AN ESTIMATION OF DISPOSABLE PERSONAL INCOME OF THE SPANISH MUNICIPALITIES IN 1997 (*)

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Documento 99/3 **Julio 1999**

(*) Ponencia presentada en el 39th Congress de la European Regional Science Association (ERSA). Dublín, 23-27 de Agosto 1999.

39th Congress of the European Regional Science Association
23-27 August 1999, Dublin

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Abstract

Since 1992, Lawrence R. Klein Institute –Autónoma University of Madrid- estimates the disposable income of the Spanish municipalities, recently published in the 'Anuario Comercial de España' –Spanish Trade Yearbook- as scaled levels. Municipal personal income has been considered as one of the most important economic indicators, very used in a wide range of studies concerned with regional convergence, welfare analysis, marketing targets, etc.

This kind of estimation can be carried out by both direct and indirect methodology. The first proceeding requires a huge information database generally difficult to obtain and not always precise, which main defect is that it cannot reflect the underground economy of Spanish municipalities. That is why direct methodology always has needed the help of indirect proceedings. These last ones find out the statistical relation of the personal disposable income and a group of socio-economic indicators for all the geographic units considered, municipalities, provinces, regions, countries, etc.

In this paper, the authors present some of the indirect methods used to estimate the disposable income of Spanish municipalities. Especially the Klein estimation combines some multivariate analysis –panel data, factor and cross-section regression analysis- with a big database of almost 200 socio-economic indicators. The final estimation of the 8.099 municipalities disposable income allows us to acquire a better knowing of Spanish micro-territorial development.

1. INTRODUCTION

Since 1992, **Lawrence R. Klein Institute** –Autónoma University of Madrid- estimates the disposable income of the Spanish municipalities. These data have been published, ranged in levels, in the 'Atlas Comercial de España 1994' –Spanish Trade Atlas- and recently in the 'Anuario Comercial de España 1999' –Spanish Trade Yearbook- sponsored by 'la Caixa' –the Barcelona Pensions and Savings Bank. Local personal income has been considered as one of the most important economic indicators, very used in a wide range of studies concerned with regional convergence, welfare analysis, marketing targets, etc.

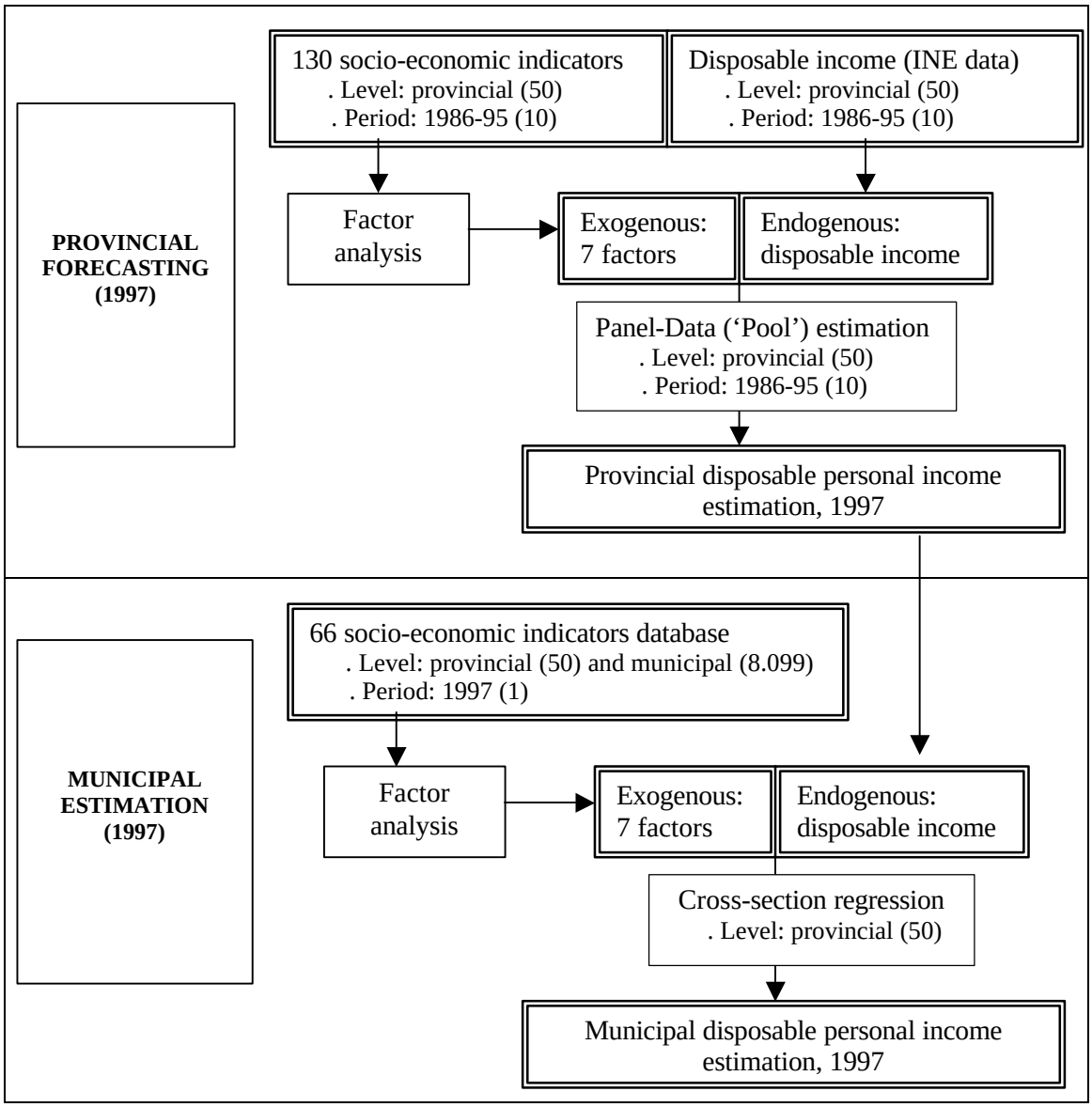
This kind of estimation can be carried out by both **direct and indirect methodology**. The first proceeding calculates the disposable income directly, considering a production function and sectorial employment matrices with municipality data. It is a complex method that requires a huge information database generally difficult to obtain and not always precise. Its main defect is that it cannot reflect the underground economy of Spanish municipalities, even when estimating agricultural gross added value (GAV). That is why direct methodology always has needed the help of indirect proceedings.

These last ones find out the statistical relation of the personal disposable income and a group of socio-economic indicators for all the geographic units considered, municipalities, provinces, regions, countries, etc. This methodology, usually based in multivariate analysis, has been used by several institutions because of its capacity to detect underground economy without requiring the excessively arduous proceedings of direct method.

In this paper, the authors explain some of the indirect methods used to estimate the **disposable income of Spanish municipalities** (Section 2); especially, Klein estimation combines some multivariate analysis with official data and own estimations (Figure 1). In Section 3, we present the selection process of some socio-economic indicators, from a big database of 130 variables related with the personal disposable income, which will be included in a panel data model. This model allows us to forecast the provincial personal disposable income, published by the INE –Spanish Institute for Statistics- with a two-year outlook.

In the third chapter, a cross-section multiple regression allows us to obtain the final estimation of the municipal disposable income, taking account a set of 66 explicative variables, available for the 8.099 Spanish municipalities, and some spatial effects. In both steps, factor analysis is needed to reduce the initial explicative variables to a few uncorrelated factors.

Figure 1: The Klein estimation process of the disposable personal income for the 8.099 Spanish municipalities (1997)



Source: Chasco and Vicéns (1998).

2. SOME METHODOLOGICAL QUESTIONS

As it has been indicated, indirect estimations of local disposable income have been used by several institutions because of its capacity to detect underground economy without requiring the excessively arduous procedures of direct method. Though municipal level approximation is always difficult, the increasingly needs of micro-data have boosted such kind of estimations during the last years.

Most indirect methodologies are made up of the following scheme:

1. Selection of one/several model/s, normally the multiple regression analysis.
2. Use of the regional/provincial income data[1] as an endogenous variable in the model.
3. Selection of some exogenous variables related with the disposable income, available for the municipal level[2].

That has been the case of the Banesto estimations (1993), which used the BBV provincial data (1997)[3], and of another municipal estimations made by regional institutions only for their particular municipalities, Sadei (1994) in Asturias, the Seville Deputation (1995) and the Community of Madrid Institute for Statistics (1998).

It is also necessary to highlight the contributions of some lecturers that have also estimated the municipal income of their respective regions, J. Arcarons (1994) in Catalonia, J. Esteban (1992) in the Valencia Community, C. Fernández (1992) in La Rioja, A. de las Heras (1992, 1998) in Cantabria and L. Herrero (1998) in Castile and Leon. Some of them have introduced more complex estimation methods, such as multivariate factor and cluster analysis or econometric multiequational models.

Nevertheless, almost the majority have used a limited set of explicative variables –in the extreme position, the Seville Deputation only include the domestic electric power consumption variable. We must also warn about some bias due to the consideration, as almost the unique variable, of data derived from the personal income tax –IRPF in Spain- as is the case of Arcarons, in Catalonia, and the Madrid Institute for Statistics. Personal income tax still does not consider the underground economy, what is an important handicap in countries like Spain. On the contrary, indirect method takes account better the real income of families through consumption, saving and production indicators.

The main **newness contributed by Klein Institute** estimation process could be summarised in the following items (Chasco and Vicéns, 1998):

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[1] The most usual statistic fonts for provincial income are BBV –Bilbao Biscay Bank- and INE estimations.

[2] Some years ago, the main font was the 'Anuario del Mercado Español' –Spanish Market Yearbook- made in Banesto –Spanish Credit Bank- and recently, it is being broadly used the Spanish Trade Yearbook made in the Klein Institute.

[3] Since long ago, BBV estimates the Spanish National and Regional Accounts, by direct methodology, as an alternative to the INE proceedings. Nowadays, the SEC-95 has reduced these criterion differences.

1. Selection of two models, a **panel data** one -to estimate the provincial disposable income –provided by INE- with a two-year outlook- and a **cross-section multiple regression** which, from the previous data, obtains the municipal income.

2. Use of macroeconomic provincial income data provided by **INE**[4].

3. Introduction of a **great amount of income explicative variables**, for both the provincial level and the municipal one, associated by **factor analysis** to be incorporated to the models as uncorrelated factors.

The use of a big deal of socio-economic information allows us to get better estimations of such a slippery variable, as well as to overcome **some biased values** especially in some middle-sized villages or in residential high-level localities with (or without) a special generating economic activity, respectively (Section 4). Therefore, instead of being a generating income indicator –production- Klein disposable income is closer to the estimation of the municipal average of family disposable income.

[4] Recently, several institutions are introducing INE data instead of BBV estimations. For example, that is the case of the Madrid Institute for Statistics.

3. EXTRAPOLATION OF THE PROVINCIAL DISPOSABLE PERSONAL INCOME (1997)

Provincial information constitutes the basis of the estimation process of municipal disposable income. As for the moment INE only supplies provincial income data for the period of 1986-95, first it is necessary to carry out a forecast-extrapolation of this variable for the year 1997.

In this step, we present the selection process of some socio-economic indicators, from a big database of 130 variables related with the personal disposable income, which will be included in a panel data model. This model allows us to forecast the provincial personal disposable income published by INE, with a two-year outlook.

3.1. Alternative ways for taking advantage of the available information

Traditional econometrics offers three ways of using these data:

1. First consists on estimating a cross-section uniequational model for the most recent period –1995 in our case-, as there are a wide enough number of observations for an only year –50 data corresponding to the Spanish provinces.

2. Second obtains an individual model for each province using temporal data, as there are 10 year-data –period 1986-95- available for each one. However, this procedure has some risks as a 10-year period produces regressions with insufficient degrees of freedom.

3. In our opinion, the third method is the appropriate for this case, though it is not very used; it is the **panel data –pool- method**. This technique uses both temporal and cross-section data to estimate a regression equation allowing a better advantage of the available information –50 spatial data x 10 years.

One of the most important advantages of pool estimation is its capacity of picking up simultaneously both the temporal evolution of the considered variable and its spatial structure or distribution (Vicéns, 1996).

3.2. Selection of disposable income explicative variables for the provincial level and 1986-95 period

Panel data model is therefore a regression equation in which the endogenous variable is the provincial personal income and the exogenous data a group of variables related with disposable income, all of them considered for the period of 1986-95. The objective is forecasting the provincial income for 1997.

To do that, it is necessary first doing a selection of a set of per capita explicative variables with available data for 1986-97 period. After examining 130 socio-economic variables, for the provincial level, finally 34 have been selected (Table 1)[5].

Table 1: Summary of the final 34 per capita explicative variables selected for panel data estimation

CONSUMPTION & SAVING Cars (number, registrations), telephone lines, nights in tourist establishments, banks, saving banks, deposits, credits, mortgages, new firms, housing.	**TAXES** Direct and indirect taxes.
EMPLOYMENT Sectorial occupation rates.	**PRODUCTION** Sectorial GAV.

3.3. Factor analysis of 34 income explicative variables for the 1986-97 period

In order to include as much information as possible in pool model avoiding multicolinearity, it has been necessary to carry out a factor analysis of the 34 previous variables (Vicéns, 1997). This analysis must consider the 50x10 vectors as only series in order to construct unique factors that could be exogenous variables in the pool model.

All these variables have been previously deflated by their corresponding price index[6] and population. Factor analysis in SPSS normalises the variables to prevent some problems derived of different units of measurement.

The analysis produces **7 factors** with 81% of cumulative variance and communalities over 0,75 in all cases, except housing variables. In Table 2, we present a summary of the obtained factors with Varimax rotation.

Table 2: Factor structure of provincial variables related with disposable income

F1	**SERVICE SECTOR ACTIVITY** Cars, telephone lines, tertiary GAV, service sector occupation rates, primary sector occupation rates (-), credits, savings banks, deposits, mortgages, nights in tourism establishments.	**F5**	**INDUSTRY ACTIVITY** GAV in industry, secondary sector occupation rates.
F2	**EMPLOYMENT** Sectorial occupation rates.	**F6**	**BUILDING INDUSTRY** GAV and occupation rates in building industry, housing.

[5] It has been necessary to exclude redundant variables as well as those without homogenous data for all the temporal-spatial range.

[6] Sectorial GAV in real terms have been obtained thanks to Hispalink (1998) estimated deflators.

F3	**TAXES** Direct and indirect.	**F7**	**POWER SECTOR ACTIVITY** GAV in power sector.
F4	**CONSUMPTION OF DURABLES** Cars, housing, credit sales.		

3.4. Panel data analysis for the extrapolation of the 1997 provincial disposable income

Once decided the use of panel data, we present its general expression as

$$Y = \alpha + X\beta + U$$
$$y_{it} = \alpha_i + \beta_{ji} x_{jit} + u_{it} \qquad \textit{Eq. 1}$$

- Y: endogenous variable matrix with cross-sectional (i = 1,2...n) and temporal (t = 1,2...T) elements, y_{it}.
- X: k-vector exogenous variables (j = 1,2...k), x_{jit}.
- β: k-vector parameters corresponding to the exogenous variables, which can adopt different values for each n cross-sectional unit.
- α: constant term or intercept which can adopt different values for each n cross-sectional units.
- U: residual term with cross-sectional (i = 1,2...n) and temporal (t, = 1,2...T) elements. u_{it}.

This kind of models can be considered as a set of n piling up cross-sectional equations with T temporal observations each one. In general terms, we must consider at least two kind of panel data modelling, random and fixed effects models.

1. **Random effects** model treats intercepts as random variables across pool members. It assumes that the term α_i is the sum of a common constant, α, and a time-invariant cross-section specific random variable, ε_i, that is uncorrelated with the general residual term u_{ij}.

$$y_{it} = \alpha + \beta_{ji} x_{jit} + (\alpha_i + \varepsilon_{it}) \qquad \textit{Eq. 2}$$

   The parameters α_i are now positive/negative increments of a common intercept α. This model is appropriate when there is an average behaviour through the cross-sectional units conditioned to the explicative variables. The individual levels will fluctuate between this average because of non-identified stochastic factors.

2. **Fixed effects** modelling reveals as the most appropriate for estimating certain spatial distributed variables such as disposable income. This kind of model considers different intercepts, α_i, for each cross-sectional or 'pool' unit –in our case, the 50 Spanish provinces- carrying out the estimation in a two-step process:

- OLS estimation of β_j parameters ($\hat{b}_j$) in an average deviate model for each pool,

$$y_{it} - \overline{Y}_i = \left(x_{jit} - \overline{X}_{ji}\right)\beta_{ji} + \left(u_{it} - \overline{U}_i\right) \qquad \textit{Eq. 3}$$

with: $\overline{Y}_i = \frac{\sum_{t=1}^{T} y_{it}}{T}; \overline{X}_i = \frac{\sum_{t=1}^{T} x_{it}}{T}; \overline{U}_i = \frac{\sum_{t=1}^{T} u_{it}}{T}$

- Estimation of fixed effects, α_i, in the expression,

$$\hat{\alpha}_i = \overline{Y}_i - \hat{b}_1 \overline{X}_{1i} - \ldots - \hat{b}_k \overline{X}_{ki} \qquad \textit{Eq. 4}$$

Consequently, this method implies that each pool will have an unrestricted intercept. In our case, this seems to be the most adequate method because of historical socio-economic and political differences existent between the Spanish provinces and regions. Therefore, the fixed effects pool model used to estimate 1997 provincial income is (see Table 3),

$$DI_{it} = \alpha_i + \beta_1 F1_{it} + \beta_2 F2_{it} + \beta_6 F6_{it} + \beta_7 F7_{it} + u_{it} \qquad \textit{Eq. 5}$$

with
- DI_{it}: per capita disposable personal income, i=1,2...50; t=86-95.
- α_i: different intercepts for each i Spanish province.
- β_j: k-vector parameter corresponding to the exogenous variables.
- F1: Factor 1, Service sector activity.
- F2: Factor 2, Employment.
- F6: Factor 6, Building industry.
- F7: Factor 7, Power sector activity.

Finally, we have only considered 4 factors as the other three ones were not valid.

In spite of being sure of the convenience of fixed over random effects in estimating provincial income, we have applied an **F test proposed by Vicéns,** 1996 which compares both models as follows,

$$F = \frac{SSR - SST / dfr - dft}{SST / dft} \qquad \textit{Eq. 6}$$

with
- SSR: sum of squared residuals in the restricted model -random effects.
- SST: sum of squared residuals in the unrestricted model –fixed effects.
- dfr: degrees of freedom in the restricted model.
- dft: degrees of freedom in the unrestricted model.

If test values exceed theoretical ones, it will be possible to reject the null hypothesis that prefers random over fixed effects model. In our case, as the test value (1,30) is higher

than theoretical one (1,28) we choose fixed effects pool model to estimate provincial disposable income (Eq. 7).

$$F_{446}^{50} = \frac{SCR - SCT / glr - glt}{SCT / glt} = \frac{0{,}721495 - 0.643682 / 495 - 446}{0.643682 / 446} = 1{,}30 \qquad \textit{Eq. 7}$$

Table 3: OLS fixed effects pool model estimation

Pooled LS // Dependent Variable is DI?
Sample: 1986 1995
Included observations: 10 Total panel observations 500

Variable	Coefficient	Std. Error	t-Statistic	Prob.
?F1	0.146891	0.004209	34.90010	0.0000
?F2	0.044863	0.005459	8.218869	0.0000
?F6	0.028055	0.003632	7.725317	0.0000
?F7	0.014021	0.006058	2.314415	0.0210

Fixed Effects		Fixed Effects	
ALAV--C	1.104667	RIOJ--C	1.045969
ALBAC--C	0.891528	LUGO--C	1.030715
ALIC--C	0.873015	MADR--C	1.103243
ALMER--C	0.923051	MALA--C	0.789657
AVIL--C	0.852952	MURC--C	0.937630
BADA--C	0.869018	NAVAR--C	1.172068
BALE--C	0.764311	OURE--C	0.949464
BARC--C	1.089979	ASTUR--C	1.086650
BURG--C	0.974162	PALEN--C	1.010545
CACE--C	0.855388	PALMA--C	0.869931
CADI--C	0.914488	PONTE--C	0.871203
CASTE--C	1.140021	SALAM--C	0.878310
CREAL--C	0.910892	SCRUZ--C	0.911592
CORDO--C	0.978098	CANTA--C	1.036261
CORU--C	0.976178	SEGO--C	0.935781
CUEN--C	0.988199	SEVIL--C	0.989137
GIRO--C	0.926793	SORI--C	1.010250
GRANA--C	0.874632	TARRA--C	0.973539
GUADA--C	0.879049	TERU--C	1.174785
GUIPU--C	1.175851	TOLED--C	0.893102
HUEL--C	0.959385	VALEN--C	1.055318
HUES--C	1.080104	VALLAD--C	1.072498
JAEN--C	1.011863	VIZCA--C	1.215822
LEO--C	0.988649	ZAMOR--C	0.949553
LLEI--C	1.095671	ZARAG--C	1.115720

R-squared	0.964766	Mean dependent var	0.962475
Adjusted R-squared	0.960579	S.D. dependent var	0.191339
S.E. of regression	0.037990	Sum squared resid	0.643682
F-statistic	4070.709	Durbin-Watson stat	1.091218
Prob(F-statistic)	0.000000		

This model allows us to obtain the 1997 provincial disposable income (Table 4), which will be used in a spatial multiple regression model as the endogenous variable to estimate municipal disposable income.

Table 4: 1997 estimated disposable income (million PTAs.) and per capita income (thousand PTAs.) for the Spanish provinces

AUTONOMOUS COMMUNITY	PROVINCE	D. Income 1995 (INE)	D. Income 1997 (KLEIN)	Pct. 9795	Populat. 1.1.98	D. Income p. inhab. 1997
ANDALUSIA	ALMERÍA	503.989	586.823	16	505.448	1.161
	CÁDIZ	972.917	1.058.407	9	1.107.484	956
	CORDOBA	769.972	842.421	9	767.175	1.098
	GRANADA	788.135	886.026	12	801.177	1.106
	HUELVA	429.400	469.804	9	453.958	1.035
	JAÉN	659.653	734.053	11	645.792	1.137
	MÁLAGA	1.120.594	1.289.815	15	1.240.580	1.040
	SEVILLE	1.718.894	1.907.037	11	1.714.845	1.112
ARAGÓN	HUESCA	328.735	349.768	6	204.956	1.707
	TERUEL	208.812	226.364	8	136.840	1.654
	SARAGOSSA	1.209.525	1.305.133	8	841.438	1.551
ASTURIAS	ASTURIAS	1.383.407	1.535.353	11	1.081.834	1.419
BALEARIC ISLANDS	BALEARIC ISLANDS	1.150.486	1.292.555	12	796.483	1.623
CANARY ISLANDS	PALMAS (LAS)	855.347	987.343	15	849.863	1.162
	SANTA CRUZ TENERIFE	952.082	1.070.337	12	780.152	1.372
CANTABRIA	CANTABRIA	649.474	727.067	12	527.137	1.379
CASTILE AND LEÓN	ÁVILA	195.739	212.192	8	167.132	1.270
	BURGOS	451.827	503.278	11	346.355	1.453
	LEÓN	602.363	680.221	13	506.365	1.343
	PALENCIA	231.136	250.564	8	179.623	1.395
	SALAMANCA	388.679	425.251	9	349.550	1.217
	SEGOVIA	188.109	209.019	11	146.755	1.424
	SORIA	118.349	130.673	10	91.593	1.427
	VALLADOLID	641.285	695.189	8	492.029	1.413
	ZAMORA	236.111	253.870	8	205.201	1.237
CASTILE-LA MANCHA	ALBACETE	348.530	387.754	11	358.597	1.081
	CIUDAD REAL	498.155	570.029	14	479.474	1.189
	CUENCA	232.452	257.531	11	199.086	1.294
	GUADALAJARA	174.212	194.102	11	159.331	1.218
	TOLEDO	525.014	613.802	17	519.664	1.181
CATALONIA	BARCELONA	6.810.139	7.497.583	10	4.666.271	1.607
	GIRONA	**892.008**	**946.429**	**6**	**543.191**	**1.742**
	LLEIDA	**600.894**	**639.340**	**6**	**357.903**	**1.786**
	TARRAGONA	826.368	895.829	8	580.245	1.544
COMUNIDAD VALENCIANA	ALICANTE	1.472.795	1.664.046	13	1.388.933	1.198
	CASTELLÓN DE LA PLANA	623.791	676.224	8	461.712	1.465
	VALENCIA	2.677.951	2.981.131	11	2.172.796	1.372
EXTREMADURA	BADAJOZ	585.313	635.979	9	663.803	958
	CÁCERES	414.514	449.356	8	405.616	1.108
GALICIA	CORUÑA (A)	1.203.787	1.365.388	13	1.106.325	1.234
	LUGO	435.290	481.607	11	367.751	1.310
	OURENSE	402.008	438.488	9	344.170	1.274
	PONTEVEDRA	867.659	993.197	14	906.298	1.096
MADRID	MADRID	7.298.282	7.985.004	9	5.091.336	1.568
MURCIA	MURCIA	1.139.520	1.310.728	15	1.115.068	1.175
NAVARRA	**NAVARRA**	**838.911**	**923.234**	**10**	**530.819**	**1.739**
BASQUE COUNTRY	ÁLAVA	400.831	442.570	10	284.595	1.555
	GUIPUZCOA	1.044.614	1.123.187	8	676.439	1.660
	BISCAY	1.671.832	1.882.198	13	1.137.594	1.655
RIOJA (LA)	RIOJA (LA)	372.592	408.248	10	263.644	1.548
CEUTA AND MELILLA	CEUTA AND MELILLA	165.510	175.393	6	132.225	1.326
SPAIN.....		49.340.135	54.618.280	11	39.852.651	1.371

Notes: Both in bold and shaded, provinces with highest estimate per capita income; only in shaded, provinces with low estimate per capita income.

4. ESTIMATION OF THE 1997 MUNICIPAL DISPOSABLE INCOME

Once estimated the 1997 provincial disposable income, they will constitute the endogenous variables of a final multiple-regression model with new explicative variables available –in this case- for the municipal level.

4.1. Selection of new explicative variables related with disposable personal income, also available for the municipal level

In this step, a new selection of explicate variables must be carried out as they have also to be available for the municipal level –in Spain there are actually 8.099 municipalities. This kind of micro-data is still difficult to obtain in Spain as official Census data are mainly outdated and only referred to demographic items. That is why Klein Institute has tackled the problem of developing a big updated municipal socio-economic database.

In the starting point, there were 66 municipal variables in any way correlated with disposable income, that have been reduced to 20 selected explicative variables (Table 4). These indicators –all rated by population- will be determinant in the municipal estimation because of their big correlation with disposable income.

Table 4: Explicative variables available for the municipal level and per capita

Cars	Building industry establishments
Banks	Restaurants, bars and cafeterias
Savings banks	Industry establishments
Credit co-operatives	Wholesale establishments
Vans and lorries	Unemployment rate –16-24 year old.
Average distance to retailing trade areas	Unemployment rate –building industry sector
1992-97 Pct. cars	Unemployment rate –industry sector
1991-96 Pct. population	Unemployment rate –public sector
1992-97 Pct. domestic telephone lines	Unemployment rate –private sector
Tourism establishments rooms	Domestic telephone lines

Notice than in this occasion we have considered domestic telephone lines instead of the total ones –domestic and business ones. Telephone lines variable is still determinant because of its great correlation with disposable income; nevertheless, its influence over provincial income data is not in the same as over municipal ones. In the municipal level, domestic lines are determinant in a 100%, while business ones must only be considered in a 25% -as we have measured business activity influence over disposable income in a quarter of the total. Therefore, the so-called 'domestic telephone lines' variable includes no only the 100% of domestic but also business lines in a 25%.

This correction helps to avoid certain biased values due to income overestimation in certain little or middle-sized income generating municipalities –because of industry or tourism activity- produced by the total telephone lines variable. This problem can be corrected by the consideration of only the domestic and the 25% of business lines.

4.2. Factor analysis of 20 income explicative variables for the provincial level

As it has been showed, in order to include as much information as possible in the final model avoiding multicolinearity, it is advisable to carry out a factor analysis of the 20 selected indicators. In this occasion, we consider a 50x20 matrix data in order to construct unique factors as exogenous variables in the spatial multiple-regression model.

The analysis produces **4 factors** with 77% of cumulative variance. In Table 5, we present a summary of these factors obtained with Varimax rotation.

Table 5: Factor structure of variables related with provincial disposable income also available for the municipal level

FAC. 1: SERVICE SECTOR ACTIVITY Provinces with big concentration of all kind of service sector activity, high occupation rates and good infrastructure equipment.	**FAC. 2: SECONDARY SECTOR & EMPLOYMENT** Provinces with big concentration of secondary sector activity –industry and building- and low unemployment rates.
FAC. 3: POPULATION GROWING & TOURISM Provinces with high rates of immigration during the last 5 years, high number of cars, vans, lorries and predominant tourism and trade activity.	**FAC. 4: UNDERDEVELOPEMENT** Provinces with traditional economic and infrastructure underdevelopment, high unemployment rates, but quick recent growth in their standards of living.
FAC. 5: INDUSTRIAL DEVELOPMENT Provinces with industrial development but high rates of unemployment.	

4.3. Cross-section multiple regression for the 1997 provincial disposable income

These 5 factors will be the explicate variables in a multiple regression analysis with estimated provincial disposable income for 1997. The final model (Eq. 8, Table 6) excludes factor 3 –Population growing & tourism- as it was not significant, but includes 3 dummy variables –FORAL, LAST, FIRST- which take account spatial heterogeneity in disposable income distribution (Fig. 2).

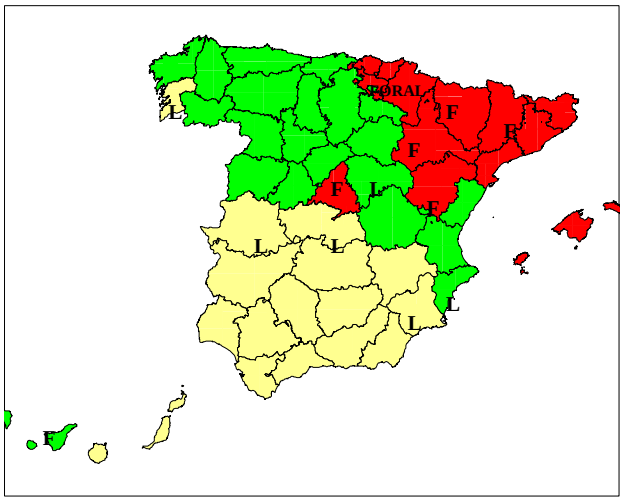
$$DI_i = \beta_0 + \beta_1 F1 + \beta_2 F2 + \beta_3 F4 + \beta_4 F5 + \beta_5 FORAL + \beta_6 FIRST + \beta_7 LAST + U_i \qquad \textit{Eq. 8}$$

with: DI_i: 1997 per capita provincial disposable income, i = 1...50.
F1...F5: factors, F1 –Service sector activity, F2 –Secondary sector & employment, F4 –Underdevelopment, F5 –Industrial development.
FORAL: Basque Country provinces, with underestimate income.

FIRST: Provinces with significantly higher income than their neighbours – Huesca, Lleida, Madrid, Santa Cruz de Tenerife, Teruel, and Saragossa.

LAST: Provinces with significantly lower income than their neighbours – Alicante, Cáceres, Guadalajara, Murcia, Pontevedra and Toledo.

Figure 2: Spatial distribution of 1997 provincial disposable income per inhabitant



Notes: It is represented the provinces with value 1 en dummy variables –FORAL, L (LAST), F (FIRST).

Disposable income distribution over the Spanish provinces produces some geographical irregularities –spatial heterogeneity- not always correctly reflected by the model. Dummy variables takes account these phenomenon.

Table 6: Multiple regression results

Dependent Variable: DI
Method: Least Squares
Sample: 1 50
Included observations: 50

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.076628	0.009574	112.4566	0.0000
F1	0.105510	0.007584	13.91273	0.0000
F2	0.062022	0.007817	7.934271	0.0000
F4	-0.059475	0.007956	-7.475217	0.0000
F5	0.028242	0.007934	3.559518	0.0009
FORAL	0.166096	0.030392	5.465122	0.0000
LAST	-0.105701	0.021508	-4.914590	0.0000
FIRST	0.187301	0.024625	7.606142	0.0000

R-squared	0.928269	Mean dependent var	1.095480
Adjusted R-squared	0.916313	S.D. dependent var	0.182062
S.E. of regression	0.052668	Akaike info criterion	-2.903967
Sum squared resid	0.116505	Schwarz criterion	-2.598043
Log likelihood	80.59917	F-statistic	77.64537
Durbin-Watson stat	1.300678	Prob(F-statistic)	0.000000

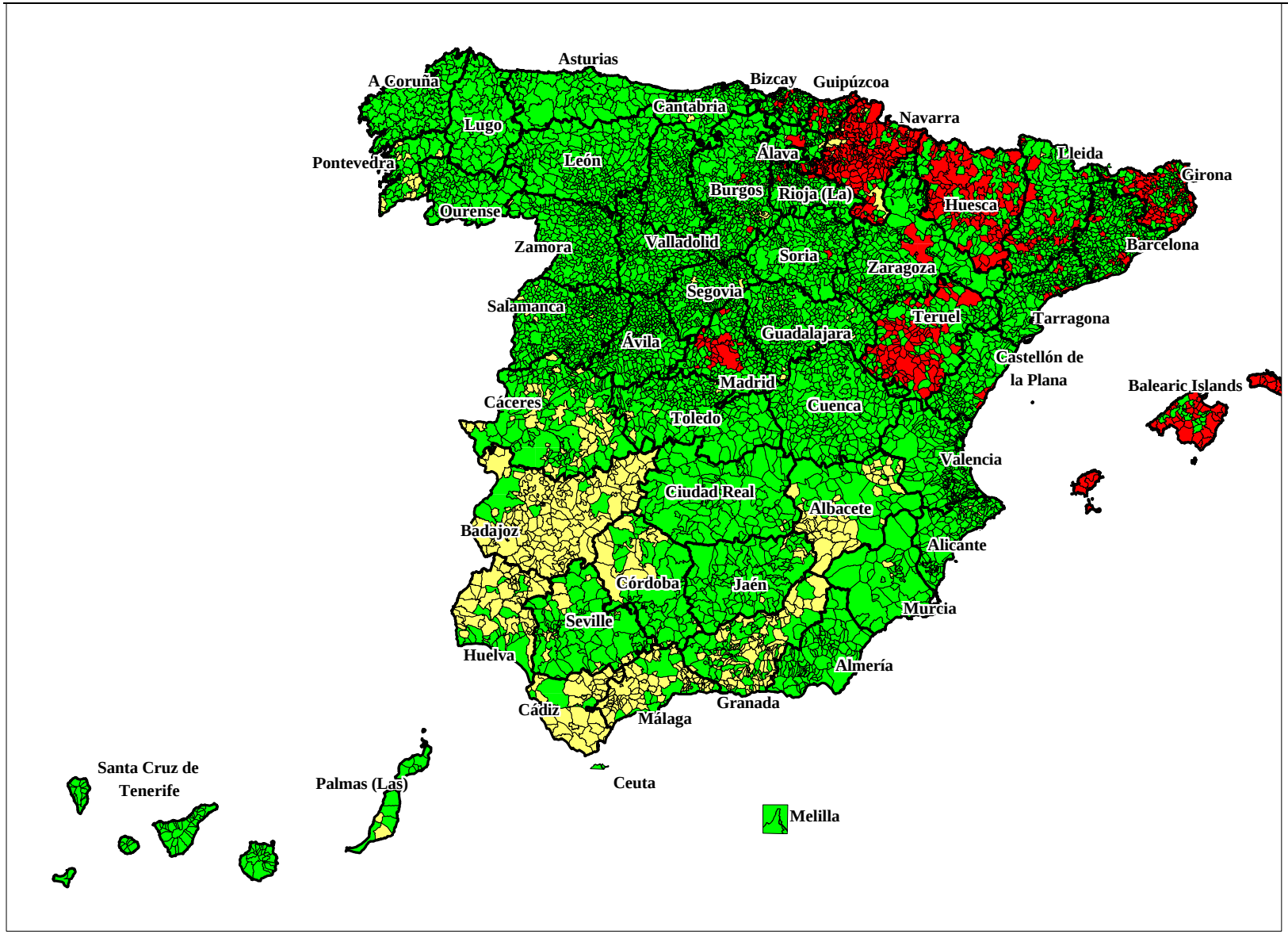
4.4. Estimation of 1997 municipal disposable income

As the previous statistical tests are correct, now it is possible to obtain the municipal income data. First, as explicate variables were also available to municipal level it is necessary to estimate factor municipal values using the factor scores to apply over them the estimate regression parameters. The resulting municipal data must be adjusted by 2 corrective coefficient:

1. Ratio of business tax –IAE in Spain- corresponding to liberal professionals over total business tax which detects those high-level localities without a special generating economic activity. Indirect income estimations tend to underestimate disposable income in these towns because of the relatively low values of explicative indicators related with economic activity.
2. The resulting municipal data must be adjusted so that the sum of municipal income values coincides with provincial ones.

In Figure 3, we present the municipal estimations of disposable income. As it can be seen, in Spain per capita disposable income distributes progressively from the south to the northeast, being Extremadura and Andalusia the poorest regions followed by Castille-La Mancha, Murcia and Galicia. In the other side, the highest levels of disposable income can be found in Navarra, the Balearic Islands, the Basque Country, Catalonia and Madrid.

Figure 3: 1997 estimated per capita disposable income for the 8.099 Spanish municipalities



Notes: In red, more than 1.600.000 PTA./inhab. In red, 1.125.000-1.600.000 PTA./inhab. In yellow, less than 1.125.000 PTA./inhab.

5. CONCLUSIONS

From the point of view of economic analysis, disposable income estimation is always a risk task, especially when it is the 8.099 Spanish municipalities because of the need of huge volumes of information. In these cases, indirect methods become essential in spite of some possible inaccuracies that encourages us to act with caution. Nevertheless, this kind of methodology leads to estimations with great comparative power between municipalities from different regions what is very useful.

Klein estimations pretend to overcome some deficiencies of indirect methods –certain biased income values from middle-sized localities with (or without) a special generating economic activity, respectively. Therefore, instead of being a generating income indicator –production- Klein disposable income is closer to the estimation of the municipal average family income.

We must also report that INE regional accounts data used by the Klein Institute conditions in a greater extent the obtained results. In effect, our income estimations differ from others made with another statistical fonts –mainly BBV or Funcas.

At last, we would point out as future lines of research the introduction of spatial econometrics techniques –spatial autocorrelation and heterogeneity- both in panel data and multiple regression analysis to avoid some estimation problems. It would also be interesting continuing the search of new better municipal variables related with disposable income. That would be the case of domestic electric power consumption -that still is not available for all the Spanish municipalities homogeneously- or socio-demographic variables –mainly instruction level- derived from official Census.

6. REFERENCES

Arcarons, J., G. García y M. Parellada (1994), *"Estimació de la Renda Familiar Disponible a les Comarques y Municipis de Catalunya 1991"*. Generalitat de Catalunya.

Aparicio, M.T. et al. (1984), *"Una Metodología para la Estimación de la Renta Disponible Municipal"*. VII Reunión de Estudios Regionales. Bilbao.

Bachero, J.M. (1993), *"Evaluación de la Renta Familiar Disponible Municipal"*. Doctorate Thesis. Universidad of Valencia.

Bachero, J.M. et al. (1997), *"Estimación de la Renta Familiar Disponible, Per Cápita, a Nivel Municipal en la Comunidad Valenciana (Año 1995)"*. XXIII Reunión de Estudios Regionales. Valencia.

Banesto (1993), *"Anuario del Mercado Español 1993"*. Madrid.

BBV (1997), *"Renta Nacional de España y su Distribución Provincial 1993. Avance 1994-1995"*. Bilbao.

Ceprede (1997), *"Junta Semestral de Predicción"*. Wharton-UAM econometric model, Lawrence R. Klein Institute. Santander, 5 y 6 de junio de 1997.

Chasco, C. (1997), *"El Anuario Comercial ofrece indicadores estadísticos municipales"*. Fuentes Estadísticas, nº 25, Abril 1997, pp. 6.

Chasco, C. (1997), *"Indicadores Socioeconómicos en el Anuario Comercial de España: el Nivel Económico Municipal"*. Actas XXIII Reunión de Estudios Regionales. Valencia.

Comrey, A.L. (1988), *"Manual de Análisis Factorial"*. Ed. Cátedra. Madrid.

Cuadrado, J.R., T. Mancha and R. Garrido (1998), *"Convergencia regional en España. Hechos, tendencias y perspectivas"*. Colección Economía Española, Fundación Argentaria.

Diputación de Sevilla (1995), *"Ingresos Personales en los Municipios de la Provincia de Sevilla 1986-1994"*. Cuadernos de Socioeconomía Sevillana, nº2. Sevilla.

Esteban, J. and A. Pedreño (1992), *"La Articulación Territorial de la Economía Valenciana"*. Estructura Económica de la Comunidad Valenciana. Madrid: Ed. Espasa Calpe; pp. 73-112.

Fernández, C. and Y. Sierra (1992), *"Estimación de la Renta Familiar Disponible a Nivel Municipal. Una Aplicación a La Rioja. Año 1985"*. Actas de la VI Reunión Asepelt España. Granada.

Heras de las, A. (1992), *"Un Modelo General de Estimación Indirecta de la Renta Familiar Disponible Municipal. Su Aplicación a la Comunidad Autónoma de Cantabria*. Tesis Doctoral.

Heras de las, A. and C. Murillo (1998), *"Información fiscal y estimación indirecta de la renta familiar disponible municipal en España"*. I Congreso de Economía Aplicada. Barcelona.

Herrero, L.C. (1998), *"Perspectivas de Desarrollo Territorial: Renta Municipal y Desarrollo Económico en las Comarcas de Castilla y León"*. Junta de Castilla y León, Consejería de Economía y Hacienda.

Hispalink (1998), *"Hispadat. Base de Datos"*. XVII Jornadas de Hispalink. Lawrence R. Klein Institute. Madrid, junio 1998.

Hispalink (1998), *"Hispalink. Modelización Regional Integrada"*. XVII Jornadas de Hispalink. Madrid, junio 1998, nº 8.

INE (1997), *"Contabilidad Nacional de España. Base 1986. Serie contable 1990-1996"*. Madrid.

INE (1997), *"Contabilidad Regional de España. Base 1986. Serie contable 1990-1994"*. Madrid.

Instituto de Estadística de la Comunidad de Madrid (1998), *"Indicadores municipales 97"*. Consejería de Hacienda de la Comunidad de Madrid.

Lawrence R. Klein Institute (1994), *"Atlas Comercial de España 1994"*. Banco Central-Hispano. Madrid.

Lawrence R. Klein Institute (1999), *"Anuario Comercial de España 1999"*. Servicio de Estudios de "la Caixa". Barcelona, 1999.

Marija, J. (1988), *"Spss/PC+ Advanced statistics V2.0.* Spss Inc. Chicago.

Sadei (1994), *"La renta de los municipios asturianos, 1994"*. Caja de Asturias. Avilés.

Vicéns, J. (1996), *"Introducción a la Modelización con Datos de Panel"*. Documento 96/3. Instituto Lawrence R. Klein, Autónoma University of Madrid.

Vicéns, J. (1997), *"Obtención y Análisis de Datos"*. Autónoma University of Madrid.

Vicéns, J. and Chasco, C. (1998), *"Estimación de la renta familiar disponible municipal y regional de 1996"*. Papeles de Discusión, nº 2; Servicio de Estudios de "la Caixa". Barcelona, 1998.