

Globalization and taxation: Theory and evidence[☆]Priyaranjan Jha^{a,*}, Giray Gozgor^b^a University of California, Irvine, USA^b Istanbul Medeniyet University, Istanbul, Turkey

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ABSTRACT

We construct a theoretical model to capture the compensation and efficiency effects of globalization in a set up where the redistributive tax rate is chosen by the median voter. The model predicts that the two alternative modes of globalization- trade liberalization and financial openness- could potentially have different effects on taxation. We then provide some empirical evidence on the relationship between taxation and the alternative modes of globalization using a large cross-country panel data set. On average, globalization is associated with lower taxation but there is some evidence that in countries with high capital-labor ratio, globalization is associated with increased taxation. We make a distinction between *de jure* and *de facto* measures of globalization and find a strong negative relationship between taxation and *de jure* measures of globalization. The results for *de facto* measures of globalization are mixed.

1. Introduction

There is a large literature studying the consequences of globalization for the welfare state. In an influential work, Rodrik (1997) highlights how increased capital mobility threatens the implicit contract between the government and the working class whereby the former offers social insurance in exchange for greater globalization. Schulze and Ursprung (1999) provide a comprehensive survey of the early literature. They argue that the globalization debate with respect to fiscal policy can be reduced to two effects—an efficiency effect and a compensation effect. The efficiency effect refers to the fact that increased mobility of goods and factors of production will induce countries to lower taxes thereby lowering their ability to provide public goods. The compensation effect refers to the fact globalization may increase demand for social insurance programs by increasing inequality as well as volatility.¹ This paper provides a theoretical model to formalize these offsetting effects in a unified framework and empirically studies the relationship between globalization and taxation.

In the theoretical model, labor income is distributed equally but capital income is distributed unequally. The median voter decides on the level of redistributive taxation. Labor supply is endogenous, and therefore, taxation distorts labor supply which acts as a check on the extent of redistribution. With capital mobility, the possibility of capital flight (or reduced capital inflows) acts as a further check on taxation. While the tax competition literature assumes perfect capital mobility so that the post-tax returns to capital are equalized across countries, a key feature of our model is imperfect mobility of capital which allows us to do comparative statics with respect to the degree of capital mobility. In the absence of capital mobility, the impact of trade liberalization depends on whether the

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¹ We focus on inequality here while Rodrik (1998) provides a model where globalization increases volatility. See Rodrik (2018) for a recent discussion of these issues.

country is capital abundant or labor abundant. In a capital abundant country, trade liberalization increases the reward of capital and reduces the reward of labor thereby increasing inequality. Consequently, the level of redistributive taxation preferred by the median voter increases. The opposite happens in a labor abundant country. Things change with capital mobility. Given our assumption of source based taxation of returns to capital, in a capital exporting country increased capital mobility makes redistributive taxation more costly because it increases capital flight. In a capital importing country, taxation of capital reduces capital inflows, which reduces the tax base. Both these effects tend to reduce taxation.

While the literature generally talks about the compensation and efficiency effects informally, our theoretical model formalizes these effects.² More importantly, our model shows that different facets of globalization may have different implications for taxation. In particular, it suggests that trade liberalization and capital market openness could have different effects on taxation depending on a country's comparative advantage and whether the country experiences inflows or outflows of capital. Also, the median voter model that we use highlights the role of inequality in determining the impact of globalization on taxation.

Empirically, we study the relationship between globalization and taxation using a large cross-country panel data set. Unlike previous studies on globalization and taxation which have focused mainly on the OECD (Organization for Economic Cooperation and Development) countries, our data set includes 155 countries, including many developing countries which have undertaken capital account liberalization in the last couple of decades. Our data on taxation comes from the Economic Freedom Dataset of the Fraser Institute (see Gwartney et al. (2017)) which provides taxation data on a large number of countries from 1970 onwards. Since this data is available at 5-year intervals till year 2000, we create a panel at 5-year frequency, starting in 1975 and ending in 2015. We use 7 different measures of globalization which include both *de facto* and *de jure* measures of trade liberalization as well as capital account liberalization.

Among the key results, we find some support for our theoretical prediction that trade liberalization increases taxation in capital abundant countries and reduces it in labor abundant countries. The results with the most commonly used *de facto* measure of trade liberalization, nominal trade-GDP ratio, are not significant, however, using real openness as a *de facto* measure of trade liberalization, which corrects for the lower price of non-tradables in developing countries as suggested by Alcalá and Ciccone (2004), yields significant results. Restricting the estimation to the pre-financial crisis years—excluding years 2010 and 2015 from the panel—we find the results to be significant for 3 out of 4 measures of trade liberalization. Most notably, the KOF index of *de jure* trade liberalization becomes strongly significant now.³ The results using measures of capital account liberalization are significant for the whole period as well as the sub-sample excluding the post-financial crisis years. Testing if the impact of globalization on taxation depends on inequality, we do not find significant results. Finally, if the impact of capital market liberalization differs across capital importing and capital exporting countries. We find that our *de jure* measures of capital account liberalization are negatively and significantly related with taxation in both capital importing and capital exporting countries. There is some evidence that the tax reducing effect of capital account liberalization is stronger in capital importing countries than capital exporting countries.

The remainder of the paper is organized as follows. In the next section we provide a brief summary of the related literature. Section 3 provides the theoretical model and section 4 provides empirical results. Section 5 provides some concluding remarks.

2. Related literature

Our theoretical model is related to the enormous tax competition literature surveyed in Keen and Konrad (2013). While this literature focuses on the strategic interaction between countries in setting taxes in a world with free capital mobility, we use a small open economy setting with imperfect mobility of capital. Our modeling of imperfect capital mobility is similar to that in Persson and Tabellini (1992) who construct a theoretical model to study the implications of European integration for taxation. They assume a convex cost of investing abroad so that even if the net returns abroad are higher, not all capital is invested abroad. Most papers in this literature derive optimal taxation by maximizing the welfare of a representative individual but Lockwood and Makris (2006) use a median voter approach to show that it is possible for the tax rate preferred by the median voter to increase with capital market integration than in a closed economy. To obtain this result they assume heterogeneous preferences for public goods as well as heterogeneous distribution of endowments. This gives rise to the possibility that the median voter after capital market integration has a stronger preference for public goods than the median voter in the closed economy.⁴ Another paper showing the possibility of the tax rate increasing upon capital market integration is Lai (2010). This paper introduces lobbying by capital owners and shows that the lobbying incentives of capital owners for a lower tax goes down upon capital market integration compared to that in the closed economy.

Also, while the main purpose of taxation in the tax competition literature is public goods provision, the motive in our model is redistribution. Since there is no heterogeneity among individuals in the standard tax competition models, the question of redistribution does not arise. In contrast, in our model the sole purpose of taxation is redistribution.

To sum up, the standard tax competition models have a single good and therefore are not suitable for studying trade liberalization. Also, they assume perfect mobility of capital which is not suitable for studying incremental capital account liberalization. Finally,

² Rodrik (1998) does model the two effects formally. The difference from Rodrik (1998) is that while in his model, compensation is in the form of insurance against risk, in our case it is redistribution. So, the models are complementary and talk about two different roles of the welfare state: insurance and redistribution.

³ For the whole period this measure just fails to be statistically significant at 10%.

⁴ Also see Poutvaara (2011) for a model where the expansion of higher education, through an educational subsidy, changes the identity of the median voter and thereby constrains future taxation and redistribution. He also shows that allowing international migration in this setting lowers the tax rate chosen by the median voter.

they assume the purpose of taxation is to finance a public good, and therefore, the compensation effect of globalization cannot be discussed. We construct a framework with multiple goods, imperfect mobility of capital, and a redistributive motive for taxation, that allows us to study the implications of trade liberalization and capital market liberalization on redistributive taxation when the tax rate is determined by a majoritarian government. The results on the implications of trade liberalization for taxation and how they depend on the capital-labor ratio of the country are novel.

As far as the empirical literature is concerned, an early influential work is [Rodrik \(1997\)](#) which studies the impact of trade openness (measured as trade-GDP ratio) on the Average Effective Tax Rate (AETR hereafter) in a panel of 18 OECD countries over the period 1965–1991 and finds a negative relationship. Several subsequent papers have studied the relationship between globalization and taxation using alternative measures of globalization as well as taxation. [Schulze and Ursprung \(1999\)](#) provide an excellent survey of the early literature.

More recently, [Adam et al. \(2013\)](#) provide a nice meta study of the research on capital taxation and globalization. Their key finding is that study characteristics related to the way capital taxation is measured (effective tax rate or statutory tax rate) do not exert any systematic impact on the results, but the study characteristics related to the measure of globalization used is a key determinant of the relationship between globalization and capital tax rates. In particular, studies using either trade-GDP ratio or the globalization index developed by [Quinn \(1997\)](#) are more likely to report a negative relationship between globalization and capital taxation, while studies employing the KOF index of globalization developed by [Dreher \(2006a\)](#) are more likely to report a positive effect of globalization on capital tax rates. To conserve space, below we mainly discuss studies published after [Adam et al. \(2013\)](#).

[Onaran and Boesch \(2014\)](#) examine the impact of the KOF indexes of globalization on AETR for capital, labor, and consumption in a panel of 15 European Union (EU) countries as well as a panel of 13 Central and Eastern European (CEE) countries over the period 1970–2007. They do not find a significant relationship between globalization and capital taxation or consumption taxation but there is a positive relationship between economic globalization and labor income taxation in the panel of 15 EU countries. For the panel of 13 CEE economies they find a positive relationship between economic globalization and capital taxation, a negative relationship for consumption taxation, and no relationship for labor income taxation. They also find some differences among countries depending on the type of the welfare regime.

[Mourmans \(2016\)](#) focuses on the top Statutory Corporate Tax Rate (SCTR hereafter) and the top Personal Income Tax Rate (ITR hereafter) for a panel data of 34 OECD countries over the period 1981–2014 and finds a negative relationship between globalization measured by trade-GDP ratio and taxation. [Swank \(2016\)](#) uses trade-GDP ratio and FDI as measures of globalization and finds both to have a negative effect on the AETR and the SCTR in a panel data of 18 capitalist democracies over the period 1982–2008.⁵

[Exbrayat \(2017\)](#) adds a twist to the standard tax competition literature by using insights from the economic geography literature. The key idea is that in the presence of trade costs and agglomeration economies, firms prefer to locate in larger markets and therefore larger countries have lower tax elasticities (less to lose from a higher tax) and they can tax agglomeration economies. Using a panel of 26 OECD countries over the period 1982–2006 this paper finds that countries with higher market potential (larger market size) set higher corporate taxes. Trade liberalization, by increasing market size, facilitates higher corporate taxes. The tax rates in a country are more responsive to the tax rates in larger countries and the country's own market potential in terms of attracting firms.

In contrast to the existing literature which has focused on the OECD countries we use a panel of 155 countries with a relatively long time-span (1970–2015). Additionally, we make a distinction between *de jure* and *de facto* measures of trade liberalization and capital market openness and find the results to differ significantly across these measures. That is, *de facto* and *de jure* measures of globalization give different results with same dependent variables and same controls. Therefore, one important contribution of our empirical exercise is to point out that it is important to make a distinction between *de jure* and *de facto* measures of globalization. We also use the KOF data like several other studies in the literature.⁶ Unlike previous studies that use the KOF index of economic globalization which combines various *de facto* and *de jure* measures of trade liberalization and financial openness into a single measure, we use a recently released version of the KOF data (see [Gygli et al. \(2019\)](#)) which allows us to separately study the effects of *de jure* and *de facto* measures of trade liberalization and capital market openness.⁷

Our key dependent variable in the empirical exercise is based on statutory tax rates. Ideally, we would like to use a measure that captures the effective tax rate by taking into account the various deductions that may be available to individuals and corporations which reduce the effective rates below the statutory rates. [Devereux et al. \(2008\)](#) use measures such as Effective Marginal Tax Rate (EMTR) and Average Effective Tax Rate (AETR), however, the data to construct such measures are available only for the OECD countries. While we recognize this shortcoming of our empirical exercise, in our defense we would like to cite the meta study of [Adam et al. \(2013\)](#) which concludes that the results on the relationship between globalization and taxes do not depend on whether the studies use EMTR, AETR, or statutory rates.

⁵ Some studies test the impact of globalization on direct redistributive outcomes. For example, using a sample of OECD countries from 1980 to 1997, [Gemmell et al. \(2008\)](#) study how globalization affects the size of government and the composition of government expenditure. [Dreher et al. \(2008\)](#) study how globalization affects the composition of government expenditure. [Gozgor and Ranjan \(2017\)](#) study the impact of globalization on redistribution where redistribution is measured by the difference between the Gini coefficient of market income and the Gini coefficient of post-tax and transfer income.

⁶ See [Potrafke \(2015\)](#) for a survey of studies using the KOF index of globalization.

⁷ We do not consider an important facet of globalization, which is immigration. See the interesting paper by [O'Rourke and Sinnott \(2006\)](#) on the economic and non-economic determinants of attitudes towards immigration using a cross-country survey data.

3. Theoretical model

The theoretical model that we develop below has a Heckscher-Ohlin structure in the sense that the pattern of comparative advantage is determined by endowment differences across countries. Even though the original Heckscher-Ohlin model with the assumption of identical technologies across countries has not been empirically successful in explaining the pattern of trade across countries, modified versions of the model that allow technologies to differ across countries in a systematic way have been much more successful (e.g. [Trefler, 1995](#)). More importantly for our purposes here, the model has been much more successful in capturing the impact of trade on factor prices.⁸ We combine the Heckscher-Ohlin model with a median voter model where the median voter chooses the appropriate level of redistributive taxation.⁹ The median voter's choice of redistributive taxation is constrained by labor supply distortions as in the seminal [Meltzer and Richard \(1981\)](#) paper. Our approach has similarities with [Dutt and Mitra \(2002\)](#) who use a combination of Heckscher-Ohlin model and median voter model to study the determinants of trade policy and find empirical support for the model.

Suppose a small economy produces two traded intermediate goods using two factors of production, capital and labor. The two intermediates are assembled into a non-traded final good which is taken as the numeraire. Everyone consumes the final good and the utility function is linear in the consumption of the final good. To keep things simple assume that X is produced using only labor while Y is produced using only capital with the following production functions¹⁰:

$$X = A_x L; Y = A_y K \quad (1)$$

There are N individuals in the economy. Individual- i owns k_i units of capital and endogenously decides how much labor, l_i , to supply. The total amount of capital is $K = \sum_{i=1}^N k_i$ and the total supply of labor is $L = \sum_{i=1}^N l_i$.

The non-traded final good Z is produced using the following Cobb-Douglas production function:

$$Z = \frac{A_z X^\eta Y^{1-\eta}}{\eta^\eta (1-\eta)^{1-\eta}} \quad (2)$$

Denote the price of good- i by p_i . We choose the non-traded final good, Z , as the numeraire: $p_z = 1$. Given the above production function and competitive markets for all goods, we get

$$p_z = \frac{1}{A_z} p_x^\eta p_y^{1-\eta} = 1 \quad (3)$$

If we know the price ratio for the intermediate goods, $\frac{p_y}{p_x}$, we can determine p_x and p_y in terms of the numeraire from the above equation.

Denoting the real wage (in terms of the numeraire) by w and the real rental of capital by r , competitive factor markets imply

$$w = A_x p_x; r = A_y p_y \quad (4)$$

Hence, for a given $\frac{p_y}{p_x}$, w and r are determined from above.

Each final good producer takes the prices of intermediate goods as given. The demand for the two intermediate goods can be easily derived from (2) as follows.

$$X_d = \frac{\eta Z}{p_x}; Y_d = \frac{(1-\eta)Z}{p_y} \quad (5)$$

where subscript d denotes demand. The above demand functions imply the following relative demand for the intermediate good X .

$$\frac{X_d}{Y_d} = \frac{\eta p_y}{(1-\eta) p_x} \quad (6)$$

If the country is in autarky (no trade or capital mobility), then the full employment of the two factors of production implies the following relative supply of the intermediate good Y .

$$\frac{X_s}{Y_s} = \frac{A_x L}{A_y K}, \quad (7)$$

where subscript s denotes supply. The autarky relative price $\frac{p_y}{p_x}$ is obtained by

$$\frac{X_d}{Y_d} = \frac{X_s}{Y_s} \Rightarrow \frac{p_y}{p_x} = \frac{(1-\eta) A_x L}{\eta A_y K} \quad (8)$$

⁸ [Trefler \(1993\)](#) showed that the differences in factor prices across countries could be explained by Hicks-neutral productivity differences. [Feenstra and Hanson \(1996\)](#) showed how a continuum of goods version of the Heckscher-Ohlin model could be used to explain trade induced increase in wage inequality.

⁹ Even though the rate of redistributive taxation is determined by the median voter in our model, the results would be similar if a government determined it by maximizing a social welfare function that is increasing in the average utility of individuals and decreasing in the standard deviation of individual utilities as is shown by [Sørensen \(2004\)](#).

¹⁰ What is required for the results is that one good is more capital intensive than the other, a key assumption in the Heckscher-Ohlin model. The extreme factor intensity assumption simplifies the algebra considerably without any loss of generality.

The real prices, p_x and p_y , are determined by (3), which in turn determine the factor prices r and w according to (4).

We are going to discuss two facets of globalization: trade liberalization and capital mobility. Trade in the model is going to be trade in intermediate goods, X and Y . As is clear from (8) the relative intermediate goods prices depend on the relative endowments: the model has a Heckscher-Ohlin structure. Therefore, a more capital abundant country (high K/L ratio) has a comparative advantage in the capital intensive intermediate good Y (low $\frac{p_y}{p_x}$). Hence, opening up to trade for a capital abundant country is going to imply an increase in the relative price of Y . We are going to capture trade liberalization in the model by a change in the relative price of Y . This can be thought of as arising from a decrease in the non-tariff barriers to trade.¹¹

Let us capture trade liberalization by a parameter τ where τ captures trade barriers of the non-tariff kind. So, if the world relative price is $\frac{p_y}{p_x}$, the effective relative price in a capital abundant country is $\frac{p_y}{\tau p_x}$ where $\tau > 1$ captures the non-tariff barriers on imports. That is, we have the following relationship between the world relative price and the domestic relative price in a capital abundant country: $\left(\frac{p_y}{p_x}\right)^d = \frac{1}{\tau} \left(\frac{p_y}{p_x}\right)^w < \left(\frac{p_y}{p_x}\right)^w$, where superscript d captures “domestic” and w captures “world”. Trade liberalization in a capital abundant country will imply a decrease in τ resulting in an increase in $\left(\frac{p_y}{p_x}\right)^d$. Then the real prices, p_x, p_y will be determined from (3) and the factor prices from (4). Verify from (3) that the real price p_x decreases while p_y increases. It immediately follows from (4) that r increases and w decreases. We capture these effects by using the notation $r(\tau)$ and $w(\tau)$ and for a capital abundant country we get $r'(\tau) < 0$ and $w'(\tau) > 0$.

Similarly, in a labor abundant country, we will have $\left(\frac{p_y}{p_x}\right)^d = \tau \left(\frac{p_y}{p_x}\right)^w > \left(\frac{p_y}{p_x}\right)^w$ because this country imports Y and hence the domestic relative price of Y is higher than the world relative price. A trade liberalization for a labor abundant country implies a lowering of τ which results in a decrease in the relative price of Y . This would result in $r'(\tau) > 0$ and $w'(\tau) < 0$. The impact of trade liberalization on factor prices is simply the well known Stolper-Samuelson result which obtains in our set up because of the Heckscher-Ohlin structure of the model.

Turning to capital mobility, capital owners can invest their capital domestically and earn a return of r (before taxes) or invest abroad and earn a return of r_f net of any foreign taxes paid. All taxation of capital income is source based as is common in practice. That is, the capital income can be taxed only in the country where it is used. Given the enforcement problems associated with residence based taxation of capital income, this is a reasonable assumption. The model economy imposes a proportional tax of t on all income and engages in redistribution. Given the domestic tax rate, t , the net return from investing capital domestically is $(1 - t)r$. So, if $r_f > (1 - t)r$, capital owners would want to invest abroad. If investing abroad is costless (as is assumed in the tax competition literature), then if $r_f > (1 - t)r$ all capital is invested abroad and therefore, equilibrium must involve $r_f = (1 - t)r$. We assume instead that it is costly to invest abroad. In particular, there is a convex cost of investing capital abroad (similar to Persson and Tabellini (1992) and Sørensen (2004)). That is, if an individual with a total amount of capital k invests k^f abroad, the cost of investment abroad is $\frac{1}{2}\beta\left(\frac{k^f}{k}\right)^2 k$, where $\beta > 0$ captures the degree of capital mobility. $\beta \rightarrow \infty$ captures the case when the economy prohibits international capital flows. A lower β captures greater mobility of capital. Note that this cost of investing abroad is very similar to the cost of adjustment of investment in the macroeconomics literature.

While we develop the case of a capital exporting country in the text, the case of a capital importing country is discussed in the appendix. That is, we implicitly assume that we are in the range of parameters where the inequality $r_f > (1 - t)r$ is satisfied.¹² The logic of the Heckscher-Ohlin model would suggest that if a country is capital abundant, then the returns to capital should be lower than abroad and hence there should be capital outflows from this country. However, there could be capital outflows even from a labor abundant country in a world where countries have different technologies. To see this possibility in a simple way, assume that countries have different A_z in (2). Now, even if a country is labor abundant, the returns to capital, r , could be less than abroad due to lower productivity. That is, for a given world relative price $\frac{p_y}{p_x}$, p_x and p_y both would be lower in a low A_z country and consequently both w and r would be lower as well.¹³ A broader point is that trade liberalization doesn't necessarily equalize factor prices despite our extreme factor intensity assumption because productivities (captured by A_i) differ across countries.

The tax rate in the economy is determined as in a standard median voter model. The model is solved in two stages. In the first stage the tax rate is determined by the preferred tax rate of the median voter. In the second stage decisions regarding labor supply and investing capital abroad are made taking the tax rate as given. The tax proceeds are redistributed to individuals in a lump sum fashion: Each individual receives a lump sum transfer of g . So, the only purpose of taxation in the model is redistribution.¹⁴

In the absence of capital mobility, the optimal tax rate balances the desire for redistribution against the cost of redistribution arising from the distortion of labor supply. It is assumed that individuals experience disutility from labor supply, l , and the disutility is modeled as a convex function: $\frac{1}{\gamma}l^\gamma$ where $\gamma > 1$. With capital mobility, higher taxes can give rise to capital flight, which puts an additional constraint on the tax rate.

Below we discuss the model in general terms with capital mobility and later we will discuss the case of trade liberalization without capital mobility by shutting down capital flows.

¹¹ To keep the model simple by abstracting away from tariff revenue issues, we think of trade liberalization as a decrease in the non-tariff barriers.

¹² In the $r_f < (1 - t)r$ case there will be capital inflows and we assume in the appendix that the capital inflow is a decreasing function of t as well as of β .

¹³ See Trefler (1993) for evidence on lower returns to both labor and capital in developing countries. More generally, he shows that allowing for such productivity differences across countries helps explain the variation in international factor prices.

¹⁴ See Bellani and Ursprung (2019) for a survey of the literature on the political economy of redistribution in democracies.

We first discuss the second stage problem where knowing the tax rate individuals decide on their labor supply as well as how much capital to invest domestically and how much to invest abroad. An individual with capital k_i decides what fraction, s , to invest abroad so that the remaining fraction $1 - s$ is invested domestically. The individual maximizes the expression below in the second stage taking t and g as given.

$$\text{Max}_{0 \leq s \leq 1, l} \{ w(1-t)l + g + (1-t)r(1-s)k_i + r_f(s - \frac{1}{2}\beta s^2)k_i - \frac{1}{\gamma}l^\gamma \} \quad (9)$$

The first order condition with respect to l yields

$$l = (w(1-t))^{\frac{1}{\gamma-1}} \quad (10)$$

Verify from (10) that

$$\frac{dl}{dt} = -\frac{1}{\gamma-1} w^{\frac{1}{\gamma-1}} (1-t)^{\frac{2-\gamma}{\gamma-1}} < 0 \quad (11)$$

That is, a higher tax rate distorts labor supply.

The first order condition with respect to s yields (assuming an interior solution, $0 < s < 1$)

$$s = \left(\frac{r_f - (1-t)r}{\beta r_f} \right) \quad (12)$$

Our assumption on the cost of investing abroad ensures that s is independent of k_i which keeps the model simple. That is, all individuals invest the same fraction of their capital abroad. Given the cost of investment abroad, an investor would invest abroad only if $r_f > (1-t)r$, which we assume to be the case. Equation (12) also implies

$$\frac{ds}{dt} = \frac{r}{r_f \beta} > 0; \frac{ds}{d\beta} = -\frac{s}{\beta} < 0 \quad (13)$$

That is, the higher the domestic tax rate, t , the greater the investment abroad and the higher the barriers to capital mobility, β , the lower the investment abroad. Since each individual invests the same fraction of capital stock abroad and chooses the same amount of labor to supply, the transfer per individual g can be written as

$$g = t \frac{Nwl + r(1-s)K}{N} = t(wl + r(1-s)\bar{k}), \quad (14)$$

where $Nwl + r(1-s)K$ is the tax base and $\bar{k} = K/N$ is the average capital stock per person. The amount of capital owned by the median voter is denoted by k^m .

Now, the preferred tax rate of the median voter is obtained by the following maximization

$$\text{Max}_{0 < t < 1} w(1-t)l + t(wl + r(1-s)\bar{k}) + (1-t)r(1-s)k^m + r_f(s - \frac{1}{2}\beta s^2)k^m - \frac{1}{\gamma}l^\gamma \quad (15)$$

The first order condition for the optimal choice of t of the median voter (using the envelope condition that the individual chooses l and s optimally in the second stage) is given by

$$tw \frac{dl}{dt} + r(1-s) \left(\bar{k} - k^m \right) - rtk \frac{ds}{dt} = 0 \quad (16)$$

Next, substituting out $\frac{dl}{dt}$ using (11) and $\frac{ds}{dt}$ using (13) obtain

$$r(1-s) \left(\bar{k} - k^m \right) = \frac{1}{\gamma-1} w^{\frac{\gamma}{\gamma-1}} t(1-t)^{\frac{2-\gamma}{\gamma-1}} + t \frac{r^2 \bar{k}}{r_f \beta} \quad (17)$$

The above determines the optimal choice of t for the median voter. The first term on the left hand side above is the marginal benefit from taxation which comes from redistribution and is proportional to the gap between the average capital and the capital of the median voter. The next two terms capture the marginal cost of taxation due to a distortion in the labor supply and capital flight. The higher the wage the more responsive the labor supply is to taxation, $\left| \frac{dl}{dt} \right| > 0$, and hence the greater the marginal cost of taxation. Similarly, the response of capital flight to taxation, $\frac{ds}{dt}$, depends positively on the domestic return to capital, r , and negatively on the cost of capital mobility, β .

If the country did not allow capital mobility then $s = 0$ in (9), and hence the optimal choice of t for the median voter is given by the solution to the following equation.

$$t(1-t)^{\frac{2-\gamma}{\gamma-1}} = (\gamma-1)r \left(\bar{k} - k^m \right) w^{\frac{\gamma}{1-\gamma}} \quad (18)$$

The second order condition for the optimal choice problem of the median voter to be concave in the no capital mobility case is

$$-\frac{1}{\gamma-1} w^{\frac{\gamma}{\gamma-1}} (1-t)^{\frac{3-2\gamma}{\gamma-1}} \left(1-t-t \frac{2-\gamma}{\gamma-1} \right) < 0 \quad (19)$$

Below we use the following definition to reduce notational clutter.

$$\Psi \equiv \frac{1}{\gamma-1} w^{\frac{\gamma}{\gamma-1}} (1-t)^{\frac{3-2\gamma}{\gamma-1}} \left(1-t-t \frac{2-\gamma}{\gamma-1} \right) \quad (20)$$

Therefore, the second order condition is $\Psi > 0$ which is true iff $t < \gamma - 1$. This condition is trivially satisfied for $\gamma > 2$. In a recent paper, [Antras et al. \(2017\)](#) take $\gamma = 2.4$ as a plausible value in their calibration exercise and following them we will assume that the condition $t < \gamma - 1$ is always satisfied.

The second order condition in the case of capital mobility is

$$-\frac{r^2}{\beta r_f} (\bar{k} - k^m) - \frac{r^2 \bar{k}}{r_f \beta} - \Psi < 0 \quad (21)$$

Note that if (19) is satisfied, then (21) is satisfied as well. Therefore, $\Psi > 0$ is a sufficient condition for the inequality in (21) to be true.

3.1. Impact of trade liberalization on taxation

Let us first discuss the case when the country prevents capital mobility. In this case, the optimal choice of t for the median voter is given by (18). As discussed earlier, the trade barriers are captured by a parameter τ and trade liberalization is captured by a decrease in τ . With this in mind, and denoting by t^m the optimal choice of t of the median voter, using (18) obtain the following expression for the impact of trade liberalization on t^m .

$$\left(\frac{1}{t^m} - \frac{2-\gamma}{\gamma-1} \frac{1}{1-t^m} \right) \frac{dt^m}{d\tau} = \frac{r'(\tau)}{r} - \frac{\gamma}{(\gamma-1)} \frac{w'(\tau)}{w} \quad (22)$$

The expression on the left hand side above is positive from the second order condition (19). Now, in a capital (labor) abundant country, $r'(\tau) < (>)0$ and $w'(\tau) > (<)0$, therefore, the expression on the right-hand-side in (22) is negative (positive), and hence $\frac{dt^m}{d\tau} < (>)0$.

Intuitively, since trade liberalization in a capital abundant country increases inequality, it increases the demand for redistribution. Hence the redistributive taxation increases. If there is no capital mobility, this is the only effect of trade liberalization which is captured in (22). Another way to understand the intuition is that the marginal benefit of taxation, $r(\bar{k} - k^m)$, increases because trade liberalization increases r while the marginal cost, $\frac{1}{\gamma-1} w^{\frac{\gamma}{\gamma-1}} t(1-t)^{\frac{\gamma}{\gamma-1}}$, decreases because w decreases. This effect of trade liberalization can be thought of as the compensation effect mentioned earlier.

The impact of trade liberalization in the presence of capital mobility brings in additional effects. The expression for $\frac{dt^m}{d\tau}$ for this case is derived in the appendix. The sign of $\frac{dt^m}{d\tau}$ is theoretically ambiguous. To see this intuitively, let us look at the equation for the optimal choice of taxation by the median voter given in (17). Let us re-write it as

$$r(1-s)(\bar{k} - k^m) = t^m \frac{r^2 \bar{k}}{r_f \beta} + \frac{1}{\gamma-1} w^{\frac{\gamma}{\gamma-1}} t^m (1-t^m)^{\frac{2-\gamma}{\gamma-1}}. \quad (23)$$

As mentioned before, the term on the left hand side above captures the marginal benefit of taxation. This increases unambiguously after trade liberalization in a capital abundant country because r increases and consequently, s decreases. The two terms on the right-hand-side capture the marginal cost. The second term is same as in the case of no capital mobility and because the wage decreases, a taxation causes a smaller distortion in the labor market, and therefore, the marginal cost of taxation decreases with globalization. The first term on the right-hand-side captures the marginal cost of taxation due to capital flight and this is increasing in r because $\frac{ds}{dt}$ is increasing in r . Therefore, while the marginal benefit from taxation increases unambiguously, the impact on the marginal cost is ambiguous. The results for a capital importing country are derived in the appendix and there we find the same ambiguity as in the case of a capital exporting country. Even though the results are theoretically ambiguous, from the inspection of the expressions in the appendix it is apparent that in order for the results discussed for the case of no capital mobility to be overturned, capital flows must be extremely highly responsive to taxes. We confirm this using a numerical exercise where we couldn't find cases with opposite results. The pattern discussed in the numerical example below is robust to changing the parametric configuration.

Numerical Example. $\gamma = 2.4$ (same as in [Antras et al. \(2017\)](#)); $\eta = 2/3$ (share of labor in output), $A = 0.5$, $\beta = 1$, $N = 1$. For the capital abundant country we choose $\bar{k} = 5$, $k^m = 4$, $r_f = 0.15$. Fig. 1a shows how the tax rate preferred by the median voter increases as the trade cost, captured by τ , decreases from 2 to 1 for a capital abundant country that exports capital. For the labor abundant country we choose $\bar{k} = 3$, $k^m = 2$, $r_f = 0.15$. Fig. 1b shows how the tax preferred by the median voter decreases as the trade cost, τ , decreases from 2 to 1 for a labor abundant country that exports capital. Fig. 1c and d repeat the same exercise for a capital importing country. The functional form for the capital import function is $k^l = \frac{\delta}{\beta} \sqrt{(r(1-t) - r_f)}$ and we set $\delta = 1$ and $r_f = .05$. For the capital abundant country with $\bar{k} = 5$, $k^m = 4$, Fig. 1c again shows that trade liberalization increases taxation while Fig. 1d, with $\bar{k} = 3$, $k^m = 2$, shows that trade liberalization reduces taxation in a labor abundant country.

The result on the relationship between taxation and trade liberalization is summarized below.

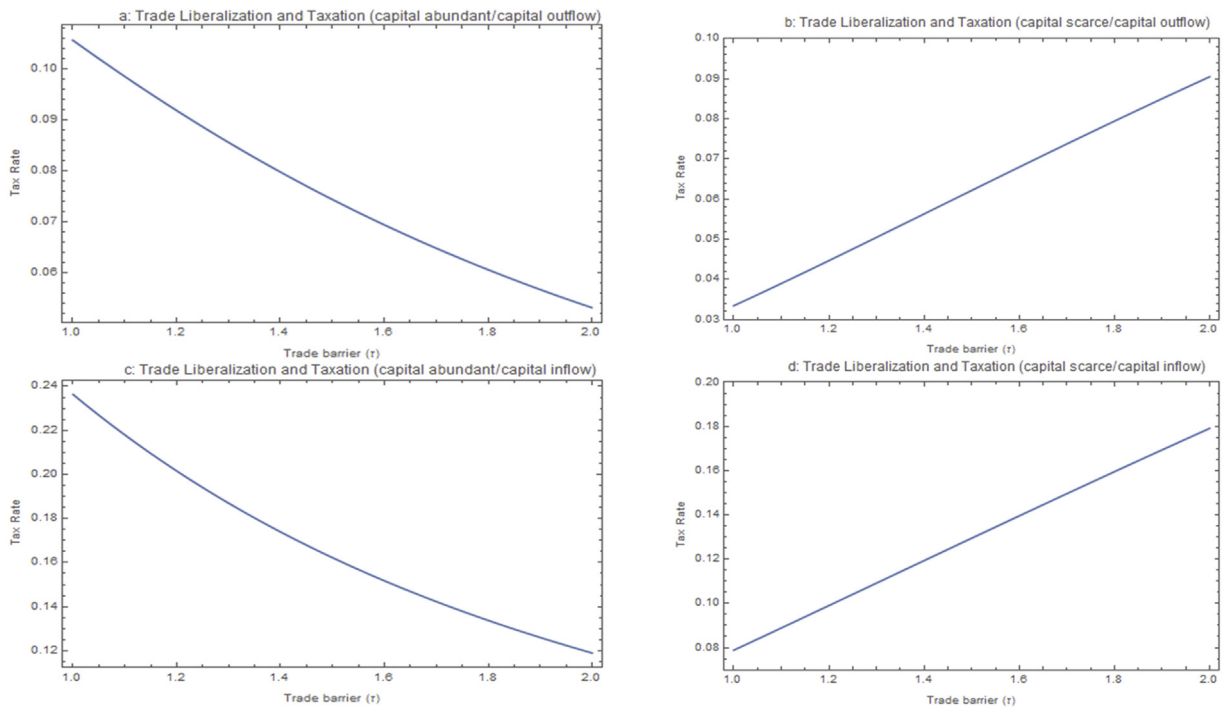


Fig. 1. Trade liberalization and taxation.

Result 1. Trade liberalization in the absence of capital mobility unambiguously increases redistributive taxation in capital abundant countries and reduces redistributive taxation in capital scarce countries. With capital mobility, there is a theoretical ambiguity in the relationship between trade liberalization and taxation but numerical exercises support the claim that trade liberalization increases taxation in a capital abundant country and reduces it in a capital scarce country.

3.2. Impact of capital market openness on taxation

Next, we look at the impact of a change in β on redistributive taxation. Taking the derivative of (17) with respect to β obtain

$$\frac{dt^m}{d\beta} = \frac{t^m \frac{r_f^2 \bar{k}}{r_f \beta} + rs (\bar{k} - k^m)}{(2\bar{k} - k^m) \frac{r_f^2}{r_f} + \beta \Psi} > 0 \quad (24)$$

The result above implies that a reduction in β leads to a lower redistributive taxation. That is, an increase in capital mobility reduces redistributive taxation. To see the intuition, look again at the expression in (23). A decrease in β reduces the marginal benefit from taxation because it increases s which reduces the amount of capital left at home which can be taxed. The marginal cost of taxation increases because $\frac{ds}{dt}$ is decreasing in β . That is, at a lower β , capital outflows become more sensitive to taxes.

The case of the capital importing country is discussed in the appendix. In that case, it is shown that a decrease in the cost of capital flows increases the marginal benefit as well as the marginal cost of taxation. The marginal benefit increases because a decrease in β causes the capital inflows to be larger which increases the tax base. The marginal cost increases because the tax base becomes more responsive. It is shown that the latter effect dominates if the elasticity of capital flows with respect to the tax rate exceeds unity. Desai (2008) reports that the elasticity of foreign assets with respect to taxes is -1.6 . So, a reduction in β is likely to reduce taxation even in a capital importing country. Intuitively, in a capital exporting country the possibility of greater capital flight constrains taxation while in a capital importing country the possibility of smaller capital inflows constrains taxation.

We summarize the results on the relationship between taxation and capital market openness below.

Result 2. A reduction in the cost of capital flows reduces redistributive taxation unambiguously in the capital exporting countries. The same result obtains in the capital importing countries if the elasticity of capital flows with respect to taxes exceeds unity and the opposite is true if the elasticity of capital flows with respect to taxes is less than unity.

3.3. Empirical implications

Note from expressions (22) and (24) that the implications of trade liberalization as well as capital market openness depend on $\bar{k} - k^m$ which can be thought of as a measure of inequality. In the empirical exercise we attempt to test the following predictions of the model.

1. Tax rate is likely to increase with trade liberalization in a capital abundant country and decrease with trade liberalization in a labor abundant country.
2. Capital market openness is likely to reduce taxation in both capital importing and capital exporting countries. Recall that the result for the capital importing countries depended on the elasticity of capital inflows with respect to taxes exceeding one. We will test this by seeing if increased capital mobility affects taxation differentially in capital exporting and capital importing countries.
3. The impacts of both trade liberalization and capital market openness on taxation depend on inequality. One would expect the redistributive taxation to increase with inequality and the impact of globalization on taxation should depend on inequality.

4. Empirical exercise

We first study the implications of trade liberalization where theory predicts the relationship between trade liberalization and taxation to be conditional upon the comparative advantage of the country as captured by its capital-labor ratio. To this end, we estimate equations of the following form.

$$Tax_rate_{it} = \gamma_0 + \gamma_1 Trade_{it} + \gamma_2 (K/L)_{it} + \gamma_3 Trade_{it} * (K/L)_{it} + \gamma'_4 X_{it} + u_i + v_t + \varepsilon_{it} \quad (25)$$

where i denotes country, t denotes year, X_{it} is a vector of controls, u_i is the country fixed effect and v_t is the year fixed effect. That is, we are going to rely on within country variation in estimating γ_1 and γ_3 , our chief parameters of interest.¹⁵ Theory predicts that trade liberalization is likely to increase taxation in a capital abundant country and decrease taxation in a labor abundant country. Therefore, we expect $\gamma_1 < 0$ and $\gamma_3 > 0$. Our theory also predicts that the tax rate depends on inequality and the impact of globalization should depend on inequality. To test this, we estimate regressions of the following form.

$$Tax_rate_{it} = \gamma_0 + \gamma_1 Trade_{it} + \gamma_2 Gini_{it} + \gamma_3 Trade_{it} * Gini_{it} + \gamma'_4 X_{it} + u_i + v_t + \varepsilon_{it} \quad (26)$$

We are going to use Gini coefficient of income as our measure of inequality.

As far as capital market openness is concerned, the impact on capital exporting countries is unambiguous in theory, but for the capital importing countries the results depended on the elasticity of capital flows with respect to taxes. Since this is an empirical issue, we test if the same relationship between taxation and capital market openness obtains for both capital exporting and capital importing countries. To this end we estimate the following regression for capital market openness.

$$Tax_rate_{it} = \gamma_0 + \gamma_1 Kopen_{it} + \gamma_2 Kopen_{it} * DK_{it} + \gamma'_3 X_{it} + u_i + v_t + \varepsilon_{it} \quad (27)$$

where DK_{it} is a dummy variable taking the value 1 for capital exporters and 0 for capital importers. A country is a capital exporter if it enjoys a current account surplus and a capital importer if it enjoys a current account deficit.

The existing literature has used both *de jure* and *de facto* measures of globalization to study the above relationship where *de facto* measures capture actual trade and capital flows such as trade-GDP ratio while *de jure* measures capture policy changes. Sometimes *de facto* measures can serve as a proxy for *de jure* measures because the two tend to move together but *de jure* measures capture policy changes as well as technological changes reducing the cost of trade and investment flows better and hence are closer to the theoretical model. Also, *de jure* measures are less subject to the reverse causality problem that would arise with *de facto* measures if changes in tax rates affect trade and capital flows. Therefore, we are going to focus on *de jure* measures but to facilitate comparison with the existing literature, we provide estimates with *de facto* measures as well.

4.1. Data

Our dataset covers the period 1970 to 2015 and includes 155 countries. Our key dependent variable is an index of the top marginal income tax rate (*TMITR*) from the Economic Freedom Dataset of the Fraser Institute (see Gwartney et al. (2017)). This index is based on the top marginal income tax rate in the country as well as the level of income at which the top tax rate becomes applicable. Therefore, in addition to capturing the statutory tax rate the index also has some information on the effective tax burden. For example, it is possible that the top marginal tax rate is very high in a country but if this rate is applicable at a very high level of income, then the effective tax burden may not be very high. The index accounts for this by using information on the threshold level of income above which the top marginal tax rate is applicable. Also, the index is less sensitive to the presence of outliers than the raw data on top marginal income tax rate. One thing to keep in mind while looking at the results is that these indexes run from 0 to

¹⁵ Two papers by Dutt and Mitra use a similar approach. Dutt and Mitra (2002) study the implications of capital abundance and inequality in the determination of trade policy while Dutt and Mitra (2005) study the role of political ideology in the determination of trade policy. They estimate regressions similar to that in (25) where the dependent variable is average trade restrictions.

10 where 0 indicates “very high tax burden” and 10 indicates “very low tax burden”. A higher number supposedly indicates greater economic freedom. Using the actual tax rates instead of the index for *TMITR* yields similar results.¹⁶

Our main measure of trade liberalization is a *de jure* measure recently released as a component of the KOF globalization index (see Gygli et al., 2019 for details). This measure is constructed from three variables: non-tariff barriers and compliance cost, average tariff rates, and income from trade taxes as a percentage of total revenue. We call this *TLIB_dj_KOF*. We also use a *de facto* measure of trade globalization from the KOF globalization index which is constructed using the world bank data on trade in goods and services as a percentage of GDP to which they add a measure of trade partner diversification. We call this *TLIB_df_KOF*. Additionally, we use both the nominal trade openness and the real trade openness from the PWT version 9.0 (see Feenstra et al. (2015)). The nominal trade openness is the nominal values of exports plus imports relative to nominal GDP. The nominal openness measure is called *TLIB_df_PWT*. Following Alcalá and Ciccone (2004), we also use the real trade openness which adjusts the trade-GDP ratio for the differences in the prices of non-traded goods.¹⁷ In particular, we use the sum of shares of real exports in GDP and real imports in GDP provided by PWT, 9.0. This variable is denoted by *TLIB_df_Real*.

We use 2 different *de jure* measures of capital market liberalization. Our first measure is the latest version of the Chinn-Ito index developed by Chinn and Ito (2006, 2008) and is denoted by *KOPEN_dj_CI*. The Chinn-Ito index is used as the benchmark indicator of capital market openness by various empirical papers since the dataset covers the most countries and the time-span (e.g. Furceri and Loungani, 2018). The index is the first principle component of four IMF binary variables: foreign exchange regime, export proceeds, capital account and current account. The index is defined from 0 to 1 and a higher value of the index specifies a greater level of financial openness. Our second *de jure* measure of capital market liberalization, denoted by *KOPEN_dj_KOF*, is a component of the KOF globalization index. This is constructed using the Chinn-Ito index, Foreign ownership and investment restrictions from Gwartney et al. (2017), and the number of Bilateral Investment Agreements (BITs) and Treaties with Investment Provisions (TIPs) from UNCTAD (2018). Clearly, *KOPEN_dj_KOF* is more comprehensive than *KOPEN_dj_CI*. In addition to the *de jure* measures discussed above we also use a *de facto* measure of financial globalization from the KOF Swiss Economic Institute which is constructed using the following financial flows: Foreign direct investment, Portfolio investment, International debt and International reserves, and International income payments. This measure is denoted by *KOPEN_df_KOF*.

According to the theoretical model, an appropriate measure of inequality would be one in the distribution of capital endowments or assets. However, such inequality measures are not available for a large number of countries. Therefore, we use inequality in the distribution of income. Since the inequality in the post-tax/transfer distribution of income is affected by taxation which is our left-hand-side variable, our preferred measure of inequality is one in the pre-tax/transfer distribution of income. Data on income inequality come from the standardized world income inequality database (SWIID) (version 7.1) of Solt (2016). We use the Gini coefficient for market income (*Market Gini*) which is the pre-tax/transfer income. For robustness, we also use the Gini coefficient of net income (*Net Gini*) which is based on the post-tax/transfer income.

Data on per capita income and capital-labor ratio come from PWT, 9.0. We obtain per capita income by dividing the output-side real GDP at current PPPs by population. Similarly, we divide the capital stock at current PPPs by total employment to obtain the capital-labor ratio.

Among the institutional variables, civil liberties ratings (index from 1 to 7; 1 represents the most-free nations and 7 represents the least-free nations) come from the Freedom House while the level of institutionalized democracy (index from 0 to 10) and a measure of overall institutional quality (constraint on the power of the executive, an index from 1 to 7) are obtained from the Polity IV Annual Time Series provided by Marshall et al. (2018). Some of our other control variables such as per capita GDP, population, and capital-labor ratio are from PWT (version 9.0). Data on current account deficit comes from the World Bank, and the data on political ideology comes from Cruz et al. (2018).

Since our tax data are available from 1970 to 2000 at 5-year intervals, we construct our panel data at 5-year frequency. To minimize the reverse causality problem, we use the averages of the right-hand-side variables between the tax years. That is, for the tax rate in 1975, the right-hand-side variables are the average values for the years 1971–74. Similarly, for the tax rate in 1980 the right-hand-side variables are averaged over 1976–79 and so on. Since our measures of globalization are available from 1970 onwards, in our panel data regressions the years for the taxation are: 1975, 1980, 1985, 1990, 1995, 2000, 2005, 2010, and 2015.

Table 1 provides summary statistics as well as data sources for the key variables. Table 2 provides the correlation matrix for the main variables used in the regressions. Our measure of taxation, *TMITR*, is positively correlated with all 8 measures of globalization suggesting that more globalization implies lower tax rates. Also, all measures of globalization are positively related with each other, however, the correlation varies considerably and perhaps accounts for the wide ranging results obtained in the literature on the impact of globalization on dependent variables of interest. For example, the correlation between our *de jure* and *de facto* measures of trade liberalization from the KOF is a meagre 0.33. Similarly, the correlation between *de jure* and *de facto* measures of financial globalization from the KOF is 0.56. The correlation between our 2 *de jure* measures of financial globalization is very high at 0.82.

Fig. 2 shows the time trend in our taxation measure and the measures of financial and trade openness. In general we observe a declining tax rate (rising *TMITR*) over time and increasing openness along both trade and financial dimensions.

¹⁶ The correlation between the index and the top marginal income tax rate is -0.94 .

¹⁷ Due to higher productivity in manufacturing (or traded goods), rich countries tend to have a higher price of non-traded goods which tends to lower their trade-GDP ratio, when both trade and GDP are expressed in nominal terms, compared to poor countries.

Table 1
Descriptive statistics.

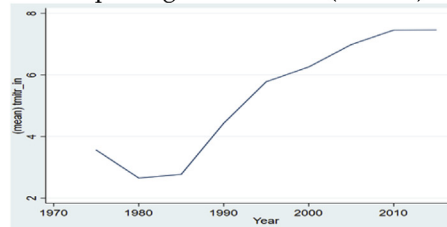
Variables	Definition	Data Source	Mean	Standard Deviation	Minimum	Maximum	Observations
Index of Top Marginal Income Tax Rate (<i>TMITR</i>)	Index from 0 to 10	Fraser Institute, Economic Freedom: Gwartney et al. (2017)	5.691	3.185	0.000	10.00	942
Financial Openness (Chinn-Ito Index) (<i>KOPEN_dj_CI</i>)	Index from 0 to 1	Chinn-Ito Index (Version 2018) Chinn and Ito (2006, 2008)	0.502	0.362	0.000	1.000	882
Real Trade Openness (Real Merchandise Exports plus Real Imports Relative to PPP GDP) (<i>TLIB_df_Real</i>)	Level, Ratio	PWT 9.0: Feenstra et al. (2015)	0.573	0.517	0.010	4.785	924
Nominal Trade Openness (Merchandise Exports plus Imports Relative to Nominal GDP) (<i>TLIB_df_PWT</i>)	Level, Ratio	PWT 9.0: Feenstra et al. (2015)	0.793	0.537	0.073	4.478	924
De Facto Measure of Trade Globalization Index (<i>TLIB_df_KOF</i>)	Index from 0 to 100	KOF: Dreher (2006b) & Gygli et al. (2019)	50.35	20.29	5.707	99.43	913
De Jure Measure of Trade Globalization Index (<i>TLIB_dj_KOF</i>)	Index from 0 to 100	KOF: Dreher (2006b) & Gygli et al. (2019)	53.21	24.37	6.738	97.13	913
De Facto Measure of Financial Globalization Index (<i>KOPEN_df_KOF</i>)	Index from 0 to 100	KOF: Dreher (2006b) & Gygli et al. (2019)	54.32	21.02	5.014	98.80	913
De Jure Measure of Financial Globalization Index (<i>KOPEN_dj_KOF</i>)	Index from 0 to 100	KOF: Dreher (2006b) & Gygli et al. (2019)	55.79	19.29	3.126	94.79	913
Per Capita GDP (PPPs, Current 2011US\$)	Logarithmic form	PWT 9.0: Feenstra et al. (2015)	9.041	1.131	5.809	12.25	924
Population, Total	Logarithmic form	PWT 9.0: Feenstra et al. (2015)	2.329	1.712	−2.355	7.214	924
Capital/Labor Ratio	Logarithmic form	PWT 9.0: Feenstra et al. (2015)	10.89	1.300	6.983	14.01	915
Level of Institutionalized Democracy	Index from 0 to 10	Polity IV Annual Time Series: Marshall et al. (2018)	5.858	3.953	0.000	10.00	868
Civil Liberties Ratings (1 Representing the Most Free; 7 the Least Free)	Index from 1 to 7	Freedom House, Freedom in the World Database	3.224	1.677	1.000	7.000	868
Institutional Quality (Executive Constraints Concept)	Index from 1 to 7	Polity IV Annual Time Series: Marshall et al. (2018)	5.064	2.093	1.000	7.000	861
Government Ideology (Chief Executive's Party's Value) (Right, Center, and Left)	Index from 1 to 3	Database of Political Institutions 2017: Cruz et al. (2018)	1.972	0.856	1.000	3.000	573
Current Account Balance	Dummy Variable	World Bank, World Development Indicators	0.295	0.454	0.000	1.000	789
Market Gini Index of Income	Index from 0 to 100	SWIID 7.1 (Version 2018): Solt (2016)	0.462	0.067	0.272	0.719	761
Net Gini Index of Income	Index from 0 to 100	SWIID 7.1 (Version 2018): Solt (2016)	0.379	0.089	0.197	0.629	761

Table 2
Correlation matrix (1970–2015).

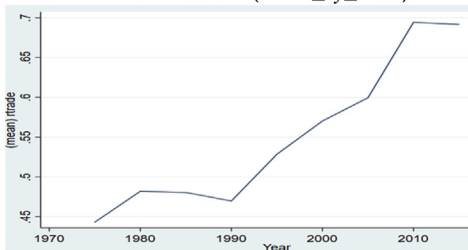
Regressors	<i>TMITR</i>	<i>TLIB_dj_KOF</i>	<i>TLIB_df_KOF</i>	<i>TLIB_df_Real</i>	<i>TLIB_df_PWT</i>	<i>KOPEN_dj_CI</i>	<i>KOPEN_dj_KOF</i>	<i>KOPEN_df_KOF</i>
<i>TMITR</i>	1.000	–	–	–	–	–	–	–
<i>TLIB_dj_KOF</i>	0.064	1.000	–	–	–	–	–	–
<i>TLIB_df_KOF</i>	0.235	0.331	1.000	–	–	–	–	–
<i>TLIB_df_Real</i>	0.120	0.446	0.629	1.000	–	–	–	–
<i>TLIB_df_PWT</i>	0.247	0.292	0.771	0.813	1.000	–	–	–
<i>KOPEN_dj_CI</i>	0.254	0.593	0.231	0.373	0.270	1.000	–	–
<i>KOPEN_dj_KOF</i>	0.204	0.638	0.219	0.384	0.260	0.820	1.000	–
<i>KOPEN_df_KOF</i>	0.271	0.548	0.623	0.621	0.598	0.518	0.560	1.000

Note: *TMITR*: Index of Top Marginal Income Tax Rate, *TLIB_dj_KOF*: *de jure* Measure of Trade Globalization Index, *TLIB_df_KOF*: *de facto* measure of Trade Globalization Index, *TLIB_df_Real*: Real Trade Openness, *TLIB_df_PWT*: Nominal Trade Openness, *KOPEN_dj_CI*: Financial Openness (Chinn-Ito Index), *KOPEN_dj_KOF*: *de jure* measure of Financial Globalization Index, *KOPEN_df_KOF*: *de facto* measure of Financial Globalization Index.

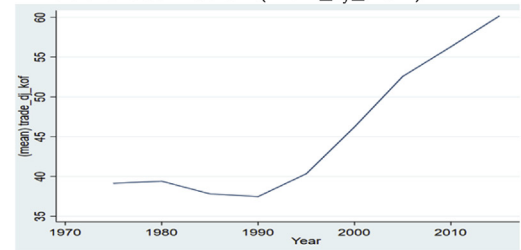
Top Marginal Tax Rate (*TMITR*)



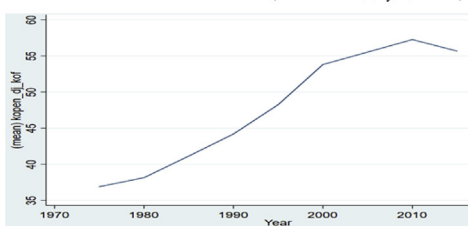
Trade Globalization (*TLIB_df_Real*)



Trade Globalization (*TLIB_dj_KOF*)



Financial Globalization (*KOPEN_dj_KOF*)



Financial Globalization (*KOPEN_dj_CI*)

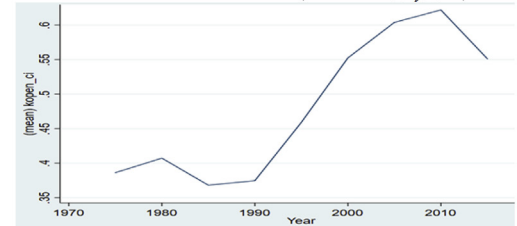


Fig. 2. Benchmark tax rate, trade globalization & financial globalization measures (1970–2015).

4.2. Empirical results

We begin our empirical exercise by estimating equation (25). Should we be worried about reverse causality? One cannot deny the possibility of tax rates affecting some of our measures of globalization. For example, *KOPEN_df_KOF* which uses actual financial flows can certainly be affected by the tax rate. To minimize the reverse causality problem, we use the average values of the right-hand-side variables between the tax years. It is also possible that some time varying omitted variables affect both the tax policy and the policies related to globalization. Our use of time varying controls such as per capita income and population partially addresses this issue but in the absence of any convincing instruments, we cannot claim to have established causality from globalization to taxation. We also use year fixed effects to control for shocks common to all countries. As well, we use country fixed effects to control for country-specific time invariant omitted factors. Therefore, our identification comes from within-country variations in the variables of interest. Finally, we use robust standard errors clustered at the country level in each regression.

Table 3
Trade globalization and *TMITR* (capital-labor ratio interaction).

Regressors	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Period	1970–2015	1970–2015	1970–2015	1970–2015	1970–2005	1970–2005	1970–2005	1970–2005
<i>TLIB_dj_KOF</i>	0.100 (0.062)	–	–	–	0.171** (0.079)	–	–	–
<i>TLIB_df_KOF</i>	–	0.092 (0.065)	–	–	–	0.174* (0.091)	–	–
<i>TLIB_df_Real</i>	–	–	6.019** (2.400)	–	–	–	10.08** (4.322)	–
<i>TLIB_df_PWT</i>	–	–	–	3.811 (2.685)	–	–	–	4.621 (3.999)
Capital-Labor Ratio	0.105 (0.455)	0.212 (0.446)	–0.029 (0.401)	–0.005 (0.386)	–0.217 (0.661)	–0.040 (0.689)	–0.558 (0.626)	–0.554 (0.601)
Capital-Labor Ratio *	–0.009 (0.005)	–0.010* (0.006)	–0.527** (0.194)	–0.306 (0.210)	–0.017** (0.007)	–0.016* (0.008)	–0.875** (0.370)	–0.371 (0.344)
Trade Globalization	0.719 (0.502)	0.694 (0.496)	0.838 (0.531)	0.747 (0.524)	0.894 (0.756)	0.783 (0.759)	1.165 (0.826)	0.870 (0.790)
Per Capita GDP	–0.423 (0.843)	–0.119 (0.741)	–0.082 (0.720)	0.020 (0.786)	–0.711 (1.138)	0.176 (1.105)	0.351 (1.103)	0.238 (1.128)
Population	–2.952 (4.658)	–3.858 (4.807)	–3.298 (4.608)	–3.118 (4.656)	–0.031 (6.588)	–3.438 (6.595)	–1.963 (6.521)	0.692 (6.769)
Constant Term								
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	905	905	915	915	618	618	626	626
Number of Countries	154	154	155	155	119	119	120	120
R-Squared (Within)	0.526	0.528	0.529	0.523	0.519	0.515	0.514	0.506

Notes: *TMITR*: Index of Top Marginal Income Tax Rate, *TLIB_dj_KOF*: *de jure* Measure of Trade Globalization Index, *TLIB_df_KOF*: *de facto* measure of Trade Globalization Index, *TLIB_df_Real*: Real Trade Openness, *TLIB_df_PWT*: Nominal Trade Openness. Robust standard errors clustered at the country level are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The first column in Table 3 uses *TLIB_dj_KOF* as the measure of trade liberalization. The coefficient of *TLIB_dj_KOF* is positive while the coefficient of its interaction with the capital-labor ratio is negative. Both these coefficients just fail to be statistically significant at the 10% level having a *p*-value of 0.11. The two coefficients together imply that the impact of trade liberalization on taxation depends on the capital-labor ratio. In particular, as the capital-labor ratio increases, the marginal effect of *TLIB_dj_KOF* on *TMITR* decreases from a positive value and for $\log_{KL}$ above 10.76 the marginal effect becomes negative. For reference, the median of $\log_{KL}$ is 11.04 for the panel data set. Following Brambor et al. (2006) we plot the marginal effect of *TLIB_dj_KOF* on *TMITR* for various levels of $\log_{KL}$ in Fig. 3a. The results imply that when the capital-labor ratio is low, trade liberalization is positively related with *TMITR* or negatively related with taxation because the higher the tax rate the lower the *TMITR* which is an index. Conversely, when the $\log_{KL}$ exceeds 10.76, trade liberalization is positively related with taxation. Column V in Table 3 repeats the same regression as in column I but excludes the post-financial crisis years 2010 and 2015. The results are much stronger and both the coefficient of *TLIB_dj_KOF* as well as its interaction with $\log_{KL}$ are larger in magnitude and statistically significant. The marginal effect of *TLIB_dj_KOF* is plotted in Fig. 3c which confirms that for high $\log_{KL}$ increased globalization increases taxation but for low $\log_{KL}$ the opposite is true.

While *TLIB_dj_KOF* is a *de jure* measure, columns II, III, and IV in Table 3 use 3 alternative *de facto* measures of trade liberalization: *TLIB_df_KOF*, *TLIB_df_Real*, and *TLIB_df_PWT*. The coefficients in these regressions have the same signs as in column I, but not all of them are statistically significant. While the coefficient of *TLIB_df_KOF* is insignificant, its interaction with $\log_{KL}$ is significant. For *TLIB_df_PWT* both the direct coefficient and the interaction are insignificant. Interestingly, for *TLIB_df_Real*, both the direct coefficient and the interaction are significant. Looking at the marginal effect here, the turning point happens at $\log_{KL} = 11.55$. Columns VI–VIII in Table 3 run the same regressions as in columns II–IV but exclude the post-financial crisis years. The coefficient of *TLIB_df_PWT* remains insignificant but the coefficient of *TLIB_df_KOF* as well as its interaction with $\log_{KL}$ becomes significant. Also, the coefficients of *TLIB_df_Real* and its interaction with $\log_{KL}$ remain significant. As well, coefficients of all trade liberalization measures are larger in magnitude than the corresponding coefficients in columns I–III. Fig. 3b and d plot the marginal effects of *TLIB_df_Real* for the whole period and for the sub-period excluding the post-financial crisis years.

Therefore, the results of the baseline regressions in Table 3 are consistent with the theoretical prediction that trade liberalization is likely to increase taxation in high capital-labor ratio (or capital-abundant) countries and lower taxation in low capital-labor ratio (or labor-abundant) countries. Digging deeper, we find that the most commonly used measure of trade liberalization, trade-GDP ratio (*TLIB_df_PWT*) is not statistically significant in explaining taxation, while a measure of real openness (*TLIB_df_Real*) is significant. Both the KOF measures of trade liberalization are insignificant for the whole period but they are significant for the sub-period that excludes post-financial crisis years.

Even though the theoretical model does not predict that the impact of capital market openness on taxation should depend on the capital labor ratio, in Table 4 we run the same regressions that we did in Table 3, with the difference that the measures of globalization related to capital market openness. The results are qualitatively similar to that in Table 3. It turns out that all 3 measures of capital account liberalization are positively and significantly related with *TMITR* while their interactions with $\log_{KL}$ are negatively and significantly related with *TMITR*. That is, even when we use capital market openness as our measure of globalization, we obtain the result that globalization is positively associated with taxation in capital abundant countries and negatively associated with taxation in

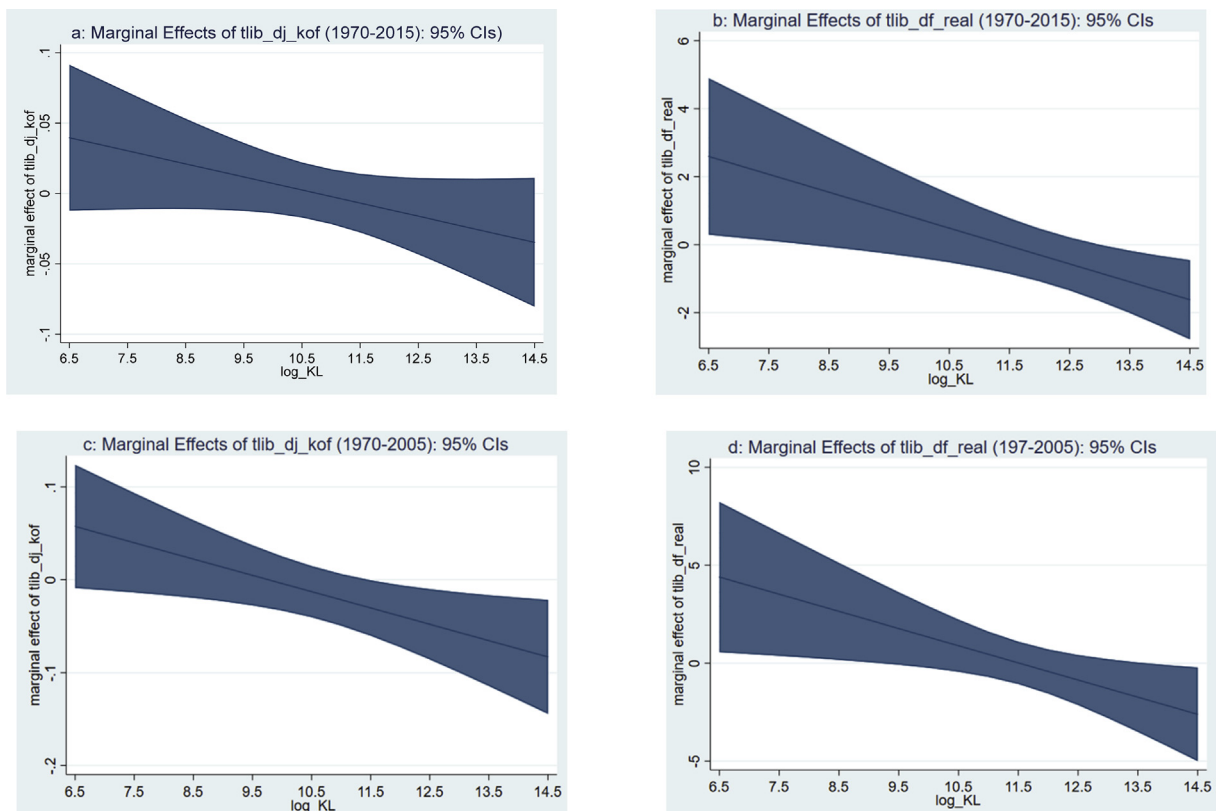


Fig. 3. Marginal Effects of Trade Globalization on Taxation conditional on capital-labor ratio (95% CI).

labor abundant countries. Compared with trade liberalization, the cutoff capital-labor ratio above which capital market openness has a positive effect on taxation is much higher. For example, comparing the KOF measure of *de jure* trade liberalization, *TLIB_dj_KOF* with the KOF measure of *de jure* capital market openness, *KOPEN_dj_KOF* (column I in Table 3 vs column II in Table 4), the cutoff $\log_{KL}$ in the former case is 10.56 while in the latter case it is 13.13. For the other *de jure* measure of capital account liberalization, *KOPEN_dj_CI* the turning point occurs at $\log_{KL} = 12.35$. Columns IV–VI in Table 4 repeat the regressions in columns I–III by excluding observations from the post-financial crisis years. The coefficients of capital market liberalization variables are much larger in magnitude than in columns I–III as was the case in Table 3. The marginal effects of the two *de jure* measures of capital account liberalization are plotted in Fig. 4.

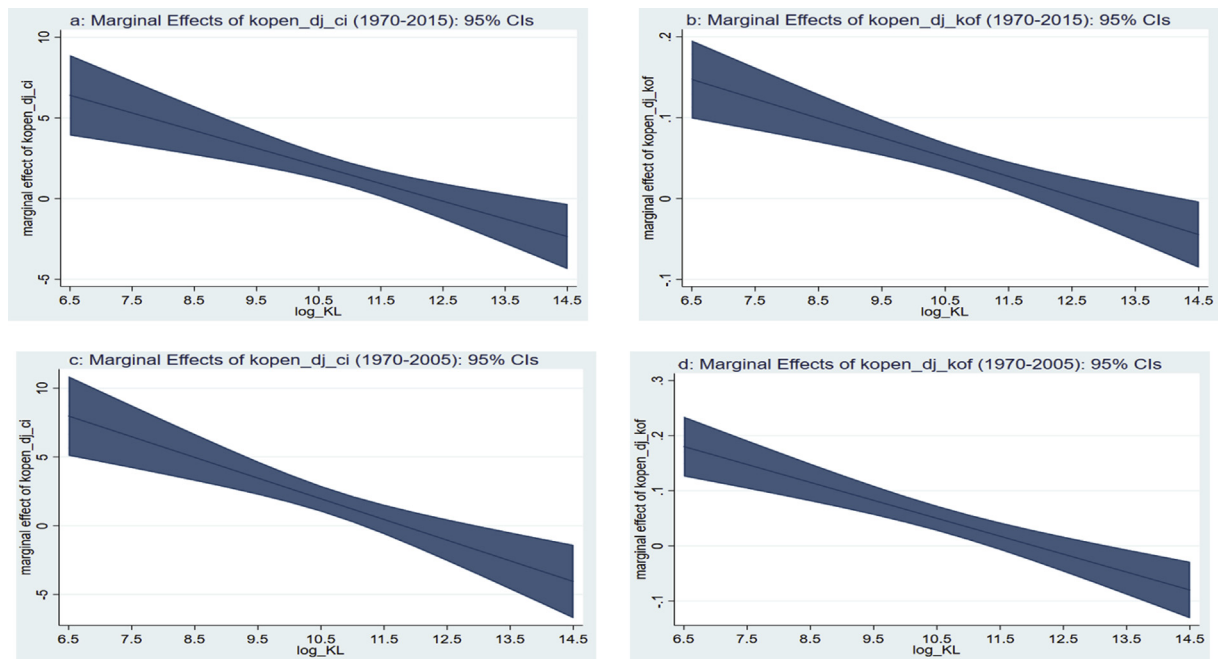
In our theoretical model, inequality played an important role in the determination of taxes. To see if our measure of inequality interacts with globalization in determining taxation, we estimated equation (26) using all 7 of our measures of globalization. We generally find the estimate of γ_1 to be positive and the estimate of γ_3 to be negative suggesting that trade liberalization increases taxation in high inequality (or high Gini) countries but decreases taxation in low inequality (or low Gini) countries. However, the coefficients are less precisely measured and fail to be statistically significant in most cases. To conserve space, we do not report these results in the paper. The results for both measures of inequality, one based on pre-tax/transfer income and the other based on post-tax/transfer income, are available in an online appendix.

Our theoretical model also suggested that the impact of capital account liberalization on taxation could vary depending on whether the country was capital importing or capital exporting. A country is a capital exporter if it has a current account surplus ($CA_dummy = 1$) and a capital importer if it has a current account deficit ($CA_dummy = 0$). We use the interaction of CA_dummy with our measures of capital account liberalization in the regressions reported in Table 5. Looking at the whole period (columns I–III) we find that the interaction coefficient is always negative but statistically significant in columns II and III. The direct coefficients of the measures of capital market liberalization are positive in all 3 cases but significant for the two *de jure* measures. In Fig. 5 we plot the marginal effects of the two *de jure* measures of capital account liberalization on taxation. As seen from Fig. 5a and b, the marginal effects are positive for both capital exporting and importing countries but larger in magnitude for the latter. That is, capital account liberalization reduces taxation more in capital importing countries. Columns IV–VI in Table 5 repeat the regressions in columns I–III by excluding the post-financial crisis years. The results are qualitatively similar to those for the whole period but the coefficients are larger in magnitude. The marginal effects for the *de jure* measures of capital account liberalization are plotted in Fig. 5c and d. Again, the marginal effects are positive for both capital importing and capital exporting countries, however, for the latter the 95% confidence interval includes zero as well as some negative values suggesting that we

Table 4Financial globalization and *TMITR* (capital-labor ratio interaction).

Regressors	(I)	(II)	(III)	(IV)	(V)	(VI)
Period	1970–2015	1970–2015	1970–2015	1970–2005	1970–2005	1970–2005
<i>KOPEN_dj_CI</i>	13.51*** (2.986)	–	–	17.74*** (3.588)	–	–
<i>KOPEN_dj_KOF</i>	–	0.302*** (0.057)	–	–	0.391*** (0.065)	–
<i>KOPEN_df_KOF</i>	–	–	0.133** (0.054)	–	–	0.160** (0.065)
Capital-Labor Ratio	–0.131 (0.377)	0.696 (0.442)	0.246 (0.451)	–0.814 (0.574)	0.539 (0.667)	–0.271 (0.652)
Capital-Labor Ratio * Financial Globalization	–1.094*** (0.269)	–0.023*** (0.005)	–0.012*** (0.004)	–1.503*** (0.333)	–0.032*** (0.006)	–0.015*** (0.005)
Per Capita GDP	0.766 (0.495)	0.696* (0.407)	0.768 (0.486)	1.063 (0.766)	0.880 (0.614)	0.970 (0.773)
Population	–0.188 (0.890)	–0.474 (0.637)	–0.430 (0.654)	–0.106 (1.345)	–0.665 (0.808)	–0.275 (0.867)
Constant Term	–2.060 (4.355)	–10.87** (4.542)	–4.964 (5.002)	2.049 (6.753)	–10.64* (5.937)	–1.784 (6.651)
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	875	905	905	596	618	618
Number of Countries	150	154	154	116	119	119
R-Squared (Within)	0.555	0.569	0.533	0.545	0.563	0.521

Notes: *TMITR*: Index of Top Marginal Income Tax Rate, *KOPEN_dj_CI*: Financial Openness (Chinn-Ito Index), *KOPEN_dj_KOF*: *de jure* measure of Financial Globalization Index, *KOPEN_df_KOF*: *de facto* measure of Financial Globalization Index. Robust standard errors clustered at the country level are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

**Fig. 4.** Marginal Effects of Financial Globalization on Taxation conditional on capital-labor ratio (95% CI).

cannot exclude the possibility of a non-negative relationship between taxation and capital market liberalization in capital exporting countries.

4.2.1. Robustness checks

Below we discuss the results of some robustness exercises. To conserve space, these estimates are presented in online appendix. Tables C1–C3 provide robustness exercises corresponding to the baseline regressions in Tables 3–5, respectively. In Table C1, we provide estimates for two measures of trade liberalization, *TLIB_dj_KOF* and *TLIB_df_Real*. In Tables C2 and C3, results are provided for the 2 *de jure* measures of capital market liberalization: *KOPEN_dj_KOF* and *KOPEN_dj_CI*.

Table 5
Financial globalization and *TMITR* (current account dummy interaction).

Regressors	(I)	(II)	(III)	(IV)	(V)	(VI)
Period	1970–2015	1970–2015	1970–2015	1970–2005	1970–2005	1970–2005
<i>KOPEN_dj_CI</i>	1.789*** (0.414)	–	–	1.965*** (0.510)	–	–
<i>KOPEN_dj_KOF</i>	–	0.040*** (0.009)	–	–	0.043*** (0.013)	–
<i>KOPEN_df_KOF</i>	–	–	0.004 (0.010)	–	–	0.005 (0.014)
Current Account Dummy	0.218 (0.334)	0.824 (0.568)	1.130** (0.507)	0.516 (0.429)	1.140* (0.653)	1.365** (0.570)
Current Account Dummy * Financial Globalization	–0.650 (0.515)	–0.015* (0.009)	–0.020** (0.008)	–1.159 (0.711)	–0.021** (0.010)	–0.026** (0.010)
Per Capita GDP	0.572 (0.415)	0.448 (0.417)	0.663 (0.429)	0.403 (0.660)	0.224 (0.633)	0.406 (0.669)
Population	1.089 (0.938)	0.384 (0.970)	0.055 (1.085)	1.463 (1.437)	0.777 (1.400)	0.050 (1.626)
Constant Term	–3.966 (4.166)	–2.421 (4.204)	–2.173 (4.560)	–3.701 (6.950)	–1.799 (6.521)	–0.320 (7.379)
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	769	788	788	500	511	511
Number of Countries	147	151	151	110	111	111
R-Squared (Within)	0.586	0.583	0.568	0.572	0.568	0.556

Notes: *TMITR*: Index of Top Marginal Income Tax Rate, *KOPEN_dj_CI*: Financial Openness (Chinn-Ito Index), *KOPEN_dj_KOF*: *de jure* measure of Financial Globalization Index, *KOPEN_df_KOF*: *de facto* measure of Financial Globalization Index. Robust standard errors clustered at the country level are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The theoretical model was based on a majoritarian government but in real world countries have very different political institutions. Therefore, we re-estimate our baseline regressions by controlling for some measures of institutional quality. Following, [Gozgor and Ranjan \(2017\)](#), we use the civil liberties ratings (index from 1 to 7 where 1 represents the most-free nations and 7 represents the least-free nations) as a measure of institutional quality. Next, we include a measure of the constraint on the executive (index from 1 to 7) as a measure of overall institutional quality. Following the spirit of [Adam and Kammass \(2007\)](#) and [Acemoglu et al. \(2019\)](#), we use the level of institutionalized democracy (index from 0 to 10) as a measure of the quality of democratic institutions. The results in [Tables C1–C3](#) suggest that the baseline regressions in [Tables 3–5](#) are robust to the inclusion of these additional controls.¹⁸

In a recent paper [Cervellati et al. \(2018\)](#) find that there is a complementarity between democracy and globalization in adopting new technologies. We also ran regressions using the interaction of democracy with globalization to see if they interact in determining taxation. The interactions were generally insignificant suggesting that there is no clear evidence that the impact of globalization on taxation varies in a systematic way with the level of democratization. Given that in our theoretical model the level of taxation is chosen by the median voter, one could have expected the results to be stronger for democracies. However, as mentioned earlier, similar theoretical results would obtain if the government cared about inequality, and there is no reason to believe that authoritarian governments do not care about inequality.

Next, we check if the results are robust to the exclusion of outliers and specific regions from the dataset. In particular, we check if the results are robust to the exclusion of the extreme observations for *TMITR*, and our measures of globalization. Following [Gozgor and Ranjan \(2017\)](#) and [Furceri and Loungani \(2018\)](#), we identify the extreme observations as those which are more than two standard deviations away from the average. There are no outliers in the tax rate by this measure.¹⁹ There are some outliers in the globalization data but the results are robust to their exclusion.

Our final robustness check is to see if the effects of globalization on taxation are driven by particular regions by excluding one region at a time. More precisely, following the spirit of the empirical analyses in [Rodrik \(1998\)](#) and [Gozgor and Ranjan \(2017\)](#), we exclude the observations for the Sub-Saharan African, the Latin American and the Caribbean, and the developing East Asian countries, one region at a time. The results again are robust to the exclusion of these regions, one at a time and this implies that the baseline results are not dominated by the presence of observations from any specific region. One result that is worth pointing out is that the coefficients of *TLIB_dj_KOF* and its interaction with *log_KL* failed to be statistically significant in column I of [Table 3](#). The exclusion of any of these regions makes these coefficients statistically significant as can be seen in column I of [Table C1](#).

Overall, robustness checks indicate that the results obtained in the baseline regressions in [Tables 3–5](#) are robust to the inclusion of institutional controls, outliers, and the exclusion of various regions, one at a time.

¹⁸ We also tried to include the political ideology of the executive as a control as was done in the studies of [Angelopoulos et al. \(2012\)](#) and [Potrafke \(2017\)](#). We use [Cruz et al. \(2018\)](#) data which assigns a value of 1 to the Right wing government, 2 to the Centrist government, and 3 to the Left wing government. A value 0 is assigned where the political orientation is not clear. If we just include observations which have a score 1, 2, or 3, we are left with very few observations and the results on globalization become insignificant in most of the regressions.

¹⁹ If we had used the top marginal tax rate instead of the index, there would have been 21 outliers by this criterion.

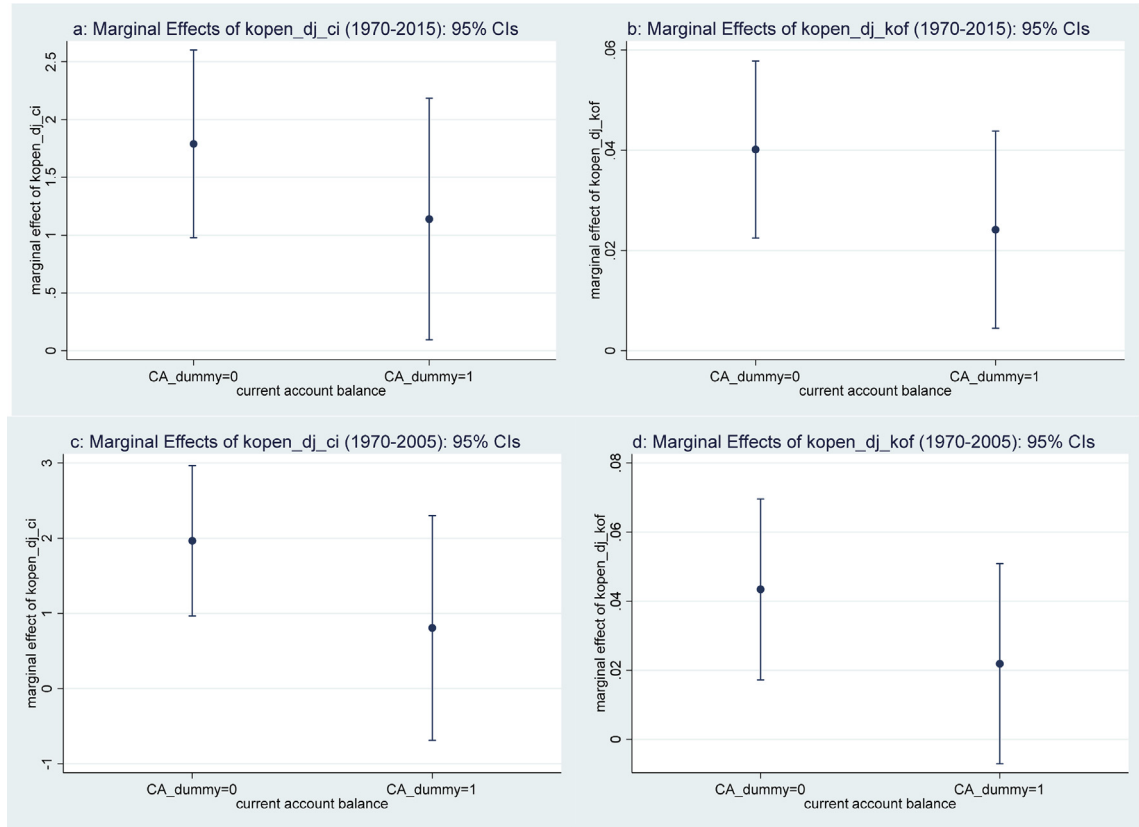


Fig. 5. Marginal Effects of Financial Globalization on Taxation conditional on current account balance (95% CI).

5. Concluding remarks

This paper constructed a theoretical model to capture the opposing compensation and efficiency effects of globalization in a set up where the redistributive tax rate is chosen by the median voter. The model predicted that the impact of trade liberalization on taxation depended on whether the country was capital abundant or labor abundant. Theory also predicted the possibility of the impact of capital market openness on taxation to differ depending on whether the country was capital exporting or capital importing. The paper then provided some empirical evidence on the relationship between taxation and two alternative modes of globalization—trade liberalization and financial openness—using a large cross-country panel dataset. Among the key findings, there was evidence that trade liberalization increased taxation in capital abundant countries and reduced taxation in labor abundant countries. The results with the most commonly used *de facto* measure of trade liberalization, nominal trade-GDP ratio, were not significant. However, using real trade openness as a *de facto* measure of trade liberalization, we found the results to be significant. Testing if the impact of globalization on taxation depended on inequality did not yield statistically significant results. We also found that both *de jure* and *de facto* measures of capital account liberalization were negatively related with taxation in both capital importing and capital exporting countries. Finally, it turned out that the relationship between both facets of globalization—trade liberalization and capital market openness—and taxation was much stronger in the pre-financial crisis period.

Appendix

Appendix A. Impact of trade liberalization (capital outflow case)

Recall from the text that the first order condition for the optimal choice of t for the median voter is

$$r(1-s)(\bar{k}-k^m) - t \frac{r^2 \bar{k}}{r_f \beta} - \frac{1}{\gamma-1} w^{\frac{\gamma}{\gamma-1}} t(1-t)^{\frac{2-\gamma}{\gamma-1}} = 0 \quad (28)$$

Take the derivative with respect to τ to obtain

$$-r(\bar{k}-k^m) \frac{ds}{d\tau} + (1-s)(\bar{k}-k^m)r' - \frac{2rt\bar{k}}{r_f \beta} r' - \frac{r^2 \bar{k}}{r_f \beta} \frac{dt}{d\tau} - \Psi \frac{dt}{d\tau} - \frac{\gamma}{(\gamma-1)^2} w^{\frac{1}{\gamma-1}} t(1-t)^{\frac{2-\gamma}{\gamma-1}} w' = 0 \quad (29)$$

Since $s = \left(\frac{r_f - (1-t)r}{\beta r_f} \right)$, $\frac{ds}{d\tau} = \left(\frac{r}{\beta r_f} \frac{dr}{d\tau} - \frac{(1-t)r'}{\beta r_f} \right)$. Use this and re-organize above to obtain

$$\underbrace{\left(\Psi + \frac{r^2 \bar{k}}{r_f \beta} + \frac{r^2 (\bar{k} - k^m)}{\beta r_f} \right)}_I \frac{dt}{d\tau} = \underbrace{\left(\frac{(1-t)r (\bar{k} - k^m)}{r_f \beta} + (1-s) (\bar{k} - k^m) - \frac{2rt\bar{k}}{r_f \beta} \right)}_{II} r' - \underbrace{\frac{\gamma}{(\gamma-1)^2} w^{\frac{1}{\gamma-1}} t(1-t)^{\frac{2-\gamma}{\gamma-1}} w'}_{III} \quad (30)$$

Verify that $I > 0$ because $\Psi > 0$. $III < 0$ because $w' > 0$ in a capital abundant country. Also, $r' < 0$ in a capital abundant country. A sufficient condition to get the same result on the impact of trade liberalization as in the case without capital mobility is $II > 0$. The only term that causes ambiguity is $-\frac{2rt\bar{k}}{r_f \beta}$ in II . We resolve the ambiguity through numerical exercises.

Appendix B. Taxation with capital inflows

Suppose we are in the range where $r(1-t) > r_f$. In this case there is capital inflow into the country. Denote the amount of capital inflow by K^I and use $k^I = \frac{K^I}{N}$ to capture the per capita capital inflow. Assume the following functional form for k^I .

$$k^I = \frac{\delta}{\beta} f(r(1-t) - r_f); f' > 0, f'' < 0. \quad (31)$$

That is, the capital inflows are positively related to the net return and negatively related to the capital market openness parameter β . Next, obtain the following useful expressions from (31).

$$\frac{dk^I}{dt} = -\frac{r\delta}{\beta} f' < 0; \frac{d^2 k^I}{dt^2} = \frac{r^2 \delta}{\beta} f'' < 0; \frac{dk^I}{d\beta} = -\frac{k^I}{\beta} < 0; \frac{d^2 k^I}{dtd\beta} = \frac{r\delta}{\beta^2} f' + r^2 \frac{\delta}{\beta} f'' \frac{dt}{d\beta}. \quad (32)$$

An individual maximizes the following objective function in the second stage.

$$\text{Max}_l \{ w(1-t)l + g + (1-t)rk_i - \frac{1}{\gamma} l^\gamma \} \quad (33)$$

The above optimization yields the same labor supply function as in the text given by

$$l = (w(1-t))^{\frac{1}{\gamma-1}} \quad (34)$$

With capital inflows, the amount of taxes collected per person, g , is

$$g = t \frac{Nwl + rK + K^I}{N} = t(wl + r\bar{k} + rk^I) \quad (35)$$

Putting the above expression in the median voter's welfare function

$$\text{Max}_{0 < t < 1} wl + (1-t)rk^m + t(\bar{k} + k^I) - \frac{1}{\gamma} l^\gamma \quad (36)$$

The first order condition for the preferred choice of t for the median voter is

$$r(\bar{k} + k^I - k^m) + rt \frac{dk^I}{dt} + (w - l^{\gamma-1}) \frac{dl}{dt} = 0 \quad (37)$$

The first term captures the marginal benefit of taxation while the next two terms capture the marginal cost of taxation. Now taxing foreign capital benefits the median voter irrespective of his own capital. Benefits from taxing domestic capital on the other hand depend on his own capital holding relative to the average capital. Note that $\frac{dk^I}{dt} < 0$ because higher taxes would reduce capital inflows and therefore, taxation is costly because it reduces capital inflows. Upon using the expression for $\frac{dl}{dt}$ from (34) and using the expression for $\frac{dk^I}{dt}$ in (32) re-write the above as

$$r(\bar{k} + k^I - k^m) - \frac{\delta r^2 t}{\beta} f' - \frac{1}{\gamma-1} w^{\frac{\gamma}{\gamma-1}} t(1-t)^{\frac{2-\gamma}{\gamma-1}} = 0 \quad (38)$$

Also, note that the second order condition for optimal t of the median voter in this case is given by

$$2r \frac{dk^I}{dt} + rt \frac{d^2 k^I}{dt^2} - \Psi < 0 \quad (39)$$

So, a sufficient condition for the inequality in (39) to be true is

$$2r \frac{dk^I}{dt} + rt \frac{d^2 k^I}{dt^2} < 0 \quad (40)$$

Verify that $f' > 0, f'' < 0$ is sufficient for the inequality in (40) to be true.

Impact of trade liberalization

As before, trade liberalization is modeled as a decrease in the non-tariff barriers, τ . Taking the derivative of (37) with respect to τ and re-organizing obtain

$$\left(\Psi - r \frac{dk^I}{d\tau}\right) \frac{d\tau}{d\tau} = \left(r \frac{dk^I}{d\tau} + r' t \frac{dk^I}{d\tau} + r t \frac{d^2 k^I}{d\tau d\tau}\right) + (\bar{k} + k^I - k^m) r' - \frac{\gamma}{(\gamma - 1)^2} w^{\frac{1}{\gamma-1}} t(1-t)^{\frac{2-\gamma}{\gamma-1}} w' \quad (41)$$

Next, note from the functional form for (31) that

$$\frac{dk^I}{d\tau} = ((1-t)r' - r \frac{dt}{d\tau}) \frac{\delta f'}{\beta}; \frac{d^2 k^I}{d\tau d\tau} = -r' \frac{\delta f'}{\beta} - r \frac{\delta}{\beta} ((1-t)r' - r \frac{dt}{d\tau}) f'' \quad (42)$$

Substitute (42) in (41) to obtain

$$\left(\Psi - \frac{\delta r^3 t f''}{\beta} + \frac{2r^2 \delta f'}{\beta}\right) \frac{d\tau}{d\tau} = \left[(\bar{k} + k^I - k^m) + \frac{(1-t)r\delta f'}{\beta} - \frac{2\delta t r f'}{\beta} - \frac{r^2 \delta t(1-t)f''}{\beta}\right] r' - \frac{\gamma}{(\gamma - 1)^2} w^{\frac{1}{\gamma-1}} t(1-t)^{\frac{2-\gamma}{\gamma-1}} w' \quad (43)$$

The coefficient of $\frac{d\tau}{d\tau}$ on the left hand side is positive because $\Psi > 0, f' > 0$ and $f'' < 0$. Now for a capital abundant country, $r' < 0$ and $w' > 0$. Therefore, if the term in the square bracket on the right-hand-side is positive then, we get the result that $\frac{d\tau}{d\tau} < 0$ for a capital abundant country and $\frac{d\tau}{d\tau} > 0$ for a labor abundant country. The only term in the square bracket that is negative is $-\frac{2\delta t r f'}{\beta}$.

Decrease in the cost of capital inflows

Let us find how the tax preferred by the median voter changes with β . Take the derivative of (38) with respect to β to obtain

$$\Psi \frac{dt^m}{d\beta} - r \frac{dk^I}{d\beta} \frac{dt^m}{d\beta} = r t \frac{d^2 k^I}{d\beta d\beta} + r \frac{dk^I}{d\beta} \quad (44)$$

Next, use the expressions in (32) to re-write above as

$$\left(\Psi + 2 \frac{r^2 \delta f'}{\beta} - \frac{r^3 \delta f''}{\beta}\right) \frac{dt^m}{d\beta} = -\frac{r}{\beta} \left(\frac{tdk^I}{dt} + k^I\right) \quad (45)$$

The expression in the parentheses on the left hand side above is clearly positive. Therefore, the sign of $\frac{dt^m}{d\beta}$ depends on the expression on the right-hand-side and hence a necessary and sufficient condition for $\frac{dt^m}{d\beta} > 0$ is $-\frac{t}{k^I} \frac{dk^I}{dt} > 1$ or the absolute value of the elasticity of capital inflows with respect to taxes is greater than 1. To gain intuition, re-write (38) as

$$r(\bar{k} + k^I - k^m) = \frac{\delta r^2 t f'}{\beta} + \frac{1}{\gamma - 1} w^{\frac{\gamma}{\gamma-1}} t(1-t)^{\frac{2-\gamma}{\gamma-1}} \quad (46)$$

Now, a decrease in β increases k^I and therefore, the marginal benefit of taxation increases. The marginal cost also increases because $\left|\frac{dk^I}{dt}\right| = r \frac{\delta f'}{\beta}$ which is reflected in the first term on the right-hand-side of (46) increases. That is, capital inflows become more responsive to taxes. If the elasticity of capital inflows with respect to taxes exceeds unity, then the marginal cost increases more and hence the tax rate preferred by the median voter decreases if β decreases.

Appendix C. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ejpolco.2019.04.001>.

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