

Research Statement

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My general research fields are applied microeconomics and public economics. I study the decisions of individuals and organizations and their effects on social and economic outcomes, often in situations where individual incentives and social goals are misaligned. My core research interests in these fields can be grouped into four topical areas: Political economics, the economics of discrimination, the economics of networks, and behavioral economics. These areas lie at the intersection of economics with political science, law, sociology, and psychology.

In terms of methodology, most of my research employs game-theoretic approaches to individual and firm behavior. For example, in several of my papers I use contest models to study competition over fixed prizes (e.g., [4], [10], [13], [15], [19]). However, empirical methods are used in a few projects as well ([4], [13], [14], [20]), as are simulation-based approaches ([5], [16]).

In Section 1 below, I will describe my contributions, as well as ongoing projects, in each of my core research areas. In addition, I have investigated a number of other questions outside of these areas, and a brief summary of this work will be given in Section 2.

1 Core research areas

1.1 Political economics

Political economics is the study of how political behavior and institutions affect economic outcomes, and how economic reasoning can explain political behavior and institutions. My work in this area focuses on a number of strategic aspects arising in electoral systems, on both the candidates' and the voters' sides. Much of this work concerns the spending of money by politicians to further their chances of election. How are spending decisions made, and how do spending decisions affect electoral outcomes? I address these questions in a series of papers.

Together with Mattias Polborn, I have theoretically examined campaign spending in the U.S. presidential primary system. In our paper "**Primaries and the New Hampshire Effect**" ([15]), we develop a contest model of sequential primaries in which candidates can influence their winning probability by spending money on campaigning. The equilibrium of this model replicates several stylized facts observed in real primary races: Campaigning is very intense in early primary states, but declines (on expectation) in later states. Thus, our model is able to endogenously generate "momentum" in the primary race. In contrast to previous research on sequential elections, this momentum is not due to learning effects on part of either voters or politicians, but is instead driven by an asymmetry in campaign incentives after the first election. Our study also compares sequential primaries with a simultaneous "one-day primary" and offers a possible economic explanation

for the sequential organization of the U.S. presidential primary system: It leads, in expectation, to fewer expenditures than a simultaneous election, and selects more effective campaigners with a higher probability. While [15] considers a resource allocation problem across elections in a multistage primary contest, there also exists a tradeoff between allocating campaign resources to primary contests and the general election. This tradeoff is examined in the paper **“Early Round Upsets and Championship Blowouts”** ([4]) by Rick Harbaugh and me. Even though we motivate the question using a sports application (namely, the semifinal-vs.-final tradeoff in sports tournaments), the theoretical model developed in [4] applies equally to the allocation of resources by candidates across primary and general election campaigns. We show that weaker candidates make strategic decisions to spend more in the primaries, while stronger ones conserve resources for the general election. These distortions increase the likelihood of weak candidates being nominated.¹

The role of money in elections also motivates my research on campaign finance mechanisms, where I examine how the *source* of campaign funds affects the political process. To ensure transparent elections, virtually all jurisdictions regulate the ways in which private campaign funds can be raised and spent. In addition, many jurisdictions provide some form of public funding to candidates and/or parties, in order to limit the influence of private interests and to create a level playing field for candidates who would not otherwise have the resources to run for elected office. But there are many ways in which private campaign funds can be regulated, and public campaign funds can be allocated. For example, private funding may be limited to individual contributions to campaigns, or it may include corporate and union advertising for candidates. Similarly, public funds can be allocated as lump-sum transfers or as variable transfers that depend on a number of other variables. These details have implications for many aspects of the democratic process—how many candidates run for office, what kind of candidates run for office, how much money candidates raise and spend, who is elected, and what policies are implemented, are all affected by the campaign funding choices available to candidates.

In the paper **“Populism, Partisanship, and the Funding of Political Campaigns”** ([10]), I address this question in a framework with privately informed candidates. I examine a setup in which a populist (or pandering) motive makes it impossible for candidates to credibly communicate their information to voters. I show that, under certain conditions, the presence of wealthy interest groups with partisan preferences can mitigate this effect and thereby improve policy. This does not happen because the groups are better informed than policy makers. Instead, their campaign contributions allow politicians to insulate themselves from the need to adopt populist platforms. I also show that a regime in which interest groups are allowed to contribute to campaigns may Pareto-dominate regimes in which such contributions are restricted, or in which political campaigns are publicly financed. Private campaign finance is also the central issue in the project **“Toward Corporate Democracy? The Impact of *Citizens United* on State Elections”** ([14]). In this project, Hugo Mialon, Michael Williams and I empirically investigate the effects of corporate and union independent political expenditures on election outcomes. Independent expenditures are activities that support a candidate or cause but are not coordinated with campaigns. In *Citizens United v. FEC* (2010), the U.S. Supreme Court held that the First Amendment to the U.S. constitution prohibits restrictions on independent expenditures by corporations and labor unions, paving the way for corporations and unions to spend money on political advertising either independently or by contributing funds to various forms of advocacy groups (e.g., SuperPACs). We examine

¹Estimation of an empirical model (using a sports dataset which allows for clean identification of the strategic effects) confirms our theoretical predictions in actual behavior, although in a different context.

whether this decision resulted in a systematic shift of election outcomes in U.S. state legislative elections. The states provide an ideal laboratory to test the impact of independent political expenditures, as a subset of states never placed any restrictions on independent expenditures and were thus unaffected by *Citizens United*, while the remaining states restricted these expenditures and were forced to lift these restrictions, beginning with the 2010 election cycle. Using a difference-in-difference regression framework based on state election data since 2000, we show that *Citizens United* increased Republican election probabilities in state legislative races by about two percentage points on average. Using a synthetic controls approach, we also show that the impact was not uniform across affected states, with some states seeing an increase in Republican election probabilities of more than 10%. Finally, we find some evidence that *Citizens United* reduced the number of candidates running for public office, as well as direct contributions given to political campaigns. A different campaign finance issue is addressed in the project “**Matching Funds in Public Campaign Finance**” ([13]). Hugo Mialon, Michael Williams and I examine a public funding mechanism in which participating candidates receive an initial distribution of state funds, and additional matching funds if privately funded candidates spend more than the initial public outlay. This method of allocating public funds reduces the likelihood that any one candidate vastly outspends his opponents, and was used in a number of U.S. states until 2010. In 2011, the U.S. Supreme Court ruled these matching funds unconstitutional, again on First Amendment grounds. By modeling political speech as a costly activity in an electoral contest, we show that matching funds can, in fact, decrease political speech, but can also increase it. We derive conditions for each effect and relate our findings to the court’s decision. We also show that the state can undo any restrictions on matching programs imposed by courts, and precisely replicate the equilibria under the matching program, by adopting an appropriate chosen lump-sum funding scheme.

Not related to my research on campaign funding is the paper “**Strategic Voting and Conservatism in Legislative Elections**” ([9]), where I examine the question under what conditions elected legislative bodies will be status-quo biased relative to a majority of constituents. I develop a model in which voters elect representatives into a legislative assembly, who then make a policy choice. A strategic delegation effect arises: Constituents may want to be represented by legislators who prefer less change of the status quo than they do, as this helps to insure against policies that contain too much change. If this motive is strong enough, equilibrium legislatures will be conservative, in the sense of being reluctant to change (relative to a majority of citizens). I show that this happens when constituencies are sufficiently heterogeneous in their policy preferences. I establish bounds on inter-district heterogeneity beyond which conservatism can, and must, arise in equilibrium. The paper hence provides a new theory of legislative reform obstacles. Some insights are also developed concerning the representation of minorities, and the coordinating role of political parties in legislative elections.

1.2 Economics of discrimination

Differences in treatment of individuals based on their gender, race, or ethnicity—and the resulting inequalities in outcomes—have been the subject of economic inquiry for a long time. One important goal is to explain the fact that, in many areas, discrimination is seemingly persistent even in otherwise free and modern societies. A second objective is to identify and evaluate policies that can address inefficiencies arising from discrimination. Developments in information economics in the last 40 years have made it possible to account for persistent discrimination as an equilibrium outcome, by building informational frictions into economic models of the labor

market. Information-based models are an alternative to taste-based (purely treator-side) or biological (purely treatee-side) explanations of discrimination, and permit the study of a richer set of policy interventions. My research in the area of discrimination falls in this tradition and extends information-based approaches to discrimination and prejudice in several directions.

Together with Phil Curry, I extend the labor-market model of statistical discrimination to the criminal justice system. In “**Crime, Punishment, and Prejudice**” ([2]) we examine the link between the penalties used to punish convicted criminals, and judicial prejudice against defendants in court. We develop a model in which individuals choose to commit crimes if their privately observed utility from doing so is high enough. A crime generates noisy evidence, and defendants are convicted when the evidence is sufficiently strong to establish their probability of guilt beyond a fixed threshold of doubt. If convicted offenders are punished by incarceration, the induced utility loss is smaller for poorer individuals than for richer ones; thus poorer individuals are less likely to be deterred by the threat of punishment. This means that, in equilibrium, poor individuals face a strong prior prejudice in trials and are convicted with less evidence than others. At the same time, they commit crimes more frequently—not because they have more to gain from crime, but because they have less to lose if caught. If income is correlated with race, this mechanism provides a novel explanation of the fact that criminal participation and conviction rates are correlated with race. However, biased outcomes can persist even if no *a priori* race-income correlation exists. This happens if an unfavorable prejudice in the justice system lowers employment opportunities or wages for certain groups. A self-fulfilling statistical discrimination equilibrium can then arise, in which race serves as a coordination device through which social roles and expectations are assigned. We develop an income-dependent penalty schedule (“day fines”) that guarantees unbiased outcomes, providing insights into penal code reform for certain offenses.

A different statistical discrimination mechanism is the focus of the paper “**Second-Order Statistical Discrimination**” ([18]). Xuejuan Su and I extend the standard statistical discrimination model to higher-order moments of individual characteristics. The conventional statistical discrimination model explains why the belief that one population is less qualified than another, on average, can be self-fulfilling. We examine whether a similar self-fulfilling prophecy can arise with respect to the variance of two distributions. We are specifically interested in the low representation of female employees in some elite jobs (e.g., CEOs), which is sometimes attributed to a tail effect: If the human capital distribution exhibits less variation among females than among males, then even with comparable average human capital there will be fewer females in the right tail of the distribution than males. We show that the belief that the female human capital distribution has a lower variance than the male distribution can be self-fulfilling, in that it provides individuals with incentives to acquire human capital such that the resulting distribution exhibits exactly this property *ex post*. If this happens, fewer females than males are employed in high-end jobs, generating a “glass ceiling” effect. Similarly, fewer females are employed in low-end jobs, and fewer males are employed in mid-level jobs. The average productivity of female workers can at the same time be higher, lower, or equal to that of male workers.

In the paper “**A Theory of Perceived Discrimination**” ([19]), Xuejuan Su and I investigate the source of persistent differences in beliefs about discrimination, instead of the persistence of discrimination itself. For example, in opinion polls African-Americans have been persistently more likely than white Americans to agree with the statement that blacks are discriminated against in matters of employment. We develop a contest model in which such differences in perception arise endogenously. In our model, a continuum of individuals compete for a fixed number of

prizes (e.g., desirable jobs), and individuals belong to two identifiable groups. We prove a number of observational equivalence results. In essence, these results show that an individual's belief that one group is allocated a lower quota of prizes than the other group will be consistent with observed data in equilibrium, regardless of whether such quotas actually exist in the contest or not. The paper also provides insights concerning the use of employment data by government agencies or courts to identify discrimination in the labor market. We are currently developing a similar model to examine perceptions of discrimination in other buyer-seller relationships.

1.3 Economics of networks

My third core research area investigates the economics of networks. The term network here encompasses physical and computer networks, but also social networks.

A question of particular interest to me concerns the regulation of natural monopolies whose market power derives from essential and costly physical network infrastructure. In such cases, network owners can extend their infrastructure monopoly to potentially competitive market segments, a practice called "vertical foreclosure." States traditionally regulated the monopoly's operations in the foreclosed segments. Following a shift in the regulatory paradigm during the 1980s and 1990s, however, policy makers in the United States and elsewhere have adopted a liberalization program aimed at opening networks in vertically integrated industries. Open network access forces network operators to lease their facilities to competitors at regulated rates, leaving service offerings and prices to be determined by competition in the end-user market. The implementation of open access has generally been successful in facilitating competition in previously closed markets, with positive effects on allocative efficiency. A concern, however, is that requiring firms to share costly network infrastructure with competitors takes away their economic incentive to invest in this infrastructure, thus diminishing the long-run, dynamic efficiency of the market.

In a series of papers, Xuejuan Su and I examine the validity of this concern. This requires that one carefully considers how network operators are compensated for their obligation to grant network access to competitors. In this respect, existing economic theories of investment incentives under open access are surprisingly divorced from how actual access pricing mechanisms work, and what the pertaining laws require. On the other hand, legal studies of the subject matter either ignore economic incentives, or base their conclusions on a flawed understanding of incentives. Finally, little is known empirically about how access regulation affects investment, even after more than a decade of liberalization. The aim of our work in this area is to address all three problems.

In the paper "**Open Access and Dynamic Efficiency**" ([17]), we examine theoretically whether laws such as the 1996 U.S. Telecom Act or the 1992 U.S. Energy Policy Act, which require open access to network infrastructure, weaken investment incentives.² We consider a regulatory mechanism that requires network owners to grant competitors access to their facilities at a linear tariff. This tariff is set according to the principles of fair, reasonable, and non-discriminatory pricing. Adherence to these principles is mandated by virtually all current open access regulations and requires only limited information on part of the regulator. Furthermore, the tariff severely restricts the network owner's ability to exploit its privileged position for supra-competitive profits. We

²Our work applies also to laws such as the 1954 U.S. Atomic Energy Act or the 1970 U.S. Clean Air Act, which allow for open access to patents and may thus weaken innovation incentives. However, an opposite paradigm shift in intellectual property protection renders these provisions essentially irrelevant today.

show that, under certain assumptions on costs and demand, the owner's investment exceeds the monopoly investment level and increases in the number of competitors. Our results hence contradict the notion that dynamic efficiency must be sacrificed for gains in static (allocative) efficiency when an open access regime is implemented. In a second paper, "**Strategic Investments under Open Access: Theory and Empirical Evidence**" ([20]), we generalize the framework of [17] and test its predictions empirically. We demonstrate that investment incentives can be decomposed into a non-strategic incentive and a strategic incentive. Under mild assumptions on demand, the first effect implies larger investments in more competitive markets, regardless of their composition. The second effect takes into account competitive responses to investments, and may strengthen or weaken the non-strategic incentive. The assumptions made in [17] guarantee that the strategic effect never overwhelms the non-strategic incentive. Under more general conditions, however, this is possible. We estimate the presence and direction of strategic investment incentives using a dataset of electric utilities regulated under the 1992 U.S. Energy Policy Act. We find evidence that investments in transmission capacity are indeed made strategically. *Ceteris paribus*, utilities are less likely to invest, and investment levels are lower, when competitors occupy a larger share of the market. The strategic effect is of comparable magnitude to the non-strategic effect. Our results suggest that, in the U.S. electricity wholesale market, gains in allocative efficiency come at the expense of some losses in dynamic efficiency.

A different set of questions is examined in the project "**Matching Markets and Social Networks**" ([16]). Mary Schroeder and I consider a spatial two-sided matching environment, based on my work in [7], but we include a "network friction:" Exchange between any pair of individuals requires that the individuals know each other prior to trade. Social relationships are costly and must be formed before individuals learn their availability for trade, and before actual matching occurs. Our theoretical results characterize the basic geometry of small stable social networks in this environment. We then use simulation techniques to examine the structure and size of larger networks. We show that regular networks (i.e., networks in which individuals know those within a given distance from themselves) are not necessarily stable. If they are, these networks grow in size as uncertainty increases and/or network costs decrease. Furthermore, an imbalanced market where one side is rationed by the other tends to decrease network size.

Finally, in the essay "**File Sharing, Network Architecture, and Copyright Enforcement: An Overview**" ([11]), I explore the relationship between technological, economic, and legal aspects of online file sharing networks. I chronicle the evolution of content sharing technology since the 1990s and examine the role of network architecture in a copyright holder's choice of enforcement strategy. I also describe how users and developers of file sharing networks have responded to various enforcement tactics by copyright holders.

1.4 Behavioral economics

Behavioral economics includes non-standard assumptions on preferences and rationality in economic models, in order to provide a richer account of human behavior than what is possible in the "standard model" of selfish rational actors. I believe that much can be learned from behavioral models, as long as they are carefully motivated and examined. This is especially true in two cases: If small deviations from the standard assumptions have strong effects on outcomes, and in the opposite case where large deviations in assumptions have only small consequences. The first case identifies instances where the predictions of the standard model are sensitive to behavioral

assumptions; the second identifies instances where one can regard the standard model as a robust approximation of actual human behavior. My research has explored both of these angles.

In the paper “**Linear Learning in Changing Environments**” ([5]) I examine the performance of simple linear learning rules, relative to the optimal non-linear Bayesian rule, in a setting where a decision maker observes signals about a time-varying state. For a range of parameter values, linear learning generates the same decisions as Bayesian learning and is therefore equivalent. Outside this parameter range, the consumption attainable with linear rules is virtually indistinguishable from that attainable under Bayes’ rule, although the respective decisions will not always be identical. A linear rule of thumb can therefore have an advantage over Bayesian updating when more complex, non-linear, calculations are costly to perform.

In the paper “**Finitely Repeated Voluntary Provision of a Public Good**” ([8]) I examine the voluntary provision of public goods when agents are either slightly altruistic or slightly irrational. A small degree of such behavioral distortions can generate large contributions to the public good in a finitely repeated game, even if the free-riding incentive calls for negligible contributions in a static setup. The equilibrium is characterized by a decline in contributions at the end of the game, and is consistent with a number of comparative results obtained in laboratory studies.

Non-standard preferences are also the topic of the paper “**On Hatred**” ([12]). In this project, Hugo Mialon and I model hate as reverse altruism, that is, a preference for low opponent payoffs. We derive a number of results for behavior in conflicts where players are motivated by hate. These results concern the zero-sum nature games with hateful players, the difficulty of deterring hateful players through punishments, and the question whether hate can ever benefit a player in terms of his material utility. These results can illuminate several policy issues, both historical and contemporary. In particular, we discuss the strategy of non-violent resistance during the American civil rights era, shifts in U.S. national security strategy following 9/11, and the justification for penalty enhancements for hate crimes, in light of our results.

2 Other research

Some questions I have examined in my research fall outside of the core areas outlined in the previous section. In this section, I will provide a brief summary of this work.

In game theory, I have examined the mathematical properties of solutions to both non-cooperative and cooperative games. Understanding the mathematical regularities of game-theoretic solutions can provide us with alternative characterizations of equilibria, which (among other things) can be useful in computational applications. In “**Perfect Equilibrium and Lexicographic Beliefs**” ([3]), Hari Govindan and I investigate the epistemic foundations of equilibrium refinements based on Selten’s perfection criterion. We obtain a finite characterization of perfect and proper equilibria in terms of lexicographic probability systems (LPSs). We depart from previous work in the area by considering LPSs defined directly over individual strategy sets. Our contribution is to define a multiplication operation by which these LPSs can be composed into a product LPS over the joint action space of the players. Checking whether a Nash equilibrium is perfect then boils down to checking whether each player’s strategy is a lexicographic best reply against the product LPS. In “**Two-Sided Matching with Spatially Differentiated Agents**” ([7]), I consider the problem of assigning individuals to stable matches in a spatial environment where the match surplus function is decreasing in distance. Under non-transferable utility, I show that all stable assignments partition the population into spatially segregated communities within which matching occurs. I then

provide conditions under which this property carries over to transferable utility. This allows for a graph-theoretic representation of assignments, in terms of a forest, which can be utilized in a simple algorithm to compute surplus shares.³

In “**Communication in Financial Markets with Several Informed Traders**” ([6]) I investigate the incentives of informed traders in financial markets to reveal their information truthfully to the public. In my model, some traders receive noisy signals about the value of an asset and can make public announcements between trading periods. An equilibrium exists in which traders make credible “buy” or “sell” recommendations, if and only if the number of informed traders is large enough. I show that the post-communication asset price converges in probability to the full-information estimate as the number of informed traders increases. Finally, in “**Entry Deterrence in Dynamic Second-Price Auctions**” ([1]), XiaoGang Che and I examine a dynamic second-price auction with sequential and costly entry. We show that collusive equilibria exist in which placing a low early bid has a signaling effect that deters entry by subsequent bidders. As a result, fewer bidders enter on expectation, and the bidders who do enter obtain a higher expected payoff in equilibrium, compared to the benchmark equilibrium where all bidders immediately submit their true values. A special case of an entry-detering equilibrium is one with incremental bidding, where, after having submitted low opening bids, buyers raise their bids by small amounts in each period. Computations show that the social effect of collusion is primarily a transfer from the seller to the buyers, while efficiency losses are relatively small.

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³In [16] we apply this framework to a model of job networking between specialized workers and firms.

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