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A COST OF LIVING INDEX FOR SPANISH CITIES

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ABSTRACT

Citizens' well-being depends both on their income levels and on the cost of living in their specific place of residence. However, very limited data are available on differences in price levels across geographical areas within a single country. This article presents a price index for Spanish urban areas covering the period 2004-2020. By way of example, according to this index, the cost of living in the two largest cities (Madrid and Barcelona) in 2020 was nearly 20% higher than the average of other Spanish urban areas. Thus, while average private sector wages in Madrid and Barcelona were 45% higher than in other cities, this gap narrows to 21% when wages are adjusted to reflect purchasing power.

Keywords: cost of living, local prices, purchasing power, urban areas.

JEL classification: E31, R11, R12, R23, R31.

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Introduction

The implications of geographical differences in income levels for citizens' well-being hinge on the cost of living for each individual in their specific place of residence. Consequently, given the significant cross-country differences in price levels, in international comparisons income levels are adjusted to reflect their purchasing power.[1] However, such disparity can also be significant across different geographical areas within a single country. For instance, the cost of living in large cities tends to be higher than in small population centres.

Such differences make it advisable to have a cost of living index for the different regions or municipalities within a country. First, it allows a more precise assessment of the regional differences in well-being derived from income gaps. In this regard and as mentioned above, the highest wage levels, which tend to be found in large cities, are usually associated with a higher cost of living. Second, subnational indices of the cost of living are useful for evaluating the local or regional impact on citizens' well-being of public policies that set certain uniform amounts of income for the country as a whole.

This article presents a cost of living index for Spanish urban areas covering the period 2004-2020.[2] Specifically, annual data at municipal level on price levels for rent (from the Ministry of Housing) and for a subset of consumer goods and services (from the Household Budget Survey) are combined with the annual provincial inflation series for all the goods and services subgroups (from the National Statistics Institute (INE)).[3] Drawing on Continuous Sample of Working Histories data, the differences in wage levels across urban areas, before and after adjusting for purchasing power, are also analysed. Table 1 summarises the statistical information used in this article.

Based on the findings of the analysis, price levels in urban areas with a higher cost of living (Madrid and Barcelona) were 20% higher than the average of other Spanish

1 See, for example, the Penn World Table project. Purchasing power refers to the quantity of goods and services that the same amount of money can buy in different areas.

2 Chapter 4 of the Annual Report 2020 of the Banco de España (2021) makes extensive use of the cost of living index presented in this article.

3 INE does not provide data on the price levels of all goods and services.

Table 1
DATA AVAILABILITY

Type of good and service	Frequency	Levels/rates	Geographical unit	Percentage of expenditure
Housing rental	Annual	Price level	Municipality	23.7%
Goods and services in the HBS (a)	Annual	Price level	Region	29.5%
Goods and services in the HBS (b)	Annual	Rates	Province	46.8%
Wages	Annual	Levels	Municipality	—

SOURCES: Ministerio de Vivienda, Household Budget Survey, INE and Continuous Sample of Working Histories.

a Food (011), non-alcoholic beverages (012), alcoholic beverages (021), tobacco (022), water supply and other services relating to the dwelling (044), electricity, gas and other fuels (045) and the operation of personal transport equipment (072).
b Data available for all groups of goods and services.

conurbations in 2020. In other words, the average citizen in Madrid or Barcelona would need €1,200 to have the same purchasing power as that afforded by €1,000 to the average citizen in other cities.[4] Thus, while average wages in Madrid and Barcelona are 45% higher than the average of other Spanish urban areas, this gap narrows to 21% after they are adjusted to reflect purchasing power.

Price index for urban areas

Preparation of the index

In order to prepare the price index for urban areas, the price levels of various goods and services in each geographical unit are calculated and aggregated on the basis of their weight in households' expenditure basket. However, it should be borne in mind that the data available on price levels at municipal level do not cover all the goods and services included in households' expenditure basket. In particular, such price data exist for rents (sourced from the Ministry of Housing) and for a subset of goods and services (from the Household Budget Survey conducted by INE). The subset of goods and services for which data are available at local level accounts for over one-half of household expenditure.[5]

For other goods and services, no data are available on unit price levels at urban area or municipality level, making it necessary to use an imputation procedure. Specifically, for

4 Nevertheless, there can be high heterogeneity in the cost of living across different parts of the same urban area. The data presented in this article refer in all cases to each urban area as a whole and, therefore, ignore such heterogeneity.

5 The goods and services for which direct price-level data are available are food, non-alcoholic beverages, alcoholic beverages, tobacco, housing rentals, water supply and other services relating to the dwelling, electricity, gas and other fuels, and the operation of personal transport equipment.

each product for which local price-level data are not available, a linear relationship is estimated between the annual inflation rate of the product at provincial level[6] and the inflation rates of the goods for which price-level data are available. The estimated parameters are then used to impute local price levels for those products for which direct data are not available as a linear function of the unit prices of the goods and services for which data are available.[7] Lastly, the price level in each urban area is obtained by weighting each product's price level on the basis of its respective share in total household spending, according to the Household Budget Survey. Annex 1 offers a more detailed description of the procedure for constructing the local price index.[8]

Findings

The estimated local price index shows that there are significant divergences in the cost of living faced by the inhabitants of different Spanish urban areas,[9] the most notable being the higher cost of living in the urban areas of Madrid and Barcelona compared with the rest of Spain (see Chart 1). As a reference, in 2020, the cost of living in Madrid and Barcelona (the most expensive urban areas in Spain) was 31% higher than in Elda-Petrer, which has the lowest cost of living. More generally, living in an area in the 75th percentile of the price distribution (e.g. Santa Cruz de Tenerife or Burgos) is 7% more costly than living in an area in the 25th percentile (e.g. Badajoz or Albacete).

In addition, the price differences between urban areas have gradually increased over time. Thus, the difference between the two most expensive cities and the least expensive city was 22% in 2004 (31% in 2020), while, between areas in the 75th and 25th percentiles, it was 4.4% (7% in 2020) (see Chart 2.1).

The size of the urban area (measured in terms of the number of inhabitants) shows a very high correlation with local price levels. For example, in 2020 the cost of living in a given urban area was 3.1% higher than in a different urban area with half the number of inhabitants. Moreover, the cost of living gap between large cities and smaller ones has gradually widened over time. For instance, in 2004 there was only

6 The provincial inflation series for each product are sourced from INE.

7 Specifically, these levels are considered for each product and urban area in deviations from the average price of that product at national level.

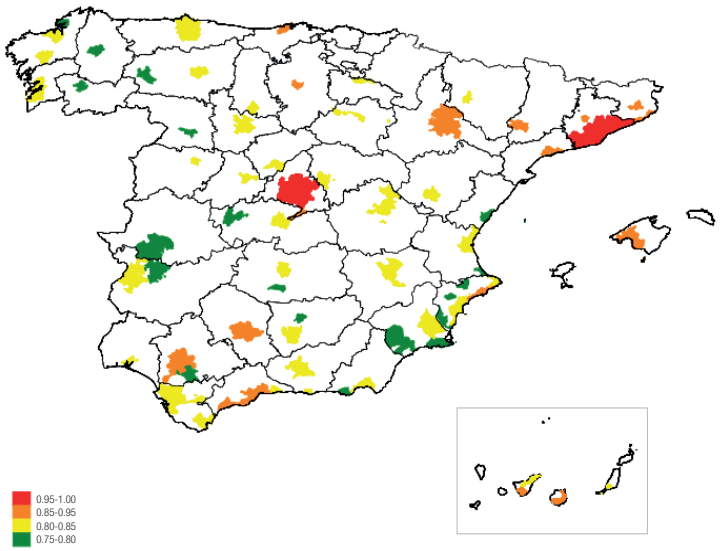
8 One of the advantages of this methodology is that it identifies the contribution of each group of goods and services to the differences in the general price level across geographical areas. This also circumvents the need to extrapolate the estimated relationship between prices and per capita income at local level in other countries in order to calculate the price level of the goods and services for which no data are directly available (see Costa et al. (2021)).

9 In the international setting, there are also significant differences in price levels within each country. Janský and Kolcunová (2017) estimate price levels for European regions at NUTS-2 level (regions in the case of Spain). Although the heterogeneity in the regions' dimension hampers cross-country comparison, the differences between Spanish regions with a higher or lower cost of living are similar to those found in other European countries. Moreover, on the data released by the US Bureau of Economic Analysis on the cost of living in metropolitan areas, the dispersion of local prices is higher in the United States than that documented for Spain in this article.

Chart 1

HEATMAP OF THE LOCAL PRICE INDEX FOR 2020 (a)

The estimated local price index shows that there are large differences in the cost of living across Spanish urban areas, the most significant being the higher cost of living in the urban areas of Madrid and Barcelona compared with the rest of Spain.



SOURCE: Banco de España calculations, based on data from the Household Budget Survey and the Ministerio de Vivienda.

a The chart depicts the ratio between the level of the local price index in each urban area and the level of that index in Madrid (in both cases, for 2020).

Chart 2

PRICE DIFFERENCES BETWEEN URBAN AREAS HAVE GRADUALLY INCREASED OVER TIME

The difference between the two most expensive cities and the least expensive city was 22% in 2004 (31% in 2020). Further, in 2020 the cost of living in the two largest urban areas was nearly 20% higher than the average of other urban areas.

1 RELATIONSHIP BETWEEN PRICE INDEX AND POPULATION OVER TIME

2 RELATIONSHIP BETWEEN PRICE INDEX AND POPULATION IN 2020

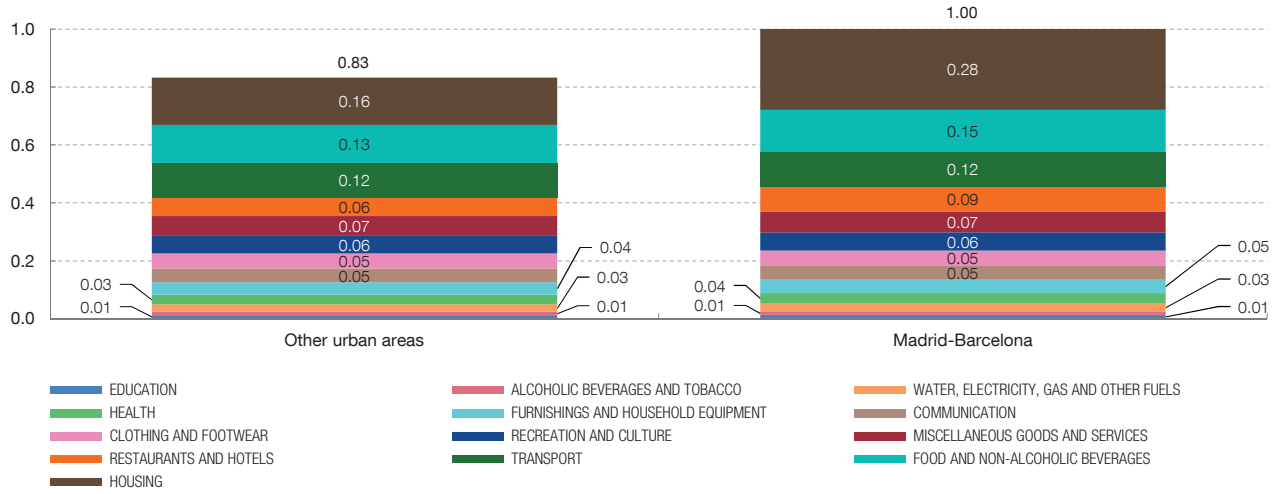
SOURCES: Ministerio de Transportes, Movilidad y Agenda Urbana, and Banco de España calculations, based on data from the Household Budget Survey and the Ministerio de Vivienda.

a Population in 2019.

Chart 3

BREAKDOWN OF THE LOCAL PRICE INDEX

In 2020, housing expenditure accounted for over two-thirds of the price difference between Madrid-Barcelona and other Spanish urban areas.



SOURCE: Banco de España calculations, based on data from the Household Budget Survey and the Ministerio de Vivienda.

a 2% gap between one urban area and another with half the number of inhabitants. In particular, the two largest urban areas (Madrid and Barcelona) are substantially more expensive than other conurbations in the country. By way of reference, in 2020 the cost of living in Madrid and Barcelona was nearly 20% higher than the average of other urban areas (see Chart 2.2).

The cost of housing accounts for a higher share of the differences in the cost of living between urban areas. There are two reasons for this. First, rentals account for the biggest share of the total cost of living, representing nearly 25% of the national average. Second, the differences in rents are substantially greater than in the case of other goods and services. For example, the cost of housing rental in Madrid and Barcelona in 2020 was 82% higher than the average of other urban areas. As a result of these two considerations, housing expenditure accounted for over two-thirds of the price difference between Madrid-Barcelona and the other Spanish urban areas in 2020 (see Chart 3).

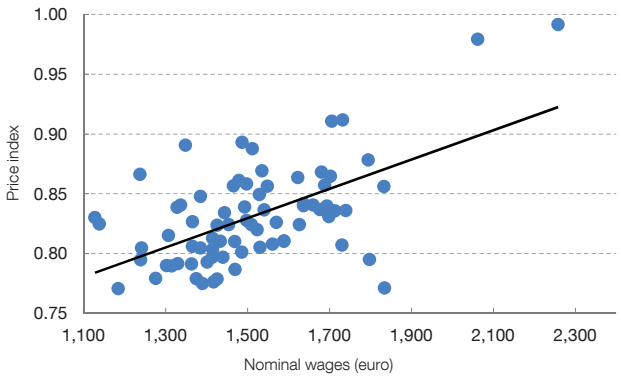
There are also significant differences in the prices of some services, such as hospitality and health care. The provision of such services includes a very significant labour component, and their costs are therefore highly influenced by the cost of living faced by the workers in these sectors. Thus, the price levels of these services and the attendant sectoral wages as a whole feed back into each other. Conversely, the price differences for other consumer goods and services, such as food, clothing and footwear, and communication, are less significant. In these cases, the products do not necessarily have to have been produced in a given urban area in order to be

Chart 4

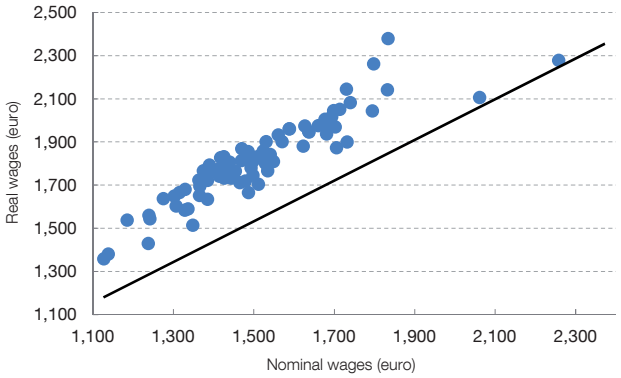
URBAN AREAS WITH HIGHER NOMINAL WAGES HAVE A HIGHER COST OF LIVING

In 2018, on average, wages in the urban areas of Madrid and Barcelona were nearly 45% higher than the average of other urban areas. Also, a 10% higher average nominal wage in an urban area is associated with a 1.9% higher cost of living.

1 RELATIONSHIP BETWEEN PRICE INDEX AND NOMINAL WAGES IN 2018



2 RELATIONSHIP BETWEEN NOMINAL AND REAL WAGES IN 2018 (a)



SOURCES: Continuous Sample of Working Histories, and Banco de España calculations, based on data from the Household Budget Survey and the Ministerio de Vivienda.

a The line represents the 45º line.

consumed there and, as a result, they tend to have the same prices across different areas (see Chart 3).

Wages and price index

One relevant application of the local price index presented in this article is for comparing wages between urban areas after they are adjusted to reflect purchasing power. According to the literature, the differences in such adjusted wages are a driving factor of migration between different geographical areas.[10]

According to the price index presented in this article, a 10% higher average nominal wage in an urban area is associated with a 1.9% higher cost of living.[11] Thus, although urban areas with higher nominal income also have higher real income, wage differences in real terms across urban areas are lesser once local prices are taken into account (see Chart 4.1).

10 Rosen (1979) and Roback (1982) introduced the basic spatial equilibrium model, relating wages, housing costs and migration decisions. Melguizo and Royuela (2021) show the influence of wages, and of employment rates, on migrations between Spanish cities. Biagi et al. (2011) and Détang-Dessendre et al. (2016) document similar effects for Italy and France.

11 The relationship between the two variables is bi-directional. On the one hand, higher nominal wages entail higher price levels, because of the upward pressure on the costs of housing and local services. On the other, a higher local price level can result in higher nominal wages to offset workers' higher cost of living.

The consequences of considering cost of living differences are more visible in the cases of Madrid and Barcelona. On average, private sector wages in these cities were nearly 45% higher than the average of other urban areas in 2018.[12] Consequently, if the price differences described in the previous section are taken into account, the gap in wages adjusted for purchasing power in Madrid and Barcelona compared with other urban areas would narrow to 21%. In other words, when the cost of living is considered, the income gap between, on the one hand, Madrid and Barcelona and, on the other, other urban areas decreases to nearly one-half (see Chart 4.2).[13]

2.8.2021.

12 Specifically, the average monthly wages of full-time employees (excluding public sector employees) in 2018 have been compared, according to the Continuous Sample of Working Histories.

13 The gap in average wage levels between two urban areas may be shaped by other factors, such as the sectoral make-up of the productive system or the average educational attainment level and the average skill levels of the employed. Similarly, the differences in average workforce productivity could explain the differences observed in wages adjusted to reflect the cost of living.

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ANNEX

This annex describes the preparation of the cost of living index for urban areas in Spain, which is aimed at providing price-level time series that are comparable across different urban areas. Specifically, the index is calculated for the 81 urban areas defined by the Ministry of Housing in 2008, which account for 68% of the total population of Spain. Given the absence of administrative data on rents, the index cannot be constructed for the four urban areas of the Basque Country and Navarre.

Construction of the index comprises four main stages. First, the local price levels of goods and services for which direct sources of data are available are calculated. Second, for other goods and services, the price level for 2015 is imputed as a function of the price levels of the expenditure groups for which such data are available. Third, on the basis of the price levels for 2015 obtained in the second step, the time series of each good and service are constructed using provincial inflation series. Lastly, the price levels of the different goods and services in each urban area are aggregated on the basis of their weight in households' expenditure basket.

Price level for expenditure subgroups for which direct data are available

Two original data sources (both annual) are used: the Ministry of Housing's Residential Rental Price Index and INE's Household Budget Survey (HBS).

The Residential Rental Price Index contains data at municipal level on median rents for leased housing, in addition to the size and type of housing, for the period 2015-2018. With this information, the rental cost per square metre in each urban area can be constructed for that period. The index for each urban area is constructed by weighting by the number of observations in each municipality. Price per square metre is estimated by controlling for type of residence (single-family home or multi-family housing).

The HBS contains data on household expenditure on and consumption of different goods and services. Data for the period 2006-2015 are used. The expenditure and consumption data are available for a subset of five-digit expenditure subgroups, as per the European Classification of Individual Consumption according to Purpose. These goods belong to the following three-digit expenditure subgroups: food (011), non-alcoholic beverages (012), alcoholic beverages (021), tobacco (022), water supply and other services relating to the dwelling (044), electricity, gas and other fuels (045) and operation of personal transport equipment (072).

In addition to the data on expenditure and consumption for each good, the observations contain additional information on the households' characteristics. Specifically, the data subset used to prepare the index includes the region of

residence, the type of municipality of residence (based on density and whether it is a provincial capital),[1] net income and size of the household.

With this information, the price level of each three-digit subgroup is calculated for each region and year.[2] First, the unit price for each consumption observation is calculated as the ratio between the nominal amount spent and the quantity consumed. The observations are then grouped by three-digit subgroup, and the logarithmic regression of the unit price is performed using a region and year fixed effect.[3] Moreover, the equation includes a fixed effect for each five-digit expenditure subgroup. In order to control for potential differences in the quality of the goods consumed, the level of household per capita income is included.

Lastly, given that, with the data available, prices can only be estimated at regional level, a two-step adjustment is made to impute the price level to each urban area within each region. First, the elasticity between the price level of each subgroup and the average income of each region is estimated. Then, using this elasticity, the observations for each urban area in each region are adjusted in order to maintain the regional average.

Imputation of prices for expenditure subgroups for which direct data are not available

The HBS does not contain data on the consumed quantities of the goods and services not mentioned in the previous section, and their unit prices therefore cannot be directly estimated. Consequently, the price levels of the other expenditure subgroups need to be imputed for each urban area. The price-level imputation described below is for 2015, as this is the only year for which direct data are available on house prices and on other subgroups in the HBS. For this imputation, the relationship between the provincial inflation series of the expenditure subgroups without direct data and those of the subgroups for which data are available in the HBS is harnessed to calculate the local price level.

INE releases provincial annual inflation series for all three-digit expenditure subgroups. These data are used to perform a regression for each expenditure subgroup for which price-level data are not available, using, as the dependent variable, the price changes in the relevant product and, as independent variables, the percentage changes in the prices of the subgroups for which such price-level data do exist (housing, food and

1 To proxy the Ministry of Housing's definition of urban areas, the sample has been restricted to households residing in densely populated municipalities or in provincial capitals.

2 The estimation is performed at three-digit expenditure subgroup level owing to the unavailability of a higher level of disaggregation of the provincial inflation series used to extend the price time series.

3 Some observations are prone to measurement errors, particularly as regards the information on the nominal amount spent on some goods and services by certain households. For this reason, observations of household expenditure in those subgroups with values exceeding, by more than two standard deviations, the average of the subgroup for that region are discarded. Also eliminated are the five-digit subgroups with fewer than 10 observations in each region and year.

non-alcoholic beverages). In both cases, the observational units are at provincial level and annual. Thus, the price elasticity of each expenditure subgroup at provincial level to housing, food and non-alcoholic beverages is estimated.[4]

The elasticities obtained in the regression are then used to impute the price levels of the expenditure subgroups for which there are no direct data. First, the percentage deviation in the price level of the expenditure subgroups with data (housing, food and beverages) in each urban area vis-à-vis the national average is calculated. Next, for each product without direct data, these price deviations, weighted by the elasticity between the product and each of the three expenditure subgroups with local price data, are added together. The outcome of this sum is the price level imputed for the expenditure subgroups in each urban area. For example, if an elasticity of 0.5 is estimated between the changes in local prices of textile products and the changes in rentals, and the housing rental prices in a given urban area are 20% higher than the national average, then textile products in that urban area will be 10% more expensive than the national average.

This means that, for those subgroups with the same inflation time series for all provinces, the unit prices are assumed to be the same across all urban areas.[5] Similarly, for those goods and services whose price changes show strong correlation with those of expenditure groups such as housing or food, their price levels will be higher in those urban areas with higher rental or food prices.

Construction of the price time series for each expenditure subgroup

Based on the direct sources and the imputation method described above, data are available on housing rental levels in the period 2015-2018 (from the Ministry of Housing) and on the price levels for some expenditure subgroups for the period 2006-2015 (from the HBS) and for other subgroups, with imputed prices, for 2015. The price-level series of each three-digit expenditure subgroup are prolonged using INE's provincial inflation series for each good and service.

Aggregation at local level of the prices for each expenditure subgroup

The price index for each urban area and year is constructed by weighting the prices of each expenditure subgroup by its share in expenditure in the previous year. This information is sourced from the HBS. For the weighting, households' monetary and non-monetary expenditures are used, the latter referring to imputed rentals.

4 The expenditure subgroups for which price-level data are available include goods whose price is highly affected by taxes and levies (tobacco, alcoholic drinks and energy), and there is little variability in their price levels. Therefore, and given that these groups are highly important in spending terms, only the food (011), non-alcoholic beverages (012) and actual rentals for housing (041) subgroups are used.

5 Examples include telecommunications and the acquisition of vehicles.