Implementation of the FCTC

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July 7, 2016

Introduction

Complex Policy Making Process

The policy making process can be viewed as a two-level game [1]. Countries, and more specific, governments try to conceal internal and external preferences and influences in a context in which domestic and international decisions are made jointly. Furthermore, more than simultaneity, domestic and international affairs affect each other, making it necessary to consider both when analyzing a particular policy issue.[1]

To increase the complexity of the problem, the way in which the dynamics are unfold depend, as one would expect, on politics and henceforth political motivations of the incumbent parties.

Politicians have roughly two sources of motivation: Office and Policy [2]. Office motivated politicians follow the classical median voter theorem in which their political stand will coincide with that of the median voter. On the other hand policy motivated parties do have a particular position on the policy space that may or may not coincide with that of the median voter. The degree in which a party will be balanced between these two will depend on their expectations on the next election process, this is, the probability of re-election.

As the incumbent party's probability of re-election increases, it will be benefited from a wider policy action space, allowing it to be policy motivated. On the other hand, with less a reduced decision making space, low approval levels may lead to more office motivated officials. This turns out on heterogeneous effects of domestic and international

1Evidently there are issues in which the cross-effects are lesser than others.

issues over political decisions across countries. The following figure illustrates these dynamics:

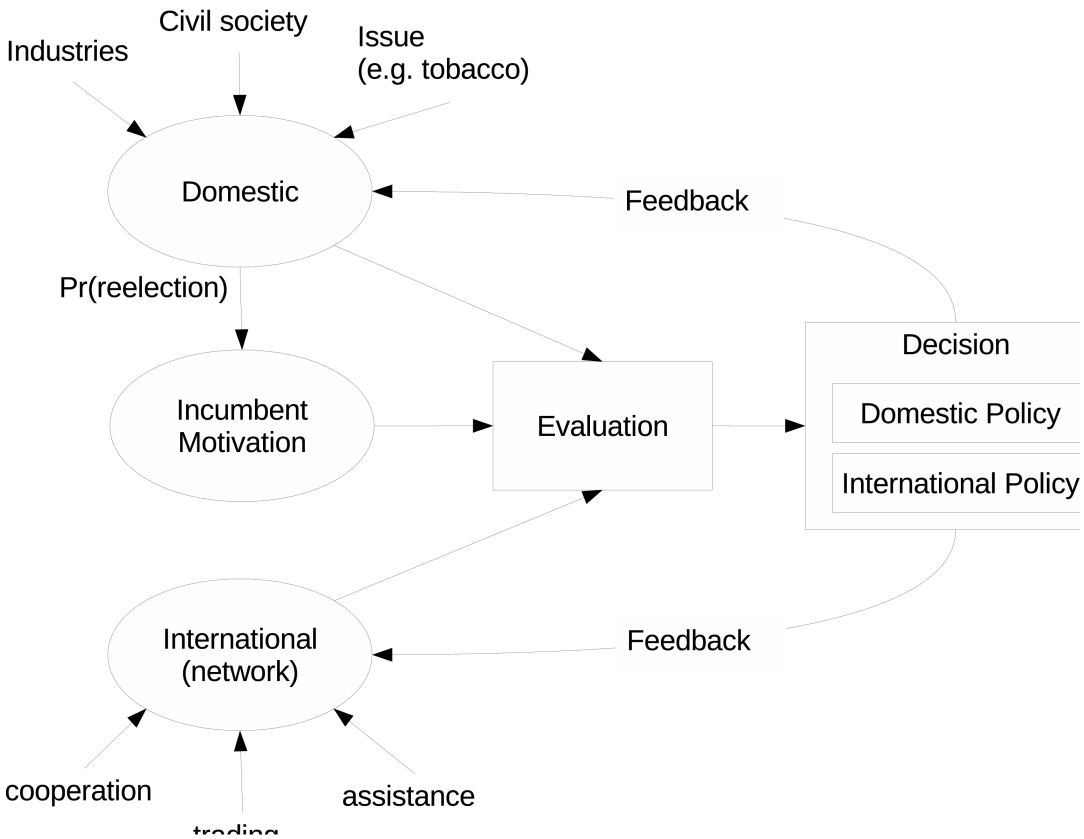

Figure 1: Complex Policy Making Process. The evaluation process of a particular policy decision depends, among other things, on three factors, domestic issues, international issues and the incumbent's motivation. Once a decision has been made over the two levels, these affect the factors.

In what follows we present a list of some factors, both domestic and international, relevant for the Framework Convention on Tobacco Control (FCTC).

Domestic factors

a **Country income** *Ceteris paribus*, higher income countries should have more flexibility for implementing the FCTC, so we should expect a positive relation between both.

b **Popularity level** Higher popularity gives more space for implementing new policies. We should expect that countries with high popularity levels and high levels of interaction with the international community should be more willing to implement the treaty. As asserted above, popularity may also be related to the incumbents' motivation, so overall we should expect to see a higher probability of implementation associated with it.

c **Shift in preferences** In [3] is shown that, under the context of Article VIII of the International Monetary Fund (IMF) Articles of Agreement, shifts in the partisan orientation--understood as national preferences--of a country due to change in office has implications on treaty compliance. They use the World Bank's Database of Political Institutions (DPI) and mark the shifts in partisanship as 0 or 1, avoiding using ordinal categories proposed by the indicator, so it can be compared across countries.

d **Cultural Beliefs** As in [4] review, they argue that cultural beliefs affect economic and political outcomes. As the authors did, we can use the World Values Survey[2] to control for such issues.[3] to account for cultural effects over the decision making process.

e **Indistry influence** Industry's level of presence in a country certainly affects the decision making process. Higher levels of investment may lead to higher levels of lobbying and, in some cases, higher numbers of national jobs depending on them. Closing factories has never been a popular policy, hence we expect to see negative effects from this variable. This can be measured using two sources: (1) Investment as proportion of the GDP and (2) Number of Jobs as a proportion of the working population.

f **Public health** As a proportion of deaths related to tobacco consumption, we should expect that higher levels of mortality lead to a higher probability of adoption/implementation of anti-tobacco policies. For this we use the Tobacco Atlas data from 2010 ().

2http://www.worldvaluessurvey.org/wvs.jsp citation: WVS_Longitudinal_1981-2014_rdata_v_2015_04_18. See table 3 in p. 43 where they provide evidence for the link between policy and cultural beliefs.

3It is important to point out that using religion and ethnicity as instruments is not necesary in this context as, as a difference from the aformentioned paper there is no reason to believe that the implementation of the FCTC has any repercusion over culture, at least in the short term.

g **Civil Society** Overall, if not funded by the industry, lobbying efforts from the civil society can have an important effect too. In particular, we use data from the *Bloomberg Initiative To Reduce Tobacco Use* to control for this. We should expect higher levels of investments to be correlated with higher probability of implementing the policies (http://www.tobaccoatlas.org/topic/cigarette-use-globally/).

International factors: networks

In general we observe three different classes of international networks: cooperation, trading and assistance networks. While all three may have an effect on the implementation level of the FCTC, some may be more directly related than others. Since FCTC has direct relation with trading treaties, we use the trading network as the main network in our model, a brief description of the three networks follows:

i **Trading** with direct implications over prices and economic regulation, the trading network used here is a direct weighted graph built from the data collected by MIT's Observatory of Economic Complexity.[4]

j **Cooperation** Neighboring countries are likely to share issues on, for example, their borders, more concretely, tobacco smuggling can be one of these issues [5–8].

k **International assistance** [9] shows evidence towards compliance been higher among countries that are exposed to higher regional compliance, in particular, higher compliance from IMF leads to higher probability of compliance for any of its member.

Data

- Id: in our database
- ego_number: In the network
- countrynameun: Name
- countrycode: Code
- year: Year
- year_bak

4http://atlas.media.mit.edu/en/

- continent
- who_region
- who_pac_sea
- population
- labor
- democracy
- GL_total
- tobac_prod
- GDP
- womens_rights
- number_ngos
- perc_female_smoke
- perc_male_smoke
- diag_inb_fctc
- time
- who_reg2
- GL_any
- toa_year_fctc
- toa_month_fctc
- toa_year_corrupt
- toa_month_corrupt
- toa_year_pollute
- toa_month_pollute
- toa_year_picc
- toa_month_picc
- meanall

- meanallart
- meanallart50
- merge_miss_imps

Methodology

We assess contagion effects using ### different country networks. Identifying contagion effects is not an easy thing to do [10,11]. While Stochastic Actor Oriented Models [12] are the *defacto* solution for analyzing complex contagion in social networks, those haven not been well implemented for handling the type of data that we have.[5] This has lead us to explore two different approaches for model fitting, Spatial Autocorrelation models (SAR) [13], and matching based methods.

SAR models have been used in to identify contagion in networks before.[14–16] In our case, the model that we will estimate is specified as follows

$$y = X\beta + \rho W_1 y + \gamma W_2 z + \omega W_3 v + \varepsilon, \quad \varepsilon \sim N(0, I_n \sigma^2) \tag{1}$$

where X are domestic factors, and W_1, W_2 and W_3 are the networks described in the previous section. Unfortunately, this model, which has been well studied, cannot be used in the case in which W_1 is endogenous, in other words, in the presence of homophily. This leads us to another method.

In [17] a new method for identifying contagion in the presence of homophily is exposed. Based on the Neyman-Rubin Causal Model framework [18], in particular, on matching methods. In their paper, they paraphrase the contagion question as follows, instead of observing exposure as a continuous variable, they dichotomize exposure defining several thresholds, in particular, for each time point, individual i's treatment at time t, T_{ilt}, is defined as follows :

5At least, to the time when we wrote this paper, Using RSiena, the R-package which implements ### version of the algorithm, won't converge successfully.

$$T_{ilt} = \begin{cases} 1 & \text{if} \quad e_{it} > l \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

where e_{it} is exposure measured as number of connections at time t that had adopted the behavior, and l is the exposure threshold. For ease of notation, from now own, we will omit the t index unless necessary. To summarize their method:

1. Estimate propensity score, $p_{il} = \Pr\{T_{il} = 1 | X = x_i\}$, using a logistic regression,
2. match treated individuals to untreated based on the propensity score,
3. remove pairs for which there was no good match, in particular, for which $|p_{ilt} - p_{jlt}| > 2\sigma_{|p_{ilt}p_{jlt}|}$, and
4. compute a pseudo Average Treatment effect on the Treated (ATT) as the ratio of adopters over non adopters, n_+/n_-

Nevertheless, while the propensity score matching estimator is widely used by literature [19], it is also a very controversial one since it is known to worsen balance—in raw terms, the comparability between treated and controlled—in post matched samples, which is the opposite of what the method itself looks for.[20] Instead, in this article we will use two different estimators which have better properties in terms of improving balance: Nearest Neighbor Matching based on Mahalanobis distance (NNM), and Inverse Probability Weighting (IPW).

Before presenting the algorithms for implementing NNM and IPW, one important difference has to be noticed. When, in Aral et al. (2009) they define the treated and untreated groups over the entire population, they do not control for individuals having adopted in time periods prior to t, in other words, at least in [22], threshold levels and exposure levels are solely important for the set of individuals who has either adopted recently or has not. Not controlling for this actually may bias the outcomes since, as more individuals adopt, exposure levels do as well, which might yield to spurious effects. Hence, when defining the relevant population for each combination of time and threshold level l, we will only use those observations that either have not adopted, or have adopted no more than 1 time period prior to t.

The NNM estimator can be described as follows:

1. For all individuals i for which $T_{il} = 1$, find the $j(i)$ such that $j(i) = \arg \min_{j:T_{jl} \neq T_{il}} (X_i - X_j)' \mathbf{S}^{-1} (X_i - X_j)$, where $\mathbf{S}^{-1}$ is the inverse of the covariance matrix of $X = \{X_i\}$. Define $\hat{Y}_i = Y_{j(i)}$.

2. Similar to Aral et al., we use what in the matching literature is called a *caliper*, so we only keep match pairs for which the Mahalanobis distance is less than 2 standard deviations. As a difference from their paper, we will match individuals from both treated and control groups. The resulting sets of pairs will be denoted M_+ and M_- respectively.

3. Compute the Average Treatment Effect as follows
$$ATE_{l(NNM)} = \frac{n_+}{n_+ + n_-} \sum_{i \in M_+} \left(Y_i - \hat{Y}_i \right) + \frac{n_-}{n_+ + n_-} \sum_{i \in M_-} \left(\hat{Y}_i - Y_i \right)$$

Alternatively, instead of using a single match, we could have used a kernel matching estimator to generate $\hat{Y}_i$ which, instead of using a single match for each individual, generates the *counterfactual* outcome $\hat{Y}_i$ by weighting Y_{-i} in the opposite group by the Euclidean distance on covariates to i. We leave this for future work.

The IPW can be estimated as follows

1. Compute the propensity score p_{ilt} using kernel regression as follows $\hat{p}_{il}(x) = \sum_i \kappa \left(\frac{X_i x}{h} \right) T_{il} \Big/ \sum_i \kappa \left(\frac{X_i x}{h} \right)$, where h is a bandwidth. We use this approach since, while we don't care about inference in the propensity score, we do care about prediction and the fact that our data is not i.i.d. may produce bias in both coefficients and predictions.

2. Then, the IPW estimator for the Average Treatment Effect can be computed as follows
$$ATE_{l(IPW)} = \sum_i \left[\frac{W_i Y_i}{\hat{p}_{il}} \Big/ \sum_i \frac{W_i}{\hat{p}_{il}} - \frac{(1 - W_i) Y_i}{(1 - \hat{p}_{il})} \Big/ \sum_i \frac{(1 - W_i)}{(1 - \hat{p}_{il})} \right],$$

In expectation, both estimators should yield the same result. One drawback of this approach is the difficulty on obtaining variance

estimators, which without strong assumptions is not analytically feasible. On the other hand, following [21], we can compute such using bootstrapping.

One important thing to notice is that in Aral et al (2009) they did not discuss the implications of the Stable Unit Treatment Value Assumption (SUTVA) which claims that $(Y_i(0), Y_i(1)) \perp W_j$, in other words, whether j received treatment or not should not affect i's outcome. While this seems to be easily violated in the context of network data, we argue that such effect, if exists, is not direct since more than who adopts is how many adopt the behavior. Notwithstanding, the feasibility of the SUTVA assumption in this context should be revised in the future.

- Internal factors. These can be either policy or office motivatedm in general we observe the following:
  - Popularity level: (+) Higher popularity gives more space for implementing new policies.
  - % of population on tobacco industries: (-) More population on that industry means less jobs, so is unpopular.
  - Tobacco induestires investment on communities: (-)
  - % of deaths related to tobacco consumption: (+) Public health problem.
  - Country income: (+) More income means more resources to implement this policies.
  - Shift in preferences (party in the office): (-) The new party may have different priorities.
  - Investments on programs against tobacco: (+) More influence
  - Government spending on anti-tobacco: (+)
  - Culture = Individualism, Western countries, etc.: (?)
- External factors:
  - Bilateral or multilateral agreements on trading: (-) Protection of foreign industries because of agreements. e.g. not been able to raise tax levels.
  - Cigarette smuggling network: (?) There can be contagion effects (see Yurekli et al. (2000), Joossens and Raw (1998),

Stoklosa and Ross (Tobacco Control 2013) and Joossens et al (2010) for data on tobacco smuggling)

- Trade networks: (?) Rather than positive or negative, we expect to see contagion effects between countries. Reinforcement of behavior. Commencial treaties may reflect deeper interactions between countries.
- Well behave for help: It is not as easy as just following internal needs since eventually that may close more doors when asking for international cooperation such as loans.

Appendix

Article 5, general obligations, requires Parties to establish essential infrastructure for tobacco control, including a national coordinating mechanism, and to develop and implement comprehensive, multisectoral tobacco-control strategies, plans and legislation to prevent and reduce tobacco use, nicotine addiction and exposure to tobacco smoke. This process must be protected from the interests of the tobacco industry. The Article also calls for international cooperation and refers to raising the necessary financial resources for implementation of the Convention.

Article 5.3 is one of the most important cross-cutting provisions of the Convention, and one for which implementation guidelines have been adopted. It requires Parties to protect their tobacco control and public health policies from commercial and other vested interests of the tobacco industry.

Article 5 also stipulates that Parties shall cooperate with international organizations and with each other to achieve the objective of the Convention and to raise financial resources for its implementation (see also Article 26).

Article 6 encourages price and tax measures as effective means to reduce the demand for tobacco. These include tax increases that result in an increase of the sales price of tobacco products; and prohibiting or restricting sales of tax- and duty-free tobacco products. Guidelines for implementation of Article 6 were adopted at COP6 in October 2014.

Article 8 addresses the adoption and implementation of effective measures to provide protection from exposure to tobacco smoke in indoor workplaces, public transport, indoor public places and, as appropriate, other public places. Guidelines for implementation of Article 8 were adopted at COP2. Although there is no timeline imposed in the treaty itself, the guidelines recommend that comprehensive smoke-free policies be put in place within five years of entry into force of the Convention for that Party

Article 11 requires each Parties, within three years of entry into force of the Convention for that Party, to adopt and implement effective measures to prohibit misleading tobacco packaging and labeling; ensure that tobacco product packages carry large health warnings and messages describing the harmful effects of tobacco use; ensure that such warnings cover 50% or more, but not less than 30%, of principal display areas and that they are in the Parties' principal language(s); and ensure that packages contain prescribed information on the tobacco products' constituents and emissions. Guidelines on implementation of Article 11 were adopted at COP3.

Article 13 requires Parties to undertake a comprehensive ban of all tobacco advertising, promotion and sponsorship (a list of forms of tobacco advertising, promotion and sponsorship within the terms of the Convention, is provided in the appendix to the guidelines for implementation of Article 13, which were adopted at COP3). To be effective, the ban should cover all types of tobacco advertising and promotion as well as any sponsorship conducted by the tobacco industry. The comprehensive ban must be put into effect within five years of entry into force of the Convention for each Party, including of a cross-border advertising ban originating from the Party's territory. Parties that are not in a position to provide for a comprehensive ban due to their constitutional principles must apply restrictions..

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