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Tax Systems Analysis

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ABSTRACT: This paper studies competition in commodity taxation and product market regulation between trading partners. To explain the strategic interaction between governments and regulators, we present a two-country general equilibrium model in which destination-based commodity taxes finance public goods and product market regulation affects the number of firms in the market. We provide empirical evidence based on data for 21 OECD countries over the 1990-2008 period. Our results suggest that commodity taxation and product market regulation are interdependent policies. We confirm the absence of strategic interaction in commodity taxation between governments. Finally, we show that domestic regulation has a negative effect on domestic commodity taxation and that product market regulation is a strategic complement policy.

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1 Introduction

This paper studies competition in product market regulation and commodity taxation between trading partners. A large literature investigates the existence and impact of tax interactions between countries, whereas much less attention has been devoted to the interdependence between taxes and market regulation in an international context. This omission is puzzling because, as Oates ([53] p. 377) writes, the “economic competition among governments makes use of a wide class of policy instruments *including both fiscal and regulatory policies* [...]”. In this paper, we aim at discussing in more detail the hypothesis that commodity taxation cannot be disentangled from the issue of product market regulation. Such a hypothesis is suggested by the recent implementation of OECD regulatory guidelines in OECD countries (OECD [50]), and in particular by the case of Australia (OECD [51]). The regulatory transformation of Australian product markets has been extremely beneficial. The resulting price drops in telecommunications and electricity were substantially beneficial given the importance of these sectors to business and households. Higher competition in product markets led to *increased tax revenues* and enhanced the government’s ability to provide social services such as education and health (OECD [51], p. 54). As suggested by the analysis across OECD countries (Nicoletti and Scarpetta, [47]), the explanations for the effects of these reforms in other OECD countries generally point to the same set of factors.

Product market regulation imposes costs on the production of goods and services and on the entry of new firms. These costs impede the creation of new product varieties, affect product prices, demand, consumer surplus and wages (see e.g. Blanchard and Giavazzi [9]), and ultimately alter governments’ incentives to raise commodity taxes (see Lockwood [40] for a survey). Analyzing this interdependence between product market regulation and taxation seems even more important given that consumption taxes (particularly VAT) represent over 20 percent of total government revenues in developed economies in 2014, with steadily increasing tax rates (OECD, [52]). Importantly, because the share of traded goods and services strongly increased in the last decades, it is critical to analyze this interdependence in an open economy setup. Indeed, when countries are open to trade, the effects of these two policy instruments are transmitted to trading partners, leading to strong interactions between countries’ policy decisions.

Our aim is theoretically and empirically to investigate the existence of strategic interactions between commodity taxation and product market regulation in an open economy. We ask the three following questions: Is there any strategic interaction in commodity taxation under the destination principle? This principle is the most widely used regime in developed countries and imposes that taxes be collected at the consumption place. How do regulation policies affect commodity tax rates in an international context? Do trade partner countries’ decisions to weaken their market regulation institutions entice a country to weaken or

strengthen its own regulatory framework?

In the first part of the paper, we discuss a general equilibrium model with two trading countries. Commodity taxation follows the destination principle and tax rates are set by benevolent governments to finance public goods. As for regulation, we propose two opposite views of regulators. In the first, bureaucrat-regulators pursue a mixed objective function: they maximize the utility of consumers as well as their utility from patronage, power or image of importance of their bureau. In the second, helping-hand regulators seek to protect consumption safety. In any case, individuals consume private and public goods while they work in firms. Firms produce private goods, set their prices, and freely enter product markets. Whatever its purpose, regulation imposes additional costs on firms' physical fixed costs affecting entry in the product market. The regulation level is decided before commodity taxation to reflect governments' greater flexibility in setting tax rates than in restructuring regulatory processes and standards.¹ The model generates three theoretical predictions. First, commodity taxes are independent instruments under the destination principle. Second, governments may lower commodity tax rates when regulation becomes stricter. This is because regulation reduces the resources for total consumption, private and public. When individual demand is more elastic for public goods, governments cut their provision and therefore taxes. Finally, regulation policies are strategic complement instruments when consumers do not excessively value product diversity. This is true for both bureaucrat and helping-hand regulators.

In the empirical part of the paper, we investigate our predictions using panel data for 21 OECD countries. Product market regulation is measured using the number of days to start up a business and the OECD measure of market regulation. Commodity tax rates are proxied by average effective tax rates on consumption. To focus on the application of the destination principle, we exclude tax items that are not subject to this principle (e.g. those subject to excise taxes). We estimate the model under a number of alternative specifications, accounting for potential endogeneity issues, which are typical in empirical analyses of policy interactions (Manski, [42]; Brueckner, [11]). Indicators of social preferences are used as instruments for product market regulation (see e.g. Inglehart [33], Aghion *et al.* [1]). To our knowledge, our paper is the first to exploit time variations of social preferences to identify the impact of product market regulation on economic outcomes. Exogenous variations associated with the introduction of VAT during the sample period are used to construct instruments for commodity taxes. Our empirical results confirm the absence of commodity tax competition under the destination principle. Furthermore, our estimates suggest that stronger domestic regulation impacts a country's ability to raise commodity taxes negatively. Finally, we

¹A reform on tax rates often requires specifying a single tax figure on which parliament votes, while a regulatory reform involves a long and cumbersome analysis of a nexus of laws and decrees and raises many industry-specific contentions before any vote can be called.

support the hypothesis that regulation policies are strategic complements.

This paper contributes to the existing literature in the following ways. First, an extensive literature studies strategic interactions between governments' taxes and suggests that competition in commodity taxes is mitigated by the adoption of the destination principle (Mintz and Tulkens, [44]; Haufler *et al.* [28], Behrens *et al.* [7]; see Lockwood, [40] for a survey). The present paper is however the first to provide empirical evidence of the absence of strategic interactions in destination-based taxation.² Second, to our knowledge, the impact of product market regulation on commodity taxation has not been investigated either from a theoretical or from an empirical perspective.³ Our paper fills the gap in the corresponding literature. Third, the paper contributes to the literature on entry regulation. Djankov *et al.* [20] and Aghion *et al.* [1] analyze the social and cultural factors that affect entry regulation. Miyagiwa and Sato [43] analyze the optimal entry policy in oligopolistic markets operating in a globalized world. However, these papers do not discuss strategic interactions in product market regulation policy. Governments' strategic interactions have however been studied in the case of labor market regulation (e.g. Haaland and Wooton, [25]).⁴

The paper is structured as follows. Section 2 presents the theoretical model. Section 3 studies the strategic interactions in regulation and commodity taxation in the case of bureaucrat-regulator. Section 4 discusses the same issues for helping-hand regulators. Section 5 presents and discusses our empirical analysis. Section 6 concludes.

2 The Model

We describe a general equilibrium economy with two countries, home and foreign, and immobile populations with unit masses. Benevolent governments decide on local commodity tax rates, while regulatory agencies independently choose regulation policies in the local product market.⁵ We discuss two extreme views about regulators' objective functions. We first consider a bureaucrat-regulator endowed with a mixed objective function that encompasses

²Empirical evidence of strategic interactions is found under the origin principle. Egger *et al.* [22] find evidence of the strategic complementarity of average effective tax rates on consumption using OECD panel data. Lockwood and Migali [41] show that the introduction of the EU Single Market in 1993 triggered strategic interactions between excise taxes in EU countries. Devereux *et al.* [18] find evidence of the strategic complementarity of excise taxes on cigarettes using US panel data.

³There are some studies in environmental economics such as Oates and Schwab's [54] or List and Gerking's [39] which discuss the impact of environmental regulations on taxes and welfare.

⁴A strand of literature in *law and economics* also discusses regulatory competition among states and legislation quality (e.g. Sun and Pelkmans, [63]). Clearly, this is not the focus of our paper.

⁵Regulatory agencies implement complex market regulatory and supervisory tasks that require economic expertise. To avoid political interference and opportunism, regulatory agencies are independent from other branches of government. Examples of regulatory agencies are the Interstate Commerce Commission and the Food and Drug Administration in the US, Ofcom in the UK, and AGCOM in Italia.

the utility from workers' consumption as well as the utility power, patronage, image, prerequisites for his office, etc, (Niskanen [48]).⁶ Later, we will follow the public interest theory of regulation (Pigou [57]) and consider the regulator as a benevolent institution who cares about the product market functioning in the context of uncertainty (see Section 4). This is a helping-hand regulator who maximizes the utility of consumers (see Djankov *et al* [20] and Arruñada [6] for discussions on these two opposing views of regulation). In what follows, we first describe the economy and then discuss the taxation and regulation decisions. Variables pertaining to the foreign country are indexed by the superscript *. We describe the model for the domestic country, symmetric expressions holding for the foreign one.

Private good demand In the domestic country, consumers' preferences are given by an increasing, separable, and concave utility function $U(C, G)$ where C is a bundle of private commodities and G is a bundle of public goods, respectively. The bundle of private commodities is defined over the varieties $\omega \in [0, N]$ such that:

$$C = N^\xi \left[\int_0^N c(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}}, \quad (1)$$

where $c(\omega)$ is the private consumption of variety ω and σ , $\sigma > 1$, is the elasticity of substitution among varieties. The world number of varieties, N , is given by the sum of the endogenous numbers of domestic and foreign varieties, n and n^* . That is, $N = n + n^*$. As in Benassy [8], the parameter $\xi \in [-1/(\sigma - 1), 0]$ measures the love for variety. With $\xi = 0$, one recovers Dixit and Stiglitz's [19] benchmark where the elasticity of substitution is equal to the love for variety. With $\xi = -1/(\sigma - 1)$, the love for variety is absent. Ardelan [5] suggests an empirical value for ξ at about the middle of this range. Each consumer chooses her private consumption $c(\cdot)$ subject to her budget constraint

$$\int_0^N p(\omega) c(\omega) d\omega = W,$$

where $p(\omega)$ is the domestic (tax-inclusive) consumer price for variety ω and W is the consumer's income. Hence, her demand for each variety is given by

$$c(\omega) = \left(\frac{p(\omega)}{P} \right)^{-\sigma} \frac{W}{P}, \quad (2)$$

where $P = \left[\int_0^N p(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}}$ is the domestic consumer price index.

⁶Notice that the bureaucracy view of regulation can be conducted to the tollbooth view in which the regulator pursues his own interest (see Shleifer and Vishny [60] and Djankov *et al* [20]) Whereas, in the 'capture' view of regulation (see Stigler [62] and Peltzman [56]), regulation is designed and operated primarily to benefit the whole regulated industry.

Public goods supply and demand In most modern economies, a large set of public goods are delivered by independent public agencies that purchase inputs from the private sector. These public goods include infrastructure, supply and private sourcing for justice, communication, education, army, and social housing among others.⁷ We assume a continuum of symmetric varieties of public goods. Each public good variety is produced by an independent public agency that uses private varieties in its production process. In particular, each public agency transforms a set of private varieties $\omega \in [0, N]$ into its own variety of public good using the following technology:

$$G = N^\xi \left[\int_0^N q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}},$$

where $q(\omega)$ is the input demand of the public agency for variety ω . Each agency chooses the input mix that maximizes the level G of its public good variety, taking all prices as given and satisfying its budget constraint $\int_0^N p(\omega)q(\omega)d\omega = B$, where B is the budget line of the agency. It naturally comes that the input demand is given by

$$q(\omega) = \left(\frac{p(\omega)}{P} \right)^{-\sigma} \frac{B}{P}. \quad (3)$$

Assuming symmetry of consumers' preferences and production technology across varieties of public goods, public agencies conveniently display the same demand for private varieties.⁸ Assuming further a unit mass of varieties of public goods, we readily have that the total demand for a private variety ω by the public sector and the bundle of public goods are given by $q(\omega)$ and G . Similarly, the government budget for the production of public goods is equal to the agency budget line B . In the end, public and private consumptions are proportionate. Indeed, one can check that

$$q(\omega)/c(\omega) = B/W \quad \text{and} \quad G/C = B/W. \quad (4)$$

Private production Each private firm has a production plant in a country and sells its products in both countries under monopolistic competition. To be profitable, each variety

⁷One can more narrowly interpret this setting as public procurement or outsourcing. In OECD countries, public procurement ranges between 10% and 30% of GDP and between 20% and 50% of government expenditures (European Commission [23]).

⁸Under the above specifications, public agencies benefit from no strategic (monopsony) power and have an input demand similar to consumers'. Our modeling strategy aims at keeping some homotheticity between private and public consumption in order to be able to discuss tax and regulation decisions. Therefore, parameter ξ reflects both the love for product diversity and the economies of scope in the production of public goods. Similar results could be obtained (i) when a unique public good is supplied under an appropriate CES production function by a price-taking public agency, (ii) under the assumption of multiple public goods, whose technology is not symmetric to consumer preferences. Still, tractability would impose congruence in love for product diversity and economies of scope.

must be produced by one and only one firm. Thus, firms can be indexed by $\omega \in [0, N]$. A domestic firm ω has a profit given by

$$\pi(\omega) = \left[\frac{p(\omega)}{\tau} - W \right] [c(\omega) + q(\omega)] + \left[\frac{p^*(\omega)}{\tau^*} - W \right] [c^*(\omega) + q^*(\omega)] - fW,$$

where $p(\omega)$ and $p^*(\omega)$ are its domestic and foreign prices, $c(\omega)$ and $q(\omega)$ are the demand from domestic private consumers and public agencies, while $c^*(\omega)$ and $q^*(\omega)$ are the demand by foreign consumers and public agencies. To produce a unit of the good, each firm hires a unit of labor paying a wage equal to W and incurs a fixed labor input f , which yields a fixed cost equal to fW . This fixed input f embeds the input needed to set up the firm's economic activity (e.g. management, R&D, marketing, distribution, etc.) and the cost of complying with regulatory requirements (e.g. quality compliance, transfers to renters, etc.). The mechanism underlying this cost will be described in Section 3.2. For the sake of exposition, we measure domestic and foreign commodity taxes by the ratio between (tax-inclusive) consumer and (tax-exclusive) factory prices: $\tau > 1$ and $\tau^* > 1$. Commodity tax rates are simply equal to $\tau - 1$ and $\tau^* - 1$. Taxes follow the destination principle and are set by governments.

Under monopolistic competition, each firm ω sets the domestic and foreign prices, $p(\omega)$ and $p^*(\omega)$ that maximize its profit, taking all other variables as given. The optimal prices are given by

$$p(\omega) = \frac{\sigma}{\sigma - 1} \tau W \quad \text{and} \quad p^*(\omega) = \frac{\sigma}{\sigma - 1} \tau^* W. \quad (5)$$

Under monopolistic competition, firms enter until profits fall to zero. In the domestic country, the above prices imply that each firm's production scale x is equal to

$$x = (\sigma - 1) f, \quad (6)$$

which increases with setup costs. Similar expressions hold for the foreign country.

Plugging the optimal prices (5) and their foreign counterparts into the price indices, we get the following property:

$$\frac{P}{\tau} = \frac{P^*}{\tau^*} = \frac{\sigma}{\sigma - 1} [nW^{1-\sigma} + n^*W^{*1-\sigma}]^{\frac{1}{1-\sigma}}. \quad (7)$$

The cost of living is the same across countries once they are deflated by local commodity tax rates.

Labor and product market equilibrium In the domestic country, each firm demands $f + x = \sigma f$ units of labor and the labor market clears when the total labor demand $n\sigma f$ equalizes its unit supply. Using the production scale (6) and applying the same argument to the foreign country, we get the following number of firms

$$n = \frac{1}{\sigma f} \quad \text{and} \quad n^* = \frac{1}{\sigma f^*}. \quad (8)$$

In each country, the number of firms is proportional to the labor force because each firm operates at the same production scale. Because of (6), setting the domestic regulatory entry cost f is equivalent to setting the domestic production scale and, ultimately, the number of domestic firms, n . For this reason, *in the rest of the paper the choice of regulation is treated as the choice of the number of firms in the country.*

For each domestic firm ω , the product supply x must satisfy the product demand: $x = c(\omega) + q(\omega) + c^*(\omega) + q^*(\omega)$. Using (2) and (3), this equality can be written as

$$x = \left(\frac{p(\omega)}{P} \right)^{-\sigma} \frac{W + B}{P} + \left(\frac{p^*(\omega)}{P^*} \right)^{-\sigma} \frac{W^* + B^*}{P^*}.$$

Then, using (5) and (7), we obtain

$$x = W^{-\sigma} \frac{\sigma - 1}{\sigma} \frac{(W + B) \tau^{-1} + (W^* + B^*) \tau^{*-1}}{nW^{1-\sigma} + n^*W^{*1-\sigma}},$$

where the ratios on the right-hand side are the same in both countries. As a result, given the production scale (6), wages satisfy

$$\frac{W}{W^*} = \left(\frac{x}{x^*} \right)^{-\frac{1}{\sigma}} = \left(\frac{f}{f^*} \right)^{-\frac{1}{\sigma}}. \quad (9)$$

The relative wage falls with larger domestic production scales and therefore with larger domestic setup costs and stronger regulation. Indeed, when setup costs rise, domestic firms need to sell more to break even, and therefore set a lower price relative to foreign firms. Since firms set constant markups over wages, domestic firms can set a lower price only by paying a lower wage, relative to foreign firms. *Ceteris paribus*, too strong a domestic regulation diminishes domestic workers' real wages. This is the effect of product market regulation on the domestic purchasing power, or equivalently, on the domestic terms of trade, W/W^* .

Government balance and consumption The government balances its tax revenues against its expenditures on the production of public goods so that

$$(\tau - 1)W = B \quad (10)$$

The equalities (6), (8) and (10) characterize the equilibrium in the product and labor markets and for a balanced budget. We can now compute the private and public consumption. The private consumption bundle is given by (1) and simplifies to

$$C = \frac{W}{P} N^\xi, \quad (11)$$

and from (4) the public good consumption is equal to

$$G = (B/W)C = (\tau - 1)C. \quad (12)$$

The consumption of private and public goods increases with real wages W/P . Using (7) and (9) real wages are given by

$$\frac{W}{P} = \frac{\sigma - 1}{\sigma} \frac{1}{\tau} \left[n + \left(\frac{n}{n^*} \right)^{1 - \frac{1}{\sigma}} n^* \right]^{\frac{1}{\sigma - 1}}, \quad (13)$$

where n , n^* and $N = n + n^*$ are given by (8). It is easy to check that taxes affect the level of private consumption negatively because they affect real wages (see (11) and (13)) negatively. By contrast, a tax increase leads to a larger supply of public goods. Indeed, substituting (11) and (13) in (12), one readily finds that $\partial G / \partial \tau > 0$.

To check how private and public good consumption changes with the number of goods produced domestically, we substitute (13) in (11) and find

$$C = \frac{1}{\tau} C_0(n, n^*) \quad (14)$$

where

$$C_0(n, n^*) \equiv \frac{\sigma - 1}{\sigma} \left[n + \left(\frac{n}{n^*} \right)^{1 - \frac{1}{\sigma}} n^* \right]^{\frac{1}{\sigma - 1}} (n + n^*)^\xi$$

is the consumption level in the absence of taxes, which is a function of n and n^* only. It follows that $G = C_0(\tau - 1) / \tau$.

Stronger domestic regulation diminishes the level of domestic diversity n and therefore changes the utility from private consumption through two channels. On the one hand, it reduces the terms of trade W/W^* , which reduces the term $(n/n^*)^{1-1/\sigma}$ in the above expression, and therefore domestic consumers' utility. On the other hand, it reduces product diversity and diminishes the utility from private consumption to the extent of the consumers' taste for variety, ξ . When consumers express the same love for product diversity as under Stiglitz-Dixit preferences ($\xi = 0$), stronger regulation makes consumers worse off both because of a lower product diversity and worse terms of trade. However, things may differ slightly when consumers express no taste for variety ($\xi = -1/(\sigma - 1)$). To show this, we compute the elasticity of private consumption with respect to n as follows:

$$\frac{\partial \ln C_0}{\partial \ln n} \equiv \Phi \left(\frac{n}{n^*} \right) = \frac{1}{(\sigma - 1)} \left[1 - \frac{1}{\sigma} \frac{1}{1 + (n/n^*)^{\frac{1}{\sigma}}} \right] + \xi \frac{1}{1 + (n/n^*)^{-1}}. \quad (15)$$

When consumers have a love for variety ($\xi = 0$), this elasticity is obviously positive, so that a rise in product diversity raises the domestic utility from private consumption. Instead, when $\xi = -1/(\sigma - 1)$, the sign of this elasticity depends on the balance between the effects of the terms of trade and product diversity. This sign is positive for any admissible ξ if and only if $\sigma (n/n^*)^{\frac{1}{\sigma}} - (n/n^*) + (\sigma - 1) > 0$. A sufficient condition is that $n/n^* \leq \sigma^{\frac{\sigma}{\sigma - 1}}$; in words, the ratio n/n^* does not lie too high above one. In this case, the effect of the terms of trade dominates that of product diversity. In the present model, this will be the most

relevant case. Finally, note that this elasticity falls with foreign product diversity n^* if and only if $\Phi'(n/n^*) \geq 0$. That is, if

$$(n/n^*)^{-\frac{\sigma-1}{\sigma}} \left(\frac{1 + n/n^*}{1 + (n/n^*)^{\frac{1}{\sigma}}} \right)^2 > -\xi \sigma^2 (\sigma - 1) \quad (16)$$

This condition holds when ξ is not too negative and does not hold for very negative ξ . About $n/n^* = 1$, it holds if and only if the love for variety is high enough, $\xi > -1/(\sigma^2 (\sigma - 1))$.

We are now equipped to discuss the strategic interactions between governments and regulators.

3 Strategic Interactions between Governments and Regulators

We model the interaction between governments and regulators as a sequential game in which regulators firstly set firms' entry requirements and then governments set their commodity tax rates. We thus take the view that regulatory processes and standards are less easy to restructure than commodity tax rates.⁹ The game is solved by backward induction.

In the next section, we assume bureaucrat-regulators whose aim is to pursue their own interest as well as that of the consumers. Under this assumption, the regulation of product markets produces only red tape procedures that raise the fixed cost of firms. In Section (4), we introduce a helping-hand regulator of a benevolent type who maximizes citizens' utility level.

We begin with the analysis of governments' competition in commodity taxes.

3.1 Commodity Tax Competition

Each government sets the commodity tax rate that maximizes its residents' utility, holding a balanced budget and taking the other tax and the regulatory setting as given. Because the domestic government maximizes $U(C, G)$ or equivalently $U[C_0/\tau, C_0(\tau - 1)/\tau]$ and because C_0 is a function of only n and n^* , the optimal domestic commodity tax τ is independent from the foreign tax. Indeed, in this setup, firms pass the entire commodity tax τ "through" consumers and the destination principle rules out cross-border shopping.

Proposition 1 *Under the destination tax principle, there exists no strategic interaction in commodity tax rates.*

⁹Whereas a tax rate reform requires specifying a single tax figure on which parliament must vote, a regulation reform requires a long and cumbersome analysis of a nexus of laws and decrees and raises many industry-specific contentions before any vote can be called for.

This is a known result in optimal taxation theory under the destination tax principle. Indeed, in their seminal paper, Mintz and Tulkens [44] show the absence of commodity tax competition under the destination principle in perfectly competitive markets. Closer to our approach, Haufler and Pfluger [27] reach the same conclusion for two countries and monopolistic competition. The type of competition can nevertheless matter as governments have incentives to use commodity taxes to correct the distortions emerging in imperfectly competitive markets.¹⁰ However, as in this paper, such incentives are mitigated when commodity taxes are used to finance public goods (Haufler and Pfluger [29]). In addition and in contrast to those contributions, here we consider the effects of the terms of trade and product diversity (entry). We also consider the more realistic situation of a tax on all goods and the use of the tax receipt for the provision of public goods.

The choice of commodity taxes can readily be understood by reformulating the government's problem in the following way. Since $C = C_0/\tau$ and $G = C_0(\tau - 1)/\tau$, we get $C + G = C_0(n, n^*)$. As in Andersson and Forslid [4], the aggregate private and public consumptions reduce to a simple expression that is independent from commodity taxes and eases our analysis.¹¹ Thus, the government's problem is simply to find the private and public consumption bundles that maximize each individual's utility $U(C, G)$ subject to the total resource constraint $C + G = C_0$. This yields the standard Samuelson condition

$$\frac{U'_C}{U'_G} = 1 \quad (17)$$

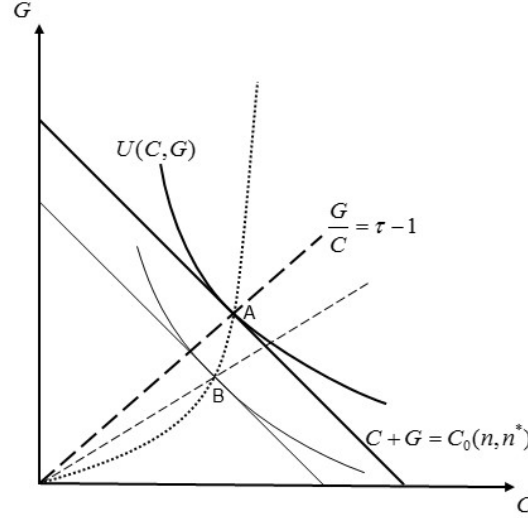
according to which the sum (over the unit mass consumers) of the marginal rate of substitution between public and private goods, U'_C/U'_G , equates the unit marginal rate of transformation between public and private goods. The optimal tax rate is given by $\tau - 1 = G/C$. A maximum is guaranteed under our standard concavity assumptions. Figure 1 represents the government's choice in a (C, G) diagram where the government objective is displayed with convex curves, the resource constraint with the -45° degree line and the commodity tax level with rising diagonals.

What is the impact of domestic regulation on the domestic tax rate? It depends on the effect of the total resource constraint on the demand for public and private goods. Stronger regulation indeed decreases the number of domestic firms n and therefore reduces the consumption level $C_0(n, n^*)$ if and only if $\partial \ln C_0 / \partial \ln n > 0$. By (15), this is the case for $n/n^* \leq \sigma^{\frac{\sigma}{\sigma-1}}$ and therefore for not too asymmetric country configurations. In this case,

¹⁰In the presence of such distortions commodity taxes can be Pareto inefficient under the destination principle, even in the absence of strategic interactions (See Lockwood [40] for a synthesis). This is the case with imperfect competition in duopoly models (Keen and Lahiri [36], Haufler *et al.* [28]), monopolistic competition (Haufler and Pfluger [27]) or labor market imperfections that create unemployment in the economy (Moriconi and Sato [45]).

¹¹This is the result of our modeling strategy for public agencies.

Figure 1: Effect of regulation on commodity tax.



Notes: The figure displays the choice of commodity tax by the government as a function of regulation levels. Start with an equilibrium at point A . When regulation becomes stronger, the resource constraint $C_0(n, n^*)$ moves downwards and the government adjusts the level of public services G to point B . The tax τ falls if the effect of the total resource constraint is stronger on the for public services.

stronger regulation yields a contraction of the resource constraint $C + G = C_0(n, n^*)$. See the move from A to B in Figure 1. In consumer theory, this corresponds to a fall in the income of a representative consumer whose income is given by $C_0(n, n^*)$ and who faces identical prices for private and public consumption bundles. Thus, income has the same impact on consumers' choices as regulation on governments' decisions. This establishes a formal link between regulation and income effects. Then, suppose that the income effect on the demand of public goods is stronger than that on private goods. That is, the income expansion path, or Engel function, is biased toward public goods. Then, a fall in resource or income must reduce the optimal consumption of public goods more than that of private goods. To achieve this outcome, the benevolent government reduces the commodity tax rate. If the income effects go in the opposite direction, the converse occurs.

The impact of stronger domestic regulation on domestic tax rates can be formally expressed by the following argument. The domestic government sets the commodity tax τ that

maximizes the domestic utility level $U[C_0/\tau, C_0(\tau - 1)/\tau]$. This yields the first-order condition, $\mathcal{F} \equiv (d/d\tau) U[C_0/\tau, C_0(\tau - 1)/\tau] = 0$, and the second-order condition, $d\mathcal{F}/d\tau < 0$. The commodity tax falls with stronger regulation if it decreases with a smaller number of domestic firms. This means that $d\tau/dn = -(d\mathcal{F}/dn) / (d\mathcal{F}/d\tau) \geq 0$. This condition is true if and only if $d\tau/dn > 0 \iff d\mathcal{F}/dn \geq 0$. Some lines of computation show that the last condition is equivalent to

$$[U''_{GG}(\tau - 1) - U''_{CC}] \frac{\partial \ln C_0}{\partial \ln n} \geq 0,$$

where U''_{CC} and U''_{GG} are all negative. The last expression clearly depends on the response of the domestic private consumption bundle C_0 to n and on the concavity of the utility function with respect to private and public goods (C and G), and therefore on the degree of consumers' satiety for these two kinds of goods. The above condition can be expressed in terms of the marginal rates of substitution, $MRS \equiv U'_C/U'_G$, as

$$\left(\frac{d \ln MRS}{d \ln C} + \frac{d \ln MRS}{d \ln G} \right) \frac{\partial \ln C_0}{\partial \ln n} \geq 0$$

The term in parentheses expresses the income effects on the marginal rates of substitution. Indeed, take any ray, $G/C = \text{cst}$, on which private and public consumptions are proportionate ($d \ln C = d \ln G$). When income effects on public and private goods are the same, the marginal rate of substitution remains constant on the ray. Changes in regulation and thus in the number of domestic firms have no impact on commodity tax rates. When income effects are stronger on the demand of public goods, the marginal rates of substitution increase on this ray when consumption rises proportionally, so that the term in parentheses becomes positive. As a result, stronger regulation reduces the number of domestic firms and thus increases commodity taxes. This is what we explained informally in the previous paragraph.

We summarize our findings in the following proposition:

Proposition 2 *Suppose that private consumption increases with the number of domestic varieties ($n/n^* \leq \sigma^{\frac{\sigma}{\sigma-1}}$). Then, stronger product market regulation lowers commodity tax rates if and only if income has a stronger effect on the demand of public goods than on that of private goods.*

Empirically, the concavity of preferences, the marginal rates of substitution for private and public goods, and the income effect on demand depend on the nature of each good. To our knowledge, the public economics literature has not identified clear and distinct patterns about these properties on private and public goods. However, the positive correlation between the share of public expenditures and GDP per capita suggests that the demand for public services increases with a higher average income.¹² This fact, known as Wagner's law,

¹²Peacock and Wiseman [55] emphasize that economic growth induced social upheavals through citizens demanding additional social services. These social improvements were made possible in a context of more effective and broader government funding. This led to a rise in government expenditure.

favors the hypothesis of a stronger income effect on a country's public good demand, and therefore suggests a negative effect of regulation on tax. Nevertheless, the direction of commodity tax changes with respect to the number of firms and market regulation is therefore an empirical issue that we will discuss in Section 5.

3.2 Regulatory Competition

In this section, we discuss the interactions between regulators. From the previous section, we know that optimal commodity tax rates are independent instruments, but change according to the regulation intensity. For the sake of simplicity, we sterilize the effect of local regulation on local tax by assuming that the utility function of agents is log-linear, i.e., $U(C, G) = \alpha \ln C + (1 - \alpha) \ln G$, where α is the specific domestic preference for private consumption. This utility function allows us to discuss the regulatory competition stage.¹³ Under this assumption, the optimal commodity tax rate is equal to $\tau_0 = 1/\alpha$. The utility becomes $V(C_0) = \ln C_0 + \ln [\alpha^\alpha (1 - \alpha)^{1-\alpha}]$. Similarly, the foreign country sets a tax $\tau_0^* = 1/\alpha^*$.

In the present section, we consider a bureaucrat-regulator who has a mixed objective function: maximize consumers' utility as well as his own utility from power, patronage, image and perquisites of his office. The discussion of benevolent regulators is of little interest in the present section. Any additional burden on local firms reduces product diversity and harms local consumers. As a result, regulators who maximize the utility of their consumers each have an incentive to avoid imposing unnecessary costs on firms. They should set zero regulation (assuming that they cannot subsidize firms' fixed costs). The competition between domestic and foreign regulators will then result in a zero regulation level everywhere. Section 4 will address a relevant role for benevolent regulators in the context of uncertain market environments.

For the sake of exposition, we assume there exists a bureaucrat-regulator that extracts utility from regulatory activities on domestic firms in the form of power, patronage or reputation. These activities take ultimately the form of red tape procedures that impose an extra input z on each firm's fixed input f_0 . Hence, the objective function of the bureaucrat-regulator is

$$V(C_0) + \rho Z(nz)$$

where Z is an increasing and concave function and nz is the total amount of resources captured by the regulator on the n firms and redirected to "produce" power or patronage for himself and ρ is the weight that the regulator puts on his own benefit.¹⁴ For analytical tractability, we set $Z(nz) \equiv \ln nz$. As a result of regulation, each firm's entry requires a

¹³There exist other utility functions that also yield constant tax rates (e.g. Cobb Douglas).

¹⁴Notice that the bureaucrat-regulator's objective function is fully aligned with the government's objective function if $\rho = 0$.

total fixed cost of $f = f_0 + z$. By (8), the extra input is equal to $z = 1/(\sigma n) - f_0$. The domestic regulator therefore chooses the regulatory setup that satisfies the following first order condition:

$$V' \frac{\partial \ln C_0}{\partial \ln n} + Z' \left(\frac{\partial \ln(nz)}{\partial \ln n} \right) nz = 0$$

which in the log linear case simplifies to

$$\frac{\partial \ln C_0}{\partial \ln n} - \rho \frac{n\sigma f_0}{1 - n\sigma f_0} = 0. \quad (18)$$

The regulator balances his marginal benefit from larger power $Z(nz)$ (second term) with the fall in workers' consumption C_0 (first term), which relates to diversity and the terms of trade.

Because of country symmetry, the equilibrium is also symmetric: $n = n^*$. The domestic regulator reduces n to a rise in n^* if and only if $\partial \ln C_0 / \partial \ln n$ falls with a higher n^* , which holds under condition (16). Applying the latter at equilibrium, we find that the domestic regulator reduces n after a rise in n^* if and only if the love for variety is high enough, $\xi > -1/(\sigma^2(\sigma - 1))$. In this case, regulation policies are strategic substitutes. The converse holds for the opposite condition.

This allows us to state the following proposition:

Proposition 3 *Regulation policies are strategic complements for a low taste for product variety $\xi \leq -1/(\sigma^2(\sigma - 1))$ and strategic substitutes otherwise.*

Proof. See Appendix A. ■

The intuition of Proposition 3 goes as follows. A relaxation of domestic regulation (higher n) raises the local purchasing power, but reduces the local regulator's utility from power and patronage. The point is how the relaxation of foreign regulation affects this balance. Consider first the case where consumers and regulators put no value on product diversity. Then, what matters is the terms of trade. When the foreign regulator relaxes his regulation intensity, more foreign firms enter so that the foreign production is boosted and puts an upward pressure on foreign wages and prices. The domestic terms of trade W/W^* become less favorable, reduce the home purchasing power, C_0 , and increase the marginal purchasing power resulting from additional local varieties ($\partial \ln C_0 / \partial \ln n$ increases with a larger n^*). The domestic regulator then has incentives to give up power and relax domestic regulation, to allow more domestic entry and restore the terms of trade. Regulatory decisions are thus strategic complements. By contrast, consider the case where consumers put a high value on product diversity. Now, what matters is the number of varieties in the economy. When the foreign regulator relaxes his regulation intensity, more foreign firms enter. Despite the decrease in the domestic terms of trade, the larger number of varieties increases the consumption of the regulator, allowing him to enjoy more power. Regulation policies are now strategic substitutes.

4 Market Uncertainties and Helping-Hand Regulators

In the previous section, we discussed the effect of self-interested regulators. Nevertheless, regulation also aims at protecting consumers and guaranteeing their safety. The regulator's tasks are then to strengthen product safety, check professional accreditation and provide business information so that consumers are less exposed to potential casualties, injuries, swindles or frauds. In this case we speak about *helping-hand regulators*. To make this idea more explicit, we will focus on a regulator who helps consumers to get a good delivery or a good consumption of purchases. Some products may not be delivered at all or may be sold at too bad a quality to be consumed. The role of the helping-hand regulator is to diminish the occurrence of such events. Towards this aim, we firstly restate the model with uncertainty and then show that our previous conclusions hold.

In the first stage of this model, helping-hand regulators implement regulation and exert a control on firms and products, aiming at improving consumer surplus. Such regulatory activities raise firms' entry cost. In the second stage and as before, governments set their commodity taxes. In the last stage, firms firstly enter and offer (catalogs of) product varieties for purchase. Consumers purchase and pay for each product variety. Firms then produce their products and, in some random state of nature, $s \in S$, are unable to deliver either their goods or a good that is worth consuming. We remain silent about whether the uncertainty stems from accident or illicit intention. The probability of each state s is denoted by $\theta(s)$.

In this framework, the bundle of private commodities is contingent on each state s and given by

$$C(s) = N^\xi \left[\int_0^N (\lambda(s, \omega) c(\omega))^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}}, \quad (19)$$

where $c(\omega)$ is the order of private consumption of variety ω (decided before the realization of the states of nature) and $\lambda(s, \omega)$ is equal to one if the variety ω is actually delivered in state s and zero otherwise. The production of a public agency is subject to the same uncertainty and, therefore, is written $G(s) = N^\xi \left[\int_0^N (\lambda(s, \omega) q(\omega))^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}}$. The consumer maximizes her expected utility $E[U(C, G)] = \int_S \theta(s) U(C(s), G(s)) ds$ subject to her budget constraint $\int_0^N p(\omega) c(\omega) d\omega = W$. Similarly, each public agency chooses its input mix that maximizes its expected production subject to its budget constraint.

In Appendix A, we show that the consumers' and public agencies' demands have easy, closed-form solutions if the uncertainty affects the delivery of varieties symmetrically. More specifically, we assume that the probabilities of home and foreign varieties (ω, ω^*) to be delivered are given by $\theta \equiv \int_S \theta(s) \lambda(s, \omega) ds$ and $\theta^* \equiv \int_S \theta(s) \lambda(s, \omega^*) ds$. Then, the optimal individual consumption and consumption bundle are given by

$$c(\omega) = p(\omega)^{-\sigma} \frac{\theta^\sigma W}{P^{1-\sigma}} \quad \text{and} \quad C = \frac{N^\xi W}{P} \quad (20)$$

where

$$P^{1-\sigma} = n\theta^\sigma p^{1-\sigma} + n^*\theta^{*\sigma} p^{*1-\sigma}$$

The demand from public agencies, $q(\omega)$, is exactly the same except that workers' income W must be replaced by agencies' budget B . So, the only change with the previous setting is that a higher probability of domestic product delivery, θ , raises the demand for these goods and increases the global price index. Intuitively, under symmetric delivery probabilities, consumers do not care which variety will not be delivered in reality and make their decisions based on the aggregate measures of delivery probabilities (θ, θ^*) . The consumption bundle then becomes a sure thing from the consumer's viewpoint.¹⁵

The short-term equilibrium analysis then shares close similarities with the previous one. Since goods are paid in advance and produced anyway, firms have the same revenues and costs. They set the same markups on marginal costs, have the same size $x = (\sigma - 1)f$, and make entry decision $n = 1/(\sigma f)$. The main difference lies in product market clearing where the demand increases with delivery probabilities. In particular, product market clearing leads to the following terms of trade:

$$\frac{W}{W^*} = \left(\frac{x\theta^{-\sigma}}{x^*\theta^{*-\sigma}} \right)^{-\frac{1}{\sigma}} = \left(\frac{f\theta^{-\sigma}}{f^*\theta^{*-\sigma}} \right)^{-\frac{1}{\sigma}} = \left(\frac{n\theta^\sigma}{n^*\theta^{*\sigma}} \right)^{\frac{1}{\sigma}}. \quad (21)$$

A higher delivery probability of domestic goods raises the demand for these goods and their relative prices. As a result, the terms of trade are more favorable to the home country. This relationship determines the domestic real wages as

$$\frac{W}{P} = \frac{\sigma - 1}{\sigma} \frac{1}{\tau} \left[n\theta^\sigma + \left(\frac{n\theta^\sigma}{n^*\theta^{*\sigma}} \right)^{1-\frac{1}{\sigma}} n^*\theta^{*\sigma} \right]^{\frac{1}{\sigma-1}},$$

which yields the domestic consumptions of private and public goods,

$$C = C_0/\tau \quad \text{and} \quad G = C_0(\tau - 1)/\tau, \quad (22)$$

where now

$$C_0(n, n^*, \theta, \theta^*) \equiv \frac{\sigma - 1}{\sigma} \left[n\theta^\sigma + \left(\frac{n\theta^\sigma}{n^*\theta^{*\sigma}} \right)^{1-\frac{1}{\sigma}} n^*\theta^{*\sigma} \right]^{\frac{1}{\sigma-1}} (n + n^*)^\xi \quad (23)$$

is the consumption level in the absence of taxes, which depends on delivery probabilities (θ, θ^*) . We are now equipped to discuss the tax and regulation competition.

¹⁵Note that the parameter θ acts as a trade cost in the demand and the price index. Actually, a share of production is lost in the transaction between firms and consumers. The difference lies in the fact that θ has a direct effect on the extensive margins, whereas a trade cost has a direct effect on the intensive margins. The parameter θ can also be seen as a product quality shifter. In this case, regulation therefore increases product quality in the country.

It is obvious from (22) that domestic consumption does not depend on the foreign commodity tax. As a consequence, governments have no strategic interactions in setting their taxes, which confirms Proposition 1. Similarly, since $C = C_0/\tau$ and $G = C_0(\tau - 1)/\tau$, the government's decision can be reformulated as the maximization of individuals' utility $U(C, G)$ subject to the budget constraint $C + G = C_0(n, n^*, \theta, \theta^*)$. Thus, as in Proposition 2, we can conclude that stronger product market regulation lowers commodity tax rates if and only if income has a stronger effect on the demand of public goods than on that of private goods, under the condition that private consumption increases with stronger regulation. More precisely, if we denote the relationship between the delivery probability and the number of firms as $\theta(n)$, this imposes that $\partial C_0/\partial n + (d\theta/dn)(\partial C_0/\partial \theta) > 0$. Since the delivery risk is low (θ close to one) as one reasonably expects, $d\theta/dn$ is low, so that the first term of the last inequality dominates. In this case, Proposition 2 applies.

Proposition 4 *Suppose delivery uncertainty. Then, under the destination tax principle, there exists no strategic interaction in commodity tax rates. Also, stronger product market regulation lowers commodity tax rates if and only if income has a stronger effect on the demand of public goods than on that of private goods, provided that private consumption increases with lower regulation ($\partial C_0/\partial n + (d\theta/dn)(\partial C_0/\partial \theta) > 0$).*

We can finally study the role of the helping-hand regulator. To allow for comparison, again we sterilize the effect of local regulation on local tax by assuming that the utility function of agents is log-linear, i.e., $U(C, G) = \alpha \ln C + (1 - \alpha) \ln G$, where α is the specific domestic preference for private consumption. The optimal commodity tax rate becomes $\tau_0 = 1/\alpha$ and the utility $V(C_0) = \ln C_0 + \ln [\alpha^\alpha (1 - \alpha)^{1-\alpha}]$. The foreign country has similar characteristics.

Here, we need to be more specific about the production side of regulation. We assume that the delivery probability θ is equal to $\theta \equiv 1 - \beta f_0/f$, where f_0 again is the physical fixed cost of entry and $\beta > 0$ is a regulation efficiency parameter. This probability increases with stronger control, which raises setup costs. This implies that $\theta \equiv 1 - \varphi n$ where $\varphi \equiv \beta \sigma f_0$. This set of assumptions imposes that $n < 1/\varphi$, which holds if β is chosen to be sufficiently low.

The domestic regulator therefore chooses the regulatory level that maximizes local consumers utility $V(C_0)$ where $C_0 = C_0(n, n^*, \theta, \theta^*)$. This amounts to choosing the number of domestic firms n under the constraint $\theta = 1 - \varphi n$. The first-order condition with respect to n can be written as

$$V'(C_0) \left(\frac{\partial C_0}{\partial n} + \frac{\partial C_0}{\partial \theta} \frac{d\theta}{dn} \right) = 0$$

or equivalently since $V' > 0$,

$$\frac{\partial \ln C_0}{\partial \ln n} + \frac{\partial \ln C_0}{\partial \ln \theta} \frac{d \ln \theta}{d \ln n} = 0$$

The helping-hand regulator chooses the regulation level that balances the effect on local consumption of increases in product diversity and entry (first term) and in product market safety (second term). Because of symmetric countries, the equilibrium is given by $n = n^* \equiv \bar{n}$ where

$$\bar{n} = \frac{1}{\varphi} \left(\frac{1}{\sigma + 1} + \frac{\sigma^2 (\sigma - 1) \xi}{(\sigma + 1) (\sigma + 2\sigma^2 - \sigma\xi + \sigma^2\xi - 1)} \right)$$

which falls with a more negative ξ . At equilibrium, we get

$$\frac{dn}{dn^*} = \frac{(-\xi) (\sigma - 1) \sigma^2 [(2\sigma - 1)^2 - (1 - \sigma) \xi]}{2 (\sigma + 1) (2\sigma - 1)^3 + \sigma (\sigma + 4) (\sigma - 1) (2\sigma - 1)^2 \xi + \sigma^2 (4\sigma - 3) (\sigma - 1)^2 \xi^2} \quad (24)$$

which is positive because the numerator and denominators are positive for $\xi \in [-1/(\sigma - 1), 0)$. Regulation is therefore a strategic complement for $\xi < 0$.

Proposition 5 *Suppose helping-hand regulators and symmetric risks of delivery failures. Then, regulation policies are strategic complements for $\xi < 0$ and independent instruments for $\xi = 0$.*

Proof. See Appendix B. ■

Consider the case where the consumer and the helping-hand regulator put no value on product diversity. Then, what matters again is the terms of trade. When the foreign regulator relaxes his regulation intensity, more foreign firms enter and more delivery problems occur. Yet, foreign production increases and puts an upward pressure on foreign wages and prices (because $\frac{d}{dn} (n\theta^\sigma) > 0$). The domestic terms of trade W/W^* deteriorate, reduce the home purchasing power, C_0 , and increase the marginal purchasing power resulting from additional local varieties. The domestic regulator then has an incentive to relax domestic regulation to restore his country's international competitiveness. More domestic firms enter while the terms of trade are restored and the purchasing power of local consumers rises. Regulatory decisions are thus strategic complements. By contrast, when the consumer and the helping-hand regulator put a high value on product diversity, they are better off when the foreign regulator relaxes his regulation intensity because this raises world product diversity. At home, the marginal value for additional product variety falls so that the regulator is enticed to cut down on local product diversity to improve local good safety. In the case of Dixit-Stiglitz preferences, the latter effect exactly balances the former, so that the regulator sets an independent regulation level given by $n = 1/(1 + \varphi)$.

To sum up, the theoretical setup suggests three facts: (i) commodity taxes are independent instruments under the destination principle, (ii) governments lower commodity tax rates if regulation becomes stricter provided individual demand is more elastic for public

goods, and finally (iii) regulation policies are strategic complement instruments if consumers do not excessively value product diversity, whenever regulators are bureaucrats or helping-hand. The presumption about Wagner's law and the estimated value of the love for variety support the view that weaker regulation leads to a rise in the commodity tax and that regulation policies are strategic complements.

Before examining these points empirically, we would like to discuss the robustness and limitations of our results. As presented above, Propositions 1, 2 and 4 hold in a general equilibrium framework for quite standard preference specifications, numerous firms, free entry and taxes used for public services. As mentioned above, the independence of tax responses under the destination principle applies to other product market structures.¹⁶ It can further be shown that these propositions apply in the presence of heterogeneous country sizes, trade costs and many symmetric countries.¹⁷ Our analysis in Propositions 2 and 4 would nevertheless deserve more care if consumers' demand and public agencies' input demand had very divergent patterns. Finally, it can be shown that our results also apply to multiple countries when they are symmetric. The behavior of the commodity tax is nevertheless unclear in the case of many asymmetric countries and firms' spatial mobility.

A final remark is in order. It is possible to show that the results encompassed in Proposition 3 and Proposition 5 apply for less specific preferences of regulators but the analytical properties of those models become very difficult to be exposed. It can further be shown that these propositions also hold under trade costs, asymmetries in country sizes and many symmetric countries.¹⁸ Still, it is natural to wonder whether these properties hold for many countries and in particular in the presence of trade costs and firms' mobility (Behrens *et al.* [7]). As most of the literature, we do not address this limitation in this paper and extrapolate the properties of the two-country model to many countries in the following empirical analysis.

¹⁶This is the case for perfect competition, international monopolies, monopolistic competition and, under specific conditions, oligopolistic markets.

¹⁷Iceberg trade costs reduce the importance of foreign products in domestic consumption, but do not qualitatively change the terms of trade and firms' entry. Also, asymmetric country sizes lead to more firms entering the country with the larger labor supply. As expected, the latter has an advantage in terms of its per capita cost of public goods. This effect is well-known in public economics and would disappear if public goods were local and their production depended on population sizes.

¹⁸As stated in the last paragraph, iceberg trade costs do not alter the terms of trade and firms' entry, so that regulation has the same effect on them. Also, a larger labor supply in one country generates a bias in product diversity and terms of trade in favor of this country, but this bias is constant. As a result, product diversity and the terms of trade respond to the number of firms in the same way as in this text. Regulation policies have the same strategic complementarity properties.

5 Empirical Evidence

5.1 Empirical Strategy

In this section, we estimate the direction of the forces described in the theoretical setup using data on product market regulation and consumption taxation. We consider an empirical model in which tax and regulation decisions are sequentially taken in a two-stage game.

The link between taxation and regulation is determined by countries' best reply functions obtained in the second-stage game and solving equation (17). Our first empirical specification linearizes the best responses in commodity taxes and extends them to many countries and time periods:

$$\tau_{it} = \sum_{j \neq i} \alpha_{ij} \tau_{jt} + \beta z_{it-1} + \boldsymbol{\gamma}' \mathbf{x}_{it} + d_i + e_t + u_{it}, \quad (25)$$

where $i = 1, \dots, I$ and $t = 1, \dots, T$ denote countries and time-periods. The variable τ_{it} is our observation of the commodity tax rate set under the destination principle, while the variable z_{it} is our observation of the regulation level in country i at time t . $\mathbf{x}_{it}$ is the vector of country i 's relevant characteristics including factors describing national consumption patterns (a bold character and a prime ' denote a vector and its transpose). Variables d_i and e_t are country and time dummies, while u_{it} is the error term. Coefficients α_{ij} measure how country i 's commodity tax responds to the commodity tax in other countries $j \neq i$. Note that $\alpha_{ii} = 0$ by construction. This specification does not assume the origin or destination taxation principle. A significant zero value for α_{ij} , $i \neq j$, would provide evidence of the absence of strategic interactions and therefore confirm our theoretical analysis, as well as previous studies on the destination principle of commodity taxation (see Lockwood [40] for a synthesis). Coefficient β describes how country i 's tax policy reacts to its own product market regulation z_{it-1} , with a one-year lag to reflect difficulties encountered in restructuring regulatory processes.¹⁹ According to our theoretical model, a significant negative value for β would indicate that the government uses commodity taxes to mitigate the negative impact of regulation on consumers' welfare. Finally, $\boldsymbol{\gamma}$ is the vector of coefficients of country i 's characteristics and we omit the coefficients of dummies for expositional purposes.

In the first stage of the theoretical model, regulators choose their regulatory pressure. Our second empirical specification linearizes and generalizes regulators' best responses (see Propositions 3 and 5) for multiple countries and periods as follows:

$$z_{it} = \sum_{j \neq i} \delta_{ij} z_{jt} + \boldsymbol{\zeta}' \mathbf{y}_{it} + d_i + e_t + v_{it}, \quad (26)$$

¹⁹The idea that a product market reform takes at least one year to be implemented is consistent with descriptive evidence for OECD countries (see Conway *et al.* [17] and the World Bank's Doing Business reports [66]-[69]).

where coefficients δ_{ij} measure how z_i responds to z_j ($\delta_{ii} = 0$ by construction). A significant positive (resp. negative) value for δ_{ij} , $i \neq j$, would indicate that country i 's regulation policy is a strategic complement (resp. substitute) of country j 's regulation. The equation includes a vector of country-specific factors $\mathbf{y}_{it}$ that measure national patterns of public and private consumption as well as regulators' behaviors. $\boldsymbol{\zeta}$ is the vector of coefficients of these factors. d_i and e_t are country and time dummies and v_{it} is the error term. Note that each regulator chooses his regulatory pressure anticipating and internalizing its effects on commodity taxes, so that taxes do not appear in the estimated model of regulators' responses.

Equations (25) and (26) show that country i accounts simultaneously for all its partners' tax and regulation policies when it chooses its tax and regulation levels τ_{it} and z_{it} . The number of the $2I(I-1)$ strategic interactions included in parameters α_{ij} and δ_{ij} is too large to permit identification. As in Brueckner [11], the econometric approach is to assume that country i responds to an average of its *trade partners*' policies. Denoting τ_{-it} and z_{-it} such average tax and regulation levels anticipated by country i at time t , we write

$$\tau_{it} = \alpha\tau_{-it} + \beta z_{it-1} + \boldsymbol{\gamma}'\mathbf{x}_{it} + d_i + e_t + u_{it}, \quad (27)$$

$$z_{it} = \delta z_{-it} + \boldsymbol{\zeta}'\mathbf{y}_{it} + d_i + e_t + v_{it} \quad (28)$$

where coefficients α and δ measure the intensity of a country's response to its trade partners' average tax and regulation policies. Coefficient β measures the response of government i 's tax policy to the level of local product market regulation.

The OLS estimates of α and δ are consistent in equations (27) and (28) only if errors u_{it} and v_{it} have zero expectation and do not correlate with the regressors of these two models. However, there are a number of reasons why these conditions are not fulfilled. First, there is a simultaneous determination of taxes in equation (27) and of regulation in equation (28).²⁰ Second, it is reasonable to suspect reverse causality issues because trade partners' policies react to each of country i 's policies. Third, the regressors for country i 's average policy measures, τ_{-it} and z_{-it} , include the tax and regulation behaviors of its trade partner j . This creates Manski's [42] contextual effects, in which observed spatial characteristics appear in the error terms and invalidate OLS estimations. Finally, country i 's tax and regulation policies are affected not only by the unobserved factors stemming from its constituencies, but also by the unobserved characteristics arising from its trade partners. The latter omitted factors are denoted by Manski [42] as correlated effects. They can relate to asymmetric economic shocks (e.g. economic and financial turmoil in Europe, following the German unification), multilateral trade agreements (e.g. NAFTA, Uruguay Round) or policy recommendations by supranational organizations (e.g. IMF, World Bank, or OECD).

²⁰For expositional simplicity, and as our baseline estimates refer to the estimation of (27) and (28) as single-equation models, in this section we do not discuss the joint determination of tax and regulation. This issue of simultaneity will be discussed in Section 5.4, below.

They may influence the efficiency of trade partners' tax systems and/or may be a cause of co-movements in product market regulations. See Appendix C for a formal discussion of these effects.

Similarly, some endogeneity issues make the OLS estimates of β biased and inconsistent in equation (27). Local regulation may indeed not be independent from the error term in the tax response function (27) (i.e. $\text{Cov}[z_{it-1}, u_{it}] \neq 0$). First, there is a reverse causality issue. Governments may have regulated their product markets in response to local commodity taxes in previous time periods. Since product market regulation and commodity taxes are very persistent institutions, past commodity tax policies may affect current regulatory decisions. Second, product market regulations and commodity taxes may be a part of broader policy packages. There could be a simultaneity problem for example if governments designed 5-year plans that implement simultaneous increases in the commodity tax and regulation. Also, an omitted variable bias would emerge if the unobserved policy package included both an increase in product market regulation and a change in fiscal measures which increases commodity taxes.

To address the endogeneity of τ_{-it} and z_{it-1} in equation (27) and z_{-it} in equation (28) we specify an appropriate weighting matrix to build the average policy measures for trade partners, and estimate these equations using instrumental variables (IV).

We construct a weighting matrix that imposes an exogenous structure on the interaction coefficients α and δ (Brueckner [11]). This can be done by assuming

$$\tau_{-it} = \boldsymbol{\omega}'_i \boldsymbol{\tau}_t \quad \text{and} \quad z_{-it} = \boldsymbol{\omega}'_i \mathbf{z}_t$$

where $\boldsymbol{\tau}_t$ and $\mathbf{z}_t$ are the vectors of countries' tax and regulation levels $[\tau_{1t}, \tau_{2t}, \dots, \tau_{It}]'$ and $[z_{1t}, z_{2t}, \dots, z_{It}]'$ and $\boldsymbol{\omega}_i$ is a vector of exogenous spatial weights $[\omega_{i1}, \omega_{i2}, \dots, \omega_{iI}]'$ that satisfy $\omega_{ii} = 0$, $\omega_{ij} \geq 0$ for $i \neq j$ and $\sum_{j \neq i} \omega_{ij} = 1$. The weights $\boldsymbol{\omega}_i$ must be chosen in order to introduce exogenous cross-sectional heterogeneity in spatial interactions and attenuate the endogeneity issues described above. The spatial econometrics literature offers an extensive discussion of the appropriate weights in spatial settings. The choice of the weighting structure critically depends on the nature of strategic interactions α_{ij} and δ_{ij} under investigation (see Brueckner [11]). In this paper, the spatial weights will proxy the structure of international trade flows because the latter are the main channel through which interactions in the commodity tax and regulation occur in our theoretical analysis.

In the construction of the weighting matrix, we make sure to exclude any spurious effects of tax or regulation policies on the weights, which may bias the estimated coefficients in equations (27) and (28).²¹ Thus, we construct the weights ω_{ij} as a function of country i 's "structural propensity to import" from country j . In particular, we project trade flows from

²¹For example, strategic interactions between trade partners' tax policies can have a direct effect on the weighting matrix, through the size of trade flows. Also, product market regulations in specific sectors

an augmented gravity equation that predicts country i 's imports (logs) ten years before the start of the sample of observations (i.e. in 1980) as a function of countries' 'monadic' characteristics (log of population and GDP) and time invariant 'dyadic' characteristics (distance and common border, legal origins, colonial relationship or language with trade partners, etc., as in Head, Mayer and Ries [31]).²² Following our theoretical approach, we focus on the destination principle and exclude goods that are likely to be subject to the origin principle and/or cause cross-border shopping. See Appendix D for details.²³

We estimate equations (27) and (28) using instrumental variables (IV). To obtain consistent estimates of α , β , and δ , the IV approach should be performed without imposing too restrictive assumptions on the structure of unobservables and exploiting sources of exogenous variations in countries' tax and regulation policies.²⁴

We propose to build an instrument for τ_{-it} using information on the adoption of the value added tax (VAT) system in OECD countries. We consider the vector $\mathbf{vat}_t = [vat_{1t}, vat_{2t}, \dots, vat_{It}]'$ such that $vat_{it} = 1$ if country i implements a VAT system of commodity taxation at time t and $vat_{it} = 0$ otherwise. The proposed instrument is the expected adoption amongst trade partners

$$vat_{-it} = \boldsymbol{\omega}'_i \mathbf{vat}_t \quad (29)$$

First, to be a good instrument for τ_{-it} in equation (27), vat_{-it} has to have a clear effect on τ_{-it} . It is indeed widely acknowledged that VAT-based systems are more efficient than general sales tax or consumption-based tax systems because they enhance tax compliance, avoid double marginalization and induce higher tax rates on consumption (OECD Consumption Tax Trends [49], Kato [35]). Therefore, commodity taxes are likely to respond to the

(e.g. energy, transport, or postal services) can have a direct effect on the weights, through international transportation costs.

²²Notice that this approach allows us to specify heterogeneous trade relationships in a parsimonious way, which preserves the exogeneity of the weighting matrix. For example, the weights account for the fact that a country that belongs to the European Union may have stronger links with other EU countries, relative to non-EU ones, as EU countries are closer, and have common legal and colonial origins. In a similar vein, the weights account for heterogeneous effects inside the EU: trade relationships are stronger between EU countries that share French legal origins (Belgium, Spain, France, Greece, Italy, the Netherlands, and Portugal) and between countries that share Germanic legal origins, or the German language (Austria and Germany).

²³Our approach differs from the existing empirical literature on commodity tax competition. While we focus on destination-based commodity taxation, previous papers highlight governments' strategic interaction in origin-based commodity taxation and use contiguity weights (see Lockwood and Migali [41] and Devereux, Lockwood and Redoano [18]).

²⁴The spatial competition literature uses the IV approach and assumes away Manski's contextual effects (see e.g. Jacobs *et al.* [34]). As a consequence, $\mathbf{x}_{-it}$ and $\mathbf{y}_{-it}$ can be considered as valid instruments for τ_{-it} and z_{-it} in equations (27) and (28), respectively.

adoption of VAT systems. Second, vat_{-it} is a valid instrument if it satisfies the exclusion restriction $Cov(vat_{-it}, \tau_{it}) = 0$ (see Appendix C). This exclusion restriction is valid under two conditions. The first condition is that trade partners' adoption vat_{-it} must not vary in a systematic way with local commodity taxes τ_{it} . We claim that this condition holds for two main reasons. On the one hand, the introduction of a VAT system during our period of analysis occurs only in four countries: Switzerland, Australia, Finland and Canada. In these countries, the political discussion of this issue took a long time (e.g. in Australia) so that the timing of the decision and the implementation of their VAT systems can be considered as independent from each other (Kato [35]). This viewpoint is confirmed by the fact that these reforms almost span the whole sample period (from 1991 in Canada to 2001 in Australia).²⁵ These arguments support the idea that the timing of the introduction of VAT in each country is not due to responses to common unobserved shocks or supranational directives. On the other hand, these countries have very limited trade relationships with each other and a very strong heterogeneity in their import compositions (See Table D-2, in the Appendix). This also supports the view that there are no network effects in the introduction of their VAT systems. The second condition for the validity of the exclusion restriction is that vat_{-it} must not have any direct effect on τ_{it} . This condition is guaranteed by the cross-border neutrality of VAT, which is explicitly stated in the international guidelines (see OECD [52]). Under this principle, the introduction of a VAT system in a country's trade partner has no efficiency effect for this country's commodity taxes.

We also propose to build instruments for z_{it} in equation (27) and z_{-it} in equation (28) from two indicators of "interpersonal distrust" $distrust_{it}$ and "demand for order" $order_{it}$. As above, we also construct instruments for trade partners' averages as $distrust_{-it} = \omega'_i \mathbf{distrust}_t$ and $order_{-it} = \omega'_i \mathbf{order}_t$. Aghion *et al.* [1], Pinotti [58], and Inglehart [33] argue that demand for regulation mainly stems from distrust and need for social order, which, in particular, allows citizens to enjoy safe consumption and restricts uncertainties in market transactions. Accordingly, these instruments have a clear effect on regulation levels z_{it} and z_{-it} . To be valid instruments for z_{it} in equation (27), these indicators must satisfy the exclusion restrictions $Cov(distrust_{it}, \tau_{it}) = 0$ and $Cov(order_{it}, \tau_{it}) = 0$. A priori, interpersonal distrust and demand for order can be considered as independent from commodity taxes. However, interpersonal distrust is a common measure of unciviness (Algan and Cahuc [2]), which obviously decreases the motivation to pay taxes. In addition, Knack and Keefer [37] and Algan and Cahuc [3] show that interpersonal distrust has persistent effects on growth, and thus on income. Inglehart [33] suggests that demand for order is related to a materialis-

²⁵This implies that vat_{-it} does not exhibit time variation for the period 2002 – 2008. However, as it will become clearer below, one of our indicators of regulation is available only for this period. Accordingly, for estimates using this indicator we will have to use instruments proposed by the existing literature on tax competition (Jacobs *et al.* [34] and Lockwood and Migali [41]).

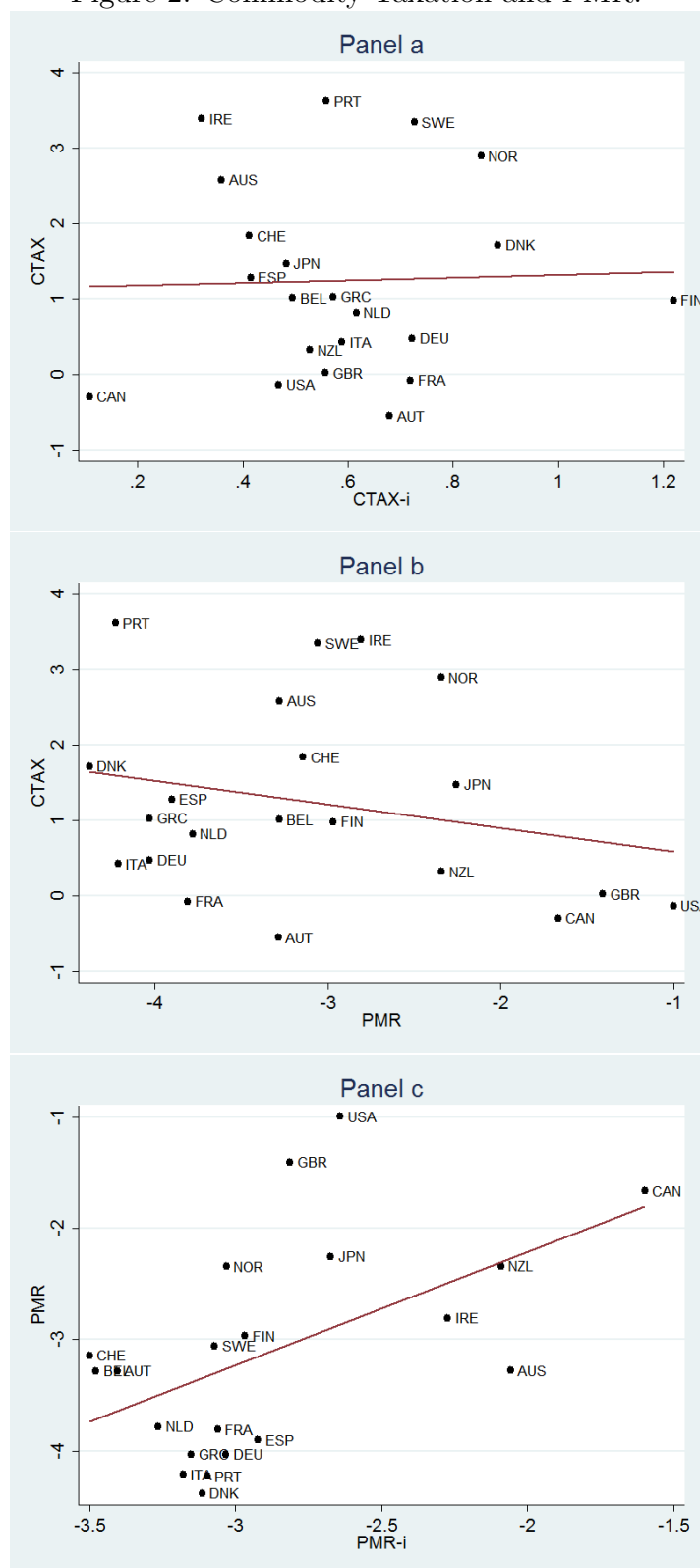
tic attitude, individual effort, and therefore income. Since income affects citizens' marginal utilities of consumption, it is also likely to impact the propensity to pay taxes. Yet, Algan and Cahuc [3] and Bjornskov [13] show that these features are rooted in each country's culture and can be considered as time invariant. As a result, the direct effects of interpersonal distrust and demand for order on taxes can be wiped out by including country fixed effects in the first stage of 2SLS. Last, the indicators for trade partners' groups $distrust_{-it}$ and $order_{-it}$ are valid instruments for z_{it} in equation (28) under the condition that they satisfy the exclusion restrictions $Cov(distrust_{-it}, z_{it}) = 0$ and $Cov(order_{-it}, z_{it}) = 0$. In our view, interpersonal distrust and demand for order in other countries can be considered as independent from local regulation. When a specific unobserved shock like a political scandal hits a trade partner of country i , it raises distrust and demand for order there, but not in country i . In addition, when a common unobserved shock hits both country i and its trade partners, the effect on distrust and demand for order are country specific and independent from z_{it} . It is also natural to exclude direct effects of trade partners' preferences on local regulation because local regulatory systems are designed to respond to local preferences but not to foreign ones. The absence of direct effects is even more evident if one considers that interpersonal distrust and materialistic attitudes have persistent effects on economic growth (see the authors mentioned above). In this case, interpersonal distrust and materialistic attitudes in trade partner countries may proxy unobserved economic performances in these countries, which could correlate with local regulation. However, as said before, these effects are time invariant and are accounted for by introducing country fixed effects. Conversely, time-varying distrust and materialistic attitudes do not enter directly as inputs into production processes.

5.2 Data and Descriptive Statistics

We exploit a unique data set that combines information about product market regulation, consumption taxation, institutional characteristics and social preferences for 21 OECD countries over the 1990-2008 period.²⁶ We proxy the commodity tax rate τ_i by the average effective tax rate on consumption, which measures each country's tax revenues as a percentage of the total value of its consumption (see Carey and Rabesona [14]). To focus on the destination principle, we only include the sales and value added taxes in our definition of commodity taxes (*CTAX*). In other words, we exclude excise taxes, customs and import duties, profits from public monopolies and taxes in specific services, whose revenues may

²⁶The countries we consider are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States. Appendix E describes the data sources and the construction of variables. It further presents our control variables and/or the variables used in our robustness checks.

Figure 2: Commodity Taxation and PMR.



Notes: Commodity taxes are measured by average effective tax rates. PMR is measured by the ETCR index. Differences between country averages over the periods 2004-2008 and 1990-1994. Authors' calculation on OECD data.

partly reflect the application of the origin principle to consumers' transactions.²⁷ We use two empirical proxies for Product Market Regulation (*PMR*), z . Our first measure is the "low-level" index of Energy, Transport and Communication Regulation indicator (ETCR) constructed by Conway and Nicoletti [17]. On a scale between 0 and 6, this index aggregates a set of qualitative and quantitative information on entry barriers (fixed costs) in seven non-manufacturing industries (electricity, gas, air passenger transport, rail transport, road freight and postal services).²⁸ Our second measure for regulation is the number of days that are necessary to start up a new business (see Djankov *et al.* [20]). It applies to the whole economy but is unfortunately available for a short time period (2002-2008).²⁹ The correlation coefficient between the two measures is equal to 0.50 and significant at the 1% level. The average commodity tax and product market regulation levels for country i 's trade partners ($CTAX_{-i}$, PMR_{-i}) are obtained by weighting trade partners according to the weights ω_{ij} presented in the previous section.

Figure 2 presents the relationships between our main variables in differences between their averages in the final and initial periods (resp., 2004-08 and 1990-94). Only the ETCR measure is presented for market regulation because it spans the whole sample period. Panel *a* plots $CTAX$ against $CTAX_{-i}$. In this panel, country observations scatter over their whole range but the fitted line is rather flat. This suggests that each country's commodity tax is not correlated with its trade partners' average commodity tax. Panel *b* plots $CTAX$ against PMR . It suggests a negative correlation between changes in taxes and product market regulation: a first group of countries incurred a fall in PMR by more than 3.5 points and increased their effective tax rates during the sample period. A second group of countries have a deregulation pace which is very close to the OECD median, and also increased their effective tax rates. Conversely, a third group of countries experienced a decrease in PMR of less than 2 points, and did not increase their effective tax rates.³⁰ Also, notice that Spain,

²⁷By contrast, existing studies adopt definitions of commodity taxes which (at least partly) reflect the application of the origin principle. For instance, Egger *et al.* [22] compute the average effective tax rate on consumption value, which accounts for excise taxes, customs and import duties, profits from fiscal monopolies and taxes in specific services. Devereux *et al.* [18] and Lockwood and Migali [41] focus on excise taxes.

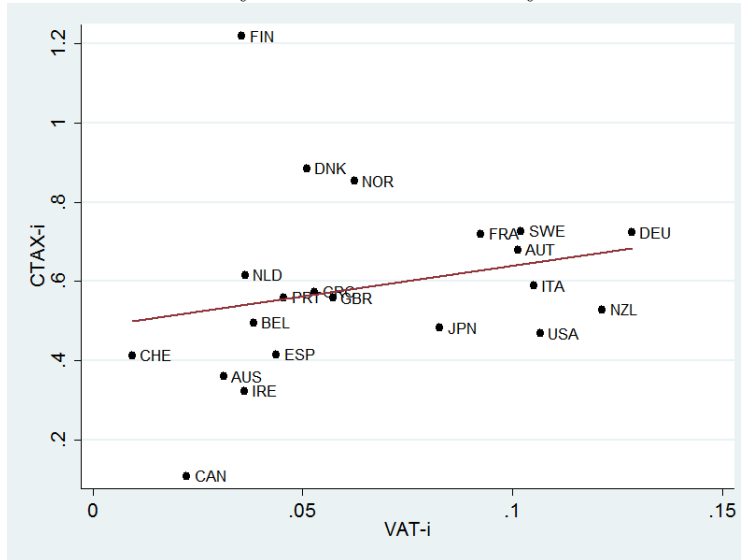
²⁸Conway and Nicoletti [17] construct the "low-level" ETCR index for each type of regulation (entry barriers, public ownership, and vertical integration) and the "aggregate" ETCR index as a weighted average of these "low-level" indicators.

²⁹The World Bank's Doing Business data include country-level observations for the 2003-2008 period. However we use the 1998 value computed by Djankov *et al.* [20] as a basis to extrapolate the country-level values for 2002.

³⁰The first group includes the EU countries that were heavily regulated until 1995 and accelerated their reforms after the EU deregulation directives, with the exception of France (see Conway and Nicoletti, [17]). The second group includes countries that started their reform efforts in the mid-eighties (i.e. Sweden, Finland, Norway and Australia) or after 1995 (i.e. Austria, Belgium, and Switzerland). The third group includes the USA, the UK and Canada. These countries had undergone important deregulation waves

Portugal, Japan, and later, Switzerland and Australia, raised their effective tax rates, which also reflects the introduction and consolidation of a VAT system (see OECD [49]). Panel *c* plots PMR against PMR_{-i} . It displays a positive correlation between the two variables, which is consistent with the view that a country is more likely to deregulate when its trade partners deregulate.

Figure 3: Introduction of a VAT system and commodity taxes in trade partner countries



Notes: Differences between country averages over the periods 2004-2008 and 1990-1994.

Authors' calculation on OECD data.

We now turn to the description of the variables we use as instruments. To instrument $CTAX_{-i}$ in equation (27), we exploit the variation associated with the introduction of a VAT system in trade partner countries. We construct a dummy variable equal to 1 if a VAT system is at work in country i at time t and zero otherwise. We then apply the weights ω_{ij} and construct a weighted average VAT_{-i} , which displays both cross-sectional and time variation. (Table F-1 in Appendix F reports the mean and standard deviation of VAT_{-i} by country). Figure 3 plots $CTAX_{-i}$ against VAT_{-i} , taking variables in differences between the averages in the 2004-2008 and 1990-1994 periods. The figure shows that VAT_{-i} is positively correlated with $CTAX_{-i}$. This suggests that the introduction of a VAT system in each trade partner country induces an increase in the commodity tax rate there. This is consistent with the view that VAT systems are more efficient than general sales tax or consumption-based tax systems (OECD Consumption Tax Trends [49], Kato [35]).

To instrument PMR in equation (27), and PMR_{-i} in equation (28), we construct two measures of the demand for regulation in each country using the last four waves of the *World Value Survey* (WVS) and the last three waves of the *European Value Study* (EVS). The first measure is the percentage of respondents who answer ‘*Can’t be too careful*’ to the question: before the 1990s and entered the sample period with a low level of product market regulation.

‘Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?’. The second measure is the percentage of individuals who respond ‘maintaining order in nation’ to the question: ‘There is a lot of talk these days about what the aims of this country should be for the next ten years, ... If you had to choose, which of the things on this card would you say is most important?’ We take the averages by country over the 1990-1994, 1995-1999, 2000-2004 and 2005-2008 periods. In this way, we obtain two time-varying measures of demand for regulation.³¹

Aghion *et al.* [1] and Pinotti [58] argue that a high share of distrustful individuals in a country creates social support for stronger local regulation policies to reduce negative externalities caused by untrustworthy agents. Inglehart [33] shows that high demand for order in a country creates social support for local regulation policies that guarantee order, physical safety and economic security. To check whether these correlations are present in our data, Figure 4 plots *PMR* against both the indicators of distrust (Panel *a*) and demand for order (Panel *b*). Variables are taken again in differences between their averages in the 2004-2008 and 1990-1994 periods. The two figures confirm a positive correlation between *PMR* and our measures of demand for regulation. The two correlations are significant at the 1% level. To check whether variation in demand for regulation over time is driven by some common trend across countries, Panel *c* plots the percentages of individuals who demand order and those who do not trust other people, in differences between the final and initial period averages. The dashed lines denote the sample medians of the changes in the two measures between 1990 and 2008. If there was any common trend in demand for regulation across countries, the country specific combinations of distrust and demand of order would place all countries very close to the OECD median. However, Figure 4 Panel *c* shows that country observations are dispersed in the four quadrants of the figure. This highlights heterogeneity in country behaviors and the absence of common trends in demand for regulation. In the top right quadrant of Panel *c*, we find countries that have experienced a higher demand for order due to social, political and economic unrest (e.g. Finland and Belgium)³² or a significant increase in distrust stemming from rising inequalities (e.g. Ireland) and the fears of terrorism (e.g. 9/11 in the USA and 7/7 in the UK). The

³¹WVS and EVS data consist of fully comparable survey waves. Under the assumption that demand for regulation has a persistent component that makes its evolution over time very slow, each wave provides the description of social attitudes in each country over the years covered. In other words, it can be assumed that social preferences for regulation change between two waves, while remaining constant within each wave. (See Appendix E for details).

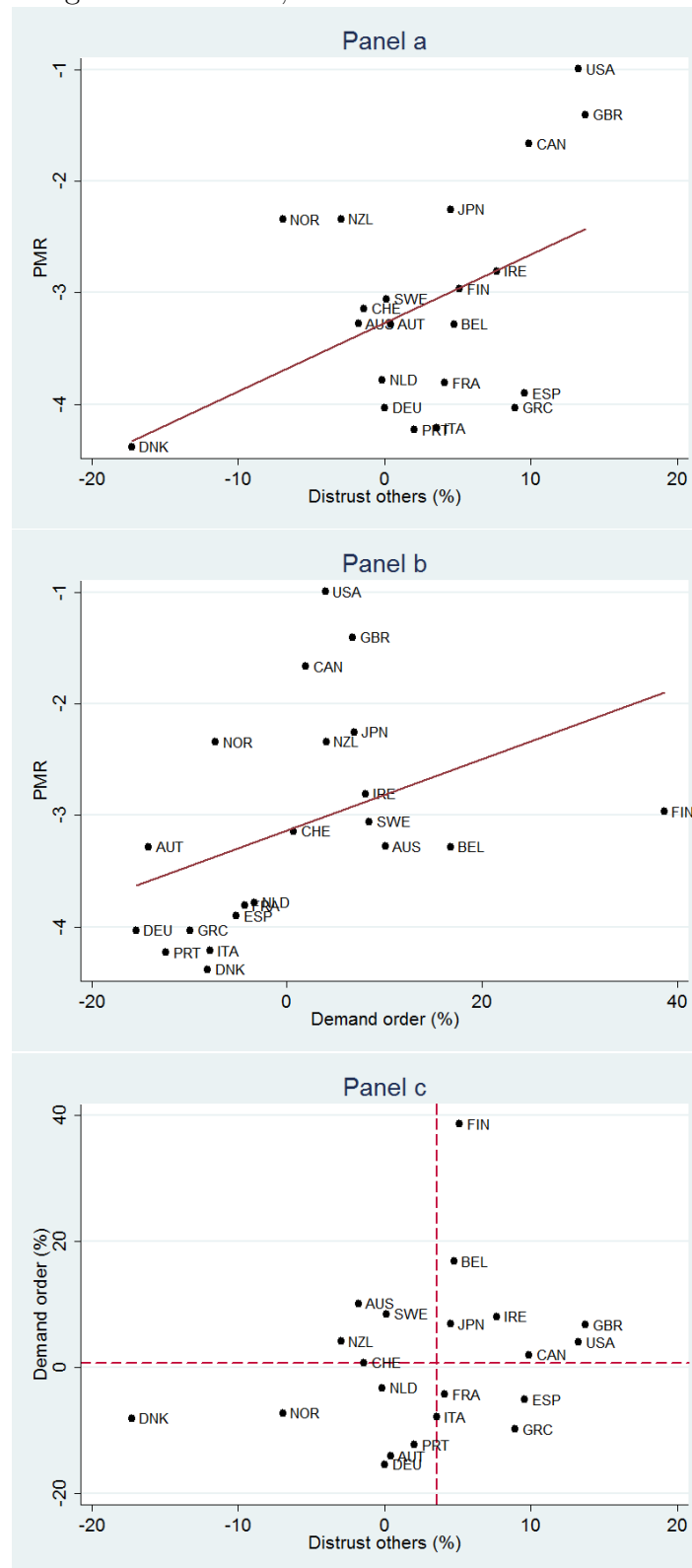
³²At the end of the 1980s, social unrest increased in Finland and Sweden due to the rise of social equality movements and the contrast between Swedish majority and minority groups. Furthermore, the collapse of the Soviet Union and the ensuing great economic depression of the first half of the 1990s increased the demand for social, political and economic stabilization. Similarly, in Belgium, demand for order increased as a consequence of serial crime episodes and the dioxin food crisis during the mid 1990s.

top left quadrant displays countries where the political inertia and economic depression at the beginning of the 1990s raised the demand for order and where the ensuing political reforms in the late 1990s increased general trust levels (e.g. Australia and New Zealand).³³ The bottom left panel presents countries that experienced successful welfare and workfare reforms inspired by the “flexicurity” principle in the 1990s (e.g. Denmark, Norway and Germany. See Algan and Cahuc [2]). Finally, the bottom right panel includes countries that faced the resurgence of nationalism and political scandals during the 1990s, while their mediocre economic performance boosted public support for more freedom and autonomy in the private sector (e.g. Italy, Greece and Spain).³⁴ It readily follows from these arguments that the change in distrust and demand for order in each country during this time period was the result of country-specific exogenous shocks. Even if some shocks hit more countries at the same time, their effects on social distrust and demand for order can be considered as specific to each country and therefore not spatially correlated.

³³At the beginning of the 1990s, Australia had very low levels of trust mostly driven by political inertia and economic depression. The increase in trust is probably related to the election of a new liberal government that launched successful waves of liberalization and structural reforms. A somehow similar path was experienced by New Zealand where, up to the early 1990s, national governments carried out reforms that might not have reflected the mood of the electorate. The rising level of trust in the 2000s seems to reflect the success of the referendum to change the electoral system to a mixed proportional representation, which led to an effective change in political representation in the country. (See Castels and Mitchell [16])

³⁴It is generally acknowledged that the ‘shock’ that triggered the resurgence of distrust in these countries during the 90s was the fall of the Communist regime in Russia and Eastern Europe. Furthermore, the fall of the Communist system and the Yugoslav Wars fostered fear and opposition to rising immigration. Immigrants have been often perceived as ‘dangerous’ to national communities and led to the election of governments supported by extreme right and nationalist parties (see European Commission [12]). In Italy, the increase in distrust and demand for freedom and autonomy was also triggered by the “Mani Pulite” political scandal.

Figure 4: Distrust, demand for order and PMR.



Notes: Differences between country averages over the periods 2004-2008 and 1990-1994.
 Authors' calculation on EVS/WVS data.

Table 1: Commodity tax and regulation regulation response functions

	[1] OLS	[2] OLS FE	[3] 2SLS FE	[4] OLS	[5] OLS FE	[6] 2SLS FE
Panel a: Commodity tax response						
CTAX _{-i}	0.79*** (0.11)	-0.56 (0.41)	-1.05 (1.25)	0.86*** (0.14)	-0.61** (0.30)	1.12 (0.98)
PMR (days to start up)	0.01 (0.01)	-0.00 (0.00)	-0.07*** (0.02)			
PMR (ETCR)				-0.36*** (0.10)	-0.18*** (0.06)	-0.47** (0.21)
VAT				2.31*** (0.68)	0.73*** (0.20)	0.72*** (0.21)
Partial Rsq CTAX _{-i}	-	-	0.39	-	-	0.11
Partial Rsq PMR	-	-	0.06	-	-	0.11
K-P rk Wald F-stat	-	-	3.100	-	-	3.981
K-P rk LM-stat (p-value)	-	-	13.79 (0.03)	-	-	21.42 (0.00)
Hansen J-stat (p-value)	-	-	0.80 (0.67)	-	-	1.568 (0.21)
Panel b: Regulation response						
PMR _{-i} (days to start up)	0.67*** (0.19)	-0.28 (0.72)	2.58** (1.15)			
PMR _{-i} (ETCR)				1.05*** (0.05)	0.57*** (0.12)	0.46*** (0.11)
Preference for order (%)	0.92*** (0.24)	0.35 (0.41)	-0.06 (0.43)	0.02*** (0.00)	0.01 (0.01)	0.01 (0.01)
Distrust others (%)	0.23* (0.14)	0.44 (0.66)	0.66 (0.63)	0.03*** (0.00)	0.03*** (0.01)	0.03*** (0.01)
Partial Rsq PMR _{-i}	-	-	0.21	-	-	0.60
K-P rk Wald F-stat	-	-	12.55	-	-	78.25
K-P rk LM-stat (p-value)	-	-	21.91 (0.00)	-	-	149.8 (0.00)
Hansen J-stat (p-value)	-	-	0.012 (0.91)	-	-	0.03 (0.86)
Observations	146	146	146	390	390	390

Notes: Controls in all specifications are reported in Table F-2. In panel a CTAX_{-i} is instrumented by average government consumption, and average population in trade partners in Column [3] and VAT_{-i} Column [6]. PMR (lagged one year) is instrumented by preferences for order and distrust (lagged five years) in Column [3] and Column [6]. In panel b, PMR_{-i} is instrumented by five years lags of preferences for order and distrust in the trade partner in Columns [3] and [6], and instruments for CTAX_{-i} in Panel a are included in the vector of controls. Robust standard errors in parentheses. Significance levels: * : 10% ** : 5% *** : 1%.

5.3 Baseline Results

Table 1 reports our baseline estimates of the commodity tax response (27) and regulation response function (28). Product market regulation is measured by the days to start up a business in Columns [1]-[3]. As mentioned earlier, the variable for the days to start up a business measures the intensity of regulation in all sectors in the economy, which fits our theoretical model. However, because it is available only for the 2002-2008 time period, the asymptotic properties of the fixed-effect estimator are not guaranteed. The variable VAT_{-i} has no time variation in this period and cannot be used as an instrument for $CTAX_{-i}$. Thus, as Jacobs *et al.* [34] and Lockwood and Migali [41], we have to assume the absence of contextual effects and we use trade partners' average population and government expenditure on final consumption as instruments. In Columns [4]-[6], we use the ETCR measure. Its advantage is that it spans the whole period of our data set, so that the asymptotic properties of the fixed-effect estimator are guaranteed. Moreover, the variable VAT_{-i} can be used as an instrument for $CTAX_{-i}$, so that we can account for contextual effects. The disadvantage is that this measure is restricted to a subset of sectors and may not be a good predictor of the true variability of product market regulation across the sample.

Panel *a* reports our results for the commodity tax response function. We start with estimates based on the days to start up a business. Column [1] presents the OLS estimates. These show a positive coefficient of $CTAX_{-i}$, significant at the 1% level, while the coefficient of PMR is not significantly different from zero. Column [2] adds country fixed effects. The coefficient of $CTAX_{-i}$ becomes not significantly different from zero. It suggests that the coefficient of $CTAX_{-i}$ in Column [1] reflects time-invariant and spatially correlated unobserved characteristics related to Manski's correlated or contextual effects. These unobserved characteristics determine commodity taxes in both the domestic country and its trade partners, providing false evidence of strategic interaction. The coefficient of PMR remains not significantly different from zero. Column [3] presents the 2SLS estimates with population and government expenditure in consumption goods as instruments for $CTAX_{-i}$, and distrust and demand for order as instruments for PMR . Econometric tests confirm that the instruments are sufficiently correlated with the endogenous regressors in the first stage and provide valid exclusion restrictions in the second stage.³⁵ The coefficient of $CTAX_{-i}$ remains not significantly different from zero. The coefficient of PMR is now negative and significant at the 1% level, which suggests that the OLS estimates in Column [2] are upward biased (e.g. due to policy packages that simultaneously increase regulation and commodity taxes).

³⁵The Kleibergen-Paap rk Wald F-statistics is below the threshold of 10, which Staiger and Stock [61] propose as a rule of thumb to detect weak instruments. In the robustness analysis, we confirm this result in alternative specifications where the Wald F-statistics is above 10.

We now discuss the estimates based on the ETCR measure. The OLS estimates in Column [4] show a positive coefficient of $CTAX_{-i}$ and a negative significant coefficient of PMR , both significant at the 1% level. Column [5] adds fixed effects. The coefficient of $CTAX_{-i}$ then takes a negative sign, significant at the 5% level. The comparison with the positive coefficient of $CTAX_{-i}$ in the OLS estimates confirms that these are biased due to time-invariant and spatially correlated unobserved characteristics. The negative coefficient of PMR becomes smaller in size but remains significant. In Column [6], we present the 2SLS estimates. We now use VAT_{-i} as an instrument for $CTAX_{-i}$ and distrust and demand for order as instruments for PMR . With respect to the estimates based on the days to start up a business (Column [3]), the instruments are correlated with the endogenous regressors in the first stage and satisfy the exclusion restrictions in the second stage. The coefficient of $CTAX_{-i}$ is not significantly different from zero. This suggests that the negative coefficient of $CTAX_{-i}$ in Column [5] is false evidence of strategic interaction. This is explained by the economic turmoil that followed the reunification of Germany i.e. the crisis of the European Monetary System and the systemic banking crises in Finland, Sweden and France (Kovzanadze, [38]). Governments hit by these shocks simultaneously increased their spending without increasing their tax revenues, which is reflected by a spatially correlated decrease of effective tax rates. The coefficient of PMR is negative, significant at the 5% level, and again suggests that the OLS estimates in Column [5] are upward biased (as for Column [2]). Finally, notice that the positive significant coefficient of VAT in Columns [4]-[6] is consistent with the view that the introduction of a value-added system of commodity taxation increases the efficiency of commodity taxation, raising the effective tax rate on consumption by about 0.7 percentage points after the inclusion of country fixed effects.

Panel *b* reports the estimates of the regulation policy response function (28). As in Panel *a*, Columns [1]-[3] report the estimates of PMR based on the days to start up, while Columns [4]-[6] display those based on ETCR. Column [1] presents the OLS estimates and shows a positive coefficient of PMR_{-i} , significant at the 1% level. Column [2] includes country fixed effects. The coefficient of PMR_{-i} becomes not significantly different from zero. This suggests that the corresponding coefficient in Column [1] reflected time-invariant and spatially correlated unobserved characteristics that determine levels of product market regulations in trade partners (e.g. common legal origins). Column [3] presents the 2SLS estimates with average distrust and demand for order in trade partners as instruments for PMR_{-i} . Econometric tests confirm that the instruments are strongly correlated with the endogenous regressors in the first stage and provide valid exclusion restrictions in the second stage. The coefficient of PMR_{-i} becomes positive, large, and significant at the 5% level. Column [4] presents the OLS estimates based on the ETCR measure of PMR . The coefficient of PMR_{-i} is positive and significant at the 1% level. Column [5] displays the estimates with country fixed effects. The coefficient of PMR_{-i} is again positive and significant but

smaller in size, which confirms the role of time-invariant and spatially correlated unobserved characteristics. Finally, Column [6] reports the 2SLS estimates with average distrust and demand for order in trade partner countries as instruments for PMR_{-i} . The instruments are now strongly correlated with the endogenous regressors in the first stage and satisfy the exclusion restrictions in the second stage. The coefficient of PMR_{-i} is again positive, statistically significant and has a similar size to Column [5]. The coefficient is now lower than one, which ensures stationarity in the spatial lag model. Notice that the coefficients for the share of people who distrust others and demand order are significant when they take the expected positive sign.

It is instructive to discuss the economic magnitude of the effects of both local regulation on local commodity tax and of trade partners' regulation on local regulation. We use the 2SLS estimates in Column [6] and interpret the coefficient of PMR in terms of the days to start up a business. Over the 2002-2008 period, for which the ETCR and days to start up measures are both available, the two measures are strongly correlated and have standard deviations of 0.56 (on a scale of 0 to 6) and 20 (days), respectively. Thus, the number of days to start up a business corresponding to the standard deviation of ETCR over the 1990-2008 period (i.e., 1.49) can be approximated by $1.49 * 20 / 0.56 \approx 53$ (days). This is about one third of the decrease in the days to start up a business achieved during the 1990s' EU deregulation waves. Taken at face value, the 2SLS estimate in Panel *a* suggests that a deregulation wave that cuts 53 days to start up a business raises the effective commodity tax rate by $(-0.47 * -1.49 =) 0.70$ percentage points. The 2SLS estimate in Panel *b* also implies that a country will cut its days to start up a new business by $(53 * 0.46 / 1.49 \approx) 16$ days in response to a deregulation wave in trade partner countries that cut their days to start up by 53 days.³⁶

To sum up, the estimates in Table 1 point towards three main results. First, we find no evidence about strategic interaction in commodity taxation under the destination principle. Second, we establish a negative impact of product market regulations on the level of commodity taxes in a country. Finally, we uncover strategic complementarity in regulation policies between trade partners. The first result adds to the previous studies that document strategic complementarity in commodity taxation under the origin principle (Devereux *et al.* [18] and Lockwood and Migali [41]). In terms of our theoretical model, the second result provides indirect evidence that the demand for public goods is more sensitive to income

³⁶In the same way, the estimates in Table 1, Column [3] suggest that a deregulation wave that reduces the days to start up a business by 53 days in a country raises the local commodity tax rate by $(-0.07 * -53 \approx) 3.7$ percentage points and leads trade partner countries to deregulate by $(53 * 2.5 \approx) 137$ days, on average. However, these figures should be taken with care because of the weak asymptotic properties of the fixed-effect estimator and the absence of stationarity in the spatial lag model.

than the demand for private goods. This is in line with Wagner’s law, which implies that the development of an industrial economy is accompanied by an increased share of public expenditure in the gross national product (see Peacock and Wiseman, [55], for an application to the U.K.). The third result can also be interpreted in terms of our theoretical model as indirect evidence of a weak love for variety. This is consistent with empirical findings by Hummels and Klenow [32] and Ardelean [5].

In the next two sections, we perform a number of robustness checks on this set of results. For the reasons explained above, we select the specification based on the ETCR measure of product market regulation as a benchmark.

Table 2: Simultaneous equations models - domestic equations

	[1] SUR		[2] SUR, FE		[3] 3SLS, FE	
	CTAX	PMR	CTAX	PMR	CTAX	PMR
CTAX _{-i}	1.04*** (0.12)		-0.70*** (0.23)		0.41 (0.35)	
PMR	-0.50*** (0.10)		-0.23*** (0.06)		-0.28** (0.11)	
VAT	2.00*** (0.47)		0.82*** (0.15)		0.84*** (0.15)	
PMR _{-i}		1.16*** (0.04)		1.01*** (0.11)		0.98*** (0.11)
Preference for order (%)		0.01** (0.00)		0.01*** (0.00)		0.01** (0.00)
Distrust others (%)		0.03*** (0.00)		0.03*** (0.01)		0.03*** (0.00)
Observations	389	389	389	389	389	389

Notes: SUR and 3SLS estimates of four equations’ system with four endogenous variables (CTAX, PMR, CTAX_{-i}, PMR_{-i}). PMR are measured in seven non-manufacturing industries (ETCR). Only estimates for the domestic country are reported. Estimates for the average of trade partners are in Table F-3. Robust standard errors in parentheses. Significance levels: * : 10% ** : 5% ***: 1%.

5.4 Simultaneous Equation Models

Up to now, we have discussed the estimation of equations (27) and (28) as single-equation models. In this way, we overlooked the potential correlation between commodity tax and regulation decisions at the country level. In fact, the two equations (27) and (28) imply the simultaneous determination of local commodity tax and product market regulation in response to the average commodity tax and product market regulation in trade partners. In

addition, to include this in a general equilibrium framework, we consider the two-equation system featuring the converse joint determination of average commodity tax and product market regulation in trade partners as a function of local commodity tax and regulation. Accordingly, we now estimate a system of four equations.

As argued in Section 5.1, each domestic regulatory system is designed to respond to domestic preferences but not to foreign ones. For this reason, we assign the measures of domestic distrust and demand for order only to the domestic regulation PMR and the measures of trade partners' average distrust and demand for order to the trade partners' average regulation level PMR_{-i} . Similarly, the application of the destination principle guarantees that the introduction of VAT in a domestic country will affect its commodity tax rate but not the foreign ones. Thus, we assign VAT to the domestic commodity tax $CTAX$ and VAT_{-i} to the average commodity tax of trade partners, $CTAX_{-i}$.

For the sake of exposition, Table 2 only reports our results for the two domestic equations. Estimates for the average trade partners' equations are presented in Appendix F³⁷. Column [1] presents Seemingly Unrelated Regressions (SUR) that assume the exogeneity of all regressors but allow for correlated error terms across equations. Column [2] shows the SUR estimates with country fixed effects. Column [3] reports the Three-Stage Least Square (3SLS) estimates that use the above instruments to address the simultaneous determination of the variables PMR , PMR_{-i} , $CTAX$ and $CTAX_{-i}$. Under the assumption that these models are correctly specified, SUR and 3SLS estimates are asymptotically more efficient than OLS and 2SLS, respectively.

These results are consistent with those in Table 1. The SUR estimates display positive coefficients for both $CTAX_{-i}$ and PMR_{-i} , significant at the 1% level. The SUR estimates with country fixed effects show that the coefficient of $CTAX_{-i}$ becomes negative and significant at the 1% level. This again suggests false evidence of strategic tax interaction in the SUR estimates because of spatially correlated omitted variables. The coefficient of PMR_{-i} is positive and significant at the 1% level. In the 3SLS estimates, the coefficient of $CTAX_{-i}$ is not significantly different from zero, which suggests that the negative significant coefficient in Column [2] reflects the spatially correlated economic shocks in the early 1990s mentioned above. The coefficient of PMR_{-i} is positive and significant at the 1% level, which confirms the strategic complementarity in product market regulation. The estimated coefficient of PMR_{-i} is bigger than in the 2SLS estimate in Table 1, Column [6], while it still guarantees stationarity in the spatial lag model.

The estimated coefficients of VAT in Table 2 are similar to those in Table 1, Columns [4]-[6]. The estimated coefficients for distrust and demand for order are now always statistically significant and have the expected positive sign.

³⁷The estimated coefficients for the average trade partners' equations in Table F-3 are very similar to those reported in Table 2.

Table 3: Alternative weighting schemes

	[1] cultural weights	[2] legal weights	[3] neighborhood weights	[4] placebo weights
Panel a: Commodity tax response				
CTAX _{<i>i</i>}	−0.08 (0.52)	−0.15 (0.31)	0.84*** (0.30)	0.27 (0.21)
PMR	−0.70*** (0.20)	−0.75*** (0.22)	−0.11 (0.21)	−0.60*** (0.17)
K-P rk Wald F-stat	3.332	7.243	4.724	10.19
K-P rk LM-stat (p-value)	9.942 (0.07)	16.51 (0.00)	21.24 (0.00)	22.98 (0.00)
Hansen J-stat (p-value)	0.10 (0.74)	0.16 (0.71)	0.61 (0.44)	1.17 (0.28)
Panel b: Regulation response				
PMR _{<i>i</i>}	0.56*** (0.13)	0.64*** (0.11)	0.39*** (0.11)	−0.19* (0.12)
K-P rk Wald F-stat	20.22	75.68	29.56	26.93
K-P rk LM-stat (p-value)	34.98 (0.00)	63.61 (0.00)	42.89 (0.00)	38.61 (0.00)
Hansen J-stat (p-value)	5.171 (0.02)	0.058 (0.81)	7.853 (0.01)	1.49 (0.22)
Observations	390	390	390	390

Notes: 2SLS estimates with robust standard errors in parentheses. PMR are measured in seven non-manufacturing industries (ETCR). All specifications in panel a,b include the same set of controls as in Tables 1 and 2. Significance levels: * : 10% ** : 5% ***: 1%.

5.5 Alternative Weighting Schemes and Specifications

The weights ω_{ij} we used in the previous analysis are based on the import shares predicted by a gravity model, which accounts for contiguity in culture, legal origins and geographical location. As we explained earlier, the choice of these weights minimizes cross-border shopping effects. We now check the robustness of our results to the use of alternative weighting schemes.

Table 3 presents the robustness results for the 2SLS estimates. Column [1] reports estimates for weights based on the number of trade partner countries that share the same culture (language, religion and historical relationships). Column [2] uses weights based on the number of trade partner countries that share the same legal origins. Column [3] presents the case of neighborhood weights, which are typically used in empirical research focusing on cross-border shopping effects (Devereux *et al.* [18] and Lockwood and Migali [41]).³⁸ This column allows us to check the sensitivity of our results to the tax principle. Under the origin principle, countries have strategic behaviors in commodity taxes, which are reinforced by

³⁸Cultural weights are constructed considering an exogenous score equal to 1 for each of the cultural controls in the initial gravity equation. The legal and neighborhood weights includes trade partners that share the same legal origin and the same border, respectively.

the presence of cross-border shopping. In this case, neighborhood weights should highlight this kind of behavior. Finally, Column [4] presents the results for some ‘placebo’ weights.³⁹ There is no expectation to keep the sign and significance level of the baseline result with these placebo weights.

Panel *a* shows the estimates of the commodity tax responses. The use of cultural and legal weights does not change the results. The use of neighboring weights presents some evidence of strategic complementarity in commodity taxes, for the reason explained in the last paragraph. The use of placebo weights unsurprisingly does not introduce any source of strategic tax interactions. Panel *b* displays the estimates of regulation responses. Cultural and neighborhood weights violate the exclusion restrictions. This suggests that language, religion, historical relationships and neighborhood may create a direct channel between domestic regulation and average distrust and demand for order in trade partner countries. By contrast, the results with legal weights is comparable to the baseline results. The placebo estimate has a negative coefficient that is marginally significant at the 10% level. This confirms that strategic complementarity in product market regulation is not attributed to systematic factors that would be present in any weighting matrix ω_{ij} .

Finally, Table 4 displays a number of robustness checks against alternative specifications. In Column [1], we run our model without controls, i.e. just with the country and time fixed effects. This allows us to reduce the number of parameters to be estimated relative to the number of observations available. The sharp increase in both the Wald F-statistic and the Hansen J-statistics in Panel *a* suggests that the absence of controls increases the correlation of the instruments in the first stage, but it also introduces some omitted variables that affect the domestic commodity tax policy directly. The absence of controls also increases the Wald F-statistic and the Hansen J-statistics in Panel *b*, but does not induce a failure in the over-identifying restriction in the regulation response function. Point estimates in Panel *a* are very similar to those reported in Table 1, Column [6], while the size of the estimated coefficient of PMR_{-i} is almost doubled.

We also investigate whether our results are driven by unobserved country specific shocks. We replace the country fixed effects with country-specific time trends in Column [2]; we add controls for the output gap in Column [3]; and we add a control for trade openness in Column [4]. The estimated coefficients and econometric tests do not significantly differ from our baseline estimates. This confirms that unobserved heterogeneity associated with asymmetric shocks is not a concern in our estimates (see Appendix F for the coefficient of the cyclical controls). In Column [5], we add a measure of social tax morale drawn from the WVS and EVS (see Appendix F for details). This is to check whether our results are driven

³⁹Placebo weights are based on a ‘nonsense’ procedure. It assigns $\omega_{ij} = 1/N$ to each of the N countries whose name starts by the same letter as country i or whose first letter is just before or just after that of country i in the Latin alphabet. It assigns $\omega_{ij} = 0$ otherwise.

by unobserved time variation in individuals' civiness and 'tax morale'. It is generally argued that distrust is a determinant not only of regulation but also of tax morale (e.g. Tekeli [64]). So, our baseline estimates could reflect the simultaneous effect of distrust on regulation, tax morale and therefore tax levels. Yet, the estimated coefficients and econometric tests confirm that the baseline estimates are not driven by unobserved tax morale.

In our baseline estimates, the Pagan-Hall and Wooldridge tests reject the null hypotheses of homoskedasticity and absence of serial correlation in the idiosyncratic errors at the 1% level. Thus, in Column [6], we compute the Heteroskedasticity and Autocorrelation Consistent (HAC) standard errors. The results show evidence of an increase in standard errors, while the estimated coefficients remain statistically significant.

We also carry out some sensitivity analysis with respect to the estimated impact of product market regulation in the commodity tax response function. It can be argued that equation (27) is misspecified because it disregards any impact of foreign regulation on domestic commodity taxes and assumes strategic interaction in commodity taxes, even though theory does not show such interaction. In Table 4 Panel *a*, Column [7], we add the regulation of trade partners and remove their commodity taxes from the regression model. The estimate shows a larger negative effect of product market regulation.

One can argue that the only endogeneity issues for product market regulation in equation (27) are simultaneity and reverse causality. In this case, one would argue that the presence of a one-year lag in product market regulation can be sufficient to exclude both issues.⁴⁰ To investigate this argument, in Column [8] we estimate a model specification in which product market regulation is exogenous, while trade partners' average tax remains endogenous. The estimated coefficient for product market regulation is still negative and significantly different from zero as it was in Table 1, Column [6]. Thus, the baseline results are robust to this argument. Finally, in Column [9], we check whether the baseline results can be attributed to medium-run effects. Towards this aim, we replace the year-by-year variation with variation between five-year periods. Point estimates and econometric tests confirm that the baseline results hold in this medium-run perspective.

⁴⁰This is true if the lagged regulation variable does not depend on previous regulation and tax levels.

Table 4: Alternative specifications

Panel a: Commodity tax response									
	[1] only country and time dummies	[2] country spec. time trends	[3] economic cycle	[4] trade openness	[5] tax morale	[6] HAC standard errors	[7] PMR _{-i} instead of CTAX _{-i}	[8] exogenous regulation	[9] 5 years averages
CTAX _{-i}	0.03 (0.81)	1.08 (1.00)	1.12 (0.99)	1.28 (0.99)	1.29 (1.03)	1.12 (1.12)		2.04 (1.53)	1.09 (1.22)
PMR	-0.40*** (0.13)	-0.47** (0.21)	-0.48** (0.21)	-0.39* (0.22)	-0.56*** (0.21)	-0.47* (0.24)	-0.68*** (0.20)	-0.12* (0.07)	-0.55** (0.23)
K-P rk Wald F-stat	11.40	3.973	3.943	3.742	4.061	2.938	8.40	10.092	3.941
K-P rk LM-stat (p-value)	21.26 (0.00)	21.63 (0.00)	21.29 (0.00)	20.45 (0.00)	22.95 (0.00)	14.93 (0.00)	28.44 (0.00)	12.83 (0.00)	9.87 (0.01)
Hansen J-stat (p-value)	6.51 (0.01)	1.57 (0.21)	1.65 (0.20)	1.70 (0.19)	1.20 (0.27)	1.14 (0.29)	1.96 (0.38)	-	2.17 (0.14)
Panel b: Regulation response									
PMR _{-i}	0.85*** (0.11)	0.46*** (0.12)	0.46*** (0.11)	0.53*** (0.13)	0.50*** (0.11)	0.46*** (0.14)			0.38** (0.19)
K-P rk Wald F-stat	193.27	148.97	156.4	124.29	146.91	149.80	-	-	18.85
K-P rk LM-stat (p-value)	94.44 (0.00)	76.58 (0.00)	77.59 (0.00)	78.38 (0.00)	76.79 (0.00)	78.26 (0.00)	-	-	24.21 (0.00)
Hansen J-stat (p-value)	2.11 (0.15)	0.04 (0.84)	0.35 (0.55)	0.17 (0.68)	0.10 (0.75)	0.03 (0.86)	-	-	0.04 (0.83)
Observations	399	390	390	390	390	390	390	390	83

Notes: 2SLS estimates with robust standard errors in parentheses. PMR are measured in seven non-manufacturing industries (ETCR). All specifications in panel a,b include the same set of controls as in Table 1. Exceptions are: Column [1] where we use only country and time dummies; Column [2] where we use country specific time trends instead of country fixed effects; Column [3] where we include the output gap; Columns [4] where we add a control for trade openness; Column [5], where we include a control for tax morale; Column [6], panel a, where we replace CTAX_{-i} by ETCR_{-i} and instrument it by the five years lags of *OrderNation_{-i}* and *DisTrust_{-i}*. Significance levels: * : 10% ** : 5% *** : 1%.

6 Conclusion

In this paper, we study competition in product market regulation and commodity tax rates between two trading partners using a general equilibrium model in which destination-based consumption taxes finance the provision of public goods and regulation influences the number of firms in the economy. The model generates three theoretical predictions. First, commodity tax rates are strategic independent instruments. This is in line with the literature on commodity tax competition under the destination principle. Second, regulation policies are strategic complements as long as consumers do not value product variety too highly. Third, regulation has a negative impact on commodity tax rates if the demand for public goods is more sensitive to income than the demand for private goods. In the empirical part of the paper, we specify an empirical model to estimate the direction of the forces described by the theory using data on OECD countries. We find evidence supporting the absence of strategic tax interactions, the presence of strategic complementarity in regulation policies, and a negative impact of regulation on commodity taxes. More specifically, taken at face value, our estimates suggest that a domestic deregulation process that reduces firms' start up time by 53 days leads to a rise in the effective commodity tax rate of 0.79 percentage points and triggers a deregulation process of about 13 start up days in trade partner countries. Overall, these magnitudes are non-negligible considering that EU countries reduced firms' start up time by an average of 160 days in the 1990s.

Finally, our results shed light on the relationship between the various policies of trading partners. First, (de)regulation policies significantly change the magnitude of tax revenues collected through consumption taxes. This is particularly important as commodity taxation remains an important instrument of public finance, particularly in the EU. Our research suggests that the deregulation of commodity markets leads to an increase in commodity tax revenues. Our findings also suggest that foreign deregulation has an indirect impact on domestic tax revenues because it leads domestic governments to deregulate and therefore raise their effective tax rates and revenues.

To our knowledge, this contribution is the first theoretical study and empirical verification of international interactions between regulators and their effects on commodity taxes. This paper sets the stage for further research. For instance, it would be interesting to disentangle the possible objectives of regulators in terms of product safety, product quality, bureaucracy and corruption. This should be done theoretically and empirically.

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Appendix A Proof of Proposition 3.

In this appendix, we first check the sufficient condition for the bureaucrate regulator's optimal decision. We then give more detail on strategic complementarity of regulation policies.

For the sufficient condition, it can first be checked that $\partial \ln C_0 / \partial \ln n > 0$ is true for all admissible ξ if $\sigma > 1$. Also, the second order condition becomes

$$\frac{\partial}{\partial n} \left(\frac{\partial \ln C_0}{\partial \ln n} \right) - \rho \frac{\sigma f_0}{(n\sigma f_0 - 1)^2} < 0$$

which should be satisfied globally. It is satisfied globally if and only if

$$(-\sigma^2 \xi + \sigma^3 \xi + 1)(n\sigma f_0 - 1)^2 - 4\rho n \sigma^2 (\sigma - 1) \sigma f_0 < 0 \quad (\text{A-1})$$

At the symmetric equilibrium, we compute

$$n = n^* = \frac{2\sigma + (\sigma - 1)\sigma\xi - 1}{\sigma^2 f_0 ((\sigma - 1)(\xi + 2\rho) + 2)}$$

which gives a local second order condition whose sign is given by,

$$-(2\sigma - \sigma\xi + \sigma^2\xi - 1)$$

that is satisfied for all admissible parameters.

The global second order condition is always satisfied under the restriction that $\rho > \frac{1}{4} \frac{(n\sigma f_0 - 1)^2}{n\sigma^3 f_0 (\sigma - 1)}$. Indeed, for $\xi = 0$, it is equivalent to the condition: $(n\sigma f_0 - 1)^2 - 4\rho n \sigma^2 (\sigma - 1) \sigma f_0 < 0$. This is always true for $\rho > \frac{1}{4} \frac{(n\sigma f_0 - 1)^2}{n\sigma^3 f_0 (\sigma - 1)}$. Since the above expression (A-1) is linear increasing in ξ and negative at upper boundary of the set $[-1/(\sigma - 1), 0]$, it is negative for any $\xi \in [-1/(\sigma - 1), 0]$ if $\rho > \frac{1}{4} \frac{(n\sigma f_0 - 1)^2}{n\sigma^3 f_0 (\sigma - 1)}$.

Regulation policies are strategic complement instruments if and only if $dn/dn^* > 0$. At the interior symmetric equilibrium,

$$\text{sign} \frac{dn}{dn^*} = \text{sign} \left(-\frac{1}{4n} \frac{1 + \sigma^2 (\sigma - 1) \xi}{\sigma^2 (\sigma - 1)} \right) \quad (\text{A-2})$$

where the denominator is positive for any value of σ . Then, regulation policies are strategic complement if and only if the numerator is negative: $1 + \sigma^2 (\sigma - 1) \xi < 0$, which confirms the proposition.

Appendix B Demand under market uncertainties.

In this appendix we suppose that delivery uncertainty symmetrically affects the varieties so that the probabilities of home and foreign varieties (ω, ω^*) to be delivered are given by

$\theta = \int_S \theta(s) \lambda(s, \omega) ds$ and $\theta^* = \int_S \theta(s) \lambda(s, \omega^*) ds$. We then show that the optimal individual consumption and consumption bundle are given by

$$c(\omega) = p(\omega)^{-\sigma} \frac{\theta^\sigma W}{P^{1-\sigma}} \text{ and } C = \frac{N^\xi W}{P} \text{ where } P^{1-\sigma} = n\theta^\sigma p^{1-\sigma} + n^*\theta^{*\sigma} p^{*1-\sigma}$$

The first order condition with respect to consumption $c(\omega)$ yields

$$\int_S \theta(s) U'_C(C(s), G(s)) N^\xi \frac{\sigma-1}{\sigma} C(s)^{\frac{1}{\sigma}} \lambda(s, \omega)^{\frac{\sigma-1}{\sigma}} c(\omega)^{-\frac{1}{\sigma}} ds = \mu p(\omega)$$

where μ is the Lagrange multiplier of the budget constraint. We get the consumption function

$$c(\omega) = p(\omega)^{-\sigma} \frac{A(\omega)^\sigma}{\mu^\sigma}$$

where

$$A(\omega) = \int_S \theta(s) U'_C(C(s), G(s)) N^\xi \frac{\sigma-1}{\sigma} C(s)^{\frac{1}{\sigma}} \lambda(s, \omega)^{\frac{\sigma-1}{\sigma}} ds \quad (\text{B-3})$$

Inserting this in the budget constraint and solving for μ , we get the consumption function

$$c(\omega) = \frac{p(\omega)^{-\sigma} A(\omega)^\sigma W}{\int_0^N p(\omega')^{1-\sigma} A(\omega')^\sigma d\omega'} \quad (\text{B-4})$$

Individuals' demand is iso-elastic in own price $p(\omega)$. The consumption bundle is

$$C(s) = \frac{N^\xi \left[\int_0^N (\lambda(s, \omega) p(\omega)^{-\sigma} A(\omega)^\sigma)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}} W}{\int_0^N p(\omega')^{1-\sigma} A(\omega')^\sigma d\omega'} \quad (\text{B-5})$$

Under the assumption of symmetric delivery uncertainty, the probability of the variety ω to be delivered is the same for all varieties in the same country and given by $\theta = \int_S \theta(s) \lambda(s, \omega) ds$. Hence, $\int_0^n \lambda(s, \omega) d\omega$ is equal to the number of domestic delivered varieties $n\theta$. Similarly, $\theta^* = \int_S \theta(s) \lambda(s, \omega) ds$ and $\int_n^{n+n^*} \lambda(s, \omega) d\omega = n^*\theta^*$ for foreign varieties $\omega \in (n, n+n^*]$. Because of this symmetry, we must have: $A(\omega) \equiv A$ for $\omega \in [0, n]$ and $A^*(\omega) \equiv A^*$ for $\omega \in (n, n+n^*]$ where A and A^* are constants. The symmetry also imposes that $C(s)$ is the same in any state so that $C(s) \equiv C$ and therefore $G(s) \equiv G$. Noting that $\int_S \theta(s) \lambda(s, \omega)^{\frac{\sigma-1}{\sigma}} ds = \int_S \theta(s) \lambda(s, \omega) ds$ and plugging those values in (B-3) yields

$$\begin{aligned} A &= \int_S \theta(s) \lambda(s, \omega) ds U'_C(C, G) N^\xi \frac{\sigma-1}{\sigma} C^{\frac{1}{\sigma}}, \quad \omega \in [0, n] \\ &= \theta U'_C(C, G) N^\xi \frac{\sigma-1}{\sigma} C^{\frac{1}{\sigma}} \\ A^* &= \int_S \theta(s) \lambda(s, \omega) ds U'_C(C, G) N^\xi \frac{\sigma-1}{\sigma} C^{\frac{1}{\sigma}}, \quad \omega \in (n, n+n^*] \\ &= \theta^* U'_C(C, G) N^\xi \frac{\sigma-1}{\sigma} C^{\frac{1}{\sigma}} \end{aligned}$$

Now, since varieties are symmetric in the preferences and in the production function, it must be that in equilibrium $p(\omega) \equiv p$, $\omega \in [0, n]$, and $p(\omega) \equiv p^*$, $\omega \in (n, n+n^*]$. So, from (B-5)

we successively get

$$\begin{aligned}
C &= \frac{N^\xi \left[(p^{-\sigma} A^\sigma)^{\frac{\sigma-1}{\sigma}} \int_0^n \lambda(s, \omega) d\omega + (p^{*- \sigma} A^{*\sigma})^{\frac{\sigma-1}{\sigma}} \int_n^{n+n^*} \lambda(s, \omega) d\omega \right]^{\frac{\sigma}{\sigma-1}} W}{\int_0^N p(\omega')^{1-\sigma} A(\omega')^\sigma d\omega'} \\
&= \frac{N^\xi \left[(p^{-\sigma} \theta^\sigma)^{\frac{\sigma-1}{\sigma}} \int_0^n \lambda(s, \omega) d\omega + (p^{*- \sigma} \theta^{*\sigma})^{\frac{\sigma-1}{\sigma}} \int_n^{n+n^*} \lambda(s, \omega) d\omega \right]^{\frac{\sigma}{\sigma-1}} W}{p^{1-\sigma} \theta^\sigma + p^{*1-\sigma} \theta^{*\sigma}} \\
&= \frac{N^\xi \left[(p^{-\sigma} \theta^\sigma)^{\frac{\sigma-1}{\sigma}} n\theta + (p^{*- \sigma} \theta^{*\sigma})^{\frac{\sigma-1}{\sigma}} n\theta \right]^{\frac{\sigma}{\sigma-1}} W}{np^{1-\sigma} \theta^\sigma + n^* p^{*1-\sigma} \theta^{*\sigma}} \\
&= \frac{N^\xi \left[(p^{-\sigma} \theta^\sigma)^{\frac{\sigma-1}{\sigma}} n\theta + (p^{*- \sigma} \theta^{*\sigma})^{\frac{\sigma-1}{\sigma}} n\theta \right]^{\frac{\sigma}{\sigma-1}} W}{np^{1-\sigma} \theta^\sigma + n^* p^{*1-\sigma} \theta^{*\sigma}} \\
&= \frac{N^\xi [n(p^{1-\sigma} \theta^\sigma) + p^{*1-\sigma} \theta^{*\sigma}]^{\frac{\sigma}{\sigma-1}} W}{np^{1-\sigma} \theta^\sigma + n^* p^{*1-\sigma} \theta^{*\sigma}} \\
&= \frac{N^\xi W}{[np^{1-\sigma} \theta^\sigma + n^* p^{*1-\sigma} \theta^{*\sigma}]^{\frac{1}{1-\sigma}}} \\
&= \frac{N^\xi W}{P}
\end{aligned}$$

where

$$P^{1-\sigma} = n\theta^\sigma p^{1-\sigma} + n^* \theta^{*\sigma} p^{*1-\sigma}$$

From (B-4), we then get the consumption of a variety

$$c(\omega) = p(\omega)^{-\sigma} \frac{\theta^\sigma W}{P^{1-\sigma}}$$

Demand is iso-elastic in own price $p(\omega)$.

Finally, for the optimal regulation decision, we need to check

$$\frac{\partial \ln C_0}{\partial \ln n} + \frac{\partial \ln C_0}{\partial \ln \theta} \frac{d \ln \theta}{d \ln n} = 0$$

We compute

$$\frac{d \ln \theta}{d \ln n} = \frac{-\varphi n}{1 - \varphi n} < 0$$

and

$$\begin{aligned}
\frac{\partial \ln C_0}{\partial \ln n} &= \frac{1}{(\sigma - 1)} \left(1 - \frac{1}{\sigma} \frac{1}{1 + \frac{\theta}{\theta^*} \left(\frac{n}{n^*} \right)^{\frac{1}{\sigma}}} \right) + \xi \frac{1}{1 + \left(\frac{n}{n^*} \right)^{-1}}. \\
\frac{\partial \ln C_0}{\partial \ln \theta} &= \frac{\sigma}{\sigma - 1} \left(1 - \frac{1}{\sigma} \frac{1}{1 + \frac{\theta}{\theta^*} \left(\frac{n}{n^*} \right)^{\frac{1}{\sigma}}} \right)
\end{aligned}$$

At the symmetric equilibrium this yields

$$\begin{aligned}\frac{\partial \ln C_0}{\partial \ln n} &= \frac{1}{(\sigma - 1)} \left(1 - \frac{1}{2\sigma}\right) + \frac{1}{2}\xi = \frac{1}{2\sigma(\sigma - 1)} \left(\frac{2\sigma - 1}{2\sigma}\right) + \frac{1}{2}\xi \\ \frac{\partial \ln C_0}{\partial \ln \theta} &= \frac{\sigma}{\sigma - 1} \left(1 - \frac{1}{2\sigma}\right) > 0 \\ \frac{\partial \ln C_0}{\partial \ln n} / \frac{\partial \ln C_0}{\partial \ln \theta} &= \frac{2\sigma - 1 + \sigma(\sigma - 1)\xi}{\sigma(2\sigma - 1)} > 0\end{aligned}$$

Those values can be used to get (24).

Appendix C Endogeneity

To analyze the endogeneity issues associated with the spatial structure of our model it is useful to refer to Manski's endogenous effect model. To solve the problem of the simultaneity of agents' decisions, Manski [42] suggests to model each agent's decision as a function of the expected action of the agents belonging to her reference group. In our model, this amounts to assume that country i chooses its policy based on the expected policy decision in country i 's reference group (typically, trade partners). For expositional simplicity, we concentrate on the cross-country dimension $i = 1, \dots, J$, and omit the time dimension. The estimated model is given by

$$\tau_i = \alpha E(\tau_i | \mathbf{g}_i) + \beta z_i + \boldsymbol{\gamma}' \mathbf{x}_i + d_i + u_i, \quad (\text{C-6})$$

$$z_i = \delta E(z_i | \mathbf{g}_i) + \boldsymbol{\zeta}' \mathbf{y}_i + d_i + v_i. \quad (\text{C-7})$$

where τ_i and z_i are observations of country i ' tax and regulation levels. We denote $\mathbf{g}_i$ as a vector of characteristics of country i 's reference group so that $E(\tau_i | \mathbf{g}_i)$ and $E(z_i | \mathbf{g}_i)$ are the expectations of the representative tax and regulation levels in the latter reference group. $\mathbf{x}_i$ and $\mathbf{y}_i$ are vectors of country i 's control characteristics. A bold character and a prime ' denotes a vector and its transpose. d_i are country fixed effects while u_i and μ_i are error terms. The scalars α , β and δ are estimated coefficients while $\boldsymbol{\gamma}$ and $\boldsymbol{\zeta}$ are vectors for control coefficients. The coefficients α and δ express a endogenous effect that gives rise to a simultaneity issue as τ_i and z_i appear as dependent and independent variables. In the text, equations (27) and (28) implicitly use the definitions $\tau_{-i} \equiv E(\tau_i | \mathbf{g}_i)$ and $z_{-i} \equiv E(z_i | \mathbf{g}_i)$, respectively.

We consider the following true model:

$$\tau_i = \alpha E(\tau_i | \mathbf{g}_i) + \beta z_i + \boldsymbol{\gamma}' \mathbf{x}_i + \eta_1 E(z_i | \mathbf{g}_i) + \boldsymbol{\eta}'_2 E(\mathbf{x}_i | \mathbf{g}_i) + \eta_3 m_i + \eta_4 E(n_i | \mathbf{g}_i) + d_i + \epsilon_i, \quad (\text{C-8})$$

$$z_i = \delta E(z_i | \mathbf{g}_i) + \boldsymbol{\zeta}' \mathbf{y}_i + \boldsymbol{\eta}'_5 E(\mathbf{y}_i | \mathbf{g}_i) + \eta_6 m_i + \eta_7 E(n_i | \mathbf{g}_i) + d_i + v_i. \quad (\text{C-9})$$

Those include five new terms. On the one hand, $E(z_j | \mathbf{g}_i)$, $E(\mathbf{x}_i | \mathbf{g}_i)$ and $E(\mathbf{y}_i | \mathbf{g}_i)$ are the expectations of the representative regulation level and control characteristics of country

i 's reference group. Those terms measure the direct effect of exogenous characteristics of country i ' reference group. Manski [42] denotes them contextual effects. On the other hand, m_i is an unobserved factor in country i such that $\text{Cov}(m_i, z_i) \neq 0$ and/or $\text{Cov}(m_i, \tau_i) \neq 0$. In addition, $E(n_i|\mathbf{g}_i)$ is the expectation of an unobserved factor representative of the reference group, with $\text{Cov}(n_i, z_i) \neq 0$ and/or $\text{Cov}(n_i, \tau_i) \neq 0$. The unobserved characteristics $E[n_i|\mathbf{g}_i]$ is related with country i 's reference group and is called a correlated effect by Manski [42]. The unobserved characteristic m_i has no such property. Finally, the coefficients $\eta_1, \eta_3, \eta_4, \eta_6$ and η_7 are scalars while $\boldsymbol{\eta}_2$ and $\boldsymbol{\eta}_5$ are vectors of control coefficients for the reference group. The error terms ϵ_i and v_i have zero expectation and are uncorrelated with the regressors.

The above true model generates the following structure for the error terms in the estimated model (C-6) and (C-7):

$$u_i = \eta_1 E(z_i|\mathbf{g}_i) + \boldsymbol{\eta}'_2 E(\mathbf{x}_i|\mathbf{g}_i) + \eta_3 m_i + \eta_4 E(n_i|\mathbf{g}_i) + \epsilon_i, \quad (\text{C-10})$$

$$v_i = \boldsymbol{\eta}'_5 E(\mathbf{y}_i|\mathbf{g}_i) + \eta_6 m_i + \eta_7 E(n_i|\mathbf{g}_i) + v_i, \quad (\text{C-11})$$

The presence of the first term (C-10) implies that $\text{Cov}(u_i, z_i) \neq 0$ and invalidates OLS estimation of equation (C-6). Assuming $\alpha \neq 1$ and $\delta \neq 1$ and taking the expectation of (C-8) and (C-9) conditional of group characteristic $\mathbf{g}_i$ one can express $E(\tau_i|\mathbf{g}_i)$ and $E(z_i|\mathbf{g}_i)$ as a linear combination of the other regressors:

$$E(\tau_i|\mathbf{g}_i) = \frac{\beta + \eta_1}{1 - \alpha} E(z_i|\mathbf{g}_i) + \frac{\boldsymbol{\gamma}' + \boldsymbol{\eta}'_2}{1 - \alpha} E(\mathbf{x}_i|\mathbf{g}_i) + \frac{\eta_3}{1 - \alpha} m_i + \frac{\eta_4}{1 - \alpha} E(n_i|\mathbf{g}_i) + \frac{1}{1 - \alpha} E(d_i|\mathbf{g}_i) \quad (\text{C-12})$$

$$E(z_i|\mathbf{g}_i) = \frac{\boldsymbol{\zeta}' + \boldsymbol{\eta}'_5}{1 - \delta} E(\mathbf{y}_i|\mathbf{g}_i) + \frac{\eta_6}{1 - \delta} m_i + \frac{\eta_7}{1 - \delta} E(n_i|\mathbf{g}_i) + \frac{1}{1 - \delta} E(d_i|\mathbf{g}_i), \quad (\text{C-13})$$

These two expressions present the expectations of the representative tax and regulation levels in country i 's reference group as functions of the true spatial interaction effects (α, δ), the contextual effects ($\eta_1, \boldsymbol{\eta}_2, \boldsymbol{\eta}_5$), the correlated effects (η_4, η_7) and the effects of non spatially correlated omitted variables (η_3, η_6). They imply that $\text{Cov}[u_i, E(\tau_i|\mathbf{g}_i)] \neq 0$ and $\text{Cov}[v_i, E(z_i|\mathbf{g}_i)] \neq 0$, which invalidates OLS regressions of (C-6) and (C-7).

To estimate the coefficients α, β and δ we need valid instruments. A valid instrumental variable s_i for the coefficient α in equation (C-6) must satisfy $\text{Cov}[E(s_i|\mathbf{g}_i), E(\tau_i|\mathbf{g}_i)] \neq 0$ and the exclusion restrictions $\text{Cov}[E(s_i|\mathbf{g}_i), E(z_i|\mathbf{g}_i)] = 0$, $\text{Cov}[E(s_i|\mathbf{g}_i), E(\mathbf{x}_i|\mathbf{g}_i)] = 0$, $\text{Cov}[E(s_i|\mathbf{g}_i), m_i] = 0$ and $\text{Cov}[E(s_i|\mathbf{g}_i), E(n_i|\mathbf{g}_i)] = 0$. When those restrictions are met, we get $\text{Cov}[E(s_i|\mathbf{g}_i), \tau_i] = 0$, which we argue in the text. Similarly, a valid instrumental variable r_i to estimate β in equation (C-6) requires $\text{Cov}[E(r_i|\mathbf{g}_i), z_i] \neq 0$ and the exclusion restrictions $\text{Cov}[E(r_i|\mathbf{g}_i), E(z_i|\mathbf{g}_i)] = 0$, $\text{Cov}[E(r_i|\mathbf{g}_i), E(\mathbf{x}_i|\mathbf{g}_i)] = 0$, $\text{Cov}[E(r_i|\mathbf{g}_i), m_i] = 0$ and $\text{Cov}[E(r_i|\mathbf{g}_i), E(n_i|\mathbf{g}_i)] = 0$. Under those restrictions, we get $\text{Cov}[E(r_i|\mathbf{g}_i), \tau_i] = 0$ as argued in the text. Finally, to estimate δ in equation (C-7), we need a second instrument r_i (it can be the same instrument as above), which satisfies $\text{Cov}[E(r_i|\mathbf{g}_i), E(z_i|\mathbf{g}_i)] \neq 0$ and the exclusion

restrictions $\text{Cov}[E(r_i|\mathbf{g}_i), E(\mathbf{y}_i|\mathbf{g}_i)] = 0$, $\text{Cov}[E(r_i|\mathbf{g}_i), m_i] = 0$ and $\text{Cov}[E(r_i|\mathbf{g}_i), E(n_i|\mathbf{g}_i)] = 0$. So, we need to check that $\text{Cov}[E(r_i|\mathbf{g}_i), z_i] = 0$, which is discussed in the text.

Finally, the expectation of a representative variable in country i 's reference group, $E(\cdot|\mathbf{g}_i)$, is equal to $\sum_{j=1}^J \text{Prob}(\cdot|\mathbf{g}_i)$. The spatial econometrics literature addresses this issue of assessing those probabilities $\text{Prob}(\tau_j|\mathbf{g}_i)$ and $\text{Prob}(z_j|\mathbf{g}_i)$ by replacing them with spatial weights ω_{ij} normalized so that $\sum_{j=1}^J \omega_{ij} = 1$. The choice of spatial weights to proxy the structure of the coefficients of strategic interactions α_{ij} and δ_{ij} is motivated by our model where the strategic interaction pass through the international trade flows.

Appendix D Derivation of the weighting matrix

Based on our theoretical priors, we want to weight the strategic interaction of country i with country j based on its propensity to import from country j . A natural measure of this propensity would be given by the share of country i 's imports from country j over total country i 's imports. This measure however is endogenous with respect to consumption taxation and product market regulation due to both reverse causality and omitted variables bias.⁴¹

The first step to address endogeneity is to focus on imports in 1980 e.g. prior to the start of our sample. In this way we rid out the possibility of direct reverse causality from commodity taxes and product market regulation to imports. Using the past values of imports however does not address the issue of omitted variable bias in the presence of unobserved structural characteristics of the country which affect both regulation, taxation and imports. The second step we perform is then to construct a weight measure based on country i 's imports predicted by the structural characteristics of each ij couple of trade partners such as countries' size, distance, culture, legal origin, and historical relationship. We thus estimate the following augmented gravity equation where imports' flows are expressed as a function of the specific attributes of the importer and exporter (as captured by population size and per capita GDP) as well as time invariant 'dyadic' characteristics (see Head, Mayer and Ries [31] for details):

$$\begin{aligned} \ln(\text{Imp}_{ij}) = & a_1 \ln(\text{POP}_i) + a_2 \ln(\text{POP}_j) + a_3 \ln(\text{GDP}x_i) + a_4 \ln(\text{GDP}x_j) + \\ & + a_5 \ln(\text{Dist}_{ij}) + a_6 \text{contig}_{ij} + a_7 \text{collink}_{ij} + a_8 \text{comlang}_{ij} + a_9 \text{legor}_{ij} + \xi_{ij}. \end{aligned} \quad (\text{D-14})$$

⁴¹For example reverse causality may go from consumption taxes towards imports' shares if the level of taxes in country i influences the decision of country j to export in country i or in some other country $-i$. Along similar lines, product market regulation in country j determines the relative prices of its goods thus influencing the decision of country i whether to import from j or from some other country $-j$. Omitted variable bias may arise if unobserved structural characteristics exist of a country which affect both its over time variation in taxation, regulation and imports.

Results from OLS estimates are reported in Table D-1. From the estimate coefficients, we reconstruct the predicted imports' flows $\widehat{Imp}_{ij}$ ⁴² and construct from it the exogenous weight as $\omega_{ij} = \frac{\widehat{Imp}_{ij}}{\sum_{i \neq j} \widehat{Imp}_{ij}}$. Table D-2 displays the weighting matrix.

Table D-1: Gravity equation estimates

$\ln(POP_i)$	0.76*** (0.03)
$\ln(POP_j)$	0.83*** (0.03)
$\ln(GDPxc_i)$	1.00*** (0.07)
$\ln(GDPxc_j)$	1.29*** (0.09)
$\ln(Dist_{ij})$	-0.65*** (0.03)
contig	0.18 (0.11)
collink	0.36* (0.19)
comlang	0.34*** (0.11)
legor	0.37*** (0.08)
Constant	-22.42*** (1.36)
R sq.	0.88
N	420

Notes: OLS estimates based on total 1980 imports by country (Source IMF DOTS). Estimates used to construct weighting matrix based on predicted imports; robust standard errors in parentheses. Significance levels: * : 10% ** : 5% ***: 1%.

⁴²In equation (D-14) the coefficient of *contig* is very weakly significant at the 10% probably due to the fact that in our sample of 21 OECD countries the variation in the geographical position is mostly captured by the *distwces* variable. Nevertheless we decided to include *contig* in (D-14) due to the strong theoretical a priori in favour of the importance of shared borders to imports.

Table D-2: Weighting matrix based on predicted imports

exporter/importer	AUS	AUT	BEL	CAN	CHE	DEU	DNK	ESP	FIN	FRA	GBR	GRC	IRE	ITA	JPN	NLD	NOR	NZL	PRT	SWE	USA
AUS	**	0.004	0.002	0.009	0.003	0.005	0.005	0.005	0.007	0.004	0.013	0.008	0.007	0.005	0.028	0.003	0.006	0.094	0.006	0.006	0.026
AUT	0.009	**	0.013	0.004	0.043	0.064	0.019	0.014	0.017	0.017	0.014	0.024	0.010	0.031	0.023	0.013	0.018	0.008	0.015	0.019	0.012
BEL	0.014	0.034	**	0.011	0.037	0.093	0.034	0.037	0.026	0.111	0.047	0.038	0.024	0.043	0.024	0.220	0.033	0.012	0.039	0.031	0.019
CAN	0.053	0.011	0.010	**	0.012	0.014	0.014	0.016	0.019	0.026	0.042	0.019	0.025	0.015	0.041	0.010	0.019	0.053	0.021	0.018	0.270
CHE	0.015	0.089	0.031	0.011	**	0.113	0.029	0.030	0.025	0.078	0.030	0.033	0.019	0.090	0.036	0.026	0.028	0.013	0.029	0.028	0.020
DEU	0.073	0.401	0.231	0.037	0.338	**	0.267	0.115	0.148	0.189	0.157	0.147	0.097	0.163	0.179	0.246	0.178	0.062	0.121	0.190	0.096
DNK	0.009	0.014	0.010	0.005	0.011	0.033	**	0.012	0.034	0.014	0.017	0.016	0.012	0.015	0.016	0.016	0.050	0.008	0.013	0.079	0.012
ESP	0.016	0.018	0.019	0.009	0.018	0.024	0.020	**	0.021	0.056	0.024	0.042	0.019	0.044	0.026	0.023	0.023	0.013	0.109	0.022	0.045
FIN	0.007	0.007	0.004	0.003	0.005	0.010	0.103	0.007	**	0.007	0.008	0.011	0.006	0.008	0.012	0.006	0.030	0.006	0.008	0.080	0.009
FRA	0.058	0.095	0.248	0.062	0.211	0.172	0.103	0.247	0.092	**	0.149	0.168	0.090	0.266	0.097	0.157	0.108	0.049	0.190	0.104	0.114
GBR	0.121	0.055	0.071	0.069	0.055	0.097	0.086	0.073	0.072	0.101	**	0.070	0.396	0.071	0.071	0.091	0.098	0.104	0.083	0.085	0.175
GRC	0.005	0.006	0.004	0.002	0.004	0.006	0.006	0.009	0.007	0.008	0.005	**	0.004	0.015	0.008	0.006	0.006	0.004	0.009	0.007	0.006
IRE	0.005	0.003	0.002	0.003	0.002	0.004	0.004	0.004	0.004	0.004	0.027	0.003	**	0.003	0.004	0.003	0.005	0.004	0.005	0.004	0.007
ITA	0.035	0.085	0.046	0.016	0.116	0.070	0.052	0.092	0.052	0.126	0.050	0.143	0.035	**	0.056	0.058	0.054	0.029	0.088	0.055	0.043
JPN	0.115	0.037	0.015	0.029	0.028	0.047	0.034	0.033	0.048	0.028	0.030	0.050	0.024	0.034	**	0.021	0.044	0.096	0.040	0.042	0.077
NLD	0.019	0.032	0.221	0.010	0.032	0.099	0.053	0.046	0.037	0.070	0.060	0.051	0.032	0.055	0.033	**	0.049	0.016	0.050	0.046	0.026
NOR	0.009	0.011	0.008	0.005	0.008	0.017	0.039	0.011	0.043	0.011	0.015	0.014	0.011	0.012	0.016	0.012	**	0.008	0.012	0.062	0.012
NZL	0.018	0.001	0.000	0.002	0.000	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.004	0.000	0.001	**	0.001	0.001	0.005
PRT	0.002	0.002	0.002	0.001	0.002	0.003	0.003	0.013	0.003	0.005	0.003	0.005	0.003	0.005	0.004	0.003	0.003	0.002	**	0.003	0.003
SWE	0.017	0.022	0.014	0.009	0.016	0.035	0.118	0.020	0.220	0.021	0.026	0.028	0.018	0.024	0.030	0.021	0.120	0.014	0.022	**	0.022
USA	0.399	0.072	0.047	0.704	0.058	0.095	0.097	0.217	0.126	0.124	0.281	0.129	0.166	0.099	0.293	0.064	0.127	0.405	0.140	0.118	**

Notes: Importers in rows, exporters in columns. Weights are predicted import shares (sum by importer =1), obtained from estimates of the gravity model reported in Table D-1.

Appendix E Data

The main variables of interest are drawn from the OECD International Regulation Database; the OECD National Accounts and Revenue Statistics; the World Value Survey and the European Value Study. The other variables used in the analysis as controls or for robustness checks come from multiple sources: the OECD Economic Outlook; the World Bank's Database on Political Institutions (DPI), World Development Indicators (WDI) and Doing Business (DOBUS); the International Monetary Fund's Direction of Trade Statistics (DOTS); and the CEPII Gravity Dataset (CEPII). The reader will find below a precise description of the variables.

ETCR: we restrict our attention on the 'low level' ETCR indicator which measures the barriers to entry of new firms in seven non-manufacturing industries: electricity, gas, air passenger transport, rail transport, road freight, and postal services. In the *energy sector* indicators for entry regulation focus on terms and conditions for third party access (TPA) and the extent of choice of supplier for consumers. Entry regulation in *rail transport services* distinguishes i) free entry (with access fees to the rail network infrastructure), ii) franchising to several firms and iii) franchising to a single firm. Entry regulation in *passenger air transport services* covers, on the domestic side, the liberalization of internal routes and, on the international side, the participation in an agreement liberalizing access to routes within a region. Entry regulation in *road freight* looks at more subtle ways in which entry can be thwarted in this eminently competitive sector: through a restrictive or discretionary licensing system and through the intervention of incumbents in decisions concerning entry or price setting. In the *communication sector*, indicators for entry regulation are based on legal limitations on the number of competitors allowed in each of the post and telecommunications markets covered by the analysis (see Conway and Nicoletti [17] for further details).

days to start up: Number of days to set up a business (Doing Business, World Bank).

CTAX: We followed the methodology by Carey and Rabesona [14] which computes the effective tax rates relating the tax revenues to the relative tax base. We thus apply the following formula

$$CTAX = \frac{T5110}{(CP + CG - CGW)} * 100 \quad (E-15)$$

where:

T5110: general taxes on good and services (includes VAT, sales taxes and other taxes on goods and services; OECD Revenue Statistics).

CP: Private final consumption expenditure (OECD National Accounts).

CG: Government final consumption expenditure (OECD National Accounts).

CGW: Government final wage consumption expenditure (OECD National Accounts).

Notice that (E-15) is different from the definition provided by Carey and Rabesona [14] in that it excludes those revenues which are most likely not to depend on value added taxation, and to reflect the application of the origin principle to consumers' transactions. So the definition of *CTAX* excludes excise taxes, profits of fiscal monopolies, custom and import duties and taxes on specific services.

Demand for order, Distrust others: *Demand for order* is constructed as the percentage of respondents which gives answer 1 (i.e., 'maintaining order in nation') to questions E003 in WVS1-5, V201 in EVS4, V190 in EVS3, Q532A in EVS2, V460 in EVS1. *Distrust others* is constructed as the percentage of respondents which gives answer 2 (i.e., 'Can't be too careful') to questions A165 in WVS1-5, V62 in EVS4, V66 in EVS3, Q241 in EVS2, V208 in EVS1. We assigned country observations for the available years to five periods, each period broadly corresponding to the intended coverage of a EVS/WVS wave. Alternative measures of DisTrust are the percentage of respondents which gives answer 4 (i.e., 'none at all') to questions E069_8 in WVS1-5, V212 in EVS4, V207 in EVS3, q553i in EVS2, v546 in EVS1 (how much confidence in civil service) and the percentage of respondents which gives answer 4 (i.e., 'none at all') to questions E069_13 in WVS1-5, v219 in EVS4, 027 in EVS3, q554K in EVS2, v547 in EVS1 (how much confidence in major companies). The period is as follows:

1980-89: coverage by EVS1/WVS1 but for CHE, CZR and SLK covered by EVS2. Surveys carried in 1981 for AUS, BEL, DEU, DNK, ESP, FIN, FRA, GBR, IRE, JPN, NLD; 1982 for CAN, HUN, NOR, KOR, NOR, SWE, USA; 1984 for ICE and 1989 for CHE, CZR, POL, SLK.⁴³

1990-94: coverage by EVS2/WVS2. Surveys carried in 1990 for AUT, BEL, CAN, DEU, DNK, ESP, FIN, FRA, GBR, ICE, ITA, JPN, KOR, NLD, NOR, POL, PRT, SWE, USA; 1991 for CZR, SLK, HUN. Notice that we have two observations for ESP (1990 and 1990) corresponding to both WVS2 and EVS2 being carried that year.

1995-99: coverage by EVS3/WVS3. Surveys carried in 1995 for AUS, ESP, JPN, USA; 1996 for CHE, FIN, KOR, NOR, SWE; 1997 for DEU and POL; 1998 for CZR, GBR, HUN, BEL, GBR, NZL, SLK; 1999 for AUT, BEL, CZR, DEU, DNK, ESP, FRA, GBR, GRC, HUN, ICE, IRE, ITA, NLD, POL, PRT, SWE, USA. Notice that we have two observations for ESP (1995 and 1999), DEU (1997 and 1999), GBR (1998, 1999), HUN (1998, 1999) and USA (1999), corresponding to both WVS3 and EVS3 being carried in those countries.

2000-04: coverage by WVS4 but for FIN and NZL, covered by EVS3 and WVS5, respectively. This period is generally not covered by any EVS wave, thus the majority of European

⁴³Data for former Czechoslovakia actually refer to 1990 but we decided to assign them to this period as 1990 in these countries is still representative of the pre-transition (transition in former Czechoslovakia was launched in 1991).

countries is not surveyed. Surveys carried in 2000 for CAN, ESP, FIN, JPN; 2001 for KOR; 2004 for NZL.

2005-08: coverage by EVS4/WVS5. Surveys carried in 2005 for AUS, FIN, ITA, JPN, KOR, POL; 2006 for CAN, DEU, FRA, GBR, NLD, SWE, USA; 2007 for CHE, ESP; 2008 for AUS, CHE, CZR, DEU, DNK, ESP, FRA, GRC, HUN, IRE, NLD, NOR, POL, PRT, SLK. Notice that we have two observations for AUS (2005 and 2008), CHE (2007 and 2008), DEU (2006, 2008), ESP (2007, 2008), FRA (2006, 2008), NLD (2006, 2008), POL (2005, 2008), corresponding to both WVS5 and EVS4 being carried.

Observations were averaged out by country and period thus obtaining an unbalanced panel of (up to) 27 countries for the covering the period 1990-2008 in five years averages. Missing observations were obtained by linear interpolation. The initial observation covering the period 1980-89, has not been used in the empirical analysis, but provided the basis to obtain the observation for the period 1990-94 by linear interpolation rather than extrapolation for countries where observations were missing for this period.

VAT, EUVAT93: Dummies equal to 1 when the VAT system/VAT EU system is introduced (OECD Consumption Tax Trends, 2008).

Other variables used in the analysis:

Euro: Dummy variable equal to 1 when a country accesses the European Monetary Union.

Right: Rightwing Orientation of the Government (EXECRLC=1, World Bank's DPI).

POP: Total population (millions of individuals, World Bank's WDI).

GDP: Gross Domestic Product, current US dollars (World Bank's WDI).

GDPxc: Per capita GDP: Gross Domestic Product/Total population (World Bank's WDI).

CGSH: Government final consumption expenditure as a share of total GDP (OECD National Accounts).

Irate: Long-term interest rate on government's bonds (OECD Economic Outlook).

Output gap: Percentage deviation of output from trend (OECD Economic Outlook).

Real exchange rate: Ratio of home country's prices to a weighted average of competitor country's prices, relative to a base year (2000) and measured in US dollars. Therefore an increase is an appreciation of the home country's real exchange rate (OECD Main Economic Indicators).

Trade to GDP ratio: Ratio of trade flows over total GDP (OECD Main Economic Indicators).

Tax Morale: percentage of respondents which give score 8-10 (i.e., 'always') to the question 'do you think it is justifiable cheating on taxes' (WVS/EVS).

Variables used for the construction of the weights

Imp: Total Imports in 1980, US dollars importer report (IMF DOTS).

contig: dummy equal to 1 if countries share a border (CEPII gravity dataset).

smctry: dummy equal to 1 if countries were are the same country (CEPII gravity dataset).

collink: dummy equal to 1 if countries have had common colonizer after 1945 or have ever had a colonial link or are currently in a colonia relationship (CEPII gravity dataset).

comlang: dummy equal to 1 if countries share a common official language or if a language is spoken by at least the 9% of the population in both countries. (CEPII gravity dataset).

legorig: dummy equal to 1 if countries share the same legal origin (Data on regulation used in Botero *et al.* [10]).

dist: distance between the most important cities/agglomerations (in terms of population) of the two countries (CEPII gravity dataset).

distwces: distance between the most important cities/agglomerations (in terms of population) of the two countries weighted by the share of the city in the overall country's population according to the general formula by Head and Mayer [30] with sensitivity of trade flows to bilateral distance equal to -1 (CEPII gravity dataset).

Appendix F Additional tables

Table F-1: Means and standard deviation of VAT_{-i}

Trade partners of:	mean	sd
Australia	0.59	0.02
Austria	0.90	0.05
Belgium	0.94	0.02
Canada	0.29	0.01
Switzerland	0.94	0.00
Germany	0.87	0.06
Denmark	0.89	0.02
Spain	0.77	0.02
Finland	0.86	0.02
France	0.85	0.04
UK	0.70	0.03
Greece	0.85	0.02
Ireland	0.82	0.02
Italy	0.87	0.05
Japan	0.68	0.04
Netherlands	0.93	0.02
Norway	0.86	0.03
New Zealand	0.54	0.06
Portugal	0.85	0.02
Sweden	0.85	0.05
USA	0.97	0.07
Total	0.80	0.16

Notes: Average of the VAT dummy across each country's trade partner, weighted by the predicted import shares reported in Table D-2.

Table F-2: Commodity tax and regulation response functions: other controls

	[1] OLS	[2] OLS FE	[3] 2SLS FE	[4] OLS	[5] OLS FE	[6] 2SLS FE
Panel a: Commodity tax response						
Total population	-0.03*** (0.00)	-0.07** (0.03)	-0.05 (0.07)	-0.02*** (0.00)	-0.04*** (0.01)	-0.02** (0.01)
GDP per capita	0.09*** (0.02)	0.17** (0.09)	0.91*** (0.26)	0.01 (0.03)	0.23*** (0.02)	0.25*** (0.04)
Rightwing government in office	-0.69* (0.37)	-0.04 (0.11)	0.26 (0.23)	-0.63*** (0.22)	0.02 (0.08)	0.01 (0.09)
Government consumption	0.40*** (0.06)	-0.17** (0.08)	-0.08 (0.13)	0.45*** (0.04)	0.12*** (0.03)	0.13*** (0.03)
Real interest rate	1.04*** (0.19)	-0.04 (0.14)	-0.08 (0.20)	0.18*** (0.07)	-0.21*** (0.03)	-0.21*** (0.03)
Real exchange rate	0.01 (0.04)	-0.01 (0.01)	-0.00 (0.01)	-0.05*** (0.02)	0.00 (0.01)	0.00 (0.01)
Member of European Union				-0.64 (0.53)	0.19 (0.28)	-0.21 (0.34)
Member of EURO area				0.14 (0.32)	-0.33*** (0.12)	-0.53*** (0.14)
Applies European VAT with hybrid DP/OP				0.35 (0.40)	-0.47*** (0.17)	-0.54*** (0.19)
Panel b: Regulation response						
Total population	0.04 (0.03)	1.63*** (0.60)	0.39 (0.64)	-0.00*** (0.00)	0.03*** (0.00)	0.03*** (0.00)
GDP per capita	-1.76*** (0.40)	8.98*** (2.19)	5.74** (2.30)	-0.01 (0.01)	0.09*** (0.02)	0.10*** (0.02)
Rightwing government in office	3.05 (3.09)	8.09** (3.16)	8.76*** (3.26)	-0.11* (0.07)	-0.12** (0.05)	-0.12** (0.05)
Government consumption	-1.59*** (0.50)	-1.82 (1.70)	-0.50 (1.59)	-0.06*** (0.01)	0.05* (0.03)	0.04 (0.02)
Real interest rate	-8.13*** (1.24)	1.55 (2.47)	0.08 (2.29)	-0.02 (0.02)	0.01 (0.02)	0.01 (0.02)
Real exchange rate	-0.41** (0.18)	0.04 (0.17)	-0.18 (0.20)	-0.00 (0.00)	-0.01** (0.00)	-0.01** (0.00)
Member of European Union				0.02 (0.18)	0.19 (0.19)	0.17 (0.18)
Member of EURO area				-0.06 (0.11)	-0.50*** (0.11)	-0.53*** (0.10)
Applies a VAT system				-0.01 (0.14)	-0.39** (0.16)	-0.38** (0.15)
Applies European VAT with hybrid DP/OP				-0.28 (0.18)	-0.31** (0.14)	-0.32** (0.13)

Notes: These are the coefficients of the control variables in estimates reported in Table 1. Estimates in Columns [1]-[3] use the days to start up a business measure of *PMR*, while estimates in Columns [4]-[6] use the ETCR measure. Significance levels: * : 10% ** : 5% *** : 1%.

Table F-3: Simultaneous equations models - trade partners' equations

	[1] SUR		[2] SUR, FE		[3] 3SLS, FE	
	CTAX _{-i}	PMR _{-i}	CTAX _{-i}	PMR _{-i}	CTAX _{-i}	PMR _{-i}
CTAX	0.03*** (0.00)		-0.04*** (0.01)		-0.01 (0.01)	
PMR _{-i}	0.36*** (0.06)		-0.16*** (0.05)		-0.49*** (0.09)	
VAT _{-i}	-0.65 (0.50)		0.51** (0.21)		0.90** (0.21)	
PMR		0.25*** (0.02)		0.08*** (0.01)		0.13*** (0.01)
Demand order (%) $-i$		0.02*** (0.01)		0.02*** (0.00)		0.02*** (0.00)
Distrust others (%) $-i$		-0.05*** (0.01)		0.06*** (0.00)		0.05*** (0.00)
N	389	389	389	389	389	389

Notes: Foreign counterparts of SUR and 3SLS estimates of four equations' system with four endogenous variables (*CTAX*, *PMR*, *PMR_{-i}*, *PMR_{-i}*). estimates for the domestic country are reported in Table 2. Robust standard errors in parentheses. Significance levels: * : 10% ** : 5% ***: 1%.

Table F-4: Additional controls for the estimates with alternative specifications

	[1]economic cycle	[2]trade openness	[3]tax morale	[4]regulation competition
Panel a: Commodity tax response				
Output gap	0.01 (0.03)			
Trade-to-GDP ratio		0.01 (0.01)		
Tax morale			-0.01** (0.00)	
PMR _{-i}				-0.00 (0.23)
Panel b: Regulation response				
Output gap	-0.05*** (0.02)			
Trade-to-GDP ratio		0.00 (0.00)		
Tax morale			0.01** (0.00)	

Notes: 2SLS estimates with robust standard errors in parentheses. Column [1] in the present table completes estimates presented in Table 4, Column [3]; Column [2] in the present table completes estimates presented in Table 4, Column [4]. Column [3] in the present table completes estimates presented in Table 4, Column [5]. Column [4] in the present table completes estimates presented in Table 4, Column [7]. Significance levels: * : 10% ** : 5% ***: 1%.

2011

- 2011/1, **Oppedisano, V.; Turati, G.:** "What are the causes of educational inequalities and of their evolution over time in Europe? Evidence from PISA"
- 2011/2, **Dahlberg, M.; Edmark, K.; Lundqvist, H.:** "Ethnic diversity and preferences for redistribution"
- 2011/3, **Canova, L.; Vaglio, A.:** "Why do educated mothers matter? A model of parental help"
- 2011/4, **Delgado, F.J.; Lago-Peñas, S.; Mayor, M.:** "On the determinants of local tax rates: new evidence from Spain"
- 2011/5, **Piolatto, A.; Schuett, F.:** "A model of music piracy with popularity-dependent copying costs"
- 2011/6, **Duch, N.; García-Estévez, J.; Parellada, M.:** "Universities and regional economic growth in Spanish regions"
- 2011/7, **Duch, N.; García-Estévez, J.:** "Do universities affect firms' location decisions? Evidence from Spain"
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- 2011/9, **Costas-Pérez, E.; Solé-Ollé, A.; Sorribas-Navarro, P.:** "Corruption scandals, press reporting, and accountability. Evidence from Spanish mayors"
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- 2011/26, **Caruso, R.; Costa, J.; Ricciuti, R.:** "The probability of military rule in Africa, 1970-2007"
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- 2011/29, **Piolatto, A.; Trotin, G.:** "Optimal tax enforcement under prospect theory"
- 2011/30, **Montolio, D.; Piolatto, A.:** "Financing public education when altruistic agents have retirement concerns"
- 2011/31, **García-Quevedo, J.; Pellegrino, G.; Vivarelli, M.:** "The determinants of YICs' R&D activity"
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- 2011/43, **Cortés, D.:** "Decentralization of government and contracting with the private sector"
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2012

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