Online Appendix for "Local Policy Choice: Theory and Empirics"

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A Introduction

In this online appendix, we discuss additional issues not covered in the main text of the paper. Section B discusses two additional mechanisms of policy interdependence: learning and policy diffusion. Section C discusses international tax issues. While this review is focused on local policy choice, we emphasize what the literature on local governments might learn from the international tax competition literature. Section D discusses empirical evidence on additional economic outcomes, including interjurisdictional spillovers and the effects of place-based policies. Finally, section E emphasizes the empirical evidence on learning and policy diffusion, including a large literature in political science.

B Additional Mechanisms: Diffusion and Learning

Social learning is a process whereby information is mobile across borders. However, unlike yardstick competition, this information is not used to discipline policymakers, but rather is information that can be used in the optimal setting of policy. With incomplete information over policy outcomes, governments can learn from their own policies and outcomes, in addition to the policies and outcomes of other jurisdictions. Such observations allow the government to update their priors on a state of nature, such as the elasticity of the tax base. States and localities act as laboratories and learn from experimental first-moving jurisdictions. In this model, beliefs converge over time, resulting in tax rate convergence.[1]

Becker and Davies (2017) show that even in the absence of fiscal externalities, learning reduces the difference between an initial tax rate and the optimal tax rate. Because the information set from which learning occurs is the same for all jurisdictions, changes in the information set have similar changes in all jurisdictions. Thus, "although each country's payoff is completely independent of the taxes set elsewhere, those taxes alter the information set it has and therefore the tax it chooses." As a result, it appears that jurisdictions interact strategically with each other, even though they have no strategic motives. However, the implications of finding a positive correlation between own-tax and neighboring jurisdictions' policies are dramatically different. In the presence of tax competition, tax coordination may be welfare improving. In the presence of learning, tax coordination prevents learning and thus prevents jurisdictions from getting closer to their optimal tax rate.

C International Tax Issues

The conclusion that small jurisdictions set lower tax rates appears throughout the tax competition literature, even in models that seemingly differ in important ways. In particular,

[1] In a model without learning, Agrawal and Trandel (2019) shows that first-movers may set policies that are different from later-moving jurisdictions. In this model, policies need not converge.

this result arises in models of cross-border shopping, discussed in the text. Mongrain and Wilson (2018) obtain the same result for a model with two types of firms, domestic and foreign, where domestic firms have heterogeneous costs of becoming foreign firms by moving from their country of origin. Both types of firms pay the same tax. Here, jurisdiction size is measured by the number of domestic firms.[2]

There is now an extensive literature on tax competition with heterogeneous firms, and these models often borrow from the heterogeneous-firms literature in international trade, including their common assumption of monopolistically-competitive firms. Davies and Eckel (2010) assume that firms all possess the same fixed costs but differ in marginal costs. Those with lower costs enter the industry first, with the marginal firm indifferent about entering the industry. Two jurisdictions compete for these firms through their choice of a profit tax, which is used to finance a public service. The low-tax jurisdiction attracts the more productive firms, whereas the less productive firms benefit from lower wages offered by the high-tax jurisdiction. A pure-strategy Nash equilibrium in tax rates exists only if one jurisdiction is sufficiently large compared to the other jurisdiction, and the large jurisdiction always sets the higher tax rate. Again, the basic reason is that the large jurisdiction faces the less elastic supply of capital. In fact, as the small jurisdiction becomes infinitesimally small, the profits of the firm that is indifferent between the two jurisdictions approaches zero, in which case the large jurisdiction's profit tax has little effect on firm location. Davies and Eckel (2010) compare their model to Wilson (1987), because in both models, there is no pure-strategy equilibrium with equal taxes. But the latter paper extends a *ZMW* model with many identical price-taking jurisdictions to include interjurisdictional trade in two private goods. An asymmetric equilibrium with different tax rates results because tax competition causes jurisdictions to necessarily specialize in producing only one of the two traded goods. Exogenous size differences, therefore, do not play a role. In both papers, however, the socially-optimal tax policy requires equal tax rates. In other words, tax competition may result in inefficient diversity in tax rates.

The international trade literature has emphasized the "home market effect" as an important advantage enjoyed by large countries. These models typically include trade costs for goods shipped from one jurisdiction to another, and a larger home market allows a firm to sell a greater share of its output to consumers within its jurisdiction, therefore avoiding these costs. Thus, if firms can move between jurisdictions, the share of firms located in a jurisdiction will be proportionally larger than the relative size of the jurisdiction in terms of consumer demand.

Baldwin and Okubo (2014) presents a model of tax competition with trade costs and, therefore, a home market effect. The assumption of firm heterogeneity allows the authors to obtain a Nash equilibrium, which would not exist if firms were homogeneous, as in Baldwin and Krugman (2004). The large jurisdiction, measured by number of immobile workers, is able to take advantage of the home market effect and set the higher tax rate, without

[2]Keen (2001) shows that preferential treatment leads to lower tax revenue in a tax competition game, but Janeba and Peters (1999) obtain the opposite result in a model where the mobile tax base is infinitely elastic. The importance of this elasticity is also evident in Wilson (2005), Konrad (2008), and Marceau, Mongrain and Wilson (2010). Janeba and Smart (2003) investigate a more general model, where tax bases also respond to a uniform increase in both regions' tax rates. A limitation of this literature is that governments are usually assumed to maximize tax revenue, rather than the welfare of their residents.

causing all firms to locate in the low-tax jurisdiction. This model builds on Haufler and Stähler (2013), which also finds that the large jurisdiction sets the higher tax rate, but does not allow for interjurisdictional trade and instead models the size advantage in a reduced-form way by assuming firms can sell at a higher price in the large jurisdiction. Burbridge, Cuff and Leach (2006) provided an early analysis of tax competition with heterogeneous firms, but where a firm's productivities differ across jurisdictions.

D Economic Effects of Local Policy

D.1 Spillovers

Even in the absence of mobility, policies in one jurisdiction may have spillovers on nearby jurisdictions. For example, pollution regulations set by one government may improve the environmental quality of nearby jurisdictions. Spending on education or human capital formation may create productivity gains in other jurisdictions. In light of the literature that has used policy reaction functions to determine the existence of spillovers, we discuss the effects of these expenditure spillovers below. A large literature on agglomeration suggests spillovers are highly localized in nature (Ahlfedlt et al. 2015; Arzaghi and Henderson 2008; Rosenthal and Strange 2001, 2008). This may contrast with expenditure spillovers from public services that are consumed by both residents and commuters.

In this section, we focus on spillovers in the context of decentralized environmental policy, because these spillovers have received attention in the literature, and because they result from sub-national policy decentralization.[3] With respect to environmental spillovers, it is useful to discuss the expected effects. Ogawa and Wildasin (2009) nicely summarize:

> An important theme in the literature of fiscal competition, exemplified by a well-known paper by Oates and Schwab (1988), is that both fiscal and regulatory instruments influence the amount and location of such externality-producing activities. In some cases, depending on the range of available instruments and on informational and other constraints, competitive pressures may lead governments to control pollution or other externalities efficiently, with the important proviso that these effects do not spill over jurisdictional boundaries. When there are interjurisdictional spillovers, the literature consistently finds, as intuition would suggest, that decentralized policymaking produces socially inefficient outcomes.

Against this backdrop, Ogawa and Wildasin (2009) provide a counter-example where, even in the presence of spillovers, decentralized policymaking may lead to efficient environmental regulations in the absence of corrective mechanisms by higher level governments. In particular, and in contrast to the literature on fiscal competition, competition for mobile capital plays a crucial role in providing efficiency-enhancing interjurisdictional linkages.

[3]By spillovers in the environmental setting, we mean the effect of one jurisdiction's policy on pollution in other jurisdictions. This does not include other effects, such the mobility of firms or consumers following a change in regulatory policy, which falls under the mobility section in the main text. Indeed, Cohen and Keiser (2017) consider the case of phosphate bans on detergents. They find that residents in phosphate-ban counties travel across county borders to purchase high-phosphate detergent.

Much of the literature has focused on the effect of environmental programs on treated areas, with less emphasis on spillovers to untreated areas (for a survey, see Pfaff and Robalino 2017). We focus on spillovers to untreated areas and not the race to the bottom in environmental policy (see, for example, Konisky 2007). Similar to studies of the effect of policy decentralization on growth, much of the early literature focused on international comparisons. Sigman (2002) shows that water monitoring stations that are upstream relative to the international borders of the E.U., and thus not subject to environmental regulation, have higher pollution than other stations; this is not the case for stations on rivers upstream to borders internal to the E.U. This suggests that countries free-ride on the environmental policies of other jurisdictions. Sigman (2005) finds similar results for the United States, exploiting the fact that states can control their Clean Water Act programs.

Recent studies have looked within countries. Lipscomb and Mobarak (2017) estimates the magnitudes of spillovers from rivers that cross county boundaries within Brazil. Identification comes from the frequent redrawing of county borders. For example, the number of counties increased by over 1500 (relative to a baseline of 4000 counties) during a twenty year period. As the number of county borders increases in between pollution monitoring stations, it is expected that the incentive to pollute increases, as the county's politicians do not consider downstream individuals following a redrawing of borders. Pollution increases as the river reaches the downstream pollution monitoring station, and it does so at an increasing rate. Furthermore, each additional border crossing induced by a border change raises pollution. Finally, the level of pollution shows a structural break at the county border where the downstream monitoring station is located, suggesting that this county restricts polluting activity. By exploiting changes in border status, the authors can isolate changes in pollution, controlling for the fixed location of the monitoring stations. Furthermore, identification can come from changes in distances, after controlling for a county's decision to split its borders. Thus, the authors exploit the fact that some border changes lead to large changes in distance between the pollution monitoring station, while other changes lead to smaller changes in distance. This strategy accounts for the potentially endogenous decision of a county to split.

The presence of these spillovers, and the fact that being upstream or downstream has different implications for who bears the burden of pollutants, implies that states have perverse incentives on getting firms to locate in various places. In particular, states have incentives to locate polluting facilities, through the use of zoning, near borders. In doing so, more of the pollutants will be borne by neighboring jurisdictions than by their own jurisdictions. Using the case of negative externalities, and not pollution per se, Jacob and McMillen (2015) shows that the city of Chicago is more likely to zone commercial areas near the city boundaries. Monogan, Konisky and Woods (2017) shows that major air-polluting firms are more likely to be located near a state's downwind border; the effect is especially large for firms with toxic air pollution. In particular, the authors argue that states may use regulatory or economic development policy incentives to induce air-polluting firms to locate near down wind borders. Some of this may also be due to companies being forward looking, and therefore avoiding upwind sites where political opposition may arise. To test these channels, they compare states with stronger environmental programs and states that make greater use of economic development incentives.

In addition to environmental policies having important spillover effects, a large literature also focuses on the effect on housing prices. Some representative articles include Chay and

Greenstone (2005), Currie et al. (2015) and Greenstone and Gallagher (2008).

D.2 Place-based Policies and Economic Effects

With respect to place-based policies, we focus on policies – surveyed in Neumark and Simpson (2015) – that apply differentially within a jurisdiction and thus treat some firms and households differentially. The emphasis in this literature is on whether these policies improve the economic outcomes of the jurisdictions in which the policy is instituted and, critically, if these improvements are a result of a zero-sum mechanism that simply "steals" activity from nearby jurisdictions. One of the largest of these policies is the federal Empowerment Zone and Enterprise Communities Program. Under this program, local governments can submit applications for eligible high-poverty and unemployment tracts to receive grants and employment credits. Many states have also created additional programs, and similar policies target places in European countries. The empirical literature on placed-based policies must deal with the endogeneity of places where policies are adopted, but also must address spillover effects, which may make selection of counterfactual control groups very difficult.

Within this literature, numerous studies have focused on the effect of enterprise zones on own-jurisdiction employment, finding either no effects, or positive effects (Kolko and Neumark 2010; Neumark and Kolko 2010; Freedman 2013; Busso et al. 2013). Our focus is on where this economic activity comes from: does it arise because new firms create spillovers to other spatially-close firms in the jurisdiction through agglomeration effects, or does it come from a zero-sum game where economic activity in the zone comes at the expense of lost activity from nearby jurisdictions. Papke (1993) found that most of the additional activity in the zone was simply activity that relocated. Of course, if the program was targeted to specific places in order to obtain agglomeration benefits, such a result may still have positive welfare implications from a social welfare perspective. Thus, to evaluate the policy, one must know the net benefit to the jurisdiction and net cost to the neighboring jurisdiction. Even if all economic activity in the zone increases due to mobility of economic activity from nearby places, the net benefits may still exceed the costs if the zone has large agglomeration benefits.

Busso et al. (2013) study federal empowerment zones. These authors identify large employment effects for workers in the zone. Using a general equilibrium model, they express the welfare change from the policy as a function of the elasticities of several responses that they estimate. The authors find relatively large welfare gains, in part because the benefits of the program are capitalized into house prices in the zone, and because their analysis suggests that migration responses do not substantially reduce the gains of the program. Other papers are more negative. For example Hanson (2009) finds no effect on employment in the zones. In a follow-up paper, Hanson and Rohlin (2013) study the effect of zones on tracts that are similar to the enterprise zones, but not in the zones. They find negative spillover effects: these similar tracts experience reductions in the amount of employment and the number of establishments. In the international setting, Givord, Rathelot and Sillard (2013) studies similar types of zone in France, called Franches Urbaines, and finds an increase in the number of establishments in the zones. To identify spillovers, the authors study firms outside the zone and find results that are opposite in sign, but similar in magnitude, to the effects in the zone. These offsetting effects happen in 300 meter rings around the zones,

which suggest that the welfare effects are likely negative if agglomeration benefits do not differ over small geographic spaces.

E Empirical Evidence on Policy Interdependence

A large literature in political science analyzes policy adoption in federalist systems. This research field comes under the broad definition of policy diffusion. Policy diffusion can be defined as how policies spread from one government to the next, or, how one government's policy choices are influenced by other governments (Shipan and Volden 2012). Given this broad definition, political scientists also seek to distinguish the mechanisms discussed in the text and study additional mechanisms not empirically discussed in the economics literature.

Within political science, Shipan and Volden (2008) define four mechanisms of diffusion: learning, competition, imitating, and coercion. These mechanisms, as in the economic literature, are normatively important. Learning can be defined as the process by which jurisdictions observe the adoption of policy and learn from the experience of other governments.[4] In other words, governments simplify their analysis by reaching a solution based on policies that have been successful elsewhere (Berry and Baybeck 2005). Learning leads to the states acting as "laboratories of democracy" (Justice Louis Brandeis writing in *New State Ice Co. v. Liebmann*, 285 U.S. 262 1932). Economic competition is the process by which governments interact competitively over their tax base (Franzese and Hays, 2007, 2008) or face economic spillovers. Berry and Baybeck (2005) argue that learning and competition can be distinguished because learning can take place across many states while competition will be confined to nearby states. However, such a distinction assumes the local mobility of the tax base. As we argue in the text, this may be appropriate for sales taxes but is unlikely the case for global capital markets. Imitation involves copying the actions of another in order to look like that other jurisdiction (Meseguer 2006 and Simmons, Dobbin and Garrett 2006). The key difference from learning is that learning focuses on information about the policy itself, but imitation focuses on the other government (i.e., the action versus the actor). Thus, in the case of imitation, leaders and laggards might imitate each other. Finally, coercion involves attempting to force, encourage, or pressure governments to take actions that meet common expectations (Simmons, Dobbin and Garrett 2006). Although common in the international setting, this might be less common in the local setting. However, coercion may arise between higher-level and lower-level governments. Nonetheless, different levels of government often stimulate policy adoptions at other levels (e.g., Allen, Pettus and Haider-Markel 2004; Karch 2006; Shipan and Volden 2006; Walker 1973; Welch and Thompson 1980). For example, the federal government may threaten a reduction of highway funds unless states change the drinking age. But, recently, the Supreme Court has placed limitations on such coercion by the federal government. For example, the Court recently struck down the Medicaid expansions in Obamacare.

Similar to the economics literature, articles on policy diffusion have also faced challenges to isolating the causal mechanisms underlying the policy diffusion process. Shipan and Volden (2008) focus on smoking bans in the policy diffusion literature, constructing four

[4]See Strumpf (2002) for a social learning model that compares policy innovation under centralization and decentralization.

different variables that attempt to get at each mechanism. These tests draw on theory that we view as having strong assumptions. They test for learning, which they argue should increase if other cities in the state have adopted smoking bans, by calculating the fraction of the state population at each point in time that faces a local smoking ban. To determine the presence of economic competition, the authors create a variable that captures the city's concern that it will lose out economically; to do this, the authors identify all other cities within ten miles of a given city and calculate the population of these cities that do not have antismoking policies. For imitation, the authors look at whether the nearest city with a larger population than the one in question has adopted the policy previously, arguing that cities will imitate other similar neighbors. Finally, coercion is tested by focusing on state laws that are passed related to smoking. The authors conclude that multiple mechanisms are at work. Nonetheless, the assumptions required such that these variables can isolate the mechanisms at work are strong.

In addition, the political science literature has attempted to identify the role of public opinion on policy diffusion (Pacheco 2012), the role of executive initiatives that create prescriptive but voluntary competitions (Howell and Magazinnik 2017), and the role of political parties in the diffusion process (Böhmelt et al. 2016).

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