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Income Redistribution and the Diversity of Consumer Goods

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Abstract

Reductions in the generosity of welfare benefits and less progressive taxation have decreased the redistributive impact of fiscal policy since the mid-1990's across the advanced democracies. We argue that the strong increase in the diversity of goods observed those last decades may have modified preferences for redistribution differently across groups in society and affected the political equilibrium tax rate. We show that if the share of diversified goods compared to that of basic (necessary) goods in the consumption bundle sufficiently increases with income, relatively rich consumers could disproportionately benefit from an increase in the diversity of goods. Consequently we show in a probabilistic voting model that this could lead to a decrease in the equilibrium tax rate. We then empirically demonstrate, using fixed effect regressions over a a panel of OECD countries, that there exists a strong correlation between our proxies for the diversity of goods and our proxies for the degree of fiscal redistribution.

Keywords: Redistribution, Diversity of goods, Taxation, Probabilistic voting

JEL codes: D72, D78, H24

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1 Introduction

In the last decades, reductions in the generosity of welfare benefits and less progressive taxation have decreased the redistributive impact of fiscal policy (Gupta and Keen, 2014)). Slemrod and Bakija (2008) note that the global decrease in the progressivity of the tax and transfer system is surprising, particularly with regards to the strong increase of income inequality over the same time period. Concurrently, the variety in consumer goods available in developed economies has widened considerably (see Broda and Weinstein, 2004, 2006; Hummels and Klenow, 2005; Arkolakis, Demidova, Klenow, and Rodriguez-Clare, 2008 for empirical evidence). We argue that the two phenomena may be related. Central to our argument is the intuition that the welfare impacts of greater goods diversity may have been heterogeneous across individuals, depending on the share of differentiated goods in individuals' consumption bundles. In this paper we analyze how such heterogeneous welfare effects of growth in the diversity of goods may have impacted individual preferences for fiscal redistribution. We then show how such a change in policy preferences affect the equilibrium income tax rate within the context of a political economic model. Examining a panel of OECD countries, we provide some empirical support for the conclusions of our theoretical analysis.

We build a model of probabilistic voting in which voters spend their net income in private markets for two types of goods: one that is homogenous and one that is a composition of varieties. The "diversity of goods" then corresponds to the number of varieties in the composite good. The key mechanism of our model lies in how the allocation of income between the two types of goods varies with income. The intuition of this mechanism goes back to Engel's Law (1857), which states that the share of food in household spending decreases with income, and which we suppose extends to other basic goods (clothing, shelter, transport, energy, health and sanitation, etc). The share of "normal" goods and services (those that are not necessities) in the consumption bundle should increase with income as a result.

We argue that basic goods are produced mainly in competitive domestic markets that did not benefit from the massive productivity gains of the past decades, nor from the accompanying increases in trade volumes (for instance, international prices for many food commodities have increased over the last decades). In this case, the introduction of new goods and services and the subsequent increase in diversity should mainly affect the quantity of "normal" differentiated goods available for consumers, which are often produced in non-competitive markets with positive profits for producers. If the "Engel effect" described above applies, then the increase in the diversity of goods and services should benefit disproportionately the rich consumers who allocate a higher share of income to those goods. We examine the consequences for fiscal redistribution of such an asymmetric gain from increasing goods diversity within the context of a political economic model.

In our model, individuals form policy preferences for a linear income tax (and the resulting lump-sum transfer that satisfies the government's budget constraint), which is the only policy dimension over which politicians compete, as in the standard political economic model of fiscal redistribution (Romer, 1975; Roberts, 1977; Meltzer and Richard, 1981). Following Lindbeck and Weibull (1987), we analyze political competition using a probabilistic voting model, which seems to us to more realistically capture the complexity of individual policy preferences and does not necessarily degenerate into a "median-voter" political equilibrium.[1] The impact of an increase in diversity on taxation depends on two competing effects. First, if all agents would have the same consumption structure, an increase in the number of varieties would increase marginal utility by more for poorer agents, due to the concavity of the utility function in consumption levels. This effect therefore favors redistribution toward the poor when goods diversity increases. The second effect goes through the above-mentioned "Engel effect" of income on consumption structure. If, due to non-homothetic preferences, richer agents allocate a higher share of income to the diversified good, they benefit more from an increase in goods diversity. In this case, fiscal redistribution should decrease with goods diversity. We show that if preferences are sufficiently non-homothetic (i.e., if the share of the diversified good in the consumption bundle is sufficiently responsive to increases in income), then the second effect dominates. We derive parametric conditions for which the second effect dominates and an increase in the diversity of goods decreases the income tax rate in the political equilibrium.

In the second part of the paper, we investigate our theoretical predictions using a panel of OECD countries. We want to analyze to what extent the decrease in redistribution observed in the last decades among advanced economies (Gupta and Keen 2014 or Slemrod and Bakija 2008 for instance) can be explained by the increase in goods diversity highlighted by our theory. Top marginal tax rates were typically very high in OECD countries during the 1960's (about 90 percentage points in the U.S. and 95 percentage points in the U.K. for example) and have sharply decreased since then.[2] In our empirical investigation, we demonstrate that increases in goods diversity can, in part, explain the drop in income tax rates during this period. Most of the difficulty in our empirical analysis lies in defining proxies for both fiscal redistribution and goods diversity. As for diversity proxies, we alternatively consider openness measures using trade data (in the spirit of Broda and Weinstein 2004, 2006 or Hummels and Klenow 2005) and research and development (R&D) capital stock data (taken from Coe et al. 2009). The idea behind the use of trade data is twofold. First, "new trade" theories that explain trade between developed economies (that is, most of the trade) are based on specialization in varieties and it is generally considered

[1] The reason for using a probabilistic voting model is twofold. First, in reality, the policy space is not unidimensional. In the probabilistic voting framework, two individuals with the same income do not necessarily vote for the same candidate even if the two candidates have different electoral platforms concerning the tax rate. Second, voting behavior is then random and both candidates design the electoral platform in order to maximize the probability of winning. Therefore any change that modifies the marginal utility for one group of agents leads to a change in the optimal policy platform (the linear tax rate in our framework). As a result, the intensity of policy preferences of each voter matters, and not just that of the "median voter". Similar divergences from the median-voter equilibrium could also be obtained by introducing special-interest-group lobbying into the framework.

[2] Indeed, even among the most beatnik of 1960's popular culture icons seemed to find such rates suffocating. Writing for the Beatles, George Harrison penned the acerbic lyrics to "Taxman" in response to the 95 percent marginal take of the tax authorities: "Let me tell you how it will be; There's one for you, nineteen for me; . . . Should five percent appear too small; Be thankful I don't take it all; Cause I'm the taxman; Yeah, I'm the taxman."

that trade should significantly increase the number of varieties available to consumers. Secondly, trade is now considered as a driving force of the decline in the manufacturing sector and the strong increase in the service sector those last decades in the advanced economies (see Acemoglu et al. 2014a, for instance). This has surely increased the variety of services available to consumers. As for fiscal redistribution, we consider three proxies: (*i*) the index of Fiscal Freedom from the Heritage Foundation, (*ii*) the share of government consumption expenditures in GDP and (*iii*) the share of total government expenditure in GDP, our theoretical model being extendable to the provision of public goods. In all specifications, we find that increases in the proxies for goods diversity are significantly correlated with future period reductions in the proxies for fiscal redistribution. This result is moreover robust to taking into account the existence of political cycles using 5-year panels, to controlling for country and period fixed effects and to controlling for variables that capture competing theoretical explanations of the recent decreases in income tax rates across the advanced democracies.

Our paper contributes to the literature on the determinants of income redistribution. According to the standard Romer–Roberts–Meltzer–Richard (RRMR) median voter model, inequality is one of the main determinants of the level of fiscal redistributive and the size of government (Romer, 1975; Roberts, 1977; Meltzer and Richard, 1981). However, there is no clear evidence of this simple and intuitive mechanism in the empirical literature. Bénabou (1996), for example, cites ten studies out of which nine did not find evidence consistent with the RRMR model.[3] More importantly, those models generally predict very high level of redistribution, much higher than the existing levels observed in many OECD countries. Finally, and as noted by Slemrod and Bakija (2008), the progressivity of the tax and transfer seems to have decreased over the last decades with a simultaneous increase in market income inequality, which goes against the theoretical predictions of the RRMR model.

As a result, an important area of research has focused why the advanced democracies do not redistribute more, and relatedly why redistribution seems to be declining. Epple and Romer (1991), for instance, propose an explanation based on fiscal competition between jurisdictions, which lowers the preferred tax rate of median income individuals since a high tax rate reduces the tax base when agents "vote with their feet" (see Wilson, 1999 for a survey). Increasing geographic mobility of (relatively rich) people could explain the decrease in the progressivity of the tax and transfer system all over the world. However, recent empirical papers have questioned this mechanism by finding a very small (Isen, 2014) or even negative correlation (Chirinko and Wilson, 2011 or Parchet, 2013) between neighbor-jurisdiction tax rates.[4] Moreover, recent research has questioned an underlying premise of the tax competition theory, that workers are indeed geographically mobile enough to shape the political agenda (Autor and Dorn, 2013). Another typical argument is that poor voters sometimes prefer politicians who are anti-redistributive policies due to party affinity or to the

[3] See also Acemoglu et al. (2014b), Bonica et al. (2013), and Gradstein and Milanovic (2004).

[4] This result seems to be robust across countries and jurisdiction level: Isen (2014) studies local referenda in the American state of Ohio, Chirinko and Wilson (2011) work on a panel of 48 contiguous U.S. states and Parchet (2013) uses tax reforms made in some Swiss provinces as a quasi-natural experiment.

politician's stance on non-economic issues (see Dixit and Londregan, 1996 or Roemer, 1998, for example). This can be due to the influence of special interest lobby groups (as in Becker, 1983, Austin-Smith, 1987 and Grossman and Helpman, 2001) or the role of social status (see Corneo and Gruner, 2000). Finally, the social mobility of voters may affect preferences for redistribution. Bénabou and Ok (2001) argue that the probability of becoming rich in the future can also moderate the redistributive ambitions of the current median voter.[5] By putting forward the role played by trade and increased goods diversity we offer an alternative political economic explanation to the observed decrease in tax rates in the advanced economies.

The rest of the paper is organized as follows. Section 2 presents the general theoretical setup. Section 3 discusses the effect of an increase in goods variety on the equilibrium tax rate. Section 4 presents extensions of the basic model. Section 5 is devoted to a simple empirical investigation and Section 6 concludes.

2 The general set up

2.1 Preferences and market equilibrium

To analyze the effect of an increase of goods diversity on agents' utility, we adopt the canonical monopolistic competition model of Dixit and Stiglitz (1977). Agents are endowed with income I and can consume $n+1$ goods: a quantity q_0 of a static good (the numeraire) and quantities q_i, $i = 1, ..., n$ of n varieties of a differentiated good (n being large enough). We suppose that preferences depend on both q_0 and an index Q composed of quantities of differentiated goods q_i: $Q = (\sum_{i=1}^n q_i^\rho)^{1/\rho}$. We denote the index Q quantity of the composite good, where $0 \leq \rho \leq 1$ represents the substitution or "love-of-variety" parameter. We describe these preferences by a utility function $U(q_0, Q)$, increasing and concave in both argument (that is $U_1 > 0$, $U_2 > 0$, $U_{11} \leq 0$ and $U_{22} \leq 0$, where f_h represents the derivative of f with respect to its hth argument). We assume independence between consumption of the static and the composite goods, i.e., $U_{12} = 0$.

Agents, therefore, optimally choose quantities to maximize their utility from consumption subject to budget constraint:

$$\max_{q_0,(q_i)_{i=1}^n} U\left(q_0, \left(\sum_{i=1}^n q_i^\rho\right)^{\frac{1}{\rho}}\right) \tag{1}$$

$$\text{s.t.} \quad q_0 + \sum_{i=1}^n p_i q_i \leq I.$$

[5] For a more complete review of the theoretical limits to redistribution in a democracy, see Harms and Zink (2003) and Borck (2007). More recently, Bonica, McCarty, Poole, and Rosenthal (2013) and Acemoglu, Naidu, Restrepo, and Robinson (2014b) demonstrate that democracies have not been able to slow rising inequality and provide some possible theoretical explanations.

As in the standard model, the prices p_i are determined by monopolist competition, i.e., in markets for differentiated goods. Since n is large, a change in q_i has little effect on $\sum_{j=1}^{n} q_j^{\rho}$ and therefore on U_1 and U_2. The demand function can therefore be approximated by $q_i = kp_i^{-\frac{1}{1-\rho}}$, with $k > 0$ and the demand elasticity for product i is approximately $\epsilon_i = -\frac{\partial q_i/\partial p_i}{q_i/p_i} = \frac{1}{1-\rho}$. The producer of good i, chooses p_i in order to maximize his profit: $\max_{p_i}(p_i - c)q_i - f$ where c represents the constant marginal cost of production and f the fixed cost. It follow that: $p_i(1 - \frac{1}{\epsilon_i}) = c$ or $p_i = c/\rho$.

Therefore, using symmetry ($q_i = q\ \forall i$), we can formulate regarding the equilibrium values of consumption and income effects.

Remark 1. *The market equilibrium (q_0^*, q^*) is defined by:*

$$\begin{aligned} &q_0^* = I - P \cdot Q^* \\ &cU_1\left(I - P \cdot Q^*, Q^*\right) = n^{\frac{1}{\rho}-1}\rho U_2\left(I - P \cdot Q^*, Q^*\right), \end{aligned} \tag{2}$$

where $Q^* \equiv n^{\frac{1}{\rho}} q^*$ and $P \equiv \frac{n^{1-\frac{1}{\rho}}c}{\rho}$ represents the price index of the differentiated goods. Consequently:

1. *The consumption of each good is increasing in income $\left(\frac{\partial q^*}{\partial I} \geq 0 \text{ and } \frac{\partial q_0^*}{\partial I} \geq 0\right)$.*
2. *Richer agents will allocate more of their extra income (if any) to consumption of the composite good $\left(\frac{\partial^2 q^*}{\partial I^2} > 0\right)$ if and only if :*

$$\frac{U_{111}(q_0^*, Q^*)}{\left[U_{11}(q_0^*, Q^*)\right]^2} < P \cdot \frac{U_{222}(q_0^*, Q^*)}{\left[U_{22}(q_0^*, Q^*)\right]^2}. \tag{3}$$

3. *the optimal quantities are linearly increasing in income $\left(\frac{\partial^2 q_0^*}{\partial I^2} = \frac{\partial^2 q^*}{\partial I^2} = 0\right)$ if the utility function is linear in one good or quadratic in both goods*

Proof. see Appendix. □

In our mind, the static good corresponds to the necessary goods and the diversified good corresponds to all other goods and services in the economy which are not needed to satisfy basic needs. As a result, it seems natural to consider that condition (3) is satisfied and that $\frac{\partial^2 q^*}{\partial I^2} > 0$, which simply corresponds to the Engel effect that the share of goods satisfying basic needs in the consumption bundle should decrease with income.

2.2 Political equilibrium

To model the political environment, we begin by borrowing the RRMR framework of the standard model of redistributive politics. We consider redistribution via a lump sum transfer T financed by a linear income tax τ. Without loss of generality, we assume two income classes of agents (we present in section 4.1 a generalization to three classes) indexed by $j = \{L; R\}$ with respective incomes I^L and $I^R (> I^L)$ and respective proportions α^L and α^R. After-tax income of all individuals in group j therefore can be written as $\widehat{I}^j(\tau) = (1-\tau)I^j + \tau\widetilde{I}$, where $\widetilde{I} \equiv \sum_j \alpha^j I^j$, and the government's budget constraint can be written as $T = \tau\widetilde{I}$. As $I^L < \widetilde{I} < I^R$, we naturally have $\partial\widehat{I}^L/\partial\tau > 0$ and $\partial\widehat{I}^R/\partial\tau < 0$. To make interpretation easy, it is useful to rewrite both incomes as a function of mean income. In that case, $I^L = \theta\widetilde{I}/\alpha^L$ and $I^R = (1-\theta)\widetilde{I}/(1-\alpha^L)$, where $\theta \equiv \alpha^L I^L/\widetilde{I} < \alpha^L$ is a measure of inequality.

Voters have to choose between two candidates, A and B, who offer tax rates τ_A and τ_B, respectively. We suppose that the political equilibrium level of taxation is determined according to the probabilistic voting model of Lindbeck and Weibull (1987).[6] In the probabilistic voting model, the voter i of group j prefers candidate A (to candidate B) if

$$U^j(\tau_A) > U^j(\tau_B) + \sigma^{ij} + \delta. \tag{4}$$

In equation (4), $U^j(\tau)$ is the utility achieved by agents of group j when the tax is τ, i.e., $U^j(\tau) \equiv U\left(q_0^*\left(\widehat{I}^j(\tau)\right), Q^*\left(\widehat{I}^j(\tau)\right)\right)$; idiosyncratic individual preferences for candidate A are represented by the random parameter σ^{ij} which may be group-specific and is assumed to be uniformly distributed over the support $\left[-\frac{1}{2\phi^j}, \frac{1}{2\phi^j}\right]$; and δ is a random parameter that represents the population's preference for candidate A, which is assumed to be uniformly distributed over the support $\left[-\frac{1}{2\xi}; \frac{1}{2\xi}\right]$. Distributions of σ^{ij} and δ are common knowledge.

The timing of the political game is as follows:

1. Both candidates announce simultaneously and non-cooperatively their political platform τ_A and τ_B (commitment is assumed to be perfect),
2. Realizations of σ^{ij} and δ are revealed (privately for the former, publicly for the latter),
3. Elections take place, and
4. The winning policy platform is implemented.

[6] As opposed to the standard median-voter models used by RRMR, in the probabilistic voting set-up, the intensity of preference of all voters matters for determining the political equilibrium and voters have idiosyncratic non-economic preferences for candidates. In such a framework, we can have poor agents support the low-tax candidates and rich candidates support the high-tax candidate, as in reality. By contrast, the RRMR-type models do not allow for voters to vote against the policy that maximizes their utility function.

Remark 2. *The political equilibrium tax rate is defined by:*

$$\underbrace{\phi^L \cdot \frac{\partial U}{\partial I}\left(q_0^*\left(\widehat{I}^L(\tau)\right), Q^*\left(\widehat{I}^L(\tau)\right)\right)\left(\alpha^L-\theta\right)}_{GAIN}+\underbrace{\phi^R \frac{\partial U}{\partial I}\left(q_0^*\left(\widehat{I}^R(\tau)\right), Q^*\left(\widehat{I}^R(\tau)\right)\right) \cdot \left(\theta-\alpha^L\right)}_{LOSS}=0. \tag{5}$$

Proof. see Appendix. □

Equation (5) implicitly defines τ^* (and therefore $\widehat{I}^{L*}$ and $\widehat{I}^{R*}$). This condition is intuitive to understand. To maximize the probability of winning, each candidate announces a tax rate such that her expected share of votes is maximized (and equal to one half at the symmetric equilibrium). At the equilibrium, τ is such that any deviation from this platform would cause a decrease in expected vote share. A marginal increase (resp. decrease) in the tax rate offered by one candidate leads to a gain (resp. loss) of $\frac{\xi}{\phi}GAIN$ poor voters and a loss (resp. gain) of $-\frac{\xi}{\phi}LOSS$ of rich voters. The number of voters who switch candidates depends on two factors: (i) the intensity of their individual preference for each candidate represented by ϕ^j (i.e., the number or swing voters in each group) and (ii) the effect on utility of a change in the tax rate: $\frac{\partial U}{\partial I} \cdot \frac{\partial \widehat{I}^j}{\partial \tau}$. At equilibrium, gains and losses compensate and no candidate has an incentive to deviate from the policy platform.

3 The effect of an increase in the number of varieties

Now that we have described both the market and the political equilibria, we can analyze the effect on the equilibrium tax rate of an exogenous increase in the number of varieties. Let us first analyze, using equation (5), under which conditions the equilibrium tax rate τ is decreasing with the number of varieties n.

Lemma 1. *Assuming $\phi^R \geq \phi^L$ (that is that the political preferences of rich agents are equally or more concentrated than the ones of poor agents), a sufficient condition for the equilibrium tax rate to be decreasing in the number of variety ($\partial\tau^*/\partial n \leq 0$) is that*

$$\frac{\partial^3 U}{\partial I^2 \partial n}(q_0^*, Q^*) \geq 0, \tag{6}$$

i.e., that the marginal utility of money increases more with the number of variety for richer agents.

Proof. see Appendix. □

Condition (6) is quite intuitive. In the limiting case, if *(i)* the political weight of the swing voter of each group is the same ($\phi^L = \phi^R = \phi$) and *(ii)* the marginal utility of income increases by the same amount for the swing voters of each group after an increase in the number of varieties, n $\left(\frac{\partial^2 U\left(q_0^*\left(\widehat{I}^L(\tau)\right), Q^*\left(\widehat{I}^L(\tau)\right)\right)}{\partial I \partial n} = \frac{\partial^2 U\left(q_0^*\left(\widehat{I}^R(\tau)\right), Q^*\left(\widehat{I}^R(\tau)\right)\right)}{\partial I \partial n}\right)$, then a marginal modification of the tax rate platform by one candidate is not profitable, as the number of voters who switch candidates exactly compensates. If, after an increase in n, the marginal utility of income increases more for rich voters than for poor ones, a marginal decrease in the tax rate becomes profitable for a candidate as, all else equal, it would attract more rich voters to its policy platform than the resulting loss of poor voters. Both candidates find this deviation profitable and the equilibrium tax rate decreases as the number of varieties increases. This effect is reinforced if $\phi^R > \phi^L$, that is if poorer voters have more dispersed preferences. Note however that most of the literature on probabilistic voting assume a common dispersion parameter across groups ($\phi^R = \phi^L$). This last case, contained in our Proposition, seems to be consistent with data. Using the World Values Survey, we indeed can compute the standard errors of political preferences for different income classes. We then find, that the dispersion (standard error) of responses on redistribution or political preferences are similar for the respondents of the upper and the lower class (see the Appendix for methodological concerns). Note finally that $\phi^R \geq \phi^L$ and (6) are sufficient conditions. Put another way, the equilibrium tax rate can be decreasing in the number of variety although richer voters have more dispersed political preferences ($\phi^R < \phi^L$) if the marginal utility of money increases "sufficiently more" with the number of variety for richer agents (i.e. if $\frac{\partial^3 U}{\partial I^2 \partial n}(q_0^*, Q^*)$ is high enough).

Let us now understand how condition (6) is linked to individual preferences, that is how the welfare effect of an increase in the number of varieties varies with income.

Proposition 1. *An increase in the number of varieties optimaly*

1. *benefits to each agents (whatever her disposable income) as soon as she consumes some of the composite good* $\left(\frac{\partial U(q_0^*, Q^*)}{\partial n} > 0 \text{ when } Q^* > 0\right)$

2. *benefits more to richer agents* $\left(\frac{\partial^2 U(q_0^*, Q^*)}{\partial n \partial I} > 0\right)$ *if and only if:*

$$\frac{-Q^* U_{22}(q_0^*, Q^*)}{U_2(q_0^*, Q^*)} \leq 1. \tag{7}$$

3. *leads to a higher increase in marginal utility for richer agents* $\left(\frac{\partial^3 U(q_0^*, Q^*)}{\partial n \partial I^2} > 0\right)$ *under conditions (3), (7) and*

$$\frac{-Q^* U_{222}(q_0^*, Q^*)}{U_{22}(q_0^*, Q^*)} < 2, \tag{8}$$

Therefore, from Lemma 1, assuming $\phi^R \geq \phi^P$, the equilibrium tax rate is decreasing in the number of varieties when (3), (7) and (8) hold.

The sign of $\frac{\partial^3 U(q_0^*,Q^*)}{\partial n \partial I^2}$ is a priori ambiguous and notably depends on the value of $\partial^2 Q^*/\partial I^2$ (which is positive under condition (3)): a feature of non-homothetic preferences. $\partial^2 Q^*/\partial^2 I > 0$ indicates that the share of an extra unit of income spent on good Q is increasing in income (see Latzer and Mayneris, 2012 for a discussion of modeling non-homothetic preferences). The larger $\partial^2 Q^*/\partial^2 I$, the more marginal utility of income increases with n for the rich compared to the poor. Note that (3), (7) and (8) are sufficient conditions for (6). In particular, (6) may hold even when (8) is not met, if $\partial^2 Q^*/\partial^2 I$ is high enough. Therefore, if preferences are "non-homothetic enough" in favor of composite good Q, an increase in the number of varieties n makes the equilibrium tax rate τ^* decrease.

Conditions (7) and (8) are typical in decision theory. Condition (7) corresponds to agents having a coefficient of relative risk aversion with respect to the composite good lower than one; which is consistent with most existing empirical results, see Chetty (2006). In the case of CRRA utility functions ($U(q_0, Q) = v(q_0) + \frac{Q^{1-\alpha}}{1-\alpha}$, $\alpha \neq 1$), it corresponds to α being lower than 1 (as then $\frac{-Q^* U_{22}}{U_2} = \alpha$).[7] Similarly, condition (8) corresponds to "relative prudence" being lower than 2, a condition which is generally accepted (see Eeckhoudt et al., 2009, Hadar and Seo, 1990 and Choi et al., 2001). In particular it is a necessary condition for a second-order dominant shift in the return of a risky asset to increase its demand.[8]

In this section, we have characterized the conditions under which an increase in the diversity of goods could have shifted the equilibrium level of redistribution toward the policy preferences of rich agents. The channel depends on how the relative marginal utility from income of rich and poor agents are affected. In a voting game, this determines the relative number of agents in the two groups who would change their vote if a marginal change in the policy platform is implemented. If the marginal utility of the rich agent increases sufficiently relatively to the poor agents, it's profitable for both candidates to deviate and decrease the tax rate. We show this is the case if preferences are sufficiently non-homothetic. To our knowledge, this is the first paper to highlight the increase in goods diversity and uneven gains from such an increase as a possible explanation for the decrease in redistribution observed over the last decades.

4 Extensions and special cases

4.1 Generalization to three income groups

Let us now extend our model to three income groups ($j = \{L, M, R\}$ with $I^L < I^M < I^R$) and show that results are qualitatively unchanged. In other words, we assume in this section the existence

[7] For logarithm utility for the composite good ($U(q_0, Q) = v(q_0) + log(Q)$) the level of income doesn't impact the utility gains from an increase in variety: $\left(\frac{\partial^2 U(q_0^*,Q^*)}{\partial n \partial I} = 0\right)$ as soon as $Q^* > 0$.

[8] For the most general case of HARA utility function, i.e. $U(q, Q) = v(q) + \alpha\left(\beta + \frac{Q}{\gamma}\right)^{1-\gamma}$ with $\frac{\alpha(1-\gamma)}{\gamma} > 0$ and $\beta + \frac{Q}{\gamma} > 0\ \forall\ Q$, that includes as special cases quadratic preferences when $\gamma = -1$, CRRA when $\beta = 0$ and CARA when $\gamma \to +\infty$; we have $\frac{-Q^* U_{22}}{U_2} = \left(\frac{\beta}{Q^*} + \frac{1}{\gamma}\right)^{-1}$ and $\frac{-Q^* U_{222}}{U_{22}} = \frac{\gamma+1}{\gamma}\left(\frac{\beta}{Q^*} + \frac{1}{\gamma}\right)^{-1}$.

of a middle class that can benefit from redistribution. As in the two-group case, let us define: $I^L = \theta^L \widetilde{I}/\alpha^L$, $I^M = \theta^M \widetilde{I}/\alpha^M$ and $I^R = (1-\theta^L-\theta^M)\widetilde{I}/(1-\alpha^L-\alpha^M)$, with $\theta^L < \alpha^L$ and $\theta^M < \alpha^M$ (this last assumption is necessary to ensure that middle class voters may benefit from redistribution). The equilibrium tax rate is then defined by:

$$\phi^L \frac{\partial U\left(\widehat{I}^L\right)}{\partial I}\left(\alpha^L-\theta^L\right)+\phi^M \frac{\partial U\left(\widehat{I}^M\right)}{\partial I}\left(\alpha^M-\theta^M\right)+\phi^R \frac{\partial U\left(\widehat{I}^R\right)}{\partial I}(\theta^M+\theta^L-\alpha^L-\alpha^M)=0, \quad (9)$$

where we are suppressing the argument of $\widehat{I}^j$, which as before denotes the net income of individuals in income group j. As before, the equilibrium tax rate will decrease with an increase in the number of varieties, if and only if:

$$\phi^L \frac{\partial^2 U\left(\widehat{I}^L\right)}{\partial I \partial n}\left(\alpha^L-\theta^L\right)+\phi^M \frac{\partial^2 U\left(\widehat{I}^M\right)}{\partial I \partial n}\left(\alpha^M-\theta^M\right)<\phi^R \frac{\partial^2 U\left(\widehat{I}^R\right)}{\partial I \partial n}(\alpha^L+\alpha^M-\theta^M-\theta^L). \quad (10)$$

Due to the existence of three parameters for concentration of political preferences (ϕ^L, ϕ^M and ϕ^L) this condition is harder to discuss than that from the two-group case. Still, one can easily see that if $\phi^L = \phi^M = \phi^R$, condition (10) is satisfied when $\frac{\partial^3 U}{\partial I^2 \partial n} > 0$. In that case, under the same conditions of Proposition 1, the equilibrium tax rate is increasing in the number of varieties.

4.2 The case of quasi-linear utility function

To analyze more precisely the effects highlighted in our general model, in this subsection we specify the utility function to be quasi-linear. More precisely, we assume $U(q_0; Q) = \ln q_0 + Q$, as is standard in the political economics literature. This allows us to analyze more specifically (in section 4.2.1) the mechanisms described above and to examine a variation of the model where taxes are used to provide a public good (in section 4.2.2).

4.2.1 The case of redistribution

Let us first analyze how the general model described in section 2 simplifies in the special case of quasi-linear preferences. With such a utility function, we have $U_1(q_0, Q) = \frac{1}{q_0}$, $U_2(q_0, Q) = 1$ and (2) gives $q_0^* = \frac{c}{\rho} n^{1-\frac{1}{\rho}} = P$. Therefore:

$$q_0^* = \begin{cases} P & \text{if } I > P \\ I & \text{if } I \leq P \end{cases} \quad \text{and } Q^* = \begin{cases} I/P - 1 & \text{if } I > P \\ 0 & \text{if } I \leq P \end{cases} \quad (11)$$

This demand system is very strongly non-homothetic. The marginal propensity to consume the composite good either equals 0 (if $I \leq P$) or 1 (if $I > P$). In such a case, the static good can be understood as a subsistence good.

Regarding the political stage, the interesting case arises when we assume that the poor don't consume the composite good $\left(\widehat{I}^L < P\right)$ whereas the rich do $\left(\widehat{I}^R > P\right)$[9]. In that situation, we have $\partial U\left(\widehat{I}^{L*}\right)/\partial n = 0$ and $\partial U\left(\widehat{I}^{R*}\right)/\partial n > 0$. Therefore, $\partial^2 U\left(\widehat{I}^{L*}\right)/\partial I \partial n = 0 < \partial U\left(\widehat{I}^{R*}\right)/\partial I \partial n$ and by Lemma 1, an increase in the number of varieties decreases the equilibrium tax rate.

This result can be made more explicit by considering the equilibrium tax rate. Using (5), the optimal tax rate is defined by:

$$\phi^L(\alpha^L - \theta)\frac{\alpha^L}{(1-\tau)\theta + \tau\alpha^L} + \phi^R(\theta - \alpha^L)\frac{\widetilde{I}}{n^{1-\frac{1}{\rho}}c/\rho} \equiv f(n,\tau) = 0. \tag{12}$$

We then easily obtain: $d\tau^*/dn = -(\partial f(n,\tau)/\partial n)/(\partial f(n,\tau)/\partial \tau) < 0$.

This clear-cut result comes from the fact that, in the present case, only rich voters benefit from an increase in the number of varieties n. At a given equilibrium tax rate, after an increase in n, a marginal decrease of the tax rate platform becomes profitable for political candidates as more rich will switch their vote.

Regarding the three-type case, the interesting equilibrium arises when both the middle class and the rich consume the differentiated good: $\widehat{I}^L < P$ and $\widehat{I}^R > \widehat{I}^M > P$. In such a situation, the equilibrium tax rate is defined by:

$$\phi^L(\alpha^L - \theta^L)\frac{\alpha^L}{(1-\tau)\theta^L + \tau\alpha^L} + \phi^M(\alpha^M - \theta^M)\frac{\widetilde{I}}{n^{1-\frac{1}{\rho}}c/\rho} + \phi^R(\theta^M + \theta^P - \alpha^L - \alpha^M)\frac{\widetilde{I}}{n^{1-\frac{1}{\rho}}c/\rho} = 0. \tag{13}$$

Here, contrary to the two-type case, an increase of the number of varieties n may have an ambiguous impact, depending on the intensity of political preferences. Still, if

$$(\phi^M - \phi^R)\cdot(\alpha^M - \theta^M) + \phi^R(\theta^P - \alpha^P) < 0, \tag{14}$$

then $\partial\tau^*/\partial n < 0$. As we assumed $\alpha^M > \theta^M$ and $\alpha^P > \theta^P$, condition (14) will be verified if $\theta^R \geq \theta^M$, i.e., if the dispersion of political preferences is not lower for the upper class than for the middle class.

4.2.2 The case of public goods

The use of a specific utility function also allows us to consider the case when tax revenues are used to finance the provision of a pure public good. We denote by G the quantity of public good provided. As is usual in the literature, we assume that G enters preferences the following way:

$$U(q_0, G, Q) = \ln q_0 + a \ln G + Q \tag{15}$$

[9] If other cases $\frac{\partial^2 U(\widehat{I}^{L*})}{\partial I \partial n} = \frac{\partial^2 U(\widehat{I}^{R*})}{\partial I \partial n}$ and an increase in n doesn't have any effect on the equilibrium tax rate.

In this case, the consumer's budget constraint is written $(1-\tau)I = \widehat{I} = q_0 + PQ$ and the government's balanced-budget condition is written $T = \tau\widetilde{I} = P_G G$, where P_G corresponds to the relative price for the government of providing the public good. As in the above case, we obtain $q_0 = P$ if $\widehat{I} > P$ and $q_0 = \widehat{I}$ if $\widehat{I} < P$. Therefore, assuming again that poor individuals do not consume the composite good ($\widehat{I}^L < P$) contrary to the rich ones ($\widehat{I}^R > P$), the following utilities are achieved at the optimum:

$$U^L(\tau) = \ln\left((1-\tau)I^L\right) + a\ln\left(\tau\widetilde{I}/P_G\right) \tag{16}$$

$$U^R(\tau) = \ln P + a\ln\left(\tau\widetilde{I}/P_G\right) + \frac{(1-\tau)I^R}{n^{1-\frac{1}{\rho}}c/\rho} \tag{17}$$

and the equilibrium tax rate is implicitly defined by:

$$-\frac{\alpha^L\phi^L}{(1-\tau)} + \left(\alpha^L\phi^L + \alpha^R\phi^R\right)\frac{a}{\tau} - \frac{\alpha^R\phi^R I^R}{n^{1-\frac{1}{\rho}}c/\rho} = 0 \tag{18}$$

If, conversely, both type of agents consume the differentiated goods, $U^R(\tau)$ remains the same but

$$U^L(\tau) = \ln P + a\ln\left(\tau\widetilde{I}/P_G\right) + \frac{(1-\tau)I^L}{n^{1-\frac{1}{\rho}}c/\rho} \tag{19}$$

The equilibrium tax rate is then implicitly defined by:

$$\left(\alpha^L\phi^L + \alpha^R\phi^R\right)\frac{a}{\tau} - \frac{\alpha^L\phi^L I^L + \alpha^R\phi^R I^R}{n^{1-\frac{1}{\rho}}} = 0 \tag{20}$$

From (18) and (20), it appears that, in both cases, an increase in the diversity of goods unambiguously decreases the equilibrium tax rate. This comes from the fact that an increase in n increases the marginal utility of consuming the private good, while the marginal utility from consuming the public good remain constant.

5 Empirical Analysis

In this section, we provide some empirical evidence that supports our theoretical conclusions. The goal of this section is not to perform a detailed analysis of the mechanism highlighted in the paper such that the degree of non-homothetic preferences between the homogeneous necessity good and the other goods in the economy. This goes beyond the scope of this paper. Rather, we provide simple correlations between the diversity of goods and redistribution which are consistent with our model. The major difficulty of such an analysis is to find a proxy for the diversity of goods. In our mind, a major force behind the increase in the diversity of goods documented in the literature (see Bils and Klenow, 2001) is globalization and increasing trade volumes. New trade theories generally predict an increase in the variety of goods available to consumers which leads to welfare gains for consumers (see Broda and Weinstein, 2004, 2006; Hummels and Klenow, 2005; Arkolakis, Demidova, Klenow, and Rodriguez-Clare, 2008 for empirical evidence).

We have analyzed a panel of OECD countries going back as far as 1962 when the data is available. Our analysis considers three proxies for fiscal redistribution: the index of Fiscal Freedom from the Heritage Foundation (Heritage Foundation, 2013), the percentage of GDP spent on government consumption from the World Development Indicators (World Bank, 2013), and the percentage of GDP spent on overall government expenditures from the Penn World Table (Heston et al., 2010). Indeed, government expenditure that provides public goods corresponds to indirect redistribution if financed through proportional taxation. We use data on imports as a percentage of GDP from the World Development Indicators (World Bank, 2013) and data on research and development capital stocks from Coe et al. (2009) as proxies for goods diversity. Summary statistics from our baseline sample are reported in table 1.[10]

Tables 2 and 3 present results from fixed effects regressions that take the following general form:

$$redistribution_{it} = \alpha \times income_{it-1} + \beta \times diversity_{it-1} + \Gamma' X_{it} + \delta_i + \delta_t + u_{it}, \tag{21}$$

where the δ_t's denote a full set of time effects that capture common shocks to the the degree of fiscal redistribution, the δ_i's denote a full set of country dummies that capture any time-invariant country characteristics that affect the degree of fiscal redistribution, and u_{it} is an error term that captures all other factors, with $E(u_{it}) = 0$ for all countries i and all time periods t. In all of the results we report standard errors that have been clustered at the country level.

We use per capita Gross National Income from the World Development Indicators (World Bank, 2013) to control for income. X is a vector composed of other variables that theoretically may have an impact on redistributive fiscal policy, namely proxies for income inequality and fiscal competition. To control for income inequality, we draw upon the recent Standardized World Inequality Indicators Database (SWIID), constructed and maintained by Frederick Solt (Solt, 2009).[11] As a rough proxy for the degree of fiscal competition between OECD countries, we calculate the period average of the relevant dependent variable across the OECD countries.

[10]Note that the foreign R&D capital stocks are calculated by Coe et al. (2009) using bilateral-import weighted averages of each countries' trading partners' domestic R&D capital stocks. This results in more weight being given to foreign R&D expenditure by trade partners with high trade flows and yields a global R&D spending index that corresponds better to the exposure of consumers to our proxy for goods diversity. Coe et al. (2009) have built these measures using the business sector R&D expenditure from the OECD Directorate of Science, Technology and Industry's ANBERD database; and the bilateral imports from the IMF Direction of Trade database.

[11]The SWIID combines the Luxembourg Income Study with the World Inequality Indicators Database and standardizes the measurements across the two databases yielding a cross-national panel that is significantly enlarged from the individual databases. We report results using Gini coefficients calculated from the net (after taxes and transfers) income distribution. The coefficients on our diversity of goods proxies are virtually identical if we control for inequality using the Gini coefficient calculated based on market (before taxes and transfers) income distribution. We do not report these results, though they are available upon request.

All results reported are from regressions that have lagged the explanatory variables one period. In both tables, the top panel presents results from panel regressions with 5-year time periods and the bottom panel presents results from panel regressions with yearly data. Despite the reduction in sample size, in general, we prefer using the 5-year time periods since political cycles that determine changes in fiscal redistribution typically exceed one year.[12]

Table 2 uses the ratio of imports to GDP as a proxy for goods diversity. The three sets of regressions each use one of the three proxies for fiscal redistribution as the dependent variable. The first column of each set of regressions does not include controls beyond income and fixed effects. The second column of each set of regressions controls for income inequality and the lagged OECD average of the dependent variable. Recalling that the Fiscal Freedom index is inversely related to the degree of fiscal redistribution, the results are qualitatively similar across (i) the three different dependent variables, (ii) the panel length used and (iii) controls for other theoretically relevant variables. Controlling for time and country fixed effects, an increase in openness is correlated with a future decrease in fiscal redistribution. Of course, we cannot say anything about the extent to which the relationship is causal, as anticipated future period reductions in fiscal redistribution could plausibly increase current period trade volumes. Demonstrating that the causal relationship runs from current openness to future fiscal redistribution is beyond the scope of our empirical investigation, which only seeks to explore whether the correlations are consistent with our theoretical intuitions.

In a seminal paper, Rodrik (1998) argues that increased trade leads to a more volatile and risky economic environment for individuals and leads to bigger governments as a means for voters to insure themselves against the volatility that globalization induces. Rodrik (1998) shows, on a cross-section of countries, that more open economies also have bigger governments. Using panel data with country and period fixed effects, we obtain the opposite results. In our estimations, when advanced economies become more open, their governments tend to become smaller.[13]

Table 3 is the analogue to table 2 with research and development (R&D) capital stocks as the proxy for goods diversity from Coe et al. (2009). Unfortunately this data is available for fewer countries and for a shorter time period, so the sample is significantly reduced from that used in the previous regressions. Nevertheless, the results are qualitatively similar: over the entire battery of regressions presented in table 3, increases in the proxy for goods diversity are significantly correlated with future period reductions in the proxies for fiscal redistribution.

6 Concluding Remarks

This paper has presented a novel explanation for the observed decline in income tax rates and fiscal redistribution in the advanced democracies over the last decades, which current political economic

[12] An additional advantage of using 5-year panels is to smooth out measurement errors.

[13] Other papers have found that the empirical conclusions of Rodrik (1998) are not robust to (*i*) sensible decompositions of government spending (Garen and Trask, 2005), nor to (*ii*) the introduction of fixed effects in panel data (Benarroch and Pandey, 2012).

theories of fiscal redistribution are not able to explain. In a probabilistic voting framework we have argued that the rise in the diversity of goods over the same period has increased the marginal utility of income for the rich, who disproportionately consume a diverse array or consumer goods, and strengthened political preferences against fiscal redistribution. Using proxies for goods diversity and for fiscal redistribution for a panel of OECD countries, we provide some supporting evidence for the theoretical predictions of our political economic model.

If the empirical part of our paper confirms the negative correlation between proxies of diversity and proxies of redistribution, more work need to be done to clearly identify the effect of good diversity on taxation. First, it might be useful to better proxy the number of goods available in the economy, for example using disaggregated sectorial data on trade in the spirit of Feenstra, Madani, Yang, and Liang (1999). This however entails computational issues as Feenstra et al. (1999) only work on U.S. data whereas we would like to build data on a panel of OECD countries. Second, one might want to test our intermediate mechanism that an increase in diversity decreases the willingness to be taxed (through marginal utility) and more so for richer individual. This seems to be testable using data from the World Value Survey questions that ask, for example, the extent to which respondent believe that "an essential characteristic of democracy" is that "governments tax the rich and subsidize the poor".

References

Acemoglu, D., Autor, D. H., Dorn, D., Hanson, G. H., Price, B., 2014a. Import competition and the great U.S. employment sag of the 2000s. MIT working paper.

Acemoglu, D., Naidu, S., Restrepo, P., Robinson, J., 2014b. Democracy, redistribution and inequality. NBER Working Paper 19746.

Arkolakis, K., Demidova, S., Klenow, P., Rodriguez-Clare, A., 2008. The gains from trade with endogenous variety. American Economic Review: Papers and Proceedings 98 (4), 444–450.

Austin-Smith, D., 1987. Interest groups, campaign contributions, and probabilistic voting. Public Choice 54, 123–139.

Autor, D. H., Dorn, D., 2013. The growth of low-skill service jobs and the polarization of the U.S. labor market. American Economic Review 103 (5), 1553–1597.

Becker, G. S., August 1983. A theory of competition among pressure groups for political influence. Quarterly Journal of Economics 98 (3), 371–400.

Bénabou, R., 1996. Inequality and growth. In: NBER Macroeconomics Annual 1996, Volume 11. MIT Press, pp. 11–92.

Bénabou, R., Ok, E. A., May 2001. Social mobility and the demand for redistribution: The POUM hypothesis. Quarterly Journal of Economics 116 (2), 447–487.

Benarroch, M., Pandey, M., 2012. The relationship between trade openness and government size: Does disaggragating government expenditure matter? Journal of Macroeconomics 34, 239–252.

Bils, M., Klenow, P. J., 2001. The acceleration in variety growth. American Economic Review 91, 274–280.

Bonica, A., McCarty, N., Poole, K. T., Rosenthal, H., 2013. Why hasn't democracy slowed rising inequality? The Journal of Economic Perspectives 27 (3), 103–123.

Borck, R., 2007. Voting, inequality and redistribution. Journal of Economic Surveys 21 (1), 90–109.

Broda, C., Weinstein, D. E., 2004. Variety growth and world welfare. American Economic Review: Papers and Proceedings 94 (2), 139–144.

Broda, C., Weinstein, D. E., May 2006. Globalization and the gains from variety. Quarterly Journal of Economics 121 (2), 541–585.

Chetty, R., December 2006. A new method of estimating risk aversion. American Economic Review 96 (5), 1821–1834.

Chirinko, R. S., Wilson, D. J., 2011. Tax competition among U.S. states: Racing to the bottom or riding on a seesaw? CESifo Working Paper Series (3535).

Choi, G., Kim, I., Snow, A., 2001. Comparative statics predictions for changes in uncertainty in the portfolio and savings problems. Bulletin of Economic Research 53 (1), 61–72.

Coe, D. T., Helpman, E., Hoffmaister, A. W., 2009. International R&D spillovers and institutions. European Economic Review 53 (7), 723–741.

Corneo, G., Gruner, H. P., 2000. Social limits to redistribution. American Economic Review 90 (5), 1491–1507.

Dixit, A., Londregan, J., Nov. 1996. The determinants of success of special interests in redistributive politics. The Journal of Politics 58 (4), 1132–1155.

Dixit, A. K., Stiglitz, J. E., June 1977. Monopolistic competition and optimum product diversity. American Economic Review 67 (3), 297–308.

Eeckhoudt, L., Etner, J., Schroyen, F., July 2009. The values of relative risk aversion and prudence: A context-free interpretation. Mathematical Social Sciences 58 (1), 1–7.

Engel, E., 1857. Die productions-und consumptionsverhaltnisse des konigreichs. Zeitschrift des Statistischen Bureaus des Koniglich Sdchsischen Ministerium des Inneren 8.

Epple, D., Romer, T., 1991. Mobility and redistribution. Journal of Political Economy 99 (4), 828–58.

Feenstra, R. C., Madani, D., Yang, T.-H., Liang, C.-Y., 1999. Testing endogenous growth in South Korea and Taiwan. Journal of Development Economics 60 (2), 317–341.

Garen, J., Trask, K., 2005. Do more open economies have bigger governments? Another look. Journal of Development Economics 77, 533–551.

Gradstein, M., Milanovic, B., 2004. Does liberté= égalité? a survey of the empirical links between democracy and inequality with some evidence on the transition economies. Journal of Economic Surveys 18 (4), 515–537.

Grossman, G. M., Helpman, E., 2001. Special Interest Politics. MIT press.

Gupta, S., Keen, M., Sep. 2014. Fiscal policy and income inequality. IMF Policy Paper 2012034.

Hadar, J., Seo, T. K., August 1990. The effects of shifts in a return distribution on optimal portfolios. International Economic Review 31 (3), 721–36.

Harms, P., Zink, S., November 2003. Limits to redistribution in a democracy: A survey. European Journal of Political Economy 19 (4), 651–668.

Heritage Foundation, 2013. Index of Economic Freedom. http://www.heritage.org/index/.

Heston, A., Sumers, R., Aten, B., 2010. Penn World Table, version 7.1. Center for International Comparisons of Production, Income and Prices, University of Pennsylvania.

Hummels, D., Klenow, P. J., 2005. The variety and quality of a nation's exports. American Economic Review 95 (3), 704–723.

Isen, A., 2014. Do local government fiscal spillovers exist? evidence from counties, municipalities, and school districts. Journal of Public Economics 110, 57–73.

Latzer, H., Mayneris, F., Sep. 2012. Income distribution and vertical comparative advantage: Theory and evidence. CORE Discussion Papers 2012034.

Lindbeck, A., Weibull, J., 1987. Balanced-budget redistribution as the outcome of political competition. Public Choice 52 (3), 273–297.

Meltzer, A. H., Richard, S. F., October 1981. A rational theory of the size of government. Journal of Political Economy 89 (5), 914–27.

Parchet, R., 2013. Are local tax rates strategic complements or substitutes? University of Lugano Working Paper.

Roberts, K. W., 1977. Voting over income tax schedules. Journal of Public Economics 8 (3), 329–340.

Rodrik, D., 1998. Why do more open economies have bigger governments? Journal of Political Economy 106 (5), 997–1032.

Roemer, J. E., December 1998. Why the poor do not expropriate the rich: An old argument in new garb. Journal of Public Economics 70 (3), 399–424.

Romer, T., 1975. Individual welfare, majority voting, and the properties of a linear income tax. Journal of Public Economics 4 (2), 163–185.

Slemrod, J., Bakija, J., 2008. Taxing Ourselves: A Citizen's Guide to the Debate over Taxes, fourth edition. MIT Press, Cambridge.

Solt, F., 2009. Standardising the world income inequality database. Social Science Quarterly 90 (2), 231–242. SWIID Version 4.0, September 2013.

Wilson, J. D., 1999. Theories of tax competition. National Tax Journal 52 (2), 269–304.

World Bank, 2013. World Development Indicators. The World Bank Group, Washington DC.

Tables

Table 1: Summary statistics for baseline sample

	Obs.	Mean	Std. Dev.	Min	Max
H.F. Fiscal Freedom	549	58.34654	13.08754	29.8	89.5
Govt. Cons. (% GDP)	1262	17.76018	4.749724	6.288419	29.78844
Govt. Exp. (% GDP)	1233	7.020303	1.95557	2.013721	17.00064
lagged Income p.c.	1262	15857.39	14994.65	110	86390
lagged Imports/GDP	1262	33.82365	20.29205	4.268964	151.7525
lagged R&D capital stock	719	49.27358	41.72371	10.83283	266.9443

Table 2: Panel Regressions. Trade Explanatory Variables from WDI.

	H.F. Fiscal Freedom		Govt. Cons. (% GDP)		Govt. Exp. (% GDP)	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: 5-year panels						
(Imports / GDP) $_{t-1}$	0.5391***	0.3891***	-0.0671*	-0.0476+	-0.0649***	-0.0525***
	(0.126)	(0.127)	(0.037)	(0.031)	(0.017)	(0.015)
Gini $_{t-1}$		1.3227*		0.0378		-0.0504
		(0.661)		(0.125)		(0.049)
OECD mean dep. var.$_{t-1}$		0.7505***		1.3881***		0.2934+
		(0.261)		(0.342)		(0.188)
Income per capita control	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Period fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	113	88	231	222	231	222
Countries	30	30	30	30	30	30
within R^2	0.4640	0.5897	0.5074	0.4726	0.2880	0.3320
Panel B: 1-year panels						
(Imports / GDP) $_{t-1}$	0.2476**	0.2243*	-0.0291	-0.0166	-0.0439***	-0.0346***
	(0.113)	(0.123)	(0.029)	(0.025)	(0.013)	(0.012)
Gini $_{t-1}$		-0.0454		0.0817		-0.0337
		(0.490)		(0.129)		(0.046)
OECD mean dep. var.$_{t-1}$		1.0829***		1.2560***		-0.8873
		(0.242)		(0.261)		(0.613)
Income per capita control	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Period fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	549	494	1262	1199	1233	1175
Countries	30	30	30	30	30	30
within R^2	0.4235	0.4139	0.5303	0.4972	0.2523	0.2923

Notes: *, **, and *** indicate significance at 10, 5, and 1 % levels, respectively. Fiscal Freedom measure is increasing in fiscal freedom, denoting less redistribution, and is from the Heritage Foundation. Government consumption as a percentage of GDP is from the World Development Indicators and Government's share of GDP is from the Penn World Tables. GNI per capita data is also from the World Development Indicators. The Gini coefficient is a measure of after-tax income inequality that has been standardized across several common sources (Solt, 2009). Higher Gini coefficients indicate greater income inequality. Standard errors have been clustered at the country level.

Table 3: Panel Regressions. R&D Explanatory Variables from CHH.

	H.F. Fiscal Freedom		Govt. Cons. (% GDP)		Govt. Exp. (% GDP)	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: 5-year panels						
foreign + domestic R&D $_{t-1}$	0.1674*	0.4066**	-0.0438**	-0.0365*	-0.0241**	-0.0208*
	(0.092)	(0.154)	(0.019)	(0.020)	(0.010)	(0.010)
Gini $_{t-1}$		0.2925		-0.0816		-0.0296
		(0.407)		(0.078)		(0.048)
OECD mean dep. var.$_{t-1}$		-1.2319		0.2958		-0.0354
		(1.172)		(0.296)		(0.165)
Income per capita control	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Period fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	60	46	131	126	131	126
Countries	23	23	23	23	23	23
within R^2	0.2059	0.5024	0.2404	0.2138	0.3488	0.3914
Panel B: 1-year panels						
foreign + domestic R&D $_{t-1}$	0.2317*	0.2383+	-0.0391**	-0.0352**	-0.0200**	-0.0183*
	(0.124)	(0.151)	(0.016)	(0.016)	(0.010)	(0.010)
Gini $_{t-1}$		0.1922		-0.0299		0.0102
		(0.737)		(0.082)		(0.045)
OECD mean dep. var.$_{t-1}$		0.5941+		1.2695**		0.7135
		(0.391)		(0.463)		(0.690)
Income per capita control	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Period fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	244	229	719	685	719	685
Countries	23	23	23	23	23	23
within R^2	0.2307	0.2580	0.4201	0.3633	0.2875	0.3176

Notes: *, **, and *** indicate significance at 10, 5, and 1 % levels, respectively. Fiscal Freedom measure is increasing in fiscal freedom, denoting less redistribution, and is from the Heritage Foundation. Government consumption as a percentage of GDP is from the World Development Indicators and Government's share of GDP is from the Penn World Tables. GNI per capita data is also from the World Development Indicators. The Gini coefficient is a measure of after-tax income inequality that has been standardized across several common sources (Solt, 2009). Higher Gini coefficients indicate greater income inequality. R&D capital stocks are taken from Coe et al. (2009). Standard errors have been clustered at the country level.

Appendix

Proof of Remark 1

The first-order conditions of the consumer's problem (1) yield the following:

$$U_1(\cdot)p_i = U_2(\cdot)\left(\sum_{j=1}^{n} q_j^{\rho}\right)^{\frac{1}{\rho}-1} q_i^{\rho-1}. \tag{22}$$

That is using producers optimal behavior ($p_i = c/\rho$) and symmetry ($q_i = q \ \forall i$):

$$\begin{array}{l} q_0^* = I - \frac{ncq^*}{\rho} \\ cU_1\left(I - \frac{ncq^*}{\rho}, n^{\frac{1}{\rho}}q^*\right) = n^{\frac{1}{\rho}-1}\rho U_2\left(I - \frac{ncq^*}{\rho}, n^{\frac{1}{\rho}}q^*\right), \end{array} \tag{23}$$

It then turns out that[14]:

$$\frac{\partial q^*}{\partial I} = \frac{cU_{11}}{\frac{nc^2}{\rho}U_{11} + n^{\frac{2}{\rho}-1}\rho U_{22}} \geq 0 \qquad \text{and} \qquad \frac{\partial q_0^*}{\partial I} = 1 - \frac{nc}{\rho}\frac{\partial q^*}{\partial I} = \frac{n^{\frac{2}{\rho}-1}\rho U_{22}}{\frac{nc^2}{\rho}U_{11} + n^{\frac{2}{\rho}-1}\rho U_{22}} \geq 0. \tag{24}$$

and

$$\frac{\partial^2 q^*}{\partial I^2} = \frac{n^{\frac{2}{\rho}-1}c\rho}{\left[\frac{nc^2}{\rho}U_{11} + n^{\frac{2}{\rho}-1}\rho U_{22}\right]^2}\left[\frac{\partial q_0^*}{\partial I}U_{111}U_{22} - \frac{\partial Q^*}{\partial I}U_{222}U_{11}\right] \tag{25}$$

which is positive if and only if :

$$\frac{U_{111}}{U_{11}^2} < P \cdot \frac{U_{222}}{U_{22}^2}. \tag{26}$$

Proof of Remark 2

For given τ_A, τ_B and δ, the swing voters in each group can be defined as

$$\sigma^j = U^j(\tau_A) - U^j(\tau_B) - \delta \tag{27}$$

and the share of votes for candidate A can be expressed as

$$\Pi_A = \sum_j \alpha^j \phi^j \left(\sigma^j + \frac{1}{2\phi^j}\right). \tag{28}$$

[14] From now on we omit the arguments of the utility function and its derivatives, which will always be evaluated at the optimum (q_0^*, Q^*).

The probability of candidate A winning the election therefore writes

$$P_A \equiv \mathbb{P}\left(\Pi_A \geq \frac{1}{2}\right) = \mathbb{P}\left(\sum_j \alpha^j \phi^j \left(\sigma^j + \frac{1}{2\phi^j}\right) > \frac{1}{2}\right). \tag{29}$$

Using the definition of swing voters, we have that

$$P_A = \mathbb{P}\left(\sum_j \alpha^j \phi^j \left[U^j(\tau_A) - U^j(\tau_B)\right] > \delta \sum_j \alpha^j \phi^j\right). \tag{30}$$

Defining $\Delta \equiv \frac{1}{\phi} \sum_j \alpha^j \phi^j \left[U^j(\tau_A) - U^j(\tau_B)\right]$ we have $P_A = \mathbb{P}(\Delta > \delta) = 1 - \mathbb{P}(\delta > \Delta)$. Now, given the distribution of δ, $\mathbb{P}(\delta > \Delta) = \xi\left(\frac{1}{2\xi} - \Delta\right) = \frac{1}{2} - \Delta\xi$. This gives

$$P_A = \frac{1}{2} + \frac{\xi}{\phi}\left[\sum_j \alpha^j \phi^j \left[U^j(\tau_A) - U^j(\tau_B)\right]\right], \tag{31}$$

where $\phi = \sum_j \alpha^j \phi^j$

Each candidate maximizes her probability of winning the election. As both candidates maximize the same program, only a symmetric equilibrium can exist in which both candidates announce the same platform in equilibrium. As a result, the swing voter in each group is $\sigma^j = \delta$. First order condition $\partial P_A / \partial \tau_A = 0$ gives

$$\frac{\xi}{\phi} \sum_j \alpha^j \phi^j \frac{\partial U^j(\tau_A)}{\partial \tau_A} = 0. \tag{32}$$

As $\frac{\partial U^j}{\partial \tau_A} = \frac{\partial U}{\partial I} \cdot \frac{\partial \widehat{I}^j}{\partial \tau_A}$ and noting that $\tau \equiv \tau_A = \tau_B$, remark 2 holds.

Proof of Lemma 1

As the left hand size of equation (5) is decreasing in τ, $\partial \tau^* / \partial n$ will be of the sign of

$$\phi^L \frac{\partial^2 U\left(q_0^*\left(\widehat{I}^L(\tau)\right), Q^*\left(\widehat{I}^L(\tau)\right)\right)}{\partial I \partial n}\left(\alpha^L - \theta\right) + \phi^R \frac{\partial^2 U\left(q_0^*\left(\widehat{I}^R(\tau)\right), Q^*\left(\widehat{I}^R(\tau)\right)\right)}{\partial I \partial n}(\theta - \alpha^L). \tag{33}$$

If $\phi^R \geq \phi(L)$, a sufficient condition for (33) to be negative is

$$\frac{\partial^2 U\left(q_0^*\left(\widehat{I}^L(\tau)\right), Q^*\left(\widehat{I}^L(\tau)\right)\right)}{\partial I \partial n} \leq \frac{\partial^2 U\left(q_0^*\left(\widehat{I}^R(\tau)\right), Q^*\left(\widehat{I}^R(\tau)\right)\right)}{\partial I \partial n}, \tag{34}$$

that is $\frac{\partial^3 U(q_0^*, Q^*)}{\partial I^2 \partial n} > 0$.

Proof of Proposition 1

Denoting

$$U^* \equiv U\left(I - \frac{ncq^*}{\rho}, n^{1/\rho}q^*\right) \tag{35}$$

with q^* satisfying (23), we first have, using the envelope theorem, that

$$\frac{\partial U^*}{\partial n} = \frac{q^*}{\rho}\left(n^{\frac{1}{\rho}-1}U_2 - cU_1\right). \tag{36}$$

As, moreover, by (23), $cU_1 = n^{\frac{1}{\rho}-1}\rho U_2 \leq n^{\frac{1}{\rho}-1}U_2$, we have

$$\frac{\partial U^*}{\partial n} = \frac{1-\rho}{\rho}n^{\frac{1}{\rho}-1}q^*U_2 > 0 \tag{37}$$

and the first point of the proposition holds.

Differentiating by I we find that

$$\frac{\partial^2 U}{\partial n \partial I} = \frac{1-\rho}{\rho}n^{\frac{1}{\rho}-1}\frac{\partial q^*}{\partial I}\left(n^{\frac{1}{\rho}}q^*U_{22} + U_2\right) = \frac{1-\rho}{\rho n}\frac{\partial Q^*}{\partial I}\left(Q^*U_{22} + U_2\right) \tag{38}$$

and the second point of the proposition follows.

Differentiating (38) again with respect to I, we find

$$\frac{\partial^3 U}{\partial n \partial I^2} = \frac{1-\rho}{\rho n}\frac{\partial^2 Q^*}{\partial I^2}\left(Q^*U_{22} + U_2\right) + \frac{1-\rho}{\rho n}\left(\frac{\partial Q^*}{\partial I}\right)^2\left(Q^*U_{222} + 2U_{22}\right), \tag{39}$$

what gives us the third point of Proposition 1.

Distribution of political preferences within socio-economic classes

Here we investigate one of the assumptions embedded in our probabilistic voting model. We use survey responses from OECD countries pooled across the four waves of the World Values Survey and the European values Survey (2008) to investigate the extent to which the the variance of political ideologies and preferences for redistribution depend on socio-economic class. We have constructed three socio-economic class indicator variables based on respondents income deciles. Lower class includes deciles $1-3$, middle class includes deciles $4-7$ and upper class includes deciles $8-10$.

We consider below the responses to two questions, which we label as $Left{-}Right$ and $Redistribution$. The question $Left-Right$ asks respondents

> In political matters, people talk of "the left" and "the right". How would you place your views on this scale, generally speaking?

Respondents must then choose a number between 1 and 10, where 1 is labelled as "Left" and 10 is labelled as "Right", so the $Left-Right$ variable takes higher values for more politically conservative individuals.

For the question *Redistribution*, respondents are again shown a 1 to 10 scale, though now 1 is labelled as "Incomes should be made more equal" and 10 is labelled as "We need larger income differences as incentives for individual effort." Respondents are asked

> How would you place your views on this scale? 1 means you completely agree with the statement on the left [income equality]; 10 means that you agree completely with the statement on the right [incentives for effort]; and if your views fall somewhere in between, you can choose any number in between.

The *Redistribution* variable thus takes higher values for individuals that are more averse to redistribution. Consistent with standard political economic theory, higher classes are more averse to redistribution and on average position themselves further to the "right" in terms of political ideology. Consistent with our assumption, the standard error of the responses are not greater for the upper class than for the lower classes.

Table 4: Left-Right political ideology and preferences for redistribution

	Left-Right			Redistribution		
	Mean	Std. Err.	95% C.I.	Mean	Std. Err.	95% C.I.
Lower class	5.322	0.016	5.291, 5.352	5.178	0.023	5.134, 5.222
Middle class	5.339	0.011	5.317, 5.361	5.655	0.017	5.621, 5.688
Upper class	5.627	0.016	5.595, 5.658	6.328	0.024	6.282, 6.374
Observations	64256			52847		

Notes: Data taken from the four waves of the World Values Survey and European Social Survey.