Research Journal of Economics and Social Science
Volume 13 Issue 2, April-June, 2025
ISSN: 2995-4231
Impact Factor: 7.57
https://kloverjournals.org/index.php/ess

COASTAL COMPETITION: THE ROLE OF LOCAL TAX POLICIES IN SHAPING ITALY'S TOURISM ECONOMY

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DOI:https://doi.org/10.5281/zenodo.15525074

Abstract: This paper investigates how tourism taxes are used by municipalities to attract tourists. We analyze how municipalities compete among each other, explicitly accounting for the spatial dimension. This paper provides a novel contribution to the literature on tax competition by explicitly modeling and testing the spatial dimension. First, we present a spatial model of tax competition, which is an adoption of the Hotelling model of imperfect competition in the linear city. We find that tax rates are strategic complements, as a change in taxes of one town will lead to a similar change of tax rates in neighboring towns. Second, we test the model with data from tourism taxes along the Italian coastline. We find that towns on the Tyrrhenian coast loose tourists to municipalities in the (south) east, if those reduce their tourism tax rate, and compete by lowering their own tax rates with respect to towns in the (north) west. We do not find similar behavior along the Adriatic coast.

Keywords Hoteling tax competition, spatial econometrics

1 Introduction and related literature

The recent popular debate on over tourism with protests in Barcelona and Ibiza and the introduction of a visitor surcharge in Venice has raised interest in regulating tourism, also through taxes. Tourism taxes are very particular taxes. Tourism taxes are also known as tourist taxes, visitor taxes, or transient occupancy taxes. They are levied either as per diem taxes, hotel taxes, restaurant taxes, and arrival or departure taxes. In most cases they are levied as excise taxes and not ad valorem taxes. Tourism taxes are not levied on residents. Very often, tourism taxes are local taxes, and can be set by every single town. The electorate is therefore not - or only indirectly - subject to the tax. Inasmuch as tourism services can be considered an "export" of services from the resort town or country to the town or country of residence of the tourists, they are also a rare case of an export duty.Tourism taxes have gained some interest in the academic literature recently, both theoretically (Descals-Tormo and Ruiz-Tamarit 2022) and empirically (Ihalanayake and Divisekera 2006). Hughes (1981) already discusses advantages and disadvantages of tourism taxes. More recently, Sheng (2017) analyses determinants of the success and failure of tourism taxes. Descals-Tormo and Ruiz-Tamarit (2022) provide the most elaborate model of tourism taxes, including their effect on both consumers and producers of tourism services. Several authors investigate tourism taxes in specific countries or regions, namely Durbarry (2008) for the UK, Ihalanayake and Divisekera (2006) for Australia, Gago et al. (2009) for Spain, and Palmer and Riera (2003) for the Spanish Balearic Islands. Three papers are particularly relevant for our analysis: Biagi et al. (2017) and Rotaris and Carrozzo (2019) investigate tourism taxes in Italy, whereas Mills et al. (2019) is to our knowledge the only other paper to explicitly account for the spatial dimension of tourism taxes. Rotaris and Carrozzo (2019) look at tourists' willingness to pay tourism taxes in two Apulian towns, and find that it depends on the use of funds. Tourists would pay more if the revenue is invested for sustainability. Unfortunately, as we will argue below, there is no general data available on the use of tourist tax revenues. Mak and Nishimura (1979) discuss the economic impact of tourism taxes in general. Bonham et al. (1992) and more recently Biagi et al. (2017) present empirical evidence that shows that tourism taxes impact arrivals, stays, and expenditure of tourists. They include taxes as an explanatory variable in their regressions, but do not include tax rates of neighboring municipalities, as stressed in our analysis. To our knowledge the literature has so far neglected the fact that tourists are mobile, and that changes in tourism taxes in one jurisdiction will not only reduce tourism, but may also divert tourism to neighboring jurisdictions.

1.2 Tax competition

The concept that jurisdictions compete over a mobile tax base was introduced by Tiebout (1956). In his seminal paper, he demonstrated how cities set property taxes in order to attract specific segments of the population and rescind others. In particular, tax revenue finance public schools, so citizens would sort themselves to high tax good school jurisdictions or low tax bad school jurisdictions. Tax competition thus leads to allocative efficiency. Space is not explicitly modeled, there are no moving costs and the new location is as good as the previous location (for instance in commuting times). Starting with Tiebout the literature has emphasized the competition over a mobile tax base by rivaling towns, regions, or countries. Whereas Tiebout focused on residents and property taxes, Wilson (1986) and Zodrow and Mieszkowski (1986) investigated mobile capital and corporate income taxes. Whilst both models require competing jurisdiction by definition, the geographical dimension was not modeled explicitly in neither of these three seminal works. By contrast, the empirical literature on tax competition (Blonigen and Davies 2004; Neumayer 2007) has always found an impact of geographical distance on international capital movements, and more recently on local spillovers of taxes on neighboring jurisdictions (Egger et al. 2006). This paper is a first attempt to close this gap in the literature, albeit with a very specific tax and setup. By contrast, Wilson (1986) and Zodrow and Mieszkowski (1986) could demonstrate that tax competition can lead to a race to the bottom between competing jurisdictions ultimately eliminating all taxes on mobile factors and an inefficiently low size of the government sector (Wilson and Wildasin 2004). Sinn (2003) demonstrates that unless public goods are in part rival in consumption (due to congestion), jurisdictions will engage in fierce tax competition and set tax rates below efficient levels for mobile factors of production. The standard model of tax competition has been extended to accommodate more than one tax rate (Bucovetsky and Wilson 1991) and different size of jurisdictions (Ottaviano and Ypersele 2005). To our knowledge, the geographical location and distance has not been considered in models of tax competition. The literature on tax competition tests whether jurisdictions lower their tax rates in order to attract tax base from neighboring jurisdictions. This of course induces their neighbors to also reduce their tax rates, such leading to a race to the bottom. However, we sometimes observe a reduction of tax rates in reaction to a reduction nearby even if the tax base doesn't move. A reason can be that citizens request from their politicians a similar practice as observed nearby, in a form of yardstick competition, as argued in the seminal paper by Shleifer (1985). Edwards and Keen (1996) present a model where the government objective function is clearly specified, and find that in either case tax competition and yardstick competition will be present. Empirical evidence for yardstick competition comes from Besley and Case (1992) and Bordignon et al. (2004). A good overview of the empirical literature is presented in Devereux and Loretz (2013), who demonstrate the inefficient low level due to tax competition throughout the literature. Evidence for the presence of tax competition for the OECD and the US is presented in Altshuler and Goodspeed (2015). Winner (2005) estimates a panel, but lacks to explicitly specify the spatial dimension in the data. That aspect has been first addressed by Egger et al. (2005), who show that competition is fiercest with countries nearby. Consumption tax competition is analyzed by Jacobs et al. (2010) , who find that US states compete over mobile consumers.

1.3 Hoteling competition

Models of imperfect competition in a (linear) space date back to Hotelling (1929). In his seminal work, Hotelling studies competition between two firms in a linear city, where consumers are distributed normally and firms can choose their location. Firms compete over consumers, and have some degree of price setting power, as the other firms further away are an inconvenient substitute for consumers. Economides (1993) and Brenner (2005) study the Hotelling model with more than one firm. The paper that may be closest to ours is Wooders and Zissmos (2003), where they adopt the Hotelling model to accommodate two cities, where both can tax firms within their city limits. Whereas firms can move between cities, consumers remain immobile. Whereas taxes are taken as given, firms react to differences in tax rates. The model presented below has three towns, and a mobile tax base in the form of tourists who react to tourism taxes. Different to Wooders and Zissmos, here towns compete for tourists by setting their tax rates. Starting with Kanbur and Keen (1993), a stream of literature emerged on crossborder shopping. Nielsen (2001) demonstrates that consumer are willing to move across borders in order to benefit from tax arbitrage advantages. A good summary of the literature is presented in Andres Leal and Rodrigo (2010), where the authors show that cross-border tax arbitrage has an important influence on tax revenues.

1.4 Overview of the paper

This paper looks at an aspect of taxation that has been so far neglected by the tax competition literature, despite the fact of the mobile nature of its tax base, namely tourist taxes. We postulate that beach holidays are essentially a different product from any other type of vacation. We make use of this property, as it allows us to investigate tax competition between beach towns in a linear space. We will model tax competition explicitly taking account of the geographical dimension, assuming a linear coastline. This paper builds on literature of industrial organization (Hotelling 1929) and fiscal competition (Tiebout 1956) to improve our understanding of tourism taxes on the flows of tourists. Our paper differs from Tiebout (1956), first and foremost as we model space explicitly and tourists have a disutility from moving further away from their preferred spot. Second, tax revenues do not predominantly benefit the taxpayers (the tourists), but the residents. Whereas Hotelling assumes mobile firms competing over inert consumers in a linear city, we will assume towns with unchangeable borders competing over mobile tourists. We will test the model with data on tourism taxes in Italy. We will investigate whether tourist towns explicitly engage in tax competition or yardstick competition by setting their tourist taxes in order to attract (mobile) tourists or in order to counteract measures undertaken in nearby towns in the spirit of yardstick competition. We will do this for towns along the Italian Tyrrhenian and Adriatic coast, assuming that a beach holiday is a distinguished product from any other type of holiday in the Hinterland. For this reason, all our jurisdictions are lined up along the coast, and this allows us to explicitly model the spatial dimension of tax competition. The paper proceeds as follows. The next section gives an introduction to the theoretical and empirical literature on tax and yardstick competition as well as tourism taxes. We will then present the model in Sect. 2 before describing the data and presenting our main results. Section 5 concludes.

2 The model

This model is an adaptation of the linear city model (Hotelling 1929). Here we assume a linear coastline with unit length, where towns of different size are lined up.[2] Towns can levy an excise tourism tax t_i from their visitors. Tourist have a preferred spot along the coastline[3] and face a linearly increasing disutility from moving away from this spot. We abstract from differences in hotel prices,[4] so that the decision where to spend the holidays depends entirely on preference and tax. Assume tourists get linear utility from a standardized consumption good x, that also serves as the numeraire good, and additively separable disutility[5] from moving away from their preferred location m_i, according to $U_i = x - d|m - m_i|$(1) Tourists can spend E on consumption x and tourism taxes τ_j, which depend on their destination, so that their budget constraint equals $x + \tau_j = E$ (2)

Figure 1 describes the model, where the coastline goes from zero to unity. Town A runs from zero to a, town B goes from a to $a+b$ and therefore has a coastline equal to b, and town Z takes up the rest of the coastline from $a+b$ to $a+b+z$. We will normalize the coastline to unity, hence $a+b+z=1$. We indicate the tax rates on the vertical axis, and assume for matters of exhibition only that $t_A > t_Z > t_B$. We have also depicted preferences (indifference curves) for two individual tourists, one in town A, one in town Z, $m_{.42}$ and $m_{.73}$. We depict the indifference curve that peaks at $U_i = \tau_i$.

Starting from their preferred point along the beach (m_i), as long as a tourist moves within town limits, expenditure net of tax $(E - \tau_j)$ remains unchanged, so that tourists would choose m_i. If the next town has higher tourism taxes, again the tourist will remain in her preferred location. Only if the neighboring town has lower taxes will

2 We assume that municipalities in the Hinterland without access to the coast are irrelevant. This can be justified by traveling costs (both in terms of time and parking fees to and from the beach), and the absence of nightlife, from boardwalks, bars, restaurants, to nightclubs.

3 Despite the fact that all tourists need to travel to their holiday destination, there is a lot of persistence in tourist behavior, driven by aversion to change, the possibility to reconnect to acquaintances at destination, or pleasant memories from previous trips.

4 It is actually sufficient for the analysis that tourism taxes are not fully born by hotels, but are at least partially passed on to tourists.

5 Instead of using absolute values for the disutility from moving away from the preferred location, we could also introduce a quadratic disutility function $-d(m-m_i)^2$. In our case, marginal utility from

moving away from the preferred location m_i is $\frac{dU_i}{dm} = -d$. In case of quadratic utility, marginal utility equals $\frac{dU_i}{dm} = -d(m - m_i)$ which again leads to costs from moving away from the preferred destination, in this case exponential. The qualitative result for tax policy would be identical.

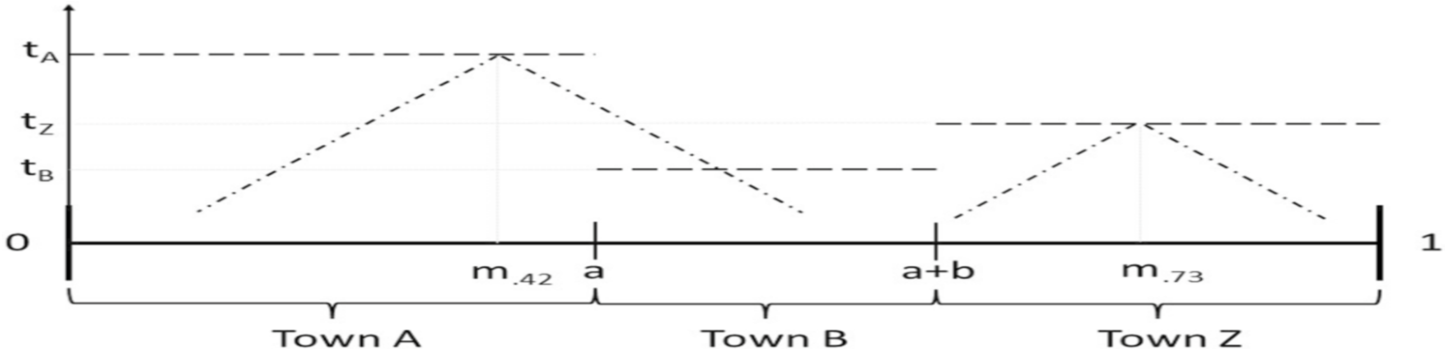

Fig. 1 The linear beach

The tourist evaluate to switch location. Note that the budget constraint exhibits a kink on the city border, so that we cannot adopt conventional marginal considerations. Tourists whose preferred location is right on the border, ill obviously switch to the town with lower taxes. We can actually identify the marginal tourist as the person who is indifferent between staying in his preferred town and switching to a neighboring town with lower taxes. We will show this both graphically and algebraically below. Whereas $m_{0.42}$ would be inclined to switch town, as the gain from lower taxes exceeds her loss from switching destination, tourist $m_{0.73}$ would remain in town Z.

Figure 2 identifies the marginal tourist, the one indifferent between vacationing in two respective towns. Tourist m_A is indifferent between town A and B, whereas m_B is indifferent between towns B and Z. For any town J, tourist m_j hence identifies the individual located most to the right (east) still inclined to vacation in town J.

Tourists are not necessarily homogeneous in their preferences. First, for every preferred point along the beach, there may be some tourists more and some tourists less affectionate to that specific location. This can be captured by different slopes of their disutility. Instead of observing single tourists, we would need to observe distribution of tourists at each point. We will refrain from pursuing this possibility. The second form of heterogeneity is possible more relevant. Some tourist towns may be more capable of maintaining tourists than others. We could model this by different

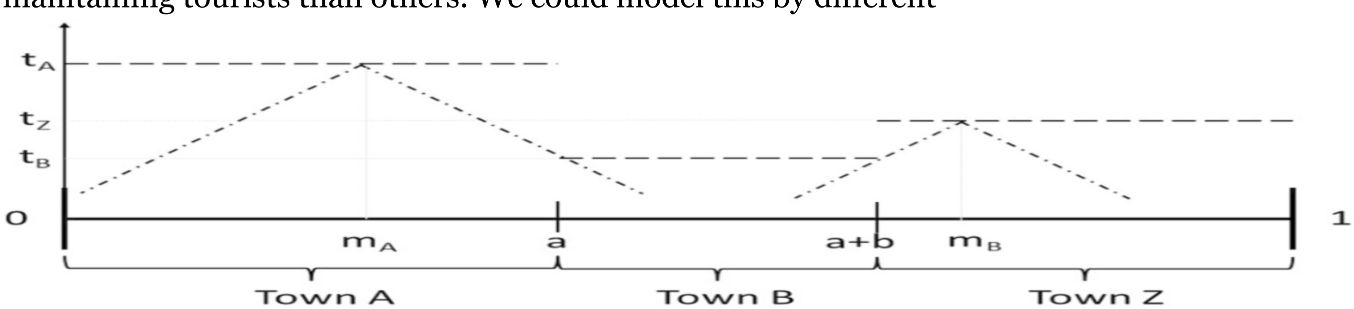

Fig. 2 the marginal tourists along the linear beach

Volume 13 Issue 2, April-June, 2025
ISSN: 2995-4231
Impact Factor: 7.57
https://kloverjournals.org/index.php/ess

Slopes of the disutility d_i line. We would need to distinguish two cases, one where tourism taxes are higher in town *A* than *B* and hence tourists from *A* leave for *B*, and one where tourism taxes are higher in town *B* then *A* and hence tourists from *B* move to *A*. We can identify the marginal tourist m^h_A when taxes are higher in *A* with respect to *B* as $mhA = a + d1A(tA - tB)$ and in cases taxes are lower in *A* with respect to *B* as $mlA = a + d1B(tB - tA)$ Depending on the slope of d_A and d_B , tourists are more or less elastic in their location preferences. This would give municipalities with loyal costumers (d_i high) the possibility to increase their tax rates without much revenue loss. This would help us to explain why tax rates are higher in some municipalities than others. In case one coast has more elastic tourist demand than the other, it suffices to assume that the slope of disutility *d* is different. We refrain from modeling different slope parameters, as it would complicate the analysis and ease of exposition. We will therefore assume $d_A = d_B = d_Z = d$ from now on. We can then identify the marginal tourist m_A as $m_A = a + \frac{1}{d}(t_B - t_A)$ (3)

Similarly, the marginal tourist between town B and Z can be identified as $m_B = a + b + \frac{1}{d}(t_Z - t_B)$ (4)

For town *A*, the number of tourists equal the interval from zero to m_A , whereas for town *B* the interval between m_A and m_B . Town Z hosts tourists from m_B to unity. We can thus identify the number of tourists in each seaside town.

Proposition 1 *An increase in its own tourism tax will reduce the number of visitors, whereas an increase in taxes of neighboring municipalities will increase the number of tourists.*

Proof The number of tourists remaining in town A equals m_A . From Eq. (3) we get $\partial m_A/\partial t_A = -\partial m_A/\partial t_B = -1/d$. The number of tourists remaining in town Z equals $1 - m_B$. From Eq. (4) we get $(1 - m_B)/\partial t_Z = \partial(1 - m_B)/\partial t_B = -1/d$, which is again consistent with Proposition 1. Finally, the number of tourists remaining in town B equals $m_B - m_A$. From Eqs. (3) and (4) we get $\partial(m_B - m_A)/\partial t_B = -2/d$ and $\partial(m_B - m_A)/\partial t_A = \partial(m_B - m_A)/\partial t_Z = 1/d$. This confirms Proposition 1. □

Proposition 1 suggests that by lowering its tax rates, towns can attract tax base in the form of additional tourists from neighboring municipalities, unless the neighboring towns react by lowering their tax rates in return. This is consistent with the standard definition of tax competition. We can actually test this proposition and will do so in Sect. 4.

Assuming that towns have tax collection costs of c_i , We can derive tax revenues of city A, which equal

$R_A = (t_A - c_A)m_A = (t_A - c_A)\left(a + \frac{1}{d}(t_B - t_A)\right)$ (5)

An increase in the tourism tax will reduce the tax base as some holidaymakers will move elsewhere, so that the revenue maximizing tourism tax rate can be derived from Eq. 5 by setting the first derivative equal to zero, which yields after some manipulation the reaction function of city A,

$t_A = \frac{1}{2}(ad + c_A + t_B)$ (6)

The length of the beach (a), the mobility of tourists ($1/d$), costs of tax collection, and tax rates of the neighboring community have an impact on the tax policy of town A. An increase in the neighboring municipality's tax rate allows city A to increase its tax rate as well, but only by half.

Similarly, we can identify tax revenues of town B as

$R_B = (t_B - c_B)(m_B - m_A) = (t_B - c_B)\, b + d^{1}(t_A + t_Z - 2t_B)$ (7)

As the middle town can lose tourists in both directions, both neighboring tax rates matter for its tax revenues. The reaction function can again by obtained by taking derivatives of Eq. 7

$t_B = \frac{1}{4}(bd + 2c_B + t_A + t_Z)$ (8)

Finally, we can identify tax revenues of town Z as

$R_Z = (t_Z - c_Z)(1 - m_B) = (t_Z - c_Z)\, z + d_1(t_B - t_Z)$

The reaction function of town Z equals (9)

$t_Z = \frac{1}{2}(zd + c_Z + t_B)$ (10)

Proposition 2 *Tourism taxes are strategic complements.*

Proof From Eqs. (6) and (10), we obtain $\partial t_A/\partial t_B = \partial t_Z/\partial t_B = 1/2$ and from Eq. (8) that $\partial t_B/\partial t_A = \partial t_B/\partial t_Z = 1/4$, which are all positive and thus confirm that tax rates are strategic complements. □

Proposition 2 finds that a reduction of the tourist tax in one town will lead to a response by neighboring towns, which will also reduce their tax rates, although less than proportional. This again suggests tax competition between towns. Both Propositions 1 and 2 can and will be tested empirically in Sect. 4. In case we find effects in both estimations, we can confirm tax competition between towns along the coast. Our empirical analysis will be based on marginal tourists (Proposition 1) and reaction functions (Proposition 2), which show that tourists and towns react to neighboring tax rates. Finally, we derive the optimal tax rates for each town, by first substituting Eq. 6 and 10 into 8, to yield after some reformulation,

$t_B^{*} = \frac{1}{6}(c_A + 4c_B + c_Z) + \frac{d}{6}(1 + b)$ (11)

Tax collection costs matter, with own costs more important than costs of neighbors.

If costs are identical, $c_A = c_B = c_Z$, then in equilibrium town *B* will set taxes above costs by the second expression, $t_B^{*} > c$. Product differentiation (a different spot on the coast) permits towns to generate tax revenues from tourist taxes despite competition from neighboring towns. There is no "race to the bottom" as in standard tax competition models, but at best a "race to the mezzanine". Note that the less elastic consumers (higher *d*), the higher will be tax rates. The length of the total coastline ($a+b+z = 1$) and its own coast (b), the higher tax rates will be. We can also identify equilibrium tax rates of town A and Z as $t_A^{*} = \frac{1}{6}(4c_A + c_B + c_Z) + \frac{d}{6}(1 + a) + \frac{1}{12}(c_A - 2c_B - c_Z) + \frac{d}{12}(3a - z)$ (12) and $t_Z^{*} = \frac{1}{6}(c_A + c_B + 4c_Z) + \frac{d}{6}(1 + z) + \frac{1}{12}(c_A - 2c_B - c_Z) + \frac{d}{12}(3z - a)$ (13)

The first and second term of the above equations is equivalent to Eq. 11. The rest is a "corner premium", as *A* and *Z* sit at the two ends of the beach. The third term controls for different tax collection costs. It would drop to zero in case tax collection costs are identical. The last term is due to the fact that in a corner town, tourists can only leave in one direction if it raises taxes (and the longer its own stretch of the beach, the more inconvenient), and only come from one side in case it reduces taxes. Corner towns will therefore have higher tax rates.

Finally, we can identify the number of tourists in town A and B by substituting the above tax rates into Eqs. (3) and (4),

$m_A^{*} = \frac{1}{12}(1 + 6a + b) - \frac{1}{12d}(5c_A - 4c_B - c_Z)$ (14)

and

$$m_B^* = \frac{1}{12}(1+b+6z)+\frac{1}{12d}(c_A+4c_B-5c_Z) \qquad (15)$$

In equilibrium, neither tax rates nor tourist numbers would depend upon tax rates of neighboring municipalities. Should all municipalities react instantaneously to changes of tax rates in neighboring communities (perfectly rational equilibrium), we would not be able to obtain significant results when testing Propositions (1) and (2). In the empirical part that follows, we will nonetheless test both propositions.

3 The data

The Italian tourism tax (*Imposta di soggiorno*) is a local tax applied to those who stay in an accommodation facility located in a municipality where this tax has been established. Historically, the tourism tax was set for the first time in Italy in 1910 giving the possibility to local municipalities provided with spas or seaside resorts to collect this tax from tourists. After being abrogated in 1989, the tourism tax was introduced again by the Italian government in 2010. Specifically, starting from 2012, an increasing number of the Italian municipalities has decided to apply this tax, reaching several hundred in 2020. In particular, the taxable person is an individual who stays overnight in some accommodation facility and pays according to the number of nights spent. In fact, rates vary according to the municipality in which the accommodation is located, the type of facility, the number of overnight stays and, in some cases, the tourism tax amount depends on the period of year in which you decide to stay. According to Italian law, one third of tourism tax revenues have to be spent on services for tourists. This implies that two thirds can be spent on services for local residents. Moreover, some public expenditures labeled for the benefit of tourists may also benefit local residents (e.g. a children's playground). Tourism taxes therefore, to a large part, do not benefit the tourists. The major expenditure of most municipalities is for lifeguards. These are - not unlike lighthouses - pure public goods. The distance between lifeguard stations is dictated by vision, and increasing the number of lifeguard stations would not improve the quality of the public services. Higher tax revenues will therefore have little or no impact on tourists' welfare. We think that we can therefore safely ignore benefits of tax revenues. Note that the data on government spending are not publicly available. They would only be revealed to the national auditors ("corte dei conti") in case of a random check of the municipality. These random checks unfortunately occur for too rarely to incorporate them into the analysis. With the aim of analyzing the interdependence among the fiscal policy choices by the neighboring municipalities in relation to the amount of the tourism tax, we decide to evaluate the behavior of the coastal municipalities of Northern Italy, and in particular those of Liguria, Toscana, Veneto, Friuli-Venezia-Giulia and Emilia Romagna, in relation to the application of the tax itself, thus investigating whether, in defining the extent of their tax, the municipal administrations are affected by the rates determined by their neighbors. We choose to focus our attention only on the North of Italy, as recovering reliable data in the south proved to be particularly hard, due to the difficulty of contacting southern municipalities and the poorly maintained documentation. The fact that local municipalities can set their own tourism tax rate within certain boundaries instead of central government fixing the tax rates gives ample scope for an empirical analysis. This is the reason why we choose to investigate the mechanism that leads institutions to determine an amount rather than another with reference to tourism tax. For this purpose, we first build a panel dataset with the introduction year of the tourism tax as well as the maximum number of nights required for the application of the charge and the related amounts divided for each category of accommodation facilities for every Municipality, ordered from west to east. In fact, in the Italian peninsula, most accommodation facilities (Hotels, RTA, holiday villages, campsites) are classified according to the number of stars (generally from one to luxury five stars), whereas other categories, such as B&B, holiday homes, hostels, farmhouse, guesthouse, do not provide this type of subdivision. It is important to underline that the tourism tax respects a progressive character: it normally grows with the increase of stars number. Moreover, we observe a high correlation, with a coefficient of correlation above 0.9 in most cases. More specifically, the analysis covers the period 2014 to 2019.[12] the type of facilities considered are 20 and the number of municipalities included in our analysis is equal to 122. On average, 2012 is the year in which most of the municipal administrations introduced this tax in their territory, but several only started applying it as late as 2018. The joint dataset ranges from 2014 to 2019, covering 31 municipalities on the Adriatic coast and 91 along the Tyrrhenian coast. Data collection was done by checking official websites of seaside municipalities, and in case the information [12] 2020 and 2021 were not taken into consideration in our analysis due to the Covid-19 pandemic, during which many towns suspended the tourist tax application.

	Mean	Std.dev	Min	Max	Q1	Q2	Q3	Q4	Q5
Tyrrhenian									
Arrivals	88 836	122 232	591	929 423	9 968	26 423	53 575	105 409	249 541
Tourism tax	0.581	0.789	0	3	0.16	0.25	0.54	0.79	1.14
Adriatic									
Arrivals	511 666	896 842	1023	5 523 283	10 449	62 811	258 455	574 610	1 666 549
Tourism tax	0.728	0.769	0	2.660	0.05	0.79	0.62	0,79	1.56
All									
Arrivals	196 278	498 625	591	5 523 283	9 667	29 636	67345	137 489	739 415
Tourism tax	0.620	0.791	0	3	0.13	0.38	0.59	0.88	1.12

Table 1 Arrivals on the Tyrrhenian and Adriatic coast

was not available by phoning the municipal tax office. We obtained complete data for the entire period for all municipalities in Northern Italy, but failed to do so for the south, where coverage was spotty at best, and - true to form - due to the absence of personnel in the tax office (for instance due to home office during the pandemic) impossible to obtain. Data on tourist arrivals and overnight presences by municipalities is well documented and could be obtained from I stat for the period 2014 - 2019. Both are again highly correlated, so we will restrict the analysis to arrivals. Summary statistics on arrivals and the tourism tax by coast are presented in Table 1 (Quantile means presented in the last 5 columns).

The length of the coastline was also provided by Istat, and due to erosion not straightforward to measure. The difference is negligible for our purpose. Unfortunately, we cannot distinguish between the types of coast, whether it is a sandy beach, rocks, or cliffs. Several municipalities stand out. Genova is the capital of the region Liguria, while La Spezia is the second largest Ligurian city by number of inhabitants. Both are located along the Tyrrhenian coast and, particularly, the latter lies near the border with Tuscany. Livorno is a city in Tuscany. All are important port cities and may attract a different type of visitor. As regards to tourism tax, both in Genova and in La Spezia, it was introduced for the first time in 2012. Venice and Trieste are two famous cities of northern Italy, which extend along the Adriatic Sea: the former is a municipality in Veneto, while the latter is situated in Friuli - Venezia - Giulia. The Venetian municipality established the tourist tax in 2011, however in Trieste this tax appeared for the first time in the late 2018. Both are important port cities, and Venice is... well, Venice. We will control for these special cases in the empirical analysis.

4 Specification and results

The data exhibit a clear panel structure, with annual observations from 2014 to 2019. There is a clear spatial relationship in the data, as all the municipalities are aligned along the coast. Due to a lack of data in the south, we split the sample into two. The Tyrrhenian Sea runs from Ventimiglia in the northwest to Capalbio in the southeast. The Adriatic Sea runs from Catholic in the southwest to Trieste in the Northeast. We can exploit these two full panels for our analysis. Moreover, given the clear spatial dimension of the dataset, we can implement a spatial lag (one municipality to the east) and lead (one municipality to the west). In order to avoid reverse causality, we also lag the spatial lag and lead variables by one period. We will estimate Proposition (1) with a random effects model using standard generalized least squares (GLS) and robust errors, according to the following specification

$$y_{i,t} = \alpha + \beta \tau_{i,t} + \beta_E E \tau_{i,t-1} + \beta_W W \tau_{i,t-1} + X_{i,t} \gamma + u_{i,t} \qquad (16)$$

where $y_{i,t}$ is the number of arrivals and $\tau_{i,t}$ the tourism tax rate in municipality i in year t. E and W are spatial matrices that shift the municipality tax rate to the east (lag) and west (lead). Note that we use temporally lagged tax rates in order to control for causality. $X_{i,t}$ is a matrix of control variables and $u_{i,t}$ is the error term.

Tables 2 and 3 show the result for arrivals on the Tyrrhenian and Adriatic coast respectively. We run seven specifications. The first column presents a standard estimation of tax elasticities, where we do not account for the spatial dimension. The second specification adds the spatial lags. Column 3 adds the length of the coastline (in km) according to Proposition 1. Column 4 controls for regional effects, and column 5 for port cities, Genova, La Spezia and Livorno on the Tyrrhenian, and Trieste and Venezia on the Adriatic Sea. Column 6 controls for year fixed effects, and column 7 estimates a fixed effects model. We include a series of tests in our analysis. We reject the null hypothesis of autocorrelation in the panel in accordance with the Woolridge test. We cannot reject the null hypothesis of normality based on a modified Jarque-Bera test for normality in panel data (Alejo et al. 2015), with one exception, column (1) in Table 2. We find evidence for heteroscedacity in the data, according to the Breusch-Pagan likelihood ratio test for panel data. Fortunately, heteroscedacity is not a serious issue with panel. We do use robust errors in all estimations in order to obtain asymptotic properties of our estimators. Given normality and a lack of autocorrelation, we run a Hausman test and find that we reject the null hypothesis of fixed effects against a random effects model. Still, taxes are set by local communities, so we cannot fully excluded that effects are non-random. We therefore present results of a fixed effects model in column 7. Finally, we check whether a spatial matrix based on contiguity (taking the value of unity for neighboring municipalities and zero otherwise), would be preferable by testing whether the two coefficients on lead and lag tourism taxes are similar. However, we reject the null hypothesis in all cases.

Table 2 Arrivals on the Tyrrhenian coast

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tourism tax	−0.034	−0.062**	−0.060*	−0.059*	−0.068**	−0.059*	−0.045
	(0.080)	(0.031)	(0.032)	(0.033)	(0.034)	(0.034)	(0.057)
... Lag (east)		0.069**	0.070**	0.066*	0.075**	0.074**	0.067**
		(0.035)	(0.036)	(0.036)	(0.036)	(0.035)	(0.032)
... Lead (west)		0.014	0.012	0.008	0.013	0.015	0.046*
		(0.035)	(0.036)	(0.038)	(0.037)	(0.036)	(0.028)
Coastal length			x	x	x	x	
Liguria control				x			
Port city controls					x		
Year FE					x		
Fixed Effects						x	
R2 within (in %)	0.2	0.1	0.1	0.2	0.2	0.8	0.5
R2 between (in %)	1.2	9.7	9.7	9.6	11.5	9.8	7.1
R2 overall (in %)	0.3	1.5	1.5	1.6	1.8	2.2	2.4
Observations	455	445	445	445	445	445	445
Woolridge F-stat	0.63	0.22	0.22	0.22	0.22	2.24	0.38
	(0.433)	(0.652)	(0.652)	(0.652)	(0.652)	(0.165)	(0.552)
Jarque-Bera (e) chi2		11.55	9.96	10.27	9.99	8.05	
		(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	
Jarque-Bera (u) chi2		4.43	21.12	20.26	24.49	22.01	
		(0.109)	(0.00)	(0.00)	(0.00)	(0.00)	
Breusch-Pagan LR chi2		154.9	79.5	53.0	167.2	53.47	72.72
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hausman chi2	0.01	1.41	1.38	1.22	1.48	0.84	
	(0.935)	(0.703)	(0.711)	(0.748)	(0.686)	(0.840)	
Spatial Symmetry chi2		0.92	0.97	0.98	1.07	1.02	0.37
		(0.338)	(0.324)	(0.323)	(0.301)	(0.313)	(0.058)

Volume 13 Issue 2, April-June, 2025
ISSN: 2995-4231
Impact Factor: 7.57
https://kloverjournals.org/index.php/ess

Dependent variable: arrivals. GLS random effect estimation with robust errors. Standard errors for estimated coefficients in parenthesis. ** (*) indicates significance at the 5% (10%) level. Probabilities for H0 for all test statistics in parenthesis

Turning to the results, we find that increasing the local tourism tax reduces arrivals in that particular town, as would be expected. The only exceptions are the simple estimation in column (1) of Table 2 and columns (2) and (4) of Table 3, and the fixed effect model. We also find that an increase in the tourism tax in a neighboring town (to the east) increases arrivals along the Tyrrhenian Sea, so tourists

Table 3 Arrivals on the Adriatic coast tourism tax

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	−0.017*	−0.014	−0.020**	−0.016	−0.025**	−0.021**	−0.024
	(0.009)	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)	(0.024)
... lag (east)		−0.004	0.002	0.002	0.003	0.003	0.057*
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.031)
... lead (west)		0.001	0.008	0.008	0.008	0.006	0.012
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.028)
Coastal length			x	x	x	x	x
Romagna control				x			
Port city controls					x		
Year FE						x	
Year FE							x
R^2 within (in %)	0.2	0.1	0.3	0.8	0.2	7.8	3.8
R^2 between (in %)	15.8	9.7	24.9	34.5	32.7	24.4	13.1
R^2 overall (in %)	2.0	1.5	4.3	5.8	5.2	10.8	6.9
Observations	154	144	144	144	144	144	144
Woolridge F-stat	0.02	0.01	0.01	0.01	0.01	3.77	0.93
	(0.890)	(0.933)	(0.933)	(0.933)	(0.933)	(0.093)	(0.337)
Jarque-Bera (e) ^{chi2}	17.12	20.10	14.93	21.92	19.22		
	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)		
Jarque-Bera (u) ^{chi2}	95.15	155.57	43.52	100.68	55.01		
	(0.000)	(0.00)	(0.00)	(0.00)	(0.00)		
Breusch-Pagan LR ^{chi2}	57.0	35.97	35.26	24.54	60.53	77.18	
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	
Hausman ^{chi2}	0.09	5.75	5.15	4.58	5.68	0.86	
	(0.766)	(0.125)	(0.161)	(0.205)	(0.128)	(0.073)	
Spatial Symmetry ^{chi2}		0.11	0.37	0.16	0.51	0.34	0.10
		(0.937)	(0.542)	(0.688)	(0.301)	(0.474)	0(0.758)

Dependent variable: arrivals. GLS random effect estimation with robust errors. Standard errors for estimated coefficients in parenthesis. **(*) indicates significance at the 5% (10%) level. Probabilities for H0 for all test statistics in parenthesis

Move southwest as taxes increase. The asymmetry may be due to the fact that the disutility of changing destination is not equal. Tourists may have a lower disutility moving east (which, along the Tyrrhenian coast corresponds to a move further north and hence closer to the populated centers of Italy), as opposed to moving west (or south, and thus further away from home). The fact that tourism taxes in a neighboring municipalities has an impact on arrivals suggests that there is some evidence in support of Proposition 1. Note that in the fixed effects model, municipalities react according to the model to both neighbors. We do not observe an effect for towns to the west, nor can we verify the same for tourism taxes along the Adriatic Sea. However, a longer stretch of coast matters along the Adriatic coast, where towns are generally larger and command a longer beach. These towns might use this fact in their favor by charging slightly higher taxes. Given the low number of observations on the Adriatic coast, we wouldn't put too much weight on the results. We will estimate Proposition (2) again with a random effects model using standard generalized least squares (GLS), according to the following specification, $\pi_{i,t} = \alpha + \beta_E E\pi_{i,t-1} + \beta_W W\pi_{i,t-1} + X_{i,t}\gamma + u_{i,t}$ (17) Tables 4 and 5 present the results. Once again we estimate a spatial panel, using spatially lagged and lead tourism taxes of the previous year to control for reverse causality. In this way, we estimate reaction functions according to Proposition 2. We repeat the same tests from Tables 2 and 3. We find that cannot reject normality, that we have an issue with heteroscedasticity, which we circumvent using robust errors.

Table 4 Tourism tax spillovers on the Tyrrhenian coast

	(1)	(2)	(3)	(4)	(5)
tourism tax (east)	−0.037	−0.039	−0.010	−0.024	−0.025
	(0.147)	(0.186)	(0.146)	(0.148)	(0.154)
tourism tax (west)	0.353**	0.357**	0.326**	0.379**	0.349**
	(0.164)	(0.163)	(0.162)	(0.166)	(0.173)
Coastal length		x	x	x	x
Liguria control			x		
Port city controls				x	
Year FE					x
R^2 within (in %)	12.2	11.6	11.9	12.1	14.2
R^2 between (in %)	4.3	11.0	20.3	12.8	12.5
R^2 overall (in %)	9.8	12.0	16.4	13.5	14.2
Observations	445	445	445	445	445
Woolridge F-stat	0.36	0.36	0.36	0.94	0.44
	(0.557)	(0.557)	(0.557)	(0.342)	(0.513)
Jarque-Bera (e) chi^2	22.07	22.35	23.25	21.06	
	(0.00)	(0.00)	(0.00)	(0.00)	
Jarque-Bera (u) chi^2	10.58	11.63	16.83	13.12	

	(0.00)	(0.00)	(0.00)	(0.00)	
Breusch-Pagan LR ^{chi2}	867.3	−1253.4	−902.9	428.6	−1258.5
	(0.00)	(1.00)	(1.00)	(0.00)	(1.00)
Hausman ^{chi2}	0.09	0.62	0.54	0.12	4.80
	(0.955)	(0.732)	(0.765)	(0.944)	(0.308)
Spatial Symmetry ^{chi2}	3.31	2.59	2.45	3.50	2.75
	(0.069)	(0.108)	(0.117)	(0.061)	(0.097)

Dependent variable: (own) tourism tax. GLS random effect estimation with robust errors. Standard errors for estimated coefficients in parenthesis. **(*) indicates significance at the 5% (10%) level. Probabilities for H0 for all test statistics in parenthesis

Table 5 Tourism tax spillovers on the Adriatic coast

	(1)	(2)	(3)	(4)	(5)
tourism tax (east)	−0.003	0.000	−0.067	0.112	0.145
	(0.113)	(0.442)	(0.448)	(0.466)	(0.424)
tourism tax (west)	−0.113	−0.116	−0.134	−0.149	−0.085
	(0.224)	(0.231)	(0.232)	(0.236)	(0.216)
Coastal length		x	x	x	x
Romagna control			x		
Port city controls				x	
Year FE					x
R^2 within (in %)	2.1	2.1	1.9	2.1	28.9
R^2 between (in %)	4.3	4.6	24.0	0.6	30.9
R^2 overall (in %)	1.2	1.2	4.3	3.4	25.6
Observations	144	144	144	144	144
Woolridge F-stat	3.55	3.55	3.55	3.55	6.11
	(0.080)	(0.080)	(0.080)	(0.080)	(0.03)
Jarque-Bera (e) ^{chi2}	23.72	20.13	21.02	20.25	
	(0.00)	(0.00)	(0.00)	(0.00)	
Jarque-Bera (u) ^{chi2}	16.76	9.47	25.96	35.04	
	(0.00)	(0.00)	(0.00)	(0.00)	
Breusch-Pagan LR ^{chi2}	262.9	84.45	64.94	−502.1	−244.6
	(0.00)	(0.00)	(0.00)	(1.00)	(1.00)
Hausman ^{chi2}	0.27	0.28	0.71	0.31	1.27
	(0.872)	(0.869)	(0.701)	(0.858)	(0.867)
Spatial Symmetry ^{chi2}	0.03	0.04	0.01	0.17	0.17
	(0.852)	(0.847)	(0.913)	(0.680)	(0.680)

Dependent variable: (own) tourism tax. GLS random effect estimation with robust errors. Standard errors for estimated coefficients in parenthesis. ** (*) indicates significance at the 5% (10%) level.

Probabilities for H0 for all test statistics in parenthesis Once again, we reject the fixed effects model against a random effects model according to the Hausman test. Whereas we reject the null of autocorrelation on the Tyrrhenian coast, we cannot reject autocorrelation on the Adriatic coast. We present the results for the Adriatic coast for completeness, but would not endorse an interpretation of the results obtained. Results for the Tyrrhenian coast are interesting. We find that municipalities lower their own tourism taxes if a neighboring municipality to the west has reduced them. This seems to be the opposite direction with respect to arrivals, Table 2. To understand what is happening, let's take the example of three municipalities along the Tuscan coast, Follonica (west), Punta Ala and Castiglione della Pescaia (east). If Follonica reduces its tourism tax, Punta Ala will see the number of arrivals fall. By contrast, if Castiglione reduces its tourism tax, Punta Ala will react by reducing its tourism tax, in order offset the loss of arrivals. We therefore observe an asymmetric behavior of tax competition on the Tyrrhenian coast. By contrast, just like before in Table 3, we observe no effects along the Adriatic coast.

5 Conclusions

This paper has made a theoretical and empirical contribution to the tax competition literature. First, we have presented a spatial model of tax competition where towns lined up in a one dimensional space. The model is based on the Hotelling (1929) model of imperfect competition due to spatial differentiation. An application for the model is tourism taxes along the coast, where towns compete over mobile tourists only with other resort towns along the beach. We were able to derive two testable predictions from the model, one based on tourist movements, one based on tax reaction functions. The empirical contribution was to test the model with data from Italian tourism taxes along the Tyrrhenian and Adriatic coast. We find evidence for tax competition along the Tyrrhenian coast, but not along the Adriatic coast. For the prior, we can confirm that tourists react to lower tourism taxes in neighboring towns by switching destination. We also find effects when testing tax reaction functions, where we can show that tourism taxes are strategic complements. A reduction of tourism taxes in neighboring towns leads a municipality to also lower their taxes. These results have of course wider implications for the tourism industry. Revenues from tourism taxes can be used to improve (public) services for citizens, with the additional benefit that they are not levied on residents themselves. These revenues can also be used to improve services for tourists themselves, thus alleviating the tax burden on tourists. Indeed by law the Italian tourism tax has to be spent in part on services for tourists. This paper has shown, however, that an increase in the tourism tax comes at a cost, as it may erode the tax base, without tourists switching to neighboring municipalities to avoid the tax. The measured effects are small, so that we are confident that we do not obtain a negative tax revenue elasticity, yet big enough to be taken into consideration. Finally, we find that Italian municipalities along the Tyrrhenian coast compete over the tax base (tourists).

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