. Thus, it would be possible to know if a woman, in average terms, earns less money than a man only because of her gender or, on the contrary, she earns less money because she has less job experience, a lower education degree or works in an sector with low wages and everybody, whatever gender he/she has, who has these features earns less money.

This procedure is very similar to partial derivatives: what extent of the observed changes in dependent variables is due to (1) changes on indicators keeping constant their relative positions, or (2) changes in the relative weights of some indicators, although all of them remain unchanged.

Expressions (4) and (5) proposed in the section before are very similar to the general linear regression model. Therefore, the variation in the well-being index between two years can be expressed by:

$$\Delta WB_{t0} = WB_t - WB_0 = X_t \beta_t - X_0 \beta_0 \quad [6]$$

where, in vector terms, X_t collects the indicators in year t , X_0 the same value in the base year, β_t the weighting scheme in year t and, finally, β_0 the scheme in the base year.

Since it is a linear combination, if the term $X_t\beta_0$ is added and subtracted, the expression (6) will keep giving the same value:

$$\Delta WB_{t0} = X_t\beta_t - X_0\beta_0 - X_t\beta_0 + X_t\beta_0 \quad [7]$$

Rearranging the expression above, it is possible to express it as:

$$\Delta WB_{t0} = X_t(\beta_t - \beta_0) - \beta_t(X_t - X_0) \quad [8]$$

where $X_t(\beta_t - \beta_0)$ is the share of the well-being changes explained by the variation of weighting schemes and $\beta_t(X_t - X_0)$ is the part due to changes in the variables values. In other words, well-being change can be decomposed into a growth part – the latter one- and a inequality –the former one.

Beyond these aggregate effects, it is possible to perform a detailed decomposition in order to evaluate the contribution of each variable or set of variables to the well-being disparities found. The procedure proposed by Yun (2004) that generalizes Even and Macpherson's (1993) decomposition is followed in this paper. In short, this method determines the relative weight of each variable and coefficient and then applies these weights to the aggregate effects shown in the formula above.

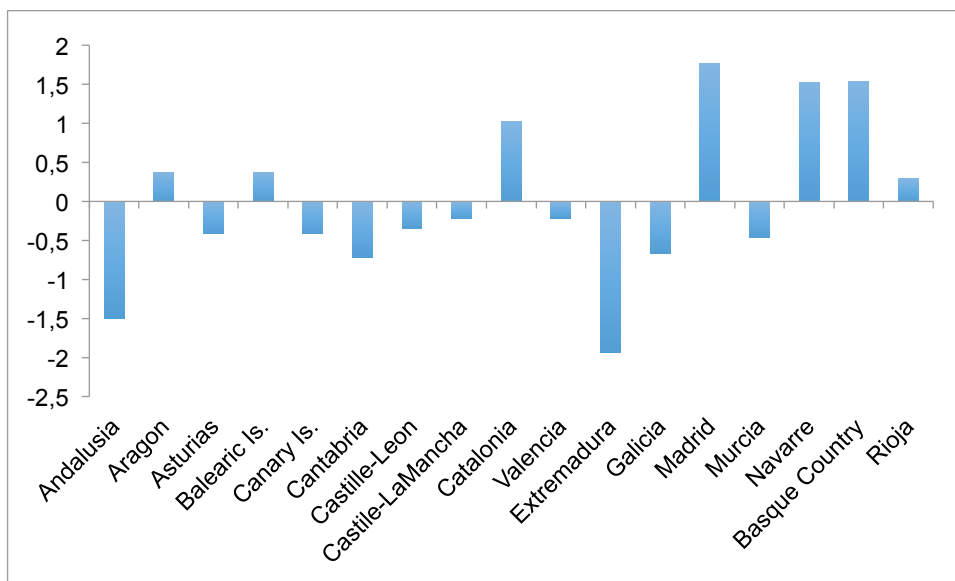
If the equation 8 is applied to expression 5, this equation can be express in an extended way as:

$$\begin{aligned} \Delta WB_{t0} = & Cons_t(\beta_{ct} - \beta_{c0}) + Wealth_t(\beta_{wt} - \beta_{w0}) + Equity_t(\beta_{et} - \beta_{e0}) + Security_t(\beta_{st} - \beta_{s0}) - \\ & \beta_{c1}(Cons_1 - Cons_0) - \beta_{w1}(Wealth_1 - Wealth_0) - \beta_{e1}(Equity_1 - Equity_0) - \\ & \beta_{s1}(Security_1 - Security_0) \quad [9] \end{aligned}$$

4.- Results

By using the methodology presented in the former section, the well-being index is estimated for the Spanish regions in 2010. It is a very interesting exercise because Spanish economy suffered a noticeable slowdown since the crisis started and the year 2010 is near to the central point of the recession. Besides, although there had been some convergence, Spanish society stands out for the important economic and social disparities between regions observed since the last century. Therefore, analysing the regional impact of the crisis on well-being could be very relevant.

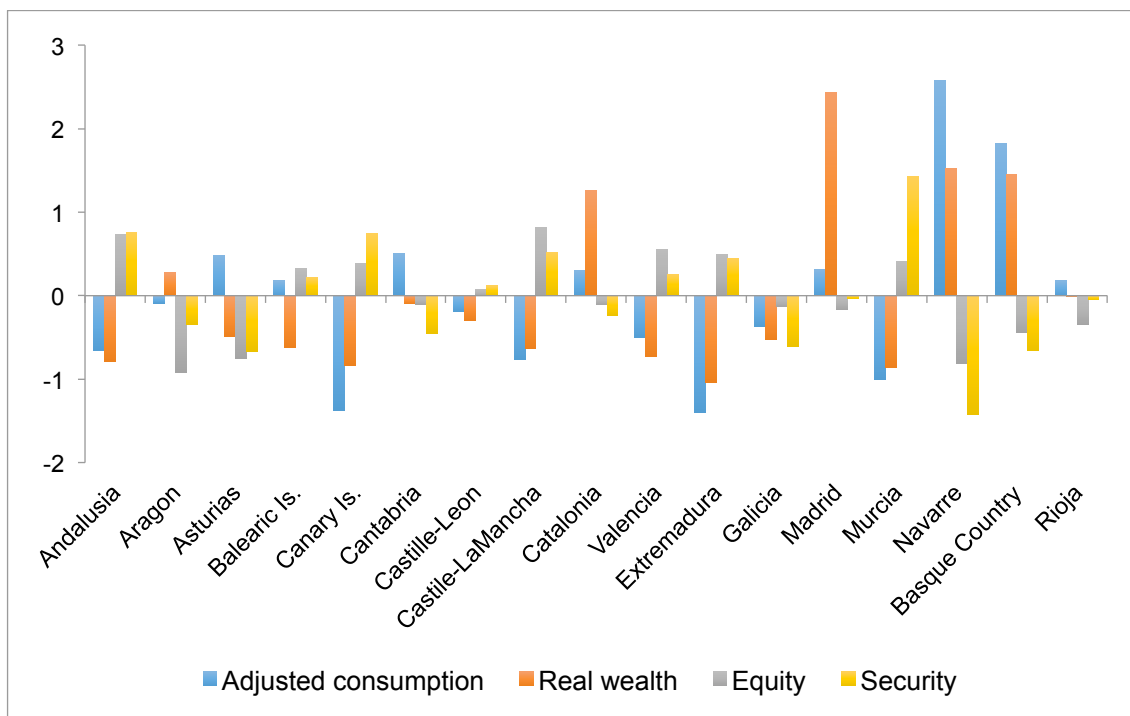
Figure 1. Well-being index in 2010



Source: Authors' elaboration

Figure 1 shows the regional distribution of well-being in which three clusters can be clearly observed. While Madrid, Basque Country, Navarre and Catalonia are in the top group, Andalusia, Extremadura, Galicia and the Canary Islands are in the group with the lowest well-being. The rest of regions can be collected in the same group because they present values around zero in absolute terms. That is, regional differences should be pointed out because they show that the crisis has not been neutral. Differences in economic structures, social conditions and labour markets make the crisis impact in a very different way depending on the region.

Figure 2. Well-being dimensions in 2010

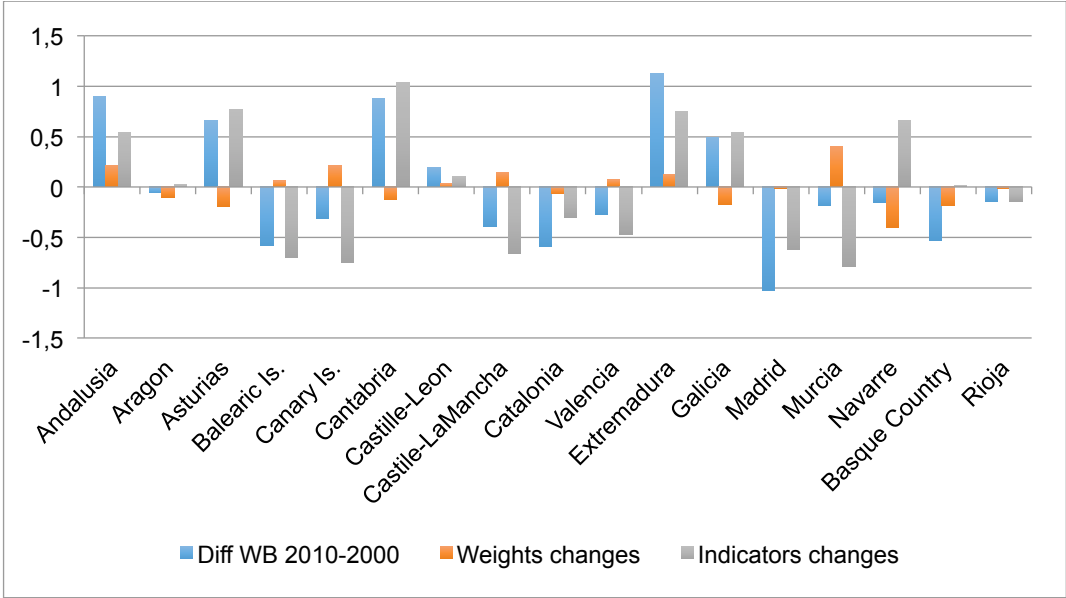


The differences commented above are better understood when Figure 2 is observed. Real wealth is the main indicator that explains more about well-being. Aragon is the only region where real wealth component shows a positive value and have not a highlighting value of well-being. Catalonia, Navarre, Basque Country and, especially, Madrid stand out for their high values in Real wealth and these regions are the ones with the highest well-being. Navarre and Basque Country report also high values in Adjusted consumption, the highest in Spain, much more larger that Catalonia and Madrid, the other regions in the top. On the other side, real wealth and adjusted consumption go down in the rest of regions. The former is very relevant because reports information about current well-being and, mainly, the ability of reaching an adequate well-being in the future. Consequently, Spanish regions show different conditions and constraints to face future situations.

The remaining dimensions, equity and security, complete the description.⁹ They inversely reflect the results obtained for adjusted consumption and real wealth. Those regions with the worst well-being report more inequity and insecurity. Even, the situation of Madrid stands out in contrast of Navarre or Basque Country because it combines a high value of real wealth with no progress in equity or security. One could expose that this region has spoiled the benefits of well-being because of inequality.

Finally, it is very interesting to compare well-being changes before and after the crisis. It seems to exist some degree of convergence because the regions with lower values in 2010 come from worse data in 2000 and the opposite for those with the highest one. Besides, Figure 3 shows how changes in indicators are a more important component than changes in relative positions or weighting schemes.

Figure 3. Well-being changes 2010-2000



5.-Conclusions

(TO BE WRITTEN)

⁹ A value above (below) zero in Figure 2 means a bad (good) situation. There are both negative signs in the expression that estimates well-being.

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