Tax Policy Design in a Globalized Economy: A Comparative Analysis of Destination and Origin Principles.*

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Abstract

This paper studies the optimal design of commodity taxation in an open economy with firm mobility and labor market heterogeneity. We develop a two-country general equilibrium model featuring monopolistic competition, endogenous firm relocation, and a segmented labor market—where skilled labor has flexible wages and unskilled labor faces wage rigidity. We compare the welfare effects of two tax principles: the destination principle (taxation at the point of consumption) and the origin principle (taxation at the point of production). Our main result establishes the existence of a threshold condition: if skilled labor accounts for more than half of production income, the origin principle yields higher welfare in non-cooperative tax settings; otherwise, the destination principle is superior. This finding provides a tractable rule based on observable labor market parameters and offers new insights into international tax coordination. The model contributes to the literature by endogenizing labor income responses and firm mobility, highlighting novel channels of tax incidence and policy spillovers in integrated markets.

Keywords: tax competition, origin principle, destination principle, monopolistic competition, labor heterogeneity.

JEL classification: F10, H20, H25.

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1 Introduction

Over the past few decades, the world economy has become increasingly integrated through global trade, capital mobility, and regional cooperation. Institutions such as the European Union (EU), the United States-Mexico-Canada Agreement (USMCA), the Association of Southeast Asian Nations (ASEAN), and the African Continental Free Trade Area (AfCFTA) have aimed to reduce or eliminate tariffs and harmonize trade policies to facilitate the free movement of goods, services, and capital. However, while these arrangements have successfully reduced traditional trade barriers, they have not eliminated the potential for harmful tax competition among member states. In the absence of fiscal coordination, countries may engage in strategic tax-setting behavior to attract investment or consumption, leading to suboptimal policy outcomes.

In this context, the design of commodity tax systems remains a crucial issue. A central debate concerns the choice between the origin principle, where goods are taxed at the point of production, and the destination principle, where goods are taxed at the point of consumption. This debate is particularly salient in value-added tax (VAT) systems and in discussions about international tax harmonization. While most countries have adopted the destination principle in practice, the theoretical and empirical justification for this choice remains a matter of active research and policy debate. The goal of this paper is to revisit this question by incorporating realistic features of globalized economies, including firm mobility and heterogeneous labor markets, into a general equilibrium framework.

The policy implications of this debate are far-reaching. For instance, under the destination principle, goods imported into a country are taxed similarly to domestically produced goods, promoting neutrality in consumption choices. By contrast, the origin principle taxes exports and exempts imports, potentially distorting trade patterns. Despite this, early proposals for European integration, notably the 1963 Neumark Report, advocated for the origin principle on the grounds that it would eliminate tax frontiers within the European Economic Community (EEC). Though ultimately rejected, the Neumark proposal highlighted the trade-offs involved in choosing between tax principles and continues to influence contemporary discussions.

Two key developments have renewed interest in this topic. First, the formation of deep regional markets, such as the EU Single Market, has intensified the scope for cross-border shopping and tax arbitrage. When production costs are similar across countries–as is often the case in developed economies like France and Germany–variations in tax rates become the primary source of price differentials. This creates incentives for consumers and firms to exploit tax differentials, undermining the fiscal autonomy of high-tax jurisdictions. To

preempt such behavior, the European Commission in 1992 proposed a VAT rate band (14-20% for standard rates, 4-9% for reduced rates), although full harmonization remains elusive.

Second, the rapid rise of e-commerce has transformed global retail and intensified tax enforcement challenges. According to Statista (2024), e-commerce accounted for 18.8% of global retail sales in 2021, rising to 19.4% in 2023, with projections of 21.8% in 2026 and 22.6% in 2027. In monetary terms, the e-commerce market grew from 5 trillion in 2021 to 5.8 trillion in 2023, and is expected to reach 8 trillion by 2027. This digital shift enables consumers to purchase goods directly from foreign jurisdictions, often circumventing domestic tax obligations. Scholars such as Sinn (1990) and McLure (1999) foresaw these challenges, arguing that destination-based taxation becomes increasingly difficult to enforce in digital contexts unless there is substantial rate harmonization.

Theoretical models have historically shown that the destination and origin principles can yield equivalent efficiency outcomes under restrictive assumptions–uniform tax rates, fixed wages, flexible prices, and inelastic factor supplies. Seminal contributions by Grossman (1980) and Lockwood (1993) demonstrated such neutrality in idealized settings. However, these assumptions rarely hold in practice. A landmark paper by Mintz and Tulkens (1986) showed that when consumers can engage in cross-border shopping, origin-based taxation leads to inefficient Nash equilibria, with at least one jurisdiction setting sub-optimally low tax rates. This insight underscores the relevance of tax coordination mechanisms to mitigate competitive undercutting.

Building on this literature, Keen and Smith (1996) argued that full harmonization of VAT rates and tight coordination of tax policies would be necessary to sustain the destination principle in integrated markets like the EU. However, achieving such coordination is politically challenging, especially as governments increasingly depend on VAT revenues to offset declining tariffs and other border taxes. Furthermore, Keen and Lahiri (1998) offer a critical contribution by examining tax competition under imperfect mobility of goods and capital. Their analysis demonstrates that tax competition can lead to asymmetric tax burdens and may justify partial tax harmonization even without full factor mobility. They show that decentralized tax setting generates inefficiencies due to strategic interaction between jurisdictions. This supports the argument for limited coordination frameworks and reveals that the standard policy dichotomy between full harmonization and laissez-faire may overlook intermediate yet efficient institutional arrangements. through their effects on skilled labor demand and wages. Later work by Haufler and Pflüger (2004) further demonstrated that under monopolistic competition and firm mobility, the destination principle may actually Pareto dominate the origin principle, challenging earlier conclusions.

Despite these advances, many existing models rely on the simplifying assumption of

homogeneous labor, abstracting from the diverse realities of modern labor markets. In practice, labor markets exhibit significant heterogeneity in skills, wage-setting mechanisms, and mobility. This paper contributes to the literature by introducing a dual labor market into a general equilibrium model of commodity taxation, distinguishing between skilled labor, whose wages are determined endogenously by market conditions, and unskilled labor, whose wages are institutionally rigid due to legal floors or collective bargaining agreements. By introducing labor heterogeneity, we enrich the analysis of tax competition and coordination, offering new perspectives on the choice between origin and destination principles

For instance, Helpman and Itskhoki (2010) and Dustmann et al. (2014) show that skilled wages are more responsive to economic shocks, whereas unskilled wages are often sticky. Dustmann et al. (2014), in particular, provide robust evidence from the German labor market showing that wage adjustments following trade shocks are markedly heterogeneous across skill groups. Their analysis demonstrates that increased exposure to trade with low-wage countries leads to significant wage declines for low-skilled workers, while wages for high-skilled workers remain either stable or increase. This heterogeneity in wage responses reflects underlying differences in bargaining power, mobility, and institutional constraints, and it underscores the importance of modeling labor as non-uniform when evaluating the incidence of taxation in open economies. By integrating a dual labor market structure into our general equilibrium framework, we are able to capture these differential responses and assess how commodity tax regimes shape income distribution across skill levels in both producing and consuming countries.

Moreover, Feenstra (2004) provides an analytical framework to understand how global production networks and offshoring shift labor demand across countries and sectors, again with heterogeneous effects on different types of labor. His work emphasizes that globalization increases the substitutability of tasks across borders, especially for routine or low-skilled work, which becomes more vulnerable to international competition. In contrast, high-skilled labor, particularly in tasks that are complementary to technology or management, becomes more valuable and more mobile. In our model, this global substitutability of low-skilled labor interacts with tax-induced shifts in production location, amplifying cross-border wage spillovers. When one country lowers its commodity tax to attract firms, the resulting increase in demand for skilled labor raises skilled wages domestically but can suppress them abroad due to firm relocation and shifting production shares–an effect consistent with Feenstra (2004) and Grossman and Rossi-Hansberg (2008) observations on labor market interdependence in global value chains. These contributions reinforce the need to move beyond representative-agent models that overlook labor market segmentation. In the context of international tax design, ignoring such heterogeneity may lead to misguided conclusions

about the neutrality or efficiency of different tax principles. By explicitly modeling how skilled and unskilled workers respond differently to fiscal and trade shocks, our approach highlights novel channels of tax incidence and policy spillovers that are crucial in today's interconnected and unevenly skilled labor markets.

Another important motivation for this paper is the continued relevance of digital platforms and cross-border e-commerce. As highlighted by Aiura and Ogawa (2019, 2023), digital technologies amplify tax competition and shift the relative efficiency of the destination versus origin principle. Their model, which incorporates monopolistic competition and online shopping, shows that destination-based taxation becomes harder to enforce in the presence of digital arbitrage, necessitating updated frameworks for strategic tax setting.

Our analytical framework builds on the literature on monopolistic competition (e.g., Dixit and Stiglitz, 1977; Krugman, 1980), extending it by incorporating labor heterogeneity and endogenous wage setting. We also draw on models of tax competition and firm mobility (e.g., Haufler et al., 2000; Devereux and Griffith, 1998) while integrating insights from optimal taxation theory (e.g., Atkinson and Stiglitz, 1976; Auerbach and Jr., 2001). The model is further enriched by considering strategic tax interactions among asymmetric countries (e.g., Kanbur and Keen, 1993), border frictions (e.g., Anderson and van Wincoop, 2003), and unemployment-related tax distortions (e.g., Moriconi and Sato, 2009).

One of the central findings of our analysis is that neither the origin nor the destination principle achieves the first-best outcome in the presence of firm mobility and labor heterogeneity. Instead, we show that their relative desirability depends on the share of production income paid to skilled labor. If this share exceeds 50%, the origin principle Pareto dominates the destination principle; otherwise, the destination principle is preferable. This result offers a tractable decision rule based on observable labor market parameters, and it challenges earlier neutrality theorems by showing how wage endogeneity and cross-border labor market effects reshape the welfare outcomes of different tax regimes.

The rest of the paper is organized as follows. In Section 2 we present the theoretical model. In Section 3, we describe what the equilibrium looks like in the destination and in the origin principle. In Section 4, we describe the optimal tax rate in the cooperative case, while in Sections 5 , we study the question in the non-cooperative case both under the destination and origin principles. In Section 6, we make conclusive remarks.

2 The Model

We consider a version of the Dixit-Stiglitz-Krugman model of monopolistic competition (Dixit and Stiglitz, 1977; Krugman, 1979 and Krugman, 1980) where firms produce monopolistically goods that enter international trade using one unit of capital and a variable amount of labor. The economy is made up of two countries, home h and foreign f. We assume that the home and the foreign countries are populated by L and L^* individuals respectively. In addition, suppose that each country is populated by two types of individuals, skilled denoted by s and unskilled denoted by u. Let us further denote by ψ_i (resp. ψ_i^*) $i \in \{s, u\}$ the proportion of individuals of type i in the total population of the home country (resp. in the foreign country). Each individual owns one unit of labor and an amount of capital that differs from one type of individual to another while being the same for all individuals of the same type.

We assume that there are two goods: a numeraire produced exclusively by unskilled individuals, and the other, a differentiated good, produced by firms using both unskilled and skilled labor. We further suppose that firms produce goods using a Cobb-Douglas technology and these goods are sold domestically and abroad. A tax is applied to each unit of good so that when it becomes too high in a given country, some firms relocate abroad, in this paper, without costs. Finally, in each country, there is a local government that collects fiscal revenues and redistributes them to their citizenship as a lump sum.

In what follows, we describe the economy and then discuss changes that occur when the level of the tax changes in one country according to the destination and origin principles.

2.1 Consumer demand

A given consumer of type i in the home country maximizes its utility under the tax principle k and defined on a set of differentiated goods $D_{i,k}$ and a numeraire $E_{i,k}$. We assume $D_{i,k}$ is produced by monopolistic firms located in the home and foreign countries and the numeraire $E_{i,k}$ is produced under perfect competition.

We further assume that the numeraire enters the utility function linearly. Therefore, the utility function of a type-i consumer is represented by the following equation :

$$U_{i,k} = \mu_i \ln D_{i,k} + E_{i,k}, \quad \mu_i > 0 \tag{1}$$

where

$$D_{i,k} = \left[\int_{\Omega} D_{i,k}^{h}(v)^{(\sigma-1)/\sigma} dv + \int_{\Omega^*} D_{i,k}^{f}(v)^{(\sigma-1)/\sigma} dv \right]^{\sigma/(\sigma-1)}, \ \sigma > 1. \tag{2}$$

$D_{i,k}^{h}$ is the demand for variety v produced in the home country h (resp. $D_{i,k}^{f}$ the demand for variety v produced in the foreign country f) of any consumer of type i located in the home country h. Ω (resp. Ω^*) is the number of varieties in the home country (resp. in the foreign country).

Let us assume that one unit of the numeraire is produced under constant return to scale and perfect competition by using one unit of unskilled labor. We further assume that this numeraire is not part of international trade.[1]. These two assumptions allow us to normalize the price of the numeraire and the wage of the unskilled workers.

For any differentiated good, an ad valorem tax is applied to the producer price regardless of destination or origin principles. Therefore, the budget constraint of a type-i consumer is given by:

$$\int_{\Omega} (1 + t_{h,k})\, p_{h,k}(v) D_{i,k}^{h}(v) dv + \int_{\Omega^*} (1 + t_{f,k})\, p_{f,k}(v) D_{i,k}^{f}(v) dv + E_{i,k} = \omega_{i,k} + R_k K_i + B_{i,k}. \tag{3}$$

K_i is the amount of capital supplied by the consumer of type i, R_k is the capital return under the tax principle k, and $B_{i,k}$ is a lump sum to any consumer of type i. In addition, $p_{h,k}$ (resp. $p_{f,k}$) represents the producer price for goods produced in the home country (resp. in the foreign country).[2]

Introducing the price index P_k, k,

$$P_k = \left(\int_{\Omega} \left[(1 + t_{h,k})\, p_{h,k} \right]^{1-\sigma} + \int_{\Omega^*} \left[(1 + t_{f,k})\, p_{f,k} \right]^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \tag{4}$$

the above budget constraint in the home country h can be re-written as

$$P_k D_{i,k} + E_{i,k} = \omega_i + R_k K_i + B_{i,k}, \qquad k \in \{d, o\}. \tag{5}$$

We can now express the demand for domestic and foreign goods as a function of tax levels

[1]The numeraire is often conceptualized as a non-tradable service or good (e.g., local haircuts, real estate services, construction) whose international exchange is either impossible or prohibitively costly. This assumption is standard in international trade and tax competition models, particularly those that aim to simplify general equilibrium dynamics while isolating the effects of tax policy on traded goods; see Grossman (1980) or Helpman and Krugman (1985). See Melitz (2003) or Costinot and RodrÃguez-Clare (2014) for cases where the numeraire is tradable.

[2]In the foreign country f, will be denoting respectively $p_{h,k}^{*}$ and $p_{f,k}^{*}$ the producer prices for goods produced in the home country h and in the foreign country f respectively.

and the price index, for a consumer located in the domestic country h, as follows:

$$D_{i,k}^{h} = \mu_i \left[(1+t_{h,k})\, p_{h,k}\right]^{-\sigma} P_k^{\sigma-1}; \quad D_{i,k}^{f} = \mu_i \left[(1+t_{f,k})\, p_{f,k}\right]^{-\sigma} P_k^{\sigma-1} \tag{6}$$

Using the same reasoning, the domestic and foreign demand of any consumer of type i located in the foreign country are given by:

$$D_{i,k}^{h,*} = \mu_i \left[\left(1+t_{h,k}^{*}\right) p_{h,k}^{*}\right]^{-\sigma} (P_k^{*})^{\sigma-1}; \quad D_{i,k}^{f,*} = \mu_i \left[\left(1+t_{f,k}^{*}\right) p_{f,k}^{*}\right]^{-\sigma} (P_k^{*})^{\sigma-1}.^{3} \tag{7}$$

$D_{i,k}^{h,*}$ (resp. $D_{i,k}^{f,*}$) is the demand for the variety v produced in the domestic country (resp. produced in the foreign country) by an individual of type i located in the foreign country.

The indirect utility function in the domestic country is then given by:

$$V_{i,k}\left(t_{h,k}, t_{f,k}\right) = \mu_i \ln\left(\mu_i P_k^{-1}\right) + \left(\omega_i + R_k K_i + B_{i,k} - \mu_i\right), \; k \in \{d, o\} \tag{8}$$

2.2 The production

A firm located in the home country h uses skilled and unskilled labor to produce goods that will be sold on the domestic and foreign markets. We assume a Cobb-Douglas production function represented as follows:

$$\sum_i \psi_i D_{i,k}^{h}(v) L + \sum_i \psi_i^{*} D_{i,k}^{h,*}(v) L^{*} = F_k\left(\ell_{s,k}, \ell_{u,k}\right) \equiv A \ell_{s,k}^{\alpha} \ell_{u,k}^{1-\alpha}, \tag{9}$$

where $\ell_{i,k}$ is the amount of labor of type i that is used by firms in their production process under the tax principle k.
The corresponding technological constraint for any firm located in the foreign country is given by :

$$\sum_i \psi_i D_{i,k}^{f}(v) L + \sum_i \psi_i^{*} D_{i,k}^{f,*}(v) L^{*} = F_k\left(\ell_{s,k}^{*}, \ell_{u,k}^{*}\right) \equiv A \left(\ell_{s,k}^{*}\right)^{\alpha} \left(\ell_{u,k}^{*}\right)^{1-\alpha} \tag{10}$$

In addition, suppose that prior to operation, each firm uses one unit of capital as fixed costs (those fixed costs encompass costs of building new factory, new machines, R&D and other

[3] Where the price index in the foreign country is given by

$$P_k^{*} = \left(\int_{\Omega} \left[(1+t_{h,k}^{*})\, p_{h,k}^{*}\right]^{1-\sigma} + \int_{\Omega^{*}} \left[(1+t_{f,k}^{*})\, p_{f,k}^{*}\right]^{1-\sigma} \right)^{\frac{1}{1-\sigma}}, \; k \in \{d, o\}$$

needs); this unit of capital is paid back in a return denoted R_k.. Further, assume that capital is freely mobile between countries without any additional costs; this assumption equalizes the price of capital in the two countries. In addition, we assume that for each unit of skilled labor used by the firms, the firms pay a cost equal to ω_k which represents the skilled wage. Therefore, the firm that produces variety w in the country h maximizes its profits given by:

$$\pi_{h,k}(v) = p_{h,k}(v) \sum_i \psi_i D^h_{i,k}(v) L + p^*_{h,k}(v) \sum_i \psi^*_i D^{h,*}_{i,k} L^* - \omega_k \ell_{s,k}(v) - \ell_{u,k}(v) - R_k, \quad (11)$$

Under monopolistic competition, each firm sets the domestic and foreign prices, $p_{h,k}(v)$ and $p^*_{h,k}(v)$, which maximize its profit in each market. Therefore from the first-order conditions we have $p_{h,k}(v) = p^*_{h,k}(v)$; and using the technological constraint (9), we can re-write firms' profit function as follow:

$$\pi_{h,k}(v) = \frac{p_{h,k}(w) F_k(w)}{\sigma} - R_k \quad (12)$$

The first term on the right-hand side of equation (12) represents firm's operating surplus i.e. the proportion of total revenue that is left after covering for variable costs (here labor). There will be an increasing number of firms entering the market until this terms exactly offset the fixed costs R_k.

Assuming no firm earns profit, therefore, the remuneration of skilled and unskilled labor used in the production process is given by the following:

$$\omega_k \ell_{s,k}(v) = \alpha(\sigma - 1) R_k; \quad \ell_{u,k}(v) = (1 - \alpha)(\sigma - 1) R_k.^{4,5} \quad (13)$$

Equation (13) show how firms distribute their markups (returns above cost) between skilled and unskilled labor. Skilled workers receive a flexible wage that adjusts with profitability, while unskilled labor is hired in quantities that vary with firm income due to fixed wages. To be more precise, as markup (i.e., market power or demand intensity) or return on capital increases, firms pay more to skilled labor, but this payment is constrained by the elasticity of skilled worker to the production α; in the other hand, as firms become more profitable (higher R_k), they hire more unskilled labor in fixed proportion.

[4]The corresponding equations in the foreign country are given by:

$$\omega^*_k \ell^*_{s,k}(v) = \alpha(\sigma - 1) R_k; \quad \ell^*_{u,k}(v) = (1 - \alpha)(\sigma - 1) R_k.$$

[5]$(\sigma - 1) R_k$ represents markup revenue above marginal cost, i.e., the total funds available for variable input payments (here in this paper, labor) after the firm covers its fixed cost R_k.

2.3 The Government

Now we will give a proper expression to the income that comes from taxes and is distributed to consumers as a lump sum. As a reminder, in our paper, the sole purpose of governments is to maximize the welfare of consumers in their respective countries. Governments therefore set the level of tax paid per unit of good consumed, and this fiscal revenue is collected and passed on to all citizens in the form of lump sum transfers. In the destination principle, taxes are collected on goods sold on the domestic market (locally and imported goods), while in the origin principle, taxes are collected on goods locally produced (whether sold domestically or exported).

Therefore, the fiscal revenue in the home and foreign countries in the destination principle are given by:

$$t_d T_d = t_d L \sum_i \psi_i \left(N_d p_{h,d} D^h_{i,d} + N^*_d p_{f,d} D^f_{i,d} \right) = L \sum_i \psi_i B_{i,d} \tag{14}$$

$$t^*_d T^*_d = t^*_d L^* \sum_i \psi^*_i \left(N_d p^*_{h,d} D^{h,*}_{i,d} + N^*_d p^*_{f,d} D^{f,*}_{i,d} \right) = L^* \sum_i \psi^*_i B^*_{i,d} \tag{15}$$

While in the origin principle, fiscal revenues in the home and foreign countries are:

$$t_o T_o = t_o N_o \left[L \sum_i \psi_i p_{h,o} D^h_{i,o} + L^* \sum_i \psi^*_i p^*_{h,o} D^{h,*}_{i,o} \right] = L \sum_i \psi_i B_{i,o} \tag{16}$$

$$t^*_o T^*_o = t^*_o N^*_o \left[L \sum_i \psi_i p_{f,o} D^f_{i,o} + L^* \sum_i \psi^*_i p^*_{f,o} D^{f,*}_{i,o} \right] = L^* \sum_i \psi^*_i B^*_{i,o} \tag{17}$$

where $T_k, k \in \{d, o\}$ (resp. $T^*_k, k \in \{d, o\}$) is the fiscal base under the tax principle k in the domestic country (resp. in the foreign country).

3 Equilibrium

In this Section we give the remaining equations that characterize the equilibrium in the model and the hypothesis associated to each of them.

- Labor market equilibria : we assume in our model that there is no international mobility of skilled labor; therefore, the supply of skilled labor in a given country is equal to the amount of skilled labor effectively used by firms located in that country. This

characterization is given by:

$$\psi_s L = N_k \ell_{s,k}; \qquad \psi_s^* L^* = N_k^* \ell_{s,k}^* \tag{18}$$

The previous equations state that the number of companies existing in the two countries depends inversely on the quantity of skilled labor used: the greater the quantity of skilled labor used, the smaller the number of companies existing.

- Capital market equilibrium: each firm used one unit of capital as fixed costs and capital is freely mobile between countries. Therefore the amount of capital in the economy determines the overall existing number of firms; this is characterized by:

$$N_k + N_k^* = \bar{K} \tag{19}$$

- Free-Entry Conditions: under monopolistic competition, firms enter markets until profits fall to zero; the entry of each new firm diminishes the profits of existing ones until revenue exactly balances fixed costs. This is therefore represented as:

$$p_{f,k} A \left(\ell_{s,k}^*\right)^{\alpha} \left(\ell_{u,k}^*\right)^{1-\alpha} = p_{h,k} A \left(\ell_{s,k}\right)^{\alpha} \left(\ell_{u,k}\right)^{1-\alpha} = \sigma R_k \tag{20}$$

From now on, we will refer to ω_k $k \in \{d, o\}$ as the wage rate of the skilled worker. Indeed, since the unskilled wage rate is constant and equal to one, thus not subject to tax variation, this will ease our notation. In addition, we choose to fix to a constant the redistribution from tax collection B_u and B_u^* that goes to the unskilled workers both in the home and in foreign countries.

Therefore the two price indexes can be re-expressed as:

$$P_k = \left[N_k \left[(1 + t_{h,k}) p_{h,k}\right]^{1-\sigma} + N_k^* \left[(1 + t_{f,k}) p_{f,k}\right]^{1-\sigma}\right]^{\frac{1}{1-\sigma}}, \; k \in \{d, o\} \tag{21}$$

and

$$P_k^* = \left[N_k \left[(1 + t_{h,k}) p_{h,k}\right]^{1-\sigma} + N_k^* \left[(1 + t_{f,k}) p_{f,k}\right]^{1-\sigma}\right]^{\frac{1}{1-\sigma}}, \; k \in \{d, o\}^{6} \tag{22}$$

[6] Using (13) and its foreign counter-part, and the free-entry conditions (20), we can derive producer prices at home and abroad as follows:

$$\begin{aligned} p_{h,k} = p_{h,k}^* &= \frac{\sigma}{\sigma - 1} \frac{\omega_k^{\alpha}}{A (\alpha)^{\alpha} (1 - \alpha)^{1-\alpha}} \\ p_{f,k} = p_{f,k}^* &= \frac{\sigma}{\sigma - 1} \frac{(\omega_k^*)^{\alpha}}{A (\alpha)^{\alpha} (1 - \alpha)^{1-\alpha}} \end{aligned}$$

where N_k (resp. N_k^*) is the number of companies located in the domestic country (resp. in the foreign country).

3.1 Destination principle

Under the destination principle, commodity taxes are levied in the country where goods and services are consumed, regardless of where they were produced. This approach is consistent with the destination-based VAT system used by most countries. It preserves competitive neutrality by ensuring that imported and domestically produced goods are taxed at the same rate. So we have, in the domestic country h, $t_{h,d} = t_{f,d}$, and in the foreign country f, $t^*_{h,d} = t^*_{f,d}$. In the remainder of this paper, when we are dealing with the destination principle, we will adopt the following notation $t_{h,d} = t_{f,d} = t$ and $t^*_{h,d} = t^*_{f,d} = t^*$.

Using the labor demand market (18) and the capital market equilibrium (19), we obtain the domestic and foreign number of firms as following:

$$N_d = \frac{\bar{K}}{1 + \frac{\psi_s^* L^*}{\psi_s L}}; \qquad N_d^* = \frac{\bar{K}}{1 + \frac{\psi_s L}{\psi_s^* L^*}} \tag{23}$$

In the destination principle, the number of firms is independent of the level of tax rate; that is, they are not mobile whatever the level of tax. They are solely dependent on the ratio of the number of skilled labor available in a given country to the total number of skilled labor. *Ceteris Paribus* , the country with the largest population of qualified workers, attracts the largest number of firms.

Using the the technological constraint and the free-entry condition, one gets the expression of the capital return as:

$$R_d = \frac{1}{\sigma \bar{K}} \left[\frac{L \sum_i \psi_i \alpha_i}{1+t} + \frac{L^* \sum_i \psi_i^* \alpha_i}{1+t^*} \right] \tag{24}$$

Using (13), (18) and (23), the wage of any skilled worker located abroad or in the domestic country is given by:

$$\omega_d^* = \omega_d = \frac{\alpha}{L\psi_s + L^*\psi_s^*} \frac{\sigma - 1}{\sigma} \left[\frac{L \sum_i \psi_i \mu_i}{1+t} + \frac{L^* \sum_i \psi_i^* \mu_i}{1+t^*} \right] \tag{25}$$

The wage rate as well as the capital return are decreasing functions of the tax rate. The intuition is that the increase in tax increases the consumer price, thus reducing the demand. This reduction of the demand of commodity goods has two effects: first, it decreases the

demand of labor (both skilled and unskilled); but since the supply of skilled labor remains unchanged, the adjustment comes by decreasing the wage rate of the skilled labor. Second, it decreases the demand for capital, and since the supply is unchanged, then the capital return decreases to adjust the gap.

Finally, the fiscal base in the domestic country h and its foreign counterpart in the foreign country f are given by

$$T_d = \frac{L \sum_i \psi_i \mu_i}{1+t}; \qquad T_d^* = \frac{L^* \sum_i \psi_i^* \mu_i}{1+t^*} \tag{26}$$

In the destination principle, the tax revenue in a given country solely depends on the tax rate applied in this country : the greater the tax level (small subsidy), the lower the fiscal base. This is due to the fact that in the destination, tax directly target the consumer by increasing the consumer price, thus reducing the demand, further increasing the distortion due by the monopolistic competition.

3.2 Origin principle

The origin principle applies taxes in the country where goods and services are produced. Exports are taxed, while imports are exempt. This approach ties tax policy directly to the production location, and thus influences firms' location decisions. Therefore in each country, we have $t_{h,k} = t_{h,k}^*$ in the domestic country h and $t_{f,k} = t_{f,k}^*$ in the foreign country f. Thus, according to the origin principle, the tax is discriminatory and can be actively used as a tool to benefit domestic producers. In the remainder of this paper, when we are dealing with the origin principle, we will adopt the following notation : $t_{h,k} = t_{h,k}^* = t$ and $t_{f,k} = t_{f,k}^* = t^*$.

From the notations in this section and equations (4) and (3), the consumer price indexes in the domestic and foreign countries are exactly the same

Using the two labor demand equations in (18) and the capital market equation (19), we have

$$N_o = \frac{\bar{K}}{1+B}; \qquad N_o^* = \frac{\bar{K}B}{1+B} \tag{27}$$

where, $B = \frac{\psi_s^* L^*}{\psi_s L} \left(\frac{1+t^*}{1+t}\right)^{-\frac{\sigma}{\alpha(\sigma-1)}}$.

The term B captures the relative attractiveness of the foreign country for the location of the firm, as seen from the perspective of the home country such that $\frac{1}{1+B}$ and $\frac{B}{1+B}$ represent the shares of firms located in the home and foreign country, respectively; this structure also governs how firm distribution affects factor demand and wages. To be more precise, B is the

relative supply of skilled labor in the foreign country, adjusted for by the tax disadvantage of being in the foreign country. It is made up of two terms:

- $\frac{\psi_s^* L^*}{\psi_s L}$, is the relative size of the skilled labor force in the foreign country compared to that in the home country: the country with the most abundant population of skilled workers attracts more firms.
- $\left(\frac{1+t^*}{1+t}\right)^{-\frac{\sigma}{\alpha(\sigma-1)}}$, captures the relative tax-induced distortion on firm profitability; it reflects how a firm's optimal location decision is distorted by tax differentials between countries: for instance, if the domestic (resp. the foreign) country raises its tax level t (resp. t^*), this raises (resp. decreases) the relative attractiveness term B.

Using the free-entry equation and the expression of the price index, the capital price in the origin principle is given by :

$$R_o = \left(1 + \frac{L^* \sum_i \psi_i^* \mu_i}{L \sum_i \psi_i \mu_i}\right) \frac{L \sum_i \psi_i \mu_i}{\bar{K}\sigma\,(1+t)} \frac{1+B}{1+B\left(\frac{1+t^*}{1+t}\right)} \tag{28}$$

In origin principle, the return on capital in the equilibrium globally depends on three terms:

- The total demand for differentiated goods in the whole economy represented by $\left(1 + \frac{L^* \sum_i \psi_i^* \mu_i}{L \sum_i \psi_i \mu_i}\right) L \sum_i \psi_i \mu_i$. Intuitively, the more consumers value variety (higher μ_i) and the larger the population ($L + L^*$), the more firms can sell, and the higher the return to capital.
- The capital cost per variety denoted here by $\bar{K}\sigma\,(1+t)$; this term captures the difficulty in generating a return to capital per variety in a given tax and competition environment.[7]
- the adjustment term $\frac{1+B}{1+B\left(\frac{1+t^*}{1+t}\right)}$, that reflects how tax differentials between countries and skilled labor distribution in the whole economy affect where firms choose to locate. It captures how tax-induced firm relocation across countries affects the economy-wide return on capital. It scales the profitability of the firm distribution by weighting the share of firms in each location against their effective tax burden. In doing so, it ensures the return on capital reflects not just global demand, but where supply is actually

[7]Since in our model the available amount of capital is $\bar{K}$, it also represents the total number of varieties in this economy since the production of one variety requires one unit of capital. But since each variety is less profitable both under high substitution (high σ) and high tax level, the term $\bar{K}\sigma\,(1+t)$ can reasonably be understood as the effective capital cost of maintaining one variety in the market.

produced.[8]

Using (13) and its foreign counterpart, the expressions of the wage rate of skilled workers in the origin principle are given by :

$$\omega_o = \frac{\alpha(\sigma-1)}{L\psi_s\sigma}\left(1+\frac{L^*\sum_i \psi_i^*\mu_i}{L\sum_i \psi_i\mu_i}\right)\frac{L\sum_i \psi_i\mu_i}{1+t}\left[\frac{1}{1+B\left(\frac{1+t^*}{1+t}\right)}\right] \tag{29}$$

$$\omega_o^* = \frac{\alpha(\sigma-1)}{L\psi_s\sigma}\left(1+\frac{L^*\sum_i \psi_i^*\mu_i}{L\sum_i \psi_i\mu_i}\right)\frac{L\sum_i \psi_i\mu_i}{1+t}\left[\frac{\left(\frac{1+t^*}{1+t}\right)^{-\frac{\sigma}{\alpha(\sigma-1)}}}{1+B\left(\frac{1+t^*}{1+t}\right)}\right] \tag{30}$$

The asymmetry in skilled wages across countries stems entirely from the term $\left(\frac{1+t^*}{1+t}\right)^{-\frac{\sigma}{\alpha(\sigma-1)}}$, which appears only in the foreign wage expression. This expression reflects how differences in production taxes translate into variations in the effective surplus available to foreign firms for skilled labor, with the magnitude of this adjustment shaped by both the elasticity of substitution, σ, and the skilled labor share in the production function, α.

Recalling that the two price indexes are equal in the origin principle, we have the following expressions of the fiscal bases in both countries:

$$T_o = \frac{Ł\sum_i \psi_i\mu_i + L^*\sum_i \psi_i^*\mu_i}{(1+t)\left[1+B\left(\frac{1+t^*}{1+t}\right)\right]} \tag{31}$$

$$T_o^* = \frac{Ł\sum_i \psi_i\mu_i + L^*\sum_i \psi_i^*\mu_i}{1+t^*}\frac{B\left(\frac{1+t^*}{1+t}\right)}{1+B\left(\frac{1+t^*}{1+t}\right)} \tag{32}$$

As the attractiveness of the foreign country increases, the fiscal base decreases in the domestic country but increases in the foreign country as some domestic firms relocate abroad. This is clearly reveals in equation (27).

4 Cooperative optimum

In this section, we derive the optimal tax formulae that characterize the cooperative case; it will be used as a benchmark case. The analyzes will be performed in a symmetric case; therefore, the optimal tax formulae can be derived by maximizing the joint utilities of the

[8] $1+B$ measures the total weight of all firms, this can be seen from equations (27) and (19). The term $(1+B)\frac{1+t^*}{1+t}$ modifies the foreign component B by the tax disadvantage of producing abroad: if the foreign (resp. domestic) tax t^* (resp. t) increases it ends up decreasing R_o. Thus, $(1+B)\frac{1+t^*}{1+t}$ captures the effective reduction in foreign firm profitability due to the tax gap.

two countries; that is to maximize the sum of the indirect utility in the domestic country h expressed in (8) and its foreign counterpart. The first-order condition is given by :

$$\frac{\partial V_{i,k}}{\partial t} + \frac{\partial V^*_{i,k}}{\partial t} = 0. \tag{33}$$

The effects that must be taken into account when changing the level of the commodity tax in the domestic country h are given by:

$$\frac{\partial V_{i,k}}{\partial t} := -\left(L\sum_i \psi_i \mu_i\right)\frac{\partial P_k/\partial t}{P_k} + L\psi_s \frac{\partial \omega_k}{\partial t} + \frac{\partial R_k}{\partial t}\left(L\sum_i \psi_i K_i\right) + L\psi_s \frac{\partial B_{s,k}}{\partial t} \tag{34}$$

For the government of the domestic country h, before taking the decision to change the existing tax level, it will have to consider the effects that this variation will have on the four terms of equation (34). *Ceteris paribus*, the first term captures the variation in welfare following a variation in private consumption. The second and third terms taken together capture the variation in welfare due to a variation in income; the second (resp. third) term being the variation in labor income (resp. capital income). Finally, the last term captures the effect of variation in public consumption (or, more specifically, variation in consumption due to government transfers) on welfare. It is therefore important to determine the effects of a tax variation on the elements described in the equation and its foreign counterpart.

4.1 Destination principle

In this subsection, we give a formula for the optimal tax in the cooperative when it is the destination principle that is used. For this purpose, we analyze how any tax variation affects the different variables and aggregate in the two countries.

In the destination principle, taxes are applied by the government of the country where the final good is consumed; therefore, we have $t_{h,d} = t_{f,d}$ in the domestic country h and $t^*_{h,d} = t^*_{f,d}$ in the foreign country f.

From (23) and (18)we have :

$$\frac{\partial N_d}{\partial t} = \frac{\partial N^*_d}{\partial t} = 0; \qquad \frac{\partial \ell_{s,d}}{\partial t} = \frac{\partial \ell^*_{s,d}}{\partial t} = 0 \tag{35}$$

In the equilibrium, since the number of firms in the destination principle is independent of the level of the commodity tax so is the amount of skilled labor used: the number of existing firms in each of the two countries does not vary as well as the amount of skilled labor used.

Using equations (21) and (22) the effect of any tax variation in the domestic country on the two price indexes are given by:

$$\frac{\partial P_d}{\partial t} = P_d \left[\frac{1}{1+t} + \frac{\alpha}{\omega_d} \frac{\partial \omega_d}{\partial t} \right]; \quad \frac{\partial P_d^*}{\partial t} = P_d^* \left(\frac{\alpha}{\omega_d} \frac{\partial \omega_d}{\partial t} \right) \tag{36}$$

Equation (36) gives the mechanism that influences the prices of home (first equation) and foreign (second equation). Any variation in the tax influences domestic prices in two ways: the first term reflects the direct effect of a variation in the tax level, and the second term captures the influence on prices in the two countries of the producer price spillovers. The effects of any variation in the tax on foreign prices are totally captured by the producer price spillovers, but on the domestic prices, a comparison needs to be done between the direct and indirect effects to see how prices evolve.

Using (13), (24), (25), (26), the effect of any tax variation in the domestic country on the skilled worker wages, capital return, tax revenue and the amount of unskilled labor are given by:

$$\frac{\partial \omega_d^*}{\partial t} = \frac{\partial \omega_d}{\partial t} = -\frac{\alpha(\sigma-1)}{\sigma} \frac{\sum_i \psi_i \mu_i}{2\psi_s (1+t)^2} < 0, \qquad \frac{\partial R_d}{\partial t} = -\frac{1}{\sigma \bar{K}} \frac{L \sum_i \psi_i \mu_i}{(1+t)^2} < 0 \tag{37}$$

$$L\psi_s \frac{\partial B_{s,d}}{\partial t} = \frac{L \sum_i \psi_i \mu_i}{(1+t)^2} > 0, \qquad L^* \psi_s^* \frac{\partial B_{s,d}^*}{\partial t} = 0 \tag{38}$$

The increase in the tax level in the home country targets in the same way domestic and foreign firms that sell in the home country. The increase in the commodity tax in the home country makes the domestic market less profitable for both domestic and foreign firms: capital return decreases, and firms reduce their demand for labor, leading to the fall of the wage of skilled labor as depicted in (37) (since the supply of skilled labor is unchanged). Since the amount of skilled labor used in the production remains unchanged, firms reduction of labor simply translates into the reduction of the amount of unskilled labor used in the equilibrium; the quantity of unskilled labor removed from the production of the differentiated good is automatically returned to the production of the numeraire, thus satisfying the full employment of unskilled labor. Fiscal revenue increases in the domestic country but is unchanged abroad since there is no tax variation abroad and there is no firm's relocation.

Replacing (36), (37) and (38) to (33), we obtain the following.

$$-\frac{L \sum_i \psi_i \mu_i}{(1+t)^2} \left[(1+t)(1-\alpha) + \frac{\alpha(\sigma-1)}{\sigma} + \frac{1}{\sigma} - 1 \right] = 0$$

$$\hat{t} = -\frac{1}{\sigma}$$

4.2 Origin principle

In the origin principle, the changes that occur in the home and foreign countries due to a variation in the level of tax in the home country are represented as follows in the symmetric equilibrium.

Using the expression of dual price (4), and the free entry condition (20), in symmetric equilibrium, we can derive the changes in aggregate consumer price due to the change of tax in the domestic country h as follows:

$$\frac{\partial P_o^*}{\partial t} = \frac{\partial P_o}{\partial t} = P_o \left[\frac{1}{1+t} \left(1 + \frac{1}{2(\sigma - 1)} \right) + \frac{\alpha}{\omega_o} \frac{\partial \omega_o}{\partial t} \right] \tag{39}$$

According to the principle of origin, a tax increase in the domestic country h increases the general price level on the domestic and foreign markets through direct and indirect effects. The direct effect is represented by the first term in brackets on the right-hand side of (39); It is made up of the direct effect of the tax on consumer prices and the effect of the change in the ratio of the number of firms in the foreign country to the number in the domestic country, is latter effect is not present in (36) since in the destination principle there is no relocation of firms abroad. In our model, the weight of domestic consumption is greater than 1, thus multiplying the direct effect of the tax. The second term in brackets reflects the indirect effect of the tax on the general price level; more precisely, this term shows that the price level is positively correlated with the wages of skilled workers; indeed, any tax that increases wages causes demand and, therefore, prices to rise.

$$\frac{\partial N_o}{\partial t} = -\frac{\sigma}{\alpha(\sigma - 1)} \frac{\bar{K}}{4(1+t)} < 0 \tag{40}$$

$$\frac{\partial \ell_{s,o}}{\partial t} = \frac{\sigma}{\alpha(\sigma - 1)} \frac{\psi_s L}{\bar{K}} \frac{1}{1+t} > 0; \qquad \frac{\partial \ell_{s,o}^*}{\partial t} = -\frac{\sigma}{\alpha(\sigma - 1)} \frac{\psi_s L}{\bar{K}} \frac{1}{(1+t)} < 0 \tag{41}$$

$$\frac{\partial \omega_o}{\partial t} = -\frac{\sum_i \psi_i \mu_i}{2\psi_s (1+t)^2} \left(1 + \frac{\alpha(\sigma - 1)}{\sigma} \right) < 0; \quad \frac{\partial \omega_o^*}{\partial t} = \frac{\sum_i \psi_i \mu_i}{2\psi_s (1+t)^2} \left(1 - \frac{\alpha(\sigma - 1)}{\sigma} \right) > 0 \tag{42}$$

Any tax increase in the home country h under the origin principle reduces the profitability of firms producing in country h in this domestic market h as well as in the foreign market f, causing some of them to relocate, as shown by (40). The remaining firms are reducing their demand for labor, especially skilled labor (41). Since, in our model, the supply of skilled labor is fixed and fully utilized in the production of differentiated goods, the fall in demand for skilled labor translates into a decrease in the wages of skilled workers as in (42). In contrast, abroad, the influx of companies from the domestic country h leads to an increase in labor demand and consequently to a rise in the wages of skilled workers, as shown by equations (41) and (42). Therefore the amount of skilled labor effectively used in the domestic h country increases while it decreases in the foreign country f as given in equation (41).

Another useful comment is that wage variation of skilled worker in the domestic and foreign countries are not exactly symmetrical even though the demand for skill labor and the movement of firms are symmetrical in those countries. In the domestic country h, the wages of skilled workers are influenced by the fall in corporate profitability resulting from higher prices –second term into parenthesis–, and also because of the relocation of some firms to the foreign country f –first term into parenthesis–. In the foreign country f, two opposing phenomena influence the wage level of skilled workers: the rise in consumer prices due to higher taxes in the domestic country h, –first term into parenthesis–but also an increase in demand for skilled labor due to an increase in the number of firms –second term into parenthesis.
Finally, comparing (42) to (37), it is easy to see that any variation on the level of tax in the domestic country has a higher negative effect on the level of wage of the skill worker in the origin principle than in the destination principle, this is simply due to the fact that the negative effect on the wage of skill worker due to firms' relocation abroad in the origin principle is nonexistent in the destination principle.

$$\frac{\partial R_o}{\partial t} = -\frac{L\sum_i \psi_i \mu_i}{\sigma \bar{K}\,(1+t)^2} < 0 \tag{43}$$

It is not surprising to see that the price of the capital falls since it is a good that is freely mobile across countries. Since firm's profitability falls for those located in the home country, this induces a decrease of the number of firms thus a reduction of the capital return. The mobility of capital thus ensures the equality of capital price in both countries. It's worth mentioning that the reduction in return on capital is exactly the same as in the destination principle.

In addition, the number of unskilled labor is decreasing in both countries. In the domestic

country, this decline is linked to a fall in demand for labor due to a decrease in profitability. This fall in demand for labor has repercussions on both the quantity of skilled and unskilled labor used. However, in other countries, the fall in the unskilled labor used is due to an increase in the skilled labor used.

$$\frac{\partial T_o}{\partial t} = -\left(1 + \frac{\sigma}{\alpha(\sigma-1)}\right)\frac{L\sum_i \psi_i\mu_i}{2(1+t)^2}; \qquad \frac{\partial T_o^*}{\partial t} = \left(\frac{\sigma}{\alpha(\sigma-1)} - 1\right)\frac{L\sum_i \psi_i\mu_i}{2(1+t)^2} \tag{44}$$

$$L\psi_s\frac{\partial B_s^o}{\partial t} = \frac{L\sum_i \psi_i\mu_i}{(1+t)^2}\left[1 - \frac{t}{2}\left(\frac{\sigma}{\alpha(\sigma-1)} - 1\right)\right]; \quad L\psi_s\frac{\partial B_s^{o,*}}{\partial t} = \frac{L\sum_i \psi_i\mu_i}{(1+t)^2}\left[\frac{t}{2}\left(\frac{\sigma}{\alpha(\sigma-1)} - 1\right)\right] \tag{45}$$

From (44), following an increase in the level of tax in the domestic country, the tax base decreases in that country but increases abroad. This is the simple result of the relocation to the foreign country f of some firms that had previously been located in the domestic country h due to the decrease in profitability. In the domestic country h, the tax revenue varies due to two effects: From the first equation in (45), the first term in brackets captures the increase in tax revenue due to the increase in the level of tax, while the second term captures the loss of tax revenue due to the fall of the fiscal base. This loss of revenue due to the reduction of the fiscal base in the domestic country is exactly what is gained in the foreign country, so these two effects cancel each other out.

Replacing (39), (42), (43) and (45) into (33), we have :

$$-\frac{L\sum_i \psi_i\mu_i}{2(1+t)^2}\left[2(1+t)(1-\alpha) + \left(1 + \frac{\alpha(\sigma-1)}{\sigma}\right) - \left(1 - \frac{\alpha(\sigma-1)}{\sigma}\right) + \frac{2}{\sigma} - \left(2 - t\left(\frac{\alpha(\sigma-1)}{\sigma} - 1\right)\right) - t\left(\frac{\alpha(\sigma-1)}{\sigma} - 1\right)\right] = 0,$$

where the first term in brackets captures changes on aggregates prices in both countries, the second (respectively the third) term is change on skilled labor revenue in the domestic (respectively foreign) country, the fourth is change on capital rent, the fifth (respectively the fifth) is changes on government revenue in the domestic (respectively foreign) country.

Changes in government revenue due to changes in the fiscal base in the two countries canceled each other out. In addition, changes in revenue in the domestic country due to an increase in the amount of tax that each remaining firm has to pay is canceled by the direct effect of the tax in both countries. The indirect effect on the aggregate level of prices is canceled out by part of changes in skilled labor revenue in the two countries. As mentioned above, all the effects canceled each other out and the cooperative optimal tax in the origin principle is

therefore a subsidy equals to :

$$t_o = -\frac{1}{\sigma}.$$

Proposition 1 *The optimal tax rate in the cooperative case is the same in the destination or origin principle; this optimal tax is a subsidy equal to*

$$\hat{t} = -\frac{1}{\sigma}. \tag{46}$$

This result reflects a canonical insight from optimal taxation theory under monopolistic competition: a unit subsidy equal to the markup distortion precisely offsets the welfare loss associated with pricing above marginal cost. At $t = -\frac{1}{\sigma}$, consumer prices are aligned with marginal costs, restoring first-best efficiency in the consumption of differentiated goods. This aligns with the theoretical benchmark derived in Reinhorn (2012), and extends the classical Atkinson and Stiglitz (1976) framework to an open economy with firm-level heterogeneity and labor segmentation. Notably, the optimal tax here acts as a Pigouvian correction—not for externalities in consumption—but for pricing distortions arising from market power, and is invariant to the choice of tax principle under cooperative regimes. This neutrality under cooperation, however, breaks down under strategic tax setting, as shown in subsequent sections.

5 Non cooperative case

In this section, we give a characterization of the optimal tax formulae for countries acting independently. The main idea here is to observe how governments set tax levels in response to any change in tax policy abroad. More specifically, the aim is to see how close the level of the non-cooperative tax is to that of the benchmark.

5.1 Non cooperative with the destination principle

In this subsection we study the non-cooperative tax in the destination principle. The key question here is to characterize what the reaction (in terms of tax policy) will be of one government in response to a foreign policy. We bring out results in a Nash-symmetric equilibrium.

For this purpose, we examine how the domestic country h adjusts its tax level to maintain the individual level of welfare described in (8). The first derivative of the question is given

by (34). This equation helps us to gain a deeper understanding on the different interactions and externalities that are needed to be taking into account by the local government when setting up its policy. Indeed, it is likely possible that, different from the cooperative case, the concern of any government in the non-cooperative case goes beyond the sole problem of resolving externalities from the monopolistic competition. Using the derivative of the results obtained in Section (3.1), equation (34) in the destination principle becomes:

$$-\frac{L\sum_i \psi_i \alpha_i}{2\left(1+t\right)^2}\left[\left(1+t\right)\left(2-\alpha\right)+\frac{\alpha\left(\sigma-1\right)}{\sigma}+\frac{1}{\sigma}-2\right] \quad = \quad 0,$$

where the first term in the above brackets are changes on welfare due to changes on the aggregate level of prices, the second and third terms are changes on welfare due to changes of revenues (labor revenue and capital revenue respectively) and the final term been changes on welfare due to changes of the level of government lump sum transfers.

Therefore, the optimal tax response of the home country for any tax policy t^* in the foreign country, in the destination principle in a symmetric Nash equilibrium as following:

$$\bar{t}_d = -\frac{1}{\sigma}\left(\frac{1-\alpha}{2-\alpha}\right) \tag{47}$$

Proposition 2 *Under the destination principle, the best response of the domestic country to any foreign policy t^* is a subsidy equals to $\bar{t}_d = -\frac{1}{\sigma}\left(\frac{1-\alpha}{2-\alpha}\right)$. This tax rate is higher (less subsidy) than in the cooperative case.*

Equation (47) characterizes the non-cooperative optimal commodity tax under the destination principle as $\bar{t}_d = -\frac{1}{\sigma}\left(\frac{1-\alpha}{2-\alpha}\right)$, contrasting with the cooperative benchmark tax in equation (46), $\hat{t} = -\frac{1}{\sigma}$, which fully internalizes the distortion from monopolistic competition. This deviation from the benchmark has direct implications for skilled wage determination. In the destination principle regime, as shown in equation (25), the skilled wage is inversely related to the domestic tax rate: a higher tax (or smaller subsidy) reduces product market demand, thereby diminishing firms' demand for skilled labor and, consequently, skilled wages. In equilibrium, the non-cooperative tax—being a less generous subsidy—induces a downward pressure on skilled wages relative to the cooperative optimum. Notably, the magnitude of this effect is governed by α, the elasticity-weighted share of skilled labor in production. As α increases, reflecting a greater reliance on skilled labor, the incentive to subsidize diminishes. This is because subsidies amplify wage costs, which in turn exacerbate price distortions under monopolistic competition. This result aligns with the broader literature that emphasizes the inefficiency of decentralized tax setting in the presence of cross-border spillovers (Mintz and Tulkens (1986); Keen et al. (1996)), but it extends those insights by introducing wage

endogeneity and labor heterogeneity into the analysis. Specifically, the presence of flexible skilled wages introduces a new channel through which tax policy affects market outcomes, and this channel is absent in frameworks assuming fixed wages or homogeneous labor (e.g., Lockwood (1993); Haufler and Pflüger (2004)). Thus, equation (47) not only quantifies the strategic deviation from the cooperative tax but also reveals how labor market composition—through α—shapes optimal policy design in open economies.

5.2 Non cooperative case with the origin principle

In the origin principle, any tax variation falls solely on goods produced in the country that set it up, hence the profit of firms that are located in that country. As we did in the previous section, we analyze the reaction of the domestic government to any tax policy in the foreign country. For this purpose we determine the tax level that set to zero equation (34).

Using the results in section (3.2) and so their derivatives, equation (34) in the origin principle writes:

$$-\frac{L\sum_i \psi_i\mu_i}{2\left(1+t\right)^2}\left[\left(1+t\right)\left(1-\alpha\right)+\left(1+\frac{\alpha\left(\sigma-1\right)}{\sigma}\right)+\frac{1}{\sigma}-\left(2-t\left(\frac{\sigma}{\alpha\left(\sigma-1\right)}-1\right)\right)\right] \quad = \quad 0,$$

where the first term in brackets is the effects of the aggregate price changes on welfare, the two following terms are the effects of changes of revenue on welfare and the last term is the effects of changes of government lump sum transfers on welfare.

Changes in revenue due to the increase in the amount collected from firms are offset by part of the change on the aggregate price level. Part of changes in revenue due to firms relocation is also canceled out by part of the changes in the aggregate price level. The remaining effects are those that form the structure of the non-cooperative tax.

Therefore, the best response to a foreign policy in a symmetric Nash equilibrium is the following tax level:

$$\bar{t}_o = -\frac{1}{\sigma}\frac{1-\alpha}{\frac{\sigma}{\alpha(\sigma-1)}-\alpha} \tag{48}$$

Proposition 3 *According to the origin principle, the best response of the domestic country h to any foreign policy t^* is a subsidy equal to $\bar{t}_o = -\frac{1}{\sigma}\frac{1-\alpha}{\frac{\sigma}{\alpha(\sigma-1)}-\alpha}$. This subsidy is lower than in the cooperative case and is inefficient.*

Equation (48) characterizes the optimal non-cooperative tax policy under the origin principle, revealing that strategic tax-setting in decentralized regimes leads to a subsidy that is

systematically lower than the cooperative benchmark defined in equation (46). This divergence arises due to the endogenous response of firm location to tax differentials, a feature unique to the origin principle. As taxes apply to production, higher domestic taxation induces firm relocation, which in turn depresses domestic demand for skilled labor and exerts downward pressure on skilled wages. Consequently, the government internalizes not only the domestic distortions from monopolistic competition but also the cross-border wage spillovers generated by mobile firms. In contrast to the cooperative setting—where subsidies fully correct for monopolistic pricing—non-cooperative governments under the origin principle offer more limited support, resulting in lower skilled wages relative to the first-best. This wage asymmetry is amplified when skilled labor accounts for a smaller share of production income, highlighting the central role of labor composition in shaping fiscal efficiency. The result underscores that wage sensitivity to tax policy is greater under the origin principle, and optimal unilateral policy tends to be more distortionary in environments characterized by mobile firms and flexible skilled wages.

This result contributes to and refines a growing body of literature on tax competition in integrated markets. Classical neutrality results—such as those by Grossman (1980) and Lockwood (1993)—demonstrated that, under idealized conditions (e.g., fixed wages, homogeneous labor, and symmetric countries), the origin and destination principles yield equivalent efficiency outcomes. However, equation (48) challenges this neutrality by introducing wage endogeneity and firm mobility into the analysis. In doing so, it aligns more closely with the insights of Mintz and Tulkens (1986) and Keen et al. (1996), who emphasized the inefficiencies induced by decentralized tax setting under the origin principle. Our result extends their framework by showing that wage flexibility, particularly for skilled labor, significantly amplifies these inefficiencies due to tax-induced relocation effects.

Proposition 4 *When the share of firm revenue allocated to the use of skilled labor is less than half, that is,*

$$\frac{\alpha\left(\sigma-1\right)}{\sigma}<\frac{1}{2}, \tag{49}$$

then the best reaction of the domestic government for any tax policy t^* abroad led to a higher tax rate under the origin principle than under the destination principle. That is, government gives less subsidies in the origin principle than in the destination principle.

Proposition 4 establishes a critical threshold condition that determines the relative efficiency of origin-based versus destination-based taxation in non-cooperative settings. Specifically, it states that when the share of production income accruing to skilled labor—captured by the expression $\frac{\alpha(\sigma-1)}{\sigma}$ —falls below one-half, the optimal unilateral subsidy under the origin

principle is smaller than that under the destination principle. This implies that governments in economies with relatively low skilled-labor intensity have stronger incentives to subsidize consumption rather than production, making destination-based taxation more effective in mitigating monopolistic distortions without triggering inefficient firm relocation.

This result carries significant theoretical weight because it identifies the composition of labor income as a sufficient statistic for ranking tax regimes. When skilled labor constitutes a minor share of production costs, the marginal welfare gain from preserving skilled labor income through origin-based tax relief is limited. In such settings, any tax-induced firm relocation imposes a disproportionate welfare cost relative to the potential gains from wage flexibility. Conversely, under the destination principle—where firm location is invariant to tax changes—governments can adjust consumption taxes without inducing relocation, making destination-based subsidies more robust in protecting domestic welfare. This insight challenges the neutrality results of earlier models, such as Lockwood (1993), by showing that labor heterogeneity and wage endogeneity break the equivalence between tax principles in a meaningful and policy-relevant way.

The implications of Proposition 4 extend beyond theoretical classification. It offers a tractable, data-driven rule for policymakers to identify the welfare-superior tax principle in decentralized settings. Labor income shares are readily observable through national accounts, input-output tables, or wage bill statistics. This makes the threshold condition operational: in skill-intensive economies—such as Germany, Sweden, or the Netherlands—the origin principle may yield higher welfare even in the absence of tax coordination, due to its ability to leverage wage flexibility and absorb tax shocks through labor market adjustments. In contrast, in labor-intensive or wage-rigid economies—such as Poland or Romania—the destination principle remains preferable, as it avoids the allocative inefficiencies associated with tax-induced firm migration.

Proposition 4 also serves as a bridge between conflicting strands of the literature. While Haufler and Pflüger (2004) argue that destination-based taxation generally Pareto-dominates origin-based taxation under monopolistic competition, our results nuance this conclusion. We show that the superiority of either principle depends not only on market structure but also on the interaction between tax incidence, firm mobility, and labor market segmentation. In doing so, Proposition 4 advances the theory of international tax design by embedding it within a richer model of production that captures the asymmetric burden of taxation across heterogeneous labor groups.

Our framework also sheds light on an increasingly relevant concern in international tax policy—the phenomenon of "skill downgrade." This refers to the possibility that commodity tax reforms, particularly those that raise producer prices or trigger firm relocation, may

disproportionately harm skilled workers by reducing the demand for high-skilled labor and thus lowering their wages. Because our model explicitly incorporates labor market segmentation and endogenously determined skilled wages, it captures this mechanism rigorously. We show that an increase in commodity taxation —especially under the origin principle—leads to a sharper decline in skilled wages, while unskilled workers remain unaffected due to wage rigidity. This asymmetric incidence highlights the distributional risks of poorly calibrated tax policies, particularly in low skill-intensive sectors or countries. The threshold condition we derive based on the share of production income accruing to skilled labor thus serves not only as a guide for welfare-maximizing tax regimes, but also as an indicator of where the risk of skill downgrade is most acute. In this sense, our results contribute to both the efficiency and equity dimensions of international tax coordination.

Ultimately, Proposition 4 provides a unifying framework for reconciling the theoretical and empirical debates on tax policy in integrated economies. By highlighting the conditional nature of tax regime efficiency, it underscores the need for differentiated tax coordination strategies across countries and sectors. Rather than advocating for a universal adoption of either the origin or destination principle, the result points toward a more nuanced, skill-sensitive approach to tax design that accounts for the structural features of national labor markets.

5.3 Sector-Specific Taxation: A Labor-Based Criterion for Differential Treatment

A key implication of Proposition 4 is that the welfare superiority of the origin or destination principle is conditional on the share of production income accruing to skilled labor. This threshold condition— $\frac{\alpha(\sigma-1)}{\sigma} < \frac{1}{2}$ —offers a simple but powerful decision rule: when the skilled labor share exceeds 50%, the origin principle yields higher welfare in non-cooperative settings; otherwise, the destination principle dominates.

This insight naturally extends to a more granular policy framework. Since labor intensity is not uniform across sectors, applying a uniform taxation principle across an entire economy may obscure substantial heterogeneity in tax efficiency. For instance, sectors such as pharmaceuticals, finance, or digital services tend to be highly skill-intensive, whereas agriculture, textiles, or hospitality typically rely more on unskilled labor and face more rigid wage-setting mechanisms. Under such conditions, the model's predictions suggest that differentiated tax treatment by sector—where the tax principle is matched to the sector's labor composition—could enhance aggregate welfare.

While current institutional frameworks, particularly within integrated markets like the European Union, emphasize harmonization and neutrality, these results motivate a reconsideration of this one-size-fits-all approach. A sector-specific application of tax principles—origin for skill-intensive sectors, destination for labor-rigid ones—could mitigate distortions arising from tax-induced firm relocation or wage suppression. The feasibility of such differentiation would depend on institutional capacity, legal constraints, and enforcement costs. However, even if full implementation is impractical, this framework can inform intermediate solutions, such as tailored VAT band allowances, sectoral pilot schemes, or labor-sensitive tax coordination protocols.

Importantly, the threshold rule derived from Proposition 4 is operational: sector-level labor shares are observable in national accounts and input-output tables, making the classification of sectors by skilled labor intensity both empirically grounded and policy-relevant. This opens the door to a more flexible and welfare-enhancing tax design, one that internalizes sectoral heterogeneity rather than suppressing it under blanket harmonization.

6 Conclusion

This paper contributes to the long-standing debate on the appropriate principle for indirect taxation in open economies, destination versus origin, by embedding the analysis within a general equilibrium model that features monopolistic competition, international firm mobility, and heterogeneous labor markets. In contrast to the standard framework that assumes homogeneous agents and uniform tax pass-through, we highlight how labor market segmentation, especially wage rigidity for unskilled workers and flexible wages for skilled workers, can fundamentally alter the incidence and efficiency of tax policies. Our central result is that neither tax principle dominates unconditionally. Instead, the relative desirability of the origin versus the destination principle depends critically on the share of production income paid to skilled labor. When this share exceeds 50%, the origin principle Pareto dominates; otherwise, the destination principle is superior. This threshold result provides a novel decision rule for policymakers, rooted in observable labor market parameters, and offers a concrete criterion for determining the appropriate tax regime in different sectors or countries. These findings qualify conventional wisdom that destination-based taxation is inherently superior in a globalized context. Although the destination principle may support consumption neutrality and minimize trade distortions, it can be welfare inferior when tax-induced firm relocation interacts with wage adjustments in the skilled labor market. The

origin principle, often viewed as trade-distorting, may in fact improve welfare when firms rely heavily on mobile, high-wage labor and when fiscal spillovers impact foreign wage levels asymmetrically.

Our framework also revisits earlier conclusions from Lockwood (1993), Mintz and Tulkens (1986), and Keen et al. (1996), and shows how their policy implications change when wage endogeneity and labor segmentation are introduced. By doing so, we contribute to the emerging literature that seeks to reconcile theoretical tax neutrality results with real-world frictions, such as labor market institutions and cross-border firm dynamics. From a policy perspective, this paper offers practical guidance. The share of skilled labor, often measurable through input-output tables or wage bill statistics, can serve as a sufficient statistic to identify when origin- or destination-based taxation improves welfare. This has implications for international tax coordination, especially in regional economic blocs where sectoral specialization and labor heterogeneity vary widely.

There are several avenues for future research. Our analysis abstracts from capital taxation, administrative costs of enforcement, and sectoral heterogeneity in markups and tax sensitivity. These factors could interact meaningfully with labor market segmentation to shape tax incidence. Further, empirical work is needed to calibrate our threshold rule and test it against real-world data, such as VAT harmonization episodes or firm-level location decisions in response to tax differentials. In sum, our findings suggest that a "one-size-fits-all" approach to commodity taxation in integrated markets may be suboptimal. Rather than universally endorsing either the destination or the origin principle, tax authorities should adopt a flexible framework informed by sector-specific labor intensity and cross-border wage responsiveness. Such a calibrated approach would enhance the efficiency of tax design and reduce the risk of unintended distributional or fiscal spillovers. Finally, although our analysis focuses on the efficiency and neutrality properties of optimal commodity taxation in the presence of monopolistic competition and international firm mobility, the redistributive implications of the fiscal system deserve mention. The optimal tax structure effectively subsidizes the consumption of differentiated goods, with the resulting revenue redistributed through uniform lump-sum transfers. In such a setting, higher-income individuals—who consume more—benefit disproportionately from the subsidy, raising potential equity concerns. While distributional objectives are beyond the scope of this paper, incorporating agent heterogeneity or equity-based welfare criteria could enrich the analysis and offer insights into the broader political and normative feasibility of international tax coordination.

A Index: Concavity conditions

A.1 Destination principle

Let define by

$$f(t) = -t + \frac{\alpha\,(1+t)}{1 + \frac{1+t^*}{1+t}\frac{L^*\sum_i \psi_i^*\mu_i}{L\sum_i \psi_i\mu_i}} - \frac{\sigma-1}{\sigma}\frac{\alpha}{1+\frac{L^*\psi_i^*}{L\psi_s}} - \frac{1}{2\sigma},$$

the function that draw the sign of the utility in the destination non cooperative case. We will study the variation of this function.

For every given t, and $h \leq 0$

$$g(h) = f(t+h) - f(t) = -h + \frac{\alpha\gamma + \alpha h}{1+\frac{\theta}{\gamma+h}} - \frac{\alpha\gamma}{1+\frac{\theta}{\gamma}},$$

where $\gamma = 1+t$ and $\theta = (1+t^*)\,\frac{L^*\sum_i \psi_i^*\alpha_i}{L\sum_i \psi_i\alpha_i}$

$$\begin{aligned}
\lim_{h\to+\infty} g(h) &= \lim_{h\to+\infty} h\left[-1 + \frac{\alpha\left(1+\frac{\gamma}{h}\right)}{1+\frac{\theta}{\gamma+h}}\right] - \frac{\alpha\gamma}{1+\frac{\theta}{\gamma}} = -\infty \\
\lim_{h\to-\infty} g(h) &= \lim_{h\to-\infty} h\left[-1 + \frac{\alpha\left(1+\frac{\gamma}{h}\right)}{1+\frac{\theta}{\gamma+h}}\right] - \frac{\alpha\gamma}{1+\frac{\theta}{\gamma}} = +\infty \\
\lim_{h\to 0} g(h) &= \lim_{h\to 0} \frac{\alpha\gamma}{1+\frac{\theta}{\gamma}} - \frac{\alpha\gamma}{1+\frac{\theta}{\gamma}} = 0
\end{aligned}$$

Moreover, for any given t,

$$g'(h) = -1 + \alpha\frac{1+\frac{2\theta}{\gamma+h}}{\left(1+\frac{\theta}{\gamma+h}\right)^2}$$

$$\begin{aligned}
g'(h) = 0 \iff \left(1+\frac{\theta}{\gamma+h}\right)^2 - \alpha\left(1+\frac{2\theta}{\gamma+h}\right) &= 0 \\
\iff X^2 - 2X\,(1-\alpha) + (1-\alpha) &= 0,
\end{aligned}$$

where $X = \frac{\theta}{\gamma+h}$.
The discriminant of the above equation is given by:

$$\begin{aligned}
\Delta &= 4\,(1-\alpha)^2 - 4\,(1-\alpha) \\
&= -4\alpha\,(1-\alpha) < 0
\end{aligned}$$

$g'(h) < 0$, then g is decreasing, meaning f is strictly decreasing in $]-\infty;+\infty[$, specially in $]-1;1[$.

A.2 Origin principle

Let define by

$$f(t) = \frac{\sigma}{\sigma-1}(1+t)(1+C)^2 - \frac{\sigma}{\alpha(\sigma-1)}\frac{(1+t)(1+C)^2}{(1-\sigma)(1+B)}$$
$$+\alpha(1+t)(1+C)\left(1+\frac{\sigma}{\alpha(\sigma-1)}C\right)+t\left(1-\frac{L^*\sum_i\psi_i^*\mu_i}{L\sum_i\psi_i\mu_i}\right)\left(1-\frac{\sigma}{\sigma-1}C\right)$$
$$\left(1-\frac{L^*\sum_i\psi_i^*\mu_i}{L\sum_i\psi_i\mu_i}\right)\left(1-\frac{\alpha(\sigma-1)}{\sigma}+\frac{(1+B)\left[\frac{\sigma}{\alpha(\sigma-1)}\frac{B-C}{1+B}-1\right]}{2\sigma}\right)$$

the function that draws the sign of the utility in the origin non-cooperative case. We will study the variation of this function.

$$\begin{aligned}\lim_{t\to-1} f(t) &= \lim_{t\to-1}(1+t)\left[\frac{\sigma}{\sigma-1}\frac{\alpha(\sigma-1)+1}{\alpha(\sigma-1)}+\alpha+\left(1-\frac{L^*\sum_i\psi_i^*\mu_i}{L\sum_i\psi_i\mu_i}\right)\right]\\ &\quad-\left(1-\frac{L^*\sum_i\psi_i^*\mu_i}{L\sum_i\psi_i\mu_i}\right)\left(\frac{\alpha(\sigma-1)}{\sigma}+\frac{1}{2\sigma}\right)\\ &= +\infty\end{aligned}$$

In addition, $f(0) < +\infty$, so there is an interval in $]-1;1[$ where f is strictly decreasing.

References

Aiura, H. and Ogawa, H. (2019). Indirect taxes in a cross-border shopping model: a monopolistic competition approach. *Journal of Economics, Springer*, 128(2):147–175.

Aiura, H. and Ogawa, H. (2023). Does e-commerce ease or intensify tax competition? destination principle versus origin principle. *International Institute of Public Finance*, 31(3):702–735.

Anderson, J. E. and van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. *The American Economic Review*, 93(1):170–192.

Atkinson, A. B. and Stiglitz, J. E. (1976). The design of tax structure: Direct versus indirect taxation. *Journal of Public Economics*, 6(1-2):55–75.

Auerbach, A. J. and Jr., J. R. H. (2001). Perfect Taxation with Imperfect Competition. NBER Working Papers 8138, National Bureau of Economic Research, Inc.

Costinot, A. and RodrÃguez-Clare, A. (2014). Trade theory with numbers: Quantifying the consequences of globalization. In Gopinath, G., Helpman, E., and Rogoff, K., editors, *Handbook of International Economics*, volume 4, pages 197–261. Elsevier.

Devereux, M. P. and Griffith, R. (1998). Taxes and the location of production: evidence from a panel of US multinationals. *Journal of Public Economics*, 68(3):335–367.

Dixit, A. K. and Stiglitz, J. E. (1977). Monopolistic Competition and Optimum Product Diversity. *American Economic Review*, 67(3):297–308.

Dustmann, C., Fitzenberger, B., Schönberg, U., and Spitz-Oener, A. (2014). From sick man of europe to economic superstar: Germany's resurgent economy. *Journal of Economic Perspectives*, 28(1):167â88.

Feenstra, R. C. (2004). *Advanced International Trade: Theory and Evidence*. Princeton University Press, Princeton, NJ, 1 edition.

Grossman, G. M. (1980). Border tax adjustments: Do they distort trade? *Journal of International Economics*, 10(1):117–128.

Grossman, G. M. and Rossi-Hansberg, E. (2008). Trading tasks: A simple theory of offshoring. *American Economic Review*, 98(5):1978â97.

Haufler, A. and Pflüger, M. (2004). International Commodity Taxation under Monopolistic Competition. *Journal of Public Economic Theory*, 6(3):445–470.

Haufler, A., Schjelderup, G., and Stähler, F. (2000). Commodity Taxation and International Trade in Imperfect Markets. CESifo Working Paper Series 376, CESifo.

Helpman, E. and Itskhoki, O. (2010). Labour market rigidities, trade and unemployment. *The Review of Economic Studies*, 77(3):1100–1137.

Helpman, E. and Krugman, P. R. (1985). *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition, and the International Economy*. MIT Press, Cambridge, MA.

Keen, M. and Lahiri, S. (1998). The comparison between destination and origin principles under imperfect competition. *Journal of International Economics*, 45(2):323–350.

Keen, M., Smith, S., Baldwin, R. E., and Christiansen, V. (1996). The future of value added tax in the european union. *Economic Policy*, 11(23):375–420.

Krugman, P. (1980). Scale economies, product differentiation, and the pattern of trade. *American Economic Review*, 70(5):950–59.

Krugman, P. R. (1979). Increasing returns, monopolistic competition, and international trade. *Journal of International Economics*, vol. 9(4)(3):469–479.

Lockwood, B. (1993). Commodity tax competition under destination and origin principles. *Journal of Public Economics*, 52:141–162.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, 71(6):1695–1725.

Mintz, J. and Tulkens, H. (1986). Commodity tax competition between member states of a federation: equilibrium and efficiency. *Journal of Public Economics*, 29(2):133–172.

Moriconi, S. and Sato, Y. (2009). International commodity taxation in the presence of unemployment. *Journal of Public Economics*, 93(7-8):939–949.

Reinhorn, L. (2012). Optimal taxation with monopolistic competition. *International Tax and Public Finance*, 19(2):216–236.

Statista (2024). E-commerce as percentage of total retail sales worldwide from 2021 to 2027.