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A FIRST APPROXIMATION TO THE EVOLUTION OF COMMUTING IN CATALONIA, 1986-1996

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ABSTRACT: Commuting consists in the fact that an important fraction of workers in developed countries do not reside close to their workplaces but at long distances from them, so they have to travel to their jobs and then back home daily. Although most workers hold a job in the same municipality where they live or in a neighbouring one, an important fraction of workers face long daily trips to get to their workplace and then back home.

Even if we divide Catalonia (Spain) in small aggregations of municipalities, trying to make them as close to *local labour markets* as possible, we will find out that some of them have a positive commuting balance, attracting many workers from other areas and providing local jobs for almost all their resident workers. On the other side, other zones seem to be mostly residential, so an important fraction of their resident workers hold jobs in different *local labour markets*.

Which variables influence an area's role as an attraction pole or a residential zone? In previous papers (presented to the ERSA and Spanish Regional Science Association Congresses) we have brought out the main individual variables that influence commuting by analysing a sample of Catalan workers and their commuting decisions. In a later paper we performed a preliminary analysis of the territorial variables that influence commuting, using data for aggregate commuting flows in Catalonia from the 1991 Spanish Population Census.

These variables influence commuting in two different ways: A zone with a dense, well-developed economical structure will have a high density of jobs. Work demand cannot be fulfilled with resident workers, so it spills over local boundaries. On the other side, this economical activity has a series of side-effects like pollution, congestion or high land prices which make these areas less desirable to live in. Workers who can afford it may prefer to live in less populated, less congested zones, where they can find cheaper land, larger homes and a better quality of life. The penalty of this decision is an increased commuting time.

Our aim in this paper is to highlight the influence of local economical structure and amenities dotation in the workplace-residence location decision. A series of place-to-place univariate commuting models are estimated in order to find the economical and amenities variables with higher influence in commuting decisions. From these models, we can outline a first approximation to the evolution of these variables in the 1986-1996 period. Data have been obtained from aggregate flow travel-matrix from the 1986, 1991 and 1996 Spanish Population Census.

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1.- Introduction

Commuting consists in the fact that workers do not usually live close to their workplaces but often at fairly large distances from them. Workers' homes and workplaces are often located in different administrative entities.

Thus, we can expect to find sizeable commuting flows across administrative boundaries. Usually, inflows and outflows will not be balanced: some local authorities will become attraction poles (*centres*), receiving a large number of commuters from other zones, while other will adopt a more residential profile, with a substantial fraction of resident workers out-commuting.

Catalonia is divided in 41 *comarcas*, or small aggregations of municipalities (smaller than NUTS-3 level, see map 1). Most of them can be considered *local labour markets*. We have chosen *comarcas* as the main territorial unit of our analysis.

A zone's (in our case, a *comarca*'s) role will be determined both by its economical structure (which will make the zone more or less attractive for commuters from other zones to work at) and its quality of life (which will determine whether workers and families find it a suitable place to live or not).

Commuting patterns have gradually changed in Catalonia through the 1986-1996 period: while in 1986 most commuting took part between Barcelona and its Metropolitan Area (which includes all Barcelonès *comarca* and part of the surrounding *comarcas*), during this decade this phenomenon has extended throughout Catalonia, while other zones have consolidated its role as *centres*, although Catalonia is still quite a monocentrical region (in 1996, 41% of inter-*comarca* commuters had their workplace in Barcelonès *comarca* and their home in another *comarca*).

Suburbanization is an important trend in Catalonia in the 1986-1996 period, too: Barcelonès *comarca* and all Barcelona's Metropolitan Area have lost population (a small loss between 1986 and 1991 and a more important one in the 1991-1996 period). Workers who abandon Barcelona are attracted by lower land prices, lower congestion

levels and higher amenities of *comarcas* surrounding Barcelona, although most of them stick to their workplace in the capital (Sau, 1993; Artís *et al*, 1998; Módenes and Pascual, 1998; Mendizàbal and Sànchez, 1998; Palacio *et al*, 1998; Asensio, 1999; García, 1999).

This evolution of commuting patterns and suburbanization arises some important questions:

* What factors (amenities or land prices) make some comarcas more attractive than other to live in?
* Why do many suburban workers keep commuting to central *comarcas* instead of seeking "decentralised" jobs?
* Does the suburbanization process "saturate" amenities of suburban *comarcas*?
* Are amenities capitalised into wages and land prices, as theory predicts?
* Have Catalan workers preferences regarding home and workplace location changed between 1986 and 1996?

In this paper we perform a preliminary approach to these questions: First, we briefly review the *standard urban model* and some theories explaining the suburbanization trend. Then we present a descriptive analysis of Catalan commuting patterns and their evolution in the 1986-1996 period. The last part of our paper is a univariate analysis of variables influencing commuting flows and their evolution over time. A preliminary outline of Catalan commuting trends in the 1986-1996 period can be deduced of our work.

Data come from Spanish Population Censuses of 1986, 1991 and 1996 and were supplied by Institut d'Estadística de Catalunya (IDESCAT).

2.- The standard urban model: a brief review

The *Theory of residential location* (also known as *standard urban model* or, sometimes, *Alonso-Mills-Muth model*) is the most widely extended theory in the study of commuting. It explains why workers choose and prefer some places to reside respect to the rest of

places. Its base is the *monocentrical model* (Alonso, 1964) and it suggests that workers have to choose between shorter commuting time and cheaper land prices for their homes. Land closer to the centre (where we suppose all jobs located) has a shorter commuting time associated with it, which makes it more desirable and demanded, and so it will be divided in small lots with higher prices. As we move away from the centre the size of lots increases while price per unit of land decreases (*density gradient*).

Later contributions by Mills, Muth and other authors (see Simpson, 1992) allow a more realistic version of the monocentrical model. For example, Muth allows workers to have different wages. Hekman (1985) extends Muth's model by adding time constraints, while White's (1988) version of the model allows the decentralisation of jobs. White's model is still monocentric in the sense that commuters are restricted to follow the periphery → centre direction.

Alonso's model has been a milestone in the urban studies field. It has been used for such different purposes as studying the structure of cities, housing prices or commuting. Alonso's seminal model has spawn many derivatives, refining the original and relaxing its original assumptions, in order to bring them closer to reality. Anyway, these models, like Mill's, Muth's, Hekman's or White's are still closely based on Alonso's.

In spite of their wide diffusion, monocentrical models have been criticised and ruled out by some researchers because of their apparent lack of realism. Some empirical studies, like Hamilton's (see Simpson, 1992) have casted doubts on the monocentrical model, and alternative models have been proposed. Many of these "new" urban models try to formulate a general scheme, which should be able to include the monocentrical model as a particular case. In this spirit, we should mention "port-city" models (Koide's (1990), or Zheng's (1990), for example), policentrical models or Simpson's "island" model (1992). The problem is that these models have not yet sustained the empirical testing the monocentrical model already has.

Related to these theories, we can find some explanations for the *suburbanization* phenomenon: as land prices increase and congestion makes amenities less accessible to

"central" residents, they might decide to decentralise their residence, seeking cheaper land and less congested amenities (Palumbo *et al*, 1990; Greenwood and Stock, 1990; Margo, 1992; Thuston and Yezer, 1992; Van der Laan, 1998; García, 1999; Asensio, 1999).

2.- A descriptive analysis of commuting patterns in Catalonia, 1986-1996

We have calculated the following indexes of commuting for the 41 Catalan *comarcas* in the years 1986, 1991 and 1996: *percentage of* inter-*comarca commuting* (% of workers who live and work in different *comarcas*), *percentage of* intra-*comarca commuting* (% of workers who live and work in the same *comarca*, but not in the same municipality), an *aperture index* (for each *comarca*, the fraction of resident workers who work outside plus the workers from outside the comarca that commute in it, measured respect the total of workers living in the *comarca*) and the *perificity index* (both with and without mobility, with the purpose of seeing if commuting traduces into higher economical concentration or the other way round (Keeble *et al*, 1988)).

Our conclusions from the study of these indexes (see tables 1 and 4, and figures 1 and 2) show that commuting is slowly evolving from a very centralised structure into a more dispersed one: in 1986, commuting was mostly restricted to Barcelona Metropolitan Area, and, in a lesser way, to the other three province capitals of Girona (Gironès *comarca*), Lleida (Segrià *comarca*) and Tarragona (Tarragonès *comarca*). The commuting pattern was mainly monocentrical, from the surrounding *comarcas* into the capitals: 44% of inter-*comarca* commuters chose Barcelona as their destination, and a further 7%, another province capital. The rest of *comarcas* formed local labour markets, scarcely connected between them. The proportion of workers who commuted across *comarca* borders was only 12.45% of the total. Only in 7 *comarcas*, the out-commuting level was higher than 12%, while 13 *comarcas* had a positive commuting balance (meaning that the number of in-commuters was larger than the number of out-commuters). Commuting balance was less than 1% (positive or negative) of the resident workers for 20 of the 41 Catalan *comarcas*, while the aperture index was 24.91%, denoting very low commuting levels. The average

commuting distance (for inter-*comarca* commuters) was 30.09 kilometres, while 89% of inter-comarca commuters went to a *comarca* adjacent to the one they lived in. Intra-*comarca* commuting accounted for 16.64% of Catalan workers.

Things started to change in 1991: the inter-*comarca* commuting level rose to 15.92%, intra-*comarca* commuting to 19.52% and the aperture index to 31.85%. The average commute for inter-*comarca* commuters increased in more than one kilometre (to 31.54 km.). The proportion of commuting between neighbouring *comarcas* decreased from 89% to 87% of all inter-*comarca* commuters. Zones that had traditionally formed closed local labour markets began a slow integration into a more global labour market. This trend was specially noticeable in *comarcas* that form the 2nd periphery of the province capitals, like Baix Penedès, Garraf and Maresme, in the Barcelona influence area, Pla de l'Estany and Selva (around Gironès, although Selva *comarca* has also a strong commuting relationship with Barcelonès), Priorat and Conca de Barberà near Tarragonès or Pla d'Urgell, Garrigues and Noguera near Segrià.

1991 was also remarkable for a change in a long established trend: Barcelona (and the whole Barcelonès *comarca*) finished a very long population growth cycle and started losing population (Sau, 1993; see table 3). This can be seen as the confirmation of the suburbanization phenomenon in Catalonia. The population decrease was not very important in the 1986-1991 period (only 3% of the population of Barcelonès in 1986), but this new trend would consolidate in the following period (Barcelonès' population loss would amount 7.4% in the 1991-1996 period). Even though the total population in Barcelonès decreased, the number of resident workers increased between 1986 and 1991.

Anyway, many workers and their families changed their residence from Barcelonès to the surrounding *comarcas*, which showed important increases in both the population and the number of resident workers. Most of these workers kept their jobs in Barcelonès, which partially explains the increase of commuting flows from these *comarcas* to Barcelonès.

Apart from the province capitals, other *comarcas* had started to change their role, becoming economic poles which attracted commuting flows from the neighbouring zones: Vallès Occidental and Vallès Oriental *comarcas*, both close to Barcelona and with an important industrial specialisation, show positive commuting balances in 1991. The direction of commuting flows in Barcelona Metropolitan Area became less monocentrical (although commuting flows to Barcelonès were still the most important). Reverse commuting (from Barcelonès to the surrounding *comarcas*) and cross-commuting (flows from a surrounding comarca to another) increased dramatically in the 1986-1991 period. In contrast, commuting increased also around the other three province capitals but it kept a mainly monocentrical pattern[1].

Most *comarcas* away from metropolitan areas had increasingly negative commuting balances in 1991, and many of them also lost both population and workers (as they were specialised in sectors with weak growth potential, mostly agriculture). In contrast, four *comarcas* became secondary attraction poles, which is remarkable due to their relatively peripheral location and small population: they were Alt Camp, Alt Penedès, Segarra and Vall d'Aran. The last *comarca* is an important mountain resort, while the other three have an important industrial concentration.

These trends consolidated in the 1991-1996 period: all around Catalonia commuting increased in 1996: 20.15% of Catalan workers were inter-*comarca* commuters, with an additional 21.71% commuting between different municipalities inside the same *comarca* (intra-*comarca* commuters). The average inter-*comarca* commute increased to 32.54 kilometres, flows between adjacent *comarcas* decreased to 85% and the province capitals became the destination of less than half of all inter-*comarca* commuters (48%).

Barcelonès not only lost population, but also resident workers in the 1991-1996 period: in 1991, 855530 workers lived in Barcelonès. In 1991 they were only 738197. In spite of this, the positive commuting balance of Barcelonès increased from 2.24% of

[1] These patterns are similar to those found by Van der Laan (1998) in the Randstad region (Netherlands): Amsterdam metropolitan area is becoming more multicentered, while other smaller metropolitan areas (like Rotterdam or Eindhoven) are still mostly monocentrical.

its resident workers in 1991 (19000 workers) to 2.82% in 1996 (20000 workers). This means that workers are increasingly changing their residences from Barcelonès to other *comarcas*, but jobs are slower to do so. Both Gironès and Segrià stopped their population growth: both population and resident workers in 1996 were in 1991 levels. Their commuting balance has also remained constant, although their proportions of inter-*comarca* commuting and their aperture indexes have increased[2]. In contrast, Tarragonès has increased its population and resident workers, while keeping its commuting balance at 1991 level. Commuting flows from the surrounding *comarcas* of Baix Camp, Baix Penedès and Priorat to Tarragonès have increased during this period.

Inter-*comarca* commuting seems to be mostly related to *comarcas'* sectorial specialisation (see Artís *et al*, 1998a, 1998b). In contrast, intra-*comarca* commuting depends on the *comarca*'s urban structure: *comarcas* with higher intracomarcal commuting are those with an homogeneous urban network, without any city undertaking an overwhelmingly dominant role (like central, industrial *comarcas* of Anoia, Bages and Osona), while *comarcas* with lower intracomarcal commuting either have a city that takes the leading role (like Barcelona in the Barcelonès *comarca*) or are too scarcely populated to generate scale or scope economies that might keep resident workers inside the *comarca* (like most inland agricultural *comarcas*).

3.- Factors determining inter-*comarca* commuting flows: a first approximation to their evolution in the 1986-1996 period

The descriptive analysis of commuting in Catalonia shows two different kinds of zones: some *comarcas* can be considered economic centres, with a high job-density and positive commuting balance (meaning there are more jobs than resident workers), while other *comarcas* can be described as residential, with a large proportion of their resident workers holding jobs outside the *comarca*. In a previous work (Artís *et al*,

[2] Is this a sign that they are following the same evolution as Barcelonès? We do not have enough information to answer this question yet. Anyway, the high-speed rail line (Madrid-Zaragoza-Lleida-Barcelona-Girona-France) is expected to be ready in 2002, and it might have an important influence in commuting patterns, as the Madrid-Sevilla line already has had in Madrid.

1998b), we identified the main factors that influence a *comarca* to become an attraction pole or a residential zone. We had specified the following model:

If we call *i* the origin *comarca* and *j* the destination *comarca*, we can use the following fraction:

$$c_{ij} = \frac{\text{Number of } i \rightarrow j \text{ commuters}}{\text{Total workers living in } i}$$

as our dependent variable. This variable will take always a value between 0 and 1, as it is the sum of n individual choices made by workers living in the origin *comarca*: each individual choice will take a value of 1 if the worker decides to commute between *i* and *j* and it will equal 0 otherwise. Our aggregate variable c_{ij} will equal 1 if all workers living in *comarca i* out-commute to *j*. $c_{ij} = 0$ if there is no commuting between *i* and *j*, and $0 < c_{ij} < 1$ for any amount of realistic commuting between *i* and *j*. A grouped data Logit model is an adequate specification for such data[3]. The model combined features from the origin and destination *comarcas* in the following way:

$$c_{ij} = \beta_0 + \beta_1 (L_j / L_i) + \beta_2 (H_j / H_i) + \beta_3 A_{ij} + u_{ij} \ , \qquad (1)$$

where L, H and A are vectors of variables: L measures labour market conditions, H, quality of life and A_{ij} measures the accessibility level (ease or difficulty of commuting) between *comarcas i* and *j*.

The model was estimated using cross-section data for 1991. As the results were coherent with the descriptive analysis and the fit was good, we consider this model a good starting point for identifying the variables that influence commuting flows.

[3] Other funcional especifications were tried, like a linear model, a probit model or an attraction model (Haag, 1989), but the logit model showed the best fit.

Anyway, as commuting patterns seem to have evolved gradually in the 1986-1996 period, we were interested also in the evolution of the variables included in model (1): Has it effect on commuting remained constant all through this period or has it changed?

Our first idea was to extend the 1991 cross-section analysis to 1986 and 1996 by the means of a panel. This option had to be discarded, due to the lack of temporal variability (there were only three periods, as commuting data are collected in Population Censuses, on a five year basis). As an alternative, we thought of a static comparative analysis: the model could be estimated independently for 1986, 1991 and 1996 and then, the estimates could be compared.

The first problem is that data on *housing prices*, which is a central explicative variable in our model, are scarce: these data exist only for 15 *comarcas* in 1986, 19 *comarcas* in 1991 and 22 *comarcas* in 1996 (see map 1). If the comparison was to be unbiased, only the 15 *comarcas* for which we have data in all three years could be included in the analysis. This caused severe multicollinearity problems in all three years, specially in 1986. As multicollinearity biases the estimates of Logit models, the results could not be trusted. Clearly, this problem was caused by the lack of observations, as it was most important in 1986, but not in 1991 or 1996 if all *comarcas* with known housing prices were included in the analysis (thus, 1991 and 1996 samples being larger than 1986 sample).

Another problem (though not an irresolvable one) was the difficulty to obtain for 1986 some of the variables that were used in the 1991 analysis.

Several ideas were thought to solve these problems: First, a Principal Components Analysis on the explicative variables was performed for 1986, 1991 and 1996. The variables obtained had not the same interpretation for the three years. As our main interest lies in this comparison, this alternative had to be discarded, too.

Another alternative would have been to use a pooled sample, including 1986, 1991 and 1996 observations. If the underlying hypothesis that there had been no important

changes in the effects of the explicative variables between 1986 and 1996, this alternative would have resulted in more accurate estimates than the cross-sectional models. The problem is that the assumption of coefficient stability cannot be held, as we will prove in section 3.1.

Finally, we opted for a univariate analysis of the effect that each explicative variable used in the 1991 model had in the commuting flows of 1986, 1991 and 1996. The models used were logistic models of the type:

$$c_{ijt} = \frac{e^{\alpha + \beta (X_{jt} / X_{it})}}{1 + e^{\alpha + \beta (X_{jt} / X_{it})}} \qquad (2)$$

where c_{ij} is the same variable we have defined above, and X is each of the explicative variables used in equation (1) for the year 1991. The subscript t denotes the year for whom the equation was estimated (1986, 1991 and 1996). Thus, we perform three Logit regressions for each variable.

Why using an univariate Logit regression instead of a simple correlation analysis? There are three main reasons:

* The relationship between the commuting flows (c_{ij}) and the dependent variables is better reflected by a logistic curve than by a linear relationship.

* An univariate analysis is always partial, as it ignores relations between explicative variables. By using a (Logit) regression model, we can include an intercept (a), which will collect (at least, partly) the effect of omitted variables.

* We can calculate confidence intervals for the b coefficients, thus being able to perform a t-test to compare them for different years.

Using this strategy, we can compare the effect that each individual variable had in commuting flows of different years. Flows between the 15 *comarcas* used in our

analysis account for 84% of inter-*comarca* commuting in 1986, 83% in 1991 and 81% in 1996.

The results are coherent with the descriptive analysis commented in section 2 and with the descriptive analysis of explicative variables for 1986, 1991 and 1996, so we consider them adequate as a first approximation to the evolution of territorial determinants of commuting in Catalonia in the 1986-1996 period.

3.1.- Results of the univariate analysis

The main results of our univariate analysis are shown in table 1 (weighted averages of the variables) and 2 (estimates of the univariate Logits).

Of the 21 variables analysed, only 5 change their sign between 1986 and 1996, but for another 7, the null hypothesis of coefficient stability cannot be accepted. Thus, pooling the 1986, 1991 and 1996 samples into a single one would not have yielded good estimates as it would have ignored the structural changes produced in the 1986-1996 period.

The *accessibility* variables show an increase of the average inter-*comarca* commute, which is also reflected in the diminishing value of the coefficient in the Logit model for *distance* between 1986 and 1996. Commuting between non-adjacent *comarcas* has increased in this decade, a trend reflected by the diminishing value of the coefficients for the *contact* variable (a dummy with a value of 1 if the origin and destination *comarcas* share borders and 0 otherwise).

As we commented in section 2, there has been a trend to move (change residence) from the capitals to their 2nd periphery between 1991 and 1996. Capitals are well connected by *regional rail* and *subway* (only Barcelonès) with their immediate influence area, but not so well connected with their 2nd periphery, specially around Gironès, Segrià and Tarragonès *comarcas*. As this trend has resulted in increasing commuting flows from these 2nd periphery *comarcas* into the capitals, we can expect

the importance of *rail* to have decreased somehow. Our results confirm this hypothesis, although none of these changes (*distance, contact* and *rail*) is significant.

Finally, the *capital* variable (a dummy taking a value of 1 if the destination *comarca* is a capital and the origin *comarca* is not) has kept a constant effect in the 1986-1996 period,

The effect of *migration* on commuting clearly reflects the suburbanization trend: the *migration balance* variable is calculated as migration balance of *comarca j* in year *t* divided by migration balance of *comarca i* in year *t*. Its coefficients change dramatically for each year: in 1986 it was positive, reflecting that commuting flows tended to go from *comarcas* that were losing population due to migration to *comarcas* with positive or null migration balance. In 1991 and 1996 the tendency had reversed: *comarcas* with large increases in their population due to migration were the origin of large commuting flows that went into *comarcas* with negative or null migration balance. This is a clear sign that workers have moved from capitals to the surrounding *comarcas*, but they have not quit their jobs in capitals (this could be caused by Spain's large unemployment rate, which discourages job changes: see Artís *et al*, 1998a). The t-test for this variable is very significant.

Housing variables also reflect the suburbanization trend: *housing prices* are an important variable in all three years, always with a positive sign (which means that commuting flows take the low prices zones $\rightarrow$ high prices zones direction, as theory predicts), but the value of the coefficient has decreased during the period analysed. Obviously, the increase of housing demand in the suburbs has risen its prices, decreasing the price differential with the capitals.

Another important variable is the *mean size of new dwellings*, which we have approximated by the *fraction of new homes larger than 150* m^2 . This variable changes its sign, from being positive in 1986 and 1991 to negative in 1996. This means that in 1996, newly built homes are larger in the origin *comarcas* than in the destination *comarcas*, reflecting the adaptation of housing planners and developers to the new demand caused by "suburbanised" workers. As the sign of the *migration balance*

variable changed in 1991, but the *housing size* variable did not change until 1996, we can deduct that housing offer needed some time to adapt to this new demand.

We have calculated two simple indexes to account for amenities: a *health* index (which includes the number of hospital beds and pharmacies *per capita*) and an *education index* (which depends on the number of schools in the *comarca* and the proportion of children per classroom).

The *health* index had positive coefficients in 1986 and 1991, but negative in 1996. This means that destination *comarcas* were better off (in health terms) in 1986 and 1991, but the situation had reversed in 1996. The reason is the extension of the hospital network across non-metropolitan *comarcas* in the 1991-1996 period, with several new public hospitals having been constructed away from the province capitals. This can make peripheral *comarcas* more attractive as a living place, increasing suburbanization.

The *education* index has a negative value in the three regressions (which means that origin *comarcas* have better educative facilities than destination *comarcas*, due to congestion in the later). Anyway, its importance has decreased in 1996, because of the steady fall in the birth rate during the 80's and the 90's, which has decreased the number of children in school age in all *comarcas*.

The vector of *economic* variables (the ones that make jobs in some *comarcas* more attractive than in other, therefore provoking commuting flows) shows some interesting facts: first, *comarcas* specialised in the *agricultural* sector were unattractive as destinations at the beginning of the period, and this unattractiveness has increased. instead, *comarcas* with a high *services* specialisation are becoming more attractive as a destination for commuters, reflecting the terciarization process of Catalan economy during the 80's and the 90's. Sadly, sectorial data for 1996 were not disaggregated, so we could not analyse the effect of the different industrial sectors[4].

[4] Previous studies (Artís *et al*, 1998a, 1998b; Casado, 1997) show that industrial branches have very different commuting patterns: generalizating, we can say that workers in *capital and intermediate goods* sectors tend to commute more than workers in *consummers' goods* sectors.

We have calculated a simple *index of specialisation difference* for each pair of Catalan *comarcas* (aggregating the absolute values of the difference of the proportion of effective workers in each sector). The results show that most commuting takes place between *comarcas* with a similar productive structure, although this might be an effect of the excessive sectorial aggregation (to homogenise data from 1986, 1991 and 1996, a 5-sector disaggregation had to be used).

The differences in the *unemployment rate* between origin and destination *comarcas* show a fluctuating evolution, with two sign changes. This behaviour can be caused by the differential effect of the economic cycle in central and peripheral *comarcas*, as their productive structure is very different.

As a proxy of the wages paid in a *comarca*, we have used the average collection of personal income tax (Impuesto sobre la Renta de las Personas Físicas or IRPF) for each comarca, as this tax charges mainly wages. For the three years, this variable has a positive sign, although its effect seems more important at the beginning of the period than in 1996. Differentials in both salaries and rents between "poor" and "rich" *comarcas* have reduced during this decade (Costa and Rovira, 1998), but commuting flows tend to follow the lower salaries *comarcas* → higher salaries *comarcas*, as it was to be expected.

Lastly, we have used *population* as a means of capturing scale economies. The coefficients for this variable in the three regressions are basically equal, and they show that most commuting flows originate in less populated *comarcas*.

4.- Conclusions and future research lines

The results of our study show that the suburbanization phenomenon has strongly affected Catalonia in the 1986-1996 decade. This trend is common to most developed countries (Palumbo *et al*, 1987 Greenwood and Stock, 1988; Margo, 1990), though it

has arrived to Spain later than to other European countries or the United States. Anyway, its patterns are mostly the same as in the rest of Europe.

The analysis of aggregate commuting flows allows us to detect the variables that commuters consider when choosing a residence zone and why they keep a job far away from the zone they have chosen to live in. Congestion and high housing prices in the capitals have induced many workers and families to suburbanise, and, when doing so, they have opted for *comarcas* with lower housing prices, larger dwellings and more amenities. Planners and policy-makers have reacted to this trend by increasing amenities in suburban *comarcas*, which, in turn, might induce more workers to leave the capitals, until these amenities saturate and land prices increase enough to make them unattractive for new potential movers. As transport network extends and enhances, suburbanization is due to extend to *comarcas* further away from the capitals, while *comarcas* close to the province capitals, which some time ago were peripheral, are becoming a part of the centre.

The models suggested at the starting of section 3 are the next step in the study of this process, but they require either more information on *comarcal* amenities and housing prices (which are difficult to obtain for years previous to 1991) or yearly commuting data, which would allow a panel model.

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APPENDIX: MAPS, TABLES AND FIGURES

MAP 1: COMARCAL DIVISION OF CATALONIA AND *COMARCAS* USED IN THE UNIVARIATE ANALYSIS

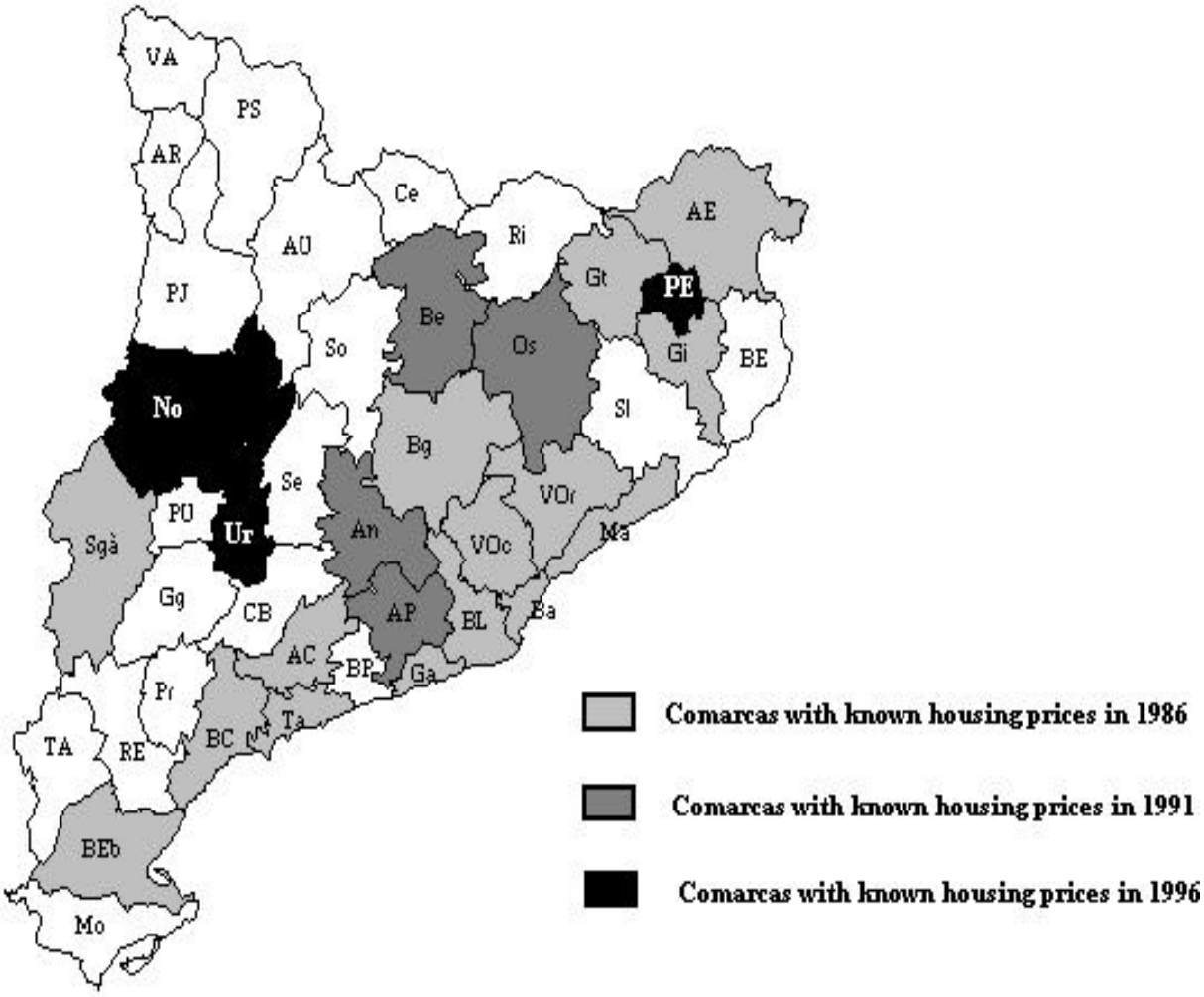

TABLE 1: WEIGHTED AVERAGES OF VARIABLES

	1986-1996	1986	1991	1996
% Of commuting between *comarcas* in the univariate analysis	0.82	0.84	0.83	0.81
% Of commuting into province capitals	0.49	0.51	0.50	0.48
% Resident workers in Agriculture (destination *comarcas*)	0.02	0.03	0.02	0.02
% Resident workers in Agriculture (origin *comarcas*)	0.03	0.04	0.03	0.03
% Resident workers in Construction (destination *comarcas*)	0.07	0.05	0.08	0.15
% Resident workers in Construction (origin *comarcas*)	0.07	0.06	0.08	0.06
% Commuting between adjacent *comarcas*	0.86	0.89	0.87	0.07
Distance	31.57	30.09	31.31	0.27
Education index (destination)	5.66	5.69	5.41	5.83
Education index (origin)	5.73	5.78	5.52	5.86
Health index (destination)	2.46	2.16	3.46	1.81
Health index (origin)	2.22	1.95	2.77	1.91
% Resident workers in Industry (destination *comarcas*)	0.35	0.39	0.36	0.43
% Resident workers in Industry (origin *comarcas*)	0.36	0.41	0.37	0.32
Average Personal Income Tax (IRPF) (destination *comarcas*)	2210.96	1674.12	2246.79	0.32
Average Personal Income Tax (IRPF) (origin *comarcas*)	2144.06	1617.16	2175.71	2455.79
Telephone lines per 100 inhabitants (destination *comarcas*)	42.78	32.03	44.39	2387.20
Telephone lines per 100 inhabitants (origin *comarcas*)	41.30	29.78	42.99	46.95
% Commuting between *comarcas* communicated by subway	0.31	0.34	0.32	0.29
Population (destination)	1182417.24	1244874.40	1219613.7	1120482.22
Population (origin)	920445.59	983790.12	945414.10	867946.68
Housing prices per m^2 (destination) *	151090.81	77405.27	163152.53	177337.34
Housing prices per m^2 (origin) *	141997.57	73285.87	155916.4	164322.16
Number of *comarcas* with known housing prices	---	15	19	22
% resident workers in Non-saleable services (destination)	0.20	0.19	0.19	0.20
% resident workers in Non-saleable services (origin)	0.19	0.18	0.18	0.19
% resident workers in Saleable services (destination)	0.35	0.32	0.33	0.19
% resident workers in Saleable services (origin)	0.34	0.31	0.32	0.38
Unemployment rate (destination)	0.14	0.24	0.11	0.12
Unemployment rate (origin)	0.14	0.24	0.11	0.12
% of commuting between *comarcas* communicated by regional railway services	0.87	0.89	0.87	0.86
% Dwellings larger than $150m^2$ (destination)	0.46	0.62	0.72	0.18
% Dwellings larger than $150m^2$ (origin)	0.46	0.62	0.70	0.19

* : Only *comarcas* with known housing prices are included in the weighted average (see map 1).

TABLE 2: ESTIMATES OF THE UNIVARIATE *PLACE-TO-PLACE* LOGIT MODELS

	1986	1991	1996	T-test for changes in the estimates			Sign changes
VARIABLE	coefficient	coefficient	coefficient	86-91	86-96	91-96	
% Agriculture	-0.13179 *	-0.16029 *	-0.43658 *	1.80	8.60	7.88	0
Intercept	-3.82	-3.52	-3.02	-4.27	-8.28	-5.19	
% Industriy	-0.17429	0.019	-0.06682	-1.26	-0.54	0.47	2
Intercept	-4.5	-4.48	-4.16	-0.11	-1.49	-1.58	
% Saleable services	2.200249 *	2.73418 *	2.73379 *	-2.53	-1.77	0.001	0
Intercept	-6.88	-7.17	-6.9	1.15	0.03	-0.79	
Destination: capital	2.06883 *	1.97422 *	1.75981 *	0.67	1.79	1.42	0
Intercept	-5.31	-5.05	-4.75	-2.38	-4.34	-2.82	
Contact	3.7336 *	3.64325 *	3.4304 *	0.32	0.94	0.78	0
Intercept	-7.08	-6.77	-6.33	-1.17	-2.42	-1.69	
Dif. prod. estructure	-0.85789 *	-1.24581 *	-1.14208 *	0.91	0.47	-0.17	0
Intercept	-4.37	-4.08	-3.92	-1.76	-2.19	-0.87	
Distance	-0.05989 *	-0.05857 *	-0.05541 *	-0.25	-0.73	-0.61	0
Intercept	-2	-1.81	-1.64	-1.27	-2.00	-1.09	
Education index	-1.78654 *	-1.9767 *	-0.59984 *	0.51	-2.67	-3.89	0
Intercept	-2.865	-2.39	-3.62	-1.27	1.68	3.41	
Health index	0.02891	0.38081 *	-0.0294	-6.76	0.77	7.07	1
Intercept	-4.72	-5.10	-4.19	3.58	-4.29	-9.36	
Income tax	6.72352 *	5.90613 *	3.99789 *	1.76	4.96	4.20	0
Intercept	-11.24	-10.16	-8.14	-2.22	-5.37	-4.26	
Tel. lines per 100 inh.	3.57215 *	3.66671 *	3.17984 *	-0.38	1.03	1.14	0
Intercept	-8.33	-8.12	-7.42	-0.70	-2.15	-1.54	
Subway	2.85174 *	2.78858 *	2.742 *	0.43	0.60	0.29	0
Intercept	-5.16	-4.91	-4.63	-2.85	-4.93	-2.97	
Population	0.05134 *	0.0584 *	0.06486 *	-1.01	-1.44	-0.74	0
Intercept	-4.77	-4.56	-4.33	-2.90	-4.85	-2.83	
Housing prices	3.21146 *	2.11335 *	2.18148 *	5.61	4.68	-0.42	0
Intercept	-7.71	-6.39	-6.27	-5.81	-5.57	-0.63	
Migration balance	0.00414	-0.27453 *	-0.0225	60.83	4.20	-13.83	1
Intercept	-4.68	-4.59	-4.24	-1.28	-5.05	-4.34	
Unemployment rate	0.79576 *	-0.1121	1.4204 *	6.27	-2.53	-5.09	2
Intercept	-5.42	-4.35	-5.61	-6.65	0.72	4.05	
Railway	1.78359 *	1.63403 *	1.53009 *	0.44	0.64	0.32	0
Intercept	-6.26	-5.90	-5.55	-1.09	-1.85	-1.12	
% Dwellings > 150 m^2	0.03921	0.1242 *	-1.73978 *	-1.97	13.32	13.89	1
Intercept	-4.72	-4.58	-2.19	-1.71	-15.99	-15.55	

*: Significant at the 95% level.

TABLE 3: *COMARCAS'* POPULATION AND RESIDENT WORKERS, 1986-1996

COMARCA	POPULATION			RESIDENT WORKERS 86							RESIDENT WORKERS 91							RESIDENT WORKERS 96						
	86	91	96	Agricult.	Energy	Industry	Constr.	Serv.	N.sal.ser.	TOTAL	Agricult.	Energy	Industry	Constr.	Serv.	N.sal.ser.	TOTAL	Agricult.	Energy	Industry	Constr.	Serv.	N.sal.ser	TOTAL
Alt Camp	33804	34016	34403	1658	105	5269	622	2207	1311	11172	1305	117	5821	1001	2845	1702	12791	1053	141	5041	859	3208	2068	12370
Alt Empordà	85398	90755	93172	4018	327	4999	3608	11868	4719	29541	3647	442	6251	5037	13682	5964	35023	3027	412	6468	4117	15397	6647	36068
Alt Penedès	67005	69863	73196	1901	251	9485	1502	5669	2413	21220	1730	244	11597	2392	6994	3689	26646	1512	191	11296	2298	8425	4325	28047
Alt Urgell	18865	19010	19006	1591	88	1623	522	1964	1048	6837	1095	95	1623	787	2646	1244	7490	789	108	1279	844	2671	1330	7021
Alta Ribagorça	3626	3514	3542	151	185	133	154	264	118	1004	153	150	107	214	390	245	1259	117	77	157	206	494	294	1345
Anoia	79594	82450	86964	1216	147	14611	1434	5302	3099	25809	1130	225	16729	2421	6884	4054	31443	916	233	15611	2272	8307	4920	32259
Bages	150421	152177	152586	1894	769	23437	2407	12136	6834	47477	1783	1116	24572	4255	14854	9047	55627	1430	1540	20755	4030	16763	9792	54310
Baix Camp	123745	131599	140540	4163	1625	9374	3331	12565	6402	37460	3607	1618	11753	5630	15859	8452	46919	2919	931	11872	4860	19326	10129	50037
Baix Ebre	64452	64645	65879	5484	336	4368	1785	4951	3040	19963	4048	272	4973	2834	6427	3981	22535	3192	206	4922	2593	6939	4330	22182
Baix Empordà	83911	89930	95986	2846	235	6561	4672	9953	4221	28488	2433	342	7774	6619	11642	5381	34191	2287	364	7852	5270	14785	6255	36813
Baix Llobregat	583354	610192	643621	2800	1768	77014	10280	43738	24741	160341	2608	1716	93323	21641	67182	35772	222242	2432	1971	84474	18153	87650	38804	233484
Baix Penedès	33211	38080	47550	968	142	3166	1385	3388	1485	10534	854	215	4042	2186	4528	2214	14039	741	209	4724	2108	6450	3142	17374
Barcelonès	2376600	2302137	2131378	2051	11399	234595	22954	270240	163019	704259	1835	8404	270072	48279	331366	195574	855530	3266	5814	195719	32572	327321	173505	738197
Berguedà	40677	38965	38389	1183	1186	5540	989	2697	1663	13258	1123	446	4808	1544	3483	2143	13547	922	377	4046	1544	3603	2368	12860
Cerdanya	12200	12396	12757	811	43	439	810	1519	528	4151	662	37	476	1099	1809	855	4938	587	45	688	919	1950	960	5149
Conca de Barberà	18404	18001	18285	1304	44	2613	474	1117	713	6266	1125	35	2391	618	1503	863	6535	734	36	2307	647	1649	1068	6441
Garraf	71816	76915	90435	947	367	7515	2086	6066	3839	20819	867	345	7876	3366	9222	5537	27213	761	336	8018	3266	13328	7175	32884
Garrigues	20214	19429	19273	3342	27	1082	516	1052	692	6712	2436	56	1390	686	1379	875	6822	2026	82	1270	664	1453	1020	6515
Garrotxa	45368	46060	46708	1510	83	9549	1107	3445	2067	17761	1305	201	8749	1638	4195	2740	18828	923	199	8530	1442	4537	3078	18709
Gironès	122350	125875	129044	1855	571	14301	2951	12715	9307	41700	1765	628	15509	4686	16913	12090	51591	1341	378	14337	3799	18731	13146	51732
Maresme	269502	293103	318891	5273	824	36124	5057	24896	13689	85863	4609	727	42654	9072	33156	18096	108314	4268	740	38615	7832	42806	22129	116390
Montsià	54027	54307	54765	5846	144	3815	1390	3678	1882	16755	4899	135	4741	2120	4969	2168	19032	4006	232	4963	1726	5282	2615	18824
Noguera	35847	34782	34390	4179	154	2598	904	2323	1232	11390	3373	130	2972	1283	3076	1624	12458	2815	128	2884	1225	3330	1934	12316
Osona	115258	117442	122923	3215	217	22880	2567	9346	5190	43416	3078	280	24167	3928	11306	6543	49302	2725	505	21922	3866	13364	7866	50248
Pallars Jussà	13817	12860	12817	1037	243	694	460	1025	696	4155	961	220	729	540	1198	938	4586	732	108	740	449	1366	1204	4599
Pallars Sobirà	5464	5418	5815	733	115	159	233	447	262	1949	488	88	220	240	633	416	2085	357	69	244	304	842	571	2387
Pla d'Urgell	28675	28802	29116	3327	34	2366	794	1675	974	9171	2734	73	3127	895	2366	1267	10462	2309	115	3201	932	2637	1496	10690
Pla de l'Estany	21416	21072	23833	953	50	3268	872	1851	1005	7999	897	94	3362	885	1938	1254	8430	759	109	3441	863	2495	1815	9482
Priorat	10051	9475	9212	1360	59	626	258	463	329	3095	1104	81	737	368	545	470	3305	784	68	639	363	624	556	3034
Ribera d'Ebre	23650	23055	22442	1495	645	2084	544	1319	708	6795	1375	730	2052	751	1548	1096	7552	1083	493	1746	599	1885	1248	7054
Ripollès	28314	27167	26365	685	169	5216	622	2130	1124	9947	718	167	5078	841	2586	1552	10942	619	121	4445	783	2694	1760	10422
Segarra	17104	17040	17407	1658	44	1656	391	1173	665	5587	1276	33	2513	520	1355	891	6588	1300	22	2671	530	1459	999	6981
Segrià	158677	162904	162529	10984	708	10243	2956	14713	10339	49942	9337	686	11278	5214	19863	13794	60172	7533	561	11172	4618	21316	14800	60000
Selva	91238	98255	104833	2345	233	11527	2876	12410	3994	33384	2157	470	13351	4222	12870	4811	37881	1707	407	13016	3579	17507	6170	42386
Solsonès	10796	10792	11171	1040	28	886	351	750	423	3478	928	42	1192	596	887	600	4245	744	39	1200	638	1119	679	4419
Tarragonès	149090	155881	169016	1915	1417	11361	3241	16755	9602	44292	1719	1591	13502	6487	19843	13452	56594	1397	574	13909	5591	24867	15552	61890
Terra Alta	13449	12945	12382	2459	46	809	289	503	255	4362	1766	64	1040	496	706	365	4437	1357	61	975	384	836	455	4068
Urgell	29964	29789	30181	2351	63	2892	726	2474	1132	9638	2131	85	3573	943	3046	1486	11264	1740	79	3706	1013	3250	1705	11493
Val d'Aran	6034	6184	7130	131	135	169	240	1011	560	2246	140	142	262	339	1207	549	2639	70	82	320	440	1416	810	3138
Vallès Occidental	620786	649699	685600	1352	1116	86413	9617	46531	29544	174572	1279	1456	104495	20101	69016	41107	237454	1386	1904	98675	17241	86073	44348	249627
Vallès Oriental	240464	262513	285129	2660	781	39412	5246	18272	9688	76059	2474	916	50351	8907	26017	13798	102463	1987	923	48400	8156	34412	17042	110920
Total Cataluña	5978638	6059494	6088661	96693	26927	680871	103223	576601	334552	1818867	82954	24914	791232	185681	741934	428699	2255414	70653	20990	686250	153595	832567	440110	2204165

TABLE 4: *COMARCAS'* COMMUTING MAIN FIGURES

COMARCA	INTER-*COMARCA* COMMUTING			INTER-*COMARCA* COMMUTING (%)			COMMUTING BALANCE			COMMUTING BALANCE (%)			INTRA-*COMARCA* COMMUTING			INTRA-*COMARCA* COMMUTING (%)			APPERTURE INDEX		
	86	91	96	86	91	96	86	91	96	86	91	96	86	91	96	86	91	96	86	91	96
Alt Camp (AC)	1035	1502	2191	9.26	11.74	17.71	85	612	201	0.25	1.80	0.58	1050	1702	1818	9.40	13.31	14.70	19.29	28.27	37.05
Alt Empordà (AE)	1092	2245	3202	3.70	6.41	8.88	176	-701	-1018	0.21	-0.77	-1.09	5316	8640	9943	18.00	24.67	27.57	7.99	10.82	14.93
Alt Penedès (AP)	2085	3179	4613	9.83	11.93	16.45	-227	402	364	-0.34	0.58	0.50	3829	6745	8057	18.04	25.31	28.73	18.58	25.37	34.19
Alt Urgell (AU)	190	417	526	2.78	5.57	7.49	110	-93	-143	0.58	-0.49	-0.75	670	857	945	9.80	11.44	13.46	7.17	9.89	12.95
Alta Ribagorça (AR)	62	225	270	6.18	17.87	20.07	-19	-180	-205	-0.52	-5.12	-5.79	41	95	137	4.08	7.55	10.19	10.46	21.45	24.91
Anoia (An)	1395	2919	4615	5.41	9.28	14.31	496	-910	-1911	0.62	-1.10	-2.20	7395	9916	10500	28.65	31.54	32.55	12.73	15.67	22.69
Bages (Bg)	2782	5153	5927	5.86	9.26	10.91	-996	-2410	-2095	-0.66	-1.58	-1.37	9369	13772	15852	19.73	24.76	29.19	9.62	14.19	17.97
Baix Camp (BC)	5738	9596	12570	15.32	20.45	25.12	-2385	-5061	-6692	-1.93	-3.85	-4.76	3444	4762	5931	9.19	10.15	11.85	24.27	30.12	36.87
Baix Ebre (BEb)	1131	2122	2440	5.67	9.42	11.00	-33	-206	-381	-0.05	-0.32	-0.58	2312	3671	3755	11.58	16.29	16.93	11.17	17.92	20.28
Baix Empordà (BE)	1998	3150	4895	7.01	9.21	13.30	-832	-1228	-2433	-0.99	-1.37	-2.53	5069	7568	9293	17.79	22.13	25.24	11.11	14.83	19.98
Baix Llobregat (BL)	56453	82716	90176	35.21	37.22	38.62	-23829	-30474	-21607	-4.08	-4.99	-3.36	33876	50080	60126	21.13	22.53	25.75	55.55	60.73	67.99
Baix Penedès (BP)	1113	2703	5241	10.57	19.25	30.17	307	-894	-2614	0.92	-2.35	-5.50	1698	2609	3260	16.12	18.58	18.76	24.05	32.14	45.29
Barcelonès (BA)	67442	104197	122263	9.58	12.18	16.56	32116	51477	60108	1.35	2.24	2.82	112040	147956	130941	15.91	17.29	17.74	23.71	30.38	41.27
Berguedà (Be)	710	1592	2105	5.36	11.75	16.37	59	-620	-1188	0.15	-1.59	-3.09	2902	2694	2909	21.89	19.89	22.62	11.16	18.93	23.50
Cerdanya (Ce)	230	427	676	5.54	8.65	13.13	-6	-101	-305	-0.05	-0.81	-2.39	333	632	746	8.02	12.80	14.49	10.94	15.25	20.33
Conca de Barberà (CB)	607	1152	1303	9.69	17.63	20.23	-270	-655	-419	-1.47	-3.64	-2.29	636	710	948	10.15	10.86	14.72	15.07	25.23	33.95
Garraf (Ga)	2690	4752	9233	12.92	17.46	28.08	-1059	-2339	-6237	-1.47	-3.04	-6.90	2961	4543	5896	14.22	16.69	17.93	20.76	26.33	37.19
Garrigues (Gg)	796	1508	1724	11.86	22.10	26.46	-580	-1114	-1230	-2.87	-5.73	-6.38	236	422	423	3.52	6.19	6.49	15.08	27.88	34.04
Garrotxa (Gt)	906	1361	1752	5.10	7.23	9.36	-364	-524	-414	-0.80	-1.14	-0.89	2936	3822	4555	16.53	20.30	24.35	8.15	11.67	16.52
Gironès (Gi)	3289	4681	7172	7.89	9.07	13.86	2445	3729	3229	2.00	2.96	2.50	10817	14963	16007	25.94	29.00	30.94	21.64	25.37	33.97
Maresme (Ma)	14694	25111	34377	17.11	23.18	29.54	-8235	-16389	-23493	-3.06	-5.59	-7.37	12870	20366	24141	14.99	18.80	20.74	24.64	31.24	38.89
Montsià (Mo)	960	2027	2202	5.73	10.65	11.70	-427	-892	-777	-0.79	-1.64	-1.42	1321	1718	2085	7.88	9.03	11.08	8.91	16.61	19.27
Noguera (No)	1195	2184	2828	10.49	17.53	22.96	-702	-1453	-1638	-1.96	-4.18	-4.76	785	1248	1506	6.89	10.02	12.23	14.82	23.40	32.62
Osona (Os)	2111	3265	4202	4.86	6.62	8.36	-764	-772	-1395	-0.66	-0.66	-1.13	11335	15264	17278	26.11	30.96	34.39	7.96	11.68	13.95
Pallars Jussà (PJ)	289	571	661	6.96	12.45	14.37	-138	-332	-415	-1.00	-2.58	-3.24	404	591	666	9.72	12.89	14.48	10.59	17.66	19.72
Pallars Sobirà (PS)	171	352	506	8.77	16.88	21.20	-116	-242	-363	-2.12	-4.47	-6.24	148	248	419	7.59	11.89	17.55	11.60	22.16	27.19
Pla d'Urgell (PU)	857	1580	2139	9.34	15.10	20.01	-132	-222	-429	-0.46	-0.77	-1.47	945	1613	1948	10.30	15.42	18.22	17.25	28.08	36.01
Pla de l'Estany (PE)	1013	1483	2114	12.66	17.59	22.29	-396	-438	-799	-1.85	-2.08	-3.35	2022	2295	2746	25.28	27.22	28.96	20.38	29.99	36.16
Priorat (Pr)	348	747	932	11.24	22.60	30.72	-200	-548	-718	-1.99	-5.78	-7.79	183	283	229	5.91	8.56	7.55	16.03	28.62	37.77
Ribera d'Ebre (RE)	461	930	899	6.78	12.31	12.74	189	-16	222	0.80	-0.07	0.99	1149	1565	1502	16.91	20.72	21.29	16.35	24.42	28.64
Ripollès (Ri)	598	1150	1408	6.01	10.51	13.51	-86	-586	-605	-0.30	-2.16	-2.29	1399	1841	2129	14.06	16.83	20.43	11.16	15.66	21.21
Segarra (Se)	595	917	1056	10.65	13.92	15.13	-130	537	1208	-0.76	3.15	6.94	419	794	898	7.50	12.05	12.86	18.97	35.99	47.56
Segrià (Sgà)	1333	3032	4212	2.67	5.04	7.02	847	620	589	0.53	0.38	0.36	3531	6554	7725	7.07	10.89	12.88	7.03	11.11	15.02
Selva (Sl)	3233	5795	8201	9.68	15.30	19.35	1005	-736	-1181	1.10	-0.75	-1.13	4009	5809	6895	12.01	15.33	16.27	22.38	28.65	35.91
Solsonès (So)	218	471	533	6.27	11.10	12.06	-79	-146	-82	-0.73	-1.35	-0.73	343	471	631	9.86	11.10	14.28	10.26	18.75	22.27
Tarragonès (Ta)	3495	6582	9341	7.89	11.63	15.09	3971	4242	4630	2.66	2.72	2.74	5266	8757	12071	11.89	15.47	19.50	24.75	30.76	37.67
Terra Alta (TA)	238	612	629	5.46	13.79	15.46	-174	-507	-469	-1.29	-3.92	-3.79	96	217	238	2.20	4.89	5.85	6.92	16.16	19.40
Urgell (Ur)	844	2084	2582	8.76	18.50	22.47	-157	-984	-1272	-0.52	-3.30	-4.21	642	1000	1213	6.66	8.88	10.55	15.89	28.27	33.86
Val d'Aran (VA)	35	156	245	1.56	5.91	7.81	62	72	-32	1.03	1.16	-0.45	293	408	742	13.05	15.46	23.65	5.88	14.55	14.60
Vallès Occidental (VOc)	30443	45435	54047	17.44	19.13	21.65	-4117	3555	9340	-0.66	0.55	1.36	27748	50787	65025	15.89	21.39	26.05	32.52	39.77	47.04
Vallès Oriental (VOr)	11644	19092	28130	15.31	18.63	25.36	4585	6527	2669	1.91	2.49	0.94	20774	32363	36362	27.31	31.59	32.78	36.65	43.64	53.13
Total Catalonia	226519	359173	444138	12.45	15.92	20.15	0	0	0	-	-	-	302612	440351	478491	16.64	19.52	21.71	24.91	31.85	40.30

FIGURE 1: INTER-*COMARCA* COMMUTING

Movilidad Intercomarcal

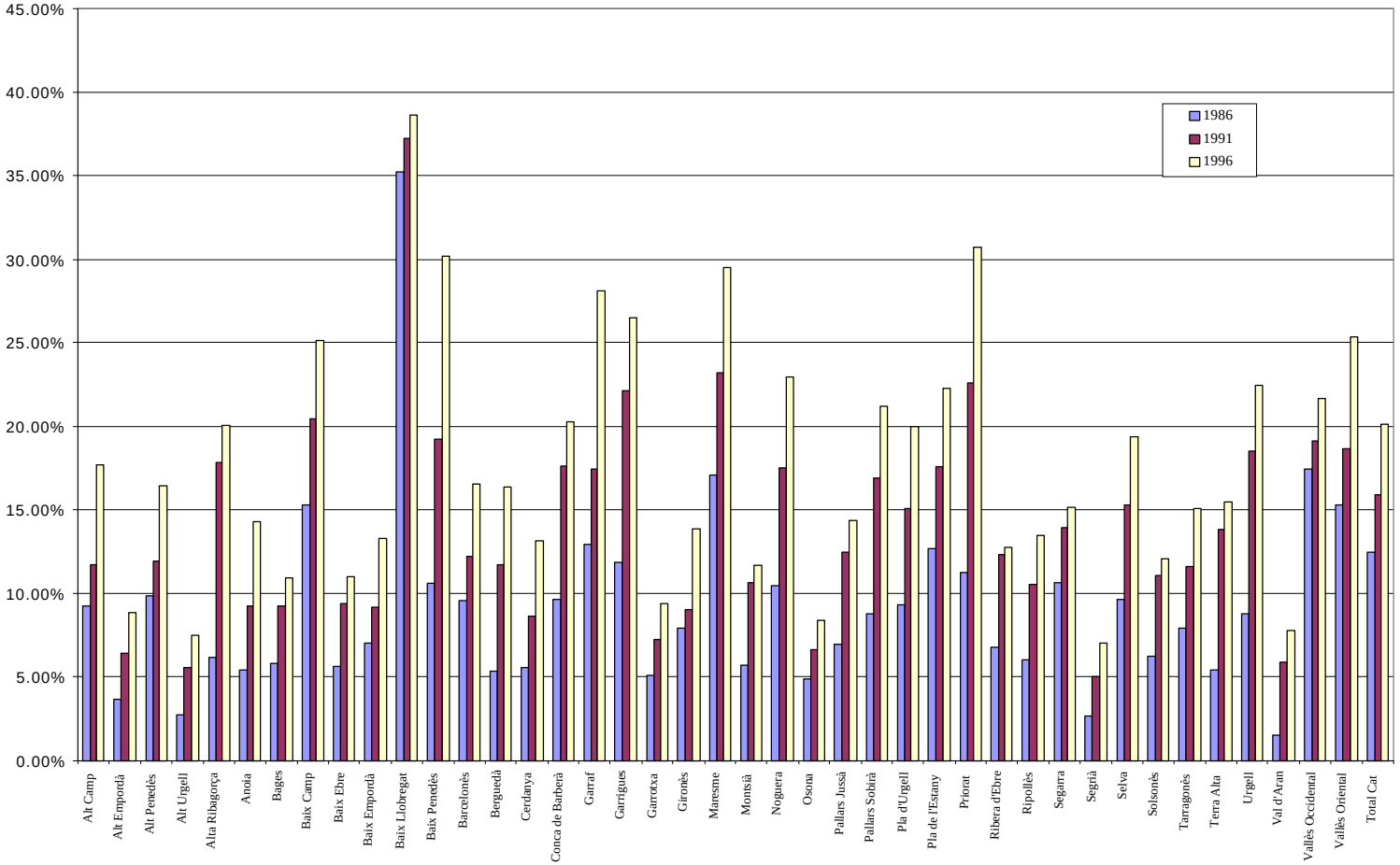

FIGURE 2: INTRA-*COMARCA* COMMUTING