Openness to Secession:

An Age-Period-Cohort Analysis of Support for Secession in Catalonia, 1991-2019

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Abstract

Support for secession in Catalonia has increased substantially in recent years. But what role has age, period and cohort factors played in such an increase? Making use of a dataset of repeated cross-sectional surveys that span over 29 years (1991-2019), we apply logistic cross-classified random effects models to quantify the contribution of each component. We show that, although there is an underlying cohort pattern by which younger generations are more favourable to secession, period effects are the main drivers of the evolution of Catalan secessionism. In recent years, all cohorts have changed their mind considerably about their preferred constitutional arrangement in response to contextual political events. Replicating the models in each national identity subgroup shows that period effects are stronger when the Catalan identity is also stronger. However, dual identifiers also played a key role in enlarging the aggregate level of support for independence. In addition, cohort effects following the same pattern are ubiquitous across identity groups. Finally, the consequences of future cohort replacement effects for secessionist attitudes are examined.

Keywords: Support for Secession, Age-Period-Cohort Effects, Cross-Classified Random Effects Models, Cohort Replacement, Catalonia.

1. Introduction

Favourable attitudes towards Catalan independence have sharply increased over the last few years. Looking at the repeated cross-section surveys of the ICPS, support for secession as a territorial preference grew at the expense of other more moderate options, especially retaining the status quo arrangement (see Figure 1). This increase has been justified on many different grounds, such as the failure of State institutions to properly accommodate the Catalan reality (Cuadras-Morató, 2016), changes in the economic situation (Cuadras-Morató & Rodon, 2019; Maria Jose Hierro & Queralt, 2021; Munõz & Tormos, 2015), or shifts in national identity (María José Hierro & Gallego, 2018), to mention a few. Among these, many have argued that support for independence will only increase, as the old generation, quantitatively more numerous and less supportive for secession, will slowly die off and will be replaced by the new more pro-independence young individuals. Or, in other words, there will be a gradual pattern of generational change based on a progressive replacement of these cohorts and the different socialization of the younger cohorts compared to the old ones.

Figure 1. Evolution of territorial preferences in Catalonia.
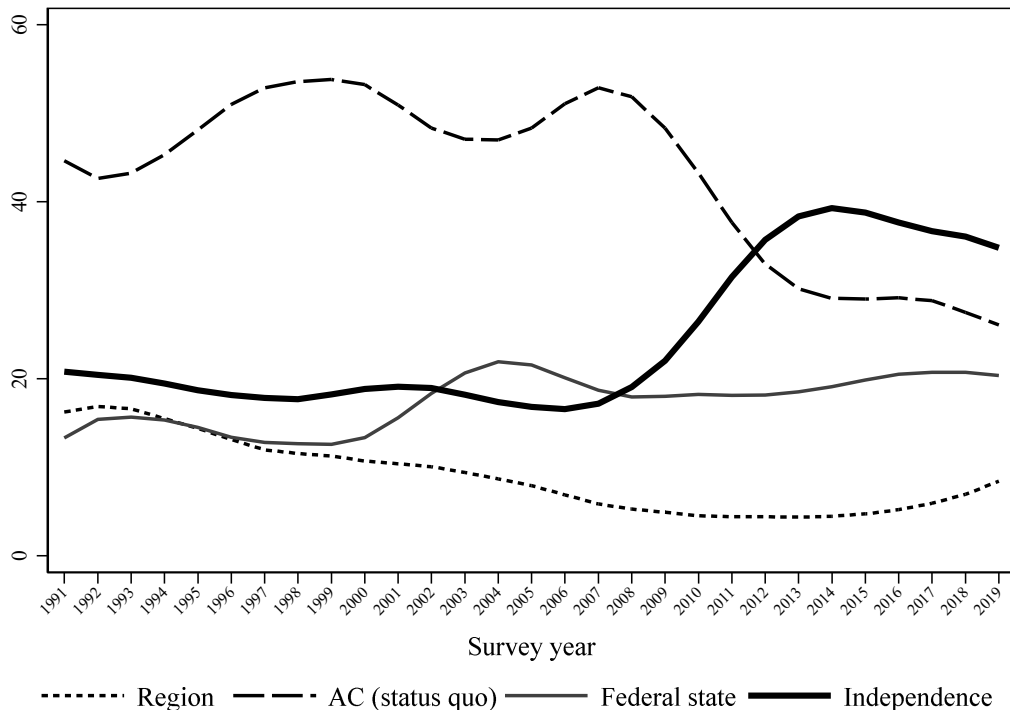
If one entertains herself by having a look at the relationship between age and support for secession in any recent poll published in Catalonia, she will quickly realize that the relationship is negative at the extremes. Indeed, if we pool the

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surveys conducted by the Centre for Opinion Studies (*Centre d'Estudis d'Opinió)* between 2015 and 2019, support for secession is significantly higher among young than among old people. Around 53% of those between 18- and 23-years old answer they are in favour of Catalan independence. This percentage drops to 40% among individuals that are older than 75 years old.

The positive correlation is not exclusive to Catalonia. For instance, if we look at the exit poll conducted by Lord Ashcroft in the wake of the Scottish referendum of independence, around 60% of 16–24-year-old Scots supported secession, while only 25% of 65 plus-year-olds Scots did.[1]

Despite the two previous empirical regularities, this relationship might not be as universal as one might think. Looking at the Quebec case, the pattern is the opposite. Young people are substantially less likely to support independence than the old generation. Or the argumentation is often coupled with other time factors. For instance, in the Catalan case, it is frequently argued that people from all age groups have changed their preferences as a function of some relevant events, such as the 2010 Constitutional ruling against the Catalan *Statute*, boosting support for independence irrespective of the cohort socialization—therefore, a period effect.

Thus, regarding the time factor, what is the basis of the increase in support for Catalan independence? Is it an age effect whereby people become less pro-independence as they grow old (age effect), as it is often assumed? Is it a generational change (cohort effect)? Or is it the effect of a common change across cohorts (period effect)? In fact, is it possible that we observe both a cohort effect and a period effect?

This letter aims at investigating more closely the role of age, period and cohort in support for sovereignty in Catalonia. By empirically teasing out the different components, we seek to make three important contributions.

First, despite we have accumulated a substantial amount of knowledge on the increase and correlates of Catalan independence, an analysis of the role of age, period and cohort is still lacking. Age is often included as a control variable in many empirical models, but the effect—and more broadly its conceptualization—is rarely discussed. To our knowledge, the only analysis dealing with the APC effect on secessionism has been conducted in Quebec. In particular, Vallée-Dubois et al (2020) conclude that three time-related variables affect constitutional preferences simultaneously.[2] Thus, our findings will help us illuminate the type of effects the

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[1] In the Scottish referendum, 16-and 17-year-old had the right to vote. Support for secession was higher in this age-group than among the 18-24-years-old group, which reinforces the conventional wisdom among some that age is positively with support for secession.

[2] For a similar approach, see Dufresne et al (2019).

time factor has had on Catalan secessionism, which would eventually allow us to be better informed on how it will increase (or not) in the future.

Second, besides deepening our understanding of the role of age, period and cohort on support for secession, this letter seeks to improve our knowledge on how the time factor affects territorial preferences, which are largely assumed to be stable. In other words, in line with the cleavage conceptualization of politics (Detterbeck & Hepburn, 2018; Lipset & Rokkan, 1967), previous works largely presume, often by default, that an individual's territorial preference is formed early in life and becomes frozen. In this sense, territorial preferences are assumed to be ingrained attitudes, such as ideology or partisanship, and less malleable to contextual circumstances. By understand the time factor in shaping these ingrained attitudes, this article also sets the ground to interpret changes in other frozen attitudes and values.

Finally, our analysis offers an empirical contribution, and it does so by applying the latest methods in APC modelling. We use repeated cross-section surveys conducted between 1991 and 2019 and apply logistic cross-classified random effects models following both a frequentist and a Bayesian approximation.

Our findings reveal that the increase in secessionist support has been mainly driven by period effects and, to a lesser extent, cohort effects. Instead, the effect of age seems to be negligible. When our analysis is replicated on each separate national identity subgroup, the more Catalan the respondent feels, the stronger impact the period effects have had. In fact, our analysis reveals that the same kind of cohort effects are present across all identity groups.

2. Methods: The age, period, and cohort components of change

A main analytical concern in the study of the evolution of secessionist preferences over time is trying to disentangle the effects of age, period, and cohort (Glenn, 2005; Smith, 2008; Yang & Land, 2008). Even though these three elements can be conceptually distinguished, they appear entangled in the data. From a theoretical standpoint, age effects relate to changes experienced by individuals as they go through the different stages of the life cycle. In the case of secessionist attitudes, they may imply an eventual attenuation with age, following the folk wisdom by which youths tend to be more radical than older people, who in turn tend to be more risk-averse. Period effects capture how the historical context, 'the times', influences an entire cross-section of individuals at a given moment in time, irrespective of their age. In this respect, several crucial political events with the potential to shape the publics' predispositions have unfolded in Catalonia since the reform of the Statute of Autonomy in the mid-2000s. Cohort effects refer to

differences among individuals coming of age at different historical moments. Sharing analogous formative experiences during their impressionable years, the phase from late adolescence to early adulthood can shape cohorts' attitudes making them different from others with distinct formative experiences. When trying to assess the independent effect of age, period, and cohort on actual data about the evolution of a given disposition, researchers face a classic dilemma in the social sciences: the identification problem (e.g., Tormos, 2019). Age, period, and cohort components are linearly related in any dataset, so that when operationalized in variables such as respondent's age, year of the survey, and year of birth, we obtain:

$$C = P - A \qquad (1)$$

where C is for cohort, P for period and A for age. The linear function would be as follows:

$$Y = f(C, P, A) \qquad (2)$$

If we were to estimate the independent effect of these variables by concurrently including them in a regression model, the assumption of absence of collinearity would be violated. As a result, differences among types of effects could not be properly identified. Over the last decades, different strategies have been proposed to overcome the identification problem (e.g., Fienberg & Mason, 1985; Robertson, Gandini, & Boyle, 1999), although some authors sustain it might be a futile quest (Bell & Jones, 2015; Glenn, 1976).

More recently, Yang and Land proposed a multilevel modelling approach to deal with the identification of age-period-cohort effects in repeated cross-section surveys (Yang, 2006; Yang & Land, 2006, 2008), which has however been contested and revised by other authors (Bell & Jones, 2013, 2014, 2015). They advocate for the use of a cross-classified random-effects model (CCREM), a type of hierarchical regression model applied to repeated cross-sectional survey data. This model assumes a clustering of responses into two kinds of contexts: periods and cohorts. The linear dependence between age, period, and cohort is circumvented by accounting for the different ontological status of each of these components. Age is seen as a feature specific of an individual at a given time point, whilst period and cohort are understood as contexts. Age enters the hierarchical model as an individual-level fixed-effect, and in a quadratic form. In turn, respondents are considered members of two groups that do not overlap: periods and cohorts, as

separate second-level units. Every individual is simultaneously nested in the cross-classification of these two contexts. Individuals surveyed at a given time point belong to different cohorts, while members of a particular cohort are interviewed at various periods. In this way, one individual concurrently belongs to two different types of second-level units that do not overlap (period and cohort). This sort of hierarchical cross-classified model is portrayed in the following set of equations[3]:

$$y_{i(j_1 j_2)} = \beta_{0j_1 j_2} + \beta_1 Age_{i(j_1 j_2)} + \beta_1 Age^2{}_{i(j_1 j_2)} + e_{i(j_1 j_2)} \qquad (3)$$

$$\beta_{0j_1 j_2} = \beta_0 + u_{ij_1} + u_{2j_2} \qquad (4)$$

$$e_{1(j_1 j_2)} \sim N(0, \sigma_e^2), \ u_{1j_1} \sim N(0, \sigma_{u_1}^2), \ u_{2j_2} \sim N(0, \sigma_{u_2}^2) \qquad (5)$$

Where the score on the dependent variable $y_{1(j_1 j_2)}$ of individual i within the cross-classification of cohort j_1 and period j_2 is modelled by the constant $\beta_{0(j_1 j_2)}$, the linear and quadratic effects of age ($\beta_1 Age_{i(j_1 j_2)}$ and $\beta_1 Age^2{}_{i(j_1 j_2)}$), and a level 1 residual error term $e_{i\ (j_1 j_2)}$ (eq. 3). The constant varies independently across both periods and cohorts (eq. 4). Periods, cohorts, and level-1 residuals are assumed to be Normally distributed, and their variances are estimated (eq. 5).

Yang and Land (2013; 2006) argue that this hierarchical model solves the classic APC dilemma. According to these authors, the specification of the quadratic function for the age effects and the setting of cohorts and periods as random effects allows overcoming the identification problem. However, in a simulation study, Bell and Jones (2014) exposed the strong assumptions underlying this model and showed that Yang and Land's statements are sometimes not supported. These authors however acknowledge the advantages of the hierarchical modelling of age-period-cohort effects but claim the need to use theory to make assumptions for setting one of the three effects to have no trend. In particular, if there are trends in periods and/or cohorts, this hierarchical model will arbitrarily assign this trend between age, period and cohort, leading to potentially deceptive results (Bell & Jones, 2014). However, Bell and Jones (2015) found that it is possible to analyse trends in periods and cohorts if we assume that at least one of the three effects – either age, period, or cohort – is constrained usually to zero.

Taking this debate into account, our modelling strategy is twofold. First, we do not consider age in the quadratic polynomial form, because it continues to be highly correlated with cohort and can distort the effects estimated (Tormos, 2016). We centre age within each cohort's average age, as indicated by Mishler and Rose (2007) or Tormos (2019). In such a way, the mathematical dependency between

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[3] For the case of a continuous dependent variable.

age and cohort is avoided, as both are orthogonal by design. Age can be interpreted now as ageing within a given cohort. Second, in another set of models, we exclude age altogether as there is no good theoretical reason to think that biological ageing *per se* has any impact on secessionist attitudes. The capacity to rule out one of the three components of the APC triad is equivalent to constraining it to zero which solves the problem. The eventual trends in either cohort or period random effects could then be identified (Bell & Jones, 2015).

From a theoretical point of view, we do not expect trends in two of the three components of our models: age and period. As mentioned before, there is no reason to anticipate meaningful age effects in secessionist attitudes. In this regard, we are more inclined to believe in the presence of cohort trends and random period effects, as seen in other similar cases such as Quebec (Vallée-Dubois et al., 2020). Period effects may tend to be random, with either ups or downs linked to the dynamics of political events and debates. Therefore, we could expect sudden increases or decreases, but not necessarily a consistent trend in either direction. Conversely, there could be a trend in cohort effects linked to the stable socialization under Catalan identity induced by autonomous institutions (the school system and media) after the Francoist period in which it was repressed.

Setting the identification problem aside, researchers dealing with this sort of hierarchical models face additional methodological questions. One of them is the insufficient number of context-level units to satisfy the large-sample criteria required for maximum likelihood (ML) or restricted ML estimation (see Yang and Land 2013). Following Yang (2006) we use Bayesian models with MCMC estimation as a robustness test of our frequentist models, since the latter are not biased to the same extent when higher-level sample sizes are small (Stegmueller, 2013).

For our analysis we employ the yearly cross-sectional data of the *Institut de Ciències Polítiques i Socials* (ICPS)[4] running from 1991 to 2019 and apply logistic cross-classified random effects models, both frequentist and Bayesian, with different modelling specifications. The dependent variable is a binary transformation of the four-options territorial preference question, present in all ICPS survey waves. In the now dichotomous variable respondents are classified among those favourable to secession (1) and those who preferred any of the other territorial arrangements (0): a federal State within Spain, the current status quo as an Autonomous Community, or less autonomy by being just a region.

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[4] The pooled dataset can be downloaded from their site: https://www.icps.cat/.

2. Results: Age, period or cohort effects?

This section illustrates our main findings. Our first set of results come from the Hierarchical Age-Period-Cohort Cross-Classified Random-Effects Model (HAPC CCREM) include only age-centred as a level 1 independent variable, while cohorts and periods are the level 2 random effects. The left sub-figure shows the period effects, the centre sub-figure the cohort effects, and the right sub-figure the age effects.

Starting from the right-side sub-figure, CCREM results indicate that there are no relevant age effects. The fixed-effect coefficient for age-centred has a p-value of 0.298. In other words, support for independence does not seem to be different when comparing young and old people. This non-significant difference is a first indication against the conventional wisdom stating that young people tend to be more pro-independence than old individuals. In other words, the increase in independence support in recent years is likely to hide something else than the age factor.

When looking at the other two graphs with the random effects, we observe strong period effects and more moderate cohort effects. Period effects indicate a clear jump in support for independence from 2008 onwards. This historical moment coincides with the political turmoil triggered by the new *Estatut* debate and, especially, by the Constitutional court ruling in 2010, which paved the way for an intense phase of secessionist mobilization. In substantive terms, if we compare the effects in 2010 versus 2007, support for independence more than doubles. Before this jump, the pattern of period effects could be considered rather stationary, quite similar to what happens after the jump, when stability is also observed, with a certain propensity to for support to decay. Overall, the general picture seems akin to a *phase change* situation, rather than a sustained trend towards increasing secessionism.

Cohort effects show a positive and significant trend, albeit the changes are more moderate than in the case of period effects. This suggests that there has existed a certain pattern of generational change by which younger cohorts are slightly more secessionist than older ones. Thus, as the old cohort, which is quantitatively more important and less pro-secession, passes away, and new and more pro-independence cohorts enter the electorate, support for independence would gradually go up.[5]

Overall, if we compare the period and the cohort effects, it seems that the effect of the period is stronger than that of the cohort.

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[5] The age structure of the Catalan population resembles any other European society, that is, partially constrictive. It has a narrow base (lower percentage of younger people) and a larger proportion of old population. In 2021, the 'baby boom' generation is between 65/70 and 50/55 years-old. Around 19% of the Catalan population is older than 64 years-old.

Figure 2. Predicted support for independence by period, cohort and age (HAPC CCREM)

| Period (random effects) | Cohort (random effects) | Age centered (fixed effects) |
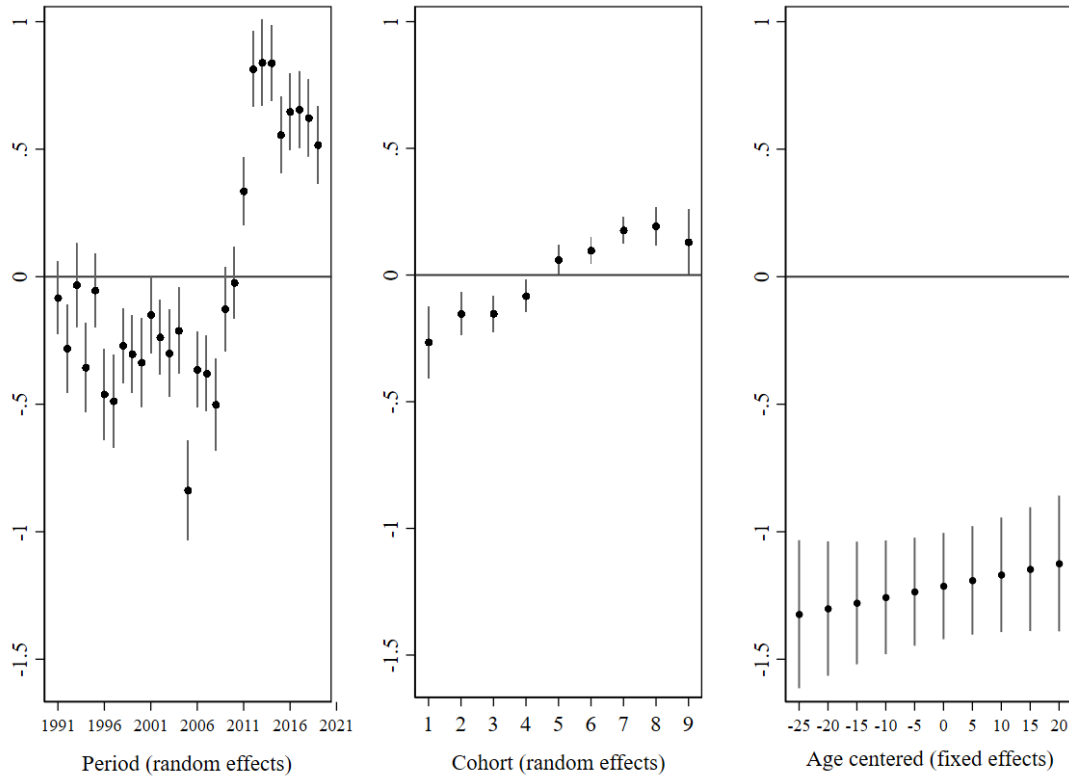
We next proceed similarly, but this time applying a different modelling strategy. In particular, we apply a Bayesian logistic CCREM HAPC model with uninformative priors, as methodologically recommended when having a small sample size of level 2 units. The predicted effects of the different time components are displayed in Figure 3. This analysis largely leads to the same conclusions. On one hand, the effect of age is non-significant across the different age groups. On the other, the model shows strong period effects, as well as moderate cohort effects. Indeed, if we compare the cohort effects to the previous model, the Bayesian model conducted here reports slightly weaker effects.

Figure 3. Predicted support for independence by period, cohort and age (Bayesian HAPC)
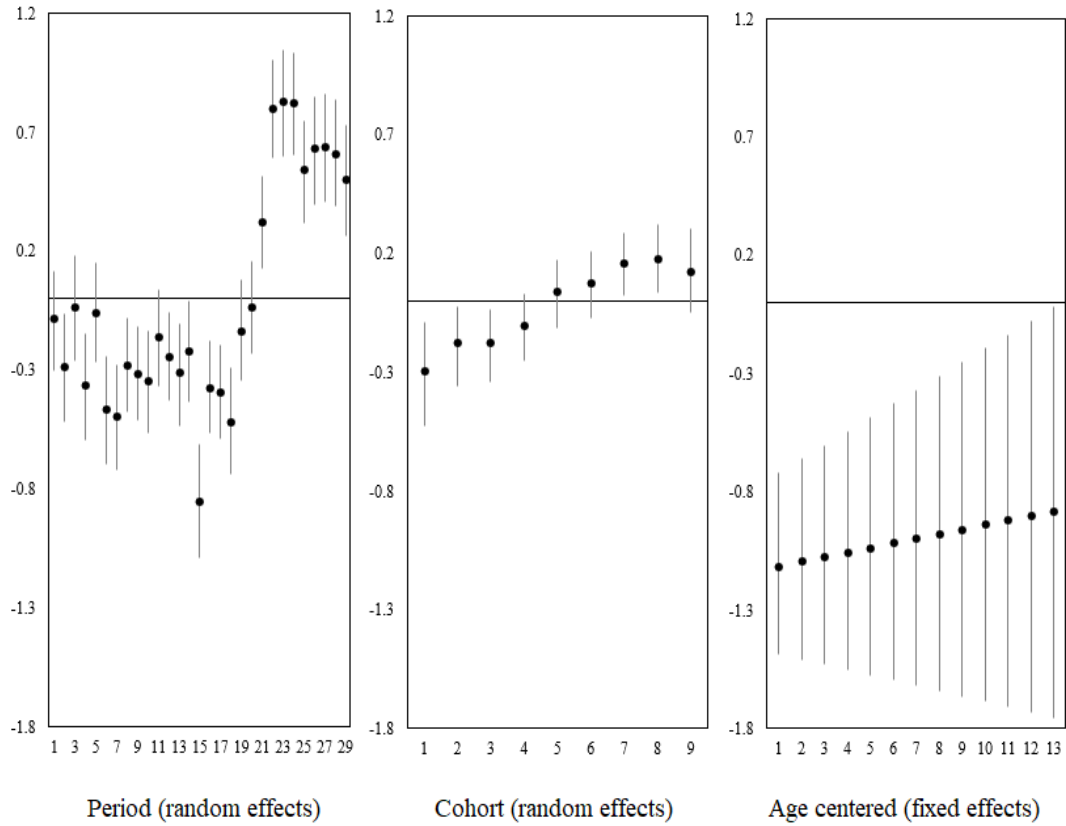
As explained in the methods section, an additional modelling strategy to test the robustness of our analysis consists of excluding age effects from the model altogether. There was not a strong theoretical reason to include age in the models *ex-ante*, before proving it to be empirically irrelevant *ex-post*. It is therefore convenient to exclude the age variable from the models to constrain its effects to be zero as a sensitivity test. Figure A2 in the appendix presents the estimates of the random effects of period and cohort in a model excluding individual-level age effects. Results are equivalent to those of our main analysis.

In an additional robustness test, we include a series of relevant level 1 controls together with age (gender, municipality size, education, and ethnic origin) to adjust for potential composition effects that may influence period and cohort factors. When these controls are included, the estimates of the model remain largely the same (see Figure A3 and A4 in the appendix).

### 3. Results: Who is behind the increase in secessionist preferences?

Results up until now point to the existence of important period effects (largely triggered around 2008-2010) and, secondly, more moderate cohort effects. Yet, a big question remains: are these period and cohort effects homogeneous across-the-board? Or are there differences patterns depending on the subpopulation? We next explore this question by looking at national identity, a key driver of secessionist support identified by previous works (Argelaguet, 2006; Rodon & Guinjoan, 2018; Serrano, 2013).

Figure 4 presents the predicted values of a cross-level interaction between national identity (level 1) and period (level 2). It visually displays the existence of heterogeneous trajectories as a function of an individual's national identity. It shows the predicted support for independence from 1991 to 2019 across different identity groups. It first does it using the national identification variable in three categories (a) and in five categories (b).[6]

Both figures show that national identification has increased its explanatory power over time. In other words, the effect of an individual's national identity on support for secession is larger in the later period than in the early years captured by our data. Thus, in the most recent period, feeling Catalan is highly related to being secessionist, while the association was less intense in the first years included in the analysis.

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[6] Some categories, such as the "only Spanish" category, are chosen by a tiny percentage of the sample. In the first figure, we collapse the "I only feel Spanish" and "I feel more Spanish than Catalan" into a single category and the "I only feel Catalan" and "I feel more Catalan than Spanish" into another one.

Figure 4. The effect of national identity on support for independence over time (cross-level interaction)
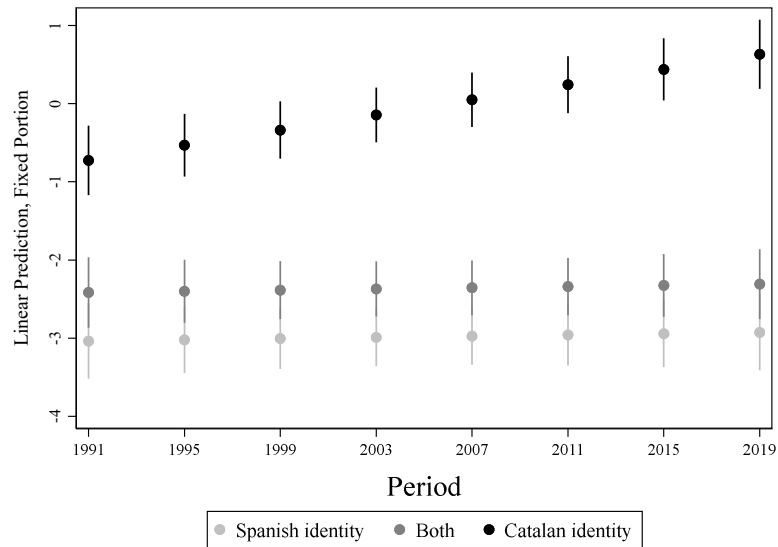

a) Identity in three categories
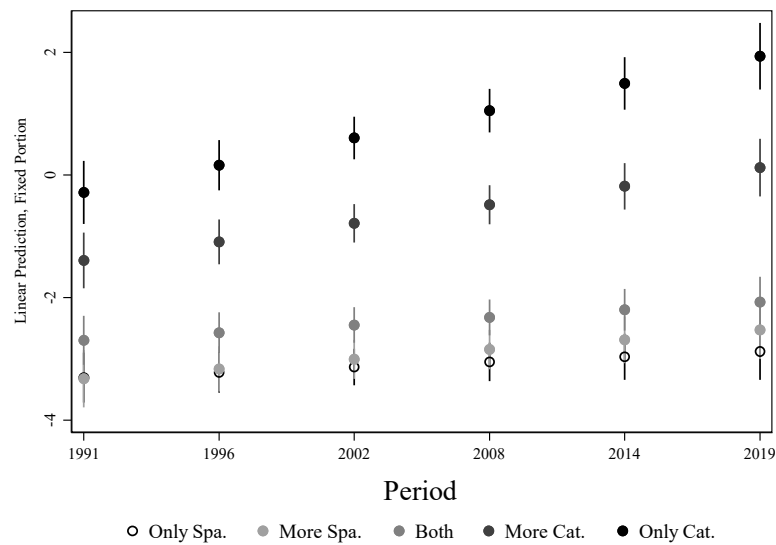
b) Identity in five categories

We next investigate this relationship further and examine the pattern of period and cohort effects on the different identity groups. Figure 5 shows the period effects, while Figure 6 shows the cohort effects.

Starting with Figure 5, we observe that period effects are especially prevalent among individuals feeling only Catalan. Thus, after the 2008-2010 period, only Catalan individuals became substantially more in favour of independence.

Interestingly, we also observe this jump among dual identifiers. Yet, the increase among the dual-identity group is only temporary and vanishes in 2016 onwards. This dual trajectory could explain why we descriptively observe an increase in secessionist support from 2010, but a slight decrease after 2016, especially considering that this identity group is the larger in the population (43%).

Figure 5. Period effects across national identity categories (CCREM HAPC)
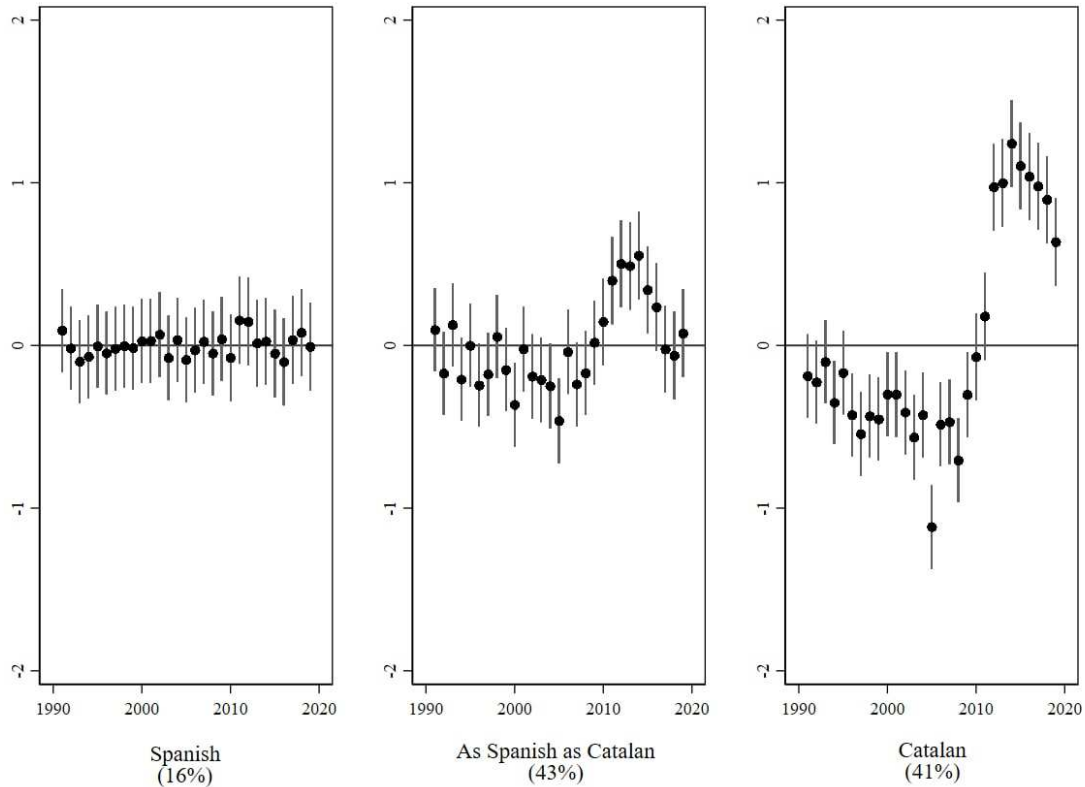
If we look at the cohort effects across identity groups, Figure 6 reveals that there are no remarkable heterogeneous effects. In other words, the increase is similar among different cohorts. This null finding is in fact remarkable because it implies the existence of a positive trend in cohort effects exists regardless of the national identification of the respondent. The main pattern shown in the Figure is that there seems to be a moderate long-term trend across groups towards more secessionism.

Figure 6. Cohort effects across national identity categories (CCREM HAPC)
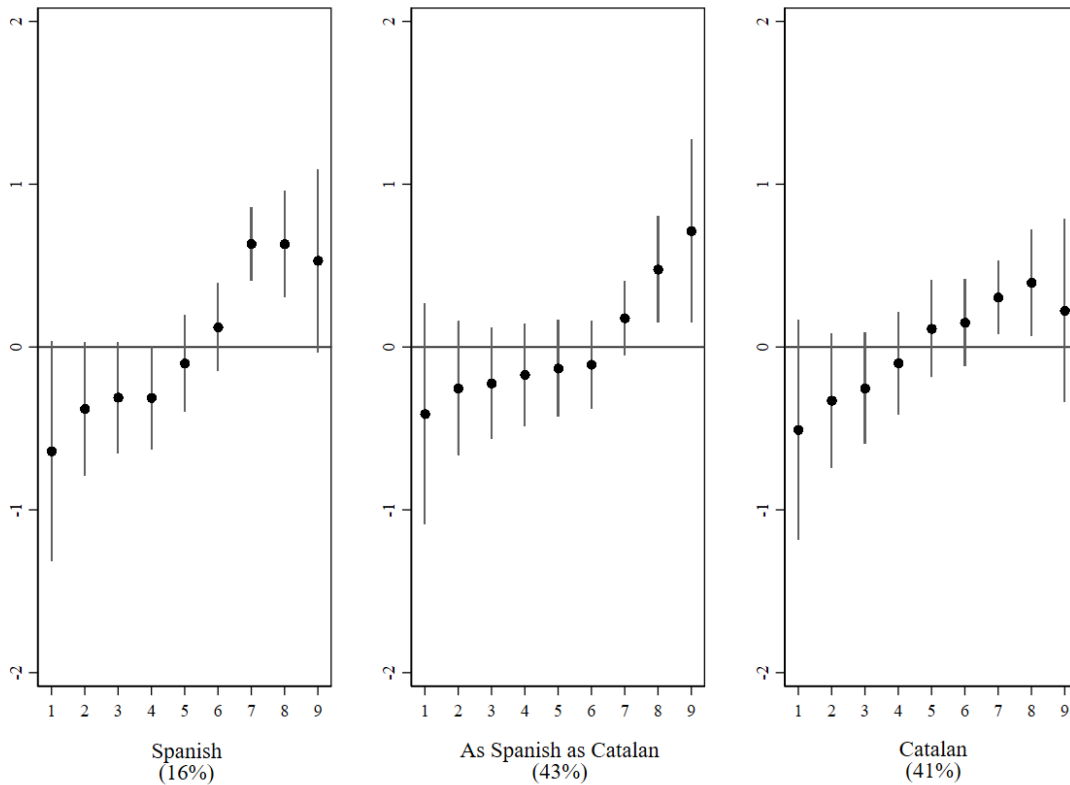
Finally, we want to examine the strength of cohort effects by simulating what will happen in the future if current trends do not change. We focus on cohort effects because they are more predictable. Period effects are inherently difficult to anticipate, as they depend on the contingencies of political events and debates. As this is complicated to foresee, we set them at zero. In comparison, cohort effects are at least subject to the insurmountable demographic law of cohort replacement. It is important to consider that this simulation should be taken with care, as it relies on several assumptions, probably the most important ones being that future period effects would not have a trend, this is, they would have a zero-average effect. The second assumption is more easily tenable: that cohort socialization patterns will continue to operate in the future as they have done in the past. Notwithstanding these caveats, this projection is useful in helping us to identify how potential mechanical effects of demographic replacement will unfold in the future.

The projection considers the demographic mortality trends that affect each "ethnic-socialization" group in Catalonia differently and extrapolate them into the future. We employ four groups: 1) people born in Catalonia from Catalan-born parents; 2) born in Catalonia from mixed parents; 3) born in Catalonia from parents born outside of Catalonia; and 4) born outside of Catalonia. Populations in each of these groups have a particular level of support for secession, as well as different life

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expectancies. The more Catalan the group, the more in favour of secession. People living in Catalonia but born in Spain (mostly economic migrants from the mid-twentieth century) are in clear demographic decline due to their advanced age. We infer the ethnic composition Catalonia would have in the future according to these current demographic trends, which are different for each ethnic group and can be forecasted. Then we assign different levels of secessionist attitudes to each group in the future using today's propensities and calculate the aggregate level of secessionism for the entire Catalan society in each forthcoming time point (see appendix B for more details of the procedure).

Figure 7 shows the results. As it can be seen, the effect of cohort replacement seems to bring secessionist support upwards, but the effect is small. In fact, it is only able to reach 2011 levels (the peak of secessionist support captured by the data) in 2030, which is probably too far to the future to accurately predict it due to the uncertainty estimates.

All in all, the data reveals that in the future, if secessionist support follows the same time-factor trajectory identified in the past (that is, strong period effects, weak cohort effects and none age effects), it will increase at a very small pace.

Figure 7. Projected support for independence (Demographic projection)
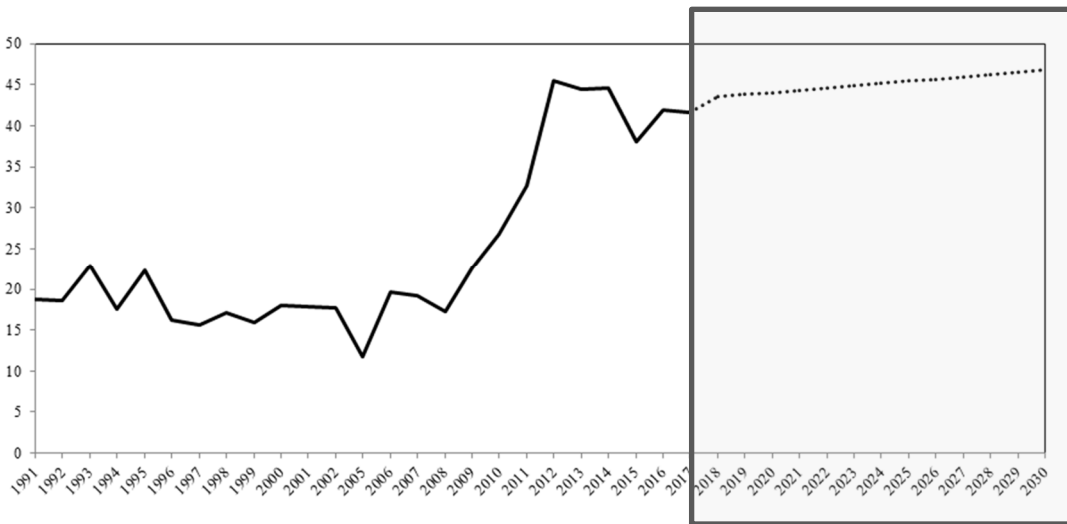
4. Conclusions

This letter has attempted to make an empirical contribution to our understanding of the role of time in secessionist support. Support for Catalan secession has substantially increased over the last years, but it was largely unclear until now whether this increase is due to period, cohort or age effects.

One of the first empirical conclusions of this letter is that preferences for secession are malleable, more so than most works would expect, as it has often been assumed to be an ingrained political attitude. This change—this volatility—, as reported by our analysis, is mainly linked to contextual events (period effects). Thus, our findings are in line with previous works suggesting that the 2010 Constitutional ruling (and the events immediately associated with it) represented a watershed moment that shook the territorial preferences of many Catalans (Casas, Curci, & De Moragas, 2021; Guinjoan & Rodon, 2016).

The different APC models additionally show that demographic cohort replacement only provides a slight upward drift towards secessionism and that this can only be seen in the long run—when uncertainty is probably too high to offer accurate predictions. Moreover, we have shown that the increase in secessionism since 2008 is partially explained by the growth in support among Catalans that feel exclusively Catalan and, to a lesser extent, dual-identity individuals. Our results also offer a tentative explanation for the recent decrease in secessionist support. In light of our results, it may be that some events, such as those related to the 1 October referendum, have triggered a sense of defeat and fatalism among some individuals. In other words, a recent (and less intense) period effect might have driven secessionist support downwards. But it may also be that the reservoir of convertible identity groups (that is, individuals feeling more Catalan) has already been depleted, reaching a ceiling after which it is more difficult to convince other people.

Overall, the observational nature of this letter comes inevitably with some limitations. The fact that we are not able to track the same individuals over time, or control for changes in identity as a result of changes in territorial preferences, inevitably hinders our findings. However, we believe our results are relevant insofar as they help us illuminate the effect of different time factors on political attitudes, especially when different hypotheses about this change have been suggested.

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Appendix A

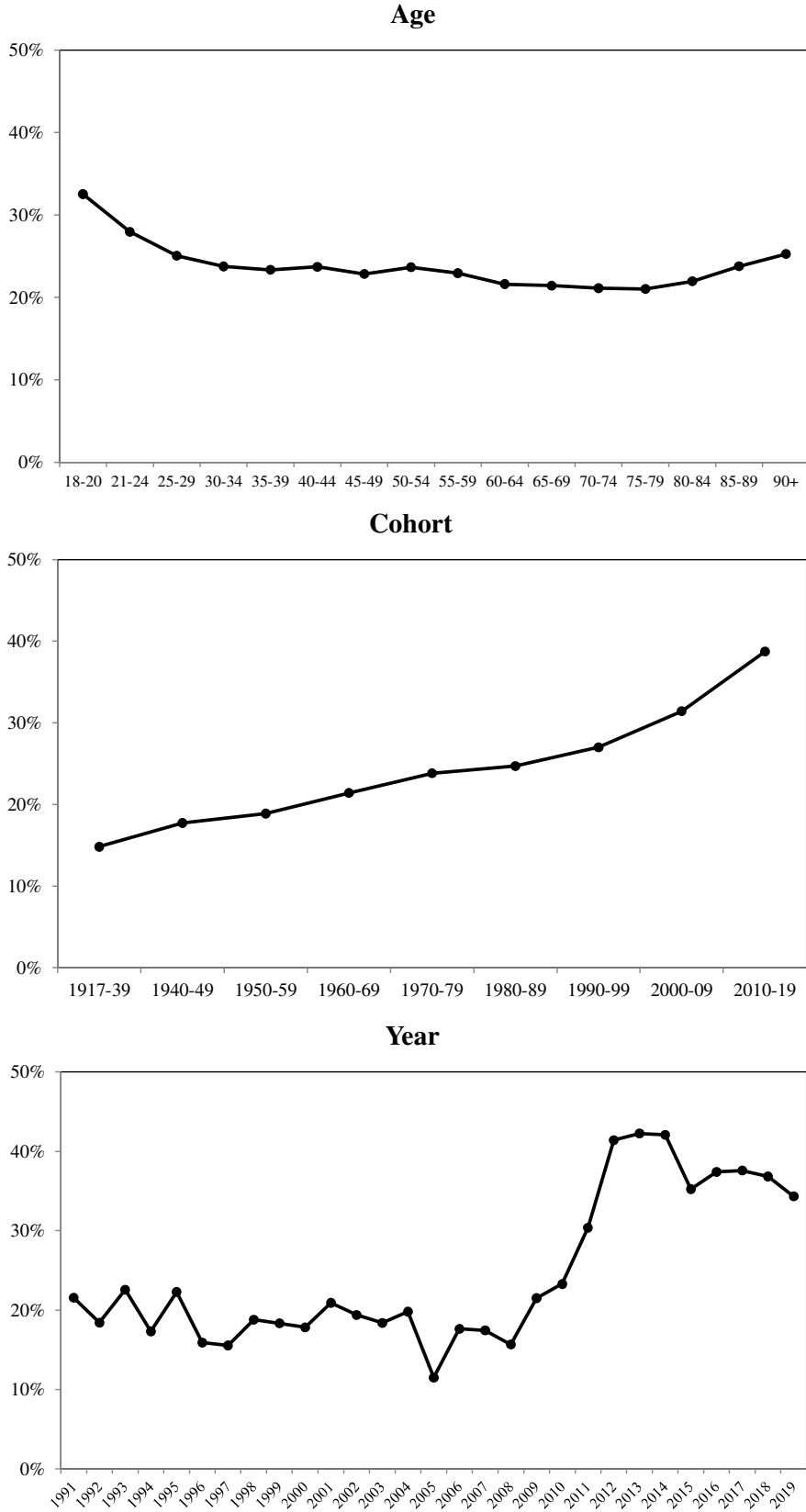**Figure A.** Support for secession by age, cohort and year

Figure A2. Period and cohort random effects without including age fixed effects in the CCREM HAPC model.
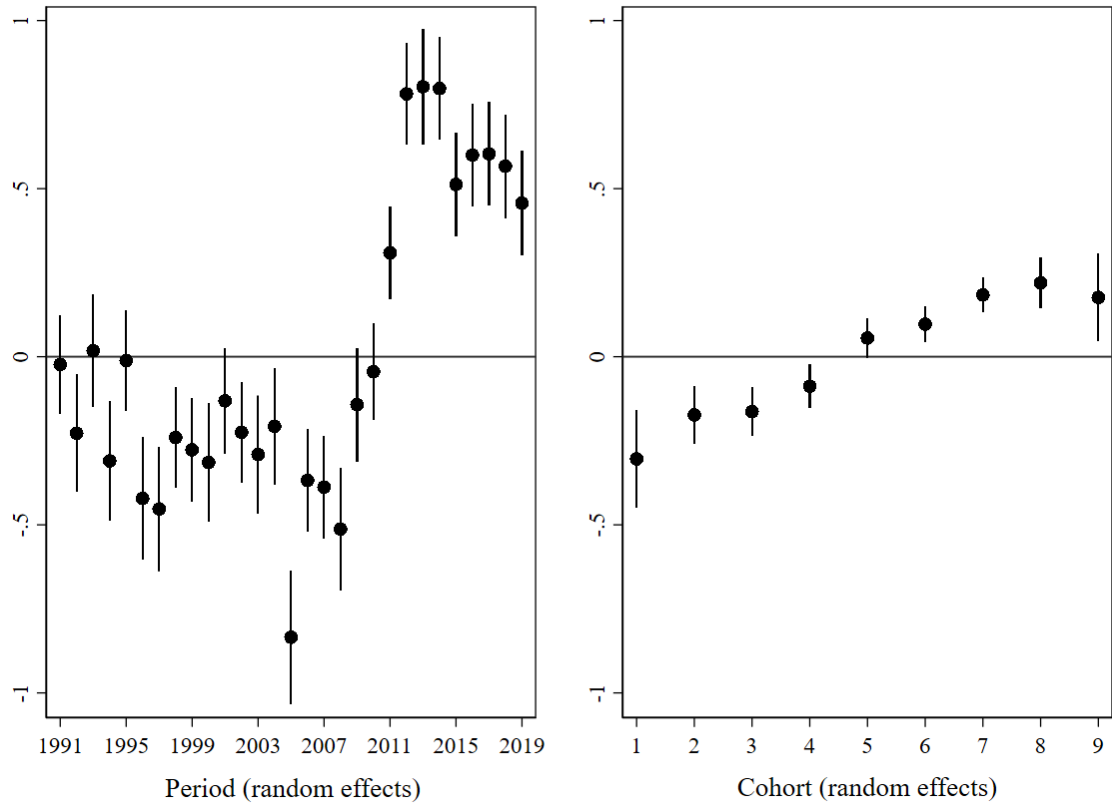
Figure A3. Effect of first-level controls on support for independence (Frequentist estimation)

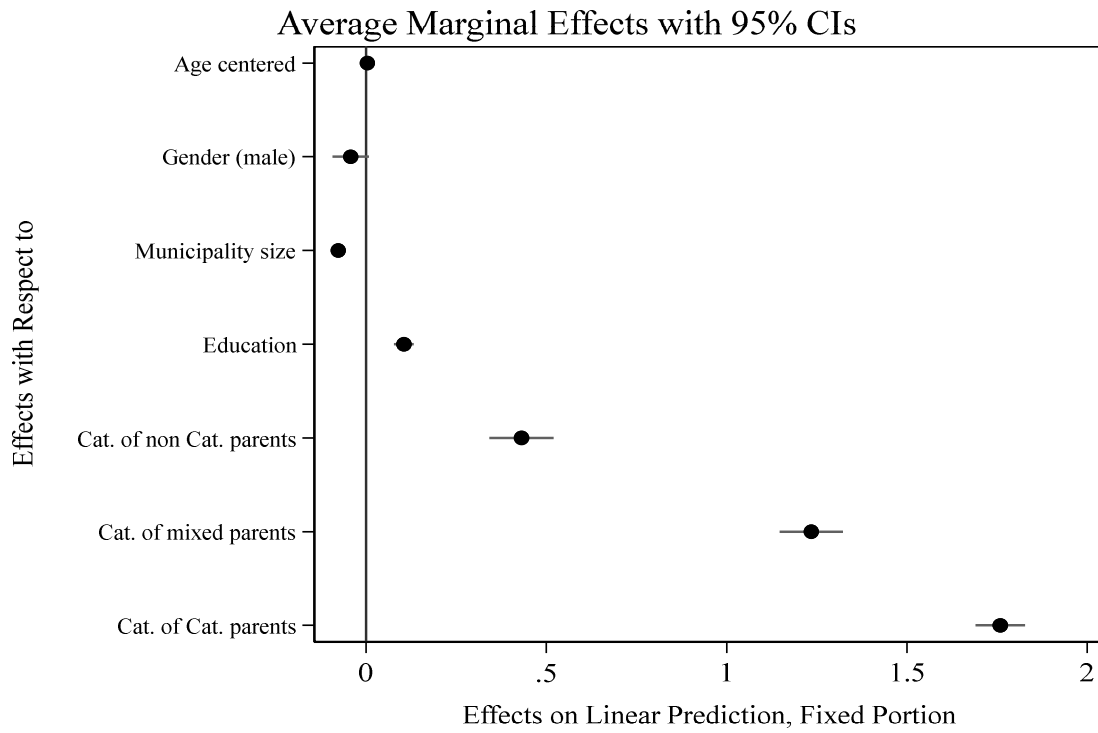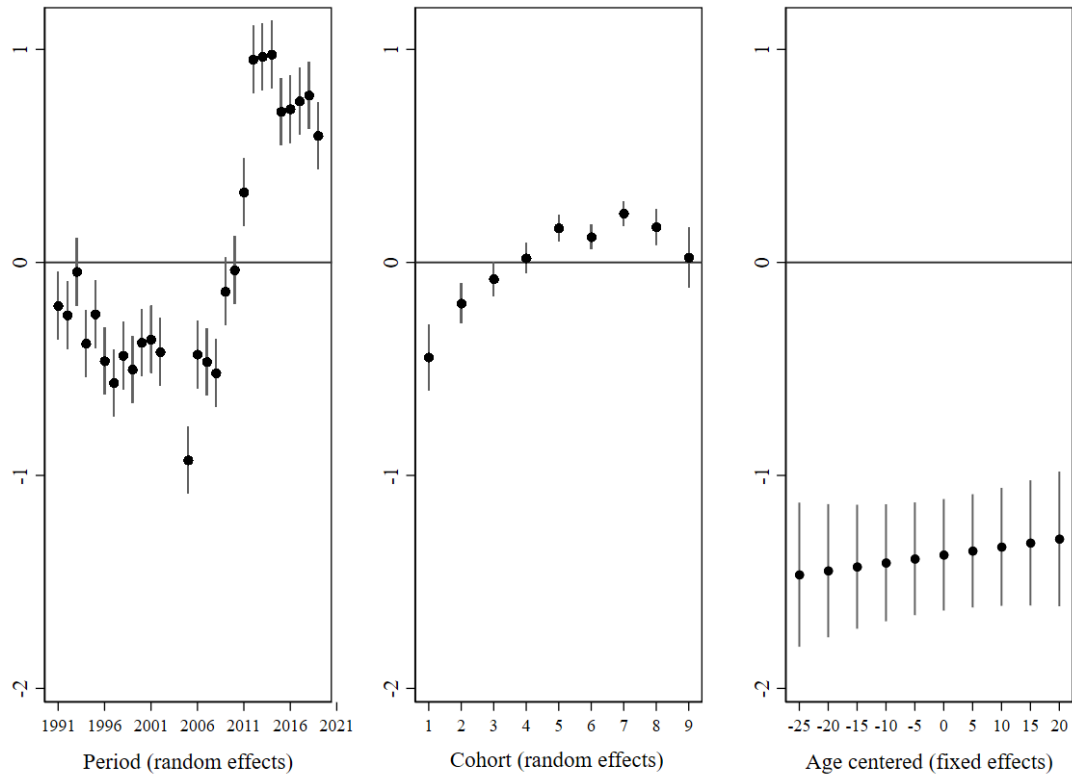Average Marginal Effects with 95% CIs

Figure A4. Predicted support for independence controlling for first-level predictors by period, cohort, and age (Frequentist estimation)

Appendix B. Demographic forecast procedure

[To be done]

[To be done]