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ORIGINAL PAPER

The employment situation of people living with HIV: a closer look at the effects of the 2008 economic crisis

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Abstract

This study aims to assess the determinants of employment probabilities among people living with Human Immunodeficiency Virus (HIV) during a 15-year period (2001–2016) in Spain, focusing on the possible effects of occurrences such as the 2008 economic crisis. The probability of people living with HIV having a job was evaluated by applying several multivariate probit regression models. Differences between the employment status of people living with HIV and that of the general population were evaluated by applying genetic matching regression models. With respect to the former evaluation, for people living with HIV, the period before the crisis (2001–2007) was associated with a probability of being employed that was 2.43 percentage points (p.p.) higher than during the crisis, and the period after the crisis (2014–2016) with a probability that was 7.58 p.p. lower than during the crisis. Greater effects were also observed among males, the probability of being in employment before the economic crisis being higher (by 2.26 p.p.) and lower after the crisis (− 3.41 p.p.) than among women, and among those infected through drug use (6.18 p.p. and − 7.34 p.p. before and after the crisis, respectively), than among those infected through sex. When analysing the differences with respect to the general population, people living with HIV reported lower probabilities of being employed: by − 18 p.p. before the crisis, by − 15 p.p. during the crisis (years 2008–2013) and by − 10 p.p. after the crisis, implying a convergence in the prospects of employment with the passage of the years. Those differences were greater for people of basic educational level (− 23 to − 16 p.p.), a weaker immune system (− 34 p.p. to − 21 p.p.) and those infected through the use of drugs (− 31 p.p. to − 26 p.p.). Although the results suggest that the economic crisis had a greater effect on the employment prospects of people living with HIV, and that effect is still felt by that group, our findings also point towards a convergence of their employment prospects with those of the general population, over the 15-year period assessed. An analysis of the employment situation of people living with HIV might have helped when designing job-seeking methods and policies on the working environment, especially through the 15-year period considered, when the economic crisis had a greater effect on the job market.

Keywords Employment · HIV · Uncertain economic period · Strength of the immune system · Source of infection

JEL Classification I0 · I10 · J20 · J40 · J70

Introduction

Since its discovery in the early 1980s, the Human Immunodeficiency Virus (HIV) has been one of the main concerns for public health worldwide [1, 2]. HIV not only causes deterioration in the health and quality of life of the population living with HIV, but also lead to serious socio-economic challenges for individuals, their families and governments [3]. Fortunately, the medical advances and the generalization of Highly Active Antiretroviral Therapy (HAART) have resulted in a radical change in the clinical management of this disease, substantially increasing the life expectancy and

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the quality of life of the population living with HIV in high-income countries [4]. However, despite these improvements, the health status of people living with HIV is worse than that of the general population [5–7]. Moreover, in these countries, one of the issues that currently most concerns people living with HIV and public authorities is the impact of HIV on other socio-economic dimensions [3].

From the economic point of view, one of the main socio-economic challenges that people with HIV are facing is their employment situation, since most of them are of working age [3, 8]. In fact, in high-income countries, the highest incidence rate occurs in the age group between 25 and 34-years-old [9, 10], posing its greatest burden in terms of death rates among the population aged 15–49-years-old [11]. The literature has proved the enormous negative impact of the disease on the employment of people living with HIV in high-income countries at the beginning of the pandemic during 1980s and early 1990s [12–16]. However, with the appearance of the first antiretrovirals and, more precisely, with the generalization of HAART, this situation appreciably changed. More specifically, therapeutic advances increased the probability of maintaining employment or finding a new one, although there were still significant differences between the employment rates of the people living with HIV and those of the general population [17]. The existing literature is consistent with respect to the improvements in the employment status of people living with HIV over the past two decades, although, depending on the country and on the period on which the analyses are focused, there are certain variations due to the different progress of the treatments and the different socio-employment conditions in the countries where the analyses were performed [17–32].

Between 2008 and 2014 the impact of the economic downturn on the European labour markets was devastating, with sharp differences between countries. The unemployment rate in the European Union (EU) stood at 7.2% and 10.2% in 2008 and 2014, respectively, whereas in Spain these figures reached 8.5% and 24.4%, respectively, showing the different effects of the crisis on the labour market, depending on the country and the geographical area [33]. One of the outstanding characteristics of the economic crisis is its asymmetric impact on different population groups. Some studies have identified vulnerable population groups, such as migrants, young people, and people with chronic diseases, who have been more harmed by the last crisis, their employment status being one of their most affected dimensions [34–36].

An analysis of the employment situation which takes a wider view of vulnerable people having any chronic disease, such as people living with HIV, might help when designing job-seeking methods and policies on working environments targeted at those populations, especially during the economic crisis. However, very few studies have analysed the determinants of the employment situation among people living with HIV [17, 18, 22], and none of them have focused on a long period including the years before, during and after an economic downturn. Then, the main aim of the manuscript is twofold. First, to assess the determinants of employment among people living with HIV over a 15-year period (2001–2016) in Spain, considering the effect that the last economic crisis might have had. Second, to evaluate differences in the probability of being employed between people living with HIV and the general population, and whether the economic crisis affected the employment status of people living with HIV more than it affected the general population.

Data and methods

Sample data

Two sources of data were used to carry out this analysis. First of all, the Hospital Survey of HIV/AIDS patients, which was provided by the General Secretariat of the AIDS Plan. This is a cross-sectional survey which contains clinical and sociodemographic information about people living with HIV. Despite the name of the survey, most of the people were interviewed in outpatient consultations (73% in 2001—minimum value—and 88% in 2012—maximum value), with the information being collected by the corresponding specialist doctor [37]. The percentage of the population covered by the participating hospitals amounts to two thirds of the people living with HIV in Spain and consisted of 9501 observations from 2001 until 2016. The survey collects information annually, using a questionnaire completed by the physician during or immediately after the patient's consultation at the healthcare centre. The information collected includes sociodemographic variables (age, gender, level of education and employment status) as well as specific information related to HIV: strength of the immune system according to the CD4 cell count, most likely source of infection, HIV severity according to the symptoms of illness, time elapsed since diagnosis of HIV, and drug use during the previous 12 months.

To obtain information about the employment status of the general population (and other information), the Labour Force Survey from 2001 to 2016 was used [38]. The survey, which is provided by the National Institute of Statistics every quarter, gives national information about the employment status of community-dwellers, as well as basic sociodemographic information such as age, gender, and level of education. The sample comprised more than 3,500,000 observations over 16 years (2001–2016).

Because the analysis relates to the probability of being employed, only individuals of working age (16–64-years-old) were included. People living with HIV who lived in

a prison or in a collective institution (less than 3% of the sample living with HIV) were excluded.

Finally, another consideration is the fact that the Labour Force Survey does not show whether respondents are HIV-positive. Considering that the prevalence rate of HIV among the general Spanish population is 3.1 cases per 1000 people, we have considered that the absence of this variable from the survey of the general population is acceptable.

Selection of variables

The main independent variable was whether an individual was employed. We used a binary variable which takes the value 1 if the person was employed and 0 otherwise.

General information about age, gender, and level of education (no education, elementary, secondary or higher education) was also included in the analysis.

HIV-related characteristics were taken from the Hospital Survey of HIV/AIDS patients. We used the information about the number of years elapsed since a diagnosis of HIV, the strength of the immune system according to the CD4 cell count per microlitre (a weak immune system if the CD4 cell count was below 200; medium if between 200 and 500; and strong if equal to or above 500), the source of infection (through sex, through intravenous drugs, or from another source), the severity of HIV according to the symptoms of illness (which ranged from no symptoms to a diagnosis of AIDS), and whether the individual had used any drugs during the previous twelve months (injected drugs or methadone).

Statistical analysis

This study consisted of two separate analyses: first of all, we assessed the relationship between a set of characteristics within the people living with HIV and the probability of being employed, considering in the regression model any economic cycle effect (before (years 2001–2007), during (years 2008–2013) or after (years 2014–2016) the economic crisis), and second, we evaluated any potential differences between people living with HIV and the general population during the same period, performing multiple comparisons according to general and HIV-specific characteristics to analyse the potential drivers of such differences, if any.

For the first purpose of the analysis, and considering the binary nature of our independent variable, being employed, we estimated a multivariate probit regression with clustered standard errors at the individual level [39].

Let $\emptyset(t) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}t^2}$ be the standard normal density function ($\varnothing$) with values ranging between zero if unemployed and one if employed, and let

$$Pr[employed_i = 1|x_i] = \emptyset\left(\beta x_i' + \varepsilon_i\right), \quad (1)$$

where i represents the individual. $employed_i$ is a dummy variable which might equal 1 indicating that respondent i is employed. x_i' is a vector of explanatory variables, which denote age and its square root, gender, level of education, HIV-specific characteristics (i.e. strength of the immune system, time elapsed since diagnosis of HIV, source of infection, etc.) and the economic-crisis dummies. Some interaction terms were included too: age and source of infection, gender and source of infection, time-period dummies and source of infection, level of education, and strength of the immune system. ε_i denotes the error term.

The regression models will be run for the whole sample, but also by gender and by source of infection, distinguishing between whether the individual with HIV was infected through sex or through intravenous drug use.

Moreover, as a robustness check, the same regression analyses were performed, but replacing the strength of the immune system by the symptoms of illness as an additional measurement of disease severity.

The software used to perform the analysis was Stata SE, version 15.0.

To provide an answer about the second objective of our research—assessing whether there are significant differences in the probability of being employed between people living with HIV (the treatment group) and the general population (the control group)—we used matching techniques which aimed to deal with selection bias due to confounding effects, assuming that there are no unobserved confounding variables and that the covariates sufficiently overlap between groups. Thus, the main assumption is that the allocation to the treatment group (people living with HIV) is not random and, hence, depends on a series of observable variables (age, gender, level of education, and time dummies) [40], for which controls can be set up. Although there are other matching approaches which have been commonly mentioned in the literature, such as propensity score matching, we used genetic matching techniques instead. Genetic matching is one of the best statistical techniques that alleviates some problems arising in other matching techniques [41]: it automatically checks the propensity score, maximising the balance between covariates and searching for the best matches between the treatment and the control groups, which leads to less bias and a minimization of the multivariate distance between individuals from both groups [42].

Several sub-analyses were run to get a deeper understanding of several factors which might explain differences between the general population and people living with HIV, such as gender, level of education, source of infection, and strength of the immune system.

The software used to carry out the genetic matching analysis was R-Studio, version 3–5.1.

Results

Descriptive statistics

Table 1 shows the sample characteristics for both sub-samples (general population and people living with HIV) for the whole period and by economic cycle period (before, during and after the economic crisis). From 2001 until 2016, the probability of being employed for the general population was 56.71%, whereas for people living with HIV the probability was 49.17%, a difference of 7.54%. That difference reached its maximum during the last period, from 2014 to 2016, when there was a difference of almost 10 points between the two sub-samples (46.32% in the case of people living with HIV vs 56.47% for the general population).

Table 1 shows that the cohort of people living with HIV changed between the different time points: new cases seem to be older in later years (mean age 43.55-years-old in 2014–2016 vs 37.54-years-old, on average, from 2001 to 2007), more educated (16.12% had a higher educational level during the period before the crisis vs 9.47% after the crisis), with a longer period elapsed since the diagnosis of HIV (13.74 years at the end of the period analysed against 8.54 years during the starting period) and being infected through sex rather than via drugs use (during the period after the crisis, in 56.81% of the sample with HIV the most likely source of infection was sex, whereas before the crisis the percentage was 42.26%) (Table 2).

Results from the statistical analysis

Results on the association between labour participation and characteristics of people living with HIV

As Table 2 shows, within the whole sample, the period before the crisis was associated with a higher probability of being employed by 3.79 percentage points (p.p.), while the period after the crisis was associated with a lower probability of being employed by − 3.32 p.p., compared with the period of the crisis. When taking into account the marginal effect of interactions with the source of infection, among those infected through sex, there was no significant association for any of the time dummies. However, for those people living with HIV infected through drugs use, the period before the crisis was associated with a higher probability of being employed by 2.43 percentage points (p.p.) (p value < 0.05) and with a lower probability by 7.58 p.p. after the crisis, compared with people living with HIV during the crisis. An additional year of age was related to a higher probability of being employed (by 14.78 p.p. if infected through sex and by 15.42 p.p. if through drugs use), although the negative sign of the square of age shows that that effect will be decreasing at some point. Compared with people living with HIV and no education or primary education only, people with secondary education and a stronger immune system were associated with a higher probability of being employed by 14.33 p.p. and by 13.89 p.p. if their strength of the immune system was high. A higher level of education in people living with HIV was associated with a higher likelihood of being employed by 24.96 p.p. and 22.76 p.p. if their immune system strength was medium or high, respectively, compared with people living with HIV and lower levels of education. The interactions were jointly significant for the whole sample.

The results by gender showed significant differences between men and women living with HIV. When taking into account the effect through interactions, the results showed that economic period variables were only significant for males infected through the use of drugs, as the probability of being employed being higher before the economic crisis (2.26 p.p.) and lower after it (− 3.41 p.p.). The strength of the immune system was significant and positively related to the probability of being employed, the coefficients being higher for men than for women. For example, among females, having a strong immune system was associated with a higher probability than among people living with HIV and a weak immune system. The probability increased by 9.98 and 8.71 p.p. among women with medium and high levels of education, respectively. Among men, those coefficients increased by 14.12 and 13.02 p.p., respectively. Interactions were not jointly significant for either gender, although the differences between men and women were indeed significant.

By source of infection, significant differences were found between those individuals infected through sex and those infected through intravenous drug use. In fact, the economic time-point dummies were only significant for those people living with HIV who were infected through the use of drugs, the probability of being employed being higher before the crisis (6.18 p.p.) and lower after it (− 7.34 p.p.). The effect of age was significantly associated with being employed in both sub-groups, being higher among those infected through sex (15.30 p.p.) than among those infected through the use of drugs (10.12 p.p.). The strength of the immune system had a higher positive impact on the probability of being employed among those who were infected through using drugs than among those infected through sex. Having a medium strength of the immune system was related to a probability of being employed that was between 7.03 and 8.64 p.p. higher, depending on whether the level of education was secondary or higher, if infected through sex

Table 1 Descriptive statistics

	Total		Before the economic crisis (years 2001–2007)		During the economic crisis (years 2008–2013)		After the economic crisis (years 2014–2016)	
	People with HIV ($N=9501$)	General population ($N=3,588,419$)	People with HIV ($N=4501$)	General population ($N=724,756$)	People with HIV ($N=3370$)	General population ($N=1,618,933$)	People with HIV ($N=1630$)	General population ($N=1,244,730$)
Being employed, *N* (%)	4672 (49.17)	2,034,848 (56.71)	2293 (50.94)	422,479 (58.29)	1624 (48.19)	909,466 (56.18)	755 (46.32)	702,903 (56.47)
Age, Mean (SD)	39.88 (8.67)	39.02 (13.39)	37.54 (7.60)	37.21 (13.51)	41.29 (8.76)	39.12 (13.29)	43.55 (9.36)	39.91 (13.35)
Age, *N* (%)								
[16–30)	676 (7.29)	861,923 (26.47)	336 (7.57)	212,787 (31.90)	228 (6.97)	376,101 (25.62)	112 (7.16)	273,035 (24.34)
[30–45)	5342 (57.61)	1,174,669 (36.07)	3242 (73.03)	239,359 (35.88)	1563 (47.81)	541,801 (36.91)	537 (34.34)	393,509 (35.09)
[45–55)	2735 (29.50)	845,247 (25.96)	717 (16.15)	147,998 (22.19)	1288 (39.40)	384,988 (26.23)	730 (46.68)	312,261 (27.84)
[55–65]	519 (5.60)	374,694 (11.51)	144 (3.24)	66,884 (10.03)	190 (5.81)	165,069 (11.24)	185 (11.83)	142,741 (12.73)
Gender: female, *N* (%)	2620 (28.51)	1,825,271 (50.87)	1238 (28.67)	366,581 (50.58)	940 (28.81)	824,344 (50.92)	442 (27.45)	634,346 (50.96)
Education, *N* (%)								
No education	202 (2.17)	30,770 (0.86)	113 (2.54)	8767 (1.21)	65 (1.97)	13,163 (0.81)	24 (1.52)	8840 (0.71)
Elementary education	4859 (52.15)	585,968 (16.33)	2489 (56.00)	185,986 (25.66)	1691 (51.29)	265,537 (16.40)	679 (43.08)	134,445 (10.80)
Secondary education	3163 (33.95)	1,961,430 (54.66)	1422 (31.99)	363,863 (50.20)	1122 (34.03)	880,192 (54.37)	619 (39.28)	717,375 (57.63)
Upper education	1094 (11.74)	1,010,251 (28.15)	421 (9.47)	166,140 (22.92)	419 (12.71)	460,041 (28.42)	254 (16.12)	384,070 (30.86)
Time elapsed since HIV diagnosis, in years Mean (SD)	10.60 (7.35)	–	8.54 (5.62)	–	11.80 (7.65)	–	13.74 (9.03)	–
Time since HIV diagnosis, *N* (%)								
Less than 2 years	1122 (12.14)	–	589 (13.56)	–	360 (10.89)	–	173 (10.85)	–
[2–5 years)	1224 (13.24)	–	635 (14.62)	–	418 (12.65)	–	171 (10.73)	–
[5–10 years)	2027 (21.93)	–	1200 (27.63)	–	575 (17.40)	–	252 (15.81)	–
[10–15 years)	2107 (22.80)	–	1212 (27.91)	–	673 (20.36)	–	222 (13.93)	–
15 years or more	2762 (29.89)	–	707 (16.28)	–	1,279 (38.70)	–	776 (48.68)	–
Strength of the immune system, *N* (%)								
Weak (CD4/μl < 200)	2020 (21.66)	–	1168 (26.57)	–	615 (18.45)	–	237 (14.86)	–
Medium (200 ≤ CD4/μl < 500)	3439 (36.88)	–	1735 (39.47)	–	1239 (37.16)	–	465 (29.15)	–
Strong (CD4/μl ≥ 500)	3866 (41.46)	–	1493 (33.96)	–	1480 (44.39)	–	893 (55.99)	–
Source of infection, *N* (%)								
Drug use	4392 (46.23)	–	2376 (52.79)	–	1417 (42.05)	–	599 (36.75)	–
Sex	4584 (48.25)	–	1902 (42.26)	–	1756 (52.11)	–	926 (56.81)	–

Table 1 (continued)

	Total		Before the economic crisis (years 2001–2007)		During the economic crisis (years 2008–2013)		After the economic crisis (years 2014–2016)	
	People with HIV ($N=9501$)	General population ($N=3,588,419$)	People with HIV ($N=4501$)	General population ($N=724,756$)	People with HIV ($N=3370$)	General population ($N=1,618,933$)	People with HIV ($N=1630$)	General population ($N=1,244,730$)
Pregnancy	63 (0.66)	–	15 (0.33)	–	30 (0.89)	–	18 (1.10)	–
Blood transfusion	77 (0.81)	–	49 (1.09)	–	22 (0.65)	–	6 (0.37)	–
Other or unknown cause	226 (2.38)	–	159 (3.53)	–	67 (1.99)	–	–	–
HIV severity, *N* (%)								
No symptoms of illness	3771 (40.57)	–	1574 (35.68)	–	1459 (44.40)	–	738 (46.21)	–
Symptoms of illness	1734 (18.66)	–	808 (18.31)	–	627 (19.08)	–	299 (18.72)	–
AIDS diagnosis	3790 (40.77)	–	2030 (46.01)	–	1200 (36.52)	–	560 (35.07)	–
Drugs use during the previous month, *N* (%)								
Intravenous drug use	435 (4.60)	–	285 (6.33)	–	130 (3.89)	–	20 (1.25)	–
Methadone	1320 (14.02)	–	734 (16.31)	–	446 (13.34)	–	140 (8.92)	–

SD Standard deviation, *N* number, *CD4* cluster of differentiation 4, *HIV* human immunodeficiency virus, *AIDS* acquired immune deficiency syndrome

and 9.91 p.p. higher (secondary education) and 13.37 p.p. higher (highly educated people living with HIV) if infected through using intravenous drugs. None of the interactions were jointly significant for any of the sub-groups by source of infection.

Within the robustness check in which we exchanged the variable strength of the immune system for symptoms of illness, although minor changes in terms of marginal effects were observed, the significance and the sign of the different variables were consistent with the results found in the main analysis. These results can be found in Table A1, Appendix.

Results from the genetic matching on the differences between people living with HIV and the general population

The results from the genetic matching (Table 3) show that, for individuals of the same age, gender, educational level and year, the difference in the employment rate decreased from the beginning of the period (when people living with HIV had a 18.9 p.p. lower probability of being employed than the general population) to the period after the economic crisis (from 2014 until 2016, when the difference in the likelihood of being employed was 9.7 p.p. between the two sub-samples).

When looking at common characteristics of both populations, we notice that those differences became larger for men, older people and individuals with a basic educational level. In the case of differences by gender, male individuals living with HIV had a 26 p.p. lower probability of being employed at the beginning of the period than the general male population. That difference decreased to − 20 p.p. during the economic crisis and finally fell to − 12.6 p.p. for the years 2014–2016. For people aged 55-years-old or more, the difference in the probability of being employed also decreased, but in a more gradual way: from 2001 until 2007, older individuals living with HIV were 19 p.p. less likely to be employed than their counterparts in the general population, whereas this difference decreased to − 13.4 p.p. for the last period. Lastly, when considering those people with basic education in both sub-groups, we notice that people living with HIV were 23 p.p. less likely to be employed than the general population during the years 2001–2007, that this figure decreased to − 20 p.p. during the economic crisis (2008–2013), and that it reached its minimum during 2014–2015, when the difference in the probability of being employed was − 15.7 p.p.

With respect to specific characteristics of people living with HIV, the results show the greatest differences among those with a weak immune system, and among those who were infected through drugs use. The formers were 33.6 p.p. less likely to be employed than the general population at the beginning of the period analysed. This figure fell to − 29.9

Table 2 Results from the probit regression models performed

Variables	Average Marginal Effects. Whole sample	Average Marginal Effects. Females	Average Marginal Effects. Males	Average Marginal Effects Sex as the source of infection	Average Marginal Effects. Drugs use as the source of infection
Age	0.1496*** (0.0130)	0.1056*** (0.0247)	0.1632*** (0.0156)	0.1530*** (0.0154)	0.1012*** (0.0284)
Age^2	− 0.0020*** (0.0002)	− 0.0014*** (0.0003)	− 0.0021*** (0.0002)	− 0.0020*** (0.0002)	− 0.0013*** (0.0004)
Gender: female	− 0.112*** (0.0111)	–	–	− 0.148*** (0.0161)	− 0.0668*** (0.0164)
Education					
Secondary education	0.158*** (0.0115)	0.191*** (0.0190)	0.131*** (0.0125)	0.172*** (0.0165)	0.141*** (0.0168)
Upper education	0.259*** (0.0176)	0.303*** (0.0341)	0.230*** (0.0195)	0.268*** (0.0194)	0.210*** (0.0441)
Time since HIV diagnosis					
[2–5 years)	− 0.0612*** (0.0200)	− 0.0375 (0.0398)	− 0.0712*** (0.0231)	− 0.0472** (0.0219)	− 0.111** (0.0516)
[5–10 years)	− 0.0810*** (0.0187)	− 0.0289 (0.0368)	− 0.101*** (0.0217)	− 0.0719*** (0.0212)	− 0.0995** (0.0466)
[10–15 years)	− 0.101*** (0.0194)	− 0.0736* (0.0379)	− 0.110*** (0.0224)	− 0.0910*** (0.0237)	− 0.111** (0.0455)
15 years or more	− 0.155*** (0.0202)	− 0.102*** (0.0393)	− 0.174*** (0.0231)	− 0.177*** (0.0265)	− 0.144*** (0.0459)
Strength of the immune system					
Medium ($200 \leq CD4/\mu l < 500$)	0.103*** (0.0140)	0.0830*** (0.0274)	0.110*** (0.0158)	0.0788*** (0.0219)	0.119*** (0.0182)
Strong ($CD4/\mu l \geq 500$)	0.165*** (0.0140)	0.129*** (0.0270)	0.178*** (0.0158)	0.153*** (0.0213)	0.179*** (0.0192)
Source of infection					
Drug use	− 0.0927*** (0.0134)	− 0.0396 (0.0242)	− 0.113*** (0.0147)	–	–
Drugs use during the previous 12 months					
Intravenous drug use	− 0.150*** (0.0278)	− 0.0575 (0.0633)	− 0.176*** (0.0325)	− 0.0469 (0.112)	− 0.144*** (0.0260)
Methadone	− 0.227*** (0.0165)	− 0.262*** (0.0367)	− 0.215*** (0.0189)	− 0.191 (0.117)	− 0.222*** (0.0158)
Economic period					
Before the crisis (years 2001–2007)	0.0379*** (0.0118)	0.0273 (0.0223)	0.0422*** (0.0138)	0.0206 (0.0159)	0.0618*** (0.0185)
After the crisis (2014–2016)	− 0.0332** (0.0151)	− 0.00671 (0.0296)	− 0.0427** (0.0190)	− 0.0162 (0.0195)	− 0.0734*** (0.0233)
Age # source of infection					
Age # drugs use	0.0015 (0.0014)	0.0029 (0.0028)	0.0017 (0.0017)	–	–
Gender # source of infection					
Females # drugs use	0.0782*** (0.0234)	–	–	–	–
Source of infection # economic period					
Drugs use # before the crisis	0.0237 (0.0234)	0.0318 (0.0443)	0.0211 (0.0276)	–	–
Drugs use # after the crisis	− 0.0480* (0.0314)	− 0.0231 (0.0625)	− 0.0452 (0.0368)	–	–
Strength of the immune system # educational level					
Medium immune system # secondary education	− 0.0245 (0.0309)	− 0.0568 (0.0609)	− 0.0138 (0.0359)	0.0306 (0.0473)	− 0.0516 (0.0438)
Medium immune system # upper education	− 0.0310 (0.0494)	− 0.0670 (0.1181)	− 0.0209 (0.0550)	− 0.0125 (0.0591)	0.1365 (0.1296)
Strong immune system # secondary education	− 0.0027 (0.0298)	0.0357 (0.0584)	− 0.0248 (0.0349)	0.0353 (0.0449)	− 0.0213 (0.0441)
Strong immune system # upper education	− 0.0305 (0.0476)	0.0149 (0.1104)	− 0.0522 (0.0535)	− 0.0069 (0.0562)	− 0.0192 (0.1322)
Observations	8227	2362	5863	4065	3854
Log-likelihood	− 4942.47	− 1444.23	− 3483.02	− 2492.06	− 2255.30

Table 2 (continued)

Variables	Average Marginal Effects. Whole sample	Average Marginal Effects. Females	Average Marginal Effects. Males	Average Marginal Effects Sex as the source of infection	Average Marginal Effects. Drugs use as the source of infection
Prob > Chi^2	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R^2	0.1531	0.1120	0.1643	0.1155	0.1172
Joint significance of interactions (χ^2)	22.21**	6.93	4.99	1.53	6.44
Wald test for differences between groups	–	143.03***		87.15***	

Reference categories: male, none or elementary education, newly HIV diagnosed (less than 2 years), weak immune system (CD4/μl < 200), sex as the source of infection, no drug use during the previous twelve months, during the economic crisis (years 2008–2013)

Robust standard errors in parentheses

*$p < 0.1$

**$p < 0.05$

***$p < 0.01$

p.p. during the years 2008–2013 and decreased steeply to − 20.6 p.p. in the last period (2014–2016). When looking at the former sub-analysis by source of infection, we notice that people living with HIV and drug use as the source of infection were 31.1 p.p. less likely to be employed during the period before the economic crisis than the general population. This figure decreased to − 27.9 p.p. during the economic crisis and to − 26.1 p.p. in the period from 2014 to 2016.

Discussion

The aims of this analysis were, first, to assess whether the economic crisis that hit Spain at the end of 2008 had an effect on the probability of being employed among people living with HIV, in addition to other factors, and, second, whether there are significant differences in the probability of being employed between people with HIV and the general population. As far as we are concerned, this is the first study analysing the determinants of employment among people living with HIV and comparing their employment rates with those of the general population, by taking a closer look at the effect of the last economic crisis and using a longer period (from 2001 to 2016).

With respect to our first purpose, the results show that, in the overall sample of people living with HIV, the 2008 financial crisis seemed to have a significant effect on the probability of being employed, with opposite signs depending on whether the period considered was before the crisis period (higher probability of having a job than during the crisis period) or after it (lower likelihood). This suggests that the employment rates of people living with HIV did not return to the levels before the crisis period. Although the literature assessing the impact of the economic crisis on the employment of people living with HIV is scarce, the evidence from that literature is in line with our results. For instance, Annequin et al. showed that, in France, from 2003 to 2011, not only did the unemployment rate among people living with HIV increase, but also access to work was even harder among that population [43]. These employment limitations among people living with HIV during or even after economic downturns might be explained by the fact that HIV prevention and treatment programmes were jeopardised by financial constraints [44–46], which even led to potentially higher risks of HIV transmission [44].

The results also revealed some differences between subgroups that are worth mentioning: the economic period dummies were only significant for males, in whom the effect of immune system strength was also greater. In the case of the most likely source of infection, more pronounced effects were observed in people infected through using intravenous drugs, with significant effects of the economic cycle variables and greater effects from education and strength of the immune system, than in those people living with HIV who had been infected through sex. The reason for this might be the composition of the HIV cohort, who are less educated and are older, as the descriptive statistics suggest. With respect to the former, people with lower educational levels are usually engaged in low-skill but very physically demanding jobs [47], which have been found to be more affected by the economic crisis [47–49]. If less well-educated people living with HIV occupied those jobs, the HIV-related effects, which might limit their physical performance, as other chronic diseases also do, might cause the loss of those jobs. Moreover, people living with HIV experience an early

Table 3 Results from the genetic matching

	Before the crisis (year 2001–2007)			During the crisis (years 2008–2013)			After the crisis (years 2014–2016)		
	N	Diff. (S.E.)	T-stat	*N*	Diff. (S.E.)	T-stat	*N*	Diff. (S.E.)	T-stat
PlwHIV vs general population	4264	− 0.189 (0.008)	− 24.45***	3178	− 0.152 (0.010)	− 18.27***	1579	− 0.097 (0.013)	− 6.75***
PlwHIV females vs females in general population	1229	− 0.012 (0.014)	− 0.91	914	− 0.061 (0.017)	− 2.17**	425	− 0.034 (0.019)	− 1.68*
PlwHIV males vs males in general population	3035	− 0.260 (0.009)	− 28.89***	2264	− 0.203 (0.011)	− 17.33***	1154	− 0.126 (0.015)	− 7.36***
PlwHIV older than 55-years-old vs general population older than 55	195	− 0.190 (0.008)	− 23.94***	273	− 0.178 (0.032)	− 14.32***	228	− 0.134 (0.026)	− 6.41***
PlwHIV younger than 55-years-old vs general population younger than 55	4069	− 0.161 (0.034)	− 4.73***	2905	− 0.142 (0.010)	− 11.18***	1311	− 0.103 (0.016)	− 4.98***
PlwHIV with weak immune system vs general population	1126	− 0.336 (0.016)	− 22.14***	586	− 0.299 (0.021)	− 17.34***	249	− 0.206 (0.033)	− 6.17***
PlwHIV with medium immune system vs general population	1697	− 0.201 (0.013)	− 13.12***	1168	− 0.153 (0.017)	− 9.26***	453	− 0.148 (0.018)	− 5.12***
PlwHIV with strong immune system vs general population	1439	− 0.073 (0.009)	− 4.62***	1424	− 0.081 (0.015)	− 4.08***	877	− 0.064 (0.019)	− 2.87***
PlwHIV infected through sex vs general population	1871	− 0.051 (0.013)	− 4.01***	1840	− 0.030 (0.015)	− 1.73*	975	− 0.016 (0.025)	− 0.38
PlwHIV infected through drugs use vs general population	2393	− 0.311 (0.012)	− 28.64***	1338	− 0.279 (0.014)	− 24.44***	604	− 0.261 (0.018)	− 10.29***
PlwHIV with basic education vs general population with basic education	2492	− 0.231 (0.010)	− 22.27***	1687	− 0.202 (0.013)	− 18.33***	738	− 0.157 (0.017)	− 11.61***
PlwHIV with secondary education vs general population with secondary education	1367	− 0.141 (0.014)	− 10.41***	1084	− 0.122 (0.017)	− 7.12***	594	− 0.078 (0.018)	− 3.79***
PlwHIV with higher education vs general population with higher education	405	− 0.080 (0.020)	− 4.05***	407	− 0.091 (0.022)	− 3.92***	217	− 0.062 (0.024)	− 1.99**

N stands for the original number of matched observations; Diff denotes the difference in the outcome between the treatments (people living with HIV) and the controls (general population); S.E. is the standard error; T-stat represents the *t*-statistic of statistical significance and PlwHIV stands for people living with HIV

Matching variables: gender, age, educational level (if not differentiated by level of education) and year of observation

*$p < 0.1$

**$p < 0.05$

***$p < 0.01$

onset of age-related complications, such as impaired physical functioning [50]. Older people living with HIV are also at a higher risk of multimorbidity, including cardiovascular and renal diseases, as well as cancer [51, 52] and polypharmacy [51], which might lead to a lower quality of life at older ages and premature mortality [52]. The worsening of health might force individuals to opt for early retirement and not returning to work, especially after economic hardships, as psychosocial stress negatively affects immunological health among people living with HIV [53]. Another explanation might be that if older people living with HIV are aware of their shorter life expectancy, they might assume that their leisure time is also shortening, becoming more willing to leave their job and permanently abandon the labour market [19].

The results from the genetic matching show that there were differences between the employment probabilities of the two sub-samples, but those differences seem to become smaller with the passage of time: from 2001 until 2007, people living with HIV were 18.9 p.p. less likely to be employed. That figure decreased to 15.2 p.p. between 2008 and 2014 and finally decreased to 9.7 p.p., pointing towards a convergence in the employment rates between people living with HIV and the general population. These convergent results extend up to 2016 the trend that was observed in a previous work up to 2010 [17], attributing the smaller difference between the employment probabilities of the two populations to therapeutic advances and better living standards. The results should be interpreted with caution, since both supply and demand might have changed during the recession, given the reduction in the number of jobs (supply) and the increase in people seeking employment (demand) (high unemployment rates). However, our findings do not coincide with those obtained in other European countries, such as France [18] or, partially, the Netherlands [54]. While the French study pointed towards no overall convergence between people living with HIV and the general population, the Dutch authors highlighted that absenteeism and presenteeism were actually the only elements that did diverge between both populations. Nevertheless, the studies should be carefully compared, as the geographical context played a key role with respect to financial hardships during the economic crisis, especially those related to (un)employment. In fact, whether employment or unemployment is analysed might be a key factor for assuring comparability between studies, as employment rates are more stable over time than unemployment rates. Changes in the unemployment rates for Spain, France and the Netherlands significantly differed between 2008 and 2016, but differences in employment were smaller between countries and varied to a much smaller extent [33]. Further analyses could, therefore, include a cross-country comparison, applying homogeneous criteria to assess potential drivers of the differences found. Moreover, the results reveal important differences between specific subgroups, especially those with a weak or medium immune system, basic education and people living with HIV infected through sex, which confirms the importance of these factors in the analysis of people living with HIV [32, 55, 56].

The present study has some limitations, too. First, despite being the result of many years of observation, the dataset did not have a panel feature, so the same individuals could not be observed throughout the 15 years included, and the observed associations cannot be interpreted as causal. Moreover, although place of residence can play a relevant role on the job opportunities or the impact of economic constraints, among others, the survey did not allow us to perform the analysis by region. We could not distinguish whether people reside in an urban or rural area either. Additionally, we were unable to include information about earnings or any other non-salary income (e.g. a partner´s earnings), but we did use education, which is known to be a suitable proxy for income. Nor were we able to include information about treatment received, as it was only available until 2010. Controlling for antiretroviral therapy in the multivariate probit regressions, for example, could have provided significant results, as it has been proved to be associated with higher employment probabilities among people living with HIV, as well as with longer working times [57]. Furthermore, a limitation of our study is that we had no information about the type of contract, occupational sector, professional category or other relevant job characteristics of people living with HIV, which could have been crucial for an analysis of employment status [58]. However, even though it would have been interesting to have such information, and although the Hospital Survey of HIV/AIDS is the best available survey of people living with HIV performed in Spain, its scope is not to analyse the employment status of people living with HIV, and this limits the available information about the employment situation of such population.

The results obtained should help policymakers aiming to promote job-seeking strategies and policies on the working environment that are directed to people living with HIV, who still experience hardship compared with the general population. In some countries, certain vocational interventions and employment services, such as rehabilitation job centres [59] or micro-enterprise employment interventions [60], peer-employment models [61] or programmes consisting of integrated services that combine medical, employment, housing, and other psychosocial services [62], have improved health-related quality of life and reduced health-risk behaviours among people living with HIV [63–65]. In spite of those positive results, vocational rehabilitation programs for people living with HIV are commonly underfunded and in the early stages of development, exacerbating gaps in income supports for people living with HIV [63, 66]. The results obtained from these programmes cannot be extrapolated to other frameworks and need further adaptation and evaluation, as they might be subject to some environmental and country-specific factors, such as social, economic and cultural issues. On the other hand, interventions with antiretrovirals did seem to have positive outcomes across different settings in terms of employment probabilities and number of hours worked [57], leaving room for improvement in the existing evidence, and for research into the effectiveness of job-related interventions for people living with HIV.

The results found show that the most vulnerable populations (i.e. people living with HIV who had been infected through drugs use, and who had weaker immune systems and lower levels of education) had more negative outcomes in terms of employment, and, since drug use is frequently

started at early ages, at which educational level is probably low, effective drug-prevention programmes might be effective. Moreover, health-related interventions, such as those which motivate adherence to treatment, or counselling campaigns for people living with HIV who have depression, which increases when they are unemployed [67], as well as societal-awareness campaigns, would improve job opportunities for people living with HIV.

Since HIV mainly affects working-age populations of adults, our findings have direct implications for public health and job-promotion policies, contributing to the discussion about how chronically ill people, such as people living with HIV, are viewed and how they are integrated into workplaces and the labour market, especially during and after periods of economic crisis. Although employment rates now point towards a convergence between people living with HIV and the general population, the results show that the economic crisis negatively affected people living with HIV, who had still not recovered in 2016. Moreover, our results identify the most vulnerable sub-groups of people living with HIV, who might be driving that negative observed effect and who have not benefited from the convergence observed in other groups. To reduce the social consequences of having HIV, policies for promoting people living with HIV access to, and retention of, employment, even during periods of financial hardship, as well as improved psychological support and treatment as a part of comprehensive combined HIV prevention efforts, should be implemented to foster the reduction of differences with respect to the general population.

Conclusions

The current study provides some insights into the effect that unstable financial situations, in addition to employment-related factors, might have among people living with HIV, also reporting sub-group differences, with respect to the general population. We found decreases in the employment prospects of people living with HIV after a period of uncertain economic conditions, which might be related to both clinical and sociodemographic characteristics. However, the difference between the employment probabilities of people living with HIV and those of the general population seemed to be diminishing during the 15-year period considered, although important differences are still observed among the more vulnerable sub-samples, such as those with low levels of education, weak immune systems and former drug users. Our findings underline the need for more appropriate data that would allow researchers to explore longitudinal associations, using additional information about employment records (income, employment history, type of job performed) to clarify the potential causality relationship between determinants and employment, and considering the effect of uncertain economic situations.

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Declarations

Conflict of interest The authors declare no conflicts of interest.

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