Social ties and the influence of public policies on individual opinions: the case of same-sex marriage*

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Abstract

There is an abundant literature on the the impact of laws on individual's behavior and the role of social ties as a determinant of this impact. This paper focuses on this issue. Using data from eight waves of the European Social Survey on the perception by individuals of gay and lesbian rights. We exploit the sequential approval of same-sex marriage among various European countries to identify the change in the individuals' opinion on gay and lesbian rights and the role of the intensity of their ties as a driver of this change. The robustness of our results are tested over the subgroup of immigrants coming from homophobic countries. The economic rationale behind the econometric findings is rationalized through a theoretical setup largely inspired on the dyadic model presented in Calvo-Armengol, Verdier, and Zenou (2007). Individuals learn about a social norm through strong ties (family or close friends) and weak ties (outside the family or close friends). Unsurprisingly weak ties tend to promote acceptance of the social norm by individuals who did not share initially this norm. Strong ties promote conformism.

Keywords: public policy, public opinion, homosexuality, social interactions
JEL: A14; J12; J15; J18

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1 Introduction

The objective of this paper is to measure the influence of a policy decision on individuals' opinions and how this influence varies with the nature of social ties. Both issues have been mostly analyzed separately by the literature (see for example the works of Granovetter (1973), Calvo-Armengol, Verdier, and Zenou (2007) or Zenou (2015) on the nature of social ties and their impact on labor market status and the recent paper by Acemoglu and Jackson (2017) on the interplay between social norms and the enforcement of laws).

Social ties convey information through observations of others' decisions as well as through conversations and the sharing of opinions. Individuals belonging to a social network are influenced in their opinions and choices by those of other members of the social network. However, we can reasonably think that all members of the network do not have an identical influence in a given individual. To illustrate this differential weight of different members of the network, we distinguish the nature of ties between strong and weak ties.

The social psychologist French (1956) was the first to propose a setup analyzing how individuals' decisions are influenced by their contacts in order to study the evolution of opinions over time. He proposed a simple setup in which each agent placed equal weights on her contacts. Harary (1959) generalized French's results on convergence by using the theory of directed graphs but in his setup all the agents continued to place equal weights on their contacts. It was not until 1974 that DeGroot (1974) generalizes the process "by allowing arbitrary weights in the individuals' contacts and by pointing out the connection between consensus opinions and the stationary distribution of a corresponding Markov chain" (see Golub and Sadler (2016) for a detailed review on learning in social networks). The literature has only begun to study how well DeGroot's model fits empirical evidence. In our paper, we will not test the model, but we recover at least one of its characterizing features. Agents are distinguished depending on the relative intensity of their contacts, which implies that all contacts do not have the same weight. We will compare how influenceable individuals are by the public sector depending on the nature and relative intensity of their social ties. We combine two streams of literature, one on the nature of social ties and other on the relationship between social norms (or beliefs) and laws.

The second stream of literature has its main representation in the recent paper by Acemoglu and Jackson (2017) which focuses on how social norms are shaped by laws while, at the same time, social norms constrain the effectiveness of laws.[1] Acemoglu and Jackson (2017) underline that conflict between prevailing norms and new laws often renders such laws ineffective. Because authorities cannot check if everyone is respecting the law, they must rely on whistle-blowing by private citizens or firms to enforce the law. When the law goes against the prevailing norms, *i.e.* it restricts the behavior excessively relative to the distribution in the society, then most people prefer to break the law, which reduces whistle-blowing and thus the effectiveness of laws. Moreover, as laws are broken by more people, whistle-blowing becomes even less likely, and law-breaking snowballs. The

[1] See also Benabou and Tirole (2011) or, for a survey, see McAdams and Rasmusen (2007).

authors conclude that "gradual imposition of laws that are more in accord with prevailing norms can successfully change behavior and thus future norms".

In our paper, we do not refer to law enforcement, which is assumed to be respected, but rather on how the approval of a law can modify the opinion of individuals on a particular social issue depending on the nature of their social ties. The idea of our work is that agents tend to imitate choices and opinions of their contacts (conformity within groups was first studied by Banerjee (1992) and Bikhchandani, Hirshleifer, and Welch (1992)). This imitating behavior is likely to affect the potential influence of the central planner on individuals' choices and opinions.

We propose a simplified version of the dyadic theoretical setup proposed in Calvo-Armengol, Verdier, and Zenou (2007), Giulietti, Wahba, and Zenou (2014), Hemet (2015) or Zenou (2015). All these papers are labor market oriented and analyze the role of the network and the strength of interpersonal relationships (weak vs. strong ties) on the decision to enter criminality, informality, employment or the decision to migrate from rural to urban areas. In our framework the approach is simpler since social interactions may allow individuals who reject a dominant social norm to get in contact with people that support this norm. As in Acemoglu and Jackson (2017) we retake from sociology the definition of the social norm: " a rule or a standard that governs our conduct in the social situations in which we participate. It's a societal expectation". The dominant social norm is the norm that is accepted by more than 50% of the population. Consistently with previous literature analyzing the role of the strength of interpersonal relationships (weak vs. strong ties) on life and labor market decisions, our theoretical setup predicts that weak ties tend to promote acceptance of the social norm by individuals who did not share initially this norm. Strong ties promote conformism, which implies that they will promote acceptance of the social norm when the non-integrated individual has an integrated partner, while they will promote rejection of the social norm when the non-integrated individual has a non-integrated partner.

We test important theoretical predictions of our simplified dyadic model using the case of same-sex marriage laws. The empirical analysis could have been implemented considering other dominant social norms such as gender equality laws, smoking restrictions, etc... Same-sex marriage and attitudes toward gays and lesbians constitutes though a particularly interesting setting for us: first, the availability of data about the opinion and attitudes of people toward gays and lesbians, as well as the progressive approval of same-sex marriage in several countries, give us the required information to empirically determine the ability of the government to modify the individual's opinion about a social norm via legislation. Second, we address here an important societal topic where the question of the impact of the law on opinions and mentality has been frequently discussed. Since early 2000s, several countries have adopted laws enforcing gay and lesbians rights, including same-sex marriage laws. Over the same period of time, gay-friendly attitudes have also increased. For instance, **?**) report that in the US 68% of people would vote against same-sex marriage in 1996, against 39% in 2016. In Europe, ADD STAT. To which extent the evolution of the legal context contributed to this favorable evolution of the opinion? The concomitant evolution of other

factors may have contributed to the development of more gay-friendly position. Several applied studies indeed show that attitudes toward gays and lesbians are influenced by a number of factors, including religious and moral values, political affiliation, contacts and social interactions with gay, lesbians and same-sex couples, and demographics such as gender and age (**?**) ; **?**) ; **?**) ; Tucker et al., 2016 ; **?**)). Still, the positive influence of same-sex marriage laws has been documented in the literature: **?**), **?**) and **?**)) show using the European Social Survey (ESS) that individuals in countries with marriage equality had significantly more pro-LGBT attitudes than individuals in countries without relationship recognition for same-sex couples.

In this paper we also use the European Social Survey and exploit variations in the timing of the same-sex marriage laws to evaluate the effect of the law, but we adopt a different empirical strategy to identify the specific role played by the nature of social ties and allow for dynamic effects. We hence provide two types of contribution to the literature.

First, we investigate the extent to which social ties may favor or on the contrary limit the influence of laws on opinion formation. Our theoretical model predicts that individuals with strong ties may be less responsive to a law change because they may be less exposed to the social norm it conveys. We provide an empirical test of this prediction, acknowledging for the potential endogenous nature of this social relation with respect to attitudes toward homosexuality (*i.e.* people who have a more open-minded attitude toward the dominant social norm may be more or less likely to find a partner). We consider same-sex marriage as the dominant social norm, since its approval by democratically elected governments reflects the fact the majority of the society supports this law. We classify individuals into two groups, depending on whether they have dominant weak or strong ties. We then use the approval of same-sex marriage to compare how the average opinion on gay and lesbian rights has progressed following the approval of the law and how this progression is influenced by the nature of the dominant social ties. Ideally, we would like to control additionally for the opinion of the members of the network and know whether they follow or not the social norm. Unfortunately, such information is not provided in the data. To remedy this issue, we adopt two strategies. First, we adopt a cell-approach and consider separately individuals that belong to socio-demographic groups that tend to express more or less gay-friendly opinion. The main assumption here is that individuals develop strong ties with people of the same socio-demographic group, which may be considered as a strong assumption. An alternative strategy we adopt to at least partially control for the opinion of individuals' ties about the dominant social norm, consists in focusing on immigrants and use the degree of homophobia in the home country[2]. The main assumption here is that networks among immigrants play an important role.

Second, we consider the dynamics of the reactions to the passing of a law. Opinion formation and diffusion of social norms among the population is not an instantaneous processus. In the specific context of same-sex marriage, time-varying effects of legalization on attitudes toward gays and

[2]To control for potential endogeneity of immigrants' destination countries we will implement an instrumental variable strategy based on the past distribution of immigrants across countries.

lesbians are expected: the debates surrounding the law passing may exacerbate extreme opinions and once the law is passed the social norm conveyed by the law may progressively be adopted as individuals interact with more and more same-sex married couples. Our empirical strategy explicitly accounts for the presence of such dynamic effects. As remarked by **?**), when treatment effects vary over time, a single-coefficient diff-in-diff model estimator confounds preexisting trends and the dynamic effects of the policy shock. Dynamics beyond a discrete series break are not fully accounted for by the simple dummy, leading the state specific trend controls to partly reflect the dynamic response of the response variable to the policy shock. Two different approaches may be implemented to solve this problem: allow for time-varying effects of the law, as proposed by **?**) and **?**), or aggregate periods. We adopt both strategies in this paper.

The remainder of the paper is organized as follows. The theoretical setup is described in section 2 and the equilibrium steady state analysis in Section 3. Data is explained in section 4.1 and the econometric analysis in section 5. Estimation results are explained in Section 6 and the last section concludes.

2 The model

2.1 Dyads and social interactions

We consider an economy composed by a population whose size is normalized to one. Time is continuous and individuals have an infinite horizon since they live forever. As in Calvo-Armengol, Verdier, and Zenou (2007), Giulietti, Wahba, and Zenou (2014), Hemet (2015) or Zenou (2015) we assume that individuals belong to mutually exclusive two-person groups, referred to as dyads. We say that two individuals belonging to the same dyad hold a strong tie with each other. We assume that dyad members do not change over time. A strong tie is created once and forever, and can never be broken. We can thus think of strong ties as links between members of the same family, or between close friends. Matchings outside the dyad partnership are refereed as weak ties (or random encounters). Time spent with a strong tie equals ω while time spent with a weak tie equals $1 - \omega$.

Individuals can be in two different states: they may accept the dominant social norm (we say they are integrated) or they may not accept this norm (we say they are non-integrated). We define the dominant social norm as the one that is being promoted by the government in place, who has actually been elected by the majority of people.

The pace at which individuals receive this information on the dominant social norm depends on the status of the dyad partner: if the partner accepts the social norm, the influence will arrive through both strong ties and some weak ties. Conversely, if the partner is non-integrated and refuses thus the dominant social norm, information about this norm can only potentially arrive through sporadic contacts outside the dyad (weak ties).

Given the two alternative status of the individual, we can distinguish among 3 different types of

dyads:

- both members accept the dominant social norm: the number of such dyads is denoted by d_{II};
- one member accepts the dominant social norm but not the other: the number of such dyads is denoted by d_{IU};
- both members reject the dominant social norm: the number of such dyads is denoted by d_{UU};

2.2 Aggregate state

The total number of individuals in the economy is denoted by $N = I + U$ where $N = 1$, I stands for the number of individuals that accepts the dominant social norm while U corresponds to the number of individuals rejecting it. We can rewrite this expression as $1 = i + u$ where i corresponds to the number (and proportion since $N = 1$) of individuals in the population that accepts the dominant social norm, while u stands for the number (or proportion) of individuals refusing this norm.
The number of integrated and non integrated individuals in period t is respectively given by:

$$i_t = 2d_{IIt} + d_{IUt} \quad (1)$$

$$u_t = 2d_{UUt} + d_{IUt} \quad (2)$$

Because $1 = i_t + u_t$ we find:

$$\frac{1}{2} = d_{IIt} + d_{UUt} + d_{IUt} \quad (3)$$

2.3 Information transmission

We make the same hypothesis as in Calvo-Armengol, Verdier, and Zenou (2007) and assume that individuals are influenced by the dominant social norm through friends and relatives (*i.e.* weak and strong ties) at rate α.
This information transmission protocol defines a Markov process. The state variable is the relative size of each type of dyad. Transitions depend on the potential gains/losses associated with each status and the nature of social interactions as captured by ω. We assume that, during a small interval of time t and $t + dt$, at most one dyad partner is influenced by the dominant social norm, and that both members of a dyad cannot change their status at the same time.

2.4 Flows of dyads across states

Figure 2.4 illustrates the different types of dyads we encounter in our model as well as the flows between the dyads. To simplify our theoretical setup we assume that individuals accepting the

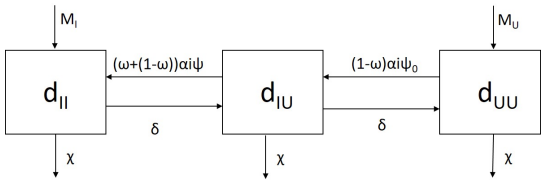


Figure 1: Flows across dyads.

dominant social norm are very unlikely to change their mind and start rejecting it. We assume that this can only happen following an exogenous shock that arrives with probability δ.

We also make the hypothesis that both members of a dyad cannot lose their status at the same time.[3] Influence of the dominant social norm may arrive through strong ties (dyad partner) or weak ties (sporadic rencounters with individuals that accept the social norm).

A non-integrated individual being in a dyad d_{UU} can only be influenced to change his mind about the dominant social norm through random contacts with integrated individuals he might meet or hear. Time spent with weak ties equals $(1-\omega)$ and the number of integrated individuals equals i. The rate at which they will exchange on the dominant social norm is assumed to be equal to α. Therefore, the probability that an individual from a d_{UU} dyad is influenced by weak ties concerning the dominant social norm equals $(1-\omega)i\alpha$. The decision to accept or not the social norm will result from a comparison between lifetime utility prospects between being integrated or non-integrated. The decision variable is denoted by ψ_0.

Individuals having a dyad partner that accepts the social norm, spend a proportion ω of their time with their partner. The probability to be influenced by the dominant norm equals then $\alpha(\omega + (1-\omega)i)$. Non-integrated individuals belonging to a d_{IU} dyad are then more likely to be influenced by the dominant social norm than individuals from a d_{UU} dyad, since they interact with strong ties and weak ties accepting the social norm. The decision to accept or not the social norm will again depend on the utility prospects of being integrated or non-integrated. The decision variable is denoted by ψ.

As revealed by Figure 2.4, integrated individuals can reject again the social norm as a result of an exogenous shock δ. All individuals have a probability χ to die. These outflows are though compensated by an identical inflow of individuals being both integrated and non-integrated. More precisely, we assume that every period a proportion $\chi 2d_{II}$ of integrated of individuals dies but it is replaced by an identical inflow of integrated people: $M_I = \chi 2d_{IIt}$. Similarly, every period

[3]To change from a d_{UU} dyad to a d_{II} dyad, we need at least two periods. In the first period one of the members accepts the social norm and so the dyad becomes d_{IU}. In the following period, the member of the dyad that is still non integrated accepts the social norm. After two periods the dyad has evolved from d_{UU} to d_{II}.

a proportion $\chi(2d_{IUt} + 2d_{UUt})$ of individuals dies and it is replaced by an identical inflow of non-integrated members : $M_U = \chi(2d_{IUt} + 2d_{UUt})$.
Entry and exit flows of dyads from each state between t and $t+1$ are given by:

$$\dot{d_{IIt}} = \chi 2d_{IIt} - \chi 2d_{IIt} - \delta 2d_{IIt} + d_{IUt}\psi\alpha(\omega + (1-\omega)i) \quad (4)$$

$$\dot{d_{IUt}} = \delta 2d_{IIt} + 2d_{UUt}\psi_0\alpha(1-\omega)i - \delta d_{IUt} - 2\chi d_{IUt} - d_{IUt}\psi\alpha(\omega + (1-\omega)i) \quad (5)$$

$$\dot{d_{UUt}} = \chi(2d_{UUt} + 2d_{IUt}) + \delta d_{IUt} - 2\chi d_{UUt} - 2d_{UUt}\psi\alpha(1-\omega)i \quad (6)$$

These dynamic equations reflect the flows across dyads. From equation (4) we see that the variation in the number of dyads where both members accept the social norm equals the inflow coming from individuals belonging to a dyad where one member is integrated but not the other and that decide to accept the social norm after social interactions minus the proportion of individuals that suffers a shock and starts rejecting the social norm. The dynamics of d_{IUt}-dyads (equation (5)) equals the inflows coming from integrated dyads that decide to reject the social norm after a shock, $2\delta d_{IIt}$, and from non-integrated dyads where one of the members decides to accept the social norm after socially interacting, $2d_{UUt}\psi_0\alpha(1-\omega)i$. Outflows equal the proportion of people dying every period $\chi 2d_{IUt}$ plus the proportion suffering an exogenous shock that makes them become non-integrated δd_{IUt} plus the proportion that decides to accept the social norm after socially interacting with weak and strong ties. Finally, the dynamics of d_{UUt}-dyads equals new born, $\chi(2d_{UUt} + 2d_{IUt})$, plus inflows from the d_{IUt}-segment δd_{IUt}, minus deaths $\chi 2d_{UUt}$, and outflows resulting from the acceptance of the social norm after socially interacting.

2.5 Incentives

The choice variables ψ and ψ_0 are endogenously determined taking into account the incentives faced by individuals in their decision making. Agents make their decisions on the basis of their future utility prospects of being integrated or not. Individuals are forward-looking with respect to their future status when taking this decision, and anticipate the impact of current decisions on their future opportunities and payoffs. Yet, they are myopic with respect to the status of their current partner, which they treat as a default state. In the long-run, individual values for each possible dyad outcome are given by the following Bellman equations, where every equation is written for the individual with the first subscript:

$$rV_{II} = w_I - \chi V_{II} - \tau(1-\omega)u + \delta(V_{IU} - V_{II}) \quad (7)$$

$$rV_{IU} = w_I - \chi V_{IU} - \tau(\omega + (1-\omega)u) + \delta(V_{UU} - V_{IU}) \quad (8)$$

$$rV_{UI} = w_U - \chi V_{UI} - \tau(\omega + (1-\omega)i) + \psi\alpha(\omega + (1-\omega)i)(V_{II} - V_{IU}) \quad (9)$$

$$rV_{UU} = w_U - \chi V_{UU} - \tau(1-\omega)i + \psi_0\alpha(1-\omega)i(V_{IU} - V_{UU}) \quad (10)$$

where r stands for the interest rate, w_I corresponds to the utility attainable only when you are integrated, w_U represents the utility attainable when you are non-integrated. This utility could

be measured in monetary terms or simply correspond to a level of satisfaction. Intuitively, we can assume that someone who accepts the majority social norm in a particular country is likely to have more employment opportunities and higher satisfaction than someone who faces social barriers, so we can assume $w_I > w_U$.[4] Consistently with Acemoglu and Jackson (2017), we assume that contacts with strong or weak ties that think differently with respect to the individual concerning the social norm, are a source of disutility. The parameter τ captures precisely the utility loss associated with having contacts with individuals that reject the social norm if we consider an integrated individual or that accept the social norm if we consider a non-integrated individual. If the individual is in a d_{UU}-dyad, the proportion of contacts with integrated individuals equals $(1-\omega)i$ implying an utility loss equal to $\tau(1-\omega)i$. In a d_{II}-dyad the proportion of contacts with non-integrated individuals equals $(1-\omega)u$ and the utility loss $\tau(1-\omega)u$. If the individual is non-integrated and his partner integrated the proportion of contacts with integrated individuals equals $\omega+(1-\omega)i$ and the utility loss $\tau(\omega+(1-\omega)i)$. Conversely if the individual is integrated and the partner non-integrated the proportion of contacts with non-integrated individuals equals $\omega+(1-\omega)u$ and the utility loss $\tau(\omega+(1-\omega)u)$.

When deciding to accept or not the social norm, individuals compare the lifetime expected utility associated which is scenario. That is, a non-integrated individual having a non-integrated partner decides to accept the social norm, $\psi_0 = 1$, if and only if $V_{IU} \geq V_{UU}$. Similarly, a non-integrated individual having an integrated partner decides to accept the social norm, $\psi = 1$, if and only if $V_{II} \geq V_{UI}$.

3 Steady state equilibrium analysis

3.1 Steady state population composition

At the equilibrium, $\dot{d_{UUt}} = \dot{d_{IUt}} = \dot{d_{IIt}} = 0$:

$$d_{II} = \frac{\psi\alpha(\omega+(1-\omega)i)d_{IU}}{2\delta} \tag{11}$$

$$d_{IU} = \frac{2\delta d_{II} + 2d_{UU}\psi_0\alpha i(1-\omega)}{\delta+2\chi+\psi\alpha(\omega+(1-\omega)i)} \tag{12}$$

$$d_{UU} = \frac{2\chi d_{IU}+\delta d_{IU}}{2\psi_0\alpha i(1-\omega)} \tag{13}$$

The equilibrium flow equality is given by:

$$d_{UU} = \frac{1}{2} - d_{II} - d_{IU} \tag{14}$$

and since total population is normalized to unity we also know that:

$$i = 1-u = 1-2d_{UU}-d_{IU} \tag{15}$$

[4] Our working hypothesis is that integration is the status that provides the largest satisfaction and the larger number of opportunities. Assuming $w_I < w_U$ would have the opposite implications, but this would seem an unreasonable assumption.

Definition: A steady state dyad equilibrium flows is a quintuple $(i^*, u_m^*, d_{UU}^*, d_{IU}^*, d_{II}^*)$ so that equations (11), (12), (13), (14) and (15) are satisfied.

3.2 Individual decisions

The only decision maker in our simple framework is the non-integrated individual, who must decide whether to accept or not the social norm after a contact with integrated individuals. To implement his decision, the non-integrated individual compares the lifetime utility prospects associated to each situation. A non-integrated individual having a non-integrated partner decides to accept the social norm, $\psi_0 = 1$, if and only if $V_{IU} \geq V_{UU}$. Since:

$$V_{IU} - V_{UU} = \frac{w_I - w_U - \tau(\omega + (1-\omega)(u-i))}{r + \chi + \delta + \psi_0 \alpha i (1-\omega)}$$

the denominator is always positive, we conclude:

$$\psi_0 \left\{ \begin{array}{l} 1 \Leftrightarrow V_{IU} \geq V_{UU} \Leftrightarrow w_I - w_U \geq \tau(\omega + (1-\omega)(u-i)) \\ 0 \Leftrightarrow V_{IU} < V_{UU} \Leftrightarrow w_I - w_U < \tau(\omega + (1-\omega)(u-i)) \end{array} \right\}$$

A non-integrated individual having a non-integrated partner is more likely to accept the social norm the larger the difference between w_I and w_U. The probability of acceptance decreases though with the disutility parameter associated with spending time with someone having a different perception of the social norm, τ, with the time spent with the non-integrated partner, ω, and with the time spent with non-integrated weak ties once the individual has chosen to accept the social norm, $(1-\omega)u$. Conversely, the probability of acceptance of the social norm increases with time spent with the integrated weak ties, $(1-\omega)i$. Focusing on the right-hand side of the inequality, we easily conclude that the longer the time spend with strong ties the lower the probability of acceptance of the social norm by an individual whose strong tie rejects this norm.[5] In contrast, under the assumption that the dominant social norm implies that there are more integrated than non-integrated people in the society, $i > u$, time spent with weak ties increases the probability that the non-integrated individual accepts the dominant social norm, since $(1-\omega)(u-i) < 0$.
Similarly, a non-integrated individual having an integrated partner decides to accept the social norm, $\psi = 1$, if and only if $V_{II} \geq V_{UI}$. Given that:

$$V_{II} - V_{UI} = \frac{w_I - w_U - \tau((1-\omega)u - (\omega + (1-\omega)i))}{r + \chi + \delta + \psi \alpha (\omega + (1-\omega)i)}$$

the denominator is always positive, we conclude:

$$\psi \left\{ \begin{array}{l} 1 \Leftrightarrow V_{II} \geq V_{UI} \Leftrightarrow w_I - w_U \geq \tau((1-\omega)u - (\omega + (1-\omega)i)) \\ 0 \Leftrightarrow V_{II} < V_{UUI} \Leftrightarrow w_I - w_U < \tau((1-\omega)u - (\omega + (1-\omega)i)) \end{array} \right\}$$

The likelihood of choosing to accept the social norm when the partner already accepts it, decreases with the utility loss associated with time spent weak non-integrated ties, $\tau(1-\omega)u$, and increases

[5] When the right-hand side is differentiated with respect to ω, we find $\partial\omega(1-u) + \partial\omega \cdot i > 0$ since $1 - u > 0$.

with time spent with strong and weak ties that already accept the social norm, $\tau(\omega + (1-\omega)i)$. By partially differentiating the right-hand side of the inequality with respect to ω we conclude that the longer the time spent with the strong tie, the higher the probability of acceptance of the social norm.[6] Moreover, again under the assumption that the social norm is dominant because $i > u$, time spent with weak ties increases the probability that the individual accepts the social norm since $(1-\omega)u - (1-\omega)i < 0$.

Depending on individual choices our theoretical setup leads to four different steady-state dyad flows equilibria which are explained in Appendix A.

Results on the role of strong ties are contradictory between ψ_0 and ψ. This is simply because the status of the strong tie differs between ψ_0 and ψ. For the former, the dyad partner rejects the social norm, so the longer the agent spends with his partner (strong tie) the lower the probability that he will accept the dominant social norm. In contrast, for ψ the dyad partner accepts the social norm, so the longer the time the agent spends with him the most likely he is to accept the social norm.

Weak ties push always the individual towards the dominant social norm. We have defined the social norm as the norm recently approved by the government, which is elected by the majority of the population. Given this definition, we must have that the proportion of individual accepting the social norm in the economy, i, should be above the proportion rejecting it, u. As a result, weak ties promote more contacts with integrated individuals than with no integrated individuals, whatever the status if the dyad partner. Weak ties promote then integration.

Strong ties are the source of conformism on individuals' behavioral choices. The longer the time the agent spends with his dyad partner the most likely he is to share the same sociopolitical opinions as him. Conversely, weak ties push the individual to adopt the dominant sociopolitical point of view in the economy. This result is important, since it implies that if the central planer wants a group of individuals to make completely different choices with respect to their strong ties (family and close friends), it should promote the development of weak ties. The spread across the city of social housing, instead of creating ghettos, or lengthening school hours are some policy measures aimed at promoting weak ties.

The econometric approach presented in the following sections test the prediction of our model, according to which weak ties always push the individual to adopt the dominant sociopolitical point of view in the economy while strong ties only push the individual to accept this dominant social norm when the strong tie already accepts it (*i.e.* integrated strong tie).

[6] Partially differentiating the right-hand side leads to $-\partial\omega - (1-i)\partial\omega < 0$ since $i < 1$.

4 An empirical illustration: Gay marriage and attitudes towards homosexuality

Since 2002 many European countries have progressively legalized same-sex marriage. This political trend has been associated with a progressive change in the perception of gay and lesbian rights in most European countries. We investigate here the extent to which the approval of same-sex marriage contributed to this observed evolution in opinion and how social ties amplified or limited the possible influence of the passing of the law on the opinion.

4.1 Data

4.1.1 The European Social Survey

We use the European Social Survey (ESS), an academically driven cross-national survey, which is conducted since 2001 to chart stability and change in social structure, conditions and attitudes in Europe and to interpret how Europe's social, political and moral fabric is changing. More than 30 countries are included in the ESS. In each participating country, face-to-face interviews are conducted every two years with newly selected, cross-sectional representative samples of residents aged of 15 and above. Individuals are asked about their attitudes, beliefs and behavior patterns in various area. We use all available waves such that data ranges from 2002 to 2016.
More details ont this database are provided in Appendix B.

4.1.2 Variables

The social norm that we take as reference in this paper concerns the acceptance of equal rights for gays and lesbians. The European Social Survey is well suited to our empirical illustration because it provides information about attitudes towards homosexuality of people in a number of countries at different periods, in particular before and after the passing of gay-friendly laws if any. More precisely, individuals are asked on their opinion about the fact that gay men and lesbians should be free to live their own life as they wish. They have to report whether they "1 Agree strongly; 2 Agree; 3 Neither agree nor disagree; 4 Disagree; 5 Disagree strongly" with this statement. We consider that people agreeing or strongly agreeing with this statement are supporters of homosexual rights.
Identifying the nature of social ties is always a complicated issue. To remain as consistent as possible with our dyad model, we consider that individuals having a spouse/partner have strong ties, while the others have weak ties. We agree that this may be a very restrictive definition of strong ties, since people may have very close friends that could be qualified as strong ties even if they are not a spouse/partner. With data on hand, we are unable to capture how close friends of the individual may be. Moreover, the definition of closeness remains very subjective, so that we believe that restricting our definition of strong ties to spouses and partners represents a sufficiently

reliable (lower bound) definition of strong ties.
We combine the ESS data with three additional data sources to gather additional country-level information about attitudes and laws about sex-same.
First, information on same-sex marriage legalization dates is obtained from the International Lesbian, Gay, Bisexual, Trans and Intersex Association.
Second, information on homophobic countries is collected combining information from:

- "Gay Voyageur" (http://www.gayvoyageur.com/), which provides advice to homosexual travelers on both gay-friendly and homophobic countries.
- The World Value Survey (wave 2010-2014)[7] asks individuals if they would not like to have as neighbor an homosexual person. We arbitrarily consider that when more than 60% of the population responds that they would not like to have as neighbor a homosexual person, the country is homophobic.

All in all, we classify as homophobic countries that are considered as such by the "Gay Voyageur" site or that have more than 60% of the population declaring that they would not like to have homosexuals as neighbors. We find that more than 43% of the 192 countries included in our sample are classified as homophobic.

4.1.3 The sample

We restrict our analysis to countries that passed same-sex marriage laws during the 2002-2016 observation period and to countries in which such laws has not been passed by the end of our observation period. Countries in our analysis sample are thus Belgium, Denmark, Spain, France, Norway, Portugal and Sweden.
We use all the individual observations of these seven countries and apply design/post-stratification weights in combination with population size weights to our estimations [8].

4.2 Descriptive analysis

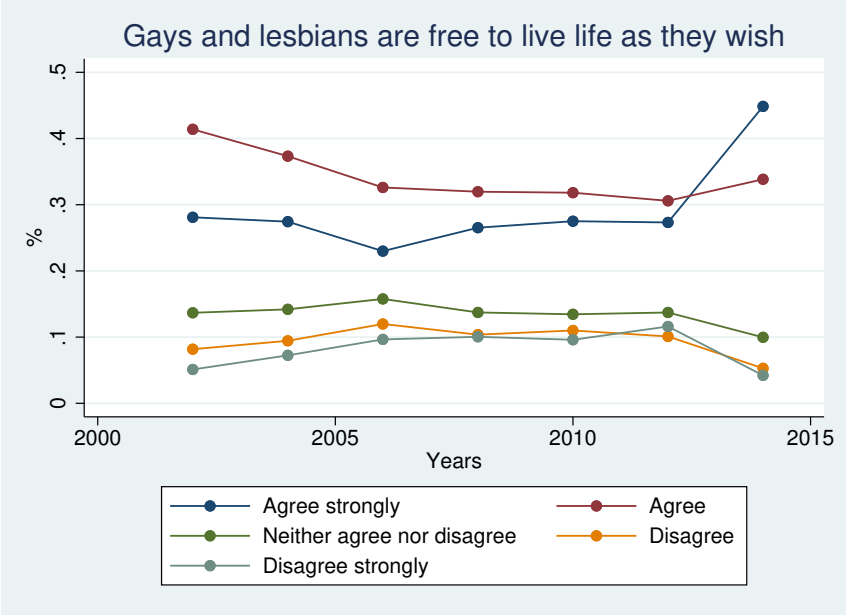
Figure 2 represents the evolution of the average opinion on gay and lesbian rights in our sample, all countries together. Whereas during 2002-2006 there was a decrease in the percentage of citizens agreeing or strongly agreeing on the fact that gays and lesbians have the right to live their life as

[7] Information on Andorra, Bulgaria, Burkina Faso, Canada,Ethiopia, Finland, France, Guatemala, Hungary, Indonesia, Iran, Italy, Mali, Moldova, Norway, Serbia, Switzerland, United Kingdom, Vietnam and Zambia comes from the 2005-2009 wave.

[8] Design weights are computed as the inverse of the inclusion probabilities. The inverse inclusion probabilities are then scaled such that their sum equals the net sample size and the mean equals one. The post-stratification weights are obtained by adjusting the design weights in such a way that they will replicate the distribution of the cross-classification of age group, gender, and education in the population and the marginal distribution for region in the population. The population size weight makes an adjustment to ensure that each country is represented in proportion to its population size.

they want, the percentage of citizens disagreeing on this same fact increased. During 2006-2012 the share of the population with favorable and unfavorable opinions remained fairly stable. Finally, since 2012 we observe a clear increase in the percentage of favorable opinions and a decrease in the share of unfavorable opinions.

Figure 2: "Gays and lesbians are free to live as they wish" : average opinion over time



Source: European Social Survey (2002-2016).

The situation is though far from being homogeneous across countries. As revealed in the left-hand side panel of Figure 3, more than 80% of the population agrees or strongly agrees on the fact that gays and lesbians have the right to live their life as they want in countries where same-sex marriage is legal, while only 23% of the population from countries where same-sex marriage is illegal strongly agrees with this statement and 37% simply agrees with it. This gap on the average opinion on gay and lesbian rights between countries with legalized same-sex marriage and the rest of the countries is confirmed by the right-hand side panel in Figure 3, which displays the progression along the years of the share of individuals agreeing or strongly agreeing on the fact that gays and lesbians have the right to live their life as they want. This gap has remained fairly constant and around 15 to 20 percentage points since 2002.

Legal framework concerning same-sex marriage and population opinion on gay and lesbian rights are then strongly correlated. This seems reasonable, since governments are elected by a majority vote. Therefore, legalization of same-sex marriage by a particular government simply reflects the dominant social norm. It seems thus interesting to study also the issue from the opposite perspective and analyze if the approval of same-sex marriage by a government induced a change in the average positive opinion of citizens on gay and lesbian rights. Figure 4 represents the

Figure 3: "Gays and lesbians are free to live as they wish" : average opinion by legal framework

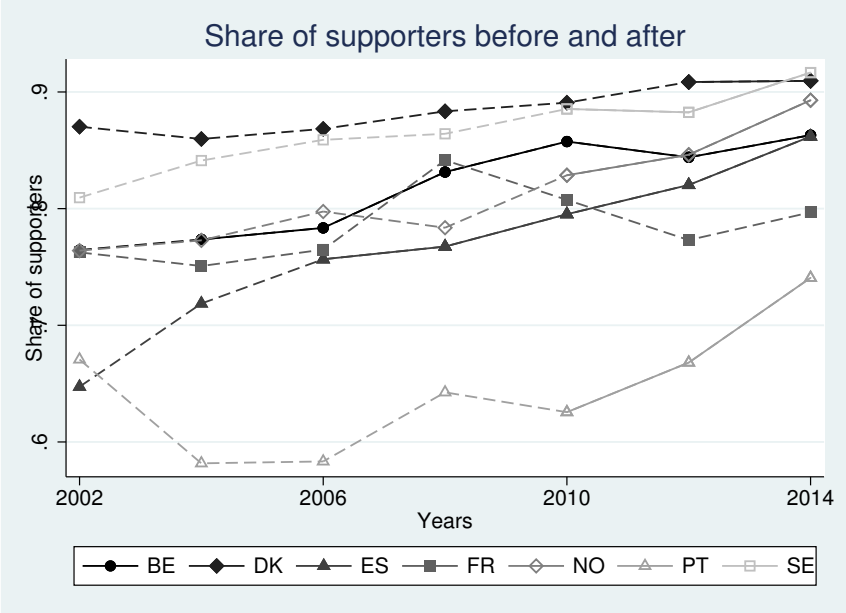
Source: European Social Survey (2002-2016). Note : Supporters are individuals who agree or strongly agree with the affirmation : "Gays and lesbians are free to live as they wish".

progression in the share of the population agreeing or strongly agreeing on the fact that gays and lesbians have the right to live their life as they want for seven European countries where same-sex marriage was approved during the period 2002-2016. Each country is represented by a line, where the dashed part corresponds to the period where same-sex marriage was illegal in the country and the solid part corresponds to the period where same-sex marriage was legalized. As observed, the legalization of same-sex marriage was preceded in all countries, except in France, by a rising path in the share of people agreeing or strongly agreeing on the fact that gays and lesbians have the right to live their life as they want. Moreover, after the legalization this increasing trend remained and even accelerated in all countries.

The question that we address in this paper is to what extent the approval of same-sex marriage modified the opinion of individuals on gay and lesbian rights (*i.e.* dominant social norm) and how the nature of the social ties (*i.e.* weak vs. strong ties) has modified this impact of the law on individuals' opinion. The main hypothesis we want to test is the following: are people less likely to adopt the social norm made legal when they have strong ties that do not support this social norm ? As explained by our theoretical framework, this relationship between law and acceptance of a social norm is not always clear. Moreover, from an econometric point of view, the individual's opinion on gay and lesbian rights may be endogenous with the nature of her ties, making identification impossible.

Let us now provide some evidence on the relationship between the composition of social ties and the opinion on gay and lesbian rights. In this descriptive part of the paper, we present simple correlations to provide intuitions on the relationship. We can definitely not talk about causality at this stage since the nature of the dominant social ties may be determined by the opinion of the individual concerning the dominant social norm or the other way round. That is, individuals

Figure 4: "Gays and lesbians are free to live as they wish" : average opinion by legal framework and over time



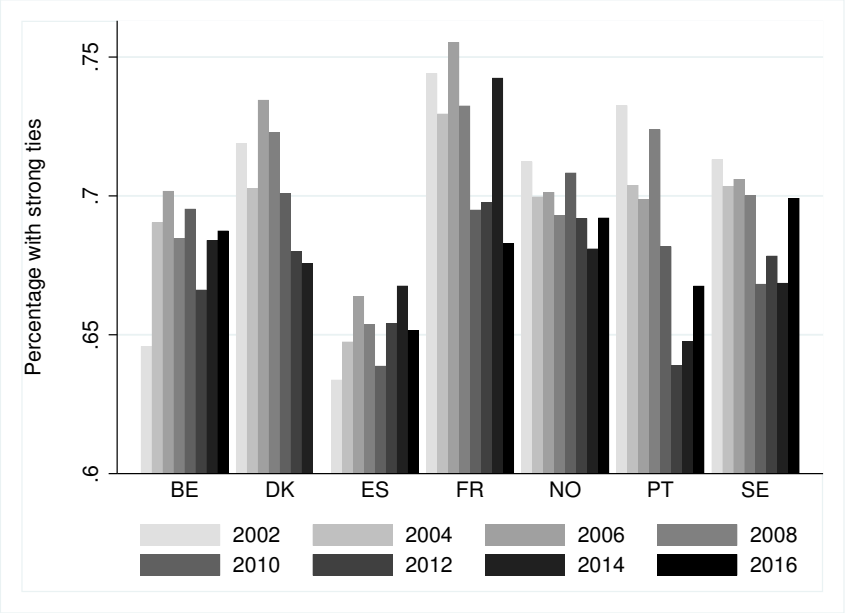
Source: European Social Survey (2002-2016). Notes: Supporters are individuals who agree or strongly agree with the affirmation : "Gays and lesbians are free to live as they wish". For each country, the dashed (solid) line indicates the share of supporters before (after) the legalization of gay marriage in the country.

having a more positive opinion on gay and lesbian rights are likely to be more open minded and they may find easier partner. And similarly, individuals that have a partner may become more open minded and have a positive opinion on gay and lesbian rights. The econometric analysis will deal with these issues.

As revealed by Figure 5 individuals having a partner/spouse represent between 65 and 75% of the population depending on the considered country. Figure 6 displays the proportion of the population agreeing or strongly agreeing on the fact that gays and lesbians can live their life as they wish by the nature of ties and the legality of same-sex marriage. We observe that, while there are strong differences in the share of gay-rights supporters depending on the legal status of same-sex marriage, the nature of ties does not seem to fundamentally modify the observed trend in the share of gay-rights supporters.

These results are confirmed by Figure C.1 in Appendix C. This figure represents the progression in the share of individuals agreeing or strongly agreeing on the fact that "gay men and lesbians should be free to live their own life as they wish" in countries where same-sex marriage has been legalized distinguishing individuals according to the nature of their social ties. The progression in the share of supporters in countries having approved same-sex marriage does not seem to display a differential trend depending on the nature of ties. But this remains an unconditional correlation to be tested more formally.

Figure 5: Population composition by ties in countries having approved same-sex marriage during 2002-2016: strong vs. intensive strong ties



Source: European Social Survey (2002-2016).

Figure 6: Gays and lesbians have the right to live their life as they want: average opinion of Europeans by legal framework

Source: European Social Survey (2002-2016).

5 Econometric Analysis

To test the predictions from our theoretical model, we propose a pseudo-panel (or cell) approach. Constructing cohorts (or cells) allows us to introduce a temporal dimension – as we can follow cohorts over time – in the repeated cross-sectional data from ESS and thus to consider fixed effects models as with genuine panel data. In a pseudo-panel approach, cohorts are formed with individuals having some common characteristics and then cohort means are treated as observations. These cohort means may be subject to measurement (or sampling) errors, in approximating population means, if the number of individuals in each cohort is not sufficiently large.[9] There is no general rule to determine whether the cohort size is large enough to ignore sampling errors.[10] Under this condition, pseudo-panel data can be treated as genuine panel data.

The variables used to define the cohorts should satisfy the same conditions as instrumental variables, *i.e.* should be uncorrelated to the unobservables in the equation of interest and appropriately correlated to the explanatory variables in the model (Verbeek (2008)). In addition, cohorts should be constructed on the basis of a stable criterion. Year of birth is an obvious stable criterion, which is often used in pseudo-panel studies, but it is not the only one despite what the term "cohort" suggests. Other variables can be used, even in combination, to construct the cohorts.[11] Using a stable criterion is a way to ensure that the cohorts (in the population) are composed of the same individuals at each period. Under this condition, cohort fixed effects can be included as well as individual fixed effects with genuine panel data.

Despite this condition, the representation in the scope of the survey of individuals satisfying the conditions to belong to a given cohort is likely to vary over time and so the cohort effects may not be really fixed over time. To make sure that the latter are fixed over time, we should remove composition effects in the ESS survey sampling.

In our paper, the cohorts, also referred as cells are defined by country, year, and individual demographics, including age (15-25, 26-35, 36-45, 46-55, more than 55) and gender. Most cohorts defined according to these two criteria are composed of more than 100 individuals.[12] Cohorts (cells) are defined in the first year (2002) and left constant for all the other years. The size of the cohorts may though vary across them and over time. These variations in cohort size may induce heteroskedasticity and thus affect the precision of the estimator. We can obtain an efficient within estimator by weighting the observations by the cell size (Guillerm (2017)).

To at least partially correct for the endogeneity of the nature of social ties with respect to the

[9] Some authors have proposed errors-in-variables estimators to carry out this problem in different configurations : when the number of cohorts goes to ∞ (Verbeek and Nijman (1993) or Collado (1997)), when the number of groups goes to ∞ (Deaton (1985)), or when the number of groups is small (Devereux (2007)).

[10] Verbeek and Nijman (1992) and Verbeek and Nijman (1993) suggest that 100 individuals per cohort is a reasonable floor.

[11] For instance, Gardes et al. (2005) combine age and education in their pseudo-panel analysis to estimate income elasticities

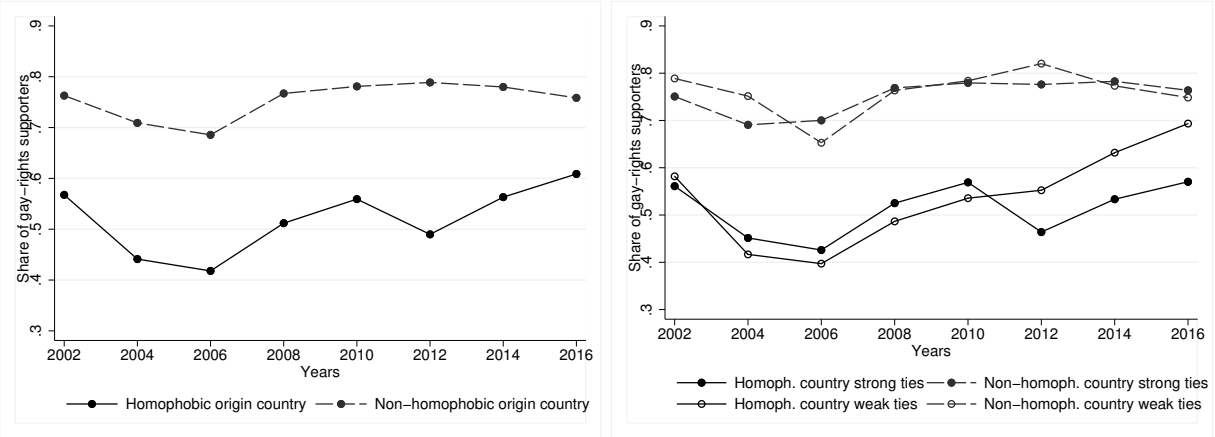
[12] 321 over 1450 cells include less than 100 individuals.

opinion on gay and lesbian rights, we compute the composition of cells according to the nature of ties in the first year – when same-sex marriage was only legal in the Netherlands – and leave constant this tie composition for the whole period of analysis. Indeed, we expect that legalization of same-sex marriage in a country can help to change mentalities in the population beyond the country's borders. Such an institutional context is largely unobserved in the data and may induce an endogeneity bias if it is related to the composition of social ties. We assume here that, outside the Netherlands, the opinion of individuals on gay and lesbian rights in 2002 was not affected by legalization of same-sex marriage in the Netherlands, *i.e.* the latter has not induced significant changes of mentalities in other countries. Indeed, the Netherlands is a country which has the reputation to legalize behaviors that were illegal in most countries, such as prostitution or selling cannabis. Over subsequent years, with the sequential legalization of same-sex marriage in most European countries, the institutional context is likely to further shape individual opinions and then the composition of social ties is likely to be endogenous. By leaving constant and equal to their 2002 levels the internal composition of cells in terms of social ties, we remove bias due to its endogenous nature. Moreover, as a robustness check, we will implement our regressions distinguishing between gay-friendly cells and non gay-friendly cells. To ensure the exogeneity of this classification between gay-friendly and non-friendly cells, we use the opinion composition of cells in 2002.

The main limitation of our econometric approach is that, contrary to our model, where the opinion of the dyad-partner (*i.e.* strong ties) on the social norm is known, we do not observe in our data the opinion of the individual's social ties on gay and lesbian rights. To deal with this concern, we propose two different strategies. On the one hand, we rely on the dominant opinion on gay and lesbian rights in the cell, as computed in 2002. We assume that individuals who belong to a cell where the dominant opinion on gay and lesbian rights was positive in 2002 are more likely to have weak ties with a positive opinion on gay and lesbian rights. Conversely, individuals belonging to cells where the dominant opinion was negative in 2002 are more likely to have weak ties with a negative opinion on gay and lesbian rights. Evidently, this implies that individuals' weak ties are only composed by people of the same country, same age-interval and same gender, which is a very strong (and unrealistic) hypothesis.

On the other hand, an alternative strategy to control for the opinion of social ties consists in focusing on immigrants and distinguishing between those coming from homophobic regions and those coming from non-homophobic regions. In the literature, network effects have been proved to be of major importance on immigrants' choices and behaviors (see *e.g.* McKenzie and Rapoport (2010), Munshi (2003), Waldinger (1996) or Patel and Vella (2013) among many others). Our guess here is that immigrants tend to interact more frequently with people coming from the same origin country. Immigrants in a host country c are likely to be included in social networks composed by members from the same country or region of birth. Immigrants coming from a region classified as homophobic (*i.e.* the dominant social norm in the country of origin is homophobia) are then likely

Figure 7: Gays and lesbians have the right to live their life as they want: average opinion of immigrants depending on the country of origin and the nature of social ties



Source: European Social Survey (2002-2016).

to have social ties from the same region and are then more likely to be homophobic. This guess seems to be confirmed in the data (Figure 7). Among immigrants coming from non homophobic countries, more than 75% (in average, over the whole period) agree on the fact that gays and lesbians have the right to live their life as they want. This percentage does not overcome 52% among immigrants coming from homophobic countries. From a dynamic perspective (left-hand side panel of Figure 7), the opinion of immigrants coming from both categories of countries has followed a similar path implying that the gap in the opinion has remained fairly constant along time. We only observe a slight reduction in the gap for 2016.

The right-hand side panel in Figure 7 presents the progression of immigrants' opinions on gay and lesbian rights by origin country (*i.e.* homophobic vs. non homophobic) and by nature of the social ties. Among immigrants coming from non-homophobic countries, there are no major differences depending on the nature of social ties. In contrast, among immigrants coming from homophobic countries, we observe from 2010 a relative more positive progression of the opinion on gay and lesbian rights for immigrants with dominant weak ties with respect to those with dominant strong ties. This finding is consistent with our theoretical predictions.

To control for the endogeneity of immigrants' geographical location choices we use the historical settlement of their peers, and allocate the current stock of immigrants in EU countries according to the sharing rule obtained using historical settlements provided by Docquier, Lohest, and Marfouk (2007). We replicate our econometric analysis over this population subgroup and test whether results are consistent with the theoretical predictions and with estimates obtained over the whole population.

5.1 Empirical Model and Identification Strategy

Once the data is collapsed by country, year and individual demographics (age, gender), we use a difference-in-difference (diff-in-diff) approach that exploits cross-country differences in the timing of adopting gay marriage. The diff-in-diff estimator compares changes in the share of gay-rights supporters between cohorts which are subject to the policy at different moments of time and those which were not subject at all.

In our econometric framework, the approval of same-sex marriage represents the treatment, which is actually applied to different individuals (*i.e.* country-age-gender cells) at different moments of time. We seek then to apply a diff-in-diff strategy with variation in treatment timing. The event study designs have though been recently a source of controversy in the economic literature. **?**) consider a setting where all units in a panel receive treatment but at random times. They conclude that "the linear trend in the dynamic schedule of causal effects is not identified, because one cannot disentangle the effects of passing of absolute time and relative time when there is no control group and in presence of unit fixed effects [...] The control group helps identify the time effects alleviating the problem". In our case, among the 21 considered countries there are 12 that did not approve same-sex marriage during the considered sample period[13] and that will thus act as a control group. **?**) already remarked that, when treatment effects vary over time, a major difficulty in diff-in-diff analyses involves separating out preexisting trends from the dynamic effects of a policy shock. Starting from the seminal work of **?**), he shows that single-coefficient diff-in-diff estimators confound preexisting trends and the dynamic effects of the policy shock, while assessing the impact on the divorce rate of the approval of Unilateral Divorce Laws by different U.S. states (at different times). Because the dynamics are not well captured by this single variable, state-specific trends pick up not only different preexisting trends across states, but also differences in the evolution of the divorce rate between reform and control states subsequent to the adoption of unilateral divorce laws. Dynamics beyond a discrete series break are not fully accounted for by the simple dummy variable, leading the state-specific trend "controls" to partly reflect the dynamic response of the response variable to the policy shock. The single-coefficient diff-in-diff estimator reflects the difference between the actual path of divorces and a systematically biased estimate of its counterfactual. These problems are exacerbated when only a few observations are available before the policy shock.

?) proposes a specification imposing very little structure on the response dynamics, including dummy variables for the first two years of the new legal regime, for years three and four, five and six, and so on. These variables identify the entire response function allowing the estimated state-specific time trends to identify preexisting trends. A similar specification is proposed by **?**) to evaluate how unilateral divorce changed family violence and whether the option provided by unilateral divorce reduced suicide and spousal homicide. Furthermore, after estimating the entire

[13] Switzerland, Czech Republic, Germany, Estonia, Finland, Hungary, Italy, Lithuania, Poland, Slovenia, Slovakia, Slovakia.

response function of suicide rate to unilateral divorce law, the authors average these effects which allows to provide a more precise average impact of treatment for the whole considered period. This idea of averaging over dynamic responses following the application of a time varying treatment has been recently formalized by **?**).[14]

We adopt the same specification as **?**) and **?**):

$$\begin{aligned} Opinion_{gct} = & \sum_{k \geq 1} \delta_k Same\ sex\ marriage\ has\ been\ in\ effect\ for\ k\ periods_{ct} \\ & + \lambda_g + \eta_c + \tau_t + \eta_c \tau_t + \lambda_g \tau_t + \lambda_g \eta_c + \varepsilon_{gct} \end{aligned} \tag{16}$$

where $Opinion_{gct}$ stands for the share of gay-rights supporters for the cell defined by demographic group g, in country c and year t. Demographic groups g are defined by age group and by gender as described above. λ_g, η_c and τ_t are vectors of cell, country and time effects, respectively. λ_g controls for systematic differences in the opinion on gay and lesbian rights across cells, η_c controls for unobservable differences across countries – that may be correlated with gay-marriage adoption, and τ_t captures the common trend across countries in the opinion on gay and lesbian rights[15]. δ_k for $k =$ 0-1 years, 2-3 years, 4-5 years, 6-7 years, 8-9 years are the coefficients of interest reflecting dynamic responses in the opinion about gay and lesbian rights after the law about gay marriage has been approved for 0-1 years, 2-3 years, 4-5 years, 6-7 years and 8-9 years. To estimate the average response of the opinion about gay and lesbian rights following the approval of same-sex marriage, we will make the average of these coefficients.

Estimates for this model and all subsequent models are weighted using the number of individuals (observations) in each (country-year-demographic) cell. To control for arbitrary patterns of serial correlation within countries, standard errors are clustered at the country level. This benchmark model is estimated both over the whole set of cells and over the subset of cells having a dominant favorable opinion on gay and lesbian rights in 2002.

Since there may have be country-specific or cell-specific shocks, we estimate (16) with a full set of year specific effects, *i.e.* we add interactions between τ_t and η_c, and between τ_t and λ_g. Including the country-specific time trends allows us to account for possible pre-existing trends that may predate the adoption of gay marriage and could otherwise be confounded with adoption. Specifications with country-specific time trends require that identification comes from the discontinuity surrounding the adoption of gay marriage. These specifications can provide reassurance that our coefficients

[14] As analyzed by **?**) when treatment effects vary over time, already treated units become controls of untreated units. Because already-treated groups act as controls, the single-coefficient diff-in-diff model estimators subtract average changes in their untreated outcomes and their treatment effects. This leads to a bias that comes from estimating a single-coefficient diff-in-diff model when treatment effects vary over time (this does not mean that the diff-in-diff research design is invalid). The author proposes a general diff-in-diff estimator, and shows that it is a weighted average of all possible two-group/two-period diff-in-diff estimators in the data, *i.e.* the estimator actually averages treatment effect heterogeneity.

[15] Year fixed effects control for time-varying factors that are common to all countries but may be correlated with the gay marriage policy in the country (*e.g.* the business cycle or international policies).

are not reflecting smoothly trending omitted variables that are potentially correlated with the adoption of gay marriage – see Autor, Kerr, and Kugler (2007b)[16] or **?**). The inclusion of cell specific trends controls for pre-existing trends at the cell level orthogonal to same-sex marriage approval.

In a second stage, we seek to estimate whether the dynamic responses in the opinion about gay and lesbian rights after same-sex marriage adoption differs depending on the dominant nature of social ties of individuals. We define a dummy variable *Strong ties* adopting the unitary value when more than 50% of the cell members declares having a wife/husband/partner (*i.e.* strong ties). The nature of ties composition by cell is computed for 2002 and remains unchanged for the rest of the period. Therefore, the dummy variable *Strong ties* is a time-invariant characteristic of the cell. The model then estimated is the following:

$$\begin{aligned} Opinion_{gct} = & \sum_{k\geq 1} \delta_{k0}\ Same\ sex\ marriage\ has\ been\ in\ effect\ for\ k\ periods_{ct} + \delta_2\, Strong\ ties_{gc} \\ & + \sum_{k\geq 1} \delta_{k1}\ Same\ sex\ marriage\ has\ been\ in\ effect\ for\ k\ periods_{ct} \times Strong\ ties_{gc} \\ & + \lambda_g + \eta_c + \tau_t + \eta_c\tau_t + \lambda_g\tau_t + \varepsilon_{gct} \end{aligned} \tag{17}$$

where δ_2 captures the average effect of strong ties on the opinion on gay rights, while δ_{k1} captures the specific dynamic responses in the opinion about gay and lesbian rights after same-sex marriage adoption among individuals with dominant strong ties. Again, this model is estimated over the whole set of cells and on the subset of cells having a positive dominant opinion on gay and lesbian rights in the base period. Within the latter cells, weak ties are more likely to support gay and lesbian rights, since the majority of the cell is gay-friendly.

Models (16) and (17) are estimated with weighted OLS, using two different weighting strategies. The first strategy consists in using the standard weights proposed by the ESS, which result from multiplying the post-stratification weights and the population size weights. Evidently, estimates obtained using these weights are affected by changes in population composition. To remove these composition effects, the second strategy consists in assigning to each cell, in a given year and in a given country, the average yearly weight of the cell in the corresponding country over the whole observed period (as in Autor, Kerr, and Kugler (2007b)).

In a third stage, we propose an alternative strategy that seeks to control for the opinion of individuals' social ties by focusing on immigrants and distinguishing them according to their region of birth. Cells are now defined for immigrants by host country, region of birth and year. Using this strategy requires dealing with the endogeneity of location choices with respect to opinions on gay and lesbian rights. In particular, immigrants may be going to countries that are more or less favorable to gay and lesbian rights depending on their own opinion on homosexuality. To

[16] See also the companion paper (Autor, Kerr, and Kugler 2007a). The authors use a year-by-year difference-in-difference model to understand how mandated employment protections reduce productive efficiency.

control for the endogeneity of location choices, we rely on the past settlement of immigrants across European countries. We specifically use data from Docquier, Lohest, and Marfouk (2007) on the stock of immigrants by European country in 1990.

One of the main concerns of this approach refers to the cell size. Given that in the database there are almost two hundred countries of birth, some of our cells, which were initially defined for every ESS round at the country-country of birth level, have too few observations. To solve the problem, we use the United Nations geoscheme[17] to define larger world regions (see Appendix D) and compute the share of immigrants from region r in the host country c in 1990 as:

$$\gamma_{cr,1990} = \frac{\sum_{o \epsilon r} Immigrants_{oc,1990}}{\sum_{o \epsilon r} Immigrants_{o,1990}} \tag{18}$$

where $\sum_{o \epsilon r} Immigrants_{oc,1990}$ stands for the sum of all immigrants living in country c in 1990 but that were born in countries o belonging to region r; $\sum_{o \epsilon r} Immigrants_{o,1990}$ represents the total number of individuals in 1990 that were born in any country o belonging to region r and that were living in any of the host countries c of our sample. This new sharing rule is then applied over the whole stock of immigrants in our considered sample in period t:

$$\widehat{Immigrants}_{crt} = \gamma_{cr,1990} \times \sum_{c} Immigrants_{crt} \tag{19}$$

In period t, the estimated number of immigrants in country c from region r, $\widehat{Immigrants}_{crt}$, is computed by multiplying the 1990 share of immigrants coming from region r that were living in host country c by the total number of immigrants from region r in period t in our sample.

Using this sharing rule to compute the number of immigrants of different countries of birth in each host country, we ensure the exogeneity of the distribution of immigrants. The implicit assumption is that the 1990's sharing rule of immigrants across host countries is exogenous to any current shock, such as the adoption of same-sex marriage.

We have initially 379 cells defined at the host country, region of birth and year levels. Among them, only 36 have more than 100 observations and only 178 have at least 30 observations. After applying the historical settlements, the number of cells with more than 30 observations is reduced to 160. Moreover, once we impose the social ties composition to be equal to that observed in 2002, the number of cells falls to 125. After dropping cells that do not appear in at least 6 waves, we have a sample composed of 113 cells, among which there are only 7 cells with dominant weak ties. This makes the identification of the role of social ties as a driver of the individuals' opinion on gay and lesbian rights impossible, since there is not enough variation.

In order to increase the number of observations by cell, we propose to stack data for every country into two periods, one corresponding to years before the approval of same-sex marriage, and another one corresponding to years after the approval of same-sex marriage. For countries that have not

[17] See https://unstats.un.org/unsd/methodology/m49/

approved same-sex marriage, we have a single period database. The number of cells is reduced to 279 and among them only 95 have in both periods (before and after approval of same-sex marriage) more than 30 observations by region of birth. Moreover, once we match with social ties' composition in 2002, our sample is reduced to 86 cells among which 19 have dominant weak ties. Results concerning the immigrant regressions must then be interpreted with caution.

To identify the effects of population composition changes, we make our estimates using two alternative weighting strategies. The first strategy does not correct for population composition changes and simply employs weights provided by the ESS. The second strategy considers a constant weight for each host country-region of birth cell over the whole period. These constant weights result from multiplying the sharing rule $\gamma_{cr,1990}$ by the total number of individuals from region r over the whole period.

As previously, in order to control for endogeneity of social ties, we compute the tie composition of these newly created cells in the first year, 2002, and classify as "strong dominant" all cells in which more than the half of its members declare having a partner (*i.e.* a strong tie). The dummy variable *Strong ties* equals unity for these cells. This base-period tie composition is imposed to be constant for all subsequent years in our sample.

For each country of birth we had defined an indicator variable $Homophobic$, which equals 1 if the corresponding country is classified as homophobic by the website "Gay Voyageur" or if there are more than 60% of individuals in the country who declare in the World Value Survey (2010-2014) that they would not like to have a homosexual person as a neighbor. Since we regroup countries of birth by regions, our new homophobic indicator will adopt for every region a value included in the interval $[0, 1]$. A region is classified as homophobic if more than 50% of the countries included in the region are homophobic, *i.e.* the indicator is above 0.5.

We estimate the following regression over our immigrant sample:

$$\begin{aligned} Opinion_{rct} = & \sum_{k\geq 1} \delta_{k0}\ Same\ sex\ marriage\ has\ been\ in\ effect\ for\ k\ periods_{ct} + \delta_2\, Homophobic_r \\ & + \sum_{k\geq 1} \delta_{k1}\ Same\ sex\ marriage\ has\ been\ in\ effect\ for\ k\ periods_{ct} \times Homophobic_r \\ & + \lambda_r + \eta_c + \tau_t + \eta_c\tau_t + \lambda_r\tau_t + \varepsilon_{rct} \end{aligned} \tag{20}$$

where we control for yearly shocks as well as for systematic differences in the opinion on gay and lesbian rights across host countries and regions of origin (τ_t, η_c and λ_r, respectively). We also control for host country yearly specific shocks and region of origin yearly specific shocks by including in the above model interactions of τ_t with η_c and λ_r. The coefficients of interest are δ_{k0}, δ_2 and δ_{k1}. δ_{k0} captures the dynamics of the response to the adoption of same-sex marriage on the opinion on gay and lesbian rights among immigrants coming from non-homophobic regions, δ_2 captures the average response effect of coming from homophobic regions (it actually captures a region of birth fixed effect, since it is a time-invariant variable specific to each region of birth) and

δ_{k1} captures the dynamics of the response to the adoption of same-sex marriage for immigrants coming from homophobic regions.

In this first stage, we are analyzing if the approval of gay marriage has been more or less successful in modifying the opinion on gay and lesbian rights over the population subgroup coming from homophobic regions. However, we do not take into account whether individuals in the subgroup have dominant strong ties or dominant weak ties. This is done in the second stage, where we estimate for the whole sample and separately, for people coming from homophobic and non homophobic regions, the following equation:

$$\begin{aligned} Opinion_{rct} = & \sum_{k\geq 1} \delta_{k0}\ Same\ sex\ marriage\ has\ been\ in\ effect\ for\ k\ periods_{ct} + \delta_2\, Strongties_{rc} \\ & + \sum_{k\geq 1} \delta_{k1}\ Same\ sex\ marriage\ has\ been\ in\ effect\ for\ k\ periods_{ct} \times Strongties_{rc} \\ & + \lambda_r + \eta_c + \tau_t + \eta_c\tau_t + \lambda_r\tau_t + \varepsilon_{rct} \end{aligned} \tag{21}$$

where year, host country and region of birth fixed effects, as well as their interactions, should be interpreted as before. δ_{k0} captures the dynamic response of immigrants having dominant weak ties to the adoption of same-sex marriage on their opinion about gay and lesbian rights; δ_2 captures the systematic difference in that opinion between immigrants having dominant strong ties and those having dominant weak ties; δ_{k1} captures the dynamics of the specific response of immigrants having dominant strong ties following the adoption of same-sex marriage.

6 Results

Parameter estimates from equation (16) are reported in Table 1. First column reports results from a specification including no fixed effects. Columns (2) and (3) add individual year, cohort, country fixed effects. Columns (4) and (5) include individual fixed effects plus interacted country-year and cohort-year fixed effects. Columns (6) and (7) add all the previous fixed effects plus the interacted cohort-year fixed effect. In columns (2), (4) and (6) we use standard weights provided by the ESS survey ("weight") while in columns (3), (5) and (7) we use counterfactual weights equal to the average employment per year in the cell over the whole considered sample period ("mweight"). The latter specification thus allows to control for the largest share of unobserved heterogeneity across cells as well as for population composition changes. We then replicate the same specification on cells with a majority of gay-rights supporters (column (9)) and cells with a minority of gay-rights supporters (column(11)), *i.e.* cells where more (less) than 50% of individuals agreed or strongly agreed with the statement "gays and lesbians have the right to live their life as they want" in the base period.

Results in columns (5) and (7) suggest that the favorable opinion on gay and lesbian rights spiked between 2-3 years after the approval of same-sex marriage. Actually, the dynamic response to the law seems to follow an humped progression, with increasing and significant coefficient between 0 and 3 years after the approval of same-sex marriage, followed by significant and decreasing coefficients from the 4th year after law approval (there is a slight increase in coefficients from 7 to 8 years).

Results are puzzling when focusing on cells with a majority (minority) of gay-rights supporters. When gay-rights supporters are the majority (column (9)), the approval of same-sex marriage is associated with negative and significant impact after 0-1 years of approval. 2-3 years after, the negative impact is reduced but we must wait until 6-7 years after the approval to find a positive and significant coefficient. When gay-rights supporters are in the minority (column(11)), we only find a positive and significant impact 4-5 years after the approval of same-sex marriage. It is likely that due to a small number of observations, the variance for these cells is not sufficient to identify all the coefficients of the dynamic response function.

The interpretation of the dynamic response coefficients, when categorizing cells depending on the initial share of gay-rights supporters, must be done taking as reference the starting point. When the starting point is high, that is, when there is initially a majority of gay-rights supporters in the cell, the approval of same-sex law is not likely to increase even more the share of supporters. If anything, some people that agreed or strongly agreed on the fact that gays and lesbians have the right to live their life as they want, may not like that same-sex couples acquire the same rights as heterosexual couples. So the initial impact of same-sex marriage law is negative. It only becomes positive after 6-7 years. In contrast, when the starting point is low, *i.e.* minority of gay-rights supporters in the cell, the approval of the law is less likely to promote a further decrease in the share of supporters. If anything, after several years, some individuals may actually change their mind on gay and lesbian rights (we find a positive coefficient after 4-5 years of the adoption of same-sex marriage law).

Table 2 evaluates the role of strong social ties (*i.e.* the reference is then weak ties) in the dynamic response following the approval of same-sex marriage. The variable "Strong ties" represents the share of individuals within the cell with dominant strong ties. To avoid endogeneity issues, this share is computed in 2002 and is then left constant over the whole period. Thus, the variable "Strong ties" captures at the same time cohort fixed effects within each country, *i.e.* what is captured by "Cohort $\times$ Year FE" in Table 1. These are therefore not included in the estimates of Table 2. We focus our comments on column (4), and then on columns (6) and (8), because this is the specification that controls for the largest share of unobserved heterogeneity and also population composition changes.

The coefficient on "Strong ties" in column (4) indicates that the average opinion on gay and lesbian rights is not significantly different between cells with dominant strong ties and those with dominant weak ties. However, there are significant differences between them in the dynamic response function

Table 1: The influence of same-sex marriage approval on the opinion about gay and lesbian rights.

Dependent variable: Share of gay rights supporters

	All cells							Cells with majority of gay-rights supporters		Cells with minority of gay-rights supporters	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
First 0-1 years	0.123**	-0.0104	-0.00869	0.0728***	0.0738***	0.0642***	0.0611***	0.0135	-0.245***	0.147**	
	(0.0552)	(0.0149)	(0.0145)	(0.00294)	(0.00197)	(0.00141)	(0.000580)	(0.0109)	(0.0162)	(0.0473)	
Years 2-3	0.154**	-0.0113	-0.0123	0.000331	0.124***	-0.00440	0.114***	0.00663	-0.0392***	0.0429	-0.00352
	(0.0553)	(0.0112)	(0.0114)	(0.00404)	(0.00303)	(0.00355)	(0.00234)	(0.0129)	(0.00655)	(0.0291)	(0.0542)
Years 4-5	0.137**	0.00137	0.000232	-0.0156***	0.108***	-0.00914***	0.109***	-0.00659	-0.0134		0.212***
	(0.0575)	(0.00996)	(0.0104)	(0.00322)	(0.00277)	(0.00321)	(0.00256)	(0.00804)	(0.00796)		(0.0113)
Years 6-7	0.159**	0.0234	0.0236	0.0683***	0.0694***	0.0653***	0.0630***	0.0154	0.0315***	0.128***	
	(0.0584)	(0.0191)	(0.0193)	(0.00137)	(0.000957)	(0.000633)	(0.000264)	(0.0110)	(0.00741)	(0.0182)	
Years 8-9	0.197***	0.0462**	0.0462**	0.0896***	0.0911***	0.0901***	0.0871***	-0.0210	-0.0103		
	(0.0558)	(0.0200)	(0.0202)	(0.00269)	(0.00246)	(0.00178)	(0.00149)	(0.0132)	(0.00735)		
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country × Year FE	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × Year FE	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × Country FE	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Weights	weight	weight	mweight	weight	mweight	weight	mweight	weight	mweight	weight	mweight
Observations	217,893	217,893	217,246	217,893	217,246	217,893	217,246	174,930	174,445	38,406	38,244
R-squared	0.100	0.912	0.911	0.955	0.955	0.974	0.974	0.944	0.943	0.981	0.980

Notes: Robust standard errors in parentheses. Statistical significance: $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. The cohort refers to a particular gender-age group, as specified in Section 5. Regressions are weighted in 2 alternative ways: (i) using the standard weights provided by the ESS ("weight"); (ii) using a counterfactual weight equal to the average employment in the cell over the whole considered sample period ("mweight"). Cells with majority (minority) of gay-rights supporters are cells where more (less) than 50% of individuals agreed or strongly agreed with the statement "gays and lesbians have the right to live their life as they want" in the base period.

following the adoption of same-sex marriage. In cells with dominant weak ties, the adoption of same-sex marriage results in a significant and large increase in the share of gay-rights supporters the year of adoption or the year after ("First 0-1 years"). Following this first spike, the impact of same-sex marriage remains positive but is smaller over all subsequent years, the effet forming a reversed a U-shape over time (from 2 to 9 years later).

Consistently with the predictions of our model, the dynamic response effects are less important for cells with dominant strong ties. In these cells, while the short-term impact of same-sex marriage adoption is not significantly different, its longer term impact is significantly different from that in cells with dominant weak ties (except for 5-6 years after the law). Using coefficient estimates in Table 2, we cannot conclude on the significance of the effects over time of the law on the share of gay-rights supporters in cells with dominant strong ties. To be able to conclude on the effects in cells with dominant strong ties, we further test the significance of each linear combination of the coefficients on the time dummy variable (*e.g.* "Years 2-3") and the corresponding interaction term (*e.g.* "Strong ties × Years 2-3). We report in Figure 8 these linear combinations along with the effects for cells with dominant weak ties, as well as the corresponding 95% confidence intervals. As suggested in Table 2 (column (4)), in cells with dominant strong ties, the adoption of same-sex marriage leads to an increase in the share of gay-rights supporters which is not significantly

Table 2: The influence of same-sex marriage approval on the opinion about gay and lesbian rights: the role of social ties

Dependent variable: Share of gay-rights supporters

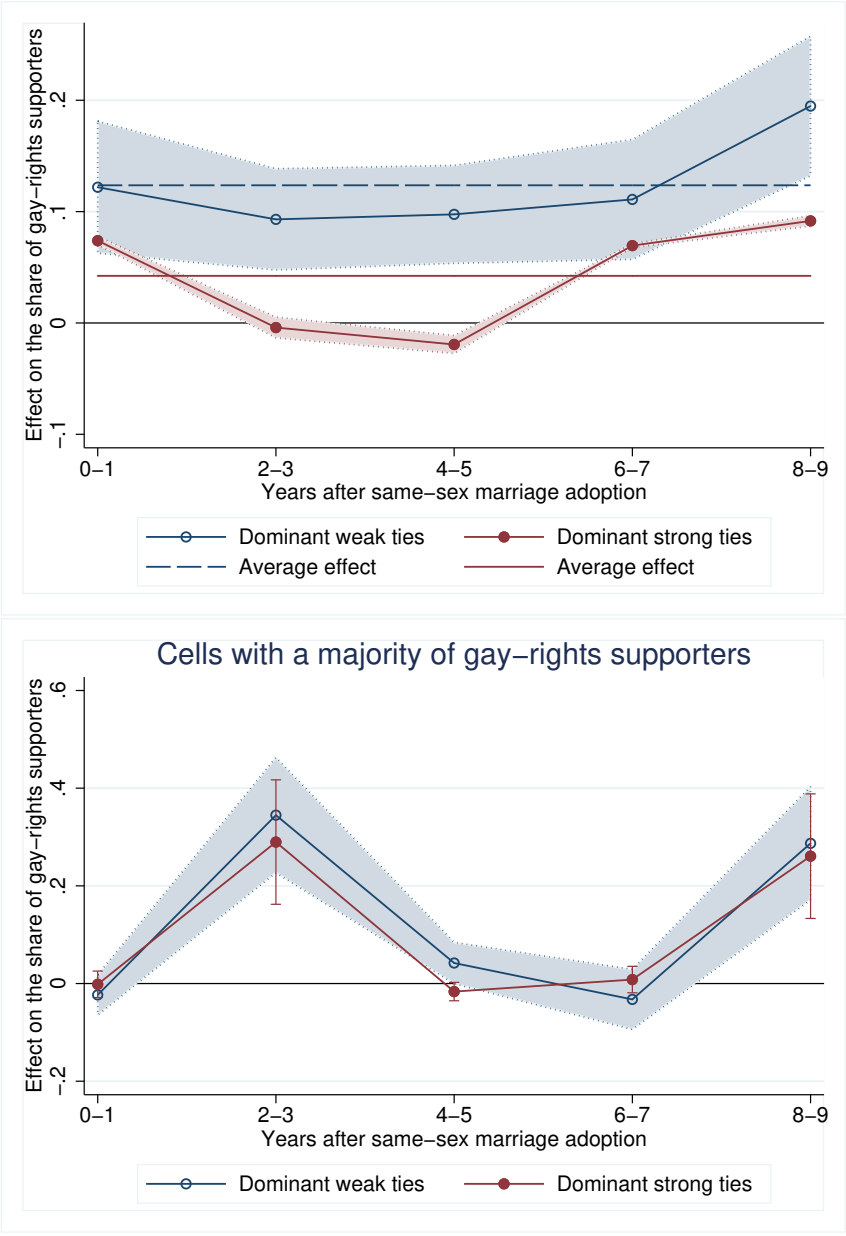
	All cells				Cells with majority of gay-rights supporters		Cells with minority of gay-rights supporters	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Strong ties	0.0284	0.0274	0.0296	0.0279	-0.0417**	-0.0415**	-0.000878	-0.00166
	(0.0246)	(0.0264)	(0.0232)	(0.0237)	(0.0195)	(0.0192)	(0.0157)	(0.0155)
First 0-1 years	0.0894***	0.0875***	-0.00108	0.122***	-0.0914***	-0.0232	0.131**	0.0786***
	(0.0276)	(0.0287)	(0.0308)	(0.0282)	(0.0277)	(0.0196)	(0.0466)	(0.0196)
Years 2-3	0.0530***	0.0471***	0.0980***	0.0930***	0.0179	0.345***	0.0150	0.0476
	(0.0142)	(0.0143)	(0.0215)	(0.0217)	(0.0118)	(0.0562)	(0.0352)	(0.0349)
Years 4-5	0.0803***	0.0788***	0.0994***	0.0975***	0.0652***	0.0420*	0.186***	
	(0.0184)	(0.0195)	(0.0202)	(0.0209)	(0.0133)	(0.0201)	(0.0134)	
Years 6-7	0.0457	0.0432	-0.0105	0.111***	-0.111***	-0.0325	0.103***	0.0659*
	(0.0311)	(0.0325)	(0.0290)	(0.0256)	(0.0228)	(0.0293)	(0.0122)	(0.0330)
Years 8-9	0.0887***	0.0865***	0.0718**	0.0669*	0.0251	0.287***		
	(0.0263)	(0.0279)	(0.0317)	(0.0325)	(0.0192)	(0.0552)		
Strong ties × First 0-1 years	-0.103***	-0.0991**	-0.0488	-0.0480	0.0221	0.0216		
	(0.0350)	(0.0361)	(0.0283)	(0.0280)	(0.0224)	(0.0226)		
Strong ties × Years 2-3	-0.0673***	-0.0623***	-0.0989***	-0.0972***	-0.0554***	-0.0552***		
	(0.0175)	(0.0176)	(0.0198)	(0.0190)	(0.0105)	(0.00988)		
Strong ties × Years 4-5	-0.0855***	-0.0850***	-0.115***	-0.117***	-0.0561***	-0.0585***		
	(0.0197)	(0.0208)	(0.0174)	(0.0178)	(0.0148)	(0.0146)		
Strong ties × Years 6-7	-0.0220	-0.0195	-0.0436*	-0.0415	0.0402*	0.0406*		
	(0.0317)	(0.0336)	(0.0251)	(0.0256)	(0.0215)	(0.0212)		
Strong ties × Years 8-9	-0.0439	-0.0423	-0.104***	-0.103***	-0.0253	-0.0263*		
	(0.0373)	(0.0396)	(0.0291)	(0.0292)	(0.0152)	(0.0144)		
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country × Year FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × Year FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Weights	weight	mweight	weight	mweight	weight	mweight	weight	mweight
Observations	213,336	212,689	213,336	212,689	174,930	174,445	38,406	38,244
R-squared	0.913	0.913	0.958	0.958	0.914	0.914	0.974	0.974

Notes: Robust standard errors in parentheses. Statistical significance: $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. The cohort refers to a particular gender-age group, as specified in Section 5. Regressions are weighted in 2 alternative ways: (i) using the standard weights provided by the ESS ("weight"); (ii) using a counterfactual weight equal to the average employment in the cell over the whole considered sample period ("mweight"). Cells with majority (minority) of gay-rights supporters are cells where more (less) than 50% of individuals agreed or strongly agreed with the statement "gays and lesbians have the right to live their life as they want" in the base period.

different from that in cells with dominant weak ties. But the impact is zero 2-3 years after and even negative 4-5 years after the adoption of same-sex marriage. The impact becomes positive again 6-7 years after the law but negative again 8-9 years after. As anticipated by our theoretical setup,

while weak ties promote acceptance of the dominant social norm, strong ties have a mitigated effect as individuals tend to adopt the opinion of their partner. In the long run, individuals with dominant weak ties are then more likely to be relatively more exposed to the dominant social norm (formalized here through the same-sex marriage law).

Figure 8: The influence of same-sex marriage approval on the opinion about gay and lesbian rights: the role of social ties



When focusing on cells with a majority of gay-rights supporters, we find that the average share of gay-rights supporters in cells with dominant strong ties is smaller than that in cells with dominant

weak ties. In addition, the adoption of same-sex marriage results in a smaller increase of the share of gay-rights supporters in cells with dominant strong ties (with respect to cells with dominant weak ties)

The analysis of the dynamic response coefficients tends to confirm this finding. While in cells with dominant weak ties we find positive and significant coefficients after 2-3, 4-5 and 7-8 years, when considering the specific response coefficients of cells with dominant strong ties we find negative and significant coefficient for exactly the same years interval, pointing to a smaller impact of the law among individuals with dominant strong ties. This finding is again consistent with our model predictions.

When considering cells where initially the share of gay-rights supporters was a minority, there is an important loss of observations. Because of the lack of variability, we are unable to identify separately the coefficients associated with the dynamic response of individuals with dominant strong ties following the adoption of same-sex marriage. For these cells, we find that the average response is not statistically different across individuals with dominant weak or strong ties. The dynamic response coefficients are positive and significant 0-1 year after the law approval and 6-7 years after. We do not provide further interpretation on these coefficient since due to the low number of observations we prefer to remain cautious.

The main limitation of estimations presented in Tables 1 and 2 is that we are only controlling for the opinion of individuals' social ties in a very approximative way: we assume that when individuals belong to cells initially dominated by gay-rights supporters, their social contacts are more likely to be gay-rights supporters. Evidently, this implies accepting the very unrealistic hypothesis that individuals' social contacts are of the same age and gender as the individual.

An alternative way to control for the opinion of individuals' social contacts consists in focusing on the immigrant population and consider the homophobic or non-homophobic nature of their country of birth. Estimation results from equations (20) and (21) are displayed in Table 3 and they control for the endogeneity of allocation across countries of immigrants. For each estimation we propose two alternative weights: 'weightiv0" stands for yearly employment level of the country-region of birth cell while "weightiv3" is a constant counterfactual weight equal to the product between the share of immigrants from region of birth r in country c in 1990 times the stock of immigrants from region g during the considered sample whole period. "Weightiv3" allows thus to control for population composition changes.

The main issue when implementing this analysis is the number of observations. Even if cohorts are now defined in a larger way at the country-region of birth level, the number of observations by cohort remains very small and, as remarked previously, at the end our sample contains only 113 cells. Moreover, among this 113 cells there are only 7 cells with dominant weak ties. This is a big issue since there is no enough variability to identify the impact of social ties on the dynamic response of individuals' opinion on gay and lesbian rights after the adoption of same-sex marriage. Estimation results in Table 3 seek to gain insight on the role that the homophobic nature or not of

Table 3: The influence of same-sex marriage approval on the opinion about gay and lesbian rights over the immigrant population.

Dependent variable: Share of gay-rights supporters

	All cells						Cells with majority of gay-rights supporters	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Homophobic					0.164***	0.0148	-0.355***	-0.203***
					(0.0280)	(0.0382)	(0.0170)	(0.0588)
First 0-1 years	-0.0449*	-0.0343	-0.00408	-0.00127	0.00563	0.00265	0.00563	0.00265
	(0.0235)	(0.0382)	(0.0170)	(0.0253)	(0.0283)	(0.0303)	(0.0283)	(0.0303)
Years 2-3	0.0111	0.0153	-0.0526	-0.0199	-0.00154	0.00359	-0.00154	0.00359
	(0.0331)	(0.0347)	(0.0435)	(0.0382)	(0.0269)	(0.0287)	(0.0269)	(0.0288)
Years 4-5	-0.0580	-0.00718	0.0223**	0.0374**	0.0422	0.0472*	0.0422	0.0472*
	(0.0435)	(0.0620)	(0.00847)	(0.0164)	(0.0240)	(0.0256)	(0.0240)	(0.0256)
Years 6-7	0.00119	-0.0169	0.0535**	0.0344	0.0374	0.0270	0.0374	0.0270
	(0.0393)	(0.0419)	(0.0190)	(0.0260)	(0.0320)	(0.0333)	(0.0320)	(0.0333)
Years 8-9	-0.0923***	-0.0698	-0.0870***	-0.0735***	-0.0701***	-0.0636***	-0.0701***	-0.0636***
	(0.0252)	(0.0548)	(0.0233)	(0.0213)	(0.0127)	(0.0137)	(0.0127)	(0.0137)
Homophobic× First 0-1 years					-0.169***	-0.158***	-0.142***	-0.0168
					(0.0280)	(0.0303)	(0.0385)	(0.0937)
Homophobic× Years 2-3					-0.315***	-0.312***	-0.0214	-0.0679
					(0.0271)	(0.0287)	(0.0326)	(0.0571)
Homophobic× Years 4-5					-0.165***	-0.162***	-0.0779**	0.0410
					(0.0237)	(0.0256)	(0.0350)	(0.0931)
Homophobic× Years 6-7					-0.0116	0.00662	0.150***	0.200***
					(0.0322)	(0.0333)	(0.0351)	(0.0461)
Homophobic× Years 8-9								
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth area FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country × Year FE	No	No	No	No	No	No	No	No
Birth area × Year FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Weights	weightiv0	weightiv3	weightiv0	weightiv3	weightiv0	weightiv3	weightiv0	weightiv3
Observations	9,605	7,041	9,605	7,041	9,605	7,041	7,093	5,122
R-squared	0.798	0.777	0.974	0.955	0.978	0.957	0.954	0.929

Notes: Robust standard errors in parentheses. Statistical significance: $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. Cell fixed effects correspond to country-region of birth fixed effects. Regressions are weighted in 2 alternative ways: (i) using the yearly employment level of the country-area of birth cell ("weightiv0"); (ii) using a constant counterfactual weight equal to the product between the share of immigrants from region of birth r in country c in 1990 times the average stock of immigrants from region g during the considered sample whole period ("weightiv3"). Homophobic is a dummy variable equal to unity if more than 50% of the countries included in the region of birth are classified as

the origin country may have on the dynamic response of individuals' opinions on gay and lesbian rights following the adoption of same-sex marriage. Because coming from an homophobic country is a time-invariant characteristic of the cell, it captures cell specific effects (which implies that we should not include in our regression the country-region of birth fixed effect). Moreover, due to the low number of cells, we are unable to individually identify our coefficients when we introduce year-country interacted fixed effects. We drop them from our regression. We are aware that the coefficients associated with our explicative variables will be actually capturing countries specific trends that may not totally come from the adoption of same-sex marriage. We are thus very cautious when interpreting these estimated coefficients.

The first four columns in Table 3 replicate the estimates of Table 1 but over the immigrant population. We find a positive and significant coefficient after 4-5 years of same-sex approval and a negative and significant coefficient after 8-9 years. All other coefficients of the dynamic response function are not significantly different from zero.

Columns (5)-(6) of Table 3 control for the homophobic nature or not of the origin region of the immigrant and distinguish the dynamics response between immigrants coming from non-homophobic countries and those coming from homophobic countries. We focus on column (6) since population composition effects are controlled for in this columns. We find that in average there is no significant difference in the opinion about gay and lesbian rights between immigrants coming from homophobic and non-homophobic countries.

When considering the dynamic response coefficients we find that, for immigrants coming from non-homophobic countries there is a positive and significant impact 4-5 years after the approval of same-sex marriage law. 8-9 years latter there is though a negative and significant coefficient. All the other coefficients are not significantly different from zero. For immigrants coming from homophobic countries, we find that there is a specific negative and significant impact 0-1 years, 2-3 years and 4-5 years after the adoption of homosexual marriage. The fact that the interacted variables "homophobic · years since law adoption" are significant, point that among immigrants coming from homophobic country the approval of same sex-marriage has promoted a decrease in the share of these people being gay-rights supporters, which contrast with the not significantly different from zero or positive response found during the same period for immigrants coming from non-homophobic countries.

Columns (7)-(8) of Table 3 consider only cells where the initial share of gay-rights supporters in 2002 was above 50%.[18] We distinguish again between the dynamic response of immigrants depending on the homophobic or not homophobic nature of their country of origin. We study estimated coefficients in column (8), where population composition effects have been controlled for. We find that among cells that had initially more than 50% of supporters of gay and lesbian rights, those where more than 50% of individuals come from homophobic countries have an average

[18] We are unable to implement the analysis over the cells whose initial share of gay-rights supporters in 2002 was below 50% since, due to the great number of observations lost, there is no enough variability to identify our coefficients.

a lower share of gay-rights supporters. Consistently with findings in column (6), for immigrants coming from non-homophobic countries there is a positive and significant impact 4-5 years after the approval of same-sex marriage law while the impact becomes negative and significant after 8-9 years. The dynamic specific response of immigrants coming from homophobic countries (but belonging to cells where there is a majority of gay-rights supporters) does not significantly differ from the dynamic response of immigrants coming from non-homophobic countries, except for the 8-9 years coefficient which is significantly positive.

Table E.1 in Appendix E studies the role of ties and implements the analysis over the whole population of immigrants and then distinguishing between immigrants coming from non-homophobic countries and immigrants coming from homophobic countries. We do not comment here these estimations results since, as remarked previously, among 113 cells there are only 7 with dominant weak ties. As a consequence our estimation is unable to identify the average effect of ties as well as the specific dynamic response function.

To solve the problem of lack of observations within cells (that leads us to drop more than 280 cells) we propose an alternative approach. Instead of considering cells defined by country-region of birth-year level, we are going to consider for every country only two periods of time. We will stack data corresponding to all years before the law on same-sex marriage was approved and we will stack data for all years after the adoption of the law. There are then two periods of time, before and after, and for each of these periods we define cells at the country-region of birth level. Countries that have not approved same-sex marriage during the considered sample period are always in the before period, and act as our control group. Because we stack data from several years the likelihood to have more observations within the cell is larger. However, since there are only 2 periods (and not 10 years as previously) the number of cells defined at the country-region of birth-period level is also lower. Moreover, once we impose a minimum of 30 observations per cells, the total number of cells in our sample is reduced to 95, which is quite small. We then remain cautious in interpreting our coefficients.

Table 4 estimates equation 20 but considering only two years of period "before" and "after". We control by period, country and region of birth individual fixed effects and we allow time shocks to be country specific and region of birth specific. Contrary to estimations provided in Table 3 where, due to the weak variability across cells we were unable to separately identify the impact of same-sex marriage law approval and the country-specific trend, when considering two periods, variability across cells does allows to introduce country specific trends and region of origin specific trends. This larger variability across cells is explained by the increase in the number of observations per cell, which makes them more representative of the average corresponding to the population cell.

Columns (1)-(2) in Table 4 study the impact of same-sex law approval on the share of favorable opinions about gays and lesbians controlling only by period, country and region of birth individual fixed effects. Columns (3)-(4) add country and region of birth specific trends. Results are strongly modified. While when not controlling for country and region of birth specific trends we

Table 4: The influence of same-sex marriage approval on the opinion about gay and lesbian rights over the immigrant population: 2 periods

Dependent variable: Share of gay-rights supporters

	All cells						Cells with majority of gay-rights supporters	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
After same-sex marriage law	0.0381***	0.0434***	-0.0545	-0.106***	-0.0201	-0.00878	-0.00935	-0.0303
	(0.0114)	(0.0106)	(0.0637)	(0.0219)	(0.0230)	(0.0206)	(0.0236)	(0.0209)
Homophobic					0.0211	-0.180***	0.0255	-0.0118
					(0.0151)	(0.0181)	(0.0161)	(0.0183)
Homophobic × After same-sex marriage law					-0.0344	-0.0975***	-0.0515	-0.0676**
					(0.0735)	(0.0302)	(0.0733)	(0.0228)
Period FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth area FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country × Period FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Birth area × Period FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Weights	weightiv0	weightiv1	weightiv0	weightiv1	weightiv0	weightiv1	weightiv0	weightiv1
Observations	16,870	23,654	16,870	23,654	16,870	23,654	14,682	19,393
R-squared	0.918	0.922	0.928	0.939	0.928	0.939	0.933	0.962

Notes: Robust standard errors in parentheses. Statistical significance: $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. Cell fixed effects correspond to country-region of birth fixed effects. Regressions are weighted in 2 alternative ways: (i) using the yearly employment level of the country-area of birth cell ("weightiv0"); (ii) using a constant counterfactual weight equal to the product between the share of immigrants from region of birth r in country c in 1990 times the total stock of immigrants from region g during the considered sample whole period ("weightiv1"). Homophobic is a dummy variable equal to unity if more than 50% of the countries included in the region of birth are classified as

find that the approval of same-sex marriage law is associated with a significant increase in the proportion of supporters of gay and lesbian rights, once country and region of birth specific trends are introduced the impact is not significantly different from zero if we do not control for population composition changes (weight "weightiv0") or the impact becomes significant and negative if population composition changes are controlled for (weight "weightiv1").

Columns (5)-(6) control by the homophobic origin of the individuals. Once population composition effects have been controlled for (column (6)), we find that the approval of same-sex marriage law has not an average significant effect on the share of supporters among immigrants coming from non-homophobic countries. Cells with a majority of immigrants coming from homophobic countries display though an average a negative and significant effect. Moreover, as displayed by the interacted term "Homophobic·After same-sex marriage law " the approval of same-sex marriage law has fostered a decrease in the share of supporters among cells where the majority of immigrants comes from homophobic countries.

Columns (7)-(8) consider only cells where in 2002 the proportion of gay-rights supporters was above 50%. Note that even if the majority of cell members was favorable to gay and lesbian rights in 2002, we can still have that a majority of these cells members comes from homophobic members. So columns (7)-(8) consider immigrants belonging to population cohorts where there is a majority of gay-rights supporters but who may actually come from homophobic countries. For these cohorts, immigrants coming from homophobic countries do not display an average a significant different opinion on gay and lesbian rights with respect to immigrants coming from non-homophobic countries. However, once same-sex marriage law has been approved, we do find a significant and negative coefficient for people coming from homophobic countries (see column (8)). Therefore, we conclude that among immigrants gay-rights supporters, different dynamics on the opinion about gay and lesbian rights arise depending on the homophobic nature of their country of origin, which may be suggestive of the role of social ties in determining the ability of a law to modify the opinion/behavior of individuals.

Table 5 internalizes thus the role of social ties as a driver of individuals' opinion on the dominant social norm. Columns (1)-(2) consider the whole population, columns (3)-(4) consider only cells where more than 50% of individuals comes from a non-homophobic country and columns (5)-(6) focus on cells having a majority of individuals coming from homophobic countries. Columns (2), (4) and (6) control for population composition changes using a counterfactual weight.

When considering all the immigrant population with constant composition (column (2)) we find that there are no significant average differences between cells with dominant strong ties and cells with dominant weak ties. In contrast, following the approval of same-sex marriage law, we find that cells with dominant weak ties experience a significant decrease in the share of gay-rights supporters. Moreover, the behavior of cells with dominant strong ties does not significantly differ from that of cells with dominant weak ties. This general decrease in the share of gay-rights supporters among immigrants following the approval of same-sex marriage law is consistent with

estimations in column (4) of Table 3.
Results are though modified when we separate cells where the majority of individuals comes from non-homophobic countries and cells where the majority of individuals comes from homophobic countries. As observed in column (4), where population composition changes are controlled for, among non-homophobic cells there are no significant differences in the opinion about gay and lesbian rights between people with dominant strong ties and people with dominant weak ties. Moreover, the approval of same-sex marriage law does not display any significant impact.
In contrast, when considering cells with a majority of immigrants coming from homophobic countries (column (6)), results are completely different. Cells with dominant strong ties display in average a significantly higher proportion of gay-rights supporters. After the approval of same-sex marriage law cells dominated by weak ties experience a significant decrease in the share of homosexual's rights supporters. This decrease is significantly more important in cells with dominant strong ties. Consistently with our theoretical setup, these results suggest that when considering cells with a majority of immigrants coming from homophobic countries, the dominant norm among these people is the rejection of same-sex marriage. After the approval of homosexual marriage, people with dominant strong ties negatively over-react with respect to people with weak ties because people with dominant strong ties are more likely to be in contact with negative opinions on homosexual marriage through both weak and strong ties.

7 Conclusion

We assess in this paper the influence of a policy decision on individuals' opinions and how this influence varies with the nature of interpersonal relationships or social ties. We first propose a simplified version of the theoretical setup initially proposed by Calvo-Armengol, Verdier, and Zenou (2007), that allows us to analyze how the strength of social ties (weak vs. strong ties) affects the acceptance of a social norm, *i.e.* a rule or a standard that governs individuals' conduct in the social situations in which they participate (Acemoglu and Jackson (2017)). Our theoretical setup predicts that weak ties tend to promote acceptance of the social norm by individuals who did not share initially this norm, while strong ties promote acceptance of the social norm.
We test our theoretical predictions considering same-sex marriage as a social norm. Using data from the European Social Survey, we assess the effect of same-sex marriage approval on individuals' opinion on gay and lesbian rights and explore how this effect varies depending on the strength of social ties. Our identification relies on variations across European countries in the timing of the same-sex marriage laws, using a diff-in-diff model estimator. We take into account time-varying effects of same-sex marriage approval using the empirical strategy proposed by **?**). To control for the opinion of individuals' dominant social ties, not available in the data, we propose different strategies, including a specific analysis focused on immigrants exploiting the degree of homophobia in their home country.

Table 5: The influence of same-sex marriage approval on the opinion about gay and lesbian rights over the immigrant population: the role of ties when considering 2 periods

Dependent variables: Share of gay-rights supporters

	All cells		Non-homophobic origin		Homophobic origin	
	(1)	(2)	(3)	(4)	(5)	(6)
After same-sex marriage law	-0.103***	-0.117***	0.00985	-0.0160	-0.0416	-0.236***
	(0.0261)	(0.0291)	(0.0379)	(0.0594)	(0.0492)	(0.0610)
Strong ties	-0.0362	-0.0377	-0.0490*	-0.0585	0.0318	0.0837***
	(0.0261)	(0.0535)	(0.0272)	(0.0635)	(0.0419)	(0.0255)
Strong ties × After same-sex marriage law	0.0779**	0.0451	0.00890	0.0332	0.122**	-0.131*
	(0.0280)	(0.0523)	(0.0372)	(0.0573)	(0.0492)	(0.0610)
Period FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth area FE	Yes	Yes	Yes	Yes	Yes	Yes
Country × Period FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth area × Period FE	Yes	Yes	Yes	Yes	Yes	Yes
Weights	weightiv0	weightiv1	weightiv0	weightiv1	weightiv0	weightiv1
Observations	16,870	23,654	10,331	14,514	6,539	9,140
R-squared	0.930	0.940	0.931	0.939	0.943	0.949

Notes: Robust standard errors in parentheses. Statistical significance: $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. Cell fixed effects correspond to country-region of birth fixed effects. Regressions are weighted in 2 alternative ways: (i) using the yearly employment level of the country-area of birth cell ("weightiv0"); (ii) using a constant counterfactual weight equal to the product between the share of immigrants from region of birth r in country c in 1990 times the total stock of immigrants from region g during the considered sample whole period ("weightiv1"). Homophobic is a dummy variable equal to unity if more than 50% of the countries included in the region of birth are classified as

References

Acemoglu, D., and M. Jackson. 2017. "Social Norms and the Enforcement of Laws." *Journal of the European Economic Association* 15 (2): 245–295.

Autor, David H., William R. Kerr, and Adriana D. Kugler. 2007a, January. "Do Employment Protections Reduce Productivity? Evidence from U.S. States." Working paper 12860, National Bureau of Economic Research.

———. 2007b. "Does Employment Protection Reduce Productivity? Evidence From US States*." *The Economic Journal* 117 (521): F189–F217.

Banerjee, A. 1992. "A simple model of herd behavior." *The Quarterly Journal of Economics* 107:797–817.

Benabou, R., and J. Tirole. 2011. "Laws and Norms." *NBER Working Paper*, no. 17579.

Bikhchandani, S., D. Hirshleifer, and I. Welch. 1992. "A theory of fads, fashion, custom, and cultural change as information cascades." *The Journal of Political Economy* 100:992–1026.

Calvo-Armengol, A., T. Verdier, and Y. Zenou. 2007. "Strong and weak ties in employment and crime." *Journal of Public Economics* 91:203–233.

Collado, M Dolores. 1997. "Estimating dynamic models from time series of independent cross-sections." *Journal of Econometrics* 82 (1): 37 – 62.

Deaton, Angus. 1985. "Panel Data from Time Series of Cross-Sections." *Journal of Econometrics* 30 (1): 109 – 126.

DeGroot, M. H. 1974. "Reaching a consensus." *Journal of the American Statistical Association* 69:118–121.

Devereux, Paul J. 2007. "Improved Errors-in-Variables Estimators for Grouped Data." *Journal of Business & Economic Statistics* 25 (July): 278–287.

Docquier, F., O. Lohest, and A. Marfouk. 2007. "Brain drain in developing countries." *World Bank Economic Review* 21:193–218.

French, Jr, J.R. 1956. "A formal theory of social power." *Psychological review* 63:191.

Gardes, Francois, Greg. J. Duncan, Patrice Gaubert, Marc Gurgand, and Christophe Starzec. 2005. "Panel and Pseudo-Panel Estimation of Cross-Sectional and Time Series Elasticities of Food Consumption: The Case of U.S. and Polish Data." *Journal of Business & Economic Statistics* 23 (2): 242–253.

Giulietti, C., J. Wahba, and Y. Zenou. 2014. "Strong versus Weak Ties in Migration." *Mimeo.*

Golub, B., and E. Sadler. 2016. Chapter Learning in Social Networks of *The Oxford Handbook of the Economics of Networks*, 504–542. Oxford University Press.

Granovetter, M. 1973. "The Strength of Weak Ties." *American Journal of Sociology* 78 (6): 1360–1380.

Guillerm, Marine. 2017. "Pseudopanel methods and an example of application to Household Wealth data." *Economie et Statistique* 491 (1): 109–130.

Harary, F. 1959. Pages 168–182 in *Studies in Social Power*. D. Cartwright, Ann Arbor: Institute for Social Research.

Hemet, C. 2015. "Ethnic Networks and the Informal Labor Market." *Mimeo*.

McAdams, R.H., and E.B. Rasmusen. 2007. Chapter Norms in Law and Economics of *Handbook of Law and Economics*, Volume 2. North Holland Press.

McKenzie, D., and H. Rapoport. 2010. "Self-Selection Patterns in Mexico-U.S. Migration: The Role of Migration Networks." *The Review of Economics and Statistics* 92 (4): 811–821.

Munshi, K. 2003. "Networks In The Modern Economy: Mexican Migrants In The U.S. Labor Market." *The Quarterly Journal of Economics* 118 (2): 549–599 (May).

Patel, K., and F. Vella. 2013. "Immigrant Networks and Their Implications for Occupational Choice and Wages." *Review of Economics and Statistics* 95:1249–1277.

Verbeek, Marno. 2008. "Pseudo panels and repeated cross-sections." In *The Econometrics of Panel Data: Fundamentals and Recent Developments in Theory and Practice*, edited by L. Matyas and P. Sevestre, 369–83. Berlin: Springer-Verlag.

Verbeek, Marno, and Theo Nijman. 1992. "Can Cohort Data Be Treated as Genuine Panel Data?" *Empirical Economics* 17 (1): 9–23.

———. 1993. "Minimum MSE Estimation of a Regression Model with Fixed Effects from a Series of Cross-Sections." *Journal of Econometrics* 59 (1): 125 – 136.

Waldinger, R. 1996. *Still the Promised City?* Boston University Press.

Zenou, Y. 2015. "A Dynamic Model of Weak and Strong Ties in the Labor Market." *Journal of Labor Economics* 33 (4): 891–932.

A Appendix: Alternative equilibria

Depending on individual choices our theoretical setup leads to four different steady-state dyad flows equilibria:

1. If $\psi = \psi_0 = 0$ we have a non-integrated equilibrium: non-integrated individuals never accept the social norm, independently on his partner status. At the steady state $d_{II} = d_{IU} = 0$, $d_{UU} = 1/2$, $i = 0$ and $u = 1$.[19]
2. If $\psi_0 = 0$ and $\psi = \{0, 1\}$ we will still find a non-integrated equilibrium: there are no transitions between d_{UU} and d_{IU}. As a result, d_{IU}-dyads could only exist if inflows into d_{IU} overcome outflows from d_{IU} which can be easily shown never to be the case.[20] At the steady state equilibrium with $\psi_0 = 0$ we have $d_{IU} = 0$. As a result, $d_{II} = 0$, since there will not be an inflow allowing to compensate the outgoing flow $\delta 2 d_{II}$. Then $d_{UU} = 1/2$, $i = 0$ and $u = 1$.
3. If $\psi = 0$ and $\psi_0 = \{0, 1\}$ we find an intermediate-mixed equilibrium: d_{II}-dyads disappear since there are no entry flows compensating outflows from d_{II} towards d_{IU}. In this equilibrium $d_{II} = 0$, $d_{IU} > 0$, $d_{UU} > 0$ and then $i > 0$, $u > 0$. There are no fully integrated partners.
4. If $\psi = \psi_0 = 1$ we find a mixed equilibrium with $d_{II}, d_{IU}, d_{UU}, i, u > 0$. While non-integrated partners always accept the social norm thanks to social interactions, integrated individuals have a probability δ of rejecting again the social norm. As a result, all dyad types arise in this equilibrium.

[19] Note that every period a proportion $\delta 2 d_{II}$ of the d_{II}-dyads becomes d_{IU}. This loss is not compensated by inflows since $\psi = 0$ and new births exactly compensate deaths. d_{II}-dyads will then disappear.

[20] Inflows overcome outflows if:

$$\delta 2 d_{II} > d_{IU}(2\chi + \delta + \alpha(\omega + (1-\omega)i)) \tag{22}$$

Replacing d_{II} by its expression (11) leads to:

$$\begin{aligned}
\delta 2\Big(\frac{\alpha(\omega + (1-\omega)i)d_{IU}}{2\delta}\Big) &> d_{IU}(2\chi + \delta + \alpha(\omega + (1-\omega)i)) \\
\alpha(\omega + (1-\omega)i)d_{IU} &> d_{IU}(2\chi + \delta + \alpha(\omega + (1-\omega)i)) \\
0 &> d_{IU}(2\chi + \delta) \\
-\chi &> \frac{\delta}{2}
\end{aligned}$$

This is not possible.

B Appendix: European Social Survey (ESS)

In each country, the national funding agency appoints a National Coordinator (NC) and a survey organization to implement the survey according to common ESS specifications. The ESS specifications are set to ensure accuracy of data in each country and to optimize comparability of data across countries. The most important standards on data collection include:

- Response rate target 70% (as a general target; actual target lower in some countries)
- Non-contact rate target of 3% maximum
- Fieldwork period of at least 1 month within the 4 months between September and December of the survey year
- Detailed briefing of interviewers in face-to-face sessions
- Restricted interviewer workload (maximum 48 sample units gross)
- Interviewer call schedule: 4 contacts attempts minimum, among which at least 1 in the evening and 1 at the weekend
- Contact forms to record and document data on fieldwork processes
- Quality control back-checks on completed interviews and non-respondents
- Close monitoring of fieldwork progress

For data collection the ESS uses strictly probability-based samples. Every element in the ESS target population should therefore have a greater than zero probability of being included into the sample. When analyzing ESS data estimates, the likelihood of each respondent to be part of the sample should also be taken into account (which means that the most accurate estimates will be obtained only after weighting the data).
Three weighting variables are available: Design weights, Post-stratification weights and Population Size weights:

- Design weights: Several countries use complex sampling designs where some groups or regions of the population have higher probabilities of selection. The main purpose of the design weights is to correct for the fact that in some countries respondents have different probabilities to be part of the sample due to the sampling design used. Applying the weights allows for the construction of design unbiased estimators. The design weights are computed as the inverse of the inclusion probabilities, i.e. the probability of each person to be included into the sample. The inverse inclusion probabilities are then scaled such that their sum equals the net sample size and the mean equals one.

- Post-stratification weights: While the design weights account for differences in inclusion probabilities, sampling errors (related to attempting to measure only a fraction of the population) and possible non-response errors (which may lead to a systematic over- or under-representation of people with certain characteristics) are still present. Post-stratification weights are a more sophisticated weighting strategy that uses auxiliary information to reduce the sampling error and potential non-response bias. They have been constructed using information on age group, gender, education, and region. The post-stratification weights are obtained by adjusting the design weights in such a way that they will replicate the distribution of the cross-classification of age group, gender, and education in the population and the marginal distribution for region in the population. The population distributions for the adjusting variables were obtained from the European Union Labour Force Survey.

- Population size weights are used when examining data for two or more countries combined. The population size weights are the same for all persons within a country but differ across countries. These weights correct for the fact that most countries taking part in the ESS have different population sizes but similar sample sizes. Without this weight, any figures combining data from two or more countries might be biased, over-representing smaller countries at the expense of larger ones. The population size weight makes an adjustment to ensure that each country is represented in proportion to its population size.

The advantage of post-stratification weights over design weights is that they can reduce the sampling error and they can reduce an existing non-response bias.
Different types of analyses require different combinations of weights. In general:

- when analysing data for one country alone, only the design weight or the poststratification weight need to be applied

- when comparing data from two or more countries but without reference to statistics that combine data from more than one country, only the design weight or the poststratification weight need be applied

- when comparing data of two or more countries and with reference to the average (or combined total) of those countries, design or post-stratification weight in combination with population size weights should be applied

- when combining different countries to describe a group of countries or a region, such as accession countries or EU member states, design or post-stratification weights in combination with population size weights should be applied.

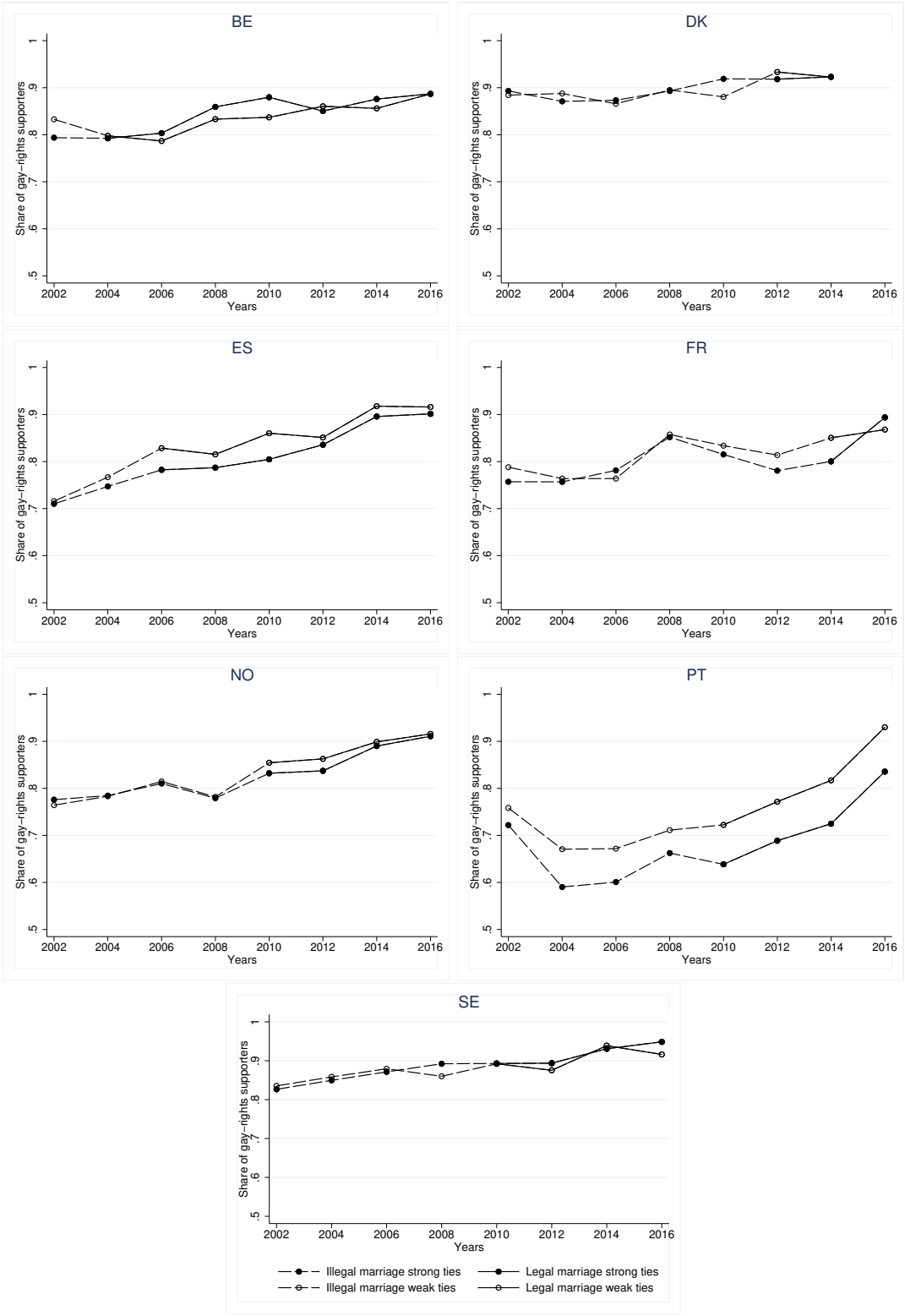
Design weights and post-stratification weights can be used independently or in combination with the population size weight, whereas the population size weight should always be used in com-

bination with either the design or post-stratification weights. However a combination of design weights and post-stratification weights is not meaningful, i.e. either one is used or the other, not both. Design or post-stratification weights can be easily combined with population size weights by creating a new variable that is the result of multiplying two existing weighting variables. Further, please note that when analyzing data from more than one round , the weights from each round should be applied.

Analysis that aims to compare countries should use the design or post-stratification weight; analysis that is based on combining data from countries should use the design/post-stratification weights in combination with population size weights.

C Appendix: Motivation

Figure C.1: Relationship between the intensity of social ties and average opinion on gay and lesbian rights depending on the country legal framework



Source: European Social Survey (2002-2016). BE = Belgium, DK = Denmark, ES = Spain, FR = France, NO = Norway, PT = Portugal, SE = Sweden.

D Appendix: United Nations geoscheme

Country	UN Region	Authors' Regional Classification
Afghanistan	South Asia	South Asia
Albania	South Europe	South Europe
Algeria	North Africa	North Africa
Andorra	South Europe	South Europe
Angola	Middle Africa	West Africa
Antigua and Barbuda	Caribbean	South America
Argentina	South America	South America
Armenia	West Asia	West Asia
Australia	Oceanie	South Asia
Austria	West Europe	West Europe
Azerbaijan	West Asia	West Asia
Bangladesh	South Asia	South Asia
Barbados	Caribbean	South America
Belarus	East Europe	East Europe
Belgium	West Europe	West Europe
Belize	Central America	South America
Benin	West Africa	West Africa
Bhutan	South Asia	South Asia
Bolivia	South America	South America
Bosnia and Herzegovina	South Europe	South Europe
Botswana	South Africa	West Africa
Brazil	South America	South America
Brunei	South-East Asia	South Asia
Bulgaria	East Europe	East Europe
Burkina Faso	West Africa	West Africa
Burma (Myanmar)	South-East Asia	South Asia
Burundi	East Africa	East Africa
Cambodia	South-East Asia	South Asia
Cameroon	Middle Africa	West Africa
Canada	North America	North America
Cape Verde	West Africa	West Africa
Central African Republic	Middle Africa	West Africa
Chad	Middle Africa	West Africa
Chile	South America	South America
China	East Asia	East Asia
	East Asia	East Asia
China, Macao SAR	East Asia	East Asia
Colombia	South America	South America
Comoros	East Africa	East Africa
Congo, Dem. Rep. of the	Middle Africa	West Africa
Congo, Rep. of the	Middle Africa	West Africa
Costa Rica	Central America	South America
Cote d'Ivoire	West Africa	West Africa
Croatia	South Europe	South Europe

E Appendix: Regression estimations

Cuba	Caribbean	South America
Cyprus	South Europe	South Europe
Czech Republic	East Europe	East Europe
Denmark	North Europe	West Europe
Djibouti	East Africa	East Africa
Dominica	Caribbean	South America
Dominican Republic	Caribbean	South America
East Timor	South-East Asia	South Asia
Ecuador	South America	South America
Egypt	North Africa	North Africa
El Salvador	Central America	South America
Equatorial Guinea	Middle Africa	West Africa
Eritrea	East Africa	East Africa
Estonia	North Europe	West Europe
Ethiopia	East Africa	East Africa
Fiji	Oceanie	South Asia
Finland	Norht Europe	West Europe
France	West Europe	West Europe
Gabon	Middle Africa	West Africa
Gambia, The	West Africa	West Africa
Georgia	West Asia	West Asia
Germany	West Europe	West Europe
Ghana	West Africa	West Africa
Greece	South Europe	South Europe
Grenada	Caribbean	South America
Guatemala	Central America	South America
Guinea	West Africa	West Africa
Guinea-Bissau	West Africa	West Africa
Guyana	South America	South America
Haiti	Caribbean	South America
Holy See (Vatican City)	South Europe	South Europe
Honduras	South America	South America
Hungary	East Europe	East Europe
Iceland	North Europe	West Europe
India	South Asia	South Asia
Indonesia	South-East Asia	South Asia
Iran	West Asia	West Asia
Iraq	West Asia	West Asia
Ireland	North Europe	West Europe
Israel	West Asia	West Asia
Italy	South Europe	South Europe
Jamaica	Caribbean	South America
Japan	East Asia	East Asia
Jordan	West Asia	West Asia
Kazakhstan	Central Asia	South Asia
Kenya	East Africa	East Africa
Kiribati	Oceanie	South Asia
Korea	East Asia	East Asia
Kuwait	West Asia	West Asia
Kyrgyzstan	Central Asia	South Asia

Laos	South-East Asia	South Asia
Latvia	North Europe	West Europe
Lebanon	West Asia	West Asia
Lesotho	South Africa	West Africa
Liberia	West Africa	West Africa
Libya	North Africa	North Africa
Liechtenstein	West Europe	West Europe
Lithuania	North Europe	West Europe
Luxembourg	West Europe	West Europe
Macedonia	South Europe	South Europe
Madagascar	East Africa	East Africa
Malawi	East Africa	East Africa
Malaysia	South-East Asia	South Asia
Maldives	South Asia	South Asia
Mali	West Africa	West Africa
Malta	South Europe	South Europe
Marshall Islands	Oceanie	South Asia
Mauritania	West Africa	West Africa
Mauritius	East Africa	East Africa
Mexico	Central America	South America
Moldova	East Europe	East Europe
Monaco	West Europe	West Europe
Mongolia	East Asia	East Asia
Morocco	North Africa	North Africa
Mozambique	East Africa	East Africa
Namibia	South Africa	West Africa
Nauru	Oceanie	South Asia
Nepal	South Asia	South Asia
Netherlands	West Europe	West Europe
New Zealand	Oceanie	South Asia
Nicaragua	Central America	South America
Niger	West Africa	West Africa
Nigeria	West Africa	West Africa
Norway	North Europe	West Europe
Occupied Palestinian Territory	West Asia	West Asia
Oman	West Asia	West Asia
Pakistan	South Asia	South Asia
Palau	Oceanie	South Asia
Panama	Central America	South America
Papua New Guinea	South-East Asia	South Asia
Paraguay	South America	South America
Peru	South America	South America
Philippines	South-East Asia	South Asia
Poland	East Europe	East Europe
Portugal	South Europe	South Europe

Qatar	West Asia	West Asia
Romania	East Europe	East Europe
Russia	East Europe	East Europe
Rwanda	East Africa	East Africa
Saint Kitts and Nevis	Caribbean	South America
Saint Lucia	Caribbean	South America
Saint Vincent and the Grenadines	Caribbean	South America
Samoa	Oceanie	South Asia
San Marino	South Europe	South Europe
Sao Tome and Principe	Middle Africa	West Africa
Saudi Arabia	West Asia	West Asia
Senegal	West Africa	West Africa
Serbia and Montenegro	South Europe	South Europe
Seychelles	East Africa	East Africa
Sierra Leone	West Africa	West Africa
Singapore	South-East Asia	South Asia
Slovakia	East Europe	East Europe
Slovenia	South Europe	South Europe
Solomon Islands	Oceanie	South Asia
Somalia	East Africa	East Africa
South Africa	South Africa	West Africa
Spain	South Europe	South Europe
Sri Lanka	South Asia	South Asia
Sudan	East Asia	East Asia
Suriname	South America	South America
Swaziland	South Africa	West Africa
Sweden	North Europe	West Europe
Switzerland	West Europe	West Europe
Syria	West Asia	West Asia
Taiwan	East Asia	East Asia
Tajikistan	Central Asia	South Asia
Tanzania	East Africa	East Africa
Thailand	South-East Asia	South Asia
Togo	West Africa	West Africa
Tonga	Oceanie	South Asia
Trinidad and Tobago	Caribbean	South America
Tunisia	North Africa	North Africa
Turkey	West Asia	West Asia
Turkmenistan	Central Asia	South Asia
Tuvalu	Oceanie	South Asia
Uganda	East Africa	East Africa
Ukraine	East Europe	East Europe
United Arab Emirates	West Asia	West Asia
United Kingdom	North Europe	West Europe
United States	North America	North America
Uruguay	South America	South America
Uzbekistan	Central Asia	South Asia
Vanuatu	Oceanie	South Asia
Venezuela	South America	South America
Vietnam	South-East Asia	South Asia
Yemen	West Asia	West Asia
Zambia	East Asia	East Asia
Zimbabwe	East Asia	East Asia

Table E.1: The influence of same-sex marriage approval on the opinion about gay and lesbian rights over the immigrant population: the role of ties

Dependent variable: Share of gay-rights supporters

	All immigrants		Immigrants from non-homophobic		Immigrants from homophobic	
	(1)	(2)	(3)	(4)	(5)	(6)
Strong ties 0			0.0559***			
			(0.0101)			
First 0-1 years	-0.0222*	-0.0222	-0.0368**	-0.0352**	-0.0896**	-0.0617
	(0.0116)	(0.0127)	(0.0131)	(0.0138)	(0.0233)	(0.0879)
Years 2-3	-0.0499	-0.0161	-0.00253	0.00555	-0.00606	-0.0149
	(0.0425)	(0.0377)	(0.0156)	(0.0124)	(0.0361)	(0.0455)
Years 4-5	0.0210**	0.0355**	-0.0108	0.00810	-0.00659	0.0363
	(0.00921)	(0.0130)	(0.0278)	(0.0284)	(0.0977)	(0.147)
Years 6-7	0.0572**	0.0392	0.00515	0.0101	0.153***	0.149**
	(0.0201)	(0.0267)	(0.0205)	(0.0290)	(0.0206)	(0.0386)
Years 8-9	-0.0839***	-0.0689***	-0.0798**	-0.0669**		
	(0.0229)	(0.0217)	(0.0227)	(0.0231)		
Strong ties × First 0-1 years	0.0288	0.0344	0.0535	0.0512		
	(0.0407)	(0.0563)	(0.0354)	(0.0453)		
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth area FE	Yes	Yes	Yes	Yes	Yes	Yes
Country × Year FE	No	No	No	No	No	No
Birth area × Year FE	Yes	Yes	No	No	No	No
Weights	weightiv0	weightiv3	weightiv0	weightiv3	weightiv0	weightiv3
Observations	9,605	7,041	3,072	2,093	6,533	4,948
R-squared	0.974	0.955	0.676	0.653	0.609	0.499

Notes: Robust standard errors in parentheses. Statistical significance: $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. Cell fixed effects correspond to country-area of birth fixed effects. Regressions are weighted in 2 alternative ways: (i) using the yearly employment level of the country-area of birth cell ("weightiv0"); (ii) using a constant counterfactual weight equal to the product between the share of immigrants from region of birth r in country c in 1990 times the average stock of immigrants from region g during the considered sample whole period ("weightiv3"). Homophobic is a dummy variable equal to unity if more than 50% of the countries included in the region of birth are classified as