Taxation in the Digital Economy

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Acknowledgments

INTRODUCTION

In the 20th century, most developed countries taxed and redistributed – either with money or in kind – a growing share of their wealth. This was done by taxing economic activities, either on the production side or the consumption side. The wave of globalization that emerged after the Second World War, and more importantly since the beginning of the 1990s, made it more difficult for countries to tax firms, as tax evasion or tax optimization became easier. Even with these cross-border activities, as long as most of the items sold were from standard brick-and-mortar companies, this was more a problem of implementation than of design. The development of the digital economy based on increasing returns to scale and intangible assets poses a more fundamental problem. Not only is it difficult to tax digital goods, but it is also hard to define what should be taxed. As a result, domestic digital business models are subject to an effective tax rate of only 9%, which is less than half that of traditional business models (see European Commission, 2018).

To understand the challenges faced by the authorities when they want to treat digital businesses like everyone else, it is useful to review the main features of the digital economy. First, the giants of the digital economy are multinational companies whose activity is not easy to localize or track. These companies sell to many different customers, located in many different countries, and can do so from a very limited number of sources. Since the goods are intangible, the production unit can be located anywhere. Using labor (skilled workers), capital (the network) and inputs (the information about consumers) from very different places, it is difficult to identify the location of production. Second, the firms dominating the digital economy are quite often platforms that enable two sides to interact. The two sides can be sellers and buyers (as on eBay or Uber) of traditional goods or services. In this case, the platforms are intermediaries taking advantage of the internet to reduce search and transaction costs. But they can also make the link between advertisers and consumers, providing the latter with free services, collecting some information about consumers, and selling this information to the former. A third element, directly connected to the feature discussed above, is that size matters. The more people that use a platform, the higher its value, i.e. the network effects. This may be true for many businesses but in the digital economy, it is important for two reasons. First, platforms often have very large fixed costs and very small marginal costs. Because of this cost structure, the industry displays increasing returns to scale which tends to favor the emergence of large firms. Second, the benefit of each side is often increasing in the

size – that is, in the number of people – of the other side. The presence of network effects also reinforces the concentration of the industry, with a premium for the firm entering the market first. Finally, as suggested earlier, the digital economy relies at least as much on information and data as on goods and services. Large internet firms provide information to consumers (where to go, where to shop, what to buy) and to sellers (where consumers are, what they bought before, who they are). This information is either provided to reduce search cost or to better target offers, in terms of goods and prices. It is generally collected without being directly paid for, and even without the explicit consent or consciousness of the economic agent from whom the information is extracted, but it is an essential input to the new economy.

These four features represent an important challenge for taxation policies. Since digital firms often do not need any physical presence in the country in which they operate, they can avoid most of the taxes for standard companies of the traditional economy. When they have a physical presence in many countries, they can use accounting tricks to locate their profit in the low-tax countries. Like any multinational firm, they tend to geographically optimize their production and operations. Since their assets are mostly intangible, it is even easier for digital firms to do this trick than for standard brick-and-mortar companies. Many dimensions of the digital economy are difficult to evaluate. Part of the business is based on free goods; that is, apparently free services for consumers are in reality provided in exchange for information about consumer characteristics. The lack of clear transaction prices makes it very difficult for tax institutions to apply the standard rule according to which value should be taxed where it is created. In the digital economy, one cannot use the market price to assign a precise location of value creation. When there is a market transaction, since the input is sometimes based on intangibles, it is very difficult to share the tax base among countries according to the actual places of value creation. Firms optimize on the transfer price, and this makes it difficult for high-tax countries to avoid competition from low-tax countries. Note that the mere definition of an economic transaction is difficult. Because there is no price paid for the service provided by firms to consumers, it is not clear when and how the economic transactions should be characterized. Let us take the example of an agent browsing on the internet using the technology provided by a search engine. One can say that the search engine provides a service to the agent, even if this is a free transaction. One can also say that the consumer provides an input to the search engine that will be useful for the firm when it transacts (later) with the advertisers. One could also say that the advertisers provide a service to the consumers, by

giving more information (for example, if the advertisers are price-comparison sites). In short, the lack of prices in some cases and the presence of transactions involving many participants (sellers, buyers, platforms, advertisers,…) make it difficult to define precisely the main transactions at stake. With so much uncertainty about the activity at stake, the value generated by the activity, and the location of this activity, it is therefore not surprising that the challenges raised by the taxation of the digital economy have been at forefront of the agenda of many national and international public institutions for the past 10 years.

The objective of this report is to give a preliminary overview of the recent economic literature focusing on the taxation of digital business. As a starting point, we will briefly review some attempts or proposals that have been made in developed countries to tax digital economics activities. Then, we will discuss the academic literature and we will focus on three main topics. First, we will investigate the impact of the taxation when network effects are at stake and in the context of platforms. This analysis, performed in the context of a monopoly or dominant firm, leads to support the idea of taxing data collection. Second, we will analyze more precisely the impact of the taxes in competitive settings, either between sides or at the level of the platform. In this case, the conclusions regarding the desirability of data taxation are more ambiguous. Lastly, we will study the issues raised by the lack of international cooperation, and how the different taxation systems influence a firm's choice of location. It is shown that the firm's ability to choose its location does not necessarily create a downward pressure on tax levels and that using good external benchmark on the value of digital activities is crucial to avoid tax dodging.

TAXATION OF THE DIGITAL ECONOMY IN THE REAL WORLD

Specific taxes targeting digital business, often called Google Taxes, have been proposed in countries such as France (in 2011, in 2016), Italy (in 2013), or Great Britain (implemented in 2015, under the name of *diverted profit tax*). The idea is to design a mechanism to tax firms that operate in a country even though their main activities are declared to be outside of this country. These proposals have been largely unsuccessful; either they have not been really implemented (like in France and Italy) or have been implemented but still fail to generate

revenues proportional to the economic activities of the digital firms (as in Great Britain[1]). The difficulties come both from legal reasons – these firms do not have a constant and physical presence, which is currently a necessary condition to be taxed – and practical reasons – the firms' services are free or the firm is located in many different countries and locates the value generating activities in low-tax countries.

It has indeed been made clear by all the stakeholders that the first key issue to solve is the definition of the location of a firm; in legal terms, the notion of permanent establishment. Having a permanent establishment, which is the basis for which a firm can be subject to a tax, usually requires some physical presence in the country. In the case of digital business, there is a disconnection between the country where consumers are located and the country in which most of the human and physical assets are located. As the starting point for determining whether a permanent establishment exists is a fixed place of business, there could be a difference between the place where the firm's official permanent establishment is located and the place where most of the business is done. This clearly opens the door for tax evasion and optimization.

Another issue is to establish the relevant tax base for digital business. If a subsidiary of a multinational company (MNC) located in country *A*, where most of the business is done, must pay most of its profits in royalties to the headquarters of this MNC, located in country *B*, it is very likely that these headquarters will be in a low-tax country and that the level of royalties will be fixed to minimize the pre-tax income in the high-tax country. There is a clear need for international cooperation so that each country benefits from the tax corresponding to the activities that take place within its borders. This is currently one of the objectives of the European Commission's proposed Fair and Efficient Tax System in the EU for the Digital Single Market (2017), following the Base Erosion and Profit Shifting (BEPS) project (see the last version of the report in OECD/G20, 2018). The Commission's idea, called Common Consolidated Corporate Tax Base, is that companies operating across borders would no longer have to deal with different sets of national rules and that a formula based on the location of labor, assets, and sales would be used to allocate to each member state its part of the tax base.

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[1] See "Google tax': Philip Hammond announces crackdown on tax avoidance by tech giants", *The Independent*, November 22, 2017.

As well as determining how the tax base should be constructed, it is important to find a clear way to calculate the value subject to taxation. In the case of direct sales, this is quite simple as one can use a monetary exchange to establish the tax levied by the country. Quite often, there is no need to design a new tax in this case. For free services, it is not that easy because there is no legal economic activity – with direct recorded monetary transactions – that could be subject to taxation. In this case, the nature of the digital business, organized through platforms that provide a service to agents in country *A* and sell the information to firms in country *B*, blurs the true nature of the transaction and makes it difficult to determine the location of the activity or where most of the value has been created. It has been suggested that in this case, data collection should be taxed as they constitute an input for a larger activity (the creation of a database allowing advertisers to better target their campaigns). This idea developed by Collin and Colin (2013) is appealing but the notion of free labor that users provide to the firms may be questioned. Indeed, digital firms also provide some services in exchange. Moreover, setting the value for this input would be extremely arbitrary. And in all cases, any structural change in the way MNCs, whether digital or not, are taxed should necessarily been made at least at the European level, and more probably at the international level since this would require changing all international tax agreements.

In this respect, the European Commission has very recently made some proposals to solve the main problems raised by the digital economy (see European Commission, 2018). First, it has suggested to extend the notion of permanent establishment to include firms with "significant digital presence" based on the revenues from the supply of digital services, the number of users or the number of business contracts for digital services. This would allow the Member States to tax digital firms where they create most of their value. But implementing this change will take time, not only to end up with a final proposal acceptable within Europe but also to change the double-taxation treaties with countries outside the European Union. Therefore, the EC has proposed to set up a temporary tax on certain revenues from digital activities. This tax would be applied to activities that escape the current tax framework and still generate some value. It concerns the revenues created 1) from selling online advertising space, 2) from digital intermediary activities which allow users to interact with other users, 3) from the sale of data generated from user-provided information. This tax proposal has been set at 3% and only intends to fill the most obvious loophole. It has also as an the objective to help European members to coordinate policies. This proposal will now be discussed within the Council of

the European Union and would need an unlikely unanimous support among Members States to be adopted.

The main problems reform proposals in the recent years have tried to tackle - what should be taxed, how to locate the sources of value, how to coordinate tax policies - have also been investigated by the academic literature. But the digital economy is very special, both because there are many different sources of profits (direct sales, sales of data, intermediary services), and also because of the two-sided nature of most of the internet giants. And very little is known about the taxation of platforms where network effects are at play and firms are relatively free to relocate their activity geographically. Moreover, the official reports or legal proposals do not discuss how the proposed change will influence the behavior of the actors of the digital economy (firms, platforms, users). Those topics will be quite central to the economic literature that we discuss further below.

TAXATION IN A TWO-SIDED CONTEXT: THE MONOPOLY CASE

This section focuses on the effect of taxes in a two-sided market context. This is done in a monopoly context, assuming first that users perfectly control the amount of information firms can use, then assuming that platforms choose how much data is collected from the user's activity.

Taxation and data collection

The first aspect is central to the research proposed by M. Bourreau, B. Caillaud and R. De Nijs (2018).[2] Assuming that digital firms cannot be subject to a specific tax on the basis of their profit, these authors study the impact of taxes levied either on the amount of data collected or on the amount of transactions realized by the firm.

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[2] This paper, as well as most of the papers discussed in this report and published in the special issue of Journal of Public Economic Theory (2018), has been written following the request of France Stratégie, a advisory body under the control of the french Prime Miniser.

To that end, they consider a model in which a monopoly platform acts as an intermediary between users and online sellers. This intermediary activity relies on the personal data about users that the platform collects and uses to sell advertising slots to sellers. It is important to keep in mind the two-sided nature of the problem. On one side, users derive benefits from being targeted by relevant advertising; so the more ads/sellers, the better. On the other side, sellers benefit from the large audience of the monopoly platform, since it helps them to be more efficient with their advertising campaigns.

To be more precise, users perfectly control the quantity x of personal data disclosed to the platform. And this data is used by the platform both to offer the consumer a personalized service of value $v(x)$ but also to improve the targeting of advertising, and so the likelihood that the resulting matches will be profitable. The authors introduce a heterogeneity regarding the marginal disutility of the amount of data collected by the platform. On the other side, online sellers have to pay the platform an amount a for each successful match. These sellers are heterogeneous, some of them being more profitable than others. This implies that, as the price changes, some sellers may not be able to operate profitably, will leave the market, and deprive consumers of their services. Note that even if the platform may not perfectly control the trade between sellers and users, it can charge the former subscription fee A. This fee and the potential benefit, derived either directly from the service offered by the platform or from the trades with the sellers, will determine how many sellers will subscribe to the platform. Lastly, one can look at the fiscal revenues generated by digital activities. On every subscription fee and activity generated by online advertising, the government will collect the standard VAT. On top of that, the authors investigate the impact of a tax on the amount of personal data consumers decide to provide the platform.

As many platforms (such as Google or Yahoo) do not charge users, the paper focuses first on the case where the platform's only revenues originate from sellers. To streamline the analysis even further, consider the situation in which all users participate. This consists in saying that the disutility of releasing personal data is not too high, even for the most sensible potential user.

In this setting, the platform chooses the price of advertising (a) to maximize the expected profit net of taxes. For reasonable levels of VAT, the price of advertising is an increasing function of the level of the tax on data. And the authors show that the introduction of a small

tax on data collection generates additional fiscal revenue if the initial VAT rate is not too high.

To understand the intuition behind this result, one must keep in mind the link between the initial VAT tax revenues and the change in tax base generated by the new tax on data. In the traditional economy, when a new tax is introduced, the tax base shrinks so the revenues from the original tax decrease, so the new tax cannibalizes the old one. In the context of two-sided markets and free-for-user services, the mechanism is different. The new tax on data does not directly affect the user's decision about the amount of data they decide to provide. If the platform wants to reduce its tax bill, it must deter the users from releasing their data, by decreasing the number of sellers willing to collect this data. Formally, this can only be done by increasing the price of advertising to reduce the number of active sellers, and thus the number of transactions. Another way to frame this idea is to say that users' participation is only elastic through the cross-externality between users and sellers. It is only by altering the supply side that the platform can decrease the amount of data transmitted, and therefore the tax bill it has to pay. Since the advertising price increases with the tax on data, consumer surplus and sellers' profits are reduced following the introduction of the tax. If the initial VAT is not high, the cannibalization is limited and fiscal revenues increase, whereas the opposite holds if the initial VAT rate is too high.

What can be said when platforms, such as Netflix or Deezer, are financed by the two sides of the market? In this new setting, it can still be shown that, for reasonable levels of VAT, the introduction of a small tax leads to an increase in the subscription fee and advertising price. Moreover, this small tax on data generates additional revenues. The mechanism is very similar to the one described when there is no subscription fee. But now the platform has two tools for reducing the user's participation. This is done both indirectly by raising the advertising price, and directly by increasing the subscription fee.

So far, the analysis has been conducted considering a tax per unit. What would the changes be if the government decided to levy a proportional tax, called *ad valorem* tax? With those types of tax on advertising or on subscriptions, the platform's optimal strategy is less obvious. Increasing the price lowers participation but increases the amount paid per user. It is therefore possible that a price decreases following the introduction of an *ad valorem* tax on data. Such a tax could not only generate additional fiscal revenues but also benefit consumers.

Taxation and privacy choice

It has often been said that platforms both collect too much information about consumers and do not pay enough taxes. It is interesting to compare the impact of different fiscal instruments on privacy choice, in order to analyze how to mitigate the overuse of data, and therefore better protect consumers' privacy when the intensity of data collection is chosen by firms. To that end, F. Bloch and G. Demange (2018) propose a model in which an internet platform provides services to users. This platform has many activities, and thus many sources of revenues. First, some revenues originate from direct sales to consumers. Second, some revenues are search-based advertising revenues from third parties like advertisers. Third, the platform can collect and sell personal data to aggregators. The extent to which data are collected by the platform depends on its policy. More precisely, each user generates a value that depends on the degree of data exploitation. But this data collection benefits consumers by improving the match quality on the internet. It is assumed that each user benefits positively from improved matching through data collection and exploitation but is also negatively impacted by the breach of privacy. This negative effect depends both on the characteristics of each user – some agents suffer more than others from this loss of privacy – and on the platform policy. For any policy chosen by the platform, one can define the marginal user as the one for whom the benefit of accessing this platform is equal to the privacy cost. Therefore, when choosing its data collection intensity, the platform makes the usual monopoly trade-off between margin and quantity. The higher the intensity and so the higher the value, the fewer the people who will access the platform.

As a benchmark, they consider first the case in which there is no public intervention. As the platform extracts some money both from access and from data collection, its policy should depend on the relative importance of these two elements. The higher the value due to access, the higher the platform's incentives to serve all consumers. Conversely, when the value of data exploitation is large relative to the value of access, the platform chooses to restrict access. How does this behavior compare to the behavior that maximizes the user's welfare? As the firm's behavior depends on the revenue function whereas the user's optimal choice depends on the benefit function, it is hard to make any general statement. The authors focus on the case in which users benefit more from access but the platform cares more about data

collection.[3] It means that, without constraint, the platform would extract more data (and therefore exclude more users) that would be optimal for the users.

How does the imposition of a tax change the data collection and exploitation strategy of the platform? There are different types of tax (per user, proportional to revenues) and they can be targeted either at the users or at the platform. The effects depend on the specific tax chosen. Consider first the case of an *ad valorem* tax on the platform's revenue. As this tax affects the firm proportionally, it has no impact on its choice. Consider instead a tax paid by the platform per user. It has the same effects as a decrease in the access benefit. This leads the platform to focus on data collection, and therefore to increase the intensity of data collection and exclusion. If instead the tax is borne by the users, it is as if the value of access for consumers drops. In this case, the effect on the firms' strategy is ambiguous: it can induce more data collection, if the platform's value of data collection is constant with the intensity; or less data collection, if the consumer's elasticity of participation with respect to privacy is large. The only efficient tax instrument to reduce the amount of data collection and exploitation would be a specific tax on the revenue generated by data exploitation. But it remains to be shown that implementing such specific tax is feasible.

TAXATION WITH COMPETING SIDES AND PLATFORMS

A natural question at this stage is to ask how tax incidence is affected by the presence of competition. We can first discuss the impact of competition between digital and standard firms, when both sides are affected by some taxes. Then we will analyze the case of competition between platforms.

Taxation in competitive digital media markets

An example of the first approach is proposed by H. J. Kind and M. Köthenbürger (2018) in their study on the digital media markets. For this, they consider a setting in which consumers have a utility function that depends on the consumption of printed and digital goods. In this

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[3] The authors claim that this choice is the most relevant one and based on « anectodal evidence ».

example, printed and digital books are substitutes, so increasing the quantity of printed (resp. digital) books reduces the marginal benefit of digital (resp. printed) books. It is assumed that the marginal cost of digital books is zero whereas it is positive for printed books.

Let us look first at the outcome of competition between exclusive sellers of printed books and e-books. For this, the authors assume that sellers have market power so choose their prices to optimize profits. Consider the case where each side is subject to a (potentially different) *ad valorem* tax. For the printed books, the price increases according to the tax; for the digital books, because there is no marginal cost, the tax has no effect on the equilibrium price.[4] In this latter case, the tax acts as a pure profit tax so it has no efficiency implications. However, as the goods are substitutes, a tax on printed books will have an impact on the price for digital books. Indeed, a tax on printed books decreases the demand for printed books and increases the demand for digital books. This also leads to an increase in the price, but the overall effect is an increase in the consumption of digital books. From a welfare point of view, a tax on printed books increases distortions in the market for printed books and reduces distortions in the eBooks market. The total impact depends on the relative intensity of those two effects. As an *ad valorem* tax has no impact on the consumption of goods with zero marginal cost, we may look instead at the effect of a unit tax. This tax plays the role of a marginal cost for the firm and has an impact on the price it chooses.

The optimal level of taxes, or subsidies, depends on the objective of the planner. If the goal is to promote consumption, in order to offset market power on both types of books, then one should set an *ad valorem* subsidy on printed books and a unit subsidy on eBooks. If the goal is to foster consumption of printed books and if tax-revenue constraints matter, then one should set an *ad valorem* subsidy on printed books and either an *ad valorem* tax on eBooks (this would also avoid lowering eBooks consumption) or a unit tax on eBooks.[5]

Lastly, one may be interested in the case where the same firm, a publisher in the case of books, has monopoly rights over all the forms of a book. The situation may be analyzed as a case of a multiproduct monopoly selling substitute goods. It is well known that such a firm chooses prices that are not only above competitive prices, but also above the prices that would be chosen by two separate monopolies. However, the presence of *ad valorem* taxes modifies

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[4] This is because the tax is proportional to the final price.
[5] Note that the origin of the problem is the market power of the firms. But it is assumed here that there is no way to use standard competition policy instruments to reduce this market power.

the analysis. In particular, the tax on digital books is not neutral for the pricing decision, because it induces the firm to shift demand from the digital market to the printed market. This is done by raising the price in the digital market. As discussed above, because of the market power of the firm, books are generally undersupplied. The social optimum can be achieved by setting *ad valorem* subsidies on the two book formats, although with different subsidy rates. In case of a tax-revenue constraint, this policy must be corrected, and positive taxes introduced for one of the book formats.

Tax incidence with competing two-sided platforms

Let us now turn to the case of competition between platforms. This issue has been investigated by P. Belleflamme and E. Toulemonde (2018). Their starting point is that well-established platforms effectively pay very low corporate taxes. To solve this situation, different tax systems have been envisioned. Some have advocated a standard corporate tax while others have pushed for more specific taxes. But in the latter case, it is likely that digital firms will react by changing the way prices are set. The objective of the researchers' paper is to understand the impact of taxes on prices in the context of competing two-sided platforms.

The authors consider a setting similar to Armstrong (2006) in which two platforms compete to attract agents from two sides, *a* and *b*. The two platforms are differentiated and located at the extreme points of the unit interval. Agents from both groups are uniformly distributed on the same unit interval. The pricing game is assumed to have two stages: first, platforms simultaneously set their access fees on both sides; and second, agents decide which platform to visit. At the second stage, agents will choose which platform to join as a function of the stand-alone value derived from visiting any platform, the price difference between the platforms, and their valuation for interacting with other agents on this platform. This last element depends not only on the number of agents of the other side who choose the same platform but also on how the presence of each agent is valued. At the first stage, the firms must choose their price. To guarantee the existence of an equilibrium where the two firms are

active, the network effect – that is, the benefit each consumer derives from the presence of an agent from the other group on the same platform – should not be too large.[6]

Let us consider first the case of platforms with identical cost structures and identical taxes for each side. There can be either an *ad valorem* (percentage) tax or a specific (unit) tax. What are the impacts on the equilibrium price?

As far the unit tax is concerned, it leads to an equivalent upward shift in the price. This tax plays the same role as an increase in the marginal cost. In this type of Hotelling model, the pass-through rate is 1 for 1. As far as the *ad valorem* tax is concerned, the analysis is more complex. Let us focus on the impact of taxes on the price set for a user of side *a*. The *ad valorem* tax on side *a* increases the perceived cost because the net markup decreases. But it also affects the way externality plays on prices by making the role of the other side more important. Conversely, a higher *ad valorem* on side *b* lowers the value of attracting more of these consumers, and so the importance of having more consumers on side *a* to do so. All things being equal, a higher *ad valorem* tax on side *b* leads platforms to increase their price on side *a*. In this setting with identical cost and taxes, both firms will propose the same price, and the market will be equally shared between them.

The authors then analyze who actually bear the cost of the various taxes. With a unit tax, because of the Hotelling modeling and the assumption of full coverage of the market (so inelastic demand), this tax will be directly borne by consumers. The results are different with the *ad valorem* tax. Without any two-sided effects – that is, assuming the externality parameter is equal to zero – a tax on one side will be shared equally by the firm and the agents on that side, the agents on the other side being unaffected. With positive external effects, this is different. Indeed, because the agents on the other side care about their interactions with agents on the taxed side, the platform has less incentive to pass on the tax on the agents of the taxed side (and the price can even decrease). Conversely, the agents on the non-taxed side are now negatively affected, simply because the externality they generate on the other side is less important, and so the platforms are less reluctant to increase their price. To sum up, because of the symmetry assumption, the level of tax affects the equilibrium prices but does not

[6] When the network effects are instead very large, or when the platforms are not differentiated enough, all consumers will join the same platform.

influence how the market is shared between the firms because both prices are affected identically by the tax. With transport costs and network effects unchanged, there is no global welfare improvement from the tax. The specific taxes are always borne by the agents on the side on which they are levied. In contrast, the *ad valorem* tax levied on one side hurts the agent on the other side, and sometimes more than the side originally targeted by the tax.

What can be said when the tax is levied only on one platform?[7] For simplicity, the authors focus on the case of a specific tax only on side *a*. With no cross-side effect, such a tax leads to an increase in the price for this side on this platform – part of the tax is indeed borne by the used - and a more moderate price increase for this side on the other platform – this increase being the result of the strategic complementary in prices between the platforms. With cross-side effects, this price increase, by impacting participation on side *a*, will also impact participation on side *b* for the same platform. This platform may, therefore, decide to reduce the price on side *b* to compensate, and this will also benefit side *a* because this will limit the drop in the number of side *b* users. Since there are many effects at stake, let us take two polar cases. Suppose first that the interactions between groups are much less important for side *a* than for side *b*. After the tax, the price set for side *a* increases but not enough to fully incorporate the tax. So the gain per side *a*'s user decreases. This makes it less interesting to keep a low price on side *b*. The price on that side will therefore rise. To sum up, because the margin on side *a*'s users is lower, the platform is less likely to make some effort to attract people on the other side. It means that part of the tax on side *a* is passed through to side *b*. Let us suppose instead that interactions between groups are much more important for side *a* than for side *b*. Then the taxed platform intensifies the pass-through on side *a* as it reduces its price on side *b*. But overall, the participation decreases on both sides of the taxed platform.

This analysis shows that it is hard to predict which side will suffer the most from taxation in the presence of competing platforms. It depends not only on the intensity of competition but also on how each side values the other side. In addition, because of the cross-side effects, a tax levied on one side can mostly hurt the agents on the other side, in particular when the tax is *ad valorem* or – rather surprisingly – when the taxed side values the presence of the agent from the untaxed side more than vice versa.

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[7] It is not very clear how this differentiated taxation could be implemented in practice.

Firms are supposed to optimize on all their strategic variables, whether it is the capital structure, the level of investment, or the location of intangible assets. But countries also optimize to attract the activity of MNCs, and more specifically the one of the affiliates where most of the value is transferred.

Tax competition and two-sided markets

The work of Kotsogiannis and Serfes (2010) analyzes this international competition to attract firms and shoppers. It does not address the digital economy *per se* but is still connected to the issue through their emphasis on two-sided markets. Their model features two countries, located at the two ends of the [0,1] interval, and each country provides a public good and levies tax in proportion to the level of public good chosen. Firms are perfectly mobile across countries and decide freely where to locate. Each firm has to pay a fixed cost to operate and benefits from the level of public good, though the extent to which each firm benefits from the public good is heterogeneous. The decision where to locate depends on these various elements (taxes, preference for and amount of public good) but also on the expected number of shoppers who will make their purchase in each country. Note that the price of each firm is exogenous here, so only the number of shoppers matters for firms. These shoppers are uniformly distributed on the [0,1] interval and incur a disutility if they do not shop in the ideal location. This means that shoppers prefer to shop at the closer location, all else being equal. It is assumed that a shopper who has chosen a given country will make all his purchases in this country. Note also that shoppers benefit from every additional firm, a "cross-group externality". So shoppers will choose where to shop as a function of their own location and of the number of firms in the two countries. The authors suppose that the countries choose their level of public goods first (country *A*, then country *B*), then they set their tax levels, and lastly firms and shoppers choose where to locate and where to make their purchase respectively. The equilibrium of this tax competition depends on how shoppers value the number of firms, the cross-group externality.

Suppose first that this externality is large. Country *A* will then choose a very high level of public good. This will attract all the firms, so all shoppers will make their purchase in this country. In contrast, as there is no firm in country *B*, there is no public good. This is a typical case of tipping due to a large cross-side externality, a situation quite common in two-sided markets. Suppose now that the cross-group externality is intermediate. It would be too costly for country *A* to attract all firms so the level of public good is reduced. As far as country *B* is concerned, it still offers no public good, but it can nevertheless attract some firms (and some shoppers). As the cross-group externality decreases further, the level of public good offered in country *A* also decreases. But this alleviates the competition between jurisdictions, which are now able to earn strictly positive revenue, with country *A*'s net revenue being higher than *B*'s.

How efficient is this situation? Because of the cross-group externality on the firm side, it is optimal that all firms choose the same location. So there is no reason to produce some public good in country *B*. Country *A*'s choice of public good is too high when the externality is high (this is the competition effect), and too low when the externality is low (the country does not sufficiently take into account the profit and utility of firms and shoppers).

An important insight of this analysis is that, if firms value public goods, there could be too much investment. Indeed, when cross-group externality is large, competition between countries leads country A to overinvest to attract all firms. But this overinvestment is also a way to make sure that all firms choose the same country, an efficient choice from the society's point of view. To sum up, even if tax competition entails some inefficiencies, it does not always lead to a race to the bottom as firms take into account both cost and benefit when deciding where to locate.

International tax competition with online-shopping

An alternative view of international competition is proposed by M. Bacache (2018) and her investigation of the impact of online sales on international tax competition. Online sales have become an issue for governments because there is discrepancy about the location where the value is created – where the consumers are located – and the location of the firm at the origin of the transaction. But it is shown that the possibility of online sales can also lower international tax competition.

The author analyzes this situation by assuming that there are two countries: a large one, and a small one. Consumers are located in each country, more or less close to the border. This is important because each consumer can choose to shop either at home, or to cross the border, and in this case, the cost will depend on how far he or she is from the border.[8] The government in each country collects tax on consumption. In addition to buying either at home or abroad in a brick-and-mortar shop, every consumer can also go online. There is also a cost of buying online that depends on the location, but it is less than the cost of shopping abroad. Note that with online shopping, there is an exogenous probability that the tax can be avoided. When it is not, the taxation principle that is implemented can be either the destination or the origin principle. As far as the firms are concerned, it is assumed that they have no production cost and no market power, so the price paid by consumers is merely the tax on the goods they sell.

It is first shown that the tax in the large country is always higher than the tax in the small country. This is simply due to the lower tax elasticity of cross-country shopping in the large country. So, a consumer in the large country may opt either for cross-country shopping or for online shopping, whereas a consumer in the small country could only be tempted by shopping online – but never by cross-country shopping - rather than shopping at home.

Without online shopping, governments set their taxes to maximize revenues. In this standard case, the tax rates are proportional to the transportation cost, and the large country has a higher tax level that increases with this country's size (that is, the distance of the average citizen to the border). With online shopping, we focus here on the case in which the destination principle applies. There are two cases to consider. Suppose first that the cost of online shopping is low and/or the probability of avoiding the tax is high. Then all cross-borderers shop online and pay the tax to their own government. Because of the possibility of avoiding the tax through internet, both countries lose part of the potential tax revenues. But there is no competition between the countries so the taxes are set at the maximum level – that is, to capture all consumers' surplus. Suppose instead that the cost of online shopping is not low and the probability of avoiding the tax is low. This means that not all cross-borderers will shop online. But now, the large-country government's revenues are diminished due to internet sales and cross-borderers. This creates competition between countries and the comparison to

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[8] So the cost is borne only if a consumer shops abroad from a brick-and-mortar shop.

the case without online shopping depends on the probability of avoiding taxes on internet purchases. It also depends on the size of the country.

In terms of tax revenues, which case is better is unclear. Indeed, with a high probability of avoiding the tax, the competition between countries is reduced but all governments are deprived of part of their revenues. When the probability of avoiding the tax is low, there is intense competition between countries when they set their tax rate. It is shown that, in terms of tax revenues, both countries benefit from the presence of online shopping if the leakage parameter is not too high; otherwise, they are worse off. One main insight from this analysis is that the cost of online shopping impacts tax competition between countries. Indeed, when this cost is low, the issue for each is not to prevent cross-border shopping but tax evasion. This is an important result, that is only valid when taxation is destination-based, and not when it is origin-based.[9] And this contrasts with Kotsogiannis and Serfes (2010) in which, in the absence of on-line shopping, the levels of public good and taxes were driven by the competition between countries.

Taxation and asset location optimization

Lastly, one major challenge is to control how MNCs transfer their profit from high-tax countries, where most of their economic activity is concentrated, to low-tax countries. This behavior is more and more common, as service companies tend to be larger and intangibles (copyrights, trademarks, customer lists) can be easily geographically separated from the other production units of the MNC. Therefore, using either royalty or transfer pricing, it is quite simple for an MNC to make all its worldwide subsidiaries pay to reduce their operating profit. Various papers have shown that affiliate pre-tax profitability is inversely related to the corporate tax rate (see H. Huizinga and L. Laeven, 2008). Going beyond this indirect evidence of profit-shifting activity, N. Dischinger and M. Riedel (2011) have shown – using panel data on European MNCs – that the lower a subsidiary's corporate tax rate relative to the MNC's other affiliates, the higher its level of intangible asset investment. It is therefore clear that an important trend of fiscal and asset location optimization is going on.

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[9] Note that Gauthier (2018) studies fiscal competition under the origin principle.

To fight back, fiscal authorities have envisioned different regulations and taxation systems. The OECD has been at the forefront of the discussion about these matters and different proposals have been made to effectively tax digital firms. An article by S. Juranek, D. Schindler, and G. Schjelderup (2018) takes a close look at the fiscal and efficiency impact of various tax proposals. Their starting point is the fact that, although the intellectual property has been developed in high-tax countries, it is quite often transferred to an offshore affiliate. Then, using the royalty payment system, the operating profit is transferred to the offshore affiliate and it is hard to determine what the arm's length price would be. Profit shifting and price strategy should, therefore, be at the forefront of the agenda of governments when they design their tax systems. One option is to tax royalty payments directly. But there is a question of the potential depressing effect on investment. This paper considers several transfer-pricing methods and fiscal rules and their effect on profit shifting and investment incentives.

For this, let us consider an MNC with affiliates A and B located in countries A and B. It is assumed that country A is a high-tax country (with corporate taxes t) whereas country B is a tax-haven country with no taxes on income. Affiliate A uses the intangible good owned by affiliate B to produce a final good at price p and for this pays a royalty R, assumed to be the sum of the arm's length price and of the abusive price. We can see the quantity of the intangible as an input used in the production function $f(.)$ along with the capital K. It is also assumed that the MNC finances its investment in country A and that the cost of capital (using equity or debt) is given by the world interest rate r. To follow the capital finance literature, the authors assume that the interest expenses on debt are tax-deductible but causes agency cost $C(b)$ per unit of capital, U-shaped and convex in the leverage ratio $b=D/K$. [10]

In this setting, the profits for affiliate B consist of royalty payments from affiliate A minus a fixed cost F for protecting/developing the intangible asset. The profits in affiliate A are more intricate to define. Let us assume that country A levies a tax τ on the royalty payments. Then after-tax profits for affiliate A are given by

$$\Pi = (1-t)[pf(K) - R(K)] - [r(1-t) + (1-t)C(b)]K - \tau R(K) - CC$$

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[10] This shape comes from the standard debt trade-off with the tax-saving benefits of debt on the one hand and cost of bankruptcy on the other hand.

The first term is the market return net of tax, the second term the capital cost, the third one the tax on royalty and the last one the concealment costs (*CC*) that affiliate *A* incurs. The form of the *CC* depends on the method tax authorities choose to determine the right price (that is, the arm's length royalty rate). The authors focus on two main methods.

- The Comparable Unrelated Price Method (CUPM) that compares the price charged for an intra-firm transaction with the price charged in a comparable transaction undertaken between independent parties. In this case, the CC is increasing in the gap between the actual royalty payment *R* and the arm-length royalty payment.
- The Transactional Profit Split Method (TPSM) that seeks to determine how a profit arising from a transaction would have been split between independent entities. It means that the tax authorities try to monitor the ratio between the actual royalty payment *R* and the transactional profit *pf(K)-F*. So the *CC* is given by the product of the transactional profit multiplied by an increasing and convex value of this ratio.

To sum up, whenever a comparable uncontrolled transaction can be identified, the CUPM should be favored by the tax authorities, whereas the TPSM is the best alternative. The authors look at firm behavior in these two cases.

Note first that the MNC maximizes global profit after tax – that is, the sum of the two affiliates' profit – by choosing the royalty payment, the leverage *b* and the optimal use of capital *K*. First, it must be clear that it is not profitable to shift profit to affiliate *B* if the tax rate on royalties *τ* exceeds the corporate tax *t*. Second, the optimal debt ratio is chosen such that the marginal incentive cost of debt is equal to the benefit of the marginal debt shield. This is quite a standard trade-off in corporate finance and in the model proposed here, this trade-off is not affected by the choice of transfer pricing methods. The main effect of the different transfer pricing methods is therefore only on the amount of capital invested by the MNC.

Let us assume first that the regulation is based on comparable transactions. As the concealment cost only depends on the abusive royalty, the first-order condition for optimal capital investment *K* is not affected by a change in this rate. So, when regulation is based on comparable transactions, abusive transfer pricing that could cause a change in any of the tax does not impact the firm's choice of investment. Suppose instead that the *CC* depends on the way profit is split between affiliates. Now, the MNC will have some incentives to distort its choice of capital. Indeed, a higher investment will increase the transactional profit and

decrease the ratio between the royalty and this transactional profit. Since the *CC* is based on this base, it marginally decreases this cost.[11] So this investment distortion with over-investment leads to higher profit shifting.

The authors also show that royalty taxes are effective in reducing abusive profit shifting, but this also reduces investment. This is true for any transfer pricing method, but the effects are large under TPSM because of a higher sensitivity to marginal tax savings. This investment reduction mitigates the over-investment effect in this case, and total effect on investment is therefore ambiguous.

CONCLUSION

The debate over the taxation of digital businesses has aroused many different reactions from politicians, citizens, NGOs, and economists. This is first because firms such as Amazon, Apple, Facebook, Google or Yahoo have been central to the modernization of the economy, generating billions of dollars in revenues, but at the same time, these companies have been able to dodge paying the same share of their revenues as more traditional firms. This has resulted in a lack of fiscal revenue but, even more importantly, a general feeling that more fairness is needed in the way the different actors of the economy are treated. This debate has been exacerbated by the fact that the business models of many digital firms – in particular, those which rely on extracting, processing and selling information – are much harder to define, control, and value.

Redefining the features of an economic activity is, therefore, a necessary step to accompany the digitalization of the economy. In particular, there is a need for defining the notion of value creation and production function for services (especially in the market for data). Moreover, and this is an important lesson that should be drawn from the recent economic literature, there should be a specific, carefully designed tax system for digital. Because of the two-sided

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[11] This effect of over-investment is reminiscent of the Averch-Johnson (1962) effect in the regulation literature.

aspects of many digital firms, the effect of a specific taxation system is much harder to foresee than it might be in the traditional economy. It does not mean that nothing should be done since the digital economy must pay its share of taxes the same way the traditional economy does and that it has been shown that some form of taxation (on data collection for example) can be beneficial. Still, the economic incidence of taxation should be carefully studied to avoid side-effects that might harm some sectors of the economy, or simply kill the golden goose.

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