



# INEQUALITY OF SPANISH HOUSEHOLD EXPENDITURE FOR THE 2006-2016 PERIOD, ARE WE CONVERGING?

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# Outline

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Aims: research questions

Methodology

- Estimators and inequality indicator

Results, period (2006-2016)

- Inequality evolution of household expenditure
- Average expenditure evolution
- Population level

Conclusions

# Aims: research questions

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Model the household Spanish expenses.

- Is the biparametric gamma model adequate for the period studied 2006-2016? If so, can we also parameterise the evolution of inequality?
- Proposed by Salem and Mount (1974); Spanish case: Rojo (1993) period 1980-81; López (1997) and Lafuente (1998). Declined by Dagum (1991).

Analyse inequality evolution.

- What has been the evolution of household expenditure, bearing in mind that the period includes the recent Great Recession?
- Has regional inequality undergone changes in composition or have relative positions been maintained?

# Methodology: data

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Source: Household Budget Survey (HBS) from the Spanish National Statistic Institute (INE).

- Period: 2006-2016 (base 2006).
- Sample: more than 225.000 households disaggregated By Autonomous Communities (AA.CC.)

Deflated data (longitudinal analysis): Consumer Price Index (IPC) from INE (base 2016).

# Methodology: model

- Newton-Raphson and Gauss-Laguerre to estimate by maximum-likelihood.
- Goodness-of-fit test ☐ Kolmogorov-Smirnov test.

$$f(x) = \frac{\lambda^\alpha e^{-\lambda x} x^{\alpha-1}}{\Gamma(\alpha)} \quad \forall x \in ]0, \infty[, \alpha > 0, \lambda > 0$$

Gamma de Euler

$$\mu = \frac{\alpha}{\lambda}$$

$$\sigma^2 = \frac{\alpha}{\lambda^2}$$

$$M_o = \frac{\alpha - 1}{\lambda}$$

$$M_e = \frac{3\alpha - 1}{3\lambda}$$

$\alpha$  Presents a negative correlation with Gini Index

Bigger ☐ Rise of equality

# Results: Kolmogorov-Smirnov test

AA.CC.	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Andalusia	0.4033	0.1863	0.1442	0.1279	<b>0.0028</b>	0.1770	0.031	0.0113	0.0211	0.0148	0.0271
Aragon	0.8714	0.6013	1.0259	1.3114	0.2834	0.5807	0.5011	0.8798	0.5169	0.3558	0.2421
Asturias	0.2004	0.5306	1.2583	0.2866	0.7650	0.7384	0.1240	0.2339	0.7732	0.2181	0.5413
Balearic Islands	0.9803	0.1681	0.7694	0.3089	0.8647	0.9257	0.8019	0.0833	0.1424	0.1999	0.3799
Canary Islands	0.3316	0.2515	0.1569	0.7393	0.3828	0.0250	0.0373	0.4025	0.5299	0.6191	0.3911
Cantabria	0.1019	1.1954	0.7082	1.1393	0.6292	0.2013	0.2421	0.4921	0.4669	0.3839	0.1258
Castille and León	0.5348	0.2787	0.8563	1.1370	0.5203	0.4676	0.1798	0.3822	0.0412	0.0130	0.3166
Castille-La Mancha	0.7047	0.7461	0.76755	0.1759	0.09619	0.57218	0.2464	0.1645	0.2242	0.3508	0.7881
Catalonia	0.3309	0.4971	0.6686	0.3348	0.31359	0.2963	0.0695	0.12848	0.0376	0.0510	0.0527
Valencian Com.	0.4122	0.0120	0.2454	0.0398	0.31316	0.0774	0.04346	<b>0.00155</b>	0.05778	0.1755	0.0144
Extremadura	0.5771	0.5248	0.4279	0.0411	0.2466	0.1327	0.1089	0.2731	0.0819	0.7634	0.5868
Galicia	0.4508	0.2126	0.3364	0.5347	0.4903	0.4629	0.2182	0.4299	0.3634	0.0212	0.0421
Madrid	0.2866	0.4089	0.0541	0.0428	0.0853	0.0622	0.4821	0.1205	0.0551	0.0228	<b>0.0068</b>
Murcia	0.6787	0.0957	0.4097	0.5048	0.0654	0.2664	0.1114	0.3924	0.6436	1.1149	1.2334
Navarre	0.5684	1.3027	1.0805	0.6404	0.6941	0.6844	0.8321	0.5514	<b>0.0071</b>	<b>0.0061</b>	0.3333
Basque Country	0.9364	0.4961	0.0491	0.4877	<b>0.0008</b>	<b>0.0063</b>	0.0482	0.0264	0.0890	0.0127	0.0169
La Rioja	0.8194	0.3300	0.2565	0.5746	0.2918	0.4941	0.3385	0.3248	0.1710	0.7151	0.5515
Ceuta and Melilla/Ceuta	0.0442	0.3705	0.5414	0.7830	0.6024	0.2307	0.8913	0.0948	0.1340	0.1436	0.7274
Melilla	n.a.	n.a.	n.a.	n.a.	n.a.	1.4629	0.2831	0.2913	1.0895	0.4560	0.2651

# Results: $\square$ parameter

AA.CC.	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Andalusia	1.9099	2.17971	2.28689	2.47752		2.5432	2.4521	2.3864	2.4117	2.5477	2.6052
Aragon	2.0363	2.05827	2.61065	2.54666	2.69340	2.6699	2.5562	2.7332	2.6035	2.4903	2.5612
Asturias	1.8554	1.83550	2.19750	2.13977	2.33080	2.4546	2.3979	2.5098	2.4430	2.3307	2.5841
Balearic Islands	2.5398	2.3967	2.5352	2.7635	2.6477	2.8276	2.9063	3.0824	2.8691	2.7532	3.0493
Canary Islands	2.0241	1.9833	2.4037	2.4894	2.6515	2.1615	2.3490	2.4748	2.2268	2.2550	2.3538
Cantabria	1.9174	2.1327	2.3056	2.5037	2.4893	2.4614	2.3380	2.4170	2.1754	2.1654	2.7188
Castille and León	1.8667	1.7465	2.0436	2.3157	2.2219	2.4391	2.4823	2.4930	2.4975	2.4192	2.5238
Castille-La Mancha	1.8433	1.9521	2.0107	2.2802	2.4968	2.6032	2.6478	2.3032	2.3598	2.3003	2.3011
Catalonia	2.1828	2.2993	2.4160	2.4631	2.6330	2.6732	2.8116	2.6039	2.5299	2.5117	2.6325
Valencian Com.	1.9657	2.1760	2.4499	2.6107	2.6040	2.6622	2.4687		2.3462	2.4037	2.4689
Extremadura	1.6789	1.7912	2.1960	2.0542	2.0991	2.2522	2.2173	2.2255	2.1326	2.0468	2.1427
Galicia	1.8991	2.1603	2.2069	2.1473	2.2001	2.1862	2.1869	2.2582	2.3311	2.0899	2.1074
Madrid	2.4282	2.4182	2.6482	2.8146	2.6556	2.7205	2.7669	2.6922	2.4993	2.6615	
Murcia	2.0068	2.1037	2.2622	2.3845	2.4389	2.4884	2.4501	2.3424	2.4736	2.5154	2.6080
Navarre	2.2321	2.2891	2.4422	2.5102	2.5951	2.7281	2.5781	2.784			2.9235
Basque Country	2.4479	2.4196	2.5863	2.8365			2.6678	2.7660	2.7558	2.6172	2.5775
La Rioja	2.0955	1.9187	2.4509	2.5407	2.6764	2.4338	2.4911	2.7265	2.6838	2.6834	2.3953
Ceuta and Melilla/Ceuta	2.1532	2.1848	2.02972	2.0754	2.2563	2.3636	2.6764	2.3389	1.9091	2.2499	2.4067
Melilla	n.a.	n.a.	n.a.	n.a.	n.a.	2.0342	1.8815	1.9707	2.5381	2.8250	2.6531

# Results

AA.CC.	2007-2006	2008-2007	2009-2008	2010-2009	2011-2010	2012-2011	2013-2012	2014-2013	2015-2014	2016-2015	No. /% Δ
Andalusia	0.270	0.107	0.191			-0.091	-0.066	0.025	0.136	0.058	6/75.0
Aragon	0.022	0.552	-0.064	0.147	-0.024	-0.114	0.177	-0.130	-0.113	0.071	5/50.0
Asturias	-0.020	0.362	-0.058	0.191	0.124	-0.057	0.112	-0.067	-0.112	0.253	5/50.0
Balearic Islands	-0.143	0.139	0.228	-0.116	0.180	0.079	0.176	-0.213	-0.116	0.296	6/60.0
Canary Islands	-0.041	0.420	0.086	0.162	-0.490	0.188	0.126	-0.248	0.028	0.099	7/70.0
Cantabria	0.215	0.173	0.198	-0.014	-0.028	-0.123	0.079	-0.242	-0.010	0.553	5/50.0
Castille and León	-0.120	0.297	0.272	-0.094	0.217	0.043	0.011	0.004	-0.078	0.105	7/70.0
Castille-La Mancha	0.109	0.059	0.269	0.217	0.106	0.045	-0.345	0.057	-0.060	0.001	8/80.0
Catalonia	0.117	0.117	0.047	0.170	0.040	0.138	-0.208	-0.074	-0.018	0.121	7/70.0
Valencian Com.	0.210	0.274	0.161	-0.007	0.058	-0.194			0.058	0.065	6/75.0
Extremadura	0.112	0.405	-0.142	0.045	0.153	-0.035	0.008	-0.093	-0.086	0.096	6/60.0
Galicia	0.261	0.047	-0.060	0.053	-0.014	0.001	0.071	0.073	-0.241	0.017	7/70.0
Madrid	-0.010	0.230	0.166	-0.159	0.065	0.046	-0.075	-0.193	0.162		5/55.6
Murcia	0.097	0.159	0.122	0.054	0.050	-0.038	-0.108	0.131	0.042	0.093	8/80.0
Navarre	0.057	0.153	0.068	0.085	0.133	-0.150	0.206				6/85.7
Basque Country	-0.028	0.167	0.250				0.098	-0.010	-0.139	-0.040	3/42.9
La Rioja	-0.177	0.532	0.090	0.136	-0.243	0.057	0.235	-0.043	0.000	-0.288	5/50.0
Ceuta and Melilla/Ceuta	0.032	-0.155	0.046	0.181	0.107	0.313	-0.337	-0.430	0.341	0.157	7/70.0
Melilla	n.a.	n.a.	n.a.	n.a.	n.a.	-0.153	0.089	0.567	0.287	-0.172	3/60.0



# Results

AA.CC.	2007-2006	2008-2007	2009-2008	2010-2009	2011-2010	2012-2011	2013-2012	2014-2013	2015-2014	2016-2015	% Δ
Andalusia	478.41	-879.22	-2021.45	-1018.89	-1868.12	-2246.56	-1548.61	170.64	175.95	1520.25	60
Aragon	-325.38	-1142.27	-1171.72	-815.65	-827.45	-890.68	-723.32	-430.05	653.65	1089.04	80
Asturias	-196.20	91.82	-907.99	223.70	-3890.05	-2602.92	-505.05	389.35	1139.78	0.32	50
Balearic Islands	1374.67	-3326.75	-3591.84	-3.52	-1722.49	-1198.04	-888.28	1217.98	597.85	2229.52	60
Canary Islands	628.93	-2520.96	-2066.18	-1558.22	-221.38	-2665.17	-771.83	1124.57	139.80	720.38	60
Cantabria	1811.22	-1862.67	-456.52	-1692.17	-1819.40	-1779.28	-2032.94	-14.27	1180.53	-185.84	80
Castille and León	747.96	-932.89	-2587.55	-907.66	-914.33	-1677.11	-919.60	346.97	1023.20	253.59	60
Castille-La Mancha	1122.35	-1860.70	-1042.38	-209.54	-1396.41	-2440.52	-166.05	175.50	777.68	70.94	60
Catalonia	-560.77	-1741.95	-1079.94	-1574.98	-1201.35	-2235.22	-630.39	556.86	509.76	537.23	70
Valencian Com.	581.23	-2781.73	-1557.57	-1527.51	-1431.64	-656.95	-1424.80	-156.53	584.44	1071.02	70
Extremadura	383.57	-1698.38	-847.30	-453.76	-1380.94	-2550.23	-174.94	62.05	-124.43	412.27	70
Galicia	56.01	-614.17	-1257.24	-1263.41	-733.21	-1798.01	-1347.32	-269.99	613.02	339.29	70
Madrid	689.96	-1382.53	-2059.87	-454.60	-685.08	-1793.87	-2259.40	-613.12	290.27	1415.36	70
Murcia	1134.71	-3182.99	-3153.97	-715.98	-982.61	-426.30	-1451.40	-101.46	496.36	1764.93	70
Navarre	-227.87	-327.86	-1635.30	-770.45	-2271.42	-1849.75	-1239.86	884.22	352.64	906.92	70
Basque Country	-471.06	-1748.85	-1254.31	421.66	-1538.28	-927.06	-745.47	-717.11	1230.08	590.02	70
La Rioja	1552.98	-1641.12	-111.73	-1064.35	-597.03	-2972.09	-213.05	51.61	524.14	626.76	60
Ceuta and Melilla/Ceuta	1623.27	-1585.59	-135.60	-1425.75	873.65	-1261.60	-5488.83	4190.35	-3153.30	3683.17	60
Melilla	n.a.	n.a.	n.a.	n.a.	n.a.	-4989.61	1342.39	-1905.07	3581.34	675.48	40



# Results

2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Madrid	Madrid	Madrid	Madrid	Madrid	Madrid	Madrid	Madrid	Ceuta	Basque C.	Madrid
Navarre	Balearic I.	Navarre	Navarre	Navarre	Ceuta	Ceuta	Basque C.	Navarre	Melilla	Navarre
Catalonia	Navarre	Catalonia	Catalonia	Basque C.	Melilla	Navarre	Navarre	Madrid	Navarre	Melilla
Balearic I.	Catalonia	Balearic I.	Ceu.-Mel.	Catalonia	Navarre	Basque C.	Melilla	Catalonia	Madrid	Balearic I.
Basque C.	Murcia	Ceu.-Mel.	Cantabria	Ceu.-Mel.	Basque C.	Catalonia	Catalonia	Basque C.	Catalonia	Basque C.
Murcia	Cantabria	Cantabria	Basque C.	Asturias	Catalonia	Cantabria	Aragon	Balearic I.	Balearic I.	Ceuta
Ceu.-Mel.	Ceu.-Mel.	Basque C.	Asturias	Cantabria	Cantabria	Murcia	Balearic I.	Melilla	Cantabria	Catalonia
Andalusia	Basque C.	Andalusia	Andalusia	Balearic I.	La Rioja	Melilla	Murcia	Aragon	Aragon	Murcia
Val. Com.	Andalusia	Murcia	La Rioja	Andalusia	Galicia	Balearic I.	Cantabria	Murcia	Ceuta	Aragon
Cantabria	Val. Com.	Asturias	Galicia	La Rioja	Balearic I.	Aragon	La Rioja	Cantabria	Murcia	La Rioja
Canary I.	Canary I.	Galicia	Balearic I.	Galicia	Aragon	Galicia	Ceuta	La Rioja	Asturias	Cantabria
Asturias	Galicia	<b>C. León</b>	Aragon	Aragon	Andalusia	La Rioja	Galicia	Asturias	La Rioja	Asturias
Galicia	Asturias	Val.Com.	Murcia	Murcia	Asturias	Val. Com.	Asturias	Galicia	Galicia	Galicia
Aragon	La Rioja	Aragon	Val. Com.	C.Mancha	Murcia	Andalusia	Val. Com.	<b>C. León</b>	<b>C. León</b>	Andalusia
<b>C. León</b>	<b>C. León</b>	Canary I.	Canary I.	Val.Com.	C.Mancha	Asturias	<b>C. León</b>	Andalusia	C.Mancha	Val.Com.
La Rioja	Aragon	La Rioja	<b>C. León</b>	<b>C. León</b>	<b>C. León</b>	<b>C. León</b>	C.Mancha	C.Mancha	Val.Com.	<b>C. León</b>
C.Mancha	C.Mancha	C.Mancha	C.Mancha	Extremad.	Val.Com.	C.Mancha	Andalusia	Val.Com.	Andalusia	C.Mancha
Extremad.	Extremad.	Extremad.	Extremad.	Canary I.	Canary I.	Canary I.	Extremad	Canary I.	Canary I.	Canary I.
					Extremad.	Extremad	Canary I.	Extremad.	Extremad.	Extremad.

# Results

AA.CC.	2007-2006	2008-2007	2009-2008	2010-2009	2011-2010	2012-2011	2013-2012	2014-2013	2015-2014	2016-2015	% Δ
Andalusia	-0.046	-0.016	-0.026			0.012	0.009	-0.003	-0.017	-0.007	75.0
Aragon	-0.004	-0.078	0.008	-0.017	0.003	0.013	-0.021	0.015	0.014	-0.009	50.0
Asturias	0.004	-0.064	0.009	-0.029	-0.017	0.008	-0.015	0.009	0.015	-0.033	50.0
Balearic Islands	0.018	-0.018	-0.027	0.013	-0.020	-0.008	-0.017	0.021	0.012	-0.030	60.0
Canary Islands	0.007	-0.065	-0.011	-0.020	0.066	-0.028	-0.017	0.034	-0.004	-0.014	70.0
Cantabria	-0.037	-0.026	-0.027	0.002	0.004	0.017	-0.011	0.035	0.002	-0.073	50.0
Castille and León	0.025	-0.057	-0.042	0.014	-0.031	-0.006	-0.001	-0.001	0.010	-0.013	70.0
Castille-La Mancha	-0.021	-0.011	-0.043	-0.029	-0.013	-0.005	0.044	-0.008	0.008	0.000	80.0
Catalonia	-0.017	-0.016	-0.006	-0.021	-0.005	-0.015	0.023	0.009	0.002	-0.015	70.0
Valencian Com.	-0.035	-0.039	-0.020	0.001	-0.007	0.024			-0.008	-0.009	75.0
Extremadura	-0.025	-0.072	0.023	-0.008	-0.024	0.005	-0.001	0.014	0.014	-0.016	60.0
Galicia	-0.045	-0.007	0.009	-0.008	0.002	0.000	-0.011	-0.010	0.037	-0.003	70.0
Madrid	0.001	-0.029	-0.018	0.018	-0.007	-0.005	0.008	0.023	-0.020		55.6
Murcia	-0.016	-0.025	-0.017	-0.007	-0.006	0.005	0.015	-0.018	-0.005	-0.011	80.0
Navarre	-0.008	-0.021	-0.009	-0.010	-0.015	0.017	-0.023				85.7
Basque Country	0.004	-0.021	-0.028				-0.011	0.001	0.016	0.005	42.9
La Rioja	0.031	-0.083	-0.011	-0.016	0.030	-0.007	-0.028	0.005	0.000	0.036	50.0
Ceuta and Melilla/Ceuta	-0.005	0.025	-0.008	-0.028	-0.015	-0.039	0.043	0.070	-0.057	-0.022	70.0
Melilla	n.a.	n.a.	n.a.	n.a.	n.a.	0.028	-0.017	-0.085	-0.033	0.019	60.0

# Conclusions

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For most of the periods and Autonomous Communities, the **biparametric Gamma model is validated** as an explanation of households' expenditures for the period 2006-2016.

Evolution of inequality:

- In general, an **increase in equality** has been detected (except for the Basque Country).
- Tendency in equality has been **more intense** in the worst years of the economic crisis: **2008-2009, 2011**, as well as in the last period, **2016**.

**Descriptive longitudinal analysis:**

- Trend: **decrease** in the **average expenditure** at the **beginning of the crisis**, especially Aragon, Cantabria, Catalonia, Valencian Community, Extremadura, Galicia, Madrid, Murcia, Navarre and the Basque Country.
- In the **recovery period**, from 2013 onwards, the **trend is reversed**, but we are still far from pre-crisis expenditure levels.

# Conclusions

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Intergroup changes: two differentiated clusters.

- Best positioned Autonomous Communities: Madrid, Navarre and Cataloni.
- Worst positioned Autonomous Communities: Extremadura, the Canary Islands, Castille and Leon, Castille-La Mancha and Valencian Community.

Representativeness of the average expenditure of the population shows a decrease in Pearson coefficient of variation value, especially in Andalusia, Canary Islands, Castille and León, Castille-La Mancha, Catalonia, Galicia, Murcia, Navarre and Ceuta and Melilla/Ceuta ☐ better population representativeness.

Thank you for your attention.

Comments are welcome:

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