Who pulls the strings?
Peer pressure under multiple activities

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Abstract

This essay considers participation-enabling behaviour under a positive peer pressure model in which agents face distinct pressure schedules in multiple activities. After showing a multiple activities specification based on the peer pressure model by Calvó-Armengol and Jackson (2010) with equal number of pressure choices can be rewritten and solved as series of independent network games in the pressure spaces with network externalities, I examine the Key Player's pressure equilibrium strategy profile for a pair of pressure schedules and further analyse Pareto-perfect payoffs of the game.

1 Introduction

The role of social pressure in economic and normative outcomes is a subject of growing interest for policy makers and a well-established research field in economics. Particular attention has been recently placed in social networks wherein, rather than *mechanically* acting on the diffusion[1] of some injected innovation, players in the network face strategic incentives to firstly, determine their own actions considering how their peer's actions affect them and secondly, explicitly influence the actions of others (by, for instance, making the said actions more or less costly) to improve on self outcomes. This essay focuses on the latter peer effects. It examines the case of players having several activities with distinct influence schedules available, but participation limited to one or a subset of them.

In games with strategic complementarity, the most common channels through which peer effects are modelled, are the externalities produced in the context of players' best responses; action profiles in equilibria are characterised by complementarity parameters and, in the case of graphical games, functions of network properties. While such peer effects are adequate for environments where relations are mostly determined by association and proximity, no role is left for *active* influence.

A key difference between the peer pressure framework in Calvó-Armengol and Jackson (2010) and other theoretical approaches to peer effects in the literature is the explicit inclusion of costly influence in the player's action set. In particular, an agent deciding to exert positive pressure reduces the participation cost of other agents. The presence of active influence is justified in settings where there's costly participation, as a binary decision to take an action is observationally more important than a level choice of the said action. Some examples include committing a crime or choosing a career path.

Notwithstanding the existence of negative (cost-increasing) pressure setups, I will focus

[1] See Ryan and Gross (1943) (innovation adoption) or Granovetter (1978) (collective behaviour) for examples of nonstrategic diffusion. For a rational framework with uncertainty and Bayesian updating, but still nonstrategic see Foster and Rosenzweig (1995).

on the positive case out of the limited scope of the project, and specific interest in the role of some agents enabling otherwise dominated strategies.

While the peer pressure model is not a graphical game by itself and is generally related to commitment and agency problems such as Kandel and Lazear (1992), its main results are certainly best suited for modelling interaction in relatively small, very well acquainted and in a sense enabling networks. As will be shown in Section 3, results mainly rely on maximal or Pareto-perfect equilibrium concepts which added to sub game perfection –the basic game is played in two stages under full information and additional structure must be specified for multiple activities– impose substantial rationality and informational requirements to the players and the environment.

Therefore, the peer pressure framework can provide insight in settings where, apart from perfect information in payoffs and game structure, players know everyone in the network relatively well, and have a vested interest in performing backward induction on a finite set of scenarios. But foremost, the Pareto perfection requirement imposes a sense of enabling cooperation to achieve the participation result. In this set of equilibria, it is likely find that those for which the participation result is initially profitable, will identify the mechanisms to pull "just a few levers" to unchain participatory reactions, and past some participation threshold, everyone will want to partake. A natural candidate to adscribe to this description is a legislative body.

Although my treatment of peer pressure is not in terms of network games, the settings where this essay's contribution is likely to provide insight are networks of individuals considering to participate in a variety of activities, and where for each such activity there exist distinct pressure abilities from peers (influence schedules); these schedules can be shown equivalent to a particular network game specification in the influence space. I then consider these multiple, competing activities to be simultaneously or sequentially pressured and ask whether Pareto-efficient outcomes exist as in the standard peer pressure model, and if so,

whether coordination around them can still be attributed to the pressure exerted by some enabling agents as in the original setup.

To motivate my research question, I provide a concrete example where multiple activities under influence schedules may account for observed behaviour more reasonably than externalities alone, and then briefly discuss the motivation conceptually.

1.1 Constitutional amendment frenzy: a spin on the key player theory

Context

As discussed in Tsebelis (2022), there is a growing academic interest, in the political science and comparative law literatures, for insight as to why countries having written constitutions with some of the most stringent amendment requirements in the world are modified so often despite the apparent political barriers and costs being substantial compared to passing equivalent law reforms (in cases law may be reformed without modifications to the constitutional text). For multi-party presidencialisms the situation is more puzzling, as the said systems normally exhibit legislative minorities for the president, and require qualified majorities for constitutional reform. In such systems opposition parties even have strong incentives for political entrenchment.

Public relevance of this issue arises because hyper-reformism is deemed a generally negative feature of a constitutional system. Rivera León (2017) (RL hereafter) reviews some of the worst systemic effects: constant changes in the attributions of fundamental institutions, a difficult environment for the judiciary to form criteria and interpretations, or general perceived risk on financial markets. RL brings attention to 227 constitutional amendments effected –251 by the end of 2021; Figure 1 can be found in the Appendix– and 650 individual modifications in 99 years of the Mexican constitutional text. It should be bore in mind

constitutional amendments in Mexico require a 67% majority in the two national legislative chambers, and majority approval of the amendment by 32 state legislatures. RL identifies 2015-2018 as a period with a mean yearly amendment rate of 6.6; Counting political allies, in this period the government party only had 43.2% of the votes in the Chamber of Deputies and 47.6% of the votes in the Senate. Similar instances of numerous constitutional amendments under government minorities as previously described exist in Brazil and Chile. Some countries such as India may not be suitable examples of this dynamic due to the constitutional text being law-specific, rather than general; in the aforementioned countries this is clearly not the case.

It must be noted that, for a median member of congress, voting for constitutional amendments is costly: it has been noted by Levinson and Sachs (2015) among others that in these regimes, rejecting constitutional amendments is a profitable entrenchment tactic. Also, a case can be made that in many Latin American countries voting for constitutional reforms is polarising for the constituents and certainly different from voting for laws.

Explaining hyper amendment as a peer pressure problem

So far, most explanations have centered on either the formal aspects aspects of the amendment process as in **?**, or more general concepts of the constitutional system such as the so called "amendment culture" as in Ginsburg and Melton (2015), which consists of the amendment rates held by past constitutions.

Although Melton and Ginsburg's explanation is more plausible, it doesn't offer any insight as to why hyper amendments are facilitated. In a way, it only describes equilibrium behaviour; for a given country, current amendment levels are well-explained by amendment rates produced within an institutional environment that is likely very similar if not the same as the one presently observed. I submit the plausible mechanism for hyper amending processes is peer pressure: consider a network of legislators with three participation options:

constitutional amendment, passing a law and doing nothing. Costs for participating in passing a law are small for all players such that this is the Pareto-perfect outcome without pressure. Then consider higher costs for constitutional amendment participation to everyone but a few individuals that are centrally located in the influence mapping. The pressure schedule for passing laws is the same as in Calvó-Armengol and Jackson (2010). It should be possible to find network displays where peer pressure from the central individuals to a few other players (and these to other connected players) results in a Pareto improvement on passing a law. In particular, hierarchical networks exhibit these properties.

The rest of this essay is organised as follows: Section 2 presents the technical literature review. In Section 3 I go over the main specification of the peer pressure model, an illustrative example and definitions on equilibria refinements and results. Section 4 presents the multiple activities specification and compares its equilibria results. Section 5 concludes.

2 Literature review

Foundational work on strategic complements was done by Bulow et al. (1985), but existence and structure of Nash equilibria with strategic complementarities for the general class of payoffs covering both the peer pressure model and most network games is due to Vives (1990). Existence and uniqueness under payoff uncertainty is shown by Frankel et al. (2003). Strategic complements are widely studied in many game-theoretic settings: relevantly for peer effects Kandel and Lazear (1992) provide a explicit negative peer pressure model for a multi agent problem with payoff complementarity in effort and conjecture that payoffs for these agents can be weakly Pareto improved with peer pressure; Calvó-Armengol and Jackson (2010) show that this is possible but not a general prediction. The authors also give peer pressure a different treatment: because they are mainly concerned with welfare outcomes of the model they focus on pure strategies, Pareto-dominant equilibria and show existence for the positive pressure case of these equilibria refinements. The action space specified is

binary in the action and continous in pressure. Mani et al. (2013) include standard negative externalities to a model with continuous action and reach analogous welfare results. The present work adds to this literature by widening the study of welfare implications in a setting of multidimensional pressure and a discrete but non binary set of actions.

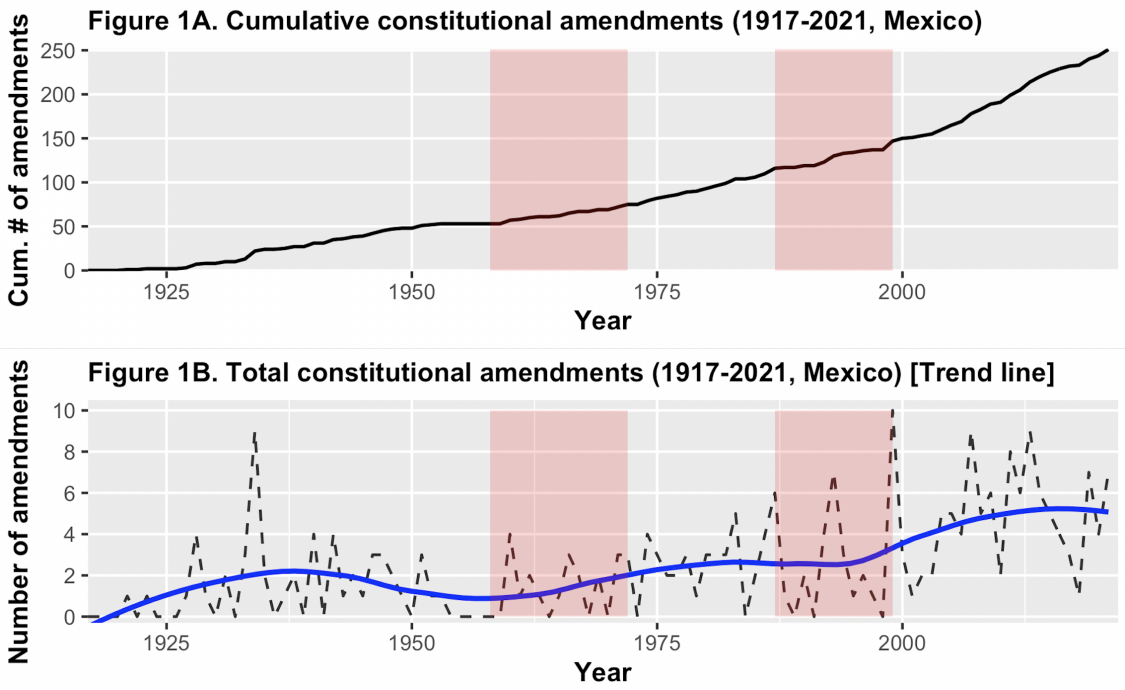
The subject of multiple actions for peer effects has been studied only in the context of network games[2]. The idea of peer effects in social networks originates from educational studies in the sociology literature as in Spady (1970), but the game-theoretic formulation –that is, peer effects as a result of best-reply functions and network structure– is the innovative work of Ballester et al. (2006); they take a well known, single action linear-quadratic game that is linear in other player's action, and show that it can be rewritten as a network game with local payoff complementarities. In that game, the equilibrium action of all players is proportional to their Katz-Bonacich measure of centrality. Examining peer effects in terms of network properties is a persistent trend in both theoretical and empirical developments. Belhaj and Deroïan (2014) examine the same game with two bounded continous, competing activities: action space for any player is $(x, 1-x) \in [0,1]^2$. They again find equilbria existence and uniqueness for relatively small network effects and thereof characterisation to be functions of the Bonacich centrality; importantly for the present essay, they determine corner solutions, called "polarization and specialization", which are equilibria characterised by action profiles $x^* \in \{0,1\}$ to depend on the sape of the network; in particular, stars and complete bipartite shapes (these are common hierarchical configurations in legislative bodies) are incompatible with polarization. Chen et al. (2018) generalise these results on unbounded, multiple continous activities, and more generally consider activities complementarity, substitutability and independence. The present work adds to the concept in Ballester et al. (2006) in that under certain regularity, linear externalities can be represented as network complementarities and then uses already shown equilibrium existence properties.

[2]A comprehensive review of the gradual integration of networks as an economics discipline can be found in Jackson (2011). Herein I discuss networks only to a limited extent: I present advancements on multiple activities and similarity with influence schedules.

Finally, an important part of peer effects-related games in the literature, be them network-formulated or not, is the simultaneous discussion of two elements: the diffusion object (whether it is strategic or "contagion" like) and the empirical strategy to test for peer effects. Determination of the former heavily influences what can be researched about the latter. Before a set of efforts to map networks of individuals in a variety of settings came to fruition, Manski (1993) correctly foresaw a very extense set of identification problems and sources of endogeneity, particularly when testing for effects on strategic diffusion objects. Banerjee et al. (2019) study the diffusion of gossip: pieces of information that in their own words are "not particularly interesting", that is, sharing them is not specially costly and there is no rivalry in use[3] (the research design in both experiments had that in mind). The main goal of such empirical work was to identify network diffusion effects under central vis-à-vis random seeding. On the other side of the diffusion spectrum, based on self-report or administrative data there exist at least a dozen studies. Of analitical interest are a couple of studies in education and crime: Calvó-Armengol et al. (2009) and Ballester et al. (2010) respectively, and they confirm results on the Key Player Theory. Henceforth, empirical research has paid more and more attention to identification strategies, in many cases the said strategies involve very costly primary data collection and mapping of the full networks themselves. Studies have also focused on harder to measure peer effects. Bursztyn et al. (2014) find both social learning and payoff complementarity effects in a financial brokerage experiment. Alatas et al. (2016) similarly find evidence for social learning, in a bounded Bayesian persuasion context. Empirical work concretely testing for peer pressure as studied in this essay is relatively more scarce and mostly in the context of compliance with social norms and beliefs; Bursztyn et al. (2020) on beliefs and participation of Saudi women in the labour market, Kim (2021) on different mechanisms for civic compliance, Bursztyn and Jensen (2015) on participation mechanisms and differential pressure given performance.

[3]possible mechanisms include that of actual contagion. Many of the economic properties of networks are retained. See for instance Stolerman et al. (2015)

Figure 1: Yearly approved constitutional amendments in Mexico



growth)].

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