Taxing Cross-Border Savings Income, EU Directive and US Fatca

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Abstract

On both sides of the Atlantic, many changes occurred during the last fifteen years regarding the taxation of cross border savings income. Related to a European Directive and the US QI and FATCA, they want to organize exchange of information across national borders, paving the way for such a system operated cooperatively at world level. That model has many properties, in terms of efficiency and equity. However their effectiveness needs exchange of information to be generalized and information to be of high quality. On both sides however those properties have been undermined by loopholes. Reassessing those loopholes and confirming their effects in a unified model is the first research question of this paper. Evaluating the role of information quality is the second one, related to one of the most challenging issues today: among countries adopting exchange of information, competition might focus on the quality of information transmitted, an issue reinforced by a feature common to the EU Directive and the US cooperative FATCA that it is up to local governments to scrutinize the compliance of the banks of their respective jurisdictions.

Keywords: Cross-border Income Taxation, Savings Income

JEL: H24, H26, H31, F36, F55

1 Introduction

On both sides of the Atlantic Ocean, the last fifteen years have seen many developments in the field of cross border savings income taxation. In 2000, after decades of debates, the Member States of the European Union (EU) came to a compromise in the Portuguese city of Feira. They agreed to set up a system of systematic exchange of information between tax administrations, and thus government of EU Member States, however basically limited to interest income. This system, which is referred to as the EU Directive in the rest of the paper, is reviewed in Appendix A. It has been applied by all Member States since mid-2005 with an exception for three of them - Austria, Belgium and Luxembourg - allowed to levy a withholding tax and required to pass 75 percent of the revenue of that tax to the country of residence of the investor, but without revealing her name. Since then, Belgium has joined the main group of Member States; and Austria and Luxembourg have also announced a similar shift. Moreover a process for enlarging the scope of the EU Directive to additional types of financial assets and income - like dividends and insurance contracts - is in progress.

On the 1st of January 2001, the United States (US) launched the Qualified Intermediary (QI) mechanism, designed to cope with tax evasion by US persons. Becoming qualified intermediaries of the US Internal Revenue Service (IRS), financial institutions from all over the world committed to report information on US taxpayers' income from US sources paid out throughout the intermediacy. Due to the presence of loopholes in the QI legislation, the US authorities replaced that system with the Financial Accounts Tax Compliance Act (FATCA), in March 2010. The idea was the same - systematic transmission of information by foreign banks to the IRS - but that transmission is enlarged to income paid to non-US entities owned by US persons. In that sense we speak about unilateral FATCA: the mechanism ignores local tax authorities while the US are enabled to audit foreign banks.

Furthermore, in February 2012 the US moved from a unilateral to a cooperative FATCA. Through a joint statement, the United States and some major EU Member States "have agreed to explore a common approach to FATCA implementation through domestic reporting and reciprocal automatic exchange and based on existing bilateral tax treaties "(U.S. Treasury Department, 2012, p.2). Since that time, many countries joined the agreement and thus entered in a process of mutual exchange of information with the US through the intermediacy of the respective tax administrations

- e.g. Belgium signed the agreement in April 2014. Since information is now channeled through local tax administrations which are also in charge of supervising the bank compliance, we can speak of cooperative FATCA.

The Organization for Economic Cooperation and Development (OECD) has recently proposed a global model of automatic information exchange based on the intergovernmental implementation of the US FATCA rules.

Those institutional changes in the taxation of savings income, whatever their deep motivation may be (moralization of tax behavior, fight against terrorism, money laundering or tax havens, ...), pave an avenue for a world cooperative system based on a generalization of information exchange across the borders of national jurisdictions, with the hope that no country in the future will be a haven for the money of its neighbors. From an economic point of view such an ideal world has many properties. On the one hand it produces efficiency gains: if an investor is made more captive of the tax authorities of her jurisdiction of residence, it can be charged the same tax rate on her savings income but with a smaller welfare loss, or a larger tax rate at a smaller efficiency cost. On the other hand by approaching the captivity of the investor and that of the labor income earner deemed to be rather immobile, it makes such a tax institution like the Global Income Tax (GIT, Haig, 1921, Simons, 1938) not only desirable on equity grounds as often suggested, but also compatible with efficiency; the same is true for the Danish Dual Income Tax (DDIT) and, a fortiori, for less demanding systems as well like the Nordic Dual Income Tax (NDIT, Sorensen, 1994), the Dutch boxes (Cnossen and Bovenberg, 2001) or the Belgian final withholding tax on savings income.

However the effectiveness of those properties needs cross border generalized exchange of high quality information. First indeed, exchange of information has to be generalized. By that requirement we mean that it has to apply to all types of income generated by all substitutable forms of savings, in the set of financial assets, of intermediaries and of geographical areas. This is the main lesson which arises from the application of the EU Directive and the US QI. On the European side, the properties of a system based on exchange of information were undermined by the quasi sole application of reporting to interest income; on the US side it was by the opportunity left to US persons to channel income though a local non-US entity. Reassessing those loopholes and confirming their effects in a unified model is the first research question that this paper copes with. To avoid redundancies we deal with that issue in Section 4.1., a section focused on the EU and the existence of a non-Directive

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asset; however the argument might be repeated and in any case we rest on the result that the interesting results of a system of information exchange vanish if the system is not generalized.

Second, the quality of information exchanged is to be of high. That key issue provides this paper with a second research question, related to what may seem to be the most challenging question today. We may conjecture that, within a population of countries who all have adopted, or forced to adopt, exchange of information, tax competition might shift to the quality of information transmitted. And that issue might be reinforced by the fact that both under the EU Directive and the US cooperative FATCA, it is up to local governments to scrutinize the compliance of the banks located on their respective own territory. We address that issue of strategically chosen information quality in Section 3.2. based on mainframe literature and then especially in the context of the cooperative version of US FATCA in Section 5.3.

To sum up, if exchange of information is generalized and the quality of information is high the real world may contradict Slemrod's opinion that "although it is not desirable to tax capital income on a source basis [because source-based taxes are distortionary], it is not administratively feasible to tax capital on a residence basis" (Slemrod, 1995, quoted by Cnossen, 2002).

Additionally, in Appendix C, we develop an alternative to generalized exchange of information which consists in model based on withholding tax charged at source but at rate decided by the country of residence of the investor; the revenue is then transferred by the source to the residence jurisdiction, possibly except for a small fee to incentivize the local authorities to comply. That alternative system has the same properties as the generalized exchange of information in terms of revenue. However, it doesn't necessarily require the communication by the foreign banks of the names of their account holders. The sole existence of such an alternative raises the issue of the goal of a tax system: though definitely in charge of providing public authorities with tax revenue to finance the provision of the desired quantity and quality of public goods, is a modern tax system also expected to provide tax administration with names, and if so, on which grounds?

Throughout the entire paper we want our modelling to be as close as possible to both existing theory and institutional reality. Therefore we start by recalling the two polar cases of pure source and pure residence taxation; we do that in Section 2 which also allows us to present the behavior of the investors and government at work in that two-jurisdiction infinitely living

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world. Exchange of information is introduced in Section 3, with information quality first supposed to be exogenously determined and then endogenously. Section 4 focuses on the EU, especially when at least one asset doesn't fall under the Directive, and when levying a withholding tax is no longer allowed when exchange of information occurs. Section 5 is then dedicated to the US and successively copes with the QI mechanism and its loopholes, the unilateral FATCA and the cooperative FATCA. Summary and conclusions occur in Section 5. Three appendices complete the paper. Appendix A provides the reader with a more detailed presentation of institutions at stake. Appendix B enlarges the model to asymmetric investors and countries. Finally Appendix C briefly describes the alternative system mentioned above and based on withholding tax levied at source but at a rate determined by the country of residence of the investor.

From a methodological point of view, our modelling strategy owes much to the one developed by Keen and Ligthart (2006a,b) and Gérard (2004). Our approach of information is in line with Bacchetta and Espinosa (1995, 2000) and Eggert and Kolmar (2002, 2004). With respect to Bacchetta and Espinosa (1995, 2000) and Keen and Ligthart (2006a, 2006b) especially, we build up a more flexible framework in the sense that: (i) we allow governments to decide not only on the tax rates on income from savings abroad, like in Keen and Ligthart (2006a, 2006b), or on the tax rates on domestic income, as in Bacchetta and Espinosa (1995, 2000), but on both simultaneously when discrimination based on investor residence or type of asset is at stake; (ii) we assume investors able to diversify their portfolio not only on the basis of geographical distribution as in Bacchetta and Espinosa (1995) and Keen and Ligthart (2006a, 2006b), but also between types of financial assets. Moreover we suppose that moving savings from one country to another or from one to another financial instrument implies costs due e.g. to the search of information on the best distribution of the portfolio.

2   Baseline Model

In this section we present as baseline scenarios the traditional two polar cases of international taxation, a pure decentralized source-based scenario on the one hand, and a pure residence-based scenario on the other hand. Those scenarios will be adapted in the further sections of the paper in order to

match actual institutional features and to meet our research questions.[1]

We suppose a world with two countries, *home* and *foreign*. In each of them a single individual investor is representative for the whole population; she has a total amount of savings standardized to unity, $w = 1$, invested in otherwise unspecified bonds and she decides on the distribution of her savings between the two jurisdictions in order to maximize a utility function, i.e. for a resident of country h the fraction invested domestically a_h^h and that invested abroad $a_f^h = 1 - a_h^h$. We thus denote by a superscript h the variables referring to the representative agent of the population living in country h and with a superscript f those referring to the representative agent of country f. A subscript h characterizes location in h and a subscript f location in f. The bonds at stake represent a single financial asset providing investors from both countries with a pre-determined and given pre-tax interest rate r over a long period of time - assume perpetuities. We will relax that assumption of a single financial asset in section 4. Moreover, in each country there is a government which maximizes a social welfare function with respect to the tax rates under its authority.

In the pure source-based setting each government taxes income paid out on its territory and deemed therefore to have its source in that jurisdiction. Then, tax rates under the authority of the government of h are a tax on savings income paid out by local financial institutions to domestic residents, t_h^h and to investors from abroad, t_h^f, respectively; and similarly for the government of country f.

Unlike that, in the pure residence-based setting, each government levies tax on income received by investors whose the country is the state of residence; the tax rates under the authority of the government of h are t_h^h levied on local income paid out to domestic residents and t_f^h charged on foreign income of domestic residents.

Hence, the model takes the form of a two-step non-cooperative game. In step 1, governments decide on their respective tax rates on savings income in a non-cooperative way. In step 2, investors choose the spatial distribution of their portfolio, i.e. the distribution of their savings between the two locations and thus the places where they will have their interests paid out. We solve that model backward, first investigating the behavior of the investors, then

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[1]In Appendix C, an additional design will be studied which consists of a system of coordinated withholding tax, like the one currently at work between Austria, Luxembourg and some competing jurisdictions on the one hand, other EU Member States on the other hand.

of the governments. As for simplicity investors and governments play just once, never revising their decision even if the time span is long. Moreover countries and investors are symmetric, which implies equal in size of both population and wealth, an assumption which is removed in the model developed in Appendix B; there N^h and N^f are the population of country h and of country f respectively.

2.1 Pure source-based setting (S)

Consider first a pure source-based setting. In that setting each government taxes all the income paid out in its territory, and deemed to be produced accordingly, both to residents and non-residents. Moreover it provides no information to the government of the other jurisdiction as to the income paid in its territory to residents of that other jurisdiction.

2.1.1 The investors

In each country the representative investor, say the investor h of country h, has an endowment $w = 1$ initially distributed between the two jurisdictions: a fraction $a_{0,h}^h$ invested at home, in country h, and a fraction $a_{0,f}^h = 1 - a_{0,h}^h$ invested abroad, in country f. Based on tax rates decided by the two governments she may decide on a revision of that distribution for a_h^h and $a_f^h = 1 - a_h^h$ so as to maximize her utility. However departing from the initial distribution has a cost supposed to be quadratic. Notice that though we only present here the simplest case where $w = 1$, in Appendix B we present the outcome of the model for a broader specification where $w \in \mathbb{R}_+$. The utility itself consists of the after-tax investment income net of the quadratic cost of reallocating the portfolio spatially. Thus the problem of representative investor h is to

$$\max_{a_h^h, a_f^h} \quad U^h = \sum_{k=h,f} z_k^h a_k^h - \frac{v}{2} \sum_{k=h,f} \left(a_k^h - a_{0,k}^h \right)^2, \tag{1}$$

$$s.t. \sum_{k=h,f} a_k^h = 1 \quad and \quad \sum_{k=h,f} a_{0,k}^h = 1,$$

where $a_{0,k}^h \in [0,1]$ and $a_k^h \in [0,1]$ are respectively the initial and chosen fraction of savings invested in country k with $k \in \{h,f\}$; $v \in (0,1)$ is the

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cost due to a change in the initial allocation of the agent's savings, and $z_k^h \in \mathbb{R}_+$ is the after-tax interest rate. That latter can still be written

$$z_h^h = \left(1 - t_h^h\right) r, \qquad z_f^h = \left(1 - t_f^h\right) r, \tag{2}$$

where $r \in (0,1)$ stands for the before-tax interest rate paid out either in country h or in country f, while $t_k^h \in [0,1]$ indicates the tax rate on the interest paid out in country k to a resident of h.

Notice that the reallocation cost does not refer specifically to the degree of capital mobility, but includes such items like banking fees and information costs linked with the reallocation of savings; the reallocation cost can be thus modelled as a fraction v of the assets reallocated that the investor has e.g. to pay to a financial intermediary.[2]

From the first order conditions of the optimization problem (1), we find that

$$a_h^{h*} = a_{0,h}^h + \frac{z_h^h - z_f^h}{2v}, \qquad a_f^{h*} = a_{0,f}^h + \frac{z_f^h - z_h^h}{2v}. \tag{3}$$

We assume that the two countries and the two representative agents are symmetric. This implies that the representative agent of country f acts similarly to the representative agent of country h. Their optimal choices are thus

$$a_f^{f*} = a_{0,f}^f + \frac{z_f^f - z_h^f}{2v}, \qquad a_h^{f*} = a_{0,h}^f + \frac{z_h^f - z_f^f}{2v}. \tag{4}$$

and in each country the optimal portfolio allocation of representative agents corresponds to the initial share of wealth invested in each country, adjusted for net-of-tax differences in returns taking into account reallocation costs. Those costs are multiplied by two because agents are supposed to pay a cost both for transferring assets from h to f and vice versa.

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[2]Also notice that we are not dealing with entry costs which would require to introduce some forms of convexity in the utility function; we suppose instead that agents are already active investors and only decide to change the initial allocation of their wealth in order to maximizze their return. Reallocation costs are then supposed to increase with the share of the portfolio reallocated in another country due to the presence of administrative burdens increasing with the size of the reallocated wealth like those implied bt anti-laundering measures. Moreover, assuming a quadratic cost in the utility function assures that the utility function U is concave and twice continuously differentiable with respect to its arguments. In addition, quadratic costs allow us not to impose any condition on the relation between the initial and final fraction of savings invested in a given country.

2.1.2 The governments

In the second step of the game, each government maximizes tax revenues, an assumption justified by Keen and Ligthart (2006a, 2006b). Each government chooses the tax rates under its control, knowing the best response investors. In this scenario government of h decides only on the tax rate it charges on the domestic income of its residents, t_h^h, and on the withholding tax it levies on interest payments paid out in its territory to residents of the other country, t_h^f. The objective of the government of h is to maximize its tax revenues W^h,[3]

$$\max_{t_h^h, t_h^f} W^h = r \left(t_h^h a_h^{h*} + t_h^f a_h^{f*} \right). \tag{5}$$

In the simplified version of the model that we present throughout the main text of the paper, we abstract from the issues relative to different sizes of the population in the two countries.

Solving the maximization programs of both governments, we obtain the best response functions[4]

$$
\begin{aligned}
t_h^h &= \frac{t_f^h}{2} + a_{0,h}^h \frac{v}{r}, \quad t_h^f = \frac{t_f^f}{2} + a_{0,h}^f \frac{v}{r}, \\
t_f^f &= \frac{t_h^f}{2} + a_{0,f}^f \frac{v}{r}, \quad t_f^h = \frac{t_h^h}{2} + a_{0,f}^h \frac{v}{r}.
\end{aligned} \tag{6}
$$

The tax rates charged turn out to be influenced by three factors. First, they are a positive function of the size of reallocation costs v: the higher the cost that agents face for moving their savings, the higher the tax rate charged by a country can be. Second, they are also positive functions of the initial investment in the location: the higher the initial share of investors' wealth invested in a country, the higher the tax rate set by the government of that country can be, reflecting the lower need to attract further savings from the partner

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[3] As for the agents' utility function, we have checked that government's revenue function is concave, with the concavity given by the presence of the portfolio allocation functions. Moreover we have also verified that the function is twice continuously differentiable with respect to its arguments as well as controlled for the validity of this result in all the sections of the paper. First and second conditions have been also examined for any of the described scenarios.

[4] The symmetry between the two countries allows us to focus our presentation on the results of country h alone. In the paper, we present the results for the government of country f only when necessary.

jurisdiction. Third, tax rates raise when the complementary tax rate paid by agents domestically or abroad increases. In particular, the withholding tax levied by the government of country f on interest payments paid out to residents of country h, t_f^h, is the strategic complement of the tax rate charged on the domestic income of those residents, t_h^h. The tax rate charged on the domestic income of its residents by the government of f, t_f^f, is instead the strategic complement for the withholding tax rate levied by the government of h on the interests paid out in that latter country to residents of country f.

The Nash equilibrium tax rates are then,

$$
\begin{aligned}
t_h^{h*} &= \frac{2v}{3r}(1 + a_{0,h}^h), & t_h^{f*} &= \frac{2v}{3r}(1 + a_{0,h}^f), \\
t_f^{f*} &= \frac{2v}{3r}(1 + a_{0,f}^f), & t_f^{h*} &= \frac{2v}{3r}(1 + a_{0,f}^h).
\end{aligned}
\tag{7}
$$

Notice that in the context of pure source-based withholding tax, countries have the possibility to discriminate between domestic rate for resident and non-resident investors. Then, if countries and investors are symmetric implying equal rates of return wealth in the two countries, tax rates charged to non-resident investors tend to be smaller whenever agents prefer to invest more in their domestic country ($a_{0,h}^h > a_{0,f}^h$ and $a_{0,f}^f > a_{0,h}^f$). Especially, if funds are initially located only in the country of residence, $\{a_{0,h}^h, a_{0,f}^f\} = 1$ and $\{a_{0,f}^h, a_{0,h}^f\} = 0$, then the domestic tax rate is equal to the double of the withholding tax rate levied on foreign investors. This result is in line with that found by Keen and Ligthart (2006a, 2006b) under the assumption that countries can only choose the withholding tax rate.

2.2   Pure residence-based setting (R)

Under that setting, the power to tax is shifted from the source to the residence country. That latter jurisdiction levies taxes on income received by its residents wherever those income come from home or from abroad. That setting increases tax revenues, as highlighted since Diamond and Mirrlees (1971a,b), allowing the governments to tax foreign source income at the same rate as local income obtained by residents investors. Otherwise, since moving savings is costly and, in this setting, no longer rewarded by less tax liabilities,

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such no longer occurs. Therefore, from (3), the optimal allocation chosen by the representative agent in each country corresponds to the initial allocation,

$$a_h^{h*} = a_{0,h}^h, \quad a_f^{h*} = a_{0,f}^h, \quad a_f^{f*} = a_{0,f}^f, \quad a_h^{f*} = a_{0,h}^f \quad (8)$$

Taxing at the same rate the income received by the residents of each jurisdiction domestically and abroad implies that $t_h^h = t_f^h = t^h$ and similarly for country f. The government objective function (5) becomes

$$\max_{t^h} W^h = r \left(a_h^{h*} + a_f^{h*} \right) t^h.$$

and the government of country h is now free to fix its tax rate without taking into account the choices of country f. It can set a tax rate t^{h*}.[5] Then one can show that, using (3), (7), (8),

$$W_R^h > W_S^h \text{ if } t^{h*} > \frac{v}{r}.$$

and the tax revenues collected by the government of country h under a residence-based regime are larger than those collected under a source-based principle of taxation when reallocation costs are low with respect to the interest rate. At the limit, for those costs going to zero, the residence principle ensures larger tax revenues than the source principle for all positive values of the tax rate t^{h*}.

2.3   Tentative conclusion

In this section we have examined two polar cases starting with the pure source-based one. That firs setting reveals to be inefficient leading to a too low taxation of cross border income and the presence of externalities. On the contrary those externalities are internalized when a pure residence-based system is introduced. Such a system allows governments to set in motion tax systems consistent with Haig-Simons Global Income Tax (Haig, 1921; Simons, 1938), **with Dual Income Tax and a fortiori with less demanding mechanisms**. However operating such system requires the government of the residence country to know the income of its residents paid out abroad, which needs information.

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[5] Countries are now independent because investors are supposed to be immobile. If this was not the case, countries could still compete on the number of resident taxpayers.

That requirement means the operation of the second polar case difficult and **some authors have not hesitated to write that, although pure source is inefficient, pure residence is unfeasible**. One can say that there is at least an information challenge or, stated otherwise, that information matters. Therefore we will mainly focus on the information issue in the rest of the paper.

Otherwise that section has followed a way in line with the history of cross border tax relations, presenting the pure source principle actually at stake for a long time, characterized by each country trying to be a tax haven for the savings of its neighbor, and opposing it to its almost ideal alternative, the pure residence principle.

3 Information exchange (IE)

We tentatively conclude at the end of the previous section that for sure information matters. Therefore, before investigating how actual institutional designs are coping with that issue, and especially the EU Directive on the one hand, and the US QI and FATCA frameworks on the other hand, we want to devote that section to a theoretical approach of information exchange. The section consists of two parts. In the first one we assume that the quality of the information exchanged between countries is neither nil nor perfect but is exogenously determined; this in line with Keen and Ligthart (2006a, 2006b) and allows us to understand how introducing information exchange affects the polar results obtained in the previous section. In the second part we follow Bacchetta and Espinosa (2000, 2005), letting governments to decide not only on the tax rates that they levy, but also on the quality of information that they transfer to the other jurisdiction; then the quality of the information exchanged is endogenously determined.

At this stage exchange of information already deserves two remarks however. First, by that term we do not mean the sole transmission of information by a government to another government. More broadly, different settings belong to that scenario, including spontaneous transmission of information or self-reporting, to adopt the terminology of Kleven, Kreiner and Saez (2009), driven either by risk aversion (Allingham and Sandmo, 1972) or by tax morale (Alm and Torgler, 2006; Frey and Torgler, 2007), exchange of information upon request advocated by the OECD Model Tax Convention on Income and Capital (OECD, 1963), and automatic and systematic provision of informa-

tion by the paying agent, either directly to the residence government of the investor, or indirectly through the agency of the tax authorities of the source jurisdiction (third party reporting in the terminology of Kleven, Kreiner and Saez, 2009).

In their pioneering work Allingham and Sandmo (1972) indeed have modeled tax evaders as rationale agents that choose to evade taxation whenever the cost of tax evasion is lower than the risk of tax audit. Over the last few years, the literature on tax evasion and the institutional designs has expanded and economists have also empirically studied when paying taxes can be rationally preferred to evading them. Alm and Torgler (2006) and Frey and Torgler (2007), for example, have analyzed the determinants of the tax morale - the willingness to pay taxes - and found that *tax morale* is highly and positively correlated with the quality of institutions of a country. Likewise, Kleven et alii (2009, 2011) assess third-party tax reporting against self-reporting in the context of labour income taxation, showing that when agents are in charge of declaring tax revenues to the government, tax evasion rises and passes from the very low rate of 0.3% for third-party tax reporting to 37% in case of self-reporting.

Second, the exchange of information examined in this section is free. The cost of information acquisition or delivery, and the associated cost of information primarily providers auditing is a key topic. We reserve its treatment for sections 5.2 and 5.3 where we concentrate on the evolution of the US practice from QI to unilateral and then cooperative FATCA. Furthermore, we assume that the information got by the country of residence of the taxpayer does not always come with the desired quality: different national tax regulations can allow public administrations to gather and transmit different taxpayer details, or, if investors rather than foreign administrations are in charge of providing information to the government of the residence country, self-reported information may be partial, or even governments may be tempted to strategically hide information. In that respect we enlarge the scope of the international taxation literature by coping explicitly with the cost of providing information.

3.1 Exogenous information exchange

Information exchange is a pre-condition for a government to be permitted to tax the global income of its residents or at least to charge the same rate to

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both domestic and foreign savings income, as in the residence-based regime analyzed in section 2.2. If, like in the OECD model tax treaty, we start with pure source and turn it to a residence-based system, interests continue to be taxed at source by the paying country, still permitted to discriminate between local and foreign investors. However, unlike in the framework based on the sole source principle, the residence country may also tax interests obtained abroad by its residents, provided it grants them a credit for the withholding tax levied in the partner country, which requires that it gets the relevant information.

The representative agent of each country faces the same utility maximization problem as in (1). The return on the share of her savings invested abroad, however, now also depends on the tax rate applied to her domestic income, whenever this rate is higher than the withholding tax charged abroad,

$$
\begin{aligned}
z_f^h &= \left[1 - t_f^h - max \left\{ 0, p \left(t_h^h - t_f^h \right) \right\} \right] r, \\
z_h^f &= \left[1 - t_h^f - max \left\{ 0, p \left(t_f^f - t_h^f \right) \right\} \right] r
\end{aligned}
\tag{9}
$$

Besides, it is a function of the quality of the information $p \in (0, 1)$ regarding agent's cross-border savings, which is provided to the authorities of the country of residence either by the financial institutions or by the authorities of the source country, in case of third party reporting, or even by the investor herself, in case of self-reporting. The credit granted to taxpayers in the country of residence for the withholding tax paid abroad is generally limited to the domestic tax liabilities on the income at stake. Therefore a country cannot charge a withholding tax larger than the upper limit of the creditable amount.[6]

The allocation of savings for the representative investor of a country continues to follow the formula found in (3) and (4), where after-tax returns are

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[6]The lower bound of the quality of the information can be larger than zero because, in the context of this institutional device, reporting is in principle mandatory for administrations or investors so that people with a high degree of risk aversion (Allingham and Sandmo, 1972) or tax morale (Alm and Torgler, 2006; Frey and Torgler, 2007) will report some foreign income at least. The upper bound is smaller than 1, perfect exchange of information, as we assume that the government receiving information cannot check its accuracy (Gérard and Hadhri, 1994).

defined as in (9). The share of savings invested in the country of residence hence decreases when the domestic tax rate rises and increases when the foreign withholding tax rate goes up. Nonetheless the outflow of savings toward the partner jurisdiction is cushioned by the importance of the exchange of information, as the share of savings invested abroad decreases

$$\frac{\partial a_f^{h*}}{\partial p} < 0, \frac{\partial a_h^{f*}}{\partial p} < 0$$

when the quality of the information exchanged improves.

The objective function of each of the two governments now integrates a new source of tax revenue, i.e. that raising from their capacity to tax foreign income of their residents thanks to the cross border exchange of information. As a result, governments face the following maximization program

$$\max_{t_h^h, t_h^f} W^h = r\left(t_h^h a_h^{h*} + t_h^f a_h^{f*}\right) + p\left(t_h^h - t_f^h\right) a_f^{h*} r,$$

$$\max_{t_f^f, t_f^h} W^f = r\left(t_f^f a_f^{f*} + t_f^h a_f^{h*}\right) + p\left(t_f^f - t_h^f\right) a_h^{f*} r.$$

The optimal tax rates charged are given by

$$
t_h^{h*} = \frac{2(1 + a_{0,h}^h)}{[(3 - 2p)(1 - p)]} \frac{v}{r}, \quad t_h^{f*} = \frac{2\left[1 + a_{0,h}^f(1 - p)\right]}{[(3 - 2p)(1 - p)]} \frac{v}{r}, \quad (10)
$$

$$
t_f^{f*} = \frac{2(1 + a_{0,f}^f)}{[(3 - 2p)(1 - p)]} \frac{v}{r}, \quad t_f^{h*} = \frac{2\left[1 + a_{0,f}^h(1 - p)\right]}{[(3 - 2p)(1 - p)]} \frac{v}{r}.
$$

Tax rates are positive functions of the quality of the information exchanged with the other country. An increase in the quality of information exchange reduces tax motivated outflows of savings and thus allows governments to increase their respective domestic tax rates

$$\frac{\partial t_h^{h*}}{\partial p} > 0, \frac{\partial t_f^{f*}}{\partial p} > 0$$

Similarly, it motivates governments to increase the withholding tax on income paid out to non-residents

$$\frac{\partial t_h^{f*}}{\partial p} > 0, \frac{\partial t_f^{h*}}{\partial p} > 0$$

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since that levy is credited on tax liabilities in the country of residence of the investors.

3.2 Endogenous information exchange

For analyzing what level of information the two countries choose to exchange, we note p^f the quality of the information shared by that country f and, similarly, with p^h the quality of information provided by country h. We do not impose the constraint $p^h = p^f$ as done in Bacchetta and Espinosa (2000, 2005). The definition of after-tax returns now becomes (9) as

$$
\begin{aligned}
z_f^h &= \left[1 - t_f^h - max\left\{ 0, p^f \left(t_h^h - t_f^h \right) \right\} \right] r, \\
z_h^f &= \left[1 - t_h^f - max\left\{ 0, p^h \left(t_f^f - t_h^f \right) \right\} \right] r.
\end{aligned}
$$

The revenue collected by the government of h thus depends on the quality of information decided by country f and vice versa, so that the objective function of the jurisdictions are,

$$
\begin{aligned}
\max_{t_h^h, t_h^f, p^h} W^h &= r \left(t_h^h a_h^{h*} + t_h^f a_h^{f*} \right) + p^f \left(t_h^h - t_f^h \right) a_f^{h*} r, \\
\max_{t_f^f, t_f^h, p^f} W^f &= r \left(t_f^f a_f^{f*} + t_f^h a_f^{h*} \right) + p^h \left(t_f^f - t_h^f \right) a_h^{f*} r.
\end{aligned}
$$

The optimal tax rates and information quality for the government of country h are

$$
t_h^{h*} = \frac{2(1 - a_{0,h}^h)^2}{a_{0,h}^h} \frac{v}{r}, \qquad t_h^{f*} = \frac{2(a_{0,h}^f)^2}{1 - a_{0,h}^f} \frac{v}{r}, \qquad p^{h*} = 1 - \frac{a_{0,f}^f}{a_{0,h}^f}, \qquad (11)
$$

while for the government of country f they become

$$
t_f^{f*} = \frac{2(1 - a_{0,f}^f)^2}{a_{0,f}^f} \frac{v}{r}, \qquad t_f^{h*} = \frac{2(a_{0,f}^h)^2}{1 - a_{0,f}^h} \frac{v}{r}, \qquad p^{f*} = 1 - \frac{a_{0,h}^h}{a_{0,f}^h}. \qquad (12)
$$

Four lessons then appear. First, in both countries the domestic tax rate is a positive function of the share of the portfolio that resident agents keep in the country while withholding tax rates are a positive function of the share of portfolio that agents keep outside of the country

$$
\frac{\partial t_h^{h*}}{\partial a_{0,h}^h} > 0, \frac{\partial t_f^{f*}}{\partial a_{0,f}^f} > 0, \frac{\partial t_h^{f*}}{\partial a_{0,h}^f} > 0, \frac{\partial t_f^{h*}}{\partial a_{0,f}^h} > 0
$$

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Second each country perfectly aligns the withholding tax rate levied on the savings income of foreign investors on the domestic tax rate charged by the other jurisdiction, i.e. t_h^{f*} in (11) is equal to t_f^{f*} in (12) and t_f^{h*} in (12) to t_h^{h*} in (11). This is due to the fact that if governments can maximize their revenue not only choosing tax rates but also the quality of information shared with the other country, the first order condition with respect to the quality of information requires that

$$
\begin{aligned}
\frac{\partial W^h}{\partial p^h} &= 0 \Leftrightarrow \frac{\partial a_h^{f*}}{\partial p^h} t_h^{f*} = 0 \Leftrightarrow t_h^{h*} = t_f^{h*}, \\
\frac{\partial W^f}{\partial p^f} &= 0 \Leftrightarrow \frac{\partial a_f^{h*}}{\partial p^f} t_f^{h*} = 0 \Leftrightarrow t_f^{f*} = t_h^{f*}.
\end{aligned}
$$

So doing, governments make an arbitrage between reaping revenue and attracting investments.

Third, in line with Bacchetta and Espinosa (2000, 2005), the optimal quality of information exchanged between governments might be positive. In our setting, however, governments do not always transmit at least some information. The quality of the information that governments decide to pass to the other country is perfect (equal to 1) when foreign investors do not held any domestic asset in their initial portfolio ($a_{0,h}^h = a_{0,f}^f = 0$). It is positive but lower than 1, thus less than perfect, when foreign investors initially have some of their savings invested in their residence country ($a_{0,h}^h > a_{0,f}^h$, $a_{0,f}^f > a_{0,h}^f$). It then becomes zero when foreign investors keep more than half of their initial portfolio in their country of residence ($a_{0,h}^h = a_{0,f}^f = 1$).

Finally, in our framework the initial distribution of agents' portfolio between their country of residence and the other country determines the level of tax rates and the quality of information exchanged. Governments need to attract more foreign investors when these people initially invest less abroad than in their own country. In order to attract foreign capitals, governments set lower withholding tax rates and reveal lower quality information to the country of residence of the foreign investors. As a result, apart the extreme case where investors initially hold only foreign assets, the quality of information shared by governments is less than 1. This means that, under the

regime of information exchange, tax revenues gathered by governments are

$$W_{IE}^h \;\leqslant\; W_R^h \;\text{ if } a_{0,f}^f \leqslant 1, \;\; W_{IE}^h \geqslant W_S^h \;\text{ if } a_{0,f}^f \leqslant \frac{1}{2},$$

$$W_{IE}^f \;\leqslant\; W_R^f \;\text{ if } a_{0,h}^h \leqslant 1, \;\; W_{IE}^f \geqslant W_S^f \;\text{ if } a_{0,h}^h \leqslant \frac{1}{2}.$$

4   EU Savings Directive (EU)

Institutional details regarding the EU Directive on the Taxation of Savings Income are reported in Appendix A at the end of this paper, where a comparison with the system suggested by the OECD is proposed and the main loophole of the directive is set forth. In short, under the OECD system, the scenario of section 2.1. mainly applies though for some investors it needs to be substituted by scenario 3.1 but with a very limited value of p since reporting to the tax authorities of the state of residence is left up to the risk aversion and the tax morale of the investor.

Two implications of the EU Directive are examined in this section. First, the introduction of the EU Directive implies in theory a move to scenario 2.2. or 3.1. or still, if Member States decide to behave strategically, 3.2. However the limitation of the scope of the Directive to nearly the sole interest income while close substitutes do exist actually returns the mechanism at stake to scenario 2.1. This is what we first want to show in that section. And second, unlike what is permitted in section 3, when the EU Directive imposes exchange of information, the levy of a withholding tax is no longer allowed. For that reason - also valid for the US mechanisms surveyed in section 5 below - we revise the models of section 3 accordingly, setting forth implications for the results obtained so far.

4.1   ...when at least one asset doesn't fall under the Directive

The series of proposals formulated since the late 1980s by the EU Commission which culminated into the adoption of the EU Directive on Savings has

already inspired several contributions. Huizinga and Nielsen (2003), for example, analyze the minimum withholding tax proposal made by the EU Commissioner Christiane Scrivener in 1989. In the same vein, Gérard (2004) and Keen and Ligthart (2006a, 2006b) assess the impact of the innovative mechanisms of revenue sharing, which the EU Commission implemented when the idea of a minimum withholding tax faced the opposition of some EU Member States. Moreover, adopting an empirical approach, Johannesen (2010) and Hemmelgarn and Nicodème (2010) show that the Directive did not lead EU residents to manage major shifts in their international allocation of savings, suggesting however that further analysis should be conducted in order to understand whether the adoption of the EU Directive influenced agents' portfolio choices among different kinds of assets. This section contributes to meet that suggestion: we put forward a theoretical explanation of the reasons why investors modify - or do not modify - their portfolio in response to the provisions of the EU Directive.

The 2003 EU Directive on Savings Income, in its version currently applied by all EU Member States apart Austria and Luxembourg, has shifted the power to tax cross-border savings income from the source to the country of residence of the investors. In principle, this framework could constitute an application of the second scenario we have presented in the baseline model, i.e. the pure residence-based setting of section 2.2. The Directive, however, applies only to interest and some interest-based financial products income. That limited scope may lead agents to hold products falling out of its range of application, like insurance contracts. To show this, we suppose that country h and country f are both members of the EU and relax the assumption that in each country investors can buy a single kind of financial product. Unlike that, we consider that in the two countries a financial product doesn't fall into the range of application of the Directive; and that income from holding that asset is only taxed by the country where interests are paid out. Otherwise the foreign product which falls under the Directive is a perfect substitute to domestic bonds and may be discarded from the reasoning. In line with EU features the financial product not falling under the directive is only sold to non-residents.

Then, the representative agent of country h maximizes the following util-

ity function:

$$\max_{a_h^h, a_{f'}^h} \quad U^h = \sum_{l=h,f'} z_l^h a_l^h - \frac{v}{2} \sum_{l=h,f'} \left(a_l^h - a_{0,l}^h\right)^2, \tag{13}$$

$$s.t. \sum_{l=h,f'} a_l^h = 1 \quad and \quad \sum_{l=h,f'} a_{0,l}^h = 1,$$

where subscript h now refers to the financial product issued by country h and regulated by the Directive, whilst f' is the insurance product issued in country f which doesn't fall under the scope of the Directive. The after-tax interest rate perceived on products h and f' can be written as

$$z_h^h = (1 - t_h^h)\, r, \ z_{f'}^h = (1 - t_{f'}^h)\, r, \tag{14}$$

where $t_{f'}^h$ is the withholding tax levied in country f on income from assets not falling under the Directive and owned by residents of country h. As in (3), the solution to the agent's maximization problem is given by

$$
\begin{aligned}
a_h^{h*} &= a_{0,h}^h + \frac{(z_h^h - z_{f'}^h)}{3v}, \\
a_{f'}^{h*} &= a_{0,f'}^h + \frac{(z_{f'}^h - z_h^h)}{3v}
\end{aligned}
\tag{15}
$$

The government of country h decides on its tax rates solving the following maximization problem

$$
\begin{aligned}
\max_{t_h^h, t_{h'}^f} W^h &= r\left[t_h^h a_h^{h*} + t_{h'}^{f*} a_{h'}^{f*}\right] \\
s.t. \ t_h^h, t_{h'}^{f*} &\leq 1
\end{aligned}
$$

where $t_{h'}^f$ is the tax rate levied by country h on $a_{h'}^{f*}$, the share of the portfolio invested by residents of country f into the Non-Directive asset issued in country h.

Tax revenues under the EU Directive regime turn out to be equal to those collected in a scenario of pure source-based taxation as long as investing abroad in Non-Directive assets is more profitable than investing at home or abroad in Directive assets. Indeed assets taxed according to the rules of the EU Directive can be compared to national assets taxed by the residence country, while the assets escaping the application of the Directive are similar to foreign assets taxed at a different rate decided by the source country.

Substituting optimal portfolio allocations and tax rates into the formula for government tax revenues, we obtain that

$$W_{EU}^h = W_S^h, \quad W_{EU}^f = W_S^f.$$

Therefore, corresponding to a pure source-based system of taxation, a limited application of the Directive leads governments to collect a smaller amount of tax revenues than in a framework of information exchange, a situation of pure residence-based taxation. A pure residence-based taxation setting, in fact, would require the application of the Directive to all financial assets.

Notice that the equivalence set forth above between the EU Savings Directive and the pure source-based scenario goes against the result claimed by Keen and Ligthart (2006a, 2006b). For them, the EU Savings Directive can be seen as a kind of information exchange regime, where information is fully exchanged about the sole kind of financial asset. Then it is right that a system of information exchange Pareto-dominates any kind of source-based taxation; and that, as claimed by those authors the EU Savings Directive should lead governments to gather more tax revenues than the source-based scenario. But it is no longer the case under the current version of the Directive when at least one asset exists which enables investors to escape being subject to the Directive.

To sum up, if investors can diversify their portfolio in such a way that at least one asset is not subject to information exchange and more profitable that any asset subject to information exchange, the Pareto-superiority of information exchange is falsified. Said otherwise, even if exchange information is perfect when applied, if its application is limited to some financial assets, the system becomes equivalent to a source-based taxation setting without leading any additional revenue for the governments. This is the reason why EU authorities attempt to revise and expand the scope of the Directive.

Moreover, whenever governments can play not only in terms of tax rates but also in terms of information quality in order to attract foreign capital, then information exchange tends to be equivalent to taxation at source when governments reduce information provision to foreign countries.

4.2 ...when levying a withholding tax is no longer allowed

As mentioned above, the EU Directive, and the US mechanisms as well, prohibits the levy of a withholding tax on capital income paid out to EU residents (vs US persons) when exchange of information is operated. The reason is obvious, though in contradiction with OECD practices that we followed in sections 2 and 3: if a source country government was enabled to levy a withholding tax it would manage in such a way to reap the tax revenue of the reidence country.

Therefore, to be in conformity with that view of cross border taxation we revise the models of section 3 accordingly.

If the source country is enabled to tax at source the sole part of savings income for which it does not pass information to the residence country, the return on the investment of the representative agent of country h is

$$z_h^h = a_{0,h}^h + \frac{\left\{\left(1 - t_h^h\right) - \left[p^f t_h^h + (1 - p^f) t_f^h\right]\right\} r}{2v},$$

$$z_f^h = a_{0,f}^h + \frac{\left\{\left[p^f t_h^h + (1 - p^f) t_f^h\right] - \left(1 - t_h^h\right)\right\} r}{2v}$$

for the share of her savings respectively invested at home or abroad. Likewise, for the agent of country f, we have

$$z_f^f = a_{0,f}^f + \frac{\left\{\left(1 - t_f^f\right) - \left[p^h t_f^f + (1 - p^h) t_h^f\right]\right\} r}{2v},$$

$$z_h^f = a_{0,h}^f + \frac{\left\{\left[p^h t_f^f + (1 - p^h) t_h^f\right] - \left(1 - t_f^f\right)\right\} r}{2v}$$

for the investment in either f - her country of residence - or h.

4.2.1 Exogenously given information

If governments take the quality of information exchanged as given, such that $p^h = p^f = p$, the government of country h maximizes

$$\max_{t_h^h, t_h^f} W^h = r\left[t_h^h \left(a_h^{h*} + p\, a_f^{h*}\right) + (1 - p) t_h^f a_h^{f*}\right], \tag{16}$$

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and the government of country f maximizes

$$\max_{t_f^f, t_f^h} W^f = r \left[t_f^f \left(a_f^{f*} + p\, a_h^{f*} \right) + (1-p) t_f^h a_f^{h*} \right]. \tag{17}$$

The optimal tax rates decided by country h then are

$$t_h^{h*} = \frac{\left\{ r(1-p) + 2[(1+p) + a_{0,h}^h(1-p)]v \right\}}{3(1-p^2)r},$$

$$t_h^{f*} = \frac{\left\{ 2\left[1 + a_{0,h}^f(1-p)\right]v - r(1-p) \right\}}{3(1-p)^2 r}$$

and similarly for the government of country f

$$t_f^{f*} = \frac{\left\{ r(1-p) + 2[(1+p) + a_{0,f}^f(1-p)]v \right\}}{3(1-p^2)r},$$

$$t_f^{h*} = \frac{\left\{ 2\left[1 + a_{0,f}^h(1-p)\right]v - r(1-p) \right\}}{3(1-p)^2 r}$$

It turns out that for a given initial investors' portfolio allocation, all tax rates increase for increasing levels of the quality of the information exchange

$$\frac{\partial t_h^{h*}}{\partial p} > 0, \frac{\partial t_h^{f*}}{\partial p} > 0, \frac{\partial t_f^{f*}}{\partial p} > 0, \frac{\partial t_f^{h*}}{\partial p} > 0$$

Moreover, domestic tax rates increase when the initial share of agents' portfolio invested in the country of residence of investors becomes larger and decrease when agents initially invest more abroad than in the country of residence

$$\frac{\partial t_h^{h*}}{\partial a_{0,h}^h} > 0, \frac{\partial t_f^{f*}}{\partial a_{0,f}^f} > 0, \frac{\partial t_h^{h*}}{\partial a_{0,f}^h} < 0, \frac{\partial t_f^{f*}}{\partial a_{0,h}^f} < 0$$

On the other hand, tax rates levied at source on foreign investments go up when the amount of investment agents initially invest abroad goes up too, and goes down the larger the share invested at home

$$\frac{\partial t_h^{f*}}{\partial a_{0,h}^f} > 0, \frac{\partial t_f^{h*}}{\partial a_{0,f}^h} > 0, \frac{\partial t_h^{f*}}{\partial a_{0,h}^h} < 0, \frac{\partial t_f^{h*}}{\partial a_{0,f}^f} < 0$$

This means that when the quality of the information exchanged is not perfect, $p < 1$, governments compete to attract savings in their territory by setting lower tax rates the more they want to attract investments.

4.2.2 Endogenously determined information

If governments can decide not only upon tax rates but also upon the quality of information they send, the optimal problems in (??) and (??) become

$$\max_{t_h^h, t_h^f, p^h} W^h = r \left[t_h^h \left(a_h^{h*} + p^f \, a_f^{h*} \right) + (1 - p^h) t_h^f a_h^{f*} \right],$$

for the government of country h and

$$\max_{t_f^f, t_f^h, p^f} W^f = r \left[t_f^f \left(a_f^{f*} + p^h \, a_h^{f*} \right) + (1 - p^f) t_f^h a_f^{h*} \right].$$

for that of country f. As a result, in country h the optimal tax rates and quality of information are

$$t_h^{h*} = \frac{\left[r - 2(1 - a_{0,h}^h)v \right]^2}{2r[(r - v) - 2(1 - a_{0,h}^h)v]}, \quad t_h^{f*} = 0, \quad p^h = 1 - \frac{2v}{r - 2a_{0,h}^f v}$$

while in country f we have

$$t_f^{f*} = \frac{\left[r - 2(1 - a_{0,f}^f)v \right]^2}{2r[(r - v) - 2(1 - a_{0,f}^f)v]}, \quad t_f^{h*} = 0, \quad p^f = 1 - \frac{2v}{r - 2a_{0,f}^h v}$$

With respect to the expressions found previously, optimal tax rates levied at source now vanish and governments deliberately give up an instrument of fiscal policy.

Domestic tax rates keep being sensitive to the initial share of agents' portfolio invested in their country of residence. In other words, domestic tax rates are higher the larger is the share of agents' portfolio initially invested in their country of residence and lower the more agents had their initial portfolio invested abroad

$$\frac{\partial t_h^{h*}}{\partial a_{0,h}^h} > 0, \frac{\partial t_f^{f*}}{\partial a_{0,f}^f} > 0, \frac{\partial t_h^{h*}}{\partial a_{0,f}^f} < 0, \frac{\partial t_f^{f*}}{\partial a_{0,h}^f} < 0$$

Quality of information now replaces taxation at source as a tool to attract foreign capital. The quality of information passed to the country of

residence of the investors is lower the larger the share of foreign investors' initial portfolio invested in the source country

$$\frac{\partial p^{h*}}{\partial a_{0,h}^{f}} < 0, \frac{\partial p^{f*}}{\partial a_{0,f}^{h}} < 0$$

As a result the more the two countries are dependent on foreign capitals to maximize their revenues, the more they try to protect foreign investors and reveal lower quality information to the country of residence of those investors.

In this framework, the competition between governments is allowed by the existence of a reallocation cost. Should that cost vanishes, $v = 0$, agents can reallocate their investments without costs; then countries share perfect quality information, $p^h = p^f = 1$, and governments are only able to set domestic tax rates.

Free capital mobility is thus the key condition to move from the actual EU or US rules to a framework of true taxation at residence.

5   The US model

As detailed in Appendix A, cross border exchange of information was also introduced on the US side of the Atlantic Ocean though in a very different way. And in both cases loopholes did appear. On the EU side exchange of information occurs between EU Member States, channeled through tax authorities, but limited to interest income, mainly. As seen in the previous section that loophole is important and EU authorities attempt to surpass it by expanding the scope of the Directive. On the US side, the corresponding QI mechanism, for Qualified Intermediary, also provides transfer of information, but unilaterally: banks all over the world provide the US tax authorities with information regarding income from US assets paid to US persons; such information is not channeled through public authorities abroad but directly served by banks to the US Tax Administration.

That information is only provided about US persons receiving US income is a deficiency of the US system since escaping the tax is made possible by having the income paid to a local institution owned by a US person. The move from QI to FATCA is expected to meet that loophole - in this section we speak about Unilateral FATCA.

The second deficiency comes from a side aspect of the lack of reciprocity: the US bear the whole cost of auditing and controlling the good diligence of the banks all over the world, a burden which may be seriously alleviate if the control is passed to local authorities in exchange of the US providing information. More generally that second loophole is related to the lack of reciprocity of the US mechanism. Therefore the move to reciprocity suggested by the US in February 2012 is one step forward in an attempt to meet that issue - we then speak of Cooperative FATCA.

5.1 QI loopholes

Due to the exemption granted to foreigners, the QI mechanism has turned out to be far from the scenario of perfect exchange of information it was aiming at.

Under that system indeed, US taxpayers were not compelled to report non-US source income and so could escape taxation using a juridical non-US person possibly subject to taxation at source. If such an alternative channel for getting interest income from foreign assets exists, then the after-tax foreign income for an investor with residence in country h in (9) becomes

$$z_f^h = \max \left\{ \left[1 - t_f^{hIE} - p^f \left(t_h^{hIE} - t_f^{hIE}\right)\right] r, \ (1 - t_f^{hS} - \tilde{c})r\right\}$$

where $\tilde{c}$ is the cost of that alternative channel, t_h^{hIE} is the tax rate levied in the country of residence h and t_f^{hIE} the tax rate levied at source on that cross border income paid out in country f to a resident of h; that latter tax rate is usually determined by tax treaties; t_f^{hS} is the corresponding effective tax rate at source when the person receiving the income doesn't claim for the benefit of the tax treaty. Finally $\tilde{c}$ is the extra cost of channelling the income through a local person in the source country; it might be understood as a fee paid to bankers or tax advisers. As a consequence, a rational US taxpayer complies with the rules of the QI system only if

$$\tilde{c} > t_f^{hIE} - t_f^{hS} + p^f \left(t_h^{hIE} - t_f^{hIE}\right)$$

If countries do not exchange information, a rational US taxpayer can freely avoid to pay taxes on foreign income under the QI system. If countries do exchange information, tax evasion (or non-compliance) takes place when the cost of creating a local foreign person is lower than the difference between

the tax liabilities under the information exchange regime and the pure source-based scenario, for a given quality of information.

5.2 Unilateral FATCA (USuni)

Given that the US authorities decided to reinforce the QI mechanism substituting it with FATCA rules: the foreign banks have also to report US income received by US persons through the intermediary of a non-US entity owned by US persons. Nevertheless, acquiring information has remained a costly activity for the US government. Under the EU Savings Directive mechanism, it is up to each EU Member State to provide its partner countries with such information. Under the regime we call Unilateral FATCA, the US authorities bypass local ones and directly audit - or make audited - the primary supplier of the information, i.e. foreign financial institutions, in order to enforce the rules they have decided. We have assumed so far that getting information was costless for the recipient country. That assumption however is counterfactual and the Unilateral FATCA system implies the US bearing the whole burden of acquiring information. In this section, building on the scenarios of section 3 above, we investigate the consequences of the existence of that burden.

If acquiring information is costly, jurisdiction h will support the cost ϕ of $p^f(t_h^h - t_f^h)a_f^h$. That cost is deemed to increase with the tax base recuperated thanks to the information acquired.

With $\phi \in [0, 1]$, the tax revenue function for country h is

$$\max_{t_h^h, t_h^f} W^h = r\left[t_h^h a_h^{h*} + t_h^f a_h^{f*} + p^f(t_h^h - t_f^h)(1 - \phi)a_f^{h*}\right],$$

generating the equilibrium tax rates in (10)

$$t_h^{h*} = \frac{2(1 + a_{0,h}^h)}{\left[3 - 2(1 - \phi)p^f\right](1 - p^f)}\frac{v}{r}, \tag{18}$$

$$t_h^{f*} = \frac{2\{1 + a_{0,h}^f[1 - (1 - \phi)p^h]\}}{\left[3 - 2(1 - \phi)p^h\right](1 - p^h)}\frac{v}{r}$$

The presence of a cost for acquiring information decreases the domestic tax rate charged to residents as well as the tax rate levied on income paid to

non-residents,

$$\frac{\partial t_h^{h*}}{\partial \phi} < 0, \frac{\partial t_h^{f*}}{\partial \phi} < 0$$

and tax revenues hence decrease for increasing values of ϕ.

If governments maximize tax revenues by also choosing the quality of information they send, the optimal solutions for the government of country h become

$$t_h^{h*} = \frac{2(1 - a_{0,h}^h)^2(1 - \phi)}{a_{0,h}^h - \phi\, a_{0,f}^h}\frac{v}{r}, \quad t_h^{f*} = \frac{2(a_{0,h}^f)^2(1 - \phi)}{a_{0,f}^f - \phi\, a_{0,h}^f}\frac{v}{r}, \qquad (19)$$

$$p^{h*} = \frac{1}{1 - \phi}\left(1 - \frac{a_{0,f}^f}{a_{0,h}^f}\right),$$

while for the government of country f they are

$$t_f^{f*} = \frac{2(1 - a_{0,f}^f)^2(1 - \phi)}{a_{0,f}^f - \phi\, a_{0,h}^f}\frac{v}{r}, \quad t_f^{h*} = \frac{2(a_{0,f}^h)^2(1 - \phi)}{a_{0,h}^h - \phi\, a_{0,f}^h}\frac{v}{r}, \qquad (20)$$

$$p^{f*} = \frac{1}{1 - \phi}\left(1 - \frac{a_{0,h}^h}{a_{0,f}^h}\right).$$

Comparing the expressions in (19) and (20) with (11) and (12), we first note that countries keep setting their withholding tax rate in line with the domestic tax rate of the country where foreign investors have their residence. Second, the quality of information that countries decide to pass to the other country is higher than under the information exchange scenario whenever $0 < p^{j*} < 1$ with $j \in \{h, f\}$. This is because the cost that countries have to pay to get information makes governments relying more on mutual exchange of information. The existence of a cost of acquiring information thus leads governments to be more collaborative. Third, the domestic and withholding tax rates levied by both countries are higher under the unilateral FATCA regime when investors do not hold the majority of their initial portfolio in their country of residence. When countries share better information, competition between them is alleviated enabling them to levy higher withholding tax rates on the income paid out to foreign investors and that, in turn, allows for higher domestic tax rates on income of resident investors.

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Summing up,

$$
\begin{aligned}
a_{0,h}^h > a_{0,f}^h, a_{0,f}^f > a_{0,h}^f &\Leftrightarrow p^{h,f} = 0 \\
&\Leftrightarrow t_{hIE}^{h,f} > t_{hUSuni}^{h,f}, t_{fIE}^{f,h} > t_{fUSuni}^{f,h} \\
&\Leftrightarrow W_{IE}^{h,f} > W_{USuni}^{h,f}, \\
a_{0,h}^h < a_{0,f}^h, a_{0,f}^f < a_{0,h}^f &\Leftrightarrow p_{USuni}^{h,f} > p_{IE}^{h,f} > 0 \\
&\Leftrightarrow t_{hIE}^{h,f} < t_{hUSuni}^{h,f}, t_{fIE}^{f,h} < t_{fUSuni}^{f,h} \\
&\Leftrightarrow W_{IE}^{h,f} < W_{USuni}^{h,f}.
\end{aligned}
$$

Notice that, though they capture the main issues related to Unilateral FATCA, the model above fail to meet the actual mechanism on at leats one point, its asymmetry. If country h stands for the US and j for another country, then $p^h = 0$ anyway.

5.3 Cooperative FATCA (UScoop)

The agreement signed on the 8th of February 2012 between the US and some of the largest EU Member States - France, Germany, Italy, Spain and the United Kingdom - makes the FATCA system moving from a unilateral to a cooperative mechanism where each partner provides information to the partner country regarding its residents who are paid out savings income on its territory. The objective function of government h turns out to be

$$
\max_{t_h^h, t_h^f} W^h = r \left[t_h^h a_h^{h*} + t_h^f a_h^{f*} + p^f (t_h^h - t_f^h)(1 - (1-\chi)\phi) a_f^{h*} \right],
$$

where $\chi \in [0,1]$ is the share of the information cost ϕ paid by the partner country f. The equilibrium solutions (18) become

$$
\begin{aligned}
t_h^{h*} &= \frac{2(1 + a_{0,h}^h)}{\{3 - 2[1 - (1-\chi)\phi] p^f\}(1 - p^f)} \frac{v}{r}, \quad (21) \\
t_h^{f*} &= \frac{2\{1 + a_{0,h}^f - a_{0,h}^f [1 - (1-\chi)\phi] p^h\}}{\{3 - 2[1 - (1-\chi)\phi] p^h\}(1 - p^h)} \frac{v}{r}.
\end{aligned}
$$

Comparative inspection of those results reveal that a larger value of χ reduces the cost of acquiring information and pushes upward both domestic and withholding tax rates

$$
\frac{\partial t_h^{h*}}{\partial \chi} > 0, \frac{\partial t_h^{f*}}{\partial \chi} > 0 \quad (22)
$$

Moreover, if governments also decide on the quality of information that they want to transmit, then

$$t_h^{h*} = \frac{2(1-a_{0,h}^h)^2[1-(1-\chi)\phi]}{a_{0,h}^h - (1-\chi)\phi\, a_{0,f}^h} \frac{v}{r}, \quad t_h^{f*} = \frac{2(a_{0,h}^f)^2[1-(1-\chi)\phi]}{a_{0,f}^f - (1-\chi)\phi\, a_{0,h}^f} \frac{v}{r},$$

$$p^{h*} = \frac{1}{1-(1-\chi)\phi}\left(1 - \frac{a_{0,f}^f}{a_{0,h}^f}\right), \tag{23}$$

and

$$t_f^{f*} = \frac{2(1-a_{0,f}^f)^2[1-(1-\chi)\phi]}{a_{0,f}^f - (1-\chi)\phi\, a_{0,h}^f} \frac{v}{r}, \quad t_f^{h*} = \frac{2(a_{0,f}^h)^2[1-(1-\chi)\phi]}{a_{0,h}^h - (1-\chi)\phi\, a_{0,f}^h} \frac{v}{r},$$

$$p^{f*} = \frac{1}{1-(1-\chi)\phi}\left(1 - \frac{a_{0,h}^h}{a_{0,f}^h}\right). \tag{24}$$

Comparing (23) and (24) with (19) and (20), we see that the quality of information is lower under the cooperative FATCA than under the unilateral one. It is still positive whenever investors have more foreign than domestic assets in their initial portfolio composition; and equal to zero otherwise. In addition withholding tax rate keeps following the domestic tax rate of the other country. That latter is higher (viz. lower) than under the unilateral FATCA regime depending on the initial composition of investor's portfolio. If investor initially holds more (viz. less) than half of her portfolio in foreign assets, then the unilateral FATCA framework leads to higher (smaller) tax rates than the cooperative FATCA regime and than the simple information exchange mechanism of section 3. Thus,

$$a_{0,h}^h < a_{0,f}^h \Longleftrightarrow t_{hIE}^{h,f} < t_{hUScoop}^{h,f} < t_{hUSuni}^{h,f}, t_{fIE}^{f,h} < t_{fUScoop}^{f,h} < t_{fUSuni}^{f,h}$$

$$a_{0,h}^h > a_{0,f}^h \Longleftrightarrow t_{hIE}^{h,f} > t_{hUScoop}^{h,f} > t_{hUSuni}^{h,f}, t_{fIE}^{f,h} > t_{fUScoop}^{f,h} > t_{fUSuni}^{f,h}$$

It comes out that under the cooperative FATCA framework, supporting the costs of acquiring information endogenizes the benefits of sharing information. To better understand that, suppose that each country has to

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contribute to the cost of acquiring information. Then country h objective function is to

$$\max_{t_h^h, t_h^f} W^h = r \left[t_h^h a_h^{h*} + t_h^f a_h^{f*} + p^f (t_h^h - t_f^h)(1 - (1-\chi)\phi) a_f^{h*} \right] - \chi \phi p^h (t_f^f - t_h^f) a_h^{f*}.$$

For a value of χ equal to 0, as in the unilateral FATCA mechanism, the tax rates chosen by the government of country h are those given by (18). As tax rates in (18) are lower than those in a situation where information is free and since governments are not able to tax the whole income from abroad of its residents, the tax revenues collected by the government of country h under cooperative FATCA are lower than in a framework where information is exchanged at no cost.

By contrast, when the burden of acquiring information is at least partially supported by the partner jurisdiction $\chi \neq 0$, optimal tax rates are higher than under an unilateral FATCA regime and can be even higher than in a situation where information is free.

Assuming that governments also select quality of information, the optimal decisions of the government of country h are

$$t_h^{h*} = \frac{2(1 - a_{0,h}^h)^2 [1 - (1-\chi)\phi] - 2\phi\chi a_{0,h}^h (1 - a_{0,h}^h)}{a_{0,h}^h - \phi\, a_{0,f}^h} \frac{v}{r},$$

$$t_h^{f*} = \frac{2(a_{0,h}^f)^2 [1 - (1-\chi)\phi] - 2\phi\chi a_{0,f}^f (1 - a_{0,f}^f)}{a_{0,f}^f - \phi\, a_{0,h}^f} \frac{v}{r},$$

$$p^{h*} = \frac{1}{1-\phi} \left(1 - \frac{a_{0,f}^f}{a_{0,h}^f} \right),$$

and similarly for country f

$$t_f^{f*} = \frac{2(1 - a_{0,f}^f)^2 [1 - (1-\chi)\phi] - 2\phi\chi a_{0,f}^f (1 - a_{0,f}^f)}{a_{0,f}^f - \phi\, a_{0,h}^f} \frac{v}{r},$$

$$t_f^{h*} = \frac{2(a_{0,f}^h)^2 [1 - (1-\chi)\phi] - 2\phi\chi a_{0,h}^h (1 - a_{0,h}^h)}{a_{0,h}^h - \phi\, a_{0,f}^h} \frac{v}{r},$$

$$p^{f*} = \frac{1}{1-\phi} \left(1 - \frac{a_{0,h}^h}{a_{0,f}^h} \right).$$

The quality of information is the same as in the case of unilateral FATCA and so higher than in the framework of simple information exchange or cooperative FATCA whenever the quality of information is different from zero, i.e. when investors hold more of their initial investment abroad than at home.

Finally, In case of zero quality information, though, this scenario allows governments to raise higher revenues by levying higher tax rates. Indeed tax rates are then higher than under information exchange and both unilateral and cooperative FATCA regimes, when investors invest more at home than abroad.

To sum up,

$$
\begin{aligned}
\mathrm{i}a_{0,h}^h > a_{0,f}^h, a_{0,f}^f > a_{0,h}^f \quad &\Leftrightarrow \quad p^{h,f} = 0 \\
&\Leftrightarrow \quad t_{hIE}^{h,f} > t_{hUSuni}^{h,f} > t_{hUScoop}^{h,f}, t_{fIE}^{f,h} > t_{fUSuni}^{f,h} > t_{fUScoop}^{f,h} \\
&\Leftrightarrow \quad W_{IE}^{h,f} > W_{USuni}^{h,f} > W_{UScoop}^{h,f}, \\
a_{0,h}^h < a_{0,f}^h, a_{0,f}^f < a_{0,h}^f \quad &\Leftrightarrow \quad p_{UScoop}^{h,f} = p_{USuni}^{h,f} > p_{IE}^{h,f} > 0 \\
&\Leftrightarrow \quad t_{hIE}^{h,f} < t_{hUSuni}^{h,f} < t_{hUScoop}^{h,f}, t_{fIE}^{f,h} < t_{fUSuni}^{f,h} < t_{fUScoop}^{f,h} \\
&\Leftrightarrow \quad W_{IE}^{h,f} < W_{USuni}^{h,f} < W_{UScoop}^{h,f}.
\end{aligned}
$$

5.4   Remark

As we have noticed above when exchange of information applies, US mechanisms as well as EU one prohibit levying a withholding tax at source. Therefore we should repeat here the corresponding section - section 4.2. - developed above for the EU case.

6   Summary and conclusions

This paper is motivated by the numerous initiatives regarding the taxation of cross-border savings income, which took place during the last fifteen years on both sides of the Atlantic Ocean. On the European side, a Directive on Savings Taxation was introduced mid-2005. On the American side, the Qualified Intermediary status was proposed in 2003 to all banks across the world in order to make the US administration able to tax US taxpayers on their worldwide savings income. In front of the loopholes of that mechanism, a new piece of legislation has been launched under the name of FATCA. This latter enlarges the application of the QI mechanism but remains characterized by the US getting information directly from foreign financial institutions and thus supporting the whole burden of acquiring information and supervising

its quality, including at the level of its transmission by foreign banks. In February 2012 the US have issued a joint statement with the largest EU Member States for exploring a cooperative version of FATCA, which has been recently adopted by the OECD as a basis for a global model of automatic exchange of information.

Against that background, the paper develops a model which exhibits a series of features. On the one hand it is able to reproduce standard results of the international public finance literature regarding taxation of cross-border savings income. On the other hand it permits to enrich that literature and simultaneously to assess the developments and loopholes of actual systems of cross-border savings income taxation.

In line with that latter purpose two main results arise. First, organizing exchange of information on an incomplete basis, by which is meant, exchange of information which doesn't apply to all financial products, all countries and all possible intermediaries inevitably turns the ambition of setting up a system based on the pure residence principle, into an interjurisdictional game played according to the pure source principle. To sum up, if investors can diversify their portfolio in such a way that at least one asset is not subject to information exchange and more profitable that any asset subject to information exchange, the Pareto-superiority of information exchange no longer holds.

And second, quality of information matters, especially when getting or providing information is costly and when information exchange can be turned into an instrument of interjurisdictional competition.

Information exchange indeed is first of all a pre-condition for a government to be permitted to tax the global income of its residents or at least to charge the same rate to both domestic and foreign savings income. Then tax rates are positive functions of the quality of the information exchanged with the other country since an increase in the quality of information exchanged reduces tax motivated outflows of savings and thus allows governments to increase their respective domestic tax rates; and similarly, that motivates governments to increase the withholding tax on income paid out to non-residents since that levy is credited on tax liabilities in the country of residence of the investors.

When the quality of information exchanged becomes a strategic variable, four lessons appear. First, in both countries the domestic tax rate is a positive function of the share of the portfolio that residents invest at home while the withholding tax rate on interest paid out to non-residents is a positive func-

tion of the share of portfolio that agents invest outside the country. Second each country perfectly aligns the withholding tax rate levied on the savings income of foreign investors on the domestic tax rate charged by the other jurisdiction. Third, the optimal quality of information exchanged between governments might be positive and that quality depends on the initial geographic distribution of portfolios: it is positive but lower than 1, thus less than perfect, when foreign investors initially have some of their savings invested in their residence country, while it vanishes when foreign investors keep more than half of their initial portfolio in their country of residence. Finally, the initial distribution of agents' portfolio between their country of residence and the other country determines the level of tax rates and the quality of information exchanged. Governments need to attract more foreign investors when these people initially invest less abroad than in their own country. In order to attract foreign capitals, governments set lower withholding tax rates and reveal lower quality information to the country of residence of the foreign investors. In some sense, whenever governments can play not only in terms of tax rates but also in terms of information quality in order to attract foreign capital, then lack of compliance in information exchange tends to be a form of taxation at source. In other terms, the more the two countries depend on foreign savings for maximizing their revenues, the more they try to protect foreign investors and reveal lower quality information to the country of residence of those investors.

A series of results have been set forth, based on a reading through the above developed model, of the evolution of the EU Directive and the US FATCA mechanisms, in particular of the move of the latter from a unilateral view – a single country, the US, directly dealing with foreign banks – to a cooperative approach – agreements between the US and foreign governments. Assuming that obtaining information on income paid abroad to resident taxpayers is no longer free of cost but instead is a costly activity, increases the quality of information exchanged when it is already positive when at no cost – i.e. when wealth is mainly invested abroad; then tax rates are pushed up and social welfare as well. In that latter case, when unilateral FATCA is replaced by cooperative FATCA, the quality of information exchanged goes down, and tax rates too, though they remain higher than under cost free information.

That paper still contributes to convince researchers that developments, loopholes and improvements of the tax systems, jointly with a search of efficiency and fairness, are powerful drivers for scientific research in taxation and

public finance. Next steps in this research agenda should include introducing dynamics in the model in order to capture possible changes in the behavior of jurisdictions; and relating that dynamics to the differences between countries in terms of e.g. size or wealth in order to capture the effects of interjurisdictional asymmetries. From the point of view of political economy indeed, one question at least arises: why did the US first propose large EU Member States to join them in the cooperative FATCA agreement? In other words how can the gains from that cooperation be shared between the participating countries? And do all countries have an interest to join?

Finally, in the appendices, we report the optimal tax rates obtained when country size, agents' wealth and interest rate are no longer equal across countries. We also show that results equivalent to pure residence can be reached through a regime of taxation at source provide that withholding tax rates are chosen by the residence country and all the collected revenues are transferred to that country of residence; in that case, withholding tax rates levied at source are set equal to domestic tax rates.

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Appendix A: institutional background

In an open economy, savings invested abroad can in principle be taxed by the country where income is generated and most often paid out - called the source country or the paying agent country -, or by the country where the investor has his residence - the residence country -, or even by both. For a long time, savings income rising from a foreign source was only subject to a withholding tax levied at source. No exchange of information was organized between the source and the residence country. Each country was a tax haven for its neighbor.

After World War II, the Model Tax Convention on Income and Capital proposed by the Organization for Economic Cooperation and Development (OECD) aimed at enabling the residence country to effectively tax worldwide income of its residents.[7] The OECD Convention (OECD, 1963) allowed the source country to levy a withholding tax on non-resident investors' income, whilst the country of residence of the taxpayer was left free to subject that income to its own tax system, provided that a credit was granted for the withholding tax levied abroad. A consequence of this system was that the residence country needed to get information from the source country in order to properly tax foreign income of its resident taxpayers and apply the crediting mechanism. Residence country legal authorities were actually entitled to claim such exchange, but could not always get all the necessary details or a high enough degree of precision of the information required.[8]

The EU approach: the EU Savings Directive

The absence of a well performing international tax scheme for capital income was rather unimportant as long as savings abroad was limited, due e.g. to risk on currency exchange rates or to legal barriers to cross border mobility of funds. Within the European Union (EU), the increasing capital

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[7]The League of Nations in 1921 began to work for eliminating double taxation through bilateral conventions. The first results of this effort were the Model Tax Convention of Mexico in 1943 and London in 1946. For a brief summary of the historical background of the OECD Model Tax Convention on Income and Capital, see the historical section of its 2010 full version (OECD, 2010).

[8]For example, this could happen because the source country administration was not entitled to legally obtain or to reveal to other subjects some information about foreign investors.

mobility resulting from the accomplishment of the Single Market in the late 1980's turned a marginal phenomenon into a larger one. The willingness to preserve undistorted capital movements across EU Member States, as well as the possibility of making foreign savings income contributing to government revenues, led the governments of the EU Member States to find a way for avoiding tax competition among countries. Two avenues were therefore suggested: either introducing a system of coordinated withholding taxes levied at source or systematically exchanging information among Member States.

The first attempt to coordinate the taxation of savings income was led by the EU Commissioner Christiane Scrivener. The proposal aimed at coordinating the withholding taxes levied by the EU Member States on interest income paid out to foreign investors having their residence in another EU Member State. The adoption of this proposal failed due to its rejection by a group of countries including Luxembourg and the United Kingdom, whilst unanimity among EU Member States is required in tax matters. The second attempt was directed by Commissioner Mario Monti, at the time in charge of Internal Market, Financial Services and Financial Integration, Customs, and Taxation. Monti's suggested reform asked each Member State to decide for one of the following two options: either a withholding tax levied at source, like in the Scrivener proposal, or a systematic exchange of information across EU internal borders. In both Scrivener's and Monti's proposal the coordinated withholding tax was in no way a final levy and reporting to the tax administration at residence, though compulsory, was actually left to investor's decision. The adoption of Monti's proposal however failed too. Finally, as already mentioned in the introduction, an agreement was reached in 2000. The text of this agreement served as basis for the EU Directive on Savings Income Taxation (EU Commission, 1989, 1998; Cattoir, 2006).

The EU Directive on Savings Income Taxation currently at work (EU Commission, 2001; Council of the EU, 2003) is based on a system of automatic exchange of information, but tentatively allows Austria and Luxembourg to apply the alternative system of coordinated withholding taxation[9] that is also in use for tax relations with a series of countries not belonging to

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[9]Belgium was initially in the same group as Austria and Luxembourg but has stopped applying the withholding tax and started exchanging information since the 1st of January 2010.

the European Union, namely Switzerland, Liechtenstein, Monaco, Andorra, and San Marino.

The main concern with the EU Directive comes from the limitation of its scope to savings income in the form of interest payments and to some interest-based financial products. This leaves away from the field of application income from dividends, insurance contracts and innovative financial products which are close to debt claims. This is why in 2008 the EU Commission proposed an extension of the EU Savings Directive to a larger class of financial assets (EU Commission, 2008a). Such extension is under discussion but the European Council of 20 March 2014 has adopted that amended directive on taxation of savings income and that Council is expected to adopt a directive on administrative cooperation (which will allow for automatic exchange of information on other income types) by the end of 2014.

The US view: QI and FATCA

On the 1st of January 2001, the United States launched the Qualified Intermediary (QI) mechanism. This system proposed US and foreign financial institutions to sign an agreement for becoming Qualified Intermediary of the US Treasury, committed to report information with regard to US taxpayers' income from US source.

There were however two major loopholes in that mechanism. First, no reporting of non-US source income or assets was requested to taxpayers. Second, it was not clear whether the QI agreement obliged financial institutions to examine foreign shell entities owned by US taxpayers. As a result, nine years later the US authorities revised the system through another legislative bill called FATCA, an acronym for Financial Accounts Tax Compliance Act.

FATCA was initially adopted on the 18th of March 2010, as part of the Hiring Incentives Restore Employment Act (HIRE), but is deemed to come into application between 2013 and 2017. Under FATCA, on the one hand, US taxpayers holding foreign financial assets are required to report this information on their annual tax return. On the other hand, foreign financial institutions have to report directly to the US Internal Revenue Service name and details of all the accounts held by US persons or foreign entities in which a US taxpayer holds substantial ownership interest (U.S. Internal Revenue Service, 2012).

Both the EU Directive and the QI/FATCA approach are based on exchange of information, enabling the residence jurisdiction to know a taxpayer personal income and to tax it at an individualized, possibly progressive, rate decided by that residence jurisdiction. In other words, both systems aim to make actual the inclusion of foreign savings income into a worldwide income tax base for properly enforcing a Haig-Simons global income tax (Haig, 1921; Simons, 1938). However, the two systems differ on a major issue. Although the primary agent in charge of providing information on the income paid out is in both cases the foreign financial institution - technically, the paying agent or the source country financial institution -, on the European side, the information is then channelled to the residence country tax authorities through the source country tax authorities, which are ultimately in charge of monitoring the quality of the information exchanged. By contrast, on the American side, this mission is up to the responsibility of the US tax authorities. In some sense, the US approach completely disregards local governments, being based on direct agreements between foreign financial institutions and US authorities. As consequence of the QI/FATCA system, the US tax authorities bear the whole cost of monitoring foreign financial institutions.

That latter reason contributed to the decision of the US authorities to revise the FATCA mechanism

Appendix B: asymmetric investors and countries

In this part of the appendix, we present the baseline model in its complete version, once interest rate, agent's wealth and country population are let to be different in the two jurisdictions. The two rates, r_h for country *home* and r_f for country *foreign*, can in fact differ for various reasons, including differences in terms of country risk or other country specific issues. Similarly, representative agents can dispose of different levels of wealth to invest, say w^h for country *home* and w^f for country *foreign*, and countries can have different sizes in terms of population. In what follows, we hence indicate with N^h the size of population in country *home* and N^f the size of population in country *foreign*.

As already pointed out, in the baseline scenario governments can choose different tax rates for local and foreign investors, because foreign interests are taxed at source by the host country and no information at all is exchanged between the residence and the host country. In such a framework, the rep-

resentative investor of each country has a positive and real wealth w, with $w \in \mathbb{R}_+$, and selects the share of her wealth to invest in both jurisdictions for maximizing her investment income. Given an arbitrary initial allocation of agents' savings, the representative investor of country *home* decides how to invest her wealth solving the following maximization problem

$$\max_{a_h^h, a_f^h} \quad U^h = w^h \sum_{k=h,f} z_k^h a_k^h - \tfrac{v}{2} \sum_{k=h,f} \left(a_k^h - a_{0,h}^h\right)^2,$$

$$s.t. \sum_{k=h,f} a_k^h = 1 \quad and \quad \sum_{k=h,f} a_{0,k}^h = 1.$$

The after-tax interest rate, $z_k^h \in \mathbb{R}_+$, can be written as

$$z_h^h = \left(1 - t_h^h\right) r_h, \qquad z_f^h = \left(1 - t_f^h\right) r_f,$$

where $r_k \in \mathbb{R}_+$, with $k \in \{h, f\}$, stands for the before-tax interest rate paid out in country k. Using the first order conditions, we find that

$$a_h^{h*} = a_{0,h}^h + \frac{z_h^h - z_f^h}{2} \frac{w^h}{v}, \qquad a_f^{h*} = a_{0,f}^h + \frac{z_f^h - z_h^h}{2} \frac{w^h}{v}.$$

With respect to what shown in section 4, an increase in w^h raises both the share of the portfolio invested in the residence country and the share invested abroad, while an increase in the interest rate paid out in the residence country, r^h, makes larger the share of the portfolio invested at home and shrinks the share of the portfolio invested abroad.

In the second step of this game, each government maximizes its revenue and chooses the tax rates under its control, knowing the best response functions of investors. In this baseline scenario, the objective function of the government of country *home* is equal to

Solving the maximization programs of both governments, we obtain the best responses for the tax rates charged by *home*,

$$t_h^{h*} = \frac{1}{r_h} \left[a_{0,h}^h \frac{v}{w^h} + \frac{r_h - r_f(1 - t_f^h)}{2} \right], \qquad t_h^{f*} = \frac{1}{r_h} \left[a_{0,h}^f \frac{v}{w^f} + \frac{r_h - r_f(1 - t_f^f)}{2} \right],$$

as well as the optimal tax rates,

$$t_h^{h*} = \left(1 + a_{0,h}^h\right) \frac{2v}{3 r_h w^h} + \frac{(r_h - r_f)}{3 r_h}, \qquad t_h^{f*} = \left(1 + a_{0,h}^f\right) \frac{2v}{3 r_h w^f} + \frac{(r_h - r_f)}{3 r_h}.$$

In figure 4, we show how best response functions are affected by a difference between the interests paid out in the two countries. If the interest rate goes up in a country, the domestic tax rate of that country decreases, while the withholding tax rate charged by the other jurisdiction increases. Similarly, in figure 5 we show the effects of an increase in the size of funds that agents can invest. If investors wealth decreases in a country, this latter needs to set its domestic tax rate to a higher level in order to maximise its revenues. At the same time, such an increase allows the partner jurisdiction to equally increase its withholding tax rate for foreign investments. This counter-intuitive feature of the model is due to the assumption that governments are Leviathans.

Both agent and government decisions due not depend on the size of the two countries. This result, similar to Keen and Ligthart (2006a, 2006b), applies to all regimes but the EU Savings Directive. In this framework, when the population of two countries is not normalised to 1, optimal tax rates are functions of the relative size of the two countries in terms of population, with the consequence that larger countries can take advantage of their dimension and set lower tax rates:

$$
t_h^{h*} = \frac{\left(w^{h2}N^h + w^{f2}N^f\right)\left[70w^{h2}N^h + w^f N^f\left(29w^h + 36w^f\right)\right]}{9r\left(8w^{h4}N^{h2} + 17w^{h2}N^h w^{f2}N^f + 8w^{f4}N^{f2}\right)} \frac{v}{w^h},
$$

$$
t_{h'}^{j*} = \frac{2v\left[26w^{h3}N^{h2} + 16w^{f3}N^{f2} + w^h N^h w^f N^f\left(19w^h + 20w^f\right)\right]}{9r\left(8w^{h4}N^{h2} + 17w^{h2}N^h w^{f2}N^f + 8w^{f4}N^{f2}\right)}.
$$

Appendix C: coordinated withholding taxation (W)

A last regime that can be assessed is the practice adopted by the EU for Member States allowed to not exchange individualized information. This framework has been already analysed in Keen and Ligthart (2006a, 2006b), reaching the conclusion that any scheme based on withholding taxation is less efficient than information exchange in terms of tax revenues. In this appendix, we review this framework and mix it with alternative systems so to check under which conditions withholding taxation leads to the same results as residence-based taxation.

In general, withholding taxation does not require the collection of detailed and personalized information in order to function. It is hence a regime to be preferred to a regime of information exchange whenever two countries refuse any exchange of information (as in the case of some European Member

States) or when the quality of information reported about taxpayers is very low. Under the practice adopted in the EU, country *home* and *foreign* do not exchange individualized information but each of them transfers to the other jurisdiction a fraction, 75 percent, of the revenue collected from a withholding tax levied on interests paid to foreign investors. In the EU case, the transfer is done anonymously - the names of the investors are not mentioned - and the rate of the withholding tax, initially set equal to 15 per cent, it has progressively increased up to 35 per cent.

Nothing changes concerning investor decisions with respect to the baseline model. They continue to solve the maximization problem explained in (1) and invest their savings according to (3). On the contrary, the maximization problem for the government of country *home* can be modified as follows

$$\max_{t_h^h, t_h^f} W^h = r \left[t_h^h a_h^{h*} + x \, t_f^h a_f^{h*} + (1-x) \, t_h^f a_h^{f*} \right],$$

where $x \in [0,1]$ is the percentage of the withholding tax that the two countries have agreed ex-ante to pass to each other. The best response functions of the tax rates charged by country *home* are equal to

$$t_h^h = a_{0,h}^h \frac{v}{r} + \frac{(1+x)t_f^h}{2}, \quad t_h^f = a_{0,h}^f \frac{v}{r} + \frac{t_f^f}{2},$$

so that, the Nash equilibrium is constituted by

$$t_h^{h*} = \frac{2v[1 + a_{0,h}^h + x \, a_{0,f}^h]}{r(3-x)}, \quad t_h^{f*} = \frac{2v(1 + a_{0,h}^f)}{r(3-x)}.$$

The tax rates levied by the two countries correspond to those found in (7), apart for the presence of the sharing factor x. In particular, in a system of coordinated withholding taxation, the slope of the reaction function of the domestic tax rate is larger than under no exchange of information due to the sharing agreement. The reaction function of the withholding tax rate charged to foreign investors, by contrast, keeps following the case of source-based taxation. Moreover, for $x = 0$, the expressions of the optimal tax rates found in this section coincide with those of the source-based scenario assessed as baseline model. For $x > 0$, the optimal tax rates in this scenario become higher than those found under a pure source-based setting studied in section 4.1.

Consequently, a regime of coordinated witholding taxation, with a positive sharing factor $x > 0$, increases tax revenues with respect to a regime of taxation at source. However, as noted by Keen and Ligthart (2006a, 2006b), this increase is less important than the increase in tax revenues that governments can enjoy passing from a source-based scenario to a residence-based scenario.

First, one could remark that the transfer of a fraction x of the revenue collected at source through the coordinated withholding tax to the state of residence of the investor does not exonerate the investor herself to report her foreign income in her state of residence, receiving a credit for the tax withheld at source. Including reporting information of quality p in the coordinated withholding tax scheme modifies both the utility function for the investors and the function of tax revenues for the governments. The former change involves information exchange in characterizing agents' portfolio allocation. The latter combines equations (10) and (25). It turns out that the two optimal tax rates at Nash equilibrium are now equal to

$$t_h^{h*} = \frac{2v[1 + a_{0,h}^h + x\, a_{0,f}^h]}{r(1-p)(3-2p-x)}, \quad t_h^{f*} = \frac{2v\left[1 + a_{0,h}^f(1-p)\right]}{r(1-p)(3-2p-x)}.$$

Self-reporting and withholding sharing reinforce each other to increase tax rates and tax revenues. In particular, if $x \to 0$ and $p \to 0$, the tax revenues under this regime tend to the level of revenues collected in a pure-source scenario, but if $x \to 1$ and $p \to 1$, this regime tend to a residence-based framework.

Second, Gérard (2004) suggests to substitute taxing foreign income at residence, on the basis of a transmission of individualized information, with a system of income taxation at source. The tax rate should be decided by the country of residence and all collected revenues should be transferred anonymously to the country of residence. The rationale behind that proposition is that it fulfils the necessary conditions of the cross border enforcement of a Dual Income Tax (DIT), at least for the version of the DIT where capital income is taxed at a flat rate (Sorensen, 1994). This mechanism is also sufficient to enforce the Dutch Box 3 mechanism (Cnossen and Bovenberg, 2001).

In this last case, the program of the government is

$$\max_{t_h^h, t_f^h} W^h = r \left[t_h^h a_h^{h*} + t_f^h a_f^{h*} \right]$$

The first order condition with regard to t_h^h is the same as in a pure source-based scenario, while the second first order condition is now computed with regard to t_f^h instead of t_h^f. The two optimal tax rates correspond to (7), where t_h^f is replaced by t_f^h,

$$t_h^{h*} = \frac{2v}{3r}(1 + a_{0,h}^h), \quad t_f^{h*} = \frac{2v}{3r}(1 + a_{0,h}^f).$$

For an even distribution of the initial agents' portfolio allocation, a residence-based regime can be obtained under this framework whenever governments decide that foreign income should be taxed at source, but at the same rate than domestic income. Domestic and foreign tax rates become then identical and taxation no longer influences agents' investment decisions. Tax revenues reach the same level **as in section 4.2.**