Title

Urban development model and municipal fiscal burden in Spain.

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ABSTRACT

Several studies have dealt with the causes of urban sprawl, but consequences have been less demonstrated in the literature. Therefore, this paper considers the measurement of the effect that urban development model has on municipal fiscal burden. The geographical area of analysis is the Mediterranean area of Spain and Madrid. The main independent variable of the study is compact population and its calculation allows a new approach to the study of the populated environment. Other control variables are also considered in the period from 2006 and 2014. The findings confirm that scattered population could contribute to increase fiscal pressure.

KEYWORDS

Compact population; municipal tax burden; panel data econometrics; Spain.

JEL CLASSIFICATION

C23, E62, H30, R14.

INTRODUCTION

The case of Spain is one of the most interesting in Europe concerning what is referred to sprawled development, because in some areas of this country, such as Mediterranean coast and Madrid, there is very great pressure to build due to tourism and the demand for a second residence (European Environment Agency, EEA 2006); this pressure on urban land on the Mediterranean coast is very high, as is that exerted on the main metropolitan areas such as Madrid, Barcelona, Bilbao and Valencia, among others (Rubiera et al. 2016).

Although the greatest development of urban sprawl started around 1987 in the above-mentioned cities in Spain (Muñoz 2007), there is a significant difference in the surface occupied by single-family houses among the Spanish regions. In relation to the total artificial surface, this percentage is relatively high in some cities, especially in the Balearic Islands, with 52.9%, followed by Catalonia with 39.2%, Valencian Region with 36.6% and Madrid with 28% (Moliní and Salgado 2012).

The expansion of tourism and residential settlement in the coastal municipalities on the Mediterranean, encouraged for decades by different administrations, has resulted in a strong competition for soil and water, with other economic functions, and the environment (Ortuño et al. 2015). Several factors are underlying this process in Spain: newer forms of mobility, expansionary policies of land development, weak land use planning, housing typology specialisation of some municipalities, speculation (Bellet and Gutiérrez 2015), tourism and little attention to sustainable territorial planning (Grindlay et al. 2011). In that context, motorways are a key element for understanding the form of cities and regions because analyzing the periphery of virtually any city shows the indisputable organizing role that the networks of motorways play; nevertheless, these developments that have accompanied those of the motorways were not planned as part of the same

vision but have generally been the unplanned consequences of the motorway (Coronado et al. 2009).

Urban sprawl generates a series of environmental, social and economic impacts, as described in the Costs of Sprawl 2000 (National Research Council 2002). During the last years, Spanish local governments have faced budgetary restrictions and, in this regard, is important the prior consideration of future costs of operation and maintenance when planning for new investment (Lara-Galera et al. 2011). In that connection, the present paper will focus on the economic effects of the urban sprawl on the public capital, specifically, on the worsening of the urban tax burden. Besides, the financial crisis has tightened the budgets of local and regional administrations in Spain regardless of their size, which has implied a severe reduction in public services.

The impact on fiscal burden is parallel with other economic effects of the urban sprawl on the public capital: the higher expenditure in infrastructure and the exploitation of public services with adverse impacts on the public finances. Henry (2007) points out that the annual public maintenance costs per household in a low density area are seven times higher than in a compact area, including direct costs – public land urbanization and supply of services –, indirect costs – land consumption and artificialization –, maintenance costs – of the public urbanization and services – and out-of-pocket costs, such as those derived from transport, the provision of services, the environmental effects and the change in life styles.

The conceptual model presented by Paulsen (2014) can serve as a template or benchmark against with to evaluate fiscal impact analysis techniques, according to the existing theory: new land development within a city generates changes in revenues and expenditures which reflect the fiscal impact of that land development, including not only direct changes but also indirect and induced effects as prices, rents, incomes, and households all adapt in response to direct effects.

Socioeconomic factors could increase tax burden, but other relevant factors can also have a major influence on local budgets, which is tourism or local fiscal capacity (Carrasco et al. 2006). In Voltes-Dorta et al. (2014) –using data from Spanish local corporations for the years 2001-2010–, results indicate a direct relationship between tourism intensity and local deficits only in the smallest and largest municipalities, while a beneficial effect is actually seen in the remainder of the sample. As regards fiscal capacity, municipalities that enjoy a high degree of tax autonomy, will have to make some fiscal effort and the consequent increase in fiscal burden will take place (Sánchez-Sánchez and Poveda-Blanco 2002; Benito et al. 2010).

According to some authors (Tufte 1978; Lee 1987; Gonçalvez and Veiga 2007; Benito et al. 2010), each electoral year also affects the fiscal burden because political leaders might reduce taxes or shift some of the tax burden from one group to another in order to gather votes as elections tactic.

Based on the previous, this study aims to determine the extent to which changes in compact population of municipalities in the Mediterranean area of Spain and Madrid (Figure 1) – which includes the provinces of Alicante, Almeria, Balearic Islands, Barcelona, Castellon, Girona, Granada, Madrid, Malaga, Murcia, Tarragona and Valencia – affect the municipal fiscal burden in the more sprawled areas of Spain. In this article, a quantitative analysis is conducted based on an econometric model of panel data collected from 2006 to 2014.

Figure 1. Location of the provinces of study, as selected in Fernández-Aracil and Ortuño-Padilla (2016).

The linkage between fiscal issues and urban development, nowadays, have not been completely browsed, because such discussions regarding local budgets in Spain, has usually focused on public expenditure in prior periods (Hortas-Rico and Solé-Ollé 2010; Prieto et al. 2015). Inversely, fiscal burden has been studied related to other causal relationships (Benito et al. 2010), without considering the urban development model.

The analysis confirms the main hypothesis: the decrease in compact population impacts on the increase in the municipal tax burden. In this sense, the speed with which the patterns of population growth and land use changed is a factor which worked against the capability of it being managed efficiently; this is because these changes had not been foreseen and no strategies had been put into effect in time to manage development or mitigate the possible negative effects of the changes: it was only after the expansion had taken place that the development control mechanisms to deal with them were developed (García-Coll 2011). For this reason, it is important to quantify the impacts and to prevent how they can influence local decision-making.

DATA AND METHODS

Per capita local revenues, coming through direct and indirect taxes, according to the respective direct and indirect fiscal impact proposed by Paulsen (2014), are used to proxy the fiscal burden variable, which is the dependent variable of a panel data model conducted by combining procedures from previous similar studies (Solé-Ollé 2001; Bel 2006; Benito et al. 2010; Voltes-Dorta 2014).

The research focuses on the municipalities of the Mediterranean area of Spain and Madrid, spanning the period 2006-2014, which together encompass a population of over 24 million living in 1,918 cities (National Statistical Institute 2016). Mediterranean area represents an ideal setting to study the impact of scattered population on fiscal burdens; its numerous municipalities have a high percentage of surface occupied by single-family houses in relation to the total artificial surface (Moliní and Salgado 2012). EEA (2006) emphasizes hot spots of urban sprawl there, which are common along already highly populated coastal strips, such as in the case of the southeast of Spain.

The municipality is the most appropriate geographical unit of analysis because it is the minimum subdivision of the administration in Spain that provides local public services. Moreover, looking at lower-level governments offers an interesting means to test the municipal finances on much broader and more homogeneous databases (Ashworth et al. 2005).

Spain is one of the most fiscal decentralized countries in the world (Lago-Peñas et al., 2017) and there are three administration levels involved: at the national level, the Ministry of Finance and Civil Service is responsible for the national taxes of the central government (for instance, corporate, income or value added taxes); at the regional level, the autonomous regions (or autonomous communities) handle its own direct power of taxation as long as this does not conflict with national regulation (for instance, capital gains, inheritance or gift taxes); and, at the local level, the municipal authorities manage the local public services in their areas of responsibility, whose funding is guaranteed by the structure of the local budgets, which consist of budget settlements that can be grouped into two blocks: local expenditures and local revenues.

The budget settlements included in the structure of the local expenditures are as follows: (0) public debt; (1) basic public services (public safety, mobility, housing, urban planning, urban services and environment); (2) social protection and promotion (social welfare and promotion of employment); (3) public assets of preferential nature (healthcare, education, culture and sports); (4) economic actions (agriculture, farming, fishing, industry, energy, commerce, tourism, small and medium enterprises, public transport, infrastructures and research); and (5) general actions (government and fiscal administration).

With regard to the structure of local revenues, budget settlements are organized in this way: (1) direct taxes (for instance, property taxes, motor vehicle taxes or tax on land value improvements); (2) indirect taxes (for instance, construction taxes or property transfer taxes); (3)

user charges (for instance, planning permissions and public services fees); (4) current transfers (from other autonomous bodies of local government or from other levels of government, such as national or regional scales); (5) asset revenues (such as equity revenues); (6) real investment sales (such as public land sales); (7) capital transfers; (8) financial assets; and (9) financial liabilities.

As discussed in section 1, previous studies have identified a number of determinants of fiscal burden including institutional variables or socioeconomic and demographic characteristics. The general equation (1) to perform the estimation is as follows:

$$\log(Y_{it}) = \beta_0 + \beta_j \cdot \log(X_{it}) + \varepsilon \quad (1)$$

Where 'Y_{it}' are fiscal burden of municipality 'i' on year 't', 'X_{it}' are independent variables, 'β' are vectors of regression coefficients, and 'ε' is the error term.

Addressing the study of fiscal burden, the model is consistent with Benito et al. (2010) and Carrasco et al. (2006), but rests on a new set of independent variables to integrate the importance of compact population on fiscal stress. Precisely, local per capita public taxes regresses on sociodemographic and compactness variables, fiscal characteristics such as local fiscal capacity, tourism, and additional dummy variables related to the municipal electoral year and the recession period.

Dependent variable, per capita revenues from direct and indirect taxes between 2006 and 2014 (BURDEN), is the sum of budget settlements of local authorities regarding two income categories: direct taxes and indirect taxes. The source is Ministry of the Finance and Public Administrations 2016.

Tables 1 and 2 summarize the independent variables used in the equation, as well as their statistical parameters and sources.

TABLE 1

TABLE 2

Dependent variables

The local provision of public services is financed primarily from local taxes (which include the property tax, local business tax and local motor vehicle tax) and the grants that local governments receive from upper levels of government (current transfers and capital transfers); thus, the econometric specification includes per capita tax revenues –direct and indirect taxes– as the dependent variable, which can be considered as a proxy of fiscal burden (Benito et al. 2010). Revenues are established in constant terms – in adjusted 2011 euros – by using the consumer price index (CPI) of each province (National Statistical Institute 2016).

Independent variables

One of the most controversial topics in urban sprawl studies is the way in which the sprawl is defined and measured. For example, on the one hand, Glaeser and Kahn (2004) argue that sprawl is the inexorable product of car-based living and they conceptualize urban compactness from a unidimensional point of view as urban density, defined as people per square mile. On the other hand, Arribas-Bel et al. (2011) categorize and extract the most relevant six dimensions that define the term urban sprawl, such as scattering, connectivity, availability of open space, density, decentralization and land-use mix. Similarly, Jaeger et al. (2010) measure the degree of urban

dispersion as the average weighted distance between any two points chosen randomly within the urban areas in the landscape investigated and three new measures are determined from this urban dispersion: total sprawl, degree of urban permeation of the landscape, and sprawl per capita.

But the characterization of urban sprawl in Galster et al. (2001) is amongst the most precise and clear (2011), where sprawl is defined as a condition of land use that is represented by low values on one or more of these eight distinct dimensions: density, continuity, concentration, clustering, centrality, nuclearity, mixed uses, and proximity. Connecting with this approach and according to Fernández-Aracil and Ortuño-Padilla (2016), compact population here indicates a conceptualized measure of concentration, given that sprawl and compact development are characterized not only by density but also by other variables (Ewing and Hamidi 2015), and is based on the elementary definition of Berry (1976).

Compact population was calculated by screening techniques on INE statistics (INE is the acronym, in Spanish, of the National Institute of Statistics of Spain) called *Nomenclátor* or list of place names, according to the theoretical foundation presented by Goerlich and Cantarino (2013) discerning about what is urban, considered here as a quantitative metric to appraise urban form.

In order to know how population is classified into different areas, National Statistical Institute (2016) provides more comprehensive definitions of subdivision of the populated areas in a specific municipality by focusing on the municipal register of inhabitants and the list of places called *Nomenclátor*:

- A municipality is divided into singular population entities, depending on the distribution of the population throughout the territory.
- A singular population entity is considered a nucleus if is made up of a set of at least ten buildings, with streets, urban roads and squares.

- Exceptionally, the number of buildings will be less than 10, as long as the population that lives there exceeds 50 inhabitants. In addition, buildings that, being isolated, measure less than 200 m from the exterior limits of the mentioned set, are included in the nucleus.
- Buildings of a singular population entity that may not be included in the concept of a nucleus are considered as a scattered, and their population, as scattered population.

Keeping in mind what has been defined, the main independent variable, that defines urban model, represents the number of inhabitants in a population nucleus classified as compact population (COMPAC): if the population of the nucleus is equal to or larger than 2,000 inhabitants (in the reference year 2014). If a given municipality has more than one population nucleus with 2,000 inhabitants and further, compact population is the sum of population of each nucleus. The remaining population is categorized as dispersed.

The choice of this threshold of 2,000 inhabitants is motivated by the fact that a European regulation on a public service, wastewater treatment, has standardized the lower limit of their efficient provision (European Union, EU 1991). This figure reflects when a population nucleus may cease to be viable, in an economically efficient way (Prieto et al. 2015) and enables operationalize the scrutiny of compact population (Fernández-Aracil and Ortuño-Padilla 2016).

On the other hand, a number of control variables have been introduced in the function to take into account the impact of socioeconomic factors (DUCRIS and DUTOUR), demography (POPULA and INCREA), fiscal capacity (LEVELA) or municipal electoral years (DUELEC) on fiscal burden.

Population size (POPULA) and annual population growth (INCREA), compared with the same period of previous year, are also included in the model because imposes fiscal burdens on established residents in the form of lower service levels (Ladd 1992).

Level of fiscal capacity (LEVELA) measures the financial capacity of a municipality by itself as the proportion of revenue sections 1, 2 and 3 (direct taxes, indirect taxes and user charges, which are the three budget settlements with tax nature) over total revenues of each municipality, which translates into a higher potential for revenue generation and less dependence on regional and central government transfers (Benito et al. 2010).

Electoral year at municipal level (DUELEC) is an important control variable, since it is expected that local politicians tend to reduce taxes, with a clear electoral intent (Gonçalvez and Veiga 2007). The crisis dummy (DUCRIS) takes on the value ‘‘1’’ for any crisis year and ‘‘0’’ otherwise. The period during which the crisis has occurred was limited to 2008-2013, because a given year has been considered into recession when the growth rate of gross domestic product has experienced negative sign during any trimester of the year. Tourism (DUTOUR) is included as a dummy in order to take into account the effect of potential users of public infrastructure, although they are a transitory visitor population (Voltes-Dorta et al. 2014).

Table 3 provides total amounts and averages of some variables at province level for the year 2014. It should be noted that Tarragona and Malaga actually have an additional municipality since 2011, which inclusion has not been possible because complete time series are not available.

TABLE 3

RESULTS AND DISCUSSION

The impact of compact population on fiscal burden, controlling for other factors, is tested by estimating the linear specifications described in equation (2):

$$\log(BURDEN_{it}) = \beta_0 + \beta_1 \cdot \log(COMPAC_{it}) + \beta_2 \cdot \log(POPULA_{it}) + \beta_3 \cdot INCREA_{it} + \beta_4 \cdot \log(LEVELA_{it}) + \beta_5 \cdot DUELEC_{it} + \beta_6 \cdot DUCRIS_{it} + \beta_7 \cdot DUTOUR_{it} + \varepsilon \quad (2)$$

When addressing panel data econometrics, different methods could be used: Generalized Least Squares (GLS), GLS with fixed effects or GLS with random effects. If the presence of individual effects is detected by means of a Breusch-Pagan Lagrange multiplier test, it can be then studied the possibility of adding fixed or random effects. A model with random effects will provide results that are more efficient, but should be used only if possible. When the hypothesis of the Hausman test is confirmed (the coefficients estimated with random effects are the same as those estimated by fixed effects), a model with random effects could be used (Wooldridge 2002).

Table 4 presents the fixed effects estimation results of the model, with fiscal burden as a dependent variable, using Stata software and according to equation (2), where R-square displays a very high value:

TABLE 4

In the light of the results, negative and statistically significant coefficients are: compact population (COMPAC), population size (POPULA), and municipal electoral year (DUELEC). This implies that the increase of this factors, or their presence (in the case of DUELEC), contributes to decrease fiscal burden.

Numerically, a 1% increase in compact population is associated with a decrease of 0.116% euros per capita in fiscal burden. Therefore, population size of a municipality possibly has a greater effect, whose increase of 1%, generates 0.795% decrease in the fiscal burden; however, their more rapid variation generates the increase of fiscal burden.

On each of the local election years, fiscal burden decreases approximately 0.035%, according to the above-mentioned theory.

The estimated coefficients, and statistically significant, for fiscal capacity and crisis are positive and confirm the expectations. They indicate that an increase of 1% of revenues coming from sections 1, 2 and 3 with respect to total local revenues (fiscal capacity) generate an increase of 1.332% in fiscal burden; in fact, in a recession period, fiscal burden is 0.124% higher, precisely to compensate the reduction of indirect revenues in recession period.

Essentially, tourism is not an influential factor in fiscal burden. Whereas tourist activity could increase public expenditure of municipalities, this is not directly reflected in their revenues, which has been used in this analysis as a proxy of fiscal burden, but it is mainly reflected in current transfers. For this reason, in the absence of a specific tourist tax (with the exception of the autonomous regions of Catalonia and Balearic Islands), required to cover the net costs incurred in manage extra public charges as a consequence of tourist activity, local administrations in tourist areas suffer from chronic deficit as a result of the limited funding alternatives to help them cover their increased expenditures (Voltes-Dorta 2014).

CONCLUSIONS

Results of this study provide evidence on how changes of the urban development model could impact on local fiscal burden. The paper has focused on the Mediterranean area of Spain and Madrid, areas of strong urban dynamism, covering the period 2006-2014 and analyzing in depth the fiscal sustainability of a model of urban growth characterized by the dispersion of the population. In a context of budgetary crisis, the topic of the paper is timely and can be used as a tool for municipal policy makers in order to prioritize the future investments and reorient the future urban plans. Moreover, the methodology used in the paper could be extrapolated to other regions in the world, however results may differ in nature according to the conditions in each fiscal system; for instance, the proxy variable used to measure fiscal burden could be different or governments (the specific tiers of government involved in each candidate geographic area) may have implemented differentiated taxation instruments to fully cover specified and real expenditure needs.

In general, the increase in fiscal burden due to a more sprawled urban development model, generates decline in socioeconomic sustainability mainly driven by the increase in demand for higher taxes in order to fully cover public services. In fact, fiscal stress –tax burden, legal limitations on local tax levels and the amount of transfers from the central to local governments– and pressure from interest group are considered explanatory factors of local privatization of services (Bel and Fageda 2007).

The land use reform movement that produced most of the contemporary anti-sprawl policy frameworks was led by critical thought regarding the extent to which development patterns actually serve the best interests of their inhabitants (Calthorpe 1993). If the local budget depends on the taxation of local firms and population, local authorities first should perceive the fiscal consequences of urban sprawl as an urgent problem (Brueckner and Kim 2003).

Finally, this work suggests that municipal planning or taxation instruments could contribute, in reverse, to decrease fiscal burden; namely, the municipal planning instruments and taxation policies must shift the focus of development towards the consolidation of existing urban areas, rather than encouraging sprawl (Almeida et al. 2013). This could for example be achieved via discriminatory taxation instruments, according to the real consumption of local public services, considering not only their provision, but also their long-term maintenance. Nevertheless, fiscal discrimination should be homogeneous in the country, because if a municipality has impact fees but the adjacent did not, could appear spillover effects that exacerbate sprawl (Burge et al. 2013).

NOTATION

The following symbols are used in this paper:

BURDEN = dependent variable, per capita revenues from direct and indirect taxes;

β = vectors of regression coefficients;

COMPAC = number of inhabitants in a population nucleus classified as compact population;

DUELEC = a dummy for electoral years;

DUCRIS = a crisis dummy;

DUTOUR = a dummy for tourist municipalities;

ε = error term;

INCREA = annual population growth compared with the same period of previous year;

i = municipality;

LEVELA = level of fiscal capacity;

POPULA = Population size*;*

t = year;

X = independent variables;

Y = fiscal burden of municipality;

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551 **Table 1.** Description of independent variables.

Independent variables (name)	**Indicator (source)**
Amount of compact population (COMPAC).	Population that is included in a population nucleus of the *Nomenclátor* and with more than 2,000 inhabitants (National Statistical Institute 2016).
Population size (POPULA).	Total annual population of each municipality (National Statistical Institute 2016).
Annual population growth (INCREA).	Municipal growth rate of population, compared to the previous year (National Statistical Institute 2016).
Level of fiscal capacity (LEVELA).	Percentage of revenues coming from direct taxes; indirect taxes; fees and public prices with respect to the total revenues of each local authority (Ministry of the Finance and Public Administrations 2016).
Electoral year (DUELEC).	Dummy variable: 1, for each electoral year at municipal level in Spain; 0, otherwise (National Statistical Institute 2016).
Recession year (DUCRIS).	Dummy variable: 1, for each recession year in Spain; 0, otherwise (National Statistical Institute 2016).
Tourist spot (DUTOUR).	Dummy variable: 1, for each tourist spot in Spain; 0, otherwise (National Statistical Institute 2016).

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553 **Table 2.** Summary of the statistical parameters of the variables of the equation.

Variable (unit)	Obs.	Average	Standard deviation	Minimum	Maximum
BURDEN (€/inhabitant)	17,262	395.66	446.82	0.00	34,736.25
COMPAC (inhabitants)	17,262	11,137.85	88,376.10	0.00	3,273,049.00
POPULA (inhabitants)	17,262	12,556.48	88,927.76	15.00	3,273,049.00
INCREA (%)	17,262	1.03	4.51	-38.32	82.19
LEVELA (%)	17,262	44.07	20.01	0.00	96.40
DUELEC (dummy)	17,262	0.22	0.42	0.00	1
DUCRIS (dummy)	17,262	0.66	0.47	0.00	1
DUTOUR (dummy)	17,262	0.03	0.17	0.00	1

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Table 3. Total amounts and averages of some variables for the last year of study, 2014.

Provinces	Total local entities	Total compact population (inhabitants)	Total population (inhabitants)	Average annual population growth (%)	Average fiscal burden (€/inhabitant)	Average fiscal capacity (%)
Alicante	141	1,553,466	1,868,438	-4	387	63
Almería	102	547,542	701,688	-2	322	38
Baleares	67	887,051	1,103,442	-1	563	66
Barcelona	311	5,045,150	5,523,784	0	511	56
Castellón	135	477,882	587,508	-4	482	54
Girona	221	548,337	756,156	2	543	56
Granada	168	734,721	917,345	-1	242	35
Madrid	179	6,313,288	6,454,440	-1	437	54
Málaga	100	1,431,060	1,618,539	-3	410	41
Murcia	45	1,143,447	1,466,818	-1	367	58
Tarragona	183	609,592	795,155	-2	471	52
Valencia	266	2,294,972	2,548,898	-1	436	56

558 **Table 4.** Determinants of the fiscal burden (t-statistics in parentheses). The statistical significance is

559 expressed through *=5% and **=1%.

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Variables and parameters names	**Coefficients**
Compact population	-0.116* (-2.14)
Population size	-0.795** (-13.04)
Population growth	0.005** (5.65)
Fiscal capacity	1.332** (263.28)
Electoral year	-0.035** (-4.33)
Recession	0.124** (16.43)
Tourism	0.026 (0.34)
Constant	7.222** (16.59)
R^2	0.82
F-statistic	F(7,15337)= 10151.88*
Breusch–Pagan test	Chi-square(1)= 10305.37
H_0: var (μ) = 0	Prob>chi-square= 0.0000
Hausman test	Chi-square(7)=185.07
H_0: difference in coefficients not systematic	Prob>chi-square= 0.0000

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