



High-speed rail and urban development in Spain from 1992 to 2016

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Abstract

In April 1992 started the first High-Speed Rail service between Madrid and Seville in Spain. In other countries, usually, the HSR services are introduced when conventional train services accomplish its top capacity. However, Spanish decide explain its HSR network to all the territory. On the other hand, traditional theory of economic growth say that infrastructures are necessary but not sufficient to economic growth. In this sense, investment in infrastructures, especially in transport infrastructures, is justified, in general, for promoting economic growth. Today, 25 years after first HSR services in Spain, a large HSR network connect many Spanish cities with a length of 2,444.1 km in 2013. Really, HSR network is a territorial laboratory to test the theory about relationship between new transport infrastructure and economic growth. In addition, from 1992 to now, economics trends in Spain has three cycles: crisis cycle 1992-1997, expansive cycle 1998-2007 and crisis cycle 2008-2016. According classical theory, new transport infrastructures allows comparative advantage to cities with new services. In consequence, today is a good moment to realize a comparative analyze between Spanish cities with or without HSR services. The population of each city is a good indicator of economic trends. In fact, cities with economic growth increase population while cities with negative economic growth decrease population. However, the analysis is more complicated because of two causes. On the one hand, the most important cities connected by HSR form metropolitan areas with special interior dynamics. For example, maybe city center can decrease while metropolitan area increase. On the other hand, the start of HSR services on each city is different because the network increase progressively. So is it necessary a special progressive comparison. This paper shows the evolution of inhabitants of cities that have HSR services and compare this evolution whit general evolution of Spain in function of date that HSR services started. On the other, hand the main cities are the center of their respective metropolitan areas. In this situation, another comparative analysis has been realized for metropolitan areas. The results show that the HSR has served to consolidate and extend the hinterland of the main metropolitan areas with interesting and significant exceptions. In fact, HSR services includes two kind of services: long and average distance. Really, the services for average distance explain the relationship between HSR and metropolitan areas evolution.

Keywords: HSR territorial impact, regional development, urban development, cities system.

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1. Introduction

High-speed railway (HSR) services began in Spain 25 years ago. Really, in 1987, the Rail Transport Plan to improve conventional train services and its railway network was approved. However, few years after, government decided put off the plan and execute the first High-Speed line (AVE services in Spanish) between Madrid and Seville, which opened in the Universal Exposition of Seville in 1992. This service have speed about 300-350 km/h and begin in Spain the new railway network with UIC gauge. Investment in this infrastructure consumed all planned budget for conventional rail plan. Train Station in Madrid for High-Speed was located in Atocha Station in city centre.

Table 1. Network railway high-speed evolution in Spain. Origin: ADIF and VIA LIBRE.

Services start date	Strech	HST Rail line	HS length (km)	% railway
1992, April	Madrid-Sevilla	Madrid - Sevilla	477,8	3,86
2003, October	Madrid-Zaragoza-Lleida	Madrid - Barcelona - France	1025,8	7,93
2005, November	Madrid-Toledo	Madrid - Sevilla	1049,9	8,17
2006, December	Lleida-Camp de Tarragona	Madrid - Barcelona - France	1253,2	9,57
2006, December	Córdoba-Antequera	Córdoba - Málaga	1253,2	9,57
2007, December	Madrid-Valladolid	Madrid - ValladolidGalicia	1492,5	11,18
2007, December	Antequera-Málaga	Córdoba - Málaga	1492,5	11,18
2008, February	Camp de Tarragona- Barcelona	Madrid - Barcelona - France	1600,5	11,89
2010, December	Mollet-Girona & Figueres- Pertús	Madrid - Barcelona - France	2135,7	15,25
2010, December	Madrid-Cuenca-Albacete- Valencia	Madrid - Valencia - Murcia	2135,7	15,25
2011, December	Ourense-Santiago-A Coruña	Atlantic Axis	2225,4	15,78
2013, January	Barcelona-Figueres, complet	Madrid - Barcelona - France	2444,1	17,32
2013, June	Albacete-Alacant	Madrid - Valencia - Murcia	2444,1	17,32

Progressively, according to reports of ADIF and VIA LIBRE, the new railroad network increase accord table 1. As the high-speed network has expanded also increased passenger network as you can see in table 2. In figure 1, you can see the HSR network in Spain in 2015. In this date, HSR services also started to the cities of Zamora (December 2015), Palencia and Leon (September 2015 both). Note you that the number of passengers is low in relation to the length of high speed lines built. According Albalate & Bel (2012; 2015), the length of Spanish high-speed rail network is more extensive than the networks of France, Germany or Japan but with a relationship km of network par inhabitant very high.

The fact that the historical rail network having a width different from the general European gauge has conditioned much decision making (Miralles, 2017). In general, instead of prioritizing the transformation of conventional lines with more passenger traffic, successive governments opted for an extensive transformation of the entire network to serve the greatest number of cities by passenger services with origin in Madrid (Bel, 2010).

To increase the use of new infrastructure, ADIF improved services by “average distance trains”. These are services provided to cities relatively close to each other. In these cases, the average speed of travel is about 200 km/h, lower than in long distance services.

Table 2. Evolution of passengers by HSR in Spain (millions).
Origin: Ministerio de Fomento (Spain) and RENFE-OPERADORA.



Figure 1. Network High-speed railway in Spain in 2015. Origin: ADIF.

Today, 25 years after start the HSR services, is possible to analyze the territorial impacts made by this new infrastructure, more specifically on the economic development of cities and regions that have this new transport service.

As de Rus (2015) reminds us, infrastructures are a necessary condition for economic development but not sufficient. Besides, he reminds us that the productivity increases with the investment in public capital. However, the Law of Decreasing Returns is also applicable in this field. So the effect of the additional investments being lower when the network presents a more advanced state as has been demonstrated in the Spanish case (Reig Martínez et al, 2007).

It is now possible to contrast these approaches once again. In fact, the new services of HSR are a comparative economic advantage with respect to cities or regions that do not have them.



Consequently, the cities or regions with HSR services should show greater economic growth than those do not have such services. On the other hand, the population growth is an indicator of economic growth. Therefore, it is possible a comparative analyze of the population growth of cities/regions with/without HSR services and to test if there is any relationship between them.

The population data series corresponds the period 1991-2016. In this period there is three economic cycles: crisis cycle from 1991 to 1996, expansion cycle from 1997 to 2007 and crisis cycle from 2008 to currently (today is complicated to stablish a data finish for this cycle). The situation is the same for all Spain. Therefore the cities with HSR services, in general, should have taken advantage of their comparative advantage over all economic cycles.

2. Objectives

The objective of this research is test the relationship between the new HSR services and the economic development of cities or regions with the new services measured by the population growth indicators.

Specifically, if the cities or regions where the new HSR services have been implemented, have experienced greater economic growth, as measured by the growth of their population, than those where HSR services have not been implemented. Or, if there have been changes in the trend of population growth before and after the start of services.

3. Methodology

The analysis focuses on the growth that has occurred in cities and regions with HSR services and their comparison with those that do not have such services.

The “Instituto Nacional de Estadística” (INE), *Statistics National Institute* in English, has annual dates of inhabitants for all municipalities of Spain by the “Register of inhabitants” from 1996. Before it exit dates of municipal inhabitants in each Census. Census dates are not annuals. They have only been made in certain years. Particularly the last Inhabitant and Houses Census corresponds to the year 1991. The first HSR services started in 1992.

The methodologies to take inhabitants dates are different in Census and Register of Inhabitants but our interest is focused in growth, not in total inhabitants, to do a comparative analysis. So this difference is not relevant.

The work analyse three matters:

- The population growth of all cities or regions with HSR services compared with the population growth of all cities or regions without HSR services.
- The population growth of each city with HSR services compared with the population growth of all cities with/without HSR services and trend changes.
- The population growth of each city/region with HSR services compared with the population growth of all cities/regions with/without HSR services and trend changes.

The analysis of first matter present two problems. On the one hand, the list of cities with/without HSR services changes over time. This problem has been solved as follow. Each year has been considered with or without HSR services according to the number of months with HSR services. Only when the number of months is greater than six, the year is considered with HSR services. This is the year of change and, from this year, the all population of cities with HSR services increase. The indicator selected to show the population growth is:

$$IC_{n+1} = \frac{P_{n+1} + P_n}{P_n} IC_n$$

Where P is the population in year $n+1$ or n and IC is the Index of growth in year $n+1$ or n . The year 1991 has been established as a 100 base, that is, $IC_{1991}=100$ for all variables. Besides, the population according to the “Register of Inhabitants” is the population on date of first of January of each year. So the indicator IC calculated with this data show the growth produced the previous year. The last IC calculated is for growth of 2015 year.

When a year is a year with new cities with HSR services, the all population of cities with/without HSR services are recalculated.

On the other hand it exist the problem of metropolitan areas. Often, the city centre of these areas are urban saturated municipalities. For example, Madrid or Barcelona have the area of their municipal territory saturated by urban uses from a long time. Consequently, they cannot increase urban areas and they cannot increase population into their municipal areas (or the growth is very conditioned). This geographical condition breaks the relationship between population growth and HSR services.

In addition, the geographical areas of metropolitan areas changes over time when commuting travels increased and new areas or municipalities are integrated into it (Feria et al, 2016). This work, to solve this problem, include two analysis. The analysis with the population growth of cities and the analysis with the population growth of provinces where are located the cities that are city centre of any metropolitan area. The provincial area is an approximation of metropolitan area where, usually, there are adequate free zones for urban expansion and, thus, the urban saturated effect is eliminated. Certainly, their total population isn’t the population of metropolitan area but the index of population growth is representative for the metropolitan population growth.

4. Results

4.1 Population growth of all cities with HSR services versus all cities without HSR services Table

Table 3 shows the evolution of Population Growth Index of all cities with HSR services, all Spain and all cities without HSR services. The graphic show that the cities without HSR services have a Growth Index (IC or *Indice de Crecimiento* in Spanish) similar to Spain while the cities with HSR services have a much smaller IC, even decreasing between 1991 and 2000. Only in two last years of the series, 2014 and 2015 after 22 years started first HSR services, there is a change of trend: cities with HSR services increases growth while cities without HSR services decreases growth.

However, as mentioned above, the result may be erroneus due to urban saturation of the municipalities that are central nucleus of metropolitan areas. Next point explain the results considering metropolitan areas.

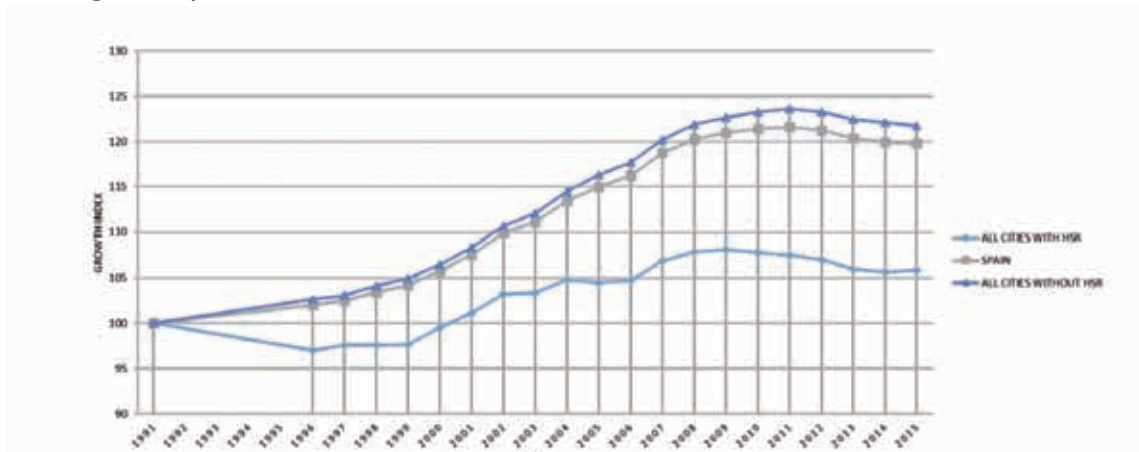


Table 3. Population Growth Index of cities with/without HSR and Spain.



4.2 Population growth of all cities and metropolitan areas with HSR services versus all cities and metropolitan areas without HSR services

Table 4 shows the evolution of Population Growth Index of all cities and metropolitan areas with HSR services, all Spain and all cities without HSR services. Remember that metropolitan areas have been assimilated to the provinces where they are located. The list of metropolitan areas considered as provinces is: Alacant, Barcelona, Córdoba, Madrid, Málaga, Sevilla, Tarragona, València, Valladolid and Zaragoza. Obviously these provinces accumulate a large part of the population of Spain.

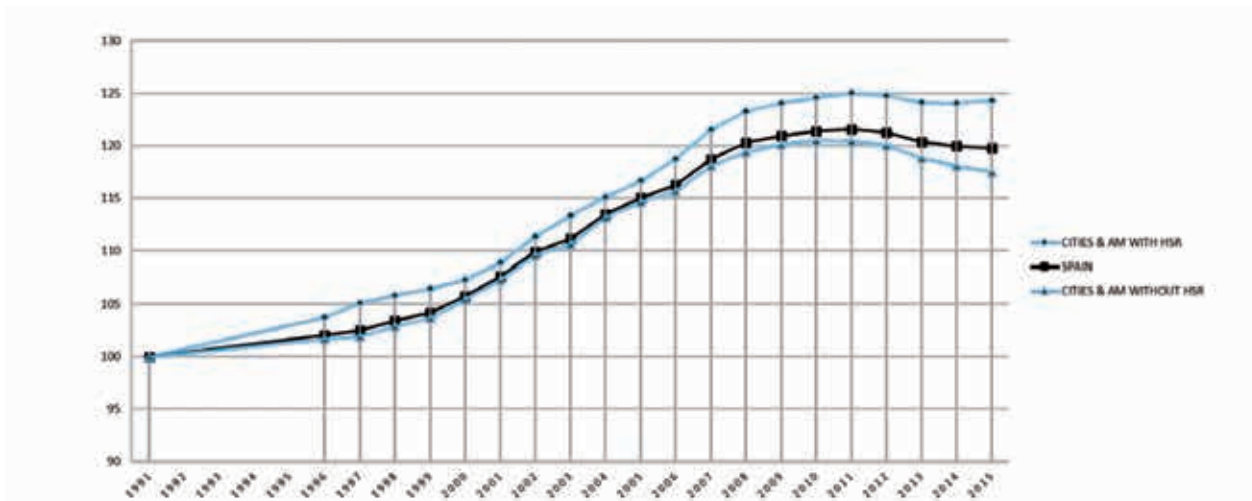


Table 4. Population Growth Index of cities and metropolitan areas with/without HSR and Spain.

This table is contradictory with the previous one. In this case cities and metropolitan areas with HSR services show a growth greater than Spain and cities without HSR services. However the differences aren't significant except in last period. The growth of cities and MA without HSR services is the same as that of Spain until about 2010. After 2010 these cities and MA have had a smaller growth than the one of Spain.

On the other hand, cities and MA with HSR services, from about 2006, have had a growth greater than the one of Spain. However, from about 2011, the differences of growth between cities and MA with or without HSR services increase significantly. The data seem to show that, during the period of the economic crisis, cities and MAs with HSR respond better and increase their relative growth relative to those without HSR.

The question is: Has the greatest growth been caused by the HSR services? Or rather, has the HSR served to reinforce a global trend of expansion of metropolitan areas produced by other causes?

Probably the correct answer is the second because of different studies about metropolitan areas show that metropolitan areas are expanding all over the world, also in Spain (Vheeler, 2008; Feria, 2016).

4.3 Population growth of each city with HSR services

Now the paper starts the analysis of population growth of different cities with HSR services from start to finish. The first HSR services started in 1992 in the cities of Sevilla, Córdoba, Puertollano, Ciudad Real and Madrid. Table 5 shows the Growth Index of these cities and general Growth Index for all cities with/without HSR services and Spain.

As you can see, only the city of Ciudad Real has an IC that stands out above the rest. Surprisingly Madrid and Sevilla have a very low IC over the period and decreasing from about 2011. Their IC trends are less than general dynamic for all cities, both those with HSR services and those who do not. In any case, the city of Puertollano has a decreasing trend of the index, despite being located very close to Ciudad Real.

In two last years, 2014-2015, Madrid changes the trend according to general evolution of all cities with HSR services and increase the IC. By contrast, Sevilla continues decreasing its CI. Sevilla increase its IC between 1991 and 2002. From the year 2002, its IC has been steadily decreasing.

Maybe, in the case of Ciudad Real, this city joins the metropolitan area of Madrid because new HSR services allows commuters travels. By contrast, Sevilla shows that new infrastructures are necessary but not sufficient condition to economic development.

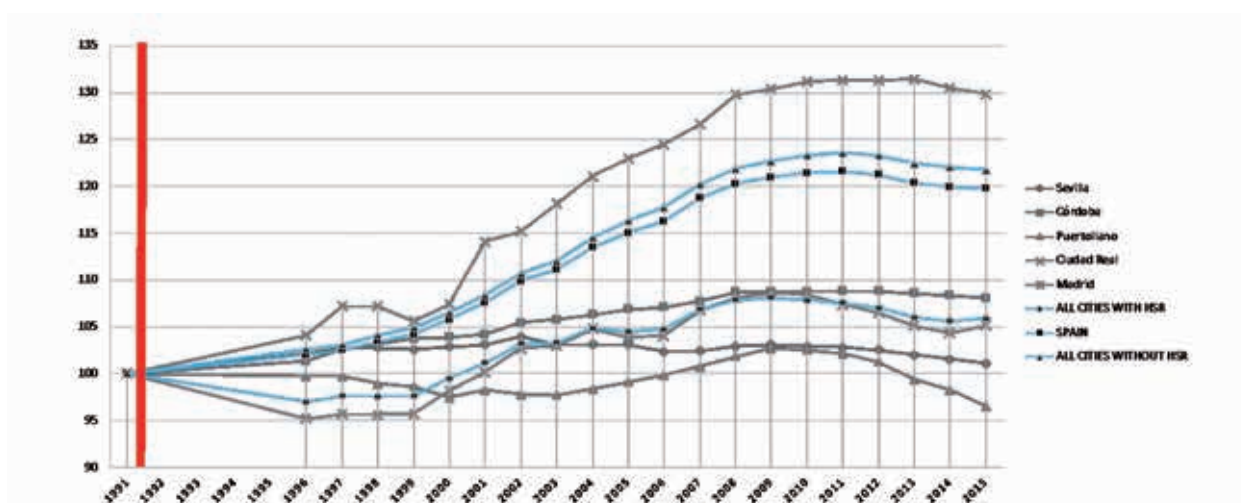


Table 5. Population Growth Index of cities that started HSR services in 1992.

Table 6 shows the evolution of IC of Guadalajara, Calatayud, Zaragoza, Lleida, Tardienta and Huesca cities when HSR services started in 2004. This table shows the case of Guadalajara as a case similar to Ciudad Real. From 2004, the growth of IC of Guadalajara is very high. Curiously, this is a special case because HSR station of Guadalajara is very far of Guadalajara city and most of the rail travel between Guadalajara and Madrid is done by conventional train, not by HSR services. Again, the most probable cause of this growth is the integration of Guadalajara in the Metropolitan Area of Madrid.

The case of Lleida is similar. The increase of IC of Lleida is greater than cities with HSR services from about 2008, when started HSR connection with Barcelona. Therefore, it is possible to understand that Lleida joins to the Metropolitan Area of Barcelona about this date. Maybe it is also the same case of Huesca with respect to Zaragoza. Nevertheless, the city of Calatayud, located near to Zaragoza, has an erratic evolution.

Tardienta is a special case because of is a city with a very low population (about 1.000 inhabitants) and HSR station built for other reasons.

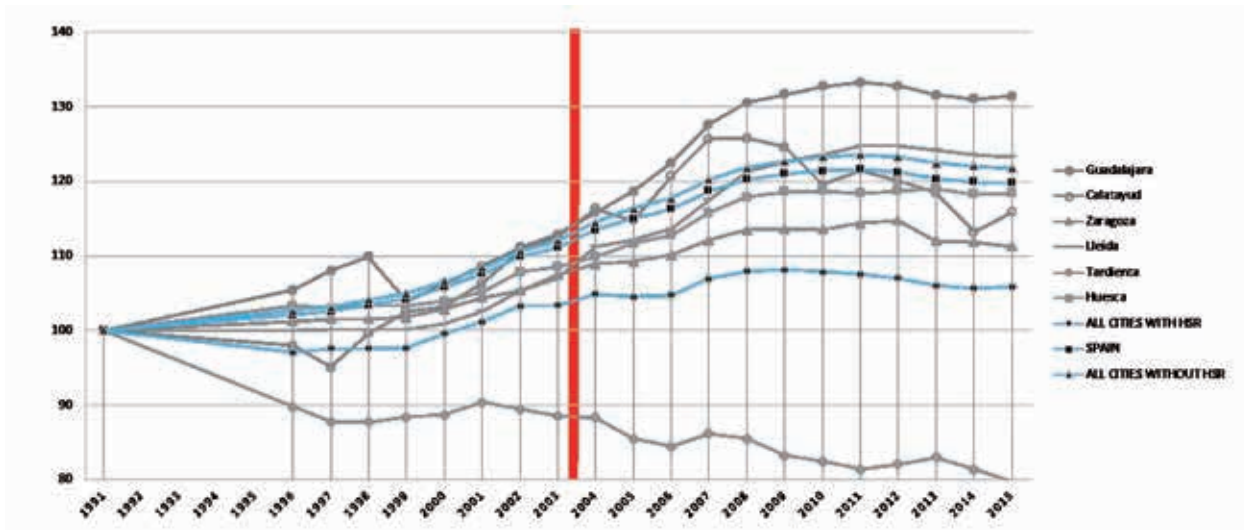


Table 6. Population Growth Index of cities that started HSR services in 2004.

Table 7 shows the case of Toledo city. This case is similar to Ciudad Real city, but you can see that the process of integration in Metropolitan Area of Madrid started before HSR services began. Therefore, in this case, HSR services has helped to join Toledo in the MA of Madrid.

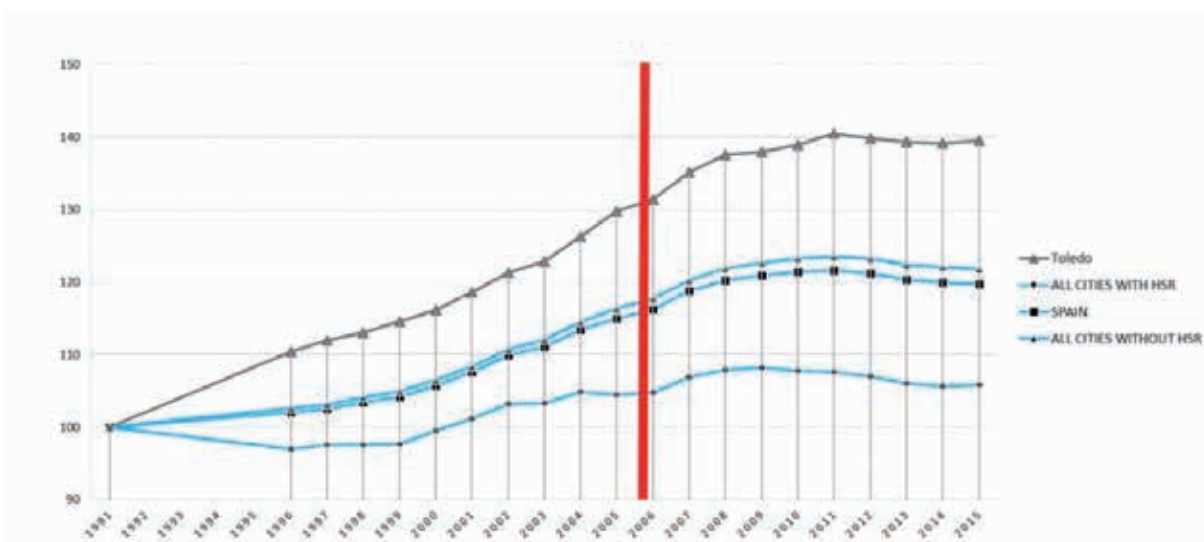


Table 7. Population Growth Index of cities that started HSR services in 2006.

Table 8 shows the cases of cities of Puente Genil, Antequera and Tarragona where HSR services started in 2007. To understand these cases is difficult, especially the case of Tarragona. Puente Genil and Antequera are two cities with low population (between 25.000 and 50.000 inhabitants) and little changes of population can produce large changes in IC. However, Tarragona city is near to Barcelona. The period 2003-2009 seems to show an integration process in Metropolitan Area of Barcelona but from 2010 the trend changes to decreasing.

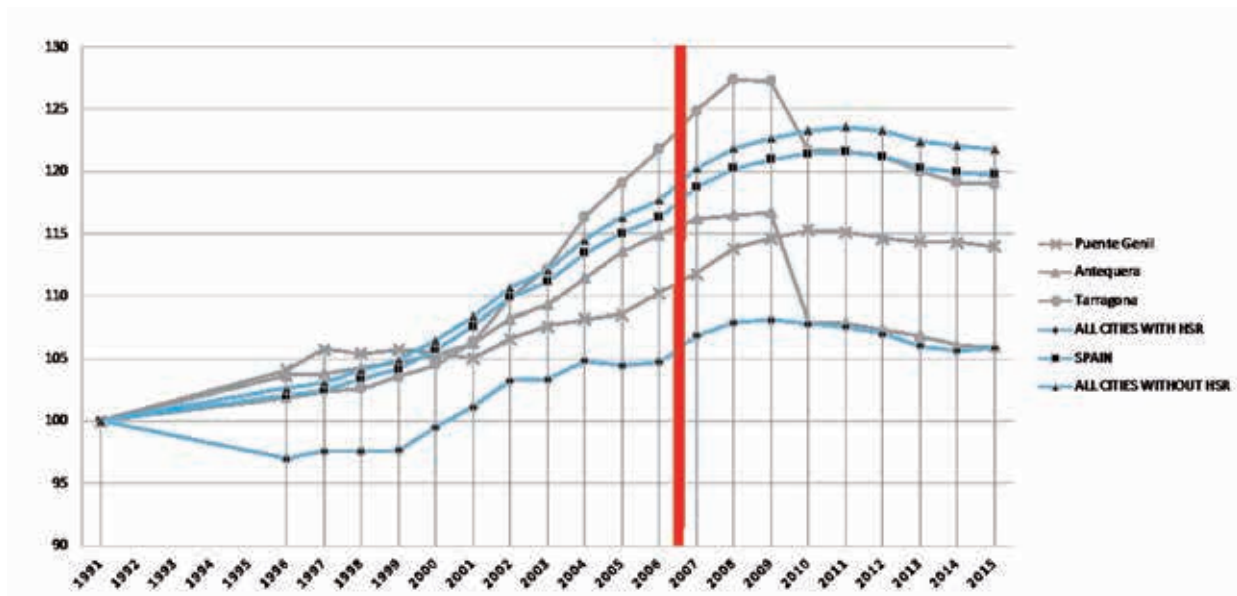


Table 8. Population Growth Index of cities that started HSR services in 2007.

Table 9 shows the cases of cities of Málaga, Segovia, Valladolid and Barcelona where HSR services started in 2008. The evolution of IC shows that Segovia and Valladolid, by contrast with Guadalajara, Toledo and Ciudad Real, not joins to Metropolitan Area. Segovia and Valladolid shows a decreasing trend of IC, especially after HSR services began in 2008.

Barcelona city shows a stabilised situation, maybe because of urban saturated effect. Málaga presents a trend of stable IC that does not change with the beginning of HSR services.

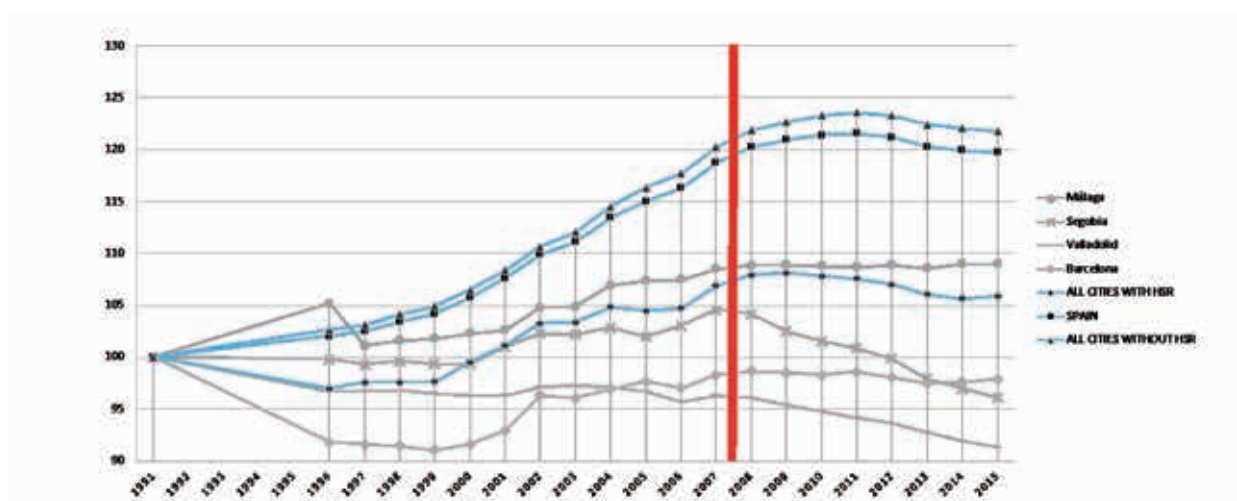


Table 9. Population Growth Index of cities that started HSR services in 2008.



Table 10 shows the cases of cities of Cuenca, Requena and València where HSR services started in 2011. The IC trend of Cuenca is similar to Guadalajara, Toledo and Ciudad Real. The process of increasing IC began about 2003 before HSR services started. Probably is a process of joining with Metropolitan Area of Madrid. From 2011, trend change and IC decrease.

València city present a trend similar to all cities without HSR services.

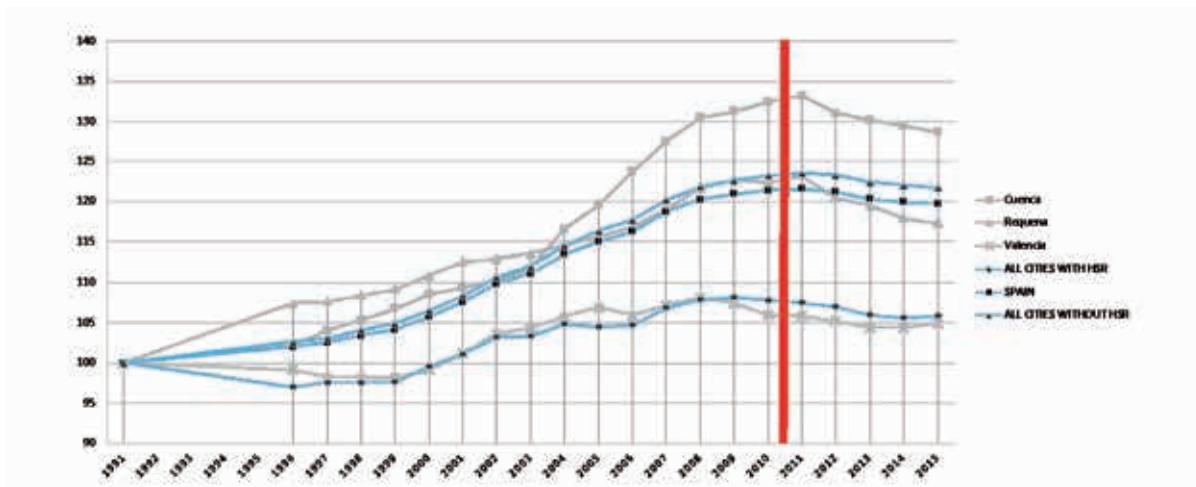


Table 10. Population Growth Index of cities that started HSR services in 2011.

Finally, Table 11 shows the cases of cities of Girona, Figueres, Albacete, Villena and Alacant where HSR services started in 2013. Except the case of Villena, all the other cities present ICs trend similar to cities in process of metropolitan integration: Girona and Figueres with Barcelona and Albacete with Alacant or Madrid. In all cases, the process of metropolitan integration started long time before HSR services began.

Alacant is the only metropolitan city centre that has an IC trend above the IC of Spain, all cities with HSR and all cities without HSR.

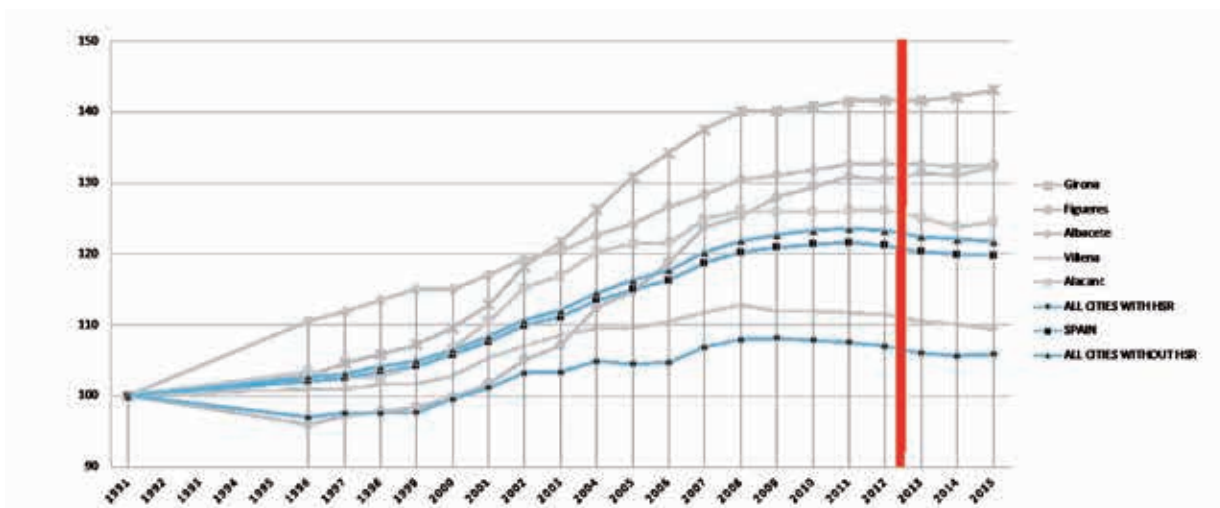


Table 11. Population Growth Index of cities that started HSR services in 2013.

4.4 Population growth of each city and metropolitan areas with HSR services

Now I show the ICs trend with provincial population in the cases of cities that are city centre of metropolitan areas (MA): Alacant, Barcelona, Córdoba, Madrid, Málaga, Sevilla, Tarragona, València, Valladolid and Zaragoza.

Table 12 shows the cases of cities and MA of Sevilla, Córdoba, Puertollano, Ciudad Real and Madrid where HSR services started in 1992. In this table, the IC trend of metropolitan area/province of Madrid is similar to the IC trend of Ciudad Real city. This fact is more coherent with the economic dynamic of metropolitan area of Madrid and more reasonable that the IC trend of Madrid city showed in table 5. In addition, if Ciudad Real city is integrating in metropolitan area of Madrid then is reasonable that both have the same IC trend. Note you also that in last two years of 2014 and 2015, the IC trend of MA of Madrid change to increasing. In fact, during economic crisis period of 1991-1996, IC of MA of Madrid increase but not very much. During the economic expansion period of 1997-2006, the IC trend increase significantly. When started the economic crisis in 2007, the IC trend of MA of Madrid change to stopping and from 2013, the IC trend now change to increasing it. This IC trend is general to cities & MA with HSR services while cities & MA without HSR services maintain the IC trend to decreasing.

The MA of Sevilla shows a period from 1991 to 1999 with a high IC trend. However, from 2000 to 2009 (economic expansion period), its IC trend is lower than that of Spain and all cities with or without HSR services. That is, the HSR services did not produce better economic development than other cities or MA of Spain. Only from 2010, in the economic crisis period, the IC trend changes and moves to values similar to Spain but always lower than values of all cities & MA with HSR services. This analysis, as in previous point 5.2 for Sevilla city, shows again that new infrastructures are necessary but not sufficient condition to economic development.

The same case is the case of MA of Córdoba. In this case the calculus of IC has been done with the population of province/MA of Córdoba. The results show an IC trend very lower than Spain or all the other cities & metropolitan areas.

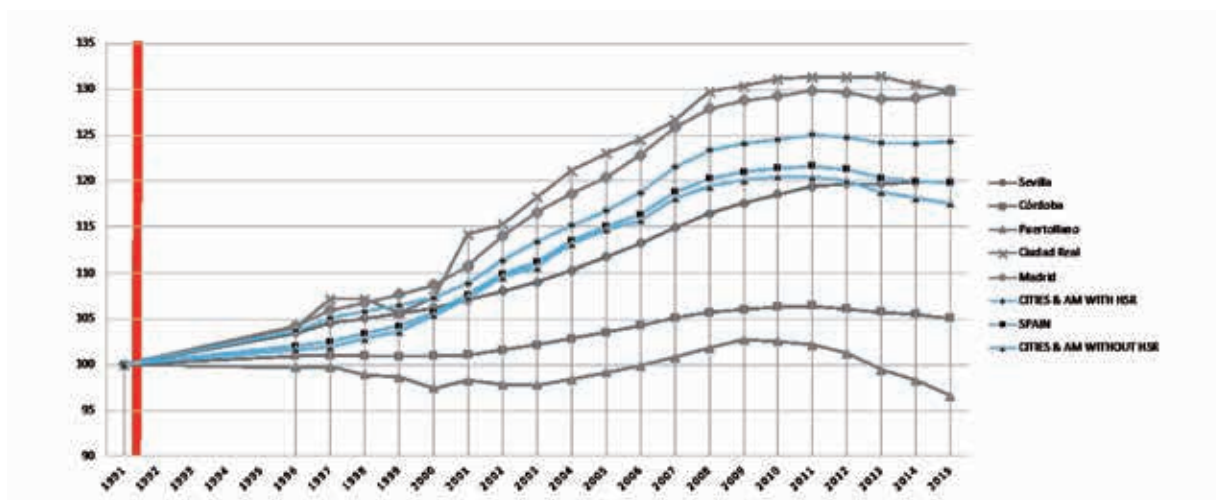


Table 12. Population Growth Index of cities/metropolitan areas that started HSR services in 1992.



Table 13 shows the cases of cities and MA of Guadalajara, Calatayud, Zaragoza, Lleida, Tardienta and Huesca where HSR services started in 2004. In this case the metropolitan area of Zaragoza shows a IC trend parallel and next to trend of Spain and cities & MA without HSR services but always lower than its. Again it is the same case of Sevilla and Córdoba.

The results about Guadalajara are the same that in previously analysis. Also in the case of Calatayud with a chaotic trend that not shows any integration process in metropolitan area of Zaragoza. Also the results are the same in the case of Lleida.

Huesca has a trend similar to all cities and MA without HSR services. The case of Tardienta already is commented previously.

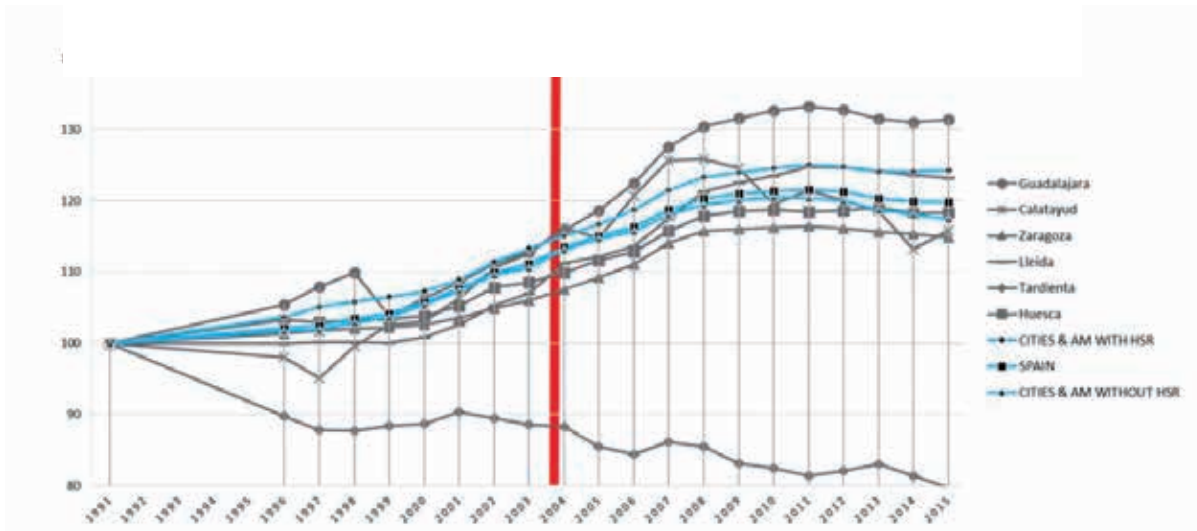


Table 13. Population Growth Index of cities/metropolitan areas that started HSR services in 2004.

Table 14 shows the case of Toledo where HSR services started in 2006. This new table not shows anything new respect to previously analysis.

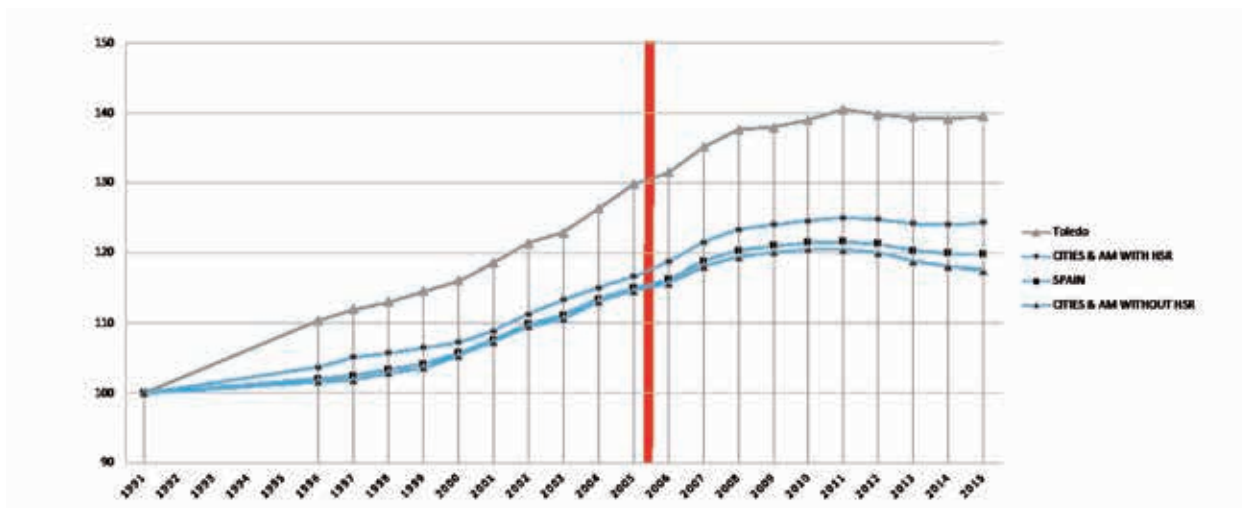


Table 14. Population Growth Index of cities/metropolitan areas that started HSR services in 2006.

Table 15 shows the cases of cities and MA of Puente Genil, Antequera y Tarragona where HSR services started in 2007.

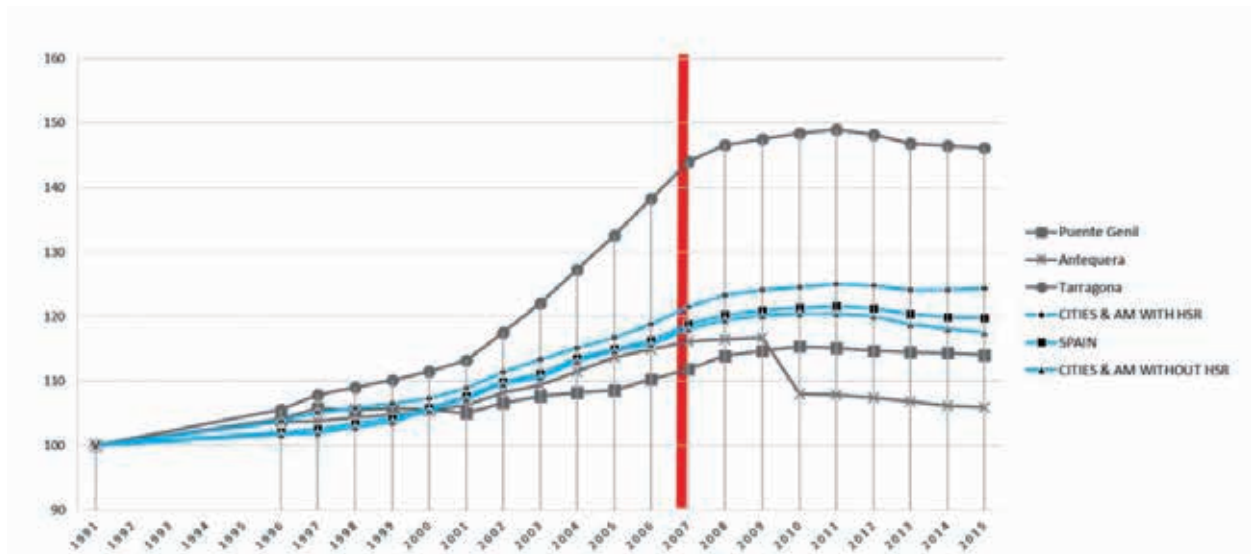


Table 15. Population Growth Index of cities/metropolitan areas that started HSR services in 2007.

Puente Genil and Antequera not show an increasing trend of their ICs after started HSR services. Tarragona shows a very growth of IC from 2000 to 2007 (economic expansion period), before HSR services started. After the HSR services started (economic crisis period), the increase of IC stopped to final of series. We can understand these results as the process of integration in metropolitan area of Barcelona stopped.

Table 16 shows the cases of cities and MA of Málaga, Segovia, Valladolid and Barcelona where HSR services started in 2008. In this case the MA of Málaga shows the greater IC increases over all economics periods before and after HSR services. By contrast, Segovia city and MA of Valladolid have the lowest IC trend. Your attention in fact that Segovia and Valladolid are located on the north of Madrid to similar distance as Guadalajara, Toledo or Ciudad Real. So, the IC trends of Segovia and Valladolid show that these cities aren't in process of integration in MA of Madrid. Particularly, Segovia show an IC decreasing especially from HSR services started in the city in period of economic crisis.

Interesting is the case of province/MA of Barcelona. The IC of Barcelona show a trend parallel to all cities with HSR services from about 1997 but more low in about 5-7 points always. Also the IC of MA of Barcelona is always lower than all the other cities and MA. From 2008, the IC stopped according to general trend of cities and MA with HSR services. This form maybe explains the IC forms of Lleida and Tarragona which also stopped its IC increases from 2008. The MA of Madrid also shows the stopped trend of IC from 2008, however the initial IC of Madrid in this period is greater than the IC of Barcelona. The begin of HSR in 2008 not produced an increase of economic activity in Barcelona, Tarragona and Lleida. However, as other cities/MA with HSR services, the two last years changed the trend increasing IC.

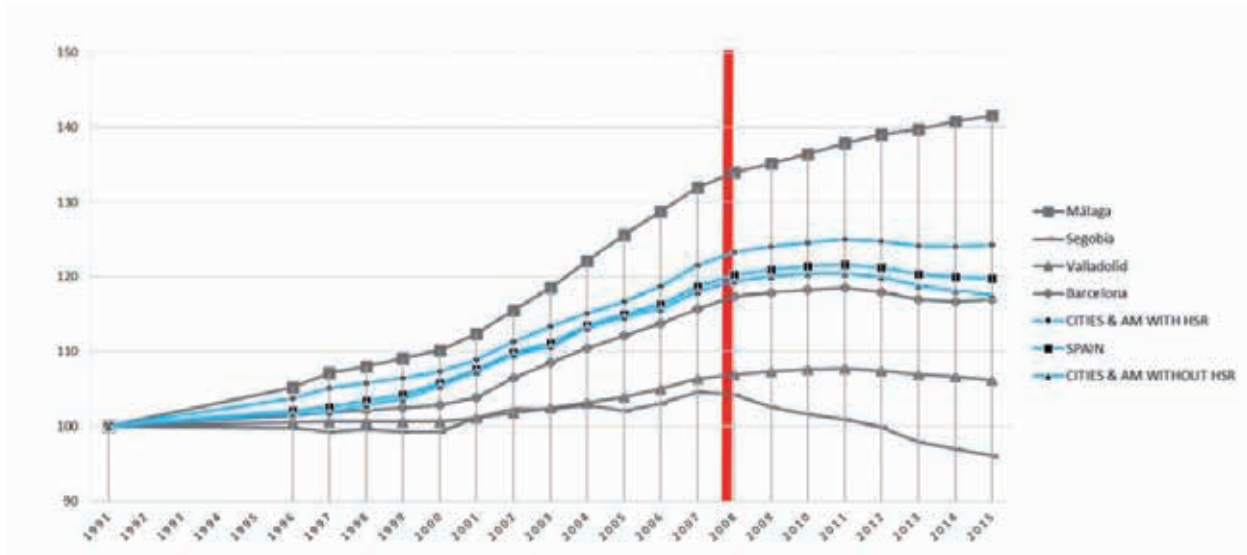


Table 16. Population Growth Index of cities/metropolitan areas that started HSR services in 2008.

Table 17 shows the cases of cities and MA of Cuenca, Requena and València where HSR services started in 2011. As you can see, the case of Cuenca is similar to Guadalajara, Todelo or Ciudad Real with a period of high IC increasing from 1997 to 2008 before HSR services started. From 2009, the IC change to decreasing especially after HSR started.

The MA of València show a trend of IC very similar to general of Spain with an increasing period until 2011, when HSR started, and a decreasing period after. HSR services not show effects in economic development.

Requena is a town with about 20.000 inhabitants and have an evolution of IC independent of HSR services. It has an important increasing period from 1991 to 2004 greater than Spain. After, from 2005 to 2015 the evolution of it IC is similar to Spain with an increasing period to 2010 and a decreasing period to 2015. The begin of HSR services in 2011 not help to Requena to integration in MA of Valencia.

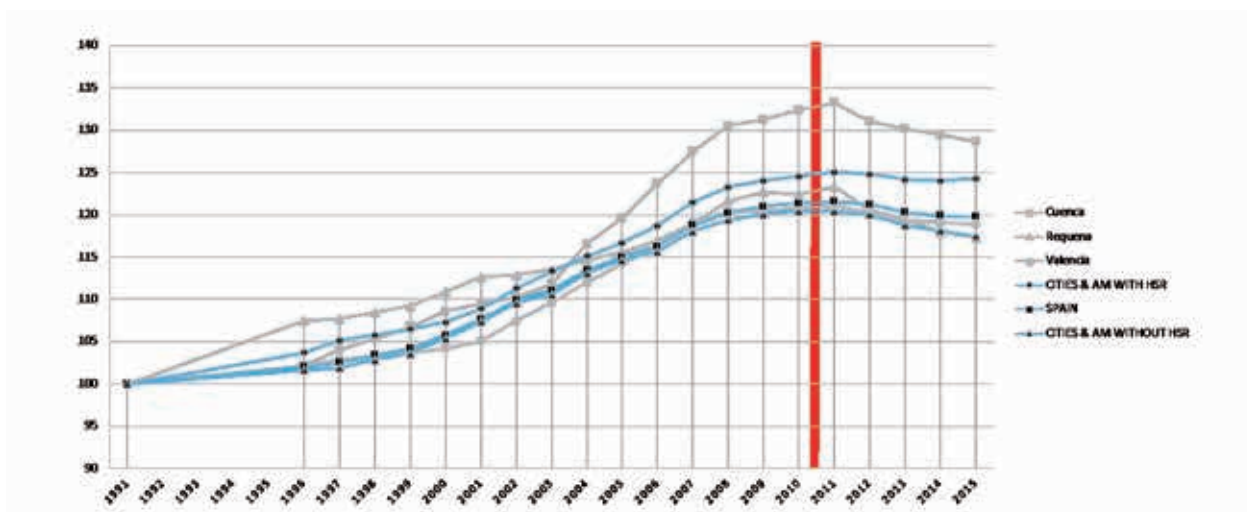


Table 17. Population Growth Index of cities/metropolitan areas that started HSR services in 2011.

Finally, table 18 shows the cases of cities of Girona, Figueres, Albacete, Villena and the MA of Alacant where HSR services started in 2013. In this case, the MA of Alacant or better Alacant/Elx shows a high increasing period of its IC until 2007, very greater than Spain or all other cities with or without HSR services and before HSR services started. On the other hand, similar to Barcelona, Madrid or Valencia, IC stopped from 2008. The begin of HSR services in Alacant/Elx not shows a change of trend.

Girona shows a trend similar to Lleida and Tarragona with a period of high increasing of IC until 2007, before HSR services started. Also Figueres that maintain the increasing of IC after 2008 despite to start the period with IC minor than 100. Therefore, the cities of Lleida, Tarragona, Girona and Figueres show trends similar that indicates a process of integration with Barcelona. Girona and Figueres show, as a Barcelona, a trend change in two last years of series.

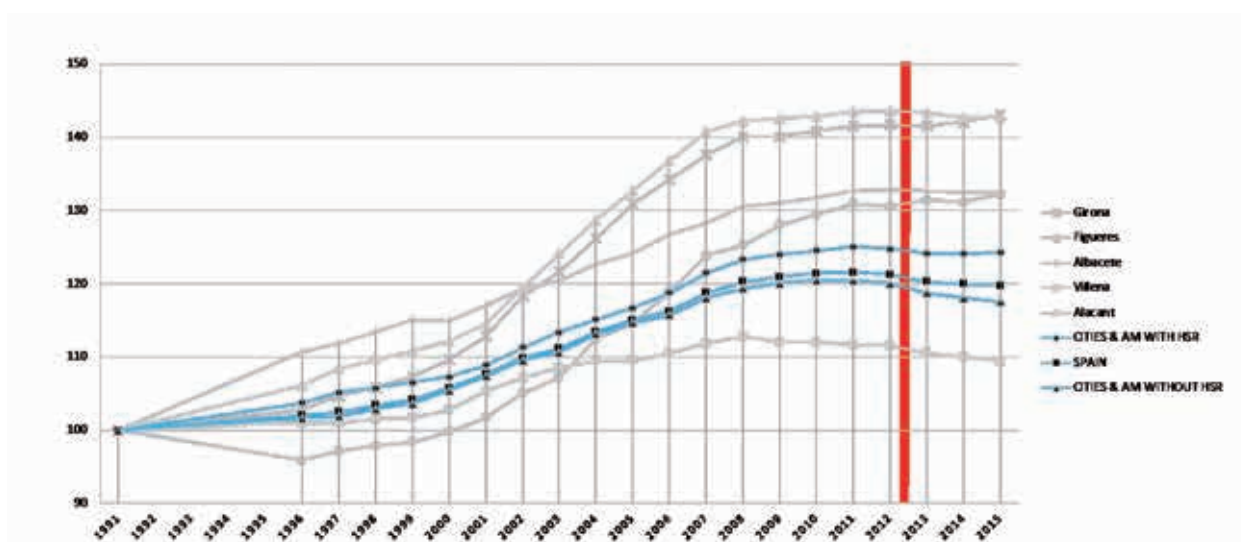


Table 18. Population Growth Index of cities/metropolitan areas that started HSR services in 2013.

Villena, a city of about 35.000 inhabitants shows a trend lower than Spain and other cities. This fact indicates that not exist a process of integration in MA of Alacant/Elx.

Albacete show a trend significantly greater than Spain or other cities however is very fast of Madrid and, consequently is not reasonable to think that it is in process to integration on MA Madrid. Respect to the MA of Alacant/Elx, Albacete is more fast than Villena is, consequently the process of integration in MA of Alacant/Elx must be previous for Villena. On the other hand, Albacete not shows trend changes after HSR services started.

5. Conclusions

According to the analysis can make the following conclusions:

- All cities and metropolitan areas have their own economic dynamics usually independent of HSR services. HSR services can help these dynamics but not necessarily. Therefore, HSR services is not synonym of economic progress.
- It is possible to identify different kind of IC dynamics for different cities and metropolitan areas.
- The metropolitan areas that always present a positive trend of IC higher than Spain



or other cities and metropolitan areas are Madrid (HSR 1992), Málaga (HSR 2008) and Alacant/Elx (HSR 2013). Probably Madrid has benefited from radial network because of all the connections go through Madrid.

- Guadalajara (HSR 1992), Toledo (HSR 2006), Ciudad Real (HSR 1992) and Cuenca (HSR 2011) show trends of IC that indicates an integration process in MA of Madrid. These processes began before HSR services started. By contrast, this process has not been carried out either in Segovia (HSR 2008) or Valladolid (HSR 2008) with similar location on the north of Madrid.
- Lleida (HSR 2004), Tarragona (HSR 2007), Girona (HSR 2013) and Figueres (HSR 2013) show trends of IC that indicate integration process in MA of Barcelona. These processes began before HSR services started.
- The HSR services have not generated an economic development of metropolitan areas of Sevilla (HSR 1992) and Zaragoza (HSR 2004).
- The case of IC trend of MA of València is more similar to MA of Barcelona than MA of Madrid.
- The most important increases of IC were produced in period 1997-2007 for Ciudad Real city, MA of Madrid, Guadalajara city, Toledo city, MA of Tarragona, MA of Málaga, Cuenca city, Girona city, Figueres city, Albacete city and MA of Alacant/Elx with or without HSR services. The tables show that, in general, the date on HSR started is independent of the process of increasing IC. The IC increasing process of the MA of Barcelona in this period is smaller.
- The HSR services is likely to help some cities in their integration process in nearby metropolitan areas: Ciudad Real, Toledo, Guadalajara and Cuenca in the MA of Madrid; Lleida, Tarragona, Girona and Figueres in the MA of Barcelona. In contrast Segovia and Valladolid do not have this integration process.

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