REGIONAL PRICES IN EARLY TWENTIETH-CENTURY SPAIN:

A COUNTRY-PRODUCT-DUMMY APPROACH

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LOS PRECIOS PROVINCIALES EN ESPAÑA A INICIOS DEL SIGLO XX: UNA APROXIMACIÓN *COUNTRY-PRODUCT-DUMMY*

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RESUMEN

En este trabajo se explora la variación de los precios provinciales en España a inicios del siglo XX. Para ello, a partir de la información de precios de consumo publicada en los Boletines del Instituto de Reformas Sociales entre 1910 y 1920, hemos construido una base de datos que incluye un total de 40.581 precios que cubren 22 bienes para el conjunto de las provincias españolas. A continuación, hemos estimado los niveles de precios provinciales siguiendo la metodología *country-product-dummy* (CPD). Nuestros resultados señalan la existencia de una importante variación espacial en los precios en esos años. Esto apuntaría, en la línea de lo que sugiere el efecto Balassa-Samuelson, a la existencia de una relación entre los niveles de precios y de productividad. Además, se observan también diferencias en los niveles de precios incluso entre las provincias menos industrializadas lo cual abre nuevas vías de investigación y discusión.

Palabras clave: España, Precios, Niveles de vida, Desarrollo económico.

ABSTRACT

This paper explores regional price variation in early twentieth-century Spain. Using consumer price information from the bulletins published by the *Instituto de Reformas Sociales* between 1910 and 1920, we build a dataset with a total of 40,581 quotes covering 22 items for each of the 49 provinces. We then estimate provincial price levels following a country-product-dummy (CPD) approach. Our preliminary findings suggest that substantial spatial price variation existed. In line with the Balassa-Samuelson conjecture, it appears that price and productivity levels were somewhat related. Nevertheless, spatial price variation prevails among the less industrialised provinces, and this calls for further research and discussion.

Keywords: Spain, Prices, Living Standards, Economic Development.

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"Every man is rich or poor according to the degree in which he can afford to enjoy the necessaries, conveniences, and amusements of human life".

Adam Smith (1776: Wealth of Nations, Book I, Chapter V)

1.- Introduction

Measurement remains the cornerstone of economics. The System of National Accounts, established after the Second World War, enabled deeper economic analysis and stimulated further research. With the creation of the International Comparison Program in 1968, it became possible to make reasonable comparisons of per-capita income across countries[1]. However, subnational data are scant, even though there are noteworthy regional disparities in productivity and prices in large developing countries (Brazil, China, India…). In economic history there have been several efforts to reconstitute macroeconomic aggregates (i.e. GDP) at subnational level (Fukao et al., 2015, Rosés & Wolf, forthcoming). Nevertheless, few if any of these look at spatial price variation.

In the absence of prices, nominal GDP has conventionally been adjusted using a national deflator which, in the presence of spatial price variation, could bias interregional comparisons of per-capita income. Using national deflators is common practice even today. Eurostat publishes regional data in terms of the purchasing power standard (PPS), which is constructed at country level[2]. Indeed, the costliness of the data collection process in a way explains the scarcity of regional price levels[3]. Obviously, this limitation is even more acute for historical periods.

In economic history the literature on living standards has received considerable attention in recent years. Following in the footsteps of Angus Maddison and the *Great Divergence* debate (Pomeranz, 2000), several studies have delved into historical wage and price data to explore living standards across major cities and regions (Allen, 2001; Broadberry & Gupta, 2006; Allen et al., 2011; Allen et al., 2012). This approach has shed further light on the matter, complementing Maddison's real per-capita GDP backward projections. Ideally, direct

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[1] The ICP collects millions of prices from around the world to compile purchasing power parities (PPPs).

[2] The European Union acknowledges the importance of having purchasing power parities (PPPs) (Regulation (EC) No 1445/2007). In addition, Eurostat requires spatial adjustment factors (SAFs) every 6 years to calculate PPPs using prices collected in various locations of each member state.

[3] For recent work in this field see Aten (2017) for the US, Biggeri, Ferrari and Zhao (2017) for China, Deaton and Dupriez (2011) for Brazil and India, and Majumder and Ray (2017) for India.

comparisons would be preferable, as Lindert (2016) points out. However, consumer price data are often unavailable or have limited coverage, especially before 1914[4].

This study explores regional prices in a historical context: early twentieth-century Spain. To do this we collected a large dataset of market prices (over 40,000 observations) from the bulletins of the *Instituto de Reformas Sociales* between 1910 and 1920. Inspired by the methodology used in the World Bank's (2013) International Comparison Program (ICP), we then estimate regional price levels using a time-adjusted country-product-dummy (CPD) model.

Overall we find substantial spatial price variation, which partly reflects the uneven development that accompanied the industrialisation of Spain. However, regional price disparities did not result only from differences in productivity, and this calls for further research and discussion. The remainder of the paper is structured as follows. In Section 2 we describe the data and methodology. Our findings are then presented in Section 3, while Section 4 concludes with the study's main implications.

2.- Data and methodology

In economics there has been a long tradition of international comparisons of income, especially since the creation of the International Comparison Program (ICP) in 1968[5]. The ICP standardised a methodology and coordinated national statistics offices to produce spatial price deflators or purchasing power parities (PPPs)[6]. Although the procedure to compute PPPs is rather technical, its fundamentals are not. National statistics offices, under the guidance of the ICP, design a representative basket of goods and services grouped under basic headings (BHs), e.g. bread, rice and so on[7]. BHs are the lowest level of aggregation for which expenditure data are available. Thus, the first step is to compute PPPs at BH level using price information at item level. Data availability usually determines whether item-specific prices or national averages are used, or whether weighting urban and rural prices is possible. The BH-PPPs and information on household expenditures are then used as inputs to compute aggregate measures of relative prices and volumes[8].

That said, it could be argued that the System of National Accounts (SNA), created in 1953, and household budget surveys developed simultaneously. In Spain the first household budget

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[4] Emery and Levitt (2002) compile price indices for thirteen Canadian cities from 1900 to 1950. Chen and Devereux (2003) study price convergence across cities in the United States since 1918. For Spain, Rosés and Sanchez-Alonso (2004) construct provincial real wages from the mid-nineteenth century to 1930.

[5] The ICP was inspired by Gilbert and Kravis (1954), among others.

[6] The ICP has already completed eight rounds since its creation (1970, 1973, 1975, 1980, 1985, 1993, 2005 and 2011). In each round the number of countries participating has increased, rising from 10 in 1970 to 199 in 2011.

[7] In the 2005 ICP there were 155 basic headings (BH) grouped into 126 classes, 61 broad commodity groups (food, clothing, health, transport…) and 26 categories.

[8] When information on BH-PPPs and expenditure is available, the Gini-Éltetö-Köves-Szulc (GEKS) aggregation method is used. Before the 2005 ICP, the Geary-Khamis (GK) aggregation method was used.

surveys were carried out in 1940, 1958 and 1964-65[9]. Without information on household expenditures, the ICP methodology cannot be properly executed[10]. To overcome this, historical sources have been used to create a representative basket of goods and services with their expenditure weights (for Spain, Ballesteros-Doncel, 1997a, 1997b; Maluquer de Motes, 2013). However, this approach is normally used for estimating a cost-of-living index (CLI) at national level and evaluating its evolution over time. But if the focus is on the spatial variation of prices and real income, a different methodology needs to be developed. In this study we estimate subnational PPPs in early twentieth-century Spain using a large dataset of market prices and a country-product-dummy (CPD) model.

2.1- Data

Our price data come from bulletins published by the *Instituto de Reformas Sociales* (IRS) from 1910 to 1920[11]. Founded in 1903, the IRS was a governmental body whose purpose was to examine the condition of the working class and the relationship between labour and capital. In the late nineteenth century, the poor conditions of agricultural and industrial workers brought about social unrest, conflict and the so-called «social question» debate. In 1883 the Spanish government formed a Commission for Social Reforms, but to little avail. Two decades later the Commission gave way to the IRS[12], which, although similar in purpose, had more muscle and resources to counter the mounting social problems[13].

The IRS decided to carry out an ambitious plan to measure the cost of living. A price questionnaire was prepared for the purpose and sent to provincial boards. To begin with the boards filled in the questionnaires and returned them to the IRS headquarters in Madrid[14]. By 1909, however, several methodological changes had been introduced to increase consistency and coverage[15]. First, the questionnaires were to be sent to municipalities instead of provincial boards. Second, prices were collected twice a year, in winter (October-March) and summer (April-September)[16]. And third, the items included in the questionnaires were to be

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[9] Although the first Spanish household budget survey dates back to 1940, there was never any technical official publication of it (Celestino-Rey, 2002).

[10] As Deaton and Heston (2010) point out, the PPP estimations rely on there being suitable data and an appropriate multilateral price index that satisfies certain properties, such as reciprocity and transitivity. It is worth noting that: "*As has been known, at least since Fisher, price indexes cannot satisfy all the properties that our price-based intuition suggests from them; price indexes are not prices*" (Deaton and Heston, 2010, p. 9).

[11] Nicolau-Nos and Pujol-Andreu (2006) used the data of the IRS in three semesters between October 1910 and march 1912 to study relative prices across Spain's provinces. Data in http://www.proyectonisal.org/index.php/en/

[12] Established during the government of Francisco Silvela, the *Instituto de Reformas Sociales* (IRS) came under the aegis of the *Ministerio de Gobernación*. Gumersindo de Azcárate, a distinguished member of the reformist *Institución Libre de Enseñanza*, was its first president.

[13] The *Instituto de Reformas Sociales* (IRS) actively contributed to the development and enforcement of labour standards such as limiting the length of the working day to eight hours, carrying out work inspections, reviewing foreign labour regulations, mediating between workers and companies, and developing an active policy to promote social housing (Palacio-Morena 1988, 2004; Sánchez-Marín 2014).

[14] There were 49 provinces in Spain at that time. The Canary Islands were a single province, but in 1927 they were split into two, thereby making up the 50 provinces of today.

[15] *Instituto de Reformas Sociales* (1916, pp. 5-6).

[16] *Instituto de Reformas Sociales* (1916, p. 6).

representative of workers' consumption. Originally a selection of 40 items was made, but this list had shrunk to 22 by 1915.

In order to have consistent and comparable information for the period from 1910 to 1920, we consider only the 22 items as summarised in Table 1. We also make some adjustments. During 1910-1915 the questionnaire included different types of bread (wheat, barley, maize, rye) and flour (wheat, maize, rye). Although we acknowledge quality differences and a marked regional variation in their consumption, we take the cheapest value reported as the price of bread and flour for these early years[17]. The remaining items appeared in both periods and those that were only reported between 1910 and 1915 are excluded[18]. This gives us representative and comparable price information.

Table 1
Items selected, 1910-1920

Code	Item	Unit
1	Bread	kg.
2	Flour	11.5 kg.
3	Beef	kg.
4	Mutton	kg.
5	Fish, fresh	kg.
6	Cod, salted	kg.
7	Vegetables	kg.
8	Potatoes	kg.
9	Chickpeas	kg.
10	Rice	kg.
11	Beans, green	kg.
12	Wine	l.
13	Milk	l.
14	Petroleum	l.
15	Electric light	5 bulbs (*bujías*)*
16	Charcoal	11.5 kg.
17	Coffee	kg.
18	Eggs	Dozen
19	Sugar	kg.
20	Soap	kg.
21	Oil, olive	l.
22	Housing (1 room)	Annual

Source: *Instituto de Reformas Sociales* (IRS)

* In some bulletins a different number is considered.

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[17] Generally speaking, wheaten bread and flour prices were available for every year and every province, while other breads and flours were region-specific. We could have taken the price of wheaten bread and flour, but instead we preferred to take the cheapest.

[18] Table A1 in the Appendix shows the listed items in both periods. Figure A1 in the Appendix shows the front page of the IRS bulletins.

Figure 1 below shows the number of questionnaires sent and returned from 1910 to 1914 and the response rate by province during this period[19]. Approximately 12,000 questionnaires were sent every year and 6,500 returned. The response rate by province ranged from 25-35% to 65-75%. Despite this roughly 50% response rate, the IRS managed to collect enough information to publish consistent and reliable summary statistics in its bulletins. Market price data were presented for each province twice a year (winter and summer). The IRS also distinguished between provincial capitals and other municipalities[20], and as a result the bulletins show values in the capital along with the highest, lowest and most frequent prices reported in the rest of the province[21].

Figure 1
Total number of questionnaires (top) and not returned (bottom) 1910-1914
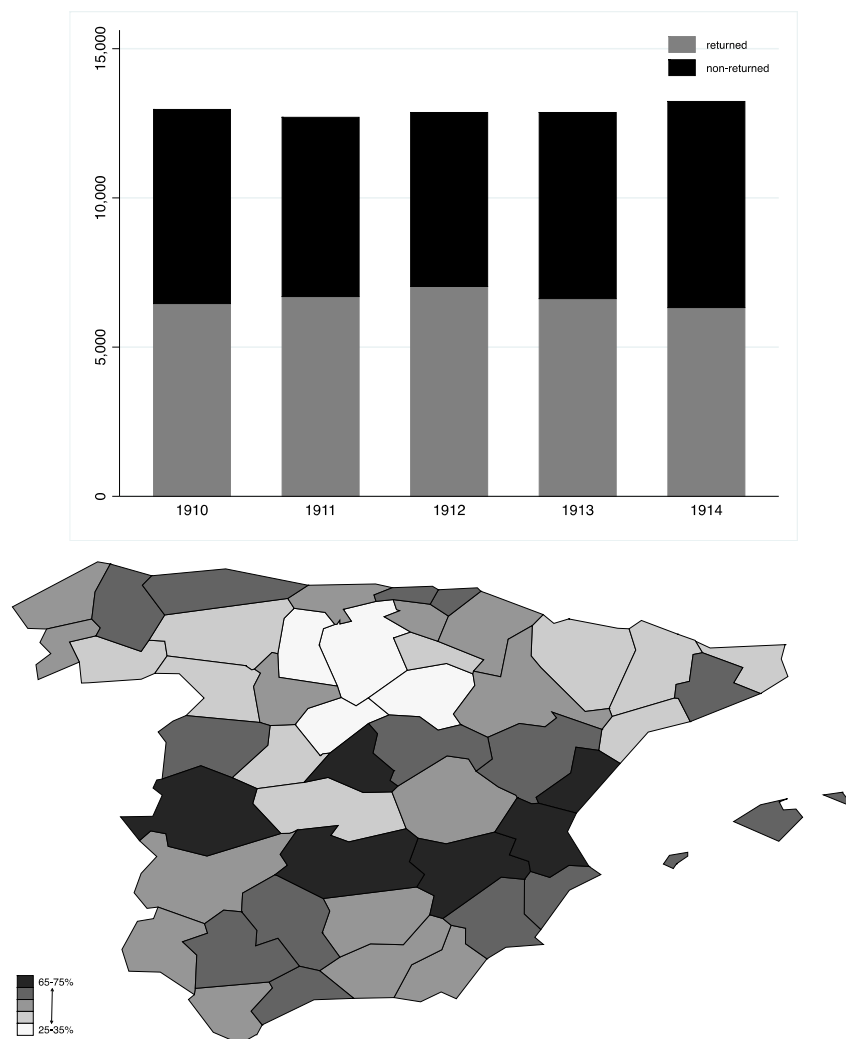
Source: *Instituto de Reformas Sociales* (1916, pp. 9-13)

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[19] Information for 1915-1920 is not available.

[20] In 1910, except for Oviedo, Ciudad Real, Jaén, Pontevedra and Tarragona, the provincial capitals were the largest centres of population in each province.

[21] The bulletins also indicate the municipalities where these prices were reported. See *Instituto de Reformas Sociales* (1916, p. 7) and Figures A2 and A3 in the Appendix.

In short, the bulletins provide the market prices of 22 items in 49 provinces (capital, province) twice a year (winter, summer) from 1910 to 1920. This would amount to a maximum total of 47,432 values[22]. However, the bulletins are occasionally incomplete. Unreported values represent 14.4% of the potential sample (6,851), leaving us with 40,581 prices. Although the distribution of missing values is relatively even, there are some peculiarities worth noting. There are a good many prices reported every year, as Figure A4 in the Appendix shows, but this is less evident when looking at specific items, where there appears to be a major issue with *Housing (1 room)*, for example, for which roughly half the values are missing[23]. Indeed, this is major concern since we expect accommodation or lodging costs to be strongly correlated with income[24].

In order to shed further light on the matter, we assess the distribution of these missing prices by year and province. In general, the annual rents for a single room are more frequently reported between 1915 and 1920, but there are some noticeable spatial disparities. Map 1 illustrates the percentage of reported values with respect to the maximum for *Housing (1 room)* and for all 22 items by province for the whole period. A fundamental issue arises when looking at Madrid and Barcelona, where data representativeness is just 34.1% and 36.4% respectively. This is a serious concern that must be taken into account and dealt with in the following section. The main urban agglomerations in the early twentieth century are Madrid and Barcelona, and thus the limited data on housing in these provinces may be affecting our analysis.

Map 1
Representativeness (30-100%) for *Housing (1 room)* (left) and all 22 items (right) by province
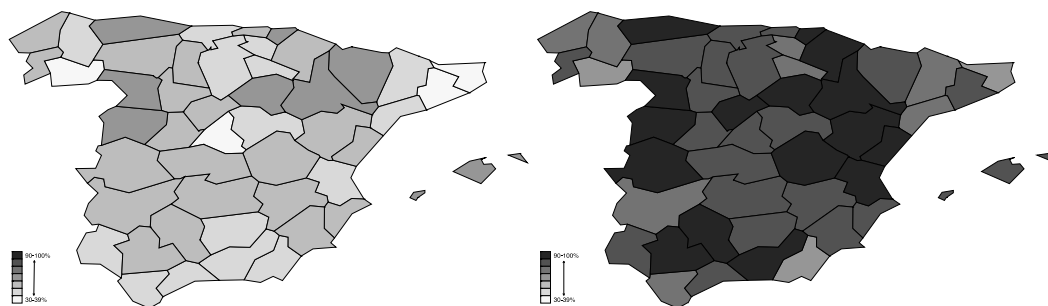
Source: Bulletins of the *Instituto de Reformas Sociales* (1910-1920)

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[22] The dataset contains 49 provinces x 2 (capital, province) x 22 items x 11 years x 2 (winter, summer) = 47,432.
[23] Unreported prices for *Housing (1 room)* also include some unusually low values (less than 21 pesetas), which we have excluded. A total of 35 reported values were removed from the sample. This threshold, though arbitrary, is well below the average housing price in our sample, so arguably those observations would be either typos or transcription errors.
[24] For a brief description of the housing market in early twentieth-century Spain, see Carmona et al. (2014). "… Spanish law did not allow ownership of land to be held separately from the ownership of rights over that land, and in consequence, all floors of any building and its land were required to have only one owner. Indeed, this created a pecuniary entry barrier to the housing property for urban workers since, typically, houses in cities had several floors and, hence, their price was quite high. As a result, a large rental market was generated. This legal framework that linked land and housing property was in force until the end of the period under study". This state of affairs changed with the Royal Order of 26 October 1939 (Carmona et al., 2014, p. 123).

Notwithstanding these issues, the IRS bulletins provide enough information to build up a dataset of 40,581 market/retail prices on 22 items representative of the consumption of Spanish workers in the early twentieth-century, covering 49 provinces. Thus our dataset fulfils the basic requirements of modern surveys since the prices are representative and comparable across space and over time, thereby permitting the living conditions in both dimensions to be studied. In fact we are unaware of the existence of any comparable datasets for other countries in a historical perspective.

2.2- Methodology

The country-product-dummy (CPD) method was developed to deal with missing data in the construction of price indices (Summers, 1973)[25]. This approach states that p_{ij}, namely the price of item i in region j, is the product of price effects, commodity effects and a random disturbance term

(1) $$p_{ij} = PPP_j . P_i . v_{ij}$$

where PPP_j is the purchasing power parity of region j with respect to other regions, P_i is the price level of item i relative to other items, and v_{ij} captures the random disturbance terms. The above expression can be rewritten as follows:

(2) $$\ln p_{ij} = \ln PPP_j + \ln P_i + \ln v_{ij} = \pi_j + \lambda_i + \varepsilon_{ij}$$

Using ordinary least squares (OLS), the above equation can be easily estimated,

(3) $$\ln p_{ij} = \sum_{j=2}^{K} \pi_j D_j + \sum_{i=2}^{N} \lambda_i D_i + \varepsilon_{ij}$$

where D_j and D_i are region and item dummy variables, while ε_{ij} captures random error terms, which are independently and identically distributed with zero mean and variance σ^2. More specifically, D_j is equal to one if the price was collected in region j and zero otherwise. Equally, D_i is equal to one if the price refers to item i, and zero otherwise. In order to escape the dummy variable trap or simply avoid multicollinearity, one region and one item are omitted and act as a reference group. Thus the estimated coefficients have to be interpreted taking into account these reference groups. Having said that, the spatial price deflators or PPP_j will be:

(4) $$PPP_j = \exp(\hat{\pi}_j)$$

The attractiveness of the CPD method lies in its simplicity and transparency (Hill & Hill, 2009), especially when dealing with non-comparable items, quality characteristics (Biggeri et al., 2017) and missing data[26]. Yet the most distinguishable feature of the CPD approach is its

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[25] When there is just one missing value, traditional price index ratios cannot be correctly computed (Summers, 1973; Aten, 1999).

[26] Both the CPD method and the weighted country-product-dummy (WCPD), which is explained later, are used to deal with missing values (Hill and Hill, 2005) on the assumption that these are randomly distributed (Rao, 2005).

stochastic nature, i.e. it is possible to implement specific econometric tools (Rao, 2004; Biggeri et al., 2017). It also provides standard errors, which could be used to detect outliers and errors in the dataset (Hill, 2004; Hill & Hill, 2009).

Although the International Comparison Program (ICP) only uses the CPD method to compute BH–PPPs, Rao (2005) recently proposed a generalization of the standard CPD to estimate general price indices. In line with the ICP approach, he suggests a weighted country-product-dummy (WCPD) method in which item prices are weighted according to their relative importance,

(5) $$w_{ij} = \frac{p_{ij}q_{ij}}{\sum_{i=1}^{N} p_{ij}q_{ij}}$$

where w_{ij} captures the relative importance or weight, expressed as the expenditure share of item i in region j. Unfortunately we only have expenditure patterns at national level (Ballesteros-Doncel, 1997a, 1997b; Maluquer de Motes, 2013). In the following section we use both CPD and WCPD methods with country weights to estimate subnational PPPs.

3.- Empirical analysis

To fully exploit our dataset, we use a CPD method with all the price data. It is worth remembering that we have prices for 22 items collected twice a year (winter and summer) over 11 years in provincial capitals and other municipalities. Since our research focus lies in the spatial dimension, we adjust equation (3) to control for time-varying effects as follows,

(6) $$\ln p_{ijt} = \alpha + \sum_{j=2}^{49} \pi_j D_j + \sum_{i=2}^{22} \lambda_i D_i + \sum_{i=2}^{22} \delta_t D_t + \gamma. \text{capital} + \theta_{jt} + \varepsilon_{ijt},$$

where α is the constant term; D_j, D_i and D_t represent province, item and semester dummy variables respectively; and *Barcelona*, *bread* and *winter 1910* are the reference groups for province, item and semester respectively. The capital variable is equal to one if the price is collected in the provincial capital, zero otherwise, and its inclusion controls for urban–rural price differences (Hill & Syed, 2015). Besides this, interaction terms (province–semester: θ_{jt}) are included to control for unobservable, time-varying characteristics, while ε_{ij} is the random error term[27]. This is important to account for the impact of the First World War on prices and its potential asymmetric effect across provinces. As previously mentioned, our main interest is parameter π_j, which captures the province-specific effect with respect to *Barcelona*, our reference group. The PPPs obtained have to be interpreted taking into account that the PPP for Barcelona is normalized to 1 (or 100). Our empirical strategy relies on both unweighted and weighted regressions. In the unweighted estimation, all prices in our sample enter the regressions with a similar weight. However, the weighted estimation requires the use of a basic consumption basket. We therefore have to assign a weight to each of the 22 goods in our sample, based on their respective expenditure share in the budget of an average family at that

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[27] We relax the homoscedasticity assumption and consider robust standard errors.

time. While consumption patterns may vary across provinces and between urban and rural areas, we use a single basket that is deemed to be representative of Spain in the 1910s[28]. The weights assigned are mainly based on the work by Ballesteros-Doncel (1997a, pp. 373-374)[29]. The weights given to each of the 22 items in our sample can be consulted in Table 2 below.

Table 2
Consumption Basket, Spain 1910-1920
Weights by item (%)

Code	Item	Weight	Basic Heading
1	Bread	18.8	Food
2	Flour	3.8	Food
3	Beef	3.8	Food
4	Mutton	3.8	Food
5	Fish, fresh	1.9	Food
6	Cod, salted	1.9	Food
7	Vegetables	7.5	Food
8	Potatoes	7.5	Food
9	Chickpeas	7.5	Food
10	Rice	1.9	Food
11	Beans, green	1.9	Food
12	Wine	3.8	Food
13	Milk	2.3	Food
14	Petroleum	2.7	Other
15	Electric light	2.7	Other
16	Charcoal	2.7	Other
17	Coffee	2.7	Other
18	Eggs	2.3	Food
19	Sugar	1.5	Food
20	Soap	2.7	Other
21	Oil, olive	4.8	Food
22	Housing (1 room)	11.5	Housing
	Total	**100.0**	

Source: own, see text.

The estimates of the key coefficients in equation (5) are reported in Table 3. CPD refers to the unweighted model while WCPD refers to the weighted model in which the price of each item is weighted according to its expenditure share[30]. The high R-squares (0.939 in the unweighted model and 0.961 in the weighted model) indicate how well the models fit the data. This means that the inclusion of the selected dummy variables (province, item, semester, capital) and the province-time fixed effects are capturing the variability of the price data very well.

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[28] Ideally, one would like to have regional baskets to measure potentially different consumption patterns (Lindert, 2016). However, obtaining regionally adapted baskets for the early decades of the twentieth century in Spain is indeed a difficult task. Baskets for specific regions can be found in Lana (2007) and Pérez-Castroviejo (2006).

[29] This author provides a representative basket constructed using the price information for 12 provinces for the period 1909-1931. Alternative baskets can be found in Rosés and Sánchez-Alonso (2004, p. 406) and Maluquer de Motes (2013, p.41 and p.43). The item 'clothing' is usually included in these consumption baskets but unfortunately is absent from our price data.

[30] Full regression results can be consulted in Table A2 in the Appendix.

However, the most interesting result is the spatial differences detected in the cost of living in Spain during the early twentieth century. According to the CPD model, all the province coefficients are negative and statistically different from zero, meaning that their cost of living was lower than in Barcelona.[31] Therefore, as expected, the province with the highest cost of living was Barcelona, followed by Vizcaya ($\hat{\pi} = -0.1607$), Sevilla ($\hat{\pi} = -0.1642$) and Cádiz ($\hat{\pi} = -0.1665$). The provinces with the lowest cost of living were Salamanca ($\hat{\pi} = -0.4465$), Ávila ($\hat{\pi} = -0.4361$) and Lugo ($\hat{\pi} = -0.4160$). In the WCPD model, although all the coefficients are still negative, some of them are not statistically different from Barcelona. This happens in those provinces with a cost of living most similar to Barcelona in the unweighted model (namely Gerona, Lérida, Oviedo, Sevilla and Vizcaya).

Apart from the spatial heterogeneity, Table 3 presents other results. In line with the literature (Rojo & Houpt, 2011; Ramon & Ramon, 2017; García-Gómez & Escudero, 2017), there seem to be marked price differences between capital cities and other municipalities. Using the unweighted approach, prices were on average 7.54% higher in the capital city[32]. This discrepancy was even higher in the weighted model, amounting to 12.27%. Finally, the last interesting result is shown by the semester dummy variables. It is noteworthy that there was a general increase in the level of prices in winter 1915 that persisted until the end of the period. This effect should be associated with the shock caused by the First World War. However, there was no positive trend over time (i.e. the coefficient of one specific semester was not statistically different from the coefficient of the next).

As previously mentioned, one of the main concerns regarding our full dataset is the number of missing values for housing. To be sure that this is not affecting our results for spatial heterogeneity in the cost of living, we repeat regression (5) considering only the food sector, which contains 15 items and represents a 75% share of expenditure (see Table 2). The estimates of the key variables are reported in Table A3 in the Appendix. As we are considering fewer items, the number of observations decreases from 40,681 to 30,188. The R-squares, although slightly lower than those obtained with the full sample, remain very high (0.9176 and 0.9200).

Regarding the spatial differences in prices, the results obtained via this new specification are in line with our previous conclusions. Barcelona is the province with by far the highest cost of living, followed by Gerona ($\hat{\pi} = -0.1358$), Vizcaya ($\hat{\pi} = -0.1471$) and Sevilla ($\hat{\pi} = -0.1534$)[33]. The group of provinces with the lowest cost of living includes Salamanca ($\hat{\pi} = -0.4986$), Ávila ($\hat{\pi} = -0.4606$) and Segovia ($\hat{\pi} = -0.4581$), among others.

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[31] We are confident about these results since our regression includes a lot of fixed effects. In fact we are controlling for the interaction between province and semester (namely 48 x 22 = 1,078 dummy variables).

[32] The estimated coefficient is $\hat{\gamma}^{CPD}$=0.0727, which indicates that the increase in prices was equal to [exp(0.0727)-1]100 = 7.54% (Halvorsen and Palmquist, 1980).

[33] The coefficients obtained for Gerona and Vizcaya are not statistically different from Barcelona.

Table 3
Coefficients from CPD and WCPD models
Full sample

	CPD			WCPD				CPD (cont.)			WCPD (cont.)		
	Coef.[1]	SE[2]	Sign.[3]	Coef.[1]	SE[2]	Sign.[3]		Coef.	SE	Sign.	Coef.	SE	Sign.
Álava	-0.3814	0.0840	***	-0.3670	0.1200	***	Madrid	-0.3112	0.0718	***	-0.3496	0.1062	***
Albacete	-0.3356	0.0771	***	-0.3235	0.0981	***	Málaga	-0.2308	0.0877	***	-0.2823	0.1351	**
Alicante	-0.2780	0.0790	***	-0.2496	0.1053	**	Murcia	-0.261	0.0856	***	-0.3245	0.1352	**
Almería	-0.3095	0.0828	***	-0.3313	0.1378	**	Navarra	-0.2909	0.0735	***	-0.2665	0.0950	***
Ávila	-0.4361	0.0774	***	-0.5102	0.1053	***	Orense	-0.3078	0.0896	***	-0.2684	0.1200	**
Badajoz	-0.2977	0.0793	***	-0.3343	0.0996	***	Oviedo	-0.1971	0.0788	**	-0.1350	0.1135	
Baleares	-0.3786	0.0830	***	-0.3395	0.1193	***	Palencia	-0.2867	0.0744	***	-0.3143	0.1033	***
Burgos	-0.3248	0.0758	***	-0.4038	0.1090	***	Pontevedra	-0.2805	0.0800	***	-0.2534	0.1177	**
Cáceres	-0.3957	0.0713	***	-0.440	0.0973	***	Salamanca	-0.4465	0.0750	***	-0.4529	0.1054	***
Cádiz	-0.1665	0.0764	**	-0.1660	0.0910	*	Santander	-0.2677	0.0772	***	-0.2312	0.0933	**
Canarias	-0.2738	0.0793	***	-0.1950	0.1067	*	Segovia	-0.4033	0.0745	***	-0.4310	0.0988	***
Castellón	-0.2969	0.0769	***	-0.2900	0.1026	***	Sevilla	-0.1642	0.0791	**	-0.1188	0.0971	
Ciudad Real	-0.2848	0.0748	***	-0.3360	0.0905	***	Soria	-0.3451	0.0728	***	-0.3797	0.1036	***
Córdoba	-0.1798	0.0714	**	-0.1867	0.0895	**	Tarragona	-0.2015	0.0861	**	-0.1871	0.0952	**
Coruña	-0.3528	0.0742	***	-0.3213	0.1018	***	Teruel	-0.3047	0.0771	***	-0.3353	0.1055	***
Cuenca	-0.3682	0.0740	***	-0.4513	0.1018	***	Toledo	-0.3437	0.0814	***	-0.3970	0.1247	***
Gerona	-0.1979	0.1126	*	-0.1391	0.1195		Valencia	-0.2768	0.0737	***	-0.2844	0.1034	***
Granada	-0.2461	0.0702	***	-0.2473	0.0861	***	Valladolid	-0.2780	0.0752	***	-0.3307	0.1042	***
Guadalajara	-0.3685	0.0757	***	-0.4468	0.1131	***	Vizcaya	-0.1607	0.0843	*	-0.1282	0.1176	
Guipúzcoa	-0.2428	0.0939	***	-0.1728	0.1262		Zamora	-0.3501	0.0744	***	-0.3988	0.1059	***
Huelva	-0.2100	0.0736	***	-0.2003	0.0918	**	Zaragoza	-0.2556	0.0753	***	-0.2597	0.1046	**
Huesca	-0.3288	0.0682	***	-0.3680	0.0877	***	Capital	0.0727	0.0031	***	0.1157	0.0043	***
Jaén	-0.2185	0.0700	***	-0.2311	0.0908	**	Fixed effects						
León	-0.3158	0.0926	***	-0.3466	0.1469	**	Item	Yes			Yes		
Lérida	-0.2039	0.0802	**	-0.1751	0.1065		Semester	Yes			Yes		
Logroño	-0.3325	0.0844	***	-0.3748	0.1294	***	Province-semester	Yes			Yes		
Lugo	-0.4160	0.0775	***	-0.3453	0.1036	***	Observations	40,581			40,581		
							R-square	0.9391			0.9612		

Notes: [1] Barcelona is the control group. [2] Robust standard errors. [3] *** p<0.01, ** p<0.05, *** p<0.1.

To make it easier to interpret the estimated coefficients ($\hat{\pi}_j$) and better quantify the spatial heterogeneity, Table 4 presents the sub-national, normalised PPPs (Spain=100). In the table we can clearly distinguish between those provinces with a price index higher than the national average (PPP>100) and those with a lower one (PPP<100). Two compelling results can be extracted from this analysis. First, the existence of price differences among Spanish provinces at the beginning of the twentieth century, and second, the big difference between Barcelona and all the other provinces.

Table 4
Sub-national PPPs
Spain=100

	CPD	WCPD		CPD	WCPD
Álava	88.8	90.3	Lérida	106.1	109.4
Albacete	93.0	94.3	Logroño	93.3	89.6
Alicante	98.5	101.5	Lugo	85.8	92.3
Almería	95.5	93.6	Madrid	95.3	91.1
Ávila	84.1	78.2	Málaga	103.3	98.3
Badajoz	96.6	93.3	Murcia	100.2	94.2
Baleares	89.1	92.8	Navarra	97.2	99.8
Barcelona	130.1	130.3	Orense	95.6	99.6
Burgos	94.0	87.0	Oviedo	106.8	113.9
Cáceres	87.6	83.9	Palencia	97.7	95.2
Cádiz	110.1	110.4	Pontevedra	98.3	101.1
Canarias	98.9	107.2	Salamanca	83.2	82.8
Castellón	96.7	97.5	Santander	99.5	103.4
Ciudad Real	97.8	93.1	Segovia	86.9	84.7
Córdoba	108.7	108.1	Sevilla	110.4	115.7
Coruña	91.4	94.5	Soria	92.1	89.1
Cuenca	90.0	83.0	Tarragona	106.3	108.1
Gerona	106.7	113.4	Teruel	95.9	93.2
Granada	101.7	101.8	Toledo	92.2	87.6
Guadalajara	90.0	83.4	Valencia	98.6	98.1
Guipúzcoa	102.0	109.6	Valladolid	98.5	93.6
Huelva	105.4	106.7	Vizcaya	110.8	114.6
Huesca	93.6	90.2	Zamora	91.7	87.5
Jaén	104.5	103.4	Zaragoza	100.7	100.5
León	94.9	92.1			

Note: Using population to normalise.

Map 2 below provides new evidence on the geographical patterns of regional prices in early twentieth-century Spain. In short, price levels were relatively higher in the northeast (Catalonia), the southwest (Western Andalusia) and in some provinces in the north, e.g. Asturias, Guipuzcoa, Vizcaya. In the northwest (Galicia) and the interior (Castile and Leon, Extremadura, Madrid, Castile-La Mancha) price levels were somewhat below the national average. This pattern is consistent using either approach, thereby pointing to a marked regional disparity in prices.

Map 2
Sub-national PPPs: CPD model (top) and WCPD (bottom)
Spain=100
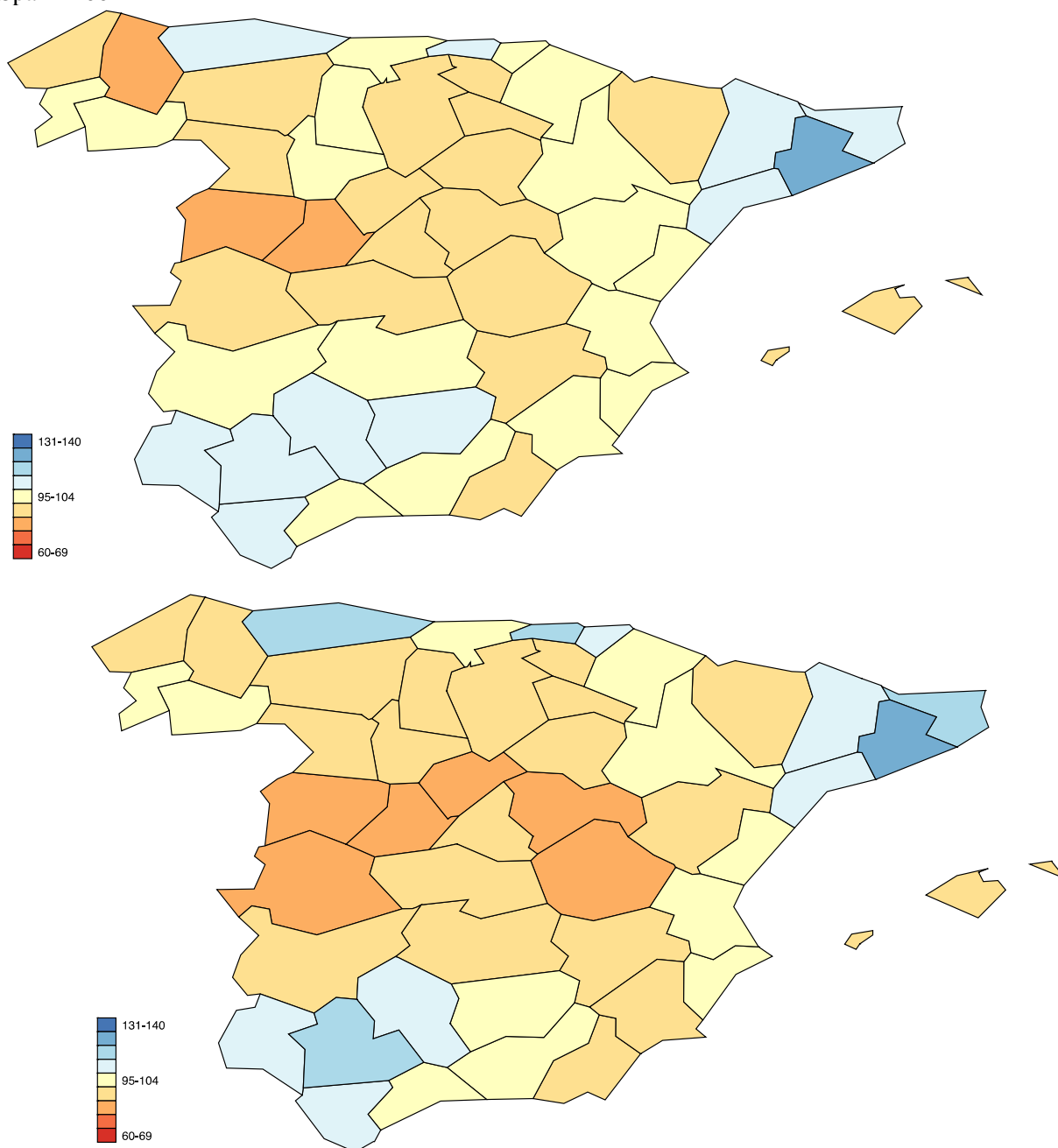
4.- Conclusions

This paper has explored regional prices in early twentieth-century Spain. Using information from bulletins published by the *Instituto de Reformas Sociales* between 1910 and 1920, we first created a database of 40,581 prices quoted for 22 items for each of the 49 provinces. In order to fully exploit this dataset, we then estimated provincial price levels for the whole period with a time-adjusted country-product-dummy (CPD) model. We also include expenditure weights in the methodology, i.e. weighted country-product-dummy (WCPD), to assess the robustness of the results.

Overall we find marked regional disparities in consumer prices in early twentieth-century Spain. In line with the Balassa-Samuelson conjecture, it appears that productivity and prices were somehow related. For example, prices in the leading industrial provinces of Barcelona and Vizcaya were well above the national average. Furthermore, we find that price levels in provincial capitals were on average higher than in other municipalities. Interestingly, there was also substantial variation across less industrialised provinces and the price level in the capital-province of Madrid was below the national average, which provides more food for thought[34].

Although this is just a preliminary investigation and "*wages…vary more from place to place than the price of provisions*" (Smith, 1776: Book I, Chapter VIII), macroeconomic aggregates used for interregional comparisons of living standards need to account for spatial price variation. In this regard, understanding why these disparities arise is important. Uneven development not only sets the Balassa-Samuelson effect in motion, but also Engel's law. Richer regions are thus expected to have a higher price level and a rather different pattern of expenditure. In our case, whether these effects feed off each other remains to be seen. Finally, we acknowledge the relevance of regional specific characteristics such as consumer preferences and market size, which call for further research and discussion.

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[34] Economic historians have highlighted that regional differences in environmental conditions and in trading networks and distribution channels may also explain the variation in the availability of foodstuffs (and therefore their price) in different areas and cities across Spain (Nicolau-Nos and Pujol-Andreu, 2006; Sinde, 2014; Gallego, 2016).

Data sources

Bulletins of the Instituto de Reformas Sociales, 1910-1920.

Semester	Bulletin Number	Date	Pages
March 1910	77	November 1910	499–511
	78	December 1910	637–659
	79	January 1911	741–767
	80	February 1911	871–891
	81	March 1911	1,043–1,059
	82	April 1911	1,133–1,152
September 1910	85	July 1911	61–83
	86	August 1911	199–215
	87	September 1911	363–389
	88	October 1911	497–523
	89	November 1911	661–691
March 1911	91	January 1912	21–65
	92	February 1912	143–185
	93	March 1912	277–319
September 1911	94	April 1912	391–435
	95	May 1912	489–533
	96	June 1912	601–635
March 1912	102	December 1912	549–573
	103	January 1913	41–67
	104	February 1913	179–219
September 1912	105	March 1913	309–344
	106	April 1913	409–441
	107	May 1913	507–531
	108	June 1913	609–629
March 1913	109	July 1913	33–59
	110	August 1913	115–139
	111	September 1913	211–225
	112	October 1913	327–353
	113	November 1913	431–451
September 1913	116	February 1914	179–201
	117	March 1914	281–303
	119	April 1914	407–429
	120	June 1914	601–627
March 1914	121	July 1914	55–75
	122	August 1914	145–167
	123	September 1914	231–249
	124	October 1914	357–377
	125	November 1914	463–483
	126	December 1914	595–605
September 1914	128	February 1915	135–151
	129	March 1915	231–255
	130	April 1915	325–347
	131	May 1915	441–463
	132	June 1915	525–553

Semester	Bulletin Number	Date	Pages
March 1915	133	July 1915	37–57
	134	August 1915	113–121
	135	September 1915	205–233
	136	October 1915	309–325
	137	November 1915	403–435
	138	December 1915	529–549
September 1915	139	January 1916	38–65
	140	February 1916	158–184
March 1916	143	May 1916	446–473
	144	June 1916	544–571
	145	July 1916	54–55
September 1916	149	November 1916	379–405
	150	December 1916	472–498
March 1917	155	May 1917	431–458
	156	June 1917	537–562
September 1917	161	November 1917	439–466
	162	December 1917	562–591
March 1918	167	May 1918	483–509
	168	June 1918	586–611
September 1918	173	November 1918	476–502
	174	December 1918	608–634
March 1919	179	May 1919	572–597
	180	June 1919	710–736
September 1919	185	November 1919	558–581
	186	December 1919	686–714
March 1920	191	May 1920	616–637
	192	June 1920	829–859
September 1920	197	November 1920	863–903
	198	December 1920	1,108–1,134

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Appendix

Table A1
Items in the price questionnaires
(a) 1910-15 (b) 1915-20

(a) 1910-1915			**(b) 1915-1920**		
Code	**Item**	**Unit**	**Code**	**Item**	**Unit**
1	Bread, wheat	kg.			
2	Bread, barley	kg.			
3	Bread, maize	kg.			
4	Bread, rye	kg.			
			1	Bread	kg.
5	Flour, wheat	11.5 kg.			
6	Flour, maize	11.5 kg.			
7	Flour, rye	11.5 kg.			
			2	Flour	11.5 kg.
8	Beef	kg.	3	Beef	kg.
9	Mutton	kg.	4	Mutton	kg.
10	Goat	kg.			
11	Pork	kg.			
12	Offal, edible	kg.			
13	Meat, prep.	kg.			
14	Fish, fresh	kg.	5	Fish, fresh	kg.
15	Fish, pickled	kg.			
16	Cod, salted	kg.	6	Cod, salted	kg.
17	Fruit	kg.			
18	Vegetables	kg.	7	Vegetables	kg.
19	Potatoes	kg.	8	Potatoes	kg.
20	Beans, broad	kg.			
21	Chickpeas	kg.	9	Chickpeas	kg.
22	Rice	kg.	10	Rice	kg.
23	Beans, green	kg.	11	Beans, green	kg.
24	Grass peas	kg.			
25	Lentils	kg.			
26	Wine	l.	12	Wine	l.
27	Cider	l.			
28	Milk	l.	13	Milk	l.
29	Petroleum	l.	14	Petroleum	l.
30	Electric light	5 bulbs	15	Electric light	5 bulbs
31	Charcoal	11.5 kg.	16	Charcoal	11.5 kg.
32	Firewood	11.5 kg.			
33	Coffee	kg.	17	Coffee	kg.
34	Eggs	dozen	18	Eggs	dozen
35	Sugar	kg.	19	Sugar	kg.
36	Soap	kg.	20	Soap	kg.
37	Salt	kg.			
38	Oil, olive	l.	21	Oil, olive	l.
39	Lard	kg.			
40	Housing (1 room)	annual	22	Housing (1 room)	annual

Source: Bulletins of the *Instituto de Reformas Sociales* (IRS)

Notes: kg. = kilogram; l. = litres; When electric light was reported in different units, information was converted to 5 bulbs (*bujías*) per month.

Figure A1
Bulletin of the *Instituto de Reformas Sociales* (IRS), Nov. 1910, p. 31

BOLETÍN

DEL

INSTITUTO DE REFORMAS SOCIALES

INSTITUTO DE REFORMAS SOCIALES

TRABAJOS DE LA SECRETARIA
Y DE LAS SECCIONES TÉCNICAS

SECRETARÍA GENERAL

SESIONES
EXTRACTO DE LAS ACTAS

Sesión del día 13 de Diciembre de 1909. — ORDEN DEL DÍA. — 1.ª *Legislación del trabajo.* — Se da cuenta de la publicación del Apéndice 4.ª de la *Legislación del Trabajo.*

2.ª *Mercado dominical de Calatayud.* — La Sección 2.ª informa favorablemente acerca de la tradicionalidad de este mercado.

El Sr. Sánchez de Toca entiende que debe plantearse, como cuestión previa, si procede que el Instituto siga informando en expedientes de mercados, ó se abstenga de ello hasta que se publique algún precepto aclaratorio del Real decreto de 15 de Noviembre sobre descentralización municipal.

El Sr. González Rojas dice que el acuerdo tomado por el Instituto, cuando se dió cuenta del Real decreto citado, no fué el de elevar consulta alguna pidiendo la opinión del Ministerio, sino el de manifestar á éste que el criterio de la Corporación era el de que dicho Real decreto no modificaba la legislación sobre descanso dominical, y que, por lo tanto, los expedientes de esta clase debían seguir los mismos trámites que venían siguiendo hasta ahora.

Después de una breve discusión, en que intervienen los citados Vocales y los Sres. Marqués de la Merced y Presidente, se acuerda de conformi-

Figure A2
Bulletin of the *Instituto de Reformas Sociales* (IRS), April-Sept. 1912 (Barcelona)

ARTÍCULOS	BARCELONA (Capital.) JUNTA LOCAL				BARCELONA (Provincia.) JUNTAS LOCALES					
	Precio corriente.	Encarecimiento.	Precio más frecuente.	Poblaciones.	Precio máximo.	Poblaciones.	Precio mínimo.	Poblaciones.	Encarecimiento.	Poblaciones.
Pan de trigo (el kilo)	0,40	»	0,40	Badalona y otras.	0,50	Gabá y otras.	0,35	Copóns y otras.	»	»
Idem cebada (id.)	»	»	»	»	»	»	»	»	»	»
Idem maíz (id.)	»	»	0,20	Masquefa.	0,20	Masquefa.	0,20	Masquefa.	»	»
Idem centeno (id.)	»	»	»	»	»	»	»	»	»	»
Harina de trigo (11 ½ k.)	4,50	»	4	Vegas y otras.	6,90	Gironella.	3,15	Malgrat.	»	»
Idem maíz (id.)	2,50	»	2,50	Abrera y otras.	4,25	Moyá.	2,30	Masquefa.	»	»
Idem centeno (id.)	4,25	»	4,05	Moyá.	6,90	Gironella.	3	Abrera.	»	»
Carne de vaca (el kilo)	2	»	2	Manlleu y otras.	2,75	Igualada.	1,60	Malgrat.	»	»
Idem carnero ú oveja (id.)	2	»	2	Gabá y otras.	2,70	Berga.	2	Gabá y otras.	»	»
Idem cabra (id)	1,60	»	1,50	Cardona.	3	Idem.	0,75	Canet de Mar.	»	»
Idem cerdo (id.)	3	»	2,25	Carme.	3	Molíns de Rey.	1	Masquefa.	»	»
Despojos de reses (id.)	0,50	»	0,50	Riells y otras.	2,50	Malgrat.	0,25	Moyá.	»	»
Embutidos (id.)	2,50	»	2,50	Berga.	3	Hospitalet.	0,95	Carme.	»	»
Pescado fresco (el kilo)	1,30	»	1,25	Molins de Rey.	2,25	Castellbisbal.	0,50	Igualada.	»	»
Idem en escabeche (id.)	3	»	1,25	Badalona y otras.	2,75	Argensola.	1,25	Badalona.	»	»
Bacalao (id.)	1,50	»	1,50	Arenys de Mar.	2,50	Igualada.	0,50	Berga.	»	»
Frutas (el kilo)	0,40	»	0,25	Capellades.	0,50	La Garriga.	0,05	Carme.	»	»
Hortalizas (id.)	0,40	»	0,20	Malgrat y otras.	0,50	Badalona.	0,05	Martorellas.	0	»
Patatas (id.)	0,20	»	0,15	Caldas de Mombuy.	0,25	Barbará.	0,05	Capolat.	»	»
Habas (id.)	0,25	»	0,20	Avinyó y otras.	0,50	Canet de Mar.	0,05	Riell y otras.	»	»
Garbanzos (el kilo)	1,20	»	0,50	Balsareny y otras.	1,10	Castellbisbal.	0,50	Balsareny y otras.	»	»
Arroz (id.)	0,80	»	0,60	Borredá y otras.	0,75	Cervelló.	0,45	Lavid y otras.	»	»
Judías (id.)	0,60	»	0,50	Gélida y otras.	0,75	Mollet.	0,50	Estañy.	»	»
Almortas (id.)	»	»	1,25	Malgrat.	1,25	Malgrat.	1,25	Malgrat.	»	»
Lentejas (id.)	0,75	»	0,50	Capellades.	4	Carme.	0,50	Capellades.	»	»
Vino (el litro)	0,35	»	0,25	Fontruby y otras.	0,35	Calella y otras.	0,15	Argensola.	»	»
Sidra (id.)	1,50	»	»	»	»	»	»	»	»	»
Leche (id.)	0,40	»	0,40	Centellas.	0,50	Gironella.	0,30	Aviñonet.	»	»
Petróleo (el litro)	2	»	1,60	Martorellas.	3	Gabá y otras.	0,70	La Garriga.	»	»
Luz eléctrica (5 bujías mens.)	»	»	1,75	Manlleu y otras.	2,25	Canet de Mar.	1	Cardona.	»	»
Carbón vegetal (11 ½ k.)	1,50	»	1	Cerbelló y otras.	5,50	Alella.	0,10	Masquefa.	»	»
Leña (id.)	3,25	»	0,35	Igualada.	2,25	Masquefa.	0,15	Borredá.	»	»
Café (el kilo)	6	»	6	Malgrat y otras.	12,50	Argensola.	2,25	Aviñonet.	»	»
Huevos (la docena)	1,75	»	1,25	Calella y otras.	2,25	Avillonet.	0,70	Moyá.	»	»
Azúcar (el kilo)	1,23	»	1,25	Gabá y otras.	1,50	Martorellas.	0,67	Cardona.	»	»
Jabón (id.)	1	»	1	Malgrat y otras.	1,20	Estañy.	0,50	Gélida.	»	»
Sal (id.)	0,10	»	0,10	Centellas.	0,25	Carme.	0,05	Caldas de Mombuy.	»	»
Aceite (el litro)	1,50	»	1,50	Calella y otras.	5,75	Masquefa.	0,80	Estañy y otras.	»	»
Manteca de cerdo (el kilo)	2,50	»	1,85	Martorellas.	2,50	Centellas.	1,25	Canet de Mar.	»	»
Habitación	400	»	»	»	»	»	»	»	»	»

Figure A3
Bulletin of the *Instituto de Reformas Sociales* (IRS), April-Sept. 1920 (Barcelona)

ARTÍCULOS	BARCELONA (Capital.) JÚNTA LOCAL Precio corriente.	BARCELONA (Provincia). JUNTAS LOCALES					
		Precio más frecuente	Pobla-ciones.	Precio máximo.	Pobla-ciones.	Precio mínimo	Pobla-ciones.
Pan (el kilo).............	0,75	0,75	112	0,80	6	0,70	35
Harina (11 ¹/₂ kilos).........	12	8-9	34	12-13	6	7-7,50	14
Carne de vaca (el kilo)......	4,50	4-5	36	5,50	5	4-5	36
Idem carnero u oveja (id.)....	4,50	4,50-4,25	83	5-5,25	12	1,80	25
Pescado fresco (id.).........	11	3-3,75	29	7,50-7,75	3	1,25	11
Bacalao (id.)...............	4	3 a 4	137	4,50-5	6	1,75	22
Hortalizas (id.)............	1,50	0,40-0,75	32	1-1,75	13	0,20	25
Patatas (id.)...............	0,50	0,30-0,40	92	0,50	6	0,20	49
Garbanzos (id.)............	3	1-1,75	115	2-2,75	7	0,75	9
Arroz (id.)................	1,50	1-1,50	127	2-2,50	11	0,85	11
Judías (id.)................	2,75	1-1,75	134	2-2,50	9	0,75	4
Vino (el litro).............	0,80	0,40-0,50	88	0,60-0,70	33	0,25	34
Leche (id.)................	1	0,60 a 0,80	100	1-1,50	17	0,40	9
Petróleo (id.).............	1,50	1,20-1,75	75	2-2,50	12	1-1,10	14
Luz eléctrica (5 bujías mens).	3	2 a 3,50	40	6-10	11	1,75	4
Carbón (11 ¹/₂ kilos)........	3	3 a 3,75	98	4-4,60	16	2 a 2,75	30
Café (el kilo)..............	9	7 a 9	77	10-12	5	4 a 6	10
Huevos (la docena).........	6	5 a 5,75	64	6-6,50	20	3 a 3,75	15
Azúcar (el kilo)............	3,75	3 a 3,75	108	4	3	2,25	46
Jabón (id.)................	1,95	2 a 2,75	114	3-3,75	3	1 a 1,75	41
Aceite (el litro)............	3	2 a 2,75	109	3 a 4	41	1,90	2
Habitación (alquiler anual)..	450	100 a 250	104	300 a 400	14	35 a 80	38

Figure A4
Representativeness (%) of reported prices
By (a) year and (b) item
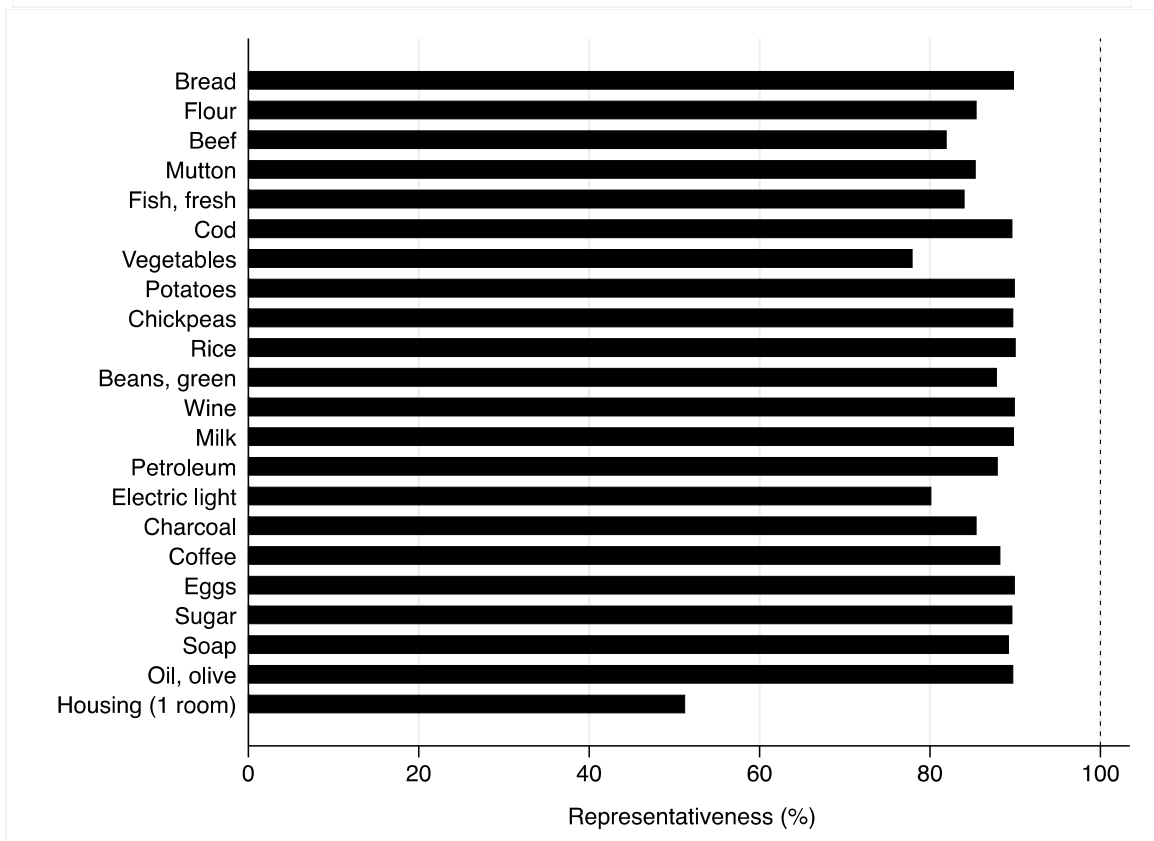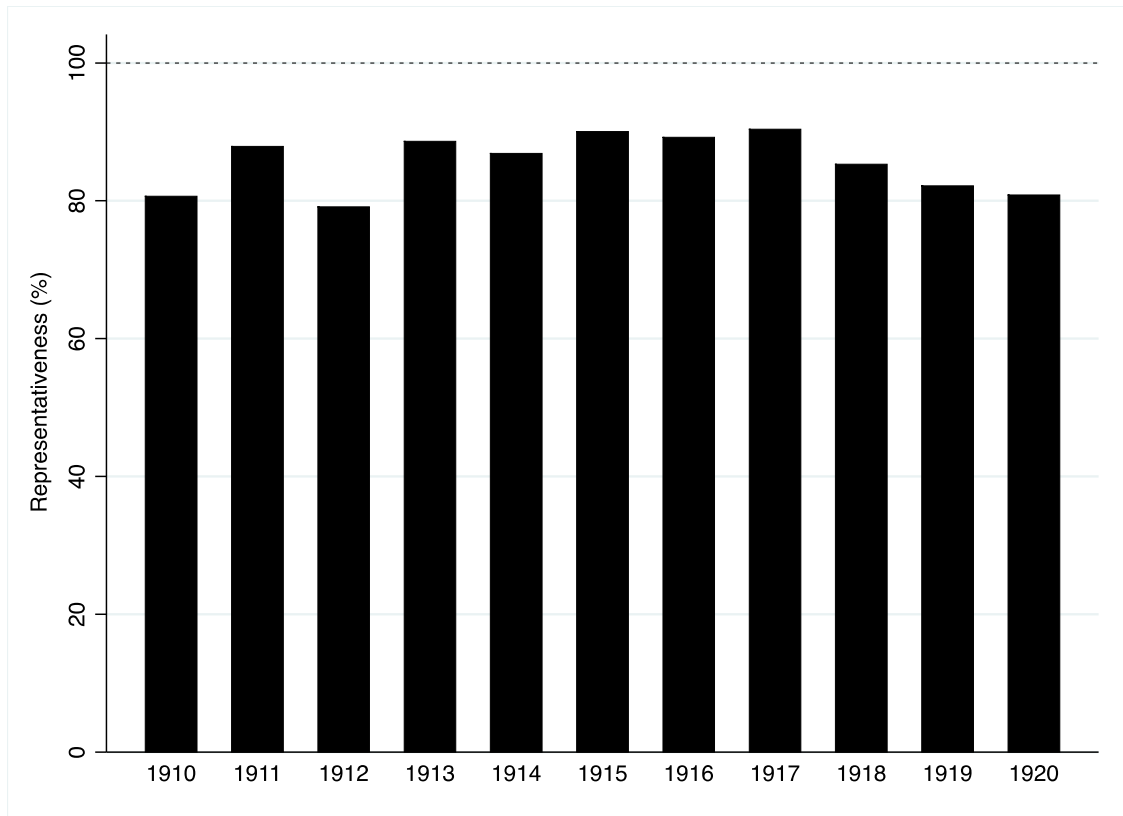
Table A2
Estimation results for CPD and WCPD models
Full sample

	CPD			WCPD		
	Coef.	SE[1]	Sign.[2]	Coef.	SE[1]	Sign.[2]
Álava	-0.3814	0.0840	***	-0.3670	0.1200	***
Albacete	-0.3356	0.0771	***	-0.3235	0.0981	***
Alicante	-0.2780	0.0790	***	-0.2496	0.1053	**
Almería	-0.3095	0.0828	***	-0.3313	0.1378	**
Ávila	-0.4361	0.0774	***	-0.5102	0.1053	***
Badajoz	-0.2977	0.0793	***	-0.3343	0.0996	***
Baleares	-0.3786	0.0830	***	-0.3395	0.1193	***
Burgos	-0.3248	0.0758	***	-0.4038	0.1090	***
Cáceres	-0.3957	0.0713	***	-0.4401	0.0973	***
Cádiz	-0.1665	0.0764	**	-0.1660	0.0910	*
Canarias	-0.2738	0.0793	***	-0.1950	0.1067	*
Castellón	-0.2969	0.0769	***	-0.2900	0.1026	***
Ciudad Real	-0.2848	0.0748	***	-0.3360	0.0905	***
Córdoba	-0.1798	0.0714	**	-0.1867	0.0895	**
Coruña	-0.3528	0.0742	***	-0.3213	0.1018	***
Cuenca	-0.3682	0.0740	***	-0.4513	0.1018	***
Gerona	-0.1979	0.1126	*	-0.1391	0.1195	
Granada	-0.2461	0.0702	***	-0.2473	0.0861	***
Guadalajara	-0.3685	0.0757	***	-0.4468	0.1131	***
Guipúzcoa	-0.2428	0.0939	***	-0.1728	0.1262	
Huelva	-0.2100	0.0736	***	-0.2003	0.0918	**
Huesca	-0.3288	0.0682	***	-0.3680	0.0877	***
Jaén	-0.2185	0.0700	***	-0.2311	0.0908	**
León	-0.3158	0.0926	***	-0.3466	0.1469	**
Lérida	-0.2039	0.0802	**	-0.1751	0.1065	
Logroño	-0.3325	0.0844	***	-0.3748	0.1294	***
Lugo	-0.4160	0.0775	***	-0.3453	0.1036	***
Madrid	-0.3112	0.0718	***	-0.3496	0.1062	***
Málaga	-0.2308	0.0877	***	-0.2823	0.1351	**
Murcia	-0.2611	0.0856	***	-0.3245	0.1352	**
Navarra	-0.2909	0.0735	***	-0.2665	0.0950	***
Orense	-0.3078	0.0896	***	-0.2684	0.1200	**
Oviedo	-0.1971	0.0788	**	-0.1350	0.1135	
Palencia	-0.2867	0.0744	***	-0.3143	0.1033	***
Pontevedra	-0.2805	0.0800	***	-0.2534	0.1177	**
Salamanca	-0.4465	0.0750	***	-0.4529	0.1054	***
Santander	-0.2677	0.0772	***	-0.2312	0.0933	**
Segovia	-0.4033	0.0745	***	-0.4310	0.0988	***
Sevilla	-0.1642	0.0791	**	-0.1188	0.0971	
Soria	-0.3451	0.0728	***	-0.3797	0.1036	***
Tarragona	-0.2015	0.0861	**	-0.1871	0.0952	**
Teruel	-0.3047	0.0771	***	-0.3353	0.1055	***
Toledo	-0.3437	0.0814	***	-0.3970	0.1247	***
Valencia	-0.2768	0.0737	***	-0.2844	0.1034	***
Valladolid	-0.2780	0.0752	***	-0.3307	0.1042	***
Vizcaya	-0.1607	0.0843	*	-0.1282	0.1176	
Zamora	-0.3501	0.0744	***	-0.3988	0.1059	***
Zaragoza	-0.2556	0.0753	***	-0.2597	0.1046	**
Capital city	0.0727	0.0031	***	0.1157	0.0043	***
Flour	2.5008	0.0082	***	2.5024	0.0078	***
Beef	1.5902	0.0077	***	1.5875	0.0077	***
Mutton	1.4683	0.0076	***	1.4705	0.0074	***
Fresh fish	1.1274	0.0106	***	1.1286	0.0106	***
Cod, salted	1.4506	0.0077	***	1.4505	0.0076	***

	CPD			WCPD		
	Coef.	SE[1]	Sign.[2]	Coef.	SE[1]	Sign.[2]
Vegetables	-0.7422	0.0124	***	-0.7395	0.0119	***
Potatoes	-0.8006	0.0090	***	-0.8007	0.0087	***
Chickpeas	0.7312	0.0088	***	0.7311	0.0085	***
Rice	0.4715	0.0063	***	0.4711	0.0063	***
Beans	0.4746	0.0067	***	0.4749	0.0067	***
Wine	-0.0106	0.0089		-0.0107	0.0087	
Milk	-0.0015	0.0079		-0.0018	0.0079	
Oil	0.9646	0.0083	***	0.9648	0.0085	***
Electric light	1.4816	0.0109	***	1.4838	0.0110	***
Charcoal	1.2588	0.0084	***	1.2605	0.0083	***
Coffee	2.5362	0.0077	***	2.5360	0.0078	***
Eggs	1.2878	0.0069	***	1.2876	0.0066	***
Sugar	1.1902	0.0069	***	1.1900	0.0071	***
Soap	0.9235	0.0077	***	0.9234	0.0078	***
Olive oil	1.2552	0.0068	***	1.2552	0.0068	***
Housing (1 room)	5.2398	0.0179	***	5.2362	0.0166	***
1910 summer	0.0216	0.0604		-0.0032	0.0936	
1911 winter	0.0498	0.0606		0.0457	0.0986	
1911 summer	0.0288	0.0591		-0.0147	0.0935	
1912 winter	0.0288	0.0622		-0.0003	0.0953	
1912 summer	-0.0138	0.0574		-0.0663	0.0886	
1913 winter	0.0324	0.0614		0.0105	0.1053	
1913 summer	0.1766	0.1284		0.2233	0.2241	
1914 winter	0.0971	0.0533	*	0.0501	0.0826	
1914 summer	0.0880	0.0617		0.0606	0.0931	
1915 winter	0.1613	0.0589	***	0.1607	0.0853	*
1915 summer	0.1345	0.0617	**	0.1334	0.1065	
1916 winter	0.2142	0.0670	***	0.2303	0.1075	**
1916 summer	0.2397	0.0560	***	0.2367	0.0986	**
1917 winter	0.2696	0.0575	***	0.2537	0.1014	**
1917 summer	0.3539	0.0544	***	0.3038	0.0837	***
1918 winter	0.4799	0.0563	***	0.4326	0.0868	***
1918 summer	0.5462	0.0644	***	0.5012	0.1005	***
1919 winter	0.6182	0.0614	***	0.5652	0.0960	***
1919 summer	0.6236	0.0571	***	0.5914	0.0922	***
1920 winter	0.7073	0.0570	***	0.6671	0.0892	***
1920 summer	0.7690	0.0627	***	0.7360	0.1001	***
Constant	-0.8536	0.0879	***	-0.8269	0.0043	***
Observations	40,581			40,581		
R-square	0.9391			0.9612		

Note: [1] Robust standard errors. [2] *** p<0.01, ** p<0.05, * p<0.1.

Table A3
Estimation results for CPD and WCPD models
Food

	CPD			WCPD		
	Coef.	SE[1]	Sign.[2]	Coef.	SE[1]	Sign.[2]
Álava	-0.4289	0.0919	***	-0.3638***	0.0977	***
Albacete	-0.3339	0.0877	***	-0.2552**	0.1035	**
Alicante	-0.3241	0.0859	***	-0.2644***	0.0987	***
Almería	-0.3159	0.0886	***	-0.2203**	0.1087	**
Ávila	-0.4603	0.0844	***	-0.4263***	0.1026	***
Badajoz	-0.3265	0.0966	***	-0.3046***	0.1084	***
Baleares	-0.3115	0.0884	***	-0.1905	0.1161	
Burgos	-0.3058	0.0826	***	-0.2752***	0.0966	***
Cáceres	-0.4030	0.0804	***	-0.3606***	0.0937	***
Cádiz	-0.2009	0.0926	**	-0.1328	0.0933	
Canarias	-0.2257	0.0847	***	-0.0822	0.1066	
Castellón	-0.2757	0.0882	***	-0.1984*	0.1059	*
Ciudad Real	-0.3093	0.0890	***	-0.3065	0.0942	***
Córdoba	-0.2287	0.0837	***	-0.1657	0.0925	*
Coruña	-0.3670	0.0870	***	-0.2606	0.1099	**
Cuenca	-0.3669	0.0829	***	-0.3581	0.0960	***
Gerona	-0.1358	0.0921		-0.0626	0.1103	
Granada	-0.2905	0.0837	***	-0.2290	0.0902	**
Guadalajara	-0.3801	0.0831	***	-0.3556	0.0965	***
Guipúzcoa	-0.2839	0.1058	***	-0.2069	0.1111	*
Huelva	-0.2348	0.0851	***	-0.1697	0.0964	*
Huesca	-0.3458	0.0795	***	-0.3109	0.0925	***
Jaén	-0.2900	0.0823	***	-0.2554	0.0970	***
León	-0.2828	0.0898	***	-0.1977	0.1018	*
Lérida	-0.2086	0.0923	**	-0.1245	0.1144	
Logroño	-0.3490	0.0890	***	-0.2828	0.1075	***
Lugo	-0.4237	0.0874	***	-0.3103	0.1103	***
Madrid	-0.3282	0.0781	***	-0.2708	0.0968	***
Málaga	-0.2292	0.0931	**	-0.1720	0.1055	
Murcia	-0.2955	0.0886	***	-0.2375	0.1078	**
Navarra	-0.2912	0.0806	***	-0.2214	0.0932	**
Orense	-0.3097	0.1046	***	-0.1966	0.1262	
Oviedo	-0.2079	0.0827	**	-0.1170	0.0951	
Palencia	-0.3274	0.0843	***	-0.2608	0.0982	***
Pontevedra	-0.3404	0.0919	***	-0.2718	0.1194	**
Salamanca	-0.4986	0.0864	***	-0.4175	0.0962	***
Santander	-0.2780	0.0877	***	-0.1760	0.0962	*
Segovia	-0.4581	0.0878	***	-0.3978	0.1049	***
Sevilla	-0.1534	0.0829	*	-0.0812	0.1011	
Soria	-0.3686	0.0818	***	-0.2975	0.0961	***
Tarragona	-0.1798	0.0819	**	-0.1198	0.0945	
Teruel	-0.2856	0.0835	***	-0.2378	0.0995	**
Toledo	-0.3464	0.0871	***	-0.3019	0.1037	***
Valencia	-0.2953	0.0819	***	-0.2082	0.0991	**
Valladolid	-0.2784	0.0835	***	-0.2414	0.0953	**
Vizcaya	-0.1471	0.0925		-0.1005	0.1060	
Zamora	-0.3625	0.0830	***	-0.3118	0.0940	***
Zaragoza	-0.2704	0.0820	***	-0.1991	0.0937	**
Capital city	0.0686	0.0034	***	0.0808	0.0043	***
Flour	2.5008	0.0080	***	2.5018	0.0075	***
Beef	1.5902	0.0077	***	1.5890	0.0076	***
Mutton	1.4679	0.0074	***	1.4697	0.0073	***
Fresh fish	1.1275	0.0104	***	1.1284	0.0104	***
Cod, salted	1.4506	0.0075	***	1.4505	0.0073	***

	CPD			WCPD		
	Coef.	SE[1]	Sign.[2]	Coef.	SE[1]	Sign.[2]
Vegetables	-0.7420	0.0123	***	-0.7410	0.0118	***
Potatoes	-0.8005	0.0089	***	-0.8006	0.0084	***
Chickpeas	0.7312	0.0088	***	0.7311	0.0084	***
Rice	0.4716	0.0063	***	0.4713	0.0061	***
Beans	0.4742	0.0066	***	0.4745	0.0064	***
Wine	-0.0104	0.0090		-0.0106	0.0087	
Milk	-0.0015	0.0079		-0.0017	0.0078	
Eggs	1.2878	0.0067	***	1.2876	0.0064	***
Sugar	1.1902	0.0068	***	1.1900	0.0068	***
Olive oil	1.2553	0.0069	***	1.2553	0.0067	***
1910 summer	0.0384	0.0665		0.0303	0.0833	
1911 winter	0.0623	0.0650		0.0461	0.0795	
1911 summer	0.0675	0.0655		0.0313	0.0829	
1912 winter	0.0446	0.0672		0.0132	0.0865	
1912 summer	0.0214	0.0570		-0.0275	0.0727	
1913 winter	0.0084	0.0601		-0.0337	0.0747	
1913 summer	0.2400	0.1670		0.2982	0.2578	
1914 winter	0.1239	0.0554	**	0.0916	0.0666	
1914 summer	0.1294	0.0679	*	0.1069	0.0824	
1915 winter	0.2155	0.0638	***	0.2182	0.0695	***
1915 summer	0.1675	0.0607	***	0.1456	0.0787	*
1916 winter	0.2784	0.0649	***	0.2617	0.0824	***
1916 summer	0.2877	0.0550	***	0.2699	0.0734	***
1917 winter	0.3137	0.0553	***	0.2817	0.0673	***
1917 summer	0.4036	0.0559	***	0.3511	0.0666	***
1918 winter	0.5267	0.0582	***	0.4708	0.0623	***
1918 summer	0.5596	0.0596	***	0.5176	0.0669	***
1919 winter	0.6615	0.0608	***	0.6108	0.0665	***
1919 summer	0.6805	0.0571	***	0.6349	0.0696	***
1920 winter	0.7518	0.0553	***	0.6910	0.0630	***
1920 summer	0.8563	0.0592	***	0.8271	0.0674	***
Constant	-0.8785	0.0932	***	-0.9146	0.1090	***
Fixed effects:						
Province-time	Yes			Yes		
Item-time	Yes			Yes		
Observations	30,188			30,188		
R-square	0.9176			0.9200		

Note:[1] Robust standard errors. [2] *** p<0.01, ** p<0.05, * p<0.1.