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The Long-term Relationship Between International Labour Migration and Unemployment in Spain

Alexandra M. Espinosa[1] · **Ignacio Díaz-Emparanza**[2]

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Abstract

This paper analyzes the relationship between the international immigration rates and the unemployment rate in Spain for the period 1981–2016. During this period, immigration and employment grew rapidly, but in 2008, the Spanish economy collapsed with a significant increase in unemployment. This paper shows that, due to the characteristics of the migration policy in Spain, unemployment and immigration are cointegrated and, in addition, immigration causes unemployment. This causal relationship is positive, in the sense that the greater the immigration, the greater the unemployment. Last but not least, we find a positive long-term relation between immigration flows and GDP per capita growth.

Keywords Immigration · Unemployment · Cointegration · VAR models

Introduction

The analysis of migration policy is an important matter for European citizens. During his campaign for the 2015 General Election, David Cameron committed to calling a referendum on UK membership of the EU pledge on immigration targets. Indeed, his manifesto for the 2010 election was to 'take steps to take net migration back to the levels of the 1990s'. Most studies provide evidence that living in an area with a higher number of immigrants increases the probability of voting for parties that promote tighter immigration policies (Levi et al. 2017).

✉ Alexandra M. Espinosa
alexandra.miranda@epn.edu.ec

Ignacio Díaz-Emparanza
ignacio.diaz-emparanza@ehu.eus

1 Department of Mathematics, Escuela Politécnica Nacional, Ladrón de Guevara E11-253, 7-01-2759, Quito, Ecuador

2 Department of Econometrics and Statistics, University of the Basque Country, Lehedakari Agirre, 83, 48015, Bilbao, Spain

The core of this discussion is the impact of international labour immigration over native unemployment. According to the Eurobarometer, 39 per cent of respondents agree that immigrants take jobs away from workers, although 72 per cent agree that immigrants make it easier to fill jobs for which it is difficult to find workers (EU 2018). The studies on natives' attitudes towards immigration (Card et al. 2012; Facchini and Mayda 2009; Mayda 2006; Scheve and Slaughter 2001) are that natives may perceive immigrants with skill sets similar to their own as producing greater competition in the labour market.

Unlike other countries, according to Arango (2013), in Spain, there is a widespread belief that immigrants are entitled to the same rights as natives. Groups in favour of immigration are large, active, and vocal in their opposition to any sentiments that could be seen as racist, xenophobic, or simply hostile to immigrants. Consequently, Spanish immigration policies have tended to be open, and integration efforts sustained and comprehensive. Indeed, a long-term relationship between immigration and unemployment is an expected result, directly related to the effectiveness of integration policies.

However, no other country in Europe has experienced such an intense and quick process of immigration in modern times (González-Enríquez 2017). Foreign-born population more than quadrupled between 2000 and 2009 (Arango 2013), and the economic crisis provoked a upswing in anti-immigration feelings. In line with this evolution of public opinion, a doubling of the foreign-born population share is associated with a 1.3 percentage point higher vote share for populist far-right parties.[1] More than ever, it is important to know the relationship between unemployment and immigration in Spain.

The relationship between immigration and native unemployment has been systematically studied for different countries and historic periods, using different data and methodologies. The general conclusion is that the studies conducted on this issue do not lead to a consensus or general rule either in the short- or long-term.

According to the studies carried out (Table 1), a long-term relationship exists between international immigration and unemployment, but immigration does not cause or reduce unemployment in Greece (Chletsos and Roupakias 2012), OECD (Damette and Fromentin 2013; Fromentin 2012), Sweden (Feridun 2007), France (Gross 1999; Fromentin 2013), Canada (Islam 2007), Finland (Feridun 2004), Macao (Chang 2014), and Australia (Kónya 2000; Withers and Pope 1985; Gang Tian and Shan 1999). But, somewhat contradictorily, Lee (1992) finds a positive long-term relationship between migration and unemployment for Canada. In the cases of Norway (Feridun 2005), the OECD (Boubtane et al. 2013), the EU countries (Ghatak and Moore 2007), South Africa (Chamunorwa and Mlambo 2014), Saudi Arabia (El-Bahlawan and Al-Maadeed 2018), and Canada (Marr and Siklos 1994), the studies do not find evidence of a long-term relationship between series.

Also, the studies for some countries lead to contradictory or weak conclusions in the short-term. Immigration has a significative negative effect or reduces the

[1]Dimiter Toshkov, in URL: blogs.lse.ac.uk/europpblog/2018/12/07/does-immigration-explain-the-comeback-of-the-radical-right-in-spain

Table 1 Time series analyses of the relationship between unemployment and international immigration

Authors	Area (countries)	Long-term	Short-term	GC	Sample	Per.
Kónya (2000)	Australia	(−)		x	1981–1998	Q
Pope and Withers (1993)	Australia	(−)	x	(0)	1861–1991	A
Withers and Pope (1985)	Australia	(0)	(−)	x	1948–1982	Q
Gang Tian and Shan (1999)	Australia	(0)		x	1983–1995	Q
Islam (2007)	Canada	(0)	(−)		1962–2002	Q
Lee (1992)	Canada	(+)			1962–1985	Q
Marr and Siklos (1994)	Canada	nc			1962–1985	Q
Ghatak and Moore (2007)	EU (13)	nc	(−)	x	1980–2004	A
Feridun (2004)	Finland	(0)		x	1962–1990	Q
Gross (1999)	France	(−)	(+)		1974–1994	Q
Fromentin (2013)	France	(0)	(−)		1970–2008	A
d'Albis et al. (2013)	France		(0)	x	1994–2008	M
Chletsos and Roupakias (2012)	Greece	(0)	(−)	x	1980–2005	A
Hercowitz and Yashiv (2002)	Israel		(+)		1990–1999	Q
Chang (2014)	Macao	(−)	(−)		1996–2008	Q
Dorantes and Huang (1997)	USA		(0)		1983–1994	A
Feridun (2005)	Norway	nc	(0)	x	1983–2003	A
Damette and Fromentin (2013)	OECD (10)	(0)	x		1970–2008	A
Fromentin (2012)	OECD (14)	(−)	(+)		1985–2005	A
Boubtane et al. (2013)	OECD (22)	nc	(0)	x	1980–2005	A
Heid and Larch (2012)	OECD (24)		(0)		1997–2007	A
El-Bahlawan and Al-Maadeed (2018)	Saudi Arabia	nc	(0)		1990–2000	A
Chamunorwa and Mlambo (2014)	South Africa	nc	(+)		1980–2011	A
Espinosa and Díaz-Emparanza (2002)	Spain	nc	(−)		1981–1999	M
Feridun (2007)	Sweden	(0)		x	1980–2004	A
Dustmann et al. (2005)	UK		(+)		1983–2000	A

(0) denotes no effect or no causality; (+) immigration cause or increase native unemployment; (−) immigration reduces native unemployment; *nc* denotes no cointegration. The column *GC* shows if the analysis uses Granger causality, and the column *P*, the periodicity: *A*, annual; *Q*, quarterly; and, *M*, monthly data. (x) Authors do not analyze or use the technique

unemployment in the short-term for Canada (Islam 2007), EU-13 countries (Ghatak and Moore 2007), France (Fromentin 2013), Greece (Chletsos and Roupakias 2012), and Macao (Chang 2014). By contrast, immigration has a significant positive effect or increases unemployment in the short-term for France (Gross 1999), Israel (Hercowitz and Yashiv 2002), the OECD 14 countries (Fromentin 2012), South Africa

(Chamunorwa and Mlambo 2014), and the UK (Dustmann et al. 2005). Finally, immigration has no effect or does not cause unemployment in France (d'Albis et al. 2013), the USA (Dorantes and Huang 1997), Norway (Feridun 2005), Saudi Arabia (El-Bahlawan and Al-Maadeed 2018), and the OECD 22 and 24 counties (Boubtane et al. 2013; Heid and Larch 2012).

The disparity of results could be due to the different sample sizes and periodicities of the data used to perform the analysis. For instance, in the case of France, Gross (1999) finds a short-term positive effect using 1974–1994 quarterly data; Fromentin (2013) finds evidences of a short-term negative effect using 1970–2008 annual data; and d'Albis et al. (2013) find that immigration has no short-term effect on unemployment using 1994–2008 monthly data.

In other cases, these disparities could be due to the structure of the data: for the OECD countries, Damette and Fromentin (2013) find no long-term effect using a panel with 10 countries and 1970–2008 annual data; Boubtane et al. (2013) find no cointegration using a panel with 22 countries and 1985–2005 annual data; and Fromentin (2012) finds a significative negative effect using a panel with 14 countries and 1980–2005 annual data. However, the size and characteristics of the data are not the explanation in the case of studies carried out for Canada, since Lee (1992) and Marr and Siklos (1994) use the same data. In these cases, the differences could be due to the different treatment of the data.

Also, these differences could be explained by the variables considered in the analysis. Obviously, all papers use the immigration and unemployment series in the econometric analysis, but in some papers, other variables are introduced, such as GDP and wages. Nevertheless, it seems that these variables do not strongly change the conclusions. For instance, the estimations for Australia do not change if the GDP and other variables are included with respect to those including only the immigration and unemployment series (Gang Tian and Shan 1999).

This paper concerns an analysis of the effect of sample size over the results obtained for Spain. The results for the period 1981–1998 indicated that unemployment and immigration were not related in the long-term; and in the short-term, the effect of immigration over unemployment is small or insignificant (Espinosa and Díaz-Emparanza 2002). Thus, the aim of this paper is to determine if the conclusions change when the sample size is enlarged to 18 years, covering the 1981–2016 period.

The "Theoretical Framework" section of this paper is devoted to an analysis of the partial and general theoretical equilibrium models, in order to explain the seemingly contradictory econometric results. In the "The Series" section, we present the data and the evolution of the series during the period 1998–2016, and we estimate an intervention model. The "Model Estimation" section is devoted to estimating the model and analyzing the long- and short-term effects of international immigration over unemployment. Also, we show that including the GDP per capita growth in the model does not change the direction of the long-term relation between immigration and unemployment flows. Finally, we discuss briefly some policy aspects of this result, and in the "Conclusions" section, we present the conclusions.

Theoretical Framework

Most of the studies quoted in "Introduction" section show that international immigration seemingly does not influence the unemployment in the long-term and, in the short-term, it could cause a small effect, whose sign depends on the conditions of the host country. These results contrast with the results obtained from the partial equilibrium analysis of the effects of an exogenous increasing in labour supply, but it is consistent with the general equilibrium analysis. This section is a brief overview of these theories.

The effect of immigration over unemployment is analyzed in partial equilibrium models, taking into consideration only the labour market in one country (in many cases closed), where individuals are mere factors of production. Thus, under the competitive markets assumption, prices adjust automatically and the salary of natives decrease as a result of the increase in the labour supply. Otherwise, under the stick prices assumption, the effect of migration over salary is partially offset by unemployment.

The more elaborated versions of these models incorporate segmented labour markets for different levels of qualification or skills. The results depend on assumptions relative to the characteristics of the immigrants, and from the degree of substitution between immigrants and native workers. In general, immigrants positively affect the wages of skilled workers and negatively affect the wages of non-skilled workers and early immigrants (Dustmann et al. 2005). Once more, the effects over employment depend on assumptions relative to price rigidities (see Longhi et al. 2010). These partial equilibrium results have some exceptions which assume efficiency wages, showing that employed immigrants tend to reduce the rate of unemployment (Bleaney 2005).

In the general equilibrium models, immigrants play different roles in the host economy: they increase the labour supply and, simultaneously, increase the demand of commodities produced in the host countries, since they increase the number of consumers (or importers located in the host country). Thus, the change in *per capita* income due to immigration in host countries also changes the income of the immigrant, with an unpredictable impact on the world economies (Dixit and Norman 1980). Therefore, in the long-term, it is not appropriate to discuss these effects by the mere displacement of curves in the labour market.

If commodities and factors can move freely across countries, the influx of immigrants implies a change in production structure and trading, i.e. migration changes employment distribution within the production sectors, but does not generate unemployment. Also, in the general case of $N \times M$ economies, the effect on the factor prices depends on the relation between N and M. So that, if $N = M$, we can predict the international convergence of factor prices; but, if $N \neq M$, the effect of migration over these prices is unpredictable (Chang 1979; Deardorff 1979; 1982; Ethier 1984; Melvin 1968).

Consequently, assuming that partial and general equilibrium are equivalent to the short- and long-term, respectively, the econometric results listed above are not contradictory. Thus, partial equilibrium predicts a negative effect of immigration over native employment and salary (except under the efficiency wage hypothesis). And, the general equilibrium models lead to a null long-term effect or to an unpredictable impact of immigration over unemployment, depending on the dynamics of convergence.

The discrepancies could thus be explained by the size of the sample or by the characteristics of the labour market, such as the rigidities or the degree of segmentation of the labour market. And, without a loss of generality, the processing of data, the explicit modelling of the short- and long-term in the econometric equations, and the correct treatment of the periodic and non-periodic components could explain the apparent contradictions.

The Series

In fact, the effect of immigration over unemployment is unobservable, since these variables are also unobservable. However, there is a set of variables that can be used as indicators. In the case of Spain, unemployment can be approximated using the monthly series that records the unemployment registered in public employment agencies (p_t). Also, the immigration can be analyzed by making use of the monthly series that quantifies the number of authorizations to work in Spain granted to immigrants to work, also known as the work permits series (m_t). The period analyzed covers 35 years, from January 1981 to February 2016.

These series represent immigration and unemployment with the particularity that such series reflect the labour force that is the best condition for competing for jobs in the labour market. Thus, on the one hand, the series m_t record the immigrants who can freely move across the country, since they are legally residing and working in Spain. On the other hand, the series p_t records registered unemployment, which is a particular subgroup of the jobseekers, linked to their eligibility for unemployment benefits, i.e. accounting for all the unemployed participating in the labour market regularly. Also, these series are publicly available and the methodological and explanatory notes of the series can be easily listed.

The Intervention Analysis

The time series considered in this paper is often affected by intervention events or policies which may produce exogenous changes in the series and bias in the parameter estimates, and hence may affect the efficiency and adequacy of the general model fitted to these data (Chen and Liu 1993). In particular, the rules granting the authorization to immigrants frequently changed, in accordance with the changing of the economic and political situation in Spain.

The approach to dealing with these intervention events (or outliers) identifies the time locations and the type of outliers: the additive outlier (AO), level shift (LS), and transitory change (TC). The intervention model is applied to detect these outliers[2] one by one, and the series are accommodated to the outlier effect (Box and Tiao 1975).

[2] The SEATS/TRAMO software has a facility to detect the outliers and to remove their effects.

Additionally, multiple regressions are used to detect the spurious outliers (Chen and Liu 1993; Tsay 1986).

The intervention events or changes in the immigration policy with a strong effect over the behaviour of the series are well documented and due mainly to the regularization process or the massive granting of work permits to immigrants with irregular or illegal residence. These regularization processes were implemented in 1985–1986, 1991–1992, 1996, 2000–2001, and 2005 (Table 2). With respect to the registered unemployment series, the regulation of the labour market carried out in 1985, 1994, 1997, 2001, and 2006 with the aim of providing incentives for employment shapes the intervention events jointly with the new methodology for registering unemployment applied to data after January 1996.

The results of the intervention analysis applied to the work permits series are the following: (a) the 1985–1986 and 1996 regularization process did not have a significant effect over the series; (b) the 1991–1992 regularization process had a significant effect, and it is modeled as the sum of a TC (from January 1991 to January 1992) with $\delta = 0.7$, an AO (January 1992), and a TC (February 1992) with $\delta = 0.5$; (c) regularization process of the year 2000 had a significative effect, and is modelled as a TC (from April 2000 to August 2000) with $\delta = 0.2$; (d) the 2005 regularization process had a significative effect, and is modelled as a TC (from April 2000 to August 2000) with $\delta = 0.95$; and (e) automatically, the program TRAMO detects an AO at January 1993 and a LS at October 1992. The model with trading day and outlier effects correction over the series in logarithms passed all normality and stability tests (Fig. 1).

The results for registered unemployment are the following: (a) the regulations of 1994, 1997, and 2006 did not have a significant effect over the series; (b) the regulations of January 1985 and May 2001 had a significant LS effect; (c) the change in the methodology of January 1996 and May 2005 had a strong and significant LS effect; (d) automatically, the program TRAMO detects an AO at February 2002 and a TC at March 2008; and (e) the trading and Easter day correction are significant. The model with Easter, trading day, and outlier effects correction over the series in logarithms passed all normality and stability tests, except for the stability of the variance (Fig. 2).

Table 2 Regularization processes

Regularization process dates	Applied	Granted
From September 1985 to March 1986	43.815	38.181
From June 1991 to February 1992	135.393	109.068
From April 1996 to August 1996	25.388	24.691
From March 2000 to August 2000	247.598	208.146
From February 2005 to May 2005	691.655	578.375

The regularization process of 1991 and 2000 includes a subprocess in 1992 and 2001, respectively (Aguilera Izquierdo 2007; Kostova Karaboytcheva 2006). Notice that these series are permanently reviewed, since the work permits granted are recorded at the moment of the application, not when the application is approved

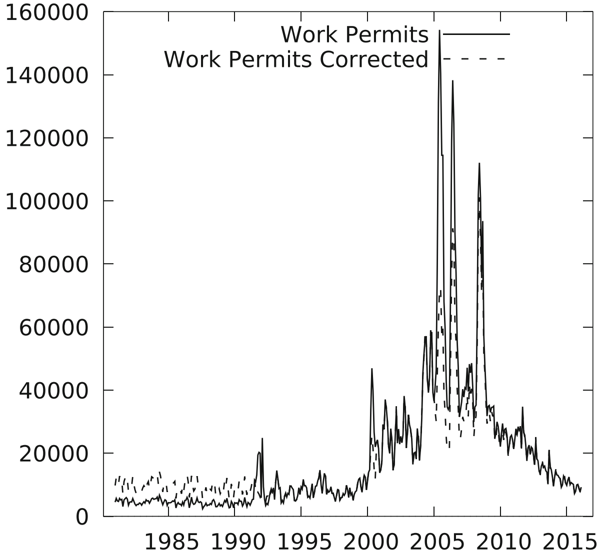

Fig. 1 The series work permits original m_t and corrected m_t^*

Model Estimation

Denoted by m_t^*, the work permits series corrected by intervention events is expressed in terms of the monthly active population, $x_{m,t} = m_t^*/a_t$. Also, denoted by p_t^*, the unemployment series corrected by intervention events is expressed in terms of the

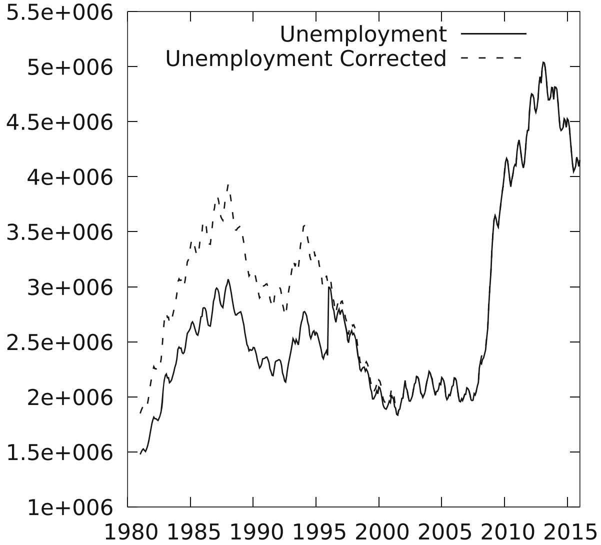

Fig. 2 The series registered unemployment p_t and corrected p_t^*

flow of the newly unemployed with respect to the monthly active population $x_{p,t} = (p_t^* - p_{t-1}^*)/a_t$. Then, we are relating the flow of immigrants with work permits with the increase in unemployment, both corrected by intervention effects. The monthly active population series a_t is constructed by the linear interpolation (with weight 1/3 and 2/3) of two sequential quarterly values of Active Population series, recorded by the National Statistics Institute (INE).

Seasonal Unit Root Tests

The contour plots (Figs. 3 and 4) of series $x_{m,t}$ and $x_{p,t}$ help us to understand the seasonal behaviour of the series. The height levels of the series are represented in light colors and deep levels in dark colors.

Series $x_{p,t}$ is clearly seasonal, with peaks in autumn and winter and troughs in spring and summer. The annual or non-seasonal component seems to dominate the work permits series; however, the series $x_{m,t}$ has a clear seasonal component, which can be seen in the peaks from spring to autumn (the harvest season and biggest tourist influx), and slumps in winter. Notice that the seasonal slumps and peaks seem to be related, in the sense that the work permits rate seems to increase when unemployment flow is negative. Hence, series may be long-term or seasonally stationary, integrated, has a deterministic seasonal pattern, or some combination of these components.

This paper tests whether or not there are seasonal unit roots in the univariate series, taking into account the non-periodic component of data, using the procedure proposed by Hylleberg et al. (1990) and Beaulieu and Miron (1993). This involves the defining of seasonality in terms of periodic functions (Fourier's theorem), so that any monthly data can be expressed as the sums of 12 functions, whose frequencies are

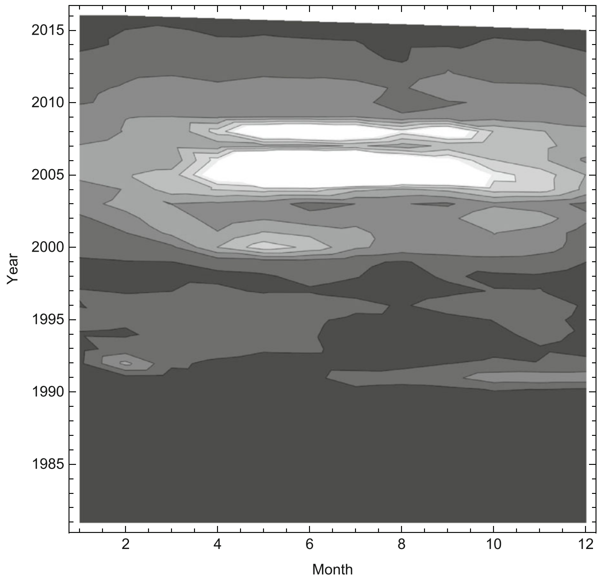

Fig. 3 Contour plot of the series x_{mt} (immigration)

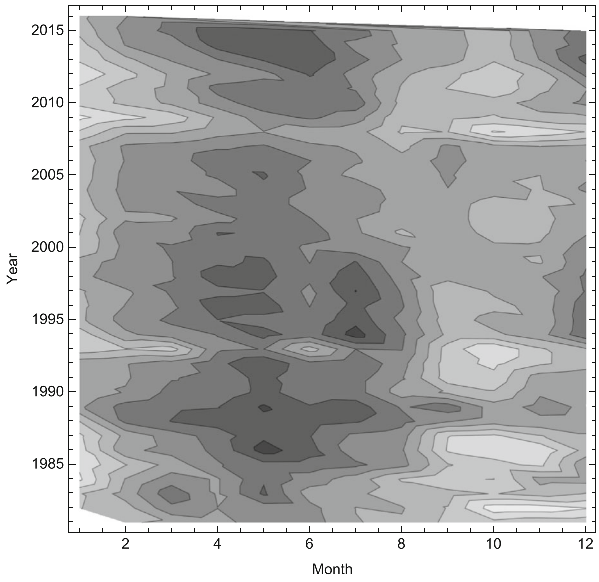

Fig. 4 Contour plot of the series x_{pt} (unemployment)

$\omega_s = 2\pi s/12$. Also, non-periodic components can be represented assuming periodicity ∞ or frequency $\omega_0 = 0$. Moreover, Hylleberg et al. (1990) show that the polynomial $(1 - B^{12})$ with roots associated with $\omega_s = \pm\pi s/6$ seasonal frequencies can be expressed in terms of elementary polynomials and a remainder. Then, series generated by the $AR(p)$ process can be written as follows:

$$\Delta_{12} x_{i,t} = \sum_{k=0}^{6} \phi_{i,k} x_{i,k,t-1} + \sum_{k=1}^{5} \phi^*_{i,k} x^*_{i,k,t-1} + cd_t + \varepsilon_{i,t} \tag{1}$$

The series $x^*_{i,k,t}$ and $x_{i,k,t}$ are generated using the properties of periodic functions, where the zero frequency is included:

$$x_{i,k,t} = \sum_{j=1}^{12} \cos(\omega_k j) B^{j-1} x_{i,t} \quad k = 0, 1, \cdots, 6 \tag{2}$$

$$x^*_{i,k,t} = a_k \sum_{j=1}^{12} \sin(\omega_k j) B^{j-1} x_{i,t} \quad k = 1, \cdots, 5, \tag{3}$$

where a_k =- 1 for $k = 1, 2, 3$ and $a_k = 1$ for $k = 4, 5$. By construction, $x^*_{i,k,t} = 0$ for k is equal to 0 and 6, consequently the inclusion of these series is neglected. The term d_t includes the deterministic terms.

In order to test hypotheses about various unit roots, we estimate (1) by ordinary least squares (OLS) and then compare the test statistics to the appropriate finite simple distributions and p values tabulated by Díaz-Emparanza (2014) and Beaulieu and Miron (1993). Under the null hypothesis that the roots lie on the unit circle against the alternative that these lie outside the unit circle, for $k = 0, 6$ we simply examine the relevant t-statistic for $\phi_{i,k} = 0$ against the alternative $\phi_{i,k} < 0$. For $k = 1, \cdots, 5$, we test $\phi_{i,k} = \phi^*_{i,k} = 0$ with the F-statistic.

The order of the polynomial is determined by the Bayes Information Criterium or Schwarz Criterion (SC) and is $p = 1$ for both series. The deterministic trend is not statistically significant, so that equations only include constant and seasonal dummies. Table 3 shows that we cannot reject the hypothesis that series $x_{m,t}$ has a unit root at $\omega_k = 0$ (the non-periodic component), and that series $x_{p,t}$ has a unit root at $\omega_k = 0$ and $\omega_k = \pi$ (2 cycles per year). These results are similar to those found for the period 1981–1998.

Cointegration Test

Since series are integrated at the frequency $\omega_k = 0$, we should test the possibility that they are cointegrated at this frequency. This test is crucial to analyze the long-term relationship between series, since this frequency is related to the non-periodic component or the long-term. If series are cointegrated, it means that there is a long-term relationship between unemployment and immigration, whose sign and direction of causality are an important matter for policy-makers. In any case, if series are not cointegrated, migration and unemployment can be related only in short-term.

A complete econometric theory about seasonal cointegration may be found in Johansen and Schaumburg (1999). If the vectors of the series are denoted by $x_t = (x_{m,t} \;\; x_{p,t})$, the vector error correction model (VECM) is the generalization of Eq. (1):

$$\Delta_{12} x_t = \sum_{k=0}^{6} \Pi_k x_{k,t-1} + \sum_{k=1}^{5} \Pi^*_k x^*_{k,t-1} + \sum_{j=1}^{p-12} \Gamma_j \Delta_{12} x_{t-j} + C D_t + \varepsilon_t, \quad (4)$$

where the order $p = 13$ is chosen using the Bayes Information Criterium.

The VECM coefficient matrices Π_k have information concerning the permanent behaviour of the series. Hence, the rank of the matrices $rk(\Pi_k) = r_k$ is equal to the cointegrating relations at frequency k. The superscript is hidden because $rk(\Pi_k) = rk(\Pi^*_k) = r_k$ for $k = 1 \cdots, 5$ and Π^*_k is not in the equation for $k = 0, 6$. The term

Table 3 Statistics for unit root tests with constant and seasonal dummies

k	0	1	2	3	4	5	6		
ω_k	0	$\pm\frac{\pi}{6}$	$\pm\frac{2\pi}{6}$	$\pm\frac{3\pi}{6}$	$\pm\frac{4\pi}{6}$	$\pm\frac{5\pi}{6}$	π	AS	AS_0
Statistics	t_1	F_1	F_2	F_3	F_4	F_5	t_2	F_s	F_t
$x_{m,t}$ (p value)	– 2.1* (0.24)	10.6 (0.00)	25.8 (0.00)	23.7 (0.00)	33.9 (0.00)	15.5 (0.00)	– 4.2 (0.00)	26.2 (0.00)	25.4 (0.00)
$x_{p,t}$ (p value)	– 2.6* (0.07)	17.3 (0.00)	10.3 (0.00)	9.4 (0.01)	7.5 (0.02)	11.9 (0.00)	– 2.7* (0.06)	11.4 (0.00)	11.0 (0.00)

The * denotes that the null hypothesis cannot be rejected at the significance level of 95 per cent. AS denotes all seasonal frequencies and AS_0 all seasonal frequencies ($k = 1, \cdots, 6$) and frequency zero ($k = 0, \cdots, 6$)

D_t includes deterministic terms, which will be discussed in the Remark 1, since the cointegration test is constructed without these terms.

The strategy for testing the rank of the matrices of dimension $m \times m$ (for the m series) is the following: we first test $r = 0$ and if this null hypothesis cannot be rejected, we assume $r_k = 0$; otherwise, if the $r_k = 0$ hypothesis is rejected, we test the null hypothesis $r_k = 1$ against the alternative $r_k > 1$. The procedure is repeated sequentially while the null hypothesis $r_k < m$ is rejected.

The asymptotic distribution of the LR statistic of the null hypothesis for the given r_0 and $r_0 + 1$ and monthly data under the normality of residuals are given in Caminero and Díaz-Emparanza (1997). Table 4 shows the results for $k = 0$ under different specifications. The order of the AR polynomial is decided using the SC criterium and by checking the whiteness of the residuals with the Portmanteau test.

This result differs from those obtained for the period 1981–1998, where the series were integrated at frequency zero but not cointegrated, and we concluded that the effects of the series were only at short-term. However, for the period 1981–2016, the series are cointegrated, and there is a common trend between series. Indeed, no-cointegration for the period 1981–1998 is a direct consequence of the recent history of the immigration in Spain. Mass migration is a recent phenomenon is Spain: just before the Great Slump, Spain received massive migration inflows that contributed to an average annual population growth of 1.4 per cent between 2000 and 2007 and increased the weight of the foreign population from 2 to 12 per cent (Izquierdo et al. 2016; Kangasniemi et al. 2012).

The VECM that describes the dynamics of unemployment and work permits is

$$\Delta_{12} x_t = \Pi_0 x_{0,t-1} + \sum_{j=1}^{p-12} \Gamma_j \Delta_{12} x_{t-j} + C D_t + \varepsilon_t. \tag{5}$$

Providing that $\Pi_0 = \alpha_0 \beta_0'$ and the series are cointegrated, then one would therefore expect $\beta_{m,0} x_{m,0,t} + \beta_{p,0} x_{p,0,t}$ to be stationary. Normalizing $\beta_{m,0} = 1$, the

Table 4 Statistic test for cointegration at zero frequency

Lags $T = 422$	$p = 25 \rightarrow p_{vecm} = 13$ (with seasonal dummies)	$p = 25 \rightarrow p_{vecm} = 13$ (no seasonal dummies)
$\lambda_{LR}(0, 1)$ $(\alpha{=}2.5\% \rightarrow 14.47)$	19.28*	15.13*
$\lambda_{LR}(1, 2)$ $(\alpha{=}2.5\% \rightarrow 5.35)$	4.64	1.68

The null hypothesis $r_0 = 0$ against $r_0 > 0$ is rejected, and $r_0 = 1$ against $r_0 > 1$ cannot be rejected. Notice that the inclusion of the dummies increases the value of the LR statistic due to the loss of power

EGLS estimator of $\beta_{p,0}$ and $Var(\beta_{p,0})$ is consistent, asymptotically normal, and more efficient if errors are white noise but non-normal (see Remark 2):

$$\widehat{\beta}_{p,0,EGLS} = (\widehat{\Pi}'_{02,LS}\widehat{\Sigma}^{-1}_{u,LS}\widehat{\Pi}_{02,LS})^{-1}\widehat{\Pi}'_{02,LS}\widehat{\Sigma}^{-1}_{u,LS}\widehat{\Pi}_{02,LS} \tag{6}$$

$$Var(\widehat{\beta}_{p,0,EGLS}) = \widehat{\Pi}'_{02,LS}\widehat{\Sigma}^{-1}_{u,LS}\widehat{\Pi}_{02,LS}\left(x'_{p,t-1}x_{p,t-1}\right)^{-1} \tag{7}$$

where the matrices $\widehat{\Pi}_{01,LS}$ and $\widehat{\Pi}_{02,LS}$ are the first r and the last $m-r$ columns of the LS estimator of Π_0 respectively; and $\widehat{\Sigma}_{u,LS}$ is the white noise covariance matrix of residuals obtained from the unrestricted LS estimator of the VECM (Lütkepohl 2007, pp. 292).

$$\underset{\text{(t-Stat)}}{\widehat{\beta}_{p,0,EGLS}} = \underset{(-\,2.000)}{-\,0.382.} \tag{8}$$

The estimated cointegration vector shows a positive and significant long-term relationship between unemployment flows and work permit rates. This result apparently contradicts that obtained for the period 1981–1998, and has an interesting interpretation: international immigration increases the long-term unemployment or (simultaneously or not) unemployment increases the immigration rate. The direction of this relation is checked in the following.

Defined by $z_{0,t-1} = x_{m,0,t-1} - 0.382x_{m,0,t-1}$, the error correction term, and by $X = (\Delta_{12}x_{t-1}, \cdots, \Delta_{12}x_{t-13}, D_t)$, the LS estimator of α in the VECM (short-term effects in Table 5) is

$$\begin{pmatrix} \underset{\text{(t-Stat)}}{x_{m,t}} \\ \underset{\text{(t-Stat)}}{x_{p,t}} \end{pmatrix} = \begin{pmatrix} \underset{(-\,1.238)}{-\,0.002} \\ \underset{(2.711)}{0.020} \end{pmatrix} z_{0,t-1} + \hat{\Gamma}_{LS}X + \varepsilon_t. \tag{9}$$

In Table 5, we may see that the lagged seasonal differences of the unemployment flows are not significant in the immigration equation (column 2). Also, the lagged seasonal differences of the immigration rate are not significant in the unemployment flows equation (column 3). Then, we do not find evidences of the short-term effects of immigration over unemployment or of unemployment over immigration.

The t-statistic for $\widehat{\alpha}_1$ in the first equation is not significant, suggesting that unemployment flows do not cause immigration. On the other hand, the t-statistic $\widehat{\alpha}_2$ associated with the error correction term $z_{0,t-1}$ in the second equation is significant, indicating that there is a highly significant relationship for immigration (work permits) causing unemployment. This result differs from the earlier empirical work for the 1981–1998 period, when we found only short-term effects between unemployment and migration in Spain.

Causality and Impulse-Response

Notice that the LS estimator of $\Pi_0, \Gamma_1 \cdots, \Gamma_{p-1}$ is consistent and the limiting distribution of $\sqrt{T}vec(\widehat{\Pi}_{LS} - \Pi)$ is normal, so that the t-ratios can be set up in the

Table 5 Estimation of the VECM by the LS

	$\Delta_{12}x_{m,t}$		$\Delta_{12}x_{p,t}$	
$z_{0,t-1}$	– 0.002 (– 1.238)		0.020* (2.711)	
j	$\Delta_{12}x_{m,t-j}$ (t-Stat)	$\Delta_{12}x_{p,t-j}$ (t-Stat)	$\Delta_{12}x_{m,t-j}$ (t-Stat)	$\Delta_{12}x_{p,t-j}$ (t-Stat)
1	1.087* (21.46)	– 0.014 (– 1.136)	0.234 (0.1110)	0.448* (8.596)
2	– 0.142** (– 1.883)	0.017 (1.274)	0.0732 (0.234)	0.115* (2.034)
3	– 0.100 (– 1.327)	0.006 (0.481)	– 0.453 (– 1.447)	– 0.005 (– 0.094)
4	0.004 (0.046)	– 0.005 (– 0.336)	0.072 (0.231)	0.126* (2.234)
5	– 0.036 (– 0.481)	0.007 (0.537)	0.512 (1.634)	– 0.048 (– 0.848)
6	– 0.054 (– 0.724)	– 0.011 (– 0.797)	– 0.232 (– 0.742)	0.113* (1.998)
7	0.216* (2.913)	– 0.008 (– 0.577)	– 0.170 (– 0.551)	0.047 (0.834)
8	– 0.132** (– 1.763)	– 0.005 (– 0.348)	0.116 (0.372)	0.021 (0.366)
9	0.029 (0.395)	– 0.008 (– 0.565)	– 0.302 (– 0.962)	– 0.012 (– 0.212)
10	0.046 (0.606)	0.019 (1.398)	0.416 (1.322)	– 0.011 (– 0.197)
11	– 0.069 (– 0.912)	– 0.015 (–1.145)	– 0.414 (– 1.318)	– 0.068 (– 1.201)
12	– 0.276* (– 3.663)	0.010 (0.775)	0.172 (0.549)	– 0.184* (– 3.291)
13	0.293* (5.713)	– 0.006 (– 0.497)	– 0.062 (– 0.289)	0.109* (2.151)

The estimation includes seasonal dummies whose results are omitted

standard way and have their usual asymptotic standard normal distributions, even if the process is not Gaussian (Lütkepohl 2007, pp. 274-276).

$$\underset{\text{(t-Stat)}}{\widehat{\Pi}_{0,LS}} = \begin{pmatrix} \underset{(-\ 1.862)}{-\ 0.0036} & \underset{(-\ 0.969)}{-\ 0.0013} \\ \underset{(+\ 1.793)}{0.0143} & \underset{(-\ 3.113)}{-\ 0.0167} \end{pmatrix} \tag{10}$$

Since $m = 2$, matrix $\widehat{\Pi}_{0,LS}$ can be interpreted in terms of causality. Then, we do not find evidence that unemployment causes the immigration, but we find evidence at a 10 per cent level of significance that immigration causes unemployment. This low significance can be due to the loss of efficiency given the strong non-normality of the errors.

Remark 1 The robustness of the rank tests is checked with respect to including seasonal dummies and irrelevant lags in the estimation of the $R_{i,t}$, $R_{i,k,t}$, and $R^*_{i,k,t}$ residuals. The inclusion of these terms reduces the powers of the LR tests, although it does not affect the asymptotic distributions of the LR statistics Lütkepohl (2007, pp. 342). In order to prevent the rejection of the null hypothesis when it is true, we decrease the significance level to 2.5 per cent, since at the 5 per cent level the null hypothesis of $r_0 = 1$ is rejected.

Remark 2 Bruggemann and Lutkepohl (2004) compare the EGLS and ML estimators in small samples using the Monte Carlo study, and found that the EGLS estimator is more robust in this respect. The normality in fact is not essential for the asymptotic properties of the estimators, but the asymptotic distribution of $\widehat{\Sigma}_u$ may be different (Lütkepohl 2007, pp. 297).

Immigration, Unemployment, and GDP per capita Growth

In the introduction, we discuss that immigration flows have different effect over the general equilibrium in the extent to which immigrants play different roles in the host and origin economies. Hence, long-term effects of immigration on the economic growth is also a relevant issue (Mihi-Ramírez et al. 2018; Arce and Mahia 2013). Additionally, we might expect short-term effects of business cycles on immigration flows through short-term increasing or decreasing in labour demand. The short-term effects of economic growth is particularly important in the case of the Spanish economy, which faced to a significant increase in unemployment during the period 2008–2011.

In this section, we estimate a model that includes the GDP per capita growth (G_t) for the period 1992–2017 (World Bank database), the flows of immigrants (M_t) in working age, from 18 to 65 years (Eurostat database), and unemployment flows (U_t) according to the International Labor Organization (ILO) estimations (World Bank database).

Notice that, in the "The Series" section, we use different definitions of series, which allows to testing if the results obtained in previous sections still hold in the case of more general definition of unemployment and immigration. Additionally, we include an impulse dummy variable D_t for the period 2008–2011, in order to capture the effects of the economic crisis over the variables (see Remark 3).

According to the asymptotic and Bartlett-corrected cointegration test (Johansen 2000), we reject the null hypothesis that the rank is $r_0 = 0$ against $r_0 > 0$, but we cannot reject the hypothesis the rank is $r_0 = 1$ against $r_0 > 1$ with confidence level of 95 per cent (Table 6). Consequently, there is evidence of long-term relationship (cointegration) between M_t, U_t, and G_t, where the estimated cointegration vector is

$$\underset{\text{(t-Stat)}}{\widehat{\beta}_{p,0,LS}} = \begin{pmatrix} \underset{(-\ 4.65)}{-\ 3.14} \\ \underset{(-\ 1.60)}{-\ 0.94} \end{pmatrix} \tag{11}$$

In the extent to which this result implies that $M_t = 3.14U_t + 0.94G_t$, we find thus a positive long-term relationship between immigration flows, unemployment flows, and GDP per capita growth. Also, if we normalize in terms of unemployment flows, $U_t = 0.32M_t - 0.30G_t$; hence, unemployment flows and GDP per capita growth are negatively related in the long-term.

Table 6 Asymptotic and Bartlett-corrected cointegration test 1992–2007 (Lags $p = 3$, $T = 26$, with D_t, an exogenous impulse dummy variable)

Rank r_0	Trace	Asymptotic	Bartlett	Bartlett
		p value	p value	Trace
0	47.213	0.001	0.016	39.248
1	18.257	0.092	0.216	15.261
2	5.824	0.212	0.287	5.056

The null hypothesis $r_0 = 0$ against $r_0 > 0$ is rejected, and $r_0 = 1$ against $r_0 > 1$ and cannot be rejected

Thus, we find a long-term relationship between immigration flows and unemployment flows (ILO definition). In the "Cointegration Test" section, we found a positive and significant long-term relationship between unemployment flows (national employment office definition) and work permit rates. Hence, introducing GDP per capita growth in the equation and using different definitions of unemployment and immigration flows do not change the conclusion that immigration and unemployment flows related in the long-term.

Let us define $X_t = [M_t \;\; U_t \;\; G_t]$, and $z_{0,t} = M_t - 3.14U_t - 0.94G_t$, the error correction term, the estimated VECM(2) is

$$\underset{\text{(t-Stat)}}{\Delta X_t} = \begin{pmatrix} \underset{(3.543)}{0.10} \\ \underset{(1.525)}{0.13} \\ \underset{(1.243)}{0.12} \end{pmatrix} z_{0,t-1} + \begin{pmatrix} \underset{(-\,5.30)}{-\,0.01} \\ \underset{(4.75)}{0.04} \\ \underset{-\,3.81}{(-\,0.03)} \end{pmatrix} D_t + \sum_{p=1}^{2} \hat{\Gamma}_p \Delta X_{t-p}. \tag{12}$$

The economic fall of the period 2008–2011 had a significant effect over all variables. According to the estimated parameters, the economic crisis had a negative impact on immigration flows and GDP per capita growth and a positive impact on unemployment flows.

Regarding the short-term effect, immigration flows have a significative effect over short-term unemployment flows and GDP per capita growth two periods ahead (Table 7). Hence, an increasing in immigration flows has a negative impact on its own short-term flows.

Regarding the efficiency and consistency of estimations, we cannot reject the hypothesis that disturbances are stationary, homoscedastic, non-autocorrelated, and normal distributed (see Remark 3).

If the innovations which actually drive the system can be identified, the forecast error variance decomposition provides a further tool for interpreting the results. The forecast error variance decomposition or variance decomposition is a way to quantify how important each shock is in explaining the variation in each of the variables in the system (Sims 1980).

In the case of immigration flows, 100 per cent of the 1-step forecast error variance M_{T+1} is accounted by its own innovations. But, the relevance of unemployment flows increases for $h > 1$ and becomes as important as immigration flows at $h = 10$. In

Table 7 Estimation of Γ_p matrices of parameters of the VECM by the LS

	ΔM_t	ΔU_t	ΔG_t
ΔM_{t-1}	− 0.48* (− 2.39)	− 0.56 (− 0.97)	− 0.78 (− 1.13)
ΔM_{t-2}	− 0.76* (− 3.55)	2.41* (3.93)	− 2.90* (− 3.97)
ΔU_{t-1}	0.03 (0.39)	− 0.35 (− 1.71)	− 0.12 (− 0.52)
ΔU_{t-2}	0.05 (0.77)	−0.26 (− 1.33)	0.00 (0.00)
ΔG_{t-1}	− 0.01 (− 0.10)	− 0.37 (− 1.66)	− 0.29 (− 1.10)
ΔG_{t-2}	− 0.12 (− 1.33)	0.08 (0.25)	− 0.42 (− 1.40)

We do not reject the hypothesis that disturbances are stationary, homoscedastic, uncorrelated and normally distributed

contrast, the GDP per capita growth accounts only about 5 per cent of the forecast variance for all h (Table 8, columns 2–4).

Similarly, about 95 per cent of the 1-step forecast error variance U_{T+1} is accounted by its own innovations. But, the relevance of immigration flows increases for $h > 1$ and becomes more than unemployment flows for $h > 6$ in explaining the variation of the forecast. The GDP per capita growth accounts only small fractions of the forecast variance of U_{T+h} (Table 8, columns 5–7).

Finally, unemployment and GDP per capita growth accounts for about 40 per cent of the forecasting variance of G_{T+1} and immigration by about 20 per cent. But, for $h > 1$, its own innovation accounts for less than 30 per cent, while immigration and unemployment share the remaining proportion of the forecast variance. In particular,

Table 8 Forecast error variance decomposition

	Immigration			Unemployment			GDP per capita		
Step h	M_{t+h}	U_{t+h}	G_{t+h}	M_{t+h}	U_{t+h}	G_{t+h}	M_{t+h}	U_{t+h}	G_{t+h}
1	1.00	0.00	0.00	0.05	0.95	0.00	0.20	0.40	0.40
2	0.77	0.20	0.03	0.05	0.86	0.09	0.24	0.49	0.26
3	0.74	0.22	0.05	0.43	0.52	0.05	0.46	0.35	0.19
4	0.71	0.24	0.05	0.45	0.49	0.07	0.50	0.28	0.22
5	0.69	0.27	0.04	0.42	0.49	0.09	0.47	0.29	0.24
6	0.59	0.37	0.04	0.40	0.51	0.09	0.46	0.30	0.24
7	0.55	0.41	0.05	0.48	0.44	0.08	0.51	0.26	0.23
8	0.53	0.42	0.05	0.48	0.43	0.09	0.52	0.24	0.24
9	0.52	0.44	0.04	0.47	0.43	0.10	0.50	0.24	0.26
10	0.48	0.48	0.04	0.46	0.43	0.10	0.50	0.25	0.25

for $h > 2$, immigration flows are the most relevant variable in explaining the variation of the GDP per capita growth (Table 8, columns 8–10).

Thus, immigration flows become more important in explaining unemployment flows as immigrants become more similar to native workers. Analogously, unemployment flows become more important in explaining immigration flows as immigrants become more similar to native workers. However, immigration and unemployment do not play the same role in the forecasting of the GDP per capita growth. Immigration flows are the most important variable in explaining GDP per capita growth, but the opposite does not occurs.

Remark 3 Impulse dummy variables which are always zero except in specific periods,do not affect the asymptotic properties of the LR tests (Lütkepohl 2007, Chapter 8, Remark 6). In fact, if we no do not include D_t, we shall reject the null hypothesis that disturbances are homoscedastic, non-autocorrelated and normal distributed.

Policy Implications

According to the European Commission, the European societies are, and will continue to become, increasingly diverse. Today, there are 20 million non-EU nationals residing in the EU who make up 4 per cent of its total population. Thus, the EU needs to step up gear not only when it comes to managing migration flows but also when it comes to its integration policies for third-country nationals (EU 2016).

The main lesson of this paper is that immigrants are integrated (or cointegrated) in the Spanish economy, which is directly related to the efficacy of the integration policies implemented in Spain (Hooper 2019). Thus, immigration flows have a long-run positive effect on the GDP per capita growth which, in turn, generates positive effects on natives' wages (Amuedo-Dorantes and de la Rica 2013). Therefore, without policies devoted to distributing the surplus generated by immigrants, unemployed workers (natives and foreigners) bear the greatest burden of the negative long-term effect of immigration flows on the economy as a whole.

However, the negative impact of immigration should be managed on its context through reforms on the labor market structure. That is, restrictions to immigration and marginalization are not solutions to the weak sensitivity of the Spanish labour market to changes in the unemployment rate (Casares and Vázquez 2016). Even more important, the negative effect of immigration on Spanish productivity (Mihi-Ramírez et al. 2018; Arce and Mahia 2013) might jeopardize the positive effects of immigration on the GDP per capita growth. An issue that policy-makers have to address correctly.

Conclusions

The results could be surprising in the literature devoted to the analysis of the relationship between international immigration and unemployment, but not taking into account the characteristics of the Spanish culture and the integration of immigrants as a target (Berry 1997).

The Spanish migration policy and related regulations approved after 1999 protected the labour status of international immigrants, in response to the pressures of natives who claimed humanitarian rules in that matter (see discussion in Arango 2013). These pressures fostered in immigrants to a fast adaptation to the Spanish labour market, which appropriately managed, it prevents against the marginalization of immigrants (EU 2018).

Consequently, for the period 1981–1998, when the immigration flows were small, the series were not cointegrated and the effects were only short-term. But, when the immigration flows increased dramatically, the immigration polices fostered the integration and assimilation of immigrants, which implies that the series are cointegrated. These successful policies made immigrants no different from natives, and the positive causality is an expected result.

Until now, it had seemed that Spain was somehow immune to an anti-immigration rhetoric. Despite the fast increasing in immigration flows, Spanish voters are more concerned by emigration than immigration (ECFR 2019). But, recent polls showed that policy-makers devoted to integration policies must be prepared to the electoral rise of populist far-right parties. Mostly because integration policies implemented since 1999 are effective in the integration of immigrants in the Spanish labour market, at least in cointegration sense. But, if policy-makers continue designing the migration policy independently from the conditions of the labour market, in the future, we can expect the non-absorption of immigrants in the labour market.

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