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**Monthly Demographic Now Cast: monthly estimates of the migration flows in Spain**

Miguel Ángel Martínez Vidal

Sixto Muriel de la Riva

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## **Abstract**

The Monthly Demographic Now Cast has the goal of covering a traditional lack of information about the demographic juncture. Besides, it is a very innovative statistical action, which introduces a new monthly basis in demographic analysis and shows a high level of accuracy immediately after the reference period. Particularly, its results are decisive in providing advanced estimates of current migration flows for the calculation of Spain's Population Now Cast.

## **Keywords**

Monthly demographic estimations; immigration; emigration; expanding coefficient; registered flows

## **Authors and Affiliations**

Miguel Ángel Martínez Vidal y Sixto Muriel de la Riva

Directorate of Population Statistics, National Statistics Institute of Spain

# Monthly Demographic Now Cast: monthly estimates of the migration flows in Spain

**Miguel Ángel Martínez Vidal and Sixto Muriel de la Riva**

*Directorate of Population Statistics, National Statistics Institute of Spain*

## **Abstract**

*The social and political demands of information about the current evolution of population has increased with a dizzy rhythm in the last years in Spain. Such exceptionality is deeply determined by the extraordinary intensity of the foreign immigration flux since the end of the nineties, which has greatly altered our own demographic structure and behaviours.*

*In this new context characterized by a great interest in the demographic progress and its socioeconomic impact, INE-Spain has carried out a new statistical project, called Monthly Demographic Now Cast. This product is focused on improving the catalogue of demographic information provided to society covering the most recent time period and, at the same time, putting a genuine monthly basis into demographic analysis. It is very innovative for demography but traditional in economy field.*

*The aim of Monthly Demographic Now Cast is to provide advanced estimates of demographic events (births, deaths, marriages and migrations) happened in recent months, based on partial information about registered events in original sources and completed with information from other statistical sources, if necessary. Precisely, regarding to Monthly Demographic Now Cast on migrations, an accurate estimate of monthly migration flows are provided only two month after the reference date.*

*With respect to methodology, we can assert that the own nature of these monthly demographic estimates has nothing to do with classic and traditional techniques of demographic analysis and prospecting, because they are mainly based on measuring certain regularities in administrative information circuit from original sources to INE databases. Opposite the apparent randomness of administrative process, the designed methodology betrays itself extremely robust.*

*Nowadays, Monthly Demographic Now Cast has become an essential element of the Spanish demographic system, especially in the calculation of Spain population figures (Population Now Cast) with updated information about recent demographic evolution. In fact, INE-Spain is now pioneering in the dissemination, through this statistical action, of timely estimates of monthly migration flows along the current year in the international statistics framework.*

## 1 Introduction

The National Statistics Institute of Spain (INE) began the development of a new statistical action with the aim of breaking the traditional lack of information about demographic juncture: the Monthly Demographic Now Cast. This new project appears into a framework of several statistical initiatives which have the common intention of improving the demographic information provided to society, in a context of growing interest for the evolution of population. Nowadays, this interest is deeply marked by the uncertainty about current demographic evolution, specially in terms of international migrations, and by the impact over the future feasibility of our welfare systems.

Besides, Monthly Demographic Now Cast supposes a very innovative statistical product in the field of demography, because it introduces a monthly basis in analysis, which is usual in economy statistics, but absolutely genuine in demographic scope.

Monthly Demographic Now Cast project has the goal of making the continue monitoring of current demographic evolution possible, through the monthly estimation of the incidence of demographic phenomena: fertility, mortality, nupciality, on one hand, and migrations, on the other hand. These are two groups of phenomena which have very different nature, spite of being clearly interrelated. In addition, the corresponding primary information sources for each group are very different too: Vital Statistics, in case of fertility, mortality and nupciality and the Municipal Population Registers, in case of migration.

The obvious distinction between the two kinds of demographic events leads to a necessary division of the original project into two subprojects: the Monthly Demographic Now Cast of fertility, mortality and nupciality, based on the information circuit of Vital Statistics, and Monthly Demographic Now Cast of migrations, based on the information circuit of the management of Municipal Population register, centralized by INE.

## **2 Needs for the development of Monthly Demographic Now Cast**

Monthly Demographic Now Cast lets INE give an answer to present needs and demands with relation to the monitoring and observation of current demographic evolution:

1. Firstly, the changeable demographic reality of Spain, especially referred to migrations flows, supposes an added difficulty in the development of current population estimates and projections of future population. In fact, the most precise estimation of the current demographic evolution determinates the accuracy of the population estimates and the relevance and usefulness of every population projection exercise.
2. Clearly, the more effective way of achieving this aim is getting a maximum reduction in the deadline of availability of the information about recent incidence of every demographic phenomena. In other words, the present delay in dissemination of Vital Statistics and available data on migration flows respect to the reference date are totally insufficient in the actual context. The improvement of the timetable of demographic information availability is the principal added value given by Monthly Demographic Now Cast.
3. Against these needs, someone could allege a lower interest for demographic analysis in a monthly basis. However, we should not look for the relevance of the Monthly Demographic Now Cast in the intrinsic value of the monthly data, but in the necessity of having instruments which allows us to monitor the current demographic evolution. Thus, they become essential in building accurate population estimates and better foreseeing the next future.

### **3 General objectives of Monthly Demographic Now Cast project**

Taking into account these premises, the main objectives of the Monthly Demographic Now Cast project can be concreted in the following items:

1. To give monthly estimates of the demographic events (births, deaths, marriages and migrations) happened along the current year with a minimum delay respect to the reference month.
2. To break down the total number of events by regions and provinces and by some basic demographic variables (age, sex, citizenship, country of birth, etc.).
3. To calculate a collection of classic demographic indicators, according to a mobile basis of 12 month period, which shows any incidental deviation or progressive change in demographic juncture.

## 4 Methodology

The own nature of Monthly Demographic Now Cast methodology has nothing to do with the classic demographic estimation and projection practices. On the contrary, it has a more simple foundation: the time regularity in the management and treatment of information about happened demographic events, from their administrative original sources (Civil Registers and municipalities) to their arrival to INE central data bases.

Thus, in general, the estimation, in a given moment, of the total number of events happened in a given month (*reference month*) is developed through the number of events happened during this reference month received in INE database until the estimation time and an *expanding coefficient*. This *expanding coefficient* is based on the regularity in the delay of the arrival of such information to INE databases. In other words, it reproduces the rhythm of the arrival of information of the previous year to the events received during the current one.

Before describing all the technical details and other statistical solutions of this methodology, it can be asserted that this simple approach shows itself as very robust, taking into account that few time after the reference month (only one month, in case of migrations), the number of happened demographic events not received in INE databases is very low and, anyway, decreasing with the delay in arrival of this information. Hence, other important feature of this new statistical action could be emphasized: the estimation error is decreasing with the delay between the reference month and the date of estimation, so Monthly Demographic Now Cast are convergent with definitive counts of demographic events.

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### 4.1 Monthly external immigration flow

As mentioned before, Monthly Demographic Now Cast of immigration flows keeps the new registrations in Local Population Register (*Padrón*) identified as entries into Spain like original source, since every month INE receives from every Municipality the variations<sup>1</sup> that have occurred in its *Padrón*.

Therefore, a key aspect, sometimes not trivial, and previous to the estimation procedure, is the identification of what kind of new registrations represents real external immigration movements. In fact, new registrations *by change of residence from abroad* are completed with new registration *by omission* of foreigners, in which the foreign individual have arrived from abroad before, but the country of origin is missing.

Then, the variable **delay** is defined as the number of month that the information about a happened migration event takes in arriving to the central INE database

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<sup>1</sup> New registrations: by change of residence (from other municipality or country), births and omissions, withdrawals (by change of residence, deaths, duplicates, undue inclusions, expiry) and other modifications.

from the corresponding Municipality since the *reference month*. The total number of each kind of registration identified as immigration movements happened during the month  $m$  of the year  $a-1$  and the cumulative number of such variations received in central INE database until the month of *delay*  $r$  are noted by  $I_{m,a-1}$  and  $I_{m,a-1}^r$ , respectively. Therefore, the **expanding coefficient** corresponding to the month  $m$  of the year  $a$  for the *delay*  $r$  is obtained as follows:

$$CE_{m,a}^r = \frac{I_{m,a-1}}{I_{m,a-1}^r}$$

The following data show the calculation of the *expanding coefficient* used in the last February to estimate the immigration flow identified with one kind of *Padrón* variations (*change of residence from abroad* of foreign people):

**New registrations of foreign people (*change of residence from abroad*) in 2009**  
**Cumulative distribution by delay in arrival of information since the month of reference**

2009 TOTAL	Delay (in months)								
	0	1	2	3	4	5	6	7	
	$I_{m,2009}^0$	$I_{m,2009}^1$	$I_{m,2009}^2$	$I_{m,2009}^3$	$I_{m,2009}^4$	$I_{m,2009}^5$	$I_{m,2009}^6$	$I_{m,2009}^7$	
January	33505	9	31233	32817	33036	33132	33208	33259	33295
February	32670	20	30708	31999	32236	32305	32368	32420	32435
March	33336	26	30988	32503	32712	32845	32943	33010	33054
April	28670	23	26127	27879	28286	28416	28474	28519	28554
May	27836	22	24566	27017	27445	27528	27649	27769	27802
June	29656	29	26609	28887	29202	29414	29585	29611	29632
July	29044	20	22442	28205	28694	28874	28974	28994	29044
August	25458	2	22387	24797	25203	25328	25379	25458	25458
September	32979	16	29309	32204	32745	32842	32979	32979	32979
October	32699	12	30102	32140	32363	32699	32699	32699	32699
November	26310	17	24749	25885	26310	26310	26310	26310	26310
December	20973	7	18216	20973	20973	20973	20973	20973	20973

**New registrations of foreign people (*change of residence from abroad*) in 2009**  
**Cumulative distribution by delay in arrival of information since the month of reference**

8	9	10	11	12	13
$I_{m,2009}^8$	$I_{m,2009}^9$	$I_{m,2009}^{10}$	$I_{m,2009}^{11}$	$I_{m,2009}^{12}$	$I_{m,2009}^{13}$
33302	33322	33382	33437	33454	33505
32466	32565	32618	32640	32670	32670
33224	33274	33300	33336	33336	33336
28586	28598	28670	28670	28670	28670
27814	27836	27836	27836	27836	27836
29656	29656	29656	29656	29656	29656
29044	29044	29044	29044	29044	29044
25458	25458	25458	25458	25458	25458
32979	32979	32979	32979	32979	32979
32699	32699	32699	32699	32699	32699
26310	26310	26310	26310	26310	26310
20973	20973	20973	20973	20973	20973



**Expanding coefficient used in February 2010 in estimates of new registrations of foreign people (change of residence from abroad) happened in January 2010**

	Delay (in months)
2010	1
January	1,072743573

Then, being  $I_{m,a}^r$  the total number of such kind of new registrations identified as immigration movements happened during the month  $m$  of the year  $a$  received in central INE database until the month (*delay*)  $r$ , the estimate of the total number of immigration movements, registered by this kind of new variation, happened during the month  $m$  of the year  $a$ ,  $\hat{I}_{m,a}$ , is calculated as follows:

$$\hat{I}_{m,a} = CE_{m,a}^r \cdot I_{m,a}^r$$

And following the example for February 2010 estimates:

**New registrations of foreign people (change of residence from abroad) in 2010**  
**Cumulative distribution by delay in arrival of information since the month of reference**  
**Delay (in months)**

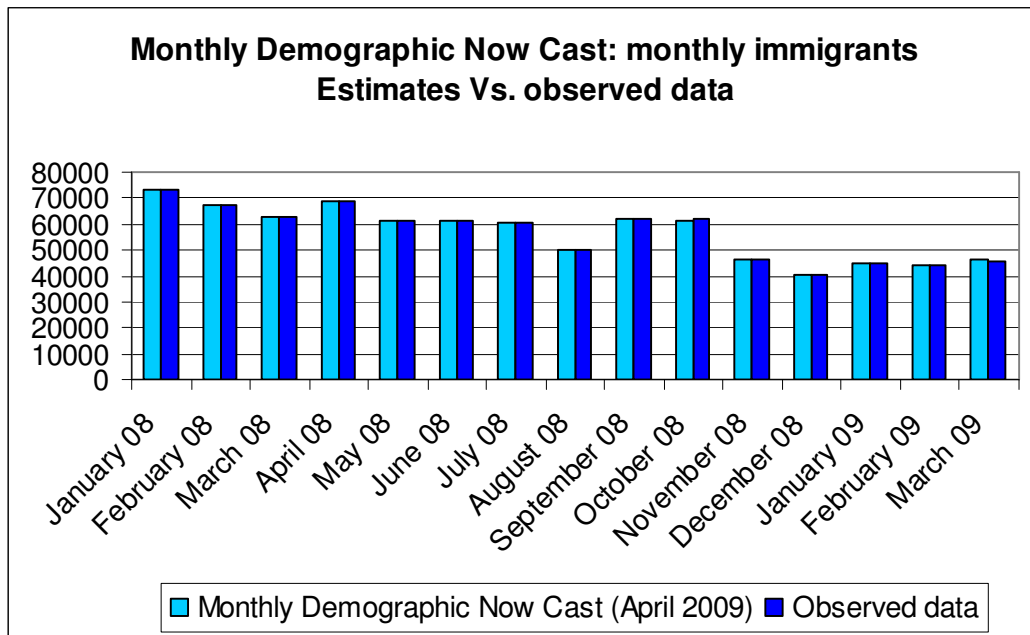
2010	TOTAL	1 <sup>a</sup>	2 <sup>a</sup>	3 <sup>a</sup>
Enero	22362		3	22362
Febrero		21	21	21

**February 2010 estimate of new registrations of foreign people (change of residence from abroad) happened in January 2010**

	Delay (in months)
2010	1
Enero	$I_{1,2010}^{*1}$ 23989

The results are considered accurate enough when the expanding coefficient is lower than five.

Besides, opposite the apparent randomness of administrative process, the designed methodology betrays itself extremely robust, keeping in mind that few months after the reference date most of events have been registered in INE databases. Furthermore, we should emphasize other decisive feature of these advanced estimates: the estimation error is decreasing with the gap between the reference month and the month of estimation. So Monthly Demographic Now Cast are convergent to definitive results of basic demographic statistics. For example, the negligible estimation error of 2008 and first quarter of 2009 monthly immigration flows provided by Monthly Demographic Now Cast in April 2009 can be appreciated in the following chart:



## 4.2 Monthly external emigration flow

Nowadays, the monitoring of external emigration phenomena represents the weakest point of the demographic statistics in Spain, like in other countries. The Monthly Demographic Now Cast strategy over the emigration phenomena starts by splitting up the total emigration flow in different kinds of flows, according to the type of variations in Municipal Population Register (Padrón) which they are associated with:

- a. Emigration flows to abroad declared in the *Padrón*.

- b. Emigration flows to abroad of foreign citizen registered in the *Padrón* through ex officio deregistrations done by municipalities.
- c. Emigration flows to abroad of non EU citizen without permanent resident permit registered in the *Padrón* through expiry procedure.
- d. Emigration flows of EU citizen not included in the previous group (non registered in the *Padrón*).
- e. Emigration flows of non EU citizen with permanent resident permit not included in the previous group (non registered in the *Padrón*).

The following items describes the estimation process for every type of emigration movement.

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#### 4.2.1 EMIGRATION FLOWS TO ABROAD DECLARED IN THE PADRÓN

The estimation method for this kind of flux is similar to the exposed one in case of monthly immigration flow, so monthly emigrants are obtained through the number of declared emigration flows in Municipal Registers happened during the reference month which have been received in INE database up to the time of estimation and a expanding coefficient that replicates the rhythm of arriving of such information from Municipalities during the year before.

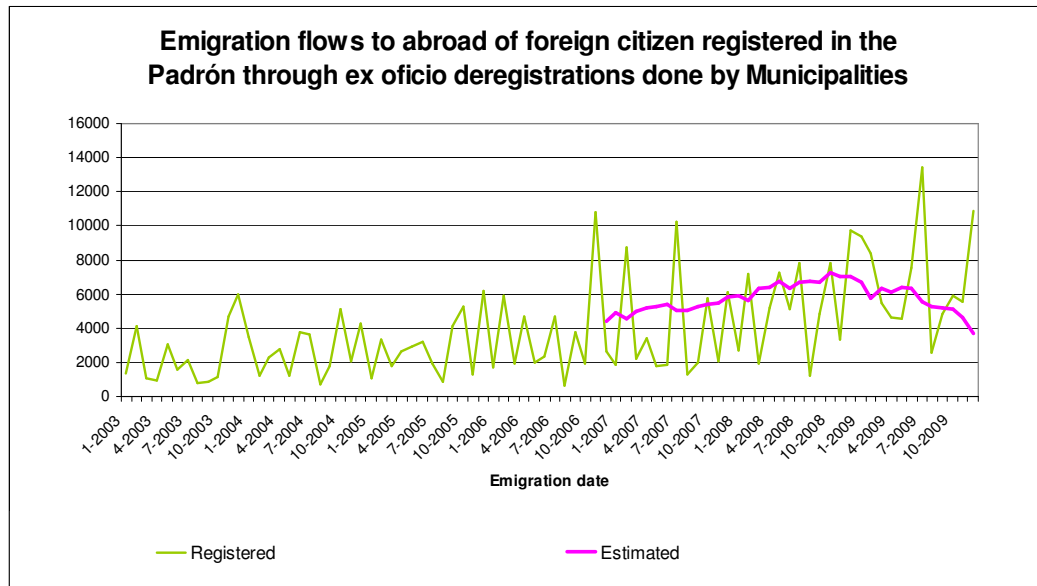
Again, the results are considered accurate enough when the expanding coefficient is lower than five.

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#### 4.2.2 EMIGRATION FLOWS TO ABROAD OF FOREIGN CITIZEN REGISTERED IN THE PADRÓN THROUGH EX OFFICIO DEREGISTRATIONS DONE BY MUNICIPALITIES

They are emigration flows identified with ex officio withdrawals declared by Municipalities of foreign citizen registrations, when municipal authorities detect the departure of the foreign citizen from the registered address. Therefore, we do not know which is the exact date of the departure, so a probabilistic imputation is needed. Precisely, this imputation is based on an uniform distribution of the emigration time between his last movement registered in the *Padrón* central database (which confirms his stay in the country) and the date of the ex officio deregistration.

After such probabilistic imputation of the emigration date of all these deregistrations received in INE database up to the estimation time, a similar method to the used in the previous group is put into practice. Once more, resulting estimates are considered accurate enough when the expanding coefficient is lower than five.



#### 4.2.3 EMIGRATION FLOWS TO ABROAD OF NON EU CITIZEN WITHOUT PERMANENT RESIDENT PERMIT REGISTERED IN THE PADRÓN THROUGH EXPIRY PROCEDURE

In December 2003, the Law for the registration of foreigners in the Padrón was modified as the foreign population was increasing and there were no possibility to deregister in the Padrón all foreigners who left Spain and did not report their emigration (and were not withdrawn ex officio by the Municipality). According to this law, foreigners not holding a permanent residence permit have to re-register themselves in the Padrón every two years. EU citizens are not concerned as well as foreigners with permanent residence permits. Thus, the so-called 'expiry procedure' provides an essential information about emigration flows not declared in municipal registers.

Estimates of the present monthly emigration flows that will be registered in the Padrón database in the future through this expiry procedure consist of foreseeing the number of registration that are going to expire in the following months, estimating which of them will be confirmed as deregistrations and, finally, estimating the real emigration date of estimated withdrawals.

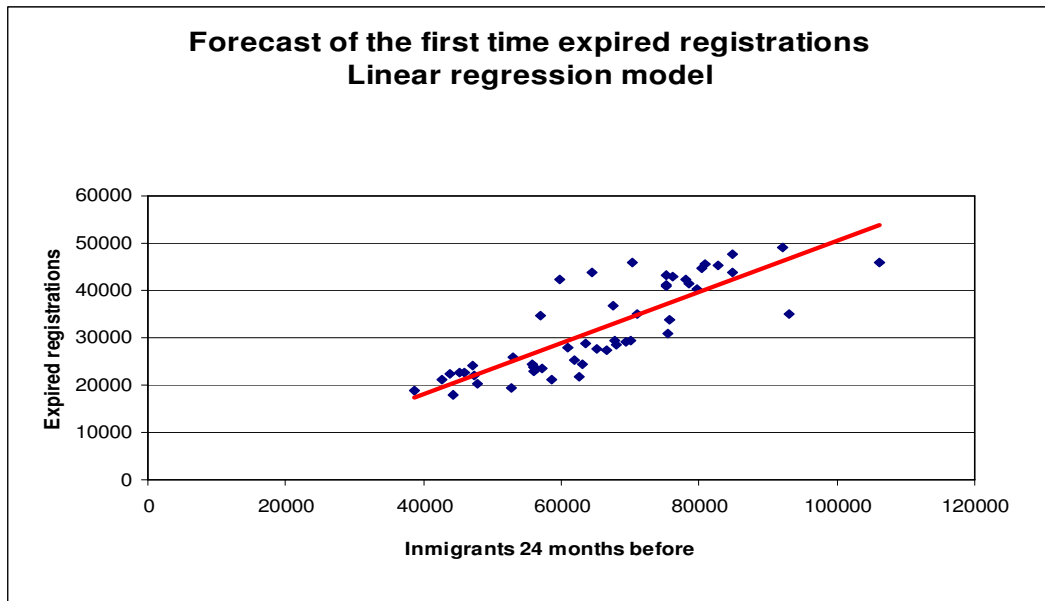
- Forecasting the expire registrations in the following 24 months:

The forecast method is different for registrations which have expired more than once than for registrations which expire for first time.

For first time expired registrations, a linear regression model is used, where the dependent variable is the monthly series of the first time expired registrations and the independent variable is the external immigration flow 24 months before, taking into account that a registration expires for first time two years after the date of the registration:

$$C_1^m = \beta_0 + \beta_1 I^{m-24}$$

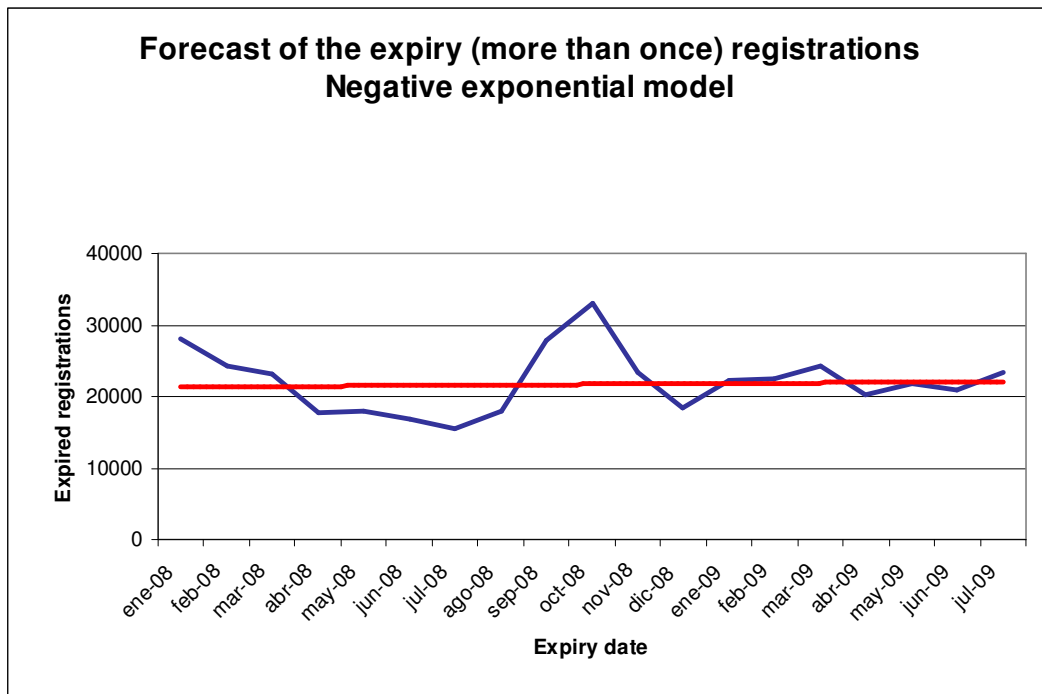
where  $C_1^m$  are the first time expired registration during the month  $m$  and  $I^{m-24}$  the total foreign immigration flow during the month  $m - 24$ .



For registration expired more than once, a time negative exponential model is estimated:

$$C_{+1}^m = \beta_0 \cdot e^{-\beta_1 m}$$

Where  $C_{+1}^m$  are the expired (more than once) registrations during the month  $m$ .



- Estimating the percentage of expired registrations finally confirmed as deregistrations:

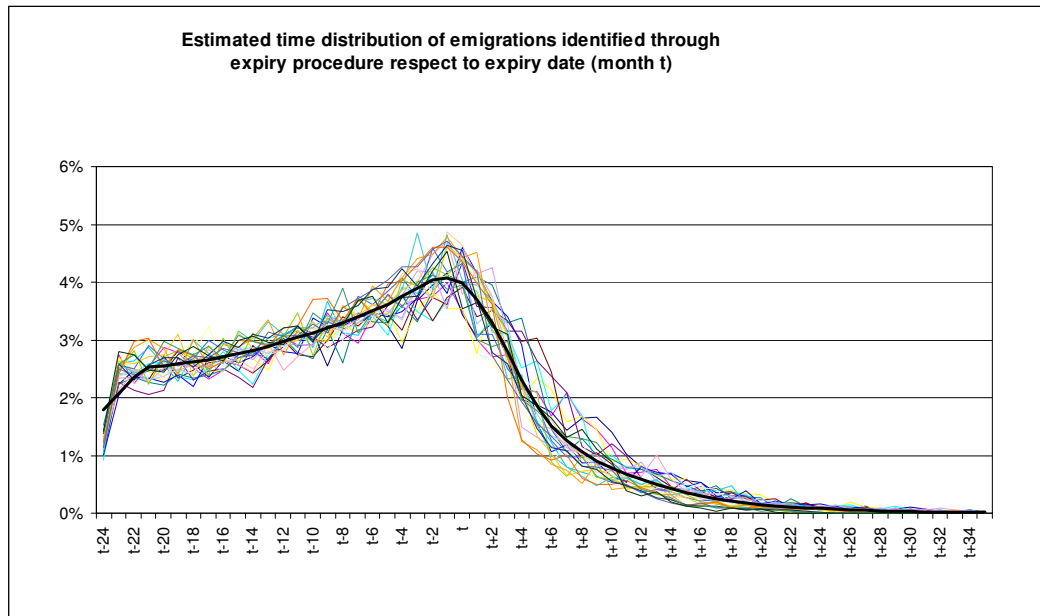
The average percentage of confirmed deregistrations over the total expired registrations in past months with almost definitive results of the expiry procedure is used as estimator. Again, the estimation process is carried out separating first time expired registrations and expired more than once, having in mind that both collectives have a very different tendency to become in confirmed withdrawals (higher for first time expired registrations).

Through these estimated percentages and the forecasted series of future expired registrations, we have the total number of past, present and future confirmed deregistrations.

- Estimating the real emigration date of estimated withdrawals:

This kind of emigration flows are identified through ex officio withdrawals declared by municipalities when they confirmed the departure from the registered address of the non EU citizen without residence permit whose registration has expired. Therefore, we do not know which is the exact date of the departure, so a probabilistic imputation is needed. Precisely, this imputation is based on an uniform distribution of the emigration time between his last movement registered in *Padrón* central database (which confirms his stay in the country) before the expiry and the date of the ex officio deregistration.

Finally, a smoothing procedure is made over the resulting time shape, getting it more robust, like next graphic shows:



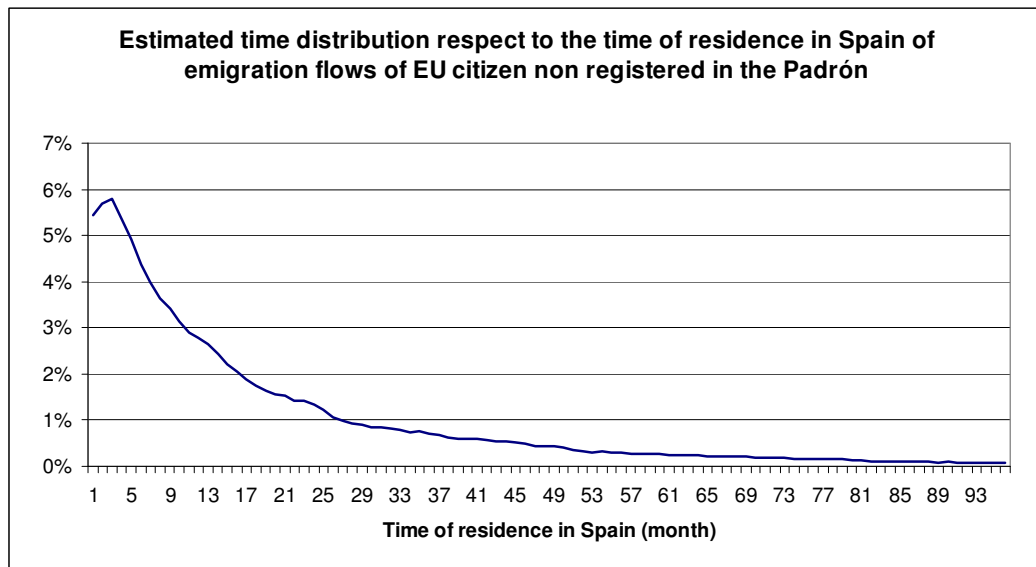
#### 4.2.4 EMIGRATION FLOWS OF EU CITIZEN NOT INCLUDED IN THE PREVIOUS GROUP (NON REGISTERED IN THE PADRÓN)

Now, estimation of emigration flows which are not registered in Municipal Population Registers in any case is faced. Therefore, Padrón database does not allow any monitoring procedure.

Then, the designed methodology is based on auxiliary sources. Specifically, a survey<sup>2</sup> over households with the objective of assessing the real situation of residence of different types of Padrón registrations has been used up to now. The last available results of this survey let estimate the percentage of UE immigrants that come back to abroad time after their arrival.

In addition to that, information about registered (by own declaration) UE emigrants says that they leave the country according to a very stable calendar, which shows a tendency of leaving Spain decreasing with the time of residence in the country. So, the emigration calendar of UE immigrants are estimated trough the smoothed distribution of emigration date respect to the time of residence in Spain of UE emigrants declared in Municipal Registers, which we can see in the following chart:

<sup>2</sup> Survey on Resident Population and Foreign Migration  
<http://www.ine.es/ioe/ioeFicha.jsp?cod=30272&codtema=&textema=&codorg=&textorg=&sig=null&L=1>



The estimated percentage of UE immigrants who come back abroad and the estimated calendar of emigration give the monthly emigration flow of UE immigrants not registered by Municipalities.

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#### 4.2.5 EMIGRATION FLOWS OF NON EU CITIZEN WITH PERMANENT RESIDENT PERMIT NOT INCLUDED IN THE PREVIOUS GROUP (NON REGISTERED IN PADRÓN)

In this case, similar procedure and sources than explained in 4.2.4. are put into practice.

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### 4.3 Monthly internal migration flows

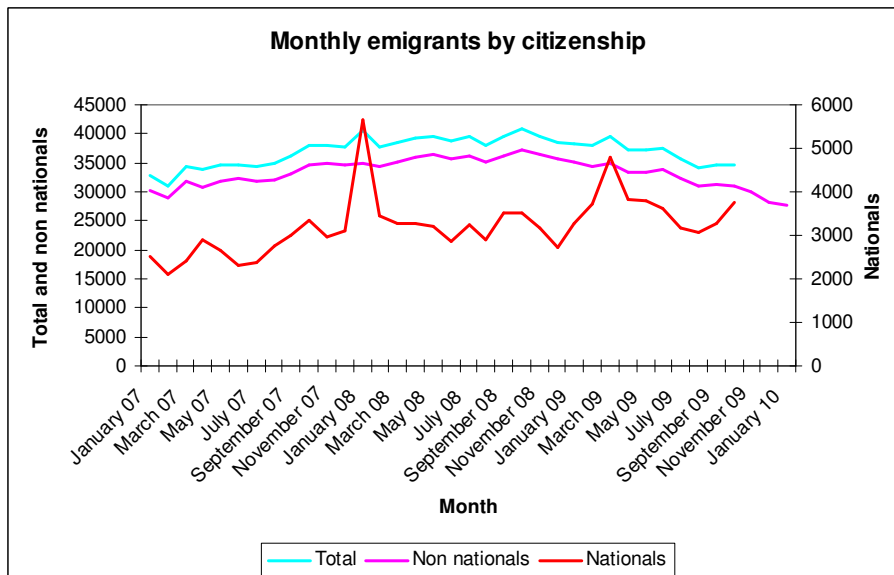
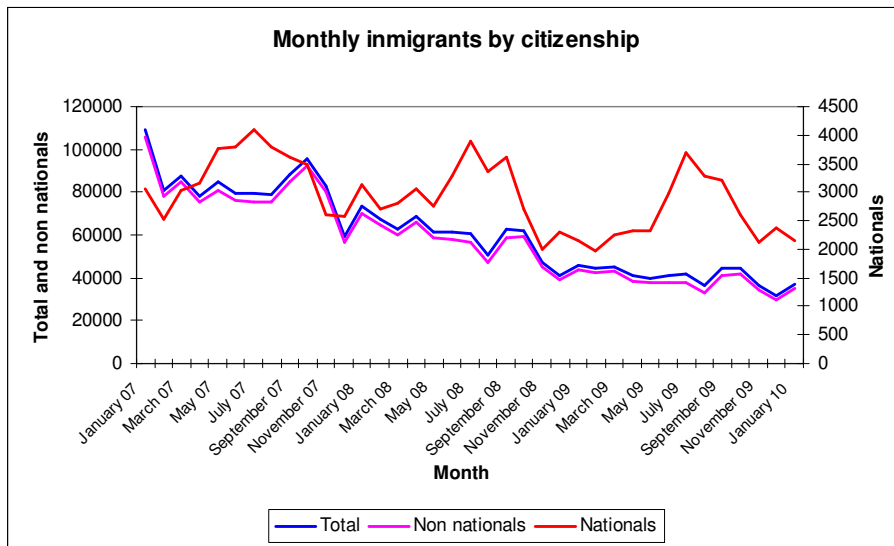
Monthly Demographic Now Cast not only provides estimates of recent external migration movements, but a general overview to follow the internal mobility of population across different provinces by means of giving an estimate of the recent interprovincial migration flows.

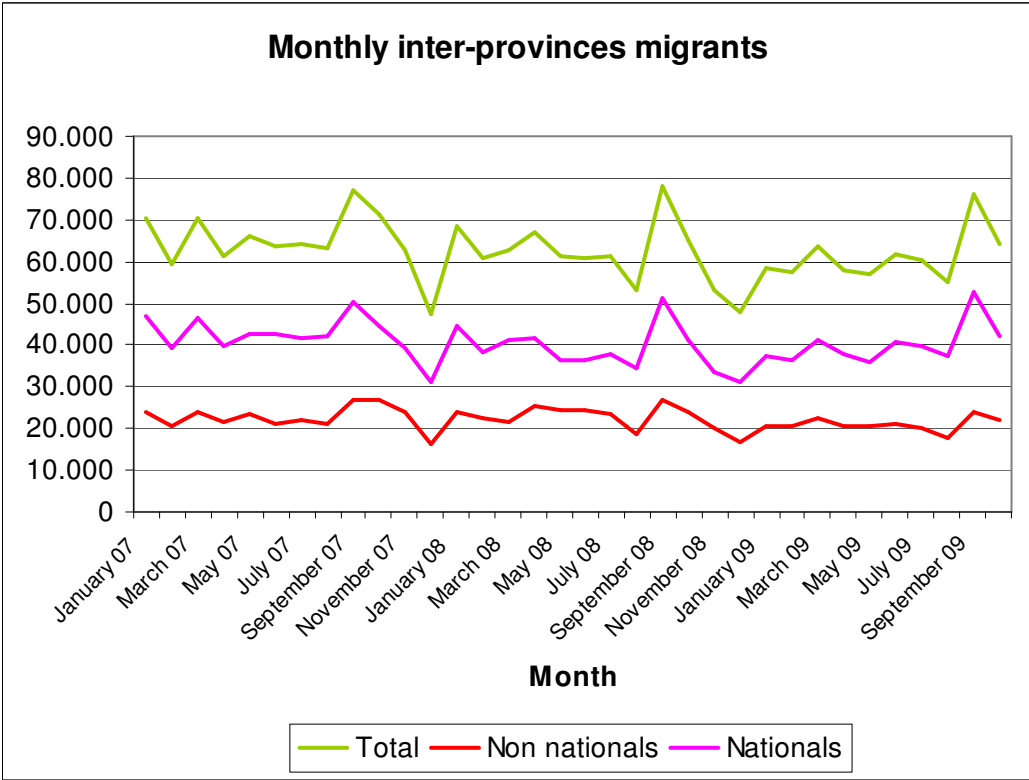
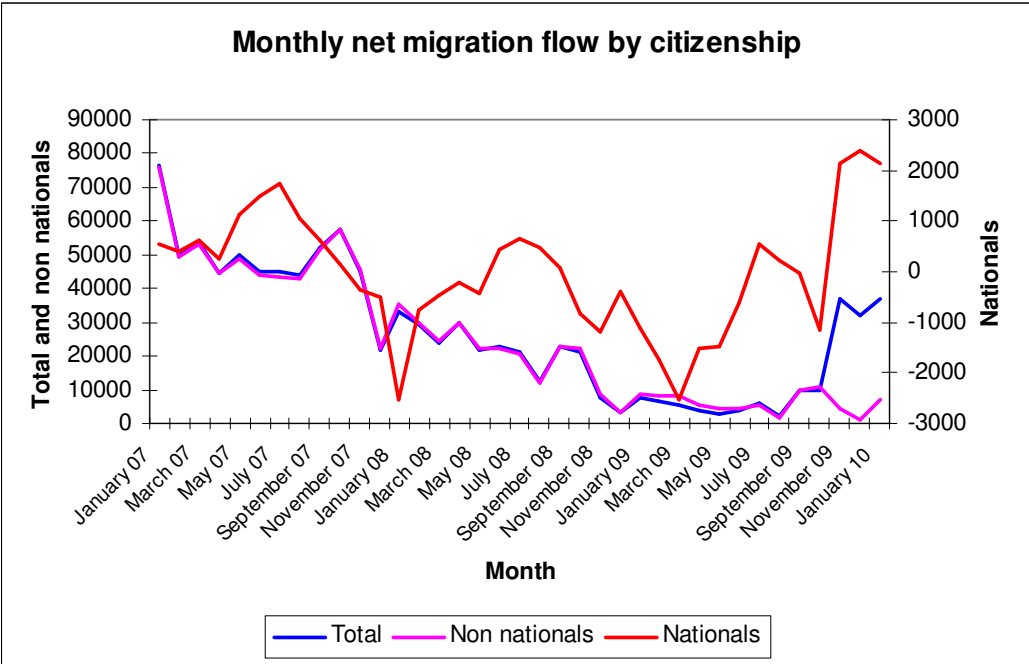
Again, the estimation method for this kind of flux is similar to the exposed one in case of monthly immigration flow. Then, monthly interprovincial migrants are obtained through the number of declared change of provinces of residence in Municipal Registers happened during the reference month that have been received in INE database up to the time of estimation and a expanding coefficient that replicates the rhythm of arriving of such information from municipalities to INE database during the year before.



#### 4.4 Last available results

The last available results of Monthly Demographic Now Cast have been developed at the end of February of 2010. Nowadays, last available information allows INE to provide: monthly external immigration flow estimates until January 2010 for national and foreign immigrants; monthly external emigration flow estimates until January 2010 for foreign emigrants and until October 2009 for national emigrants; and internal (interprovincial) migration flows until October 2009.





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## 4.5 Conclusions

One of the most outstanding insufficiency of Spanish statistic on demography until 2005 were the complete lack of information about current development of population and each basic demographic phenomena. The deadlines of provision of definitive data on Vital Statistics and annual information about migrations for past years supposed a thick statistical blindness over the most recent time period, which avoid any approach to the current demographic evolution.

In a context of extremely changeable demographic trends and high interest by population figures, Monthly Demographic Now Cast comes to solve this traditional lack providing advance and very accurate estimates of monthly demographic events, few time after the reference date (only one month, in case of migrations).

Consequently, Monthly Demographic Now Cast has become in a key action within the National Statistics System on demography, conforming an essential input for Spain population figures, provided by Population Now Cast<sup>3</sup>.

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<sup>3</sup> <http://www.ine.es/jaxi/menu.do?L=1&type=pcaxis&path=%2Ft20%2Fp259&file=inebase&L=>

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