Transatlantic Differences in Taxation, Redistribution and Provision of Public Goods: How Fair is Inequality?*

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Abstract

Structural differences between the U.S.'s and European countries' tax and redistribution systems, and public versus private good choices are well-documented. Further, several survey results suggest that while a majority of Europeans believe in a more pivotal role of luck, Americans often share the view that competence and hard work is more decisive. To study the coexistence of these differences, this paper introduces the idea of decomposing income inequality with respect to its"fairness" by defining whether inequality arises from foreseeable actions and abilities of individuals, or pure luck; and study the role of taxes on this decomposition. I propose a heterogeneous-agent OLG model featuring two different types of shocks: an inborn competence shock which affects optimal education, labor and consumption decisions together with parental and economy-wide human capital, and an additively-separable income shock which is orthogonal to decision rules and competence levels. I find that low taxes coupled with low public education provision in the U.S. induce a large impact of inborn competence on schooling and labor supply, which in turn implies that a large share of the U.S. income differences are due to skill, education and effort. In Europe, by contrast, a combination of high taxes and high public education minimizes differences due to inborn competence, and magnifies the impact of luck on income inequality, in accordance with the existing beliefs. I also show that due to the U-shaped behavior of macro variables over taxes, as seen in the data, both the U.S. and European economies can be preferred by large measures of electorates, providing insight into how the two regimes can be politically sustainable at the same time.

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1 Introduction

Transatlantic differences in taxation, redistribution, and provision of public and private goods have been investigated extensively. In particular, the fact that the U.S. has lower average tax revenue as a share of production, lower share of public expenditure in overall education and health care provision, lower social protection expenditure as a share of government budget, higher average number of hours worked and higher income, education and health care inequality than its continental European counterparts has been a source of inspiration for a number of studies.[1] Further, a growing body of literature documents that while the majority of Americans believe in a more pivotal role of effort and skill in the determination of final outcomes, Europeans put more emphasis on the decisiveness of luck. This paper proposes a model to explain for the coexistence of these Transatlantic differences, and intends to provide insight on their political sustainability.

To illustrate the differences in the size of government, Figure 1 shows the level and composition of government spending by country. Noticeably, the U.S. government spends less as a share of its GDP compared to all developed European economies, and the difference is especially more pronounced when the comparison is between the U.S. and Northern European countries. Figure 1 also displays the composition of government expenditures, which differs considerably across countries in most but not all accounts. Of particular importance, while at first glance education and health care expenditures do not seem to differ radically across the Atlantic, further investigation on the private provision of these goods reveal otherwise. In order to highlight these Transatlantic differences, Figure 2 shows the level and composition of overall health care and education expenditure as a share of GDP. It can be seen that while the share of public resources allocated to health care and education in the U.S. is only mildly lower than that of the European average, private funds allocated in the U.S. on the two accounts far exceed that of the European average, which in turn implies both the fraction of private expenditure and the level of aggregate expenditure on education and health care to be markedly higher in the U.S.[2]

Next, I turn to the analysis of Transatlantic differences in health care and education expenditures separately, and show in Figure 3 that as the U.S. spends significantly more on health care compared to the European countries, it relies more heavily on private financing. Also, in Figure 4, I display total education expenditure by source and show that the U.S. spends the most on education of any country save Iceland, and private spending on education in the U.S. exceeds that of all other countries under examination. As higher education plays a seminal

[1] For a detailed discussion on the economic and political differences between the U.S. and Europe, see Alesina and Glaeser (2004).

[2] For the European average, I use the same subset of developed countries as in Alesina and Angeletos (2005): Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom.

role in the determination of earnings, in Figure 5 I concentrate solely on tertiary education and show that U.S.'s reliance on private resources for tertiary education financing far exceeds that of the European countries, even more so than the figures in overall education, implying similar expenditure compositions in primary and secondary education provisions among countries under investigation.[3]

On the income side, I display total tax revenue by country in Figure 6 and show that in accordance with the patterns in government spending, the U.S. has the lowest average tax revenue as a share of its GDP among countries of interest.

When income inequalities of the U.S. and Europe are investigated, gini coefficients suggest that both pre-tax and post-tax income inequality in the U.S. exceeds those of all developed European countries, as shown in Figure 7.[4] While the gini coefficient on pre-tax income in the U.S. is only slightly higher than that of the European average, post-tax income inequality is noticeably greater in the U.S., consistent with the moderating role of higher taxes, redistribution and provision of public goods in Europe.

Although there are no directly comparable measures of educational attainment by country, the literature on education employs international standardized surveys conducted on population samples to infer the nature of educational dispersion. For instance, Blau and Kahn (2005) use OECD's International Adult Literacy Survey and show that there is a higher degree of variation in the U.S. educational attainment compared to the European countries, as shown in Table 1. They document that while the mean scores are not significantly different between the U.S. and the European countries, U.S. displays more disperse scores in both the right and the left end of the distribution. Further anecdotal evidence supporting greater inequality in the U.S. educational attainment is by Barry McGaw, (Director of Education for the OECD) who states in a speech that "...the very best schools in the U.S. are extraordinary ... but the big concern in the U.S. is the *diversity* of the quality of institutions..."(Fuller, 2005).[5]

In accordance with economic theory, higher taxes in Europe coincide with lower average hours worked, as documented by a large number of studies.[6] Figure 8 displays this pattern by showing average annual hours actually worked per worker by country. While the Transatlantic differences in hours worked are not as pronounced as the spending and revenue indicators, it can be seen that American employees work 9.9% more on average than their European counterparts.

[3]Figures on primary and secondary education expenditure by country are available in the Appendix section.

[4]The same pattern is observed when other inequality measures, such as the mean log deviation of income from country means are employed. For a detailed discussion on the Transatlantic differences in income inequality and their evolution, see Güvenen et al. (2009).

[5]Regarding health care attainment inequality, although there are not any studies quantifying inequality across countries, many medical researchers, e.g. Starfield (2000), emphasize that greater income inequality in the U.S. translates into a relatively higher degree of health care attainment inequality as well, particularly through the extensive variation in the extent of private medical insurance coverage.

[6]Among others, see Prescott (2004), and Alesina et al. (2005).

Further, except for Iceland and Italy, American workers on average work longer hours than average workers in all developed European economies.

Alesina and Angeletos (2005) and Bénabou and Tirole (2006) emphasize another striking Transatlantic difference in regards to the perception of fairness and relative importance of effort vs. luck in the determination of final outcomes. They show that according to the World Values Survey (WVS) 54% of Americans believe skill and effort is decisive in final outcomes whereas only 29% of Europeans are in agreement with this belief, with the majority of Europeans believing that luck is more pivotal. They also argue for significant uni-directional causality from the perception of high decisiveness of luck to higher per-capita social protection spending, and they conclude that cross-country differences in perception of fairness endogenously lead to different levels of governmental intervention in the form of taxation and redistribution, which in turn induces a more unequal income distribution in the U.S. compared to Europe. Using the same source WVS and extending the sample size to to 2009, I display the fraction of populations with the belief that luck determines outcomes in Figure 9, which suggests comparable statistics as in Alesina and Angeletos (2005).[7]

A final remark on the countries of interest is that both the U.S. and the Western European countries are known to be well-established democracies with good performances in measures of electoral process quality and pluralism.[8] Therefore, it can be safe to conclude that tax and redistribution systems, as well as public good provision policies of the U.S. and European governments should receive considerable consent from the electorates of their respective countries.

It is a puzzle how such differences in taxation, public good provision, inequalities and beliefs can persist. Earlier attempts addressing Transatlantic differences succeed to explain only a limited subset of the aforementioned discrepancies, and only a very limited number of papers incorporate beliefs in their analyses.[9] Alesina and Angeletos (2005), being an exception, argue that if common perception in an economy is that luck is strongly decisive in economic outcomes,

[7]WVS Association and International Social Survey Programme conduct some further surveys on the role of effort and roots of poverty. Due to the relatively limited sample size of these survey results, as well as for comparability and brevity purposes, I display only the results from the question with the WVS code E040, as in Alesina and Angeletos (2005) and Bénabou and Tirole (2006). In the Appendix I also show the results from the survey question with the code E131, which asks the respondents why they believe people are in need. Results reveal that while a predominant majority of Europeans believe people are in need due an unfair society, even a greater fraction of Americans believe people are poor due to laziness. Such findings, implying even more pronounced differences across the Atlantic, support evidence on the divergence in beliefs on the role of effort vs. luck.

[8]See The Economist Intelligence Unit's Index of Democracy, 2007 and Freedom in the World: 2009 Edition among others.

[9]Bénabou and Tirole (2006) propose a stylized model with beliefs about the "need" to believe in a just world through cognitive dissonance mechanism. In their model multiple equilibria emerge due to different levels of effort and concealing bad news from offsprings. The elements of their model, such as the degree of holding back bad news from offsprings are hard, if not impossible, to measure, which makes the testing of their model challenging and casts doubts on the reliability of predictions of their model.

agents will unlikely be motivated to exert high effort, which in equilibrium causes luck to be strongly influential and initial beliefs to be verified. In this environment, in order to insure themselves against unlucky future scenarios, electorates favor redistributive policies over *laissez-faire* ones and economy stays inertial at the high tax high-luck-decisiveness equilibrium. In contrast, if agents perceive market to be fair and the role of luck to be minimal, they will be motivated to exert high effort, which in turn reduces the decisiveness of luck and motivates electorates to favor *laissez-faire* policies over pronounced redistributive ones due to foreseeable future, and thus less need for insurance. However, tailored to explain variations in beliefs, conclusions of the model by Alesina and Angeletos (2005) rely on unorthodox restrictions on preferences such as a distaste in inequality, and provide unreasonable predictions on the political sustainability of the multiple equilibria since their suggested U.S. and European economies are Pareto-ranked.[10] Further, authors do not study on the role of public vs. private goods in their analysis.[11]

This paper intends to fill this gap in the literature by proposing an overlapping generations (OLG) general equilibrium model to address the aforementioned economic differences and differences in perceptions. In order to do so, I propose a heterogeneous-agent model in which agents can either choose public or private good (e.g. education), where public education confers positive externalities but requires distortionary taxation. To study Transatlantic differences in perceptions, I introduce the idea of decomposing income inequality with respect to its "fairness" by defining whether inequality arises from foreseeable actions and abilities of individuals, or pure luck. For this purpose, the model features two different types of shocks: an inborn competence shock which affects optimal consumption, labor and public vs. private education decision rules together with parental and economy-wide human capital, and an additively-separable income shock which is orthogonal to decision rules and individual competence levels. I show that low taxes coupled with low public education provision in the U.S. induce a large impact of inborn competence on schooling and labor supply, which in turn implies that a large share of U.S. income differences are due to skill, education and effort, in line with the perceptions of Americans on income inequality. In Europe, by contrast, a combination of high taxes and high public education provision minimizes differences due to inborn competence, and magnifies the impact of luck on income differences, in accordance with European beliefs.

[10] In particular, the low-tax equilibrium for the U.S. by Alesina and Angeletos (2005) features roughly 5 times greater per-capita labor supply and output than the high-tax equilibrium for the E.U., and the authors leave it unanswered why Europeans would be content to stay at the Pareto-dominated equilibrium.

[11] This paper also relates to the education and human capital literature. Of the few papers addressing Transatlantic differences, Bénabou (2000) investigates the role of progressivity of taxes and redistribution on education and shows that two distinct equilibria can emerge depending on whether the efficiency-enhancing effect of education or the redistributive one dominates. However, he does not study the implications of the coexistence of public and private education, and does not take the predictions of his stylized model to data. For other studies, see Zhang (2005), Soares (2006), Bénabou (2002), Bénabou (2005).

The intuition behind these findings is briefly as follows: first, macro variables in the model display a U-shaped pattern over taxes, a phenomenon that I show is also seen the data. This U-shape of variables is because of the fact that starting from the *laissez-faire* economy as economy's tax rate increases, so do public education provision and redistribution. This, however, reduces private education attainment of agents due to the distortionary role of taxes, as well as the disincentivizing extensive margin effect of free public education. In low tax regimes, decreases in private education attainment due to higher taxes outweigh the benefits acquired from greater public education provision, which in turn lowers aggregate education attainment. Lower education attainment induces lower aggregate human capital accumulation, which accordingly reduces total production in the economy, hence generating the left arm of the U-shape. As the tax rate keeps increasing, public good provision gets large enough that the majority of the population optimally chooses public education over the private one, and an incremental increase in taxes boosts public education attainment more so than it dampens private education, thereby fostering total education attainment, and thus elevating aggregate human capital and output over taxes.

In regards to the structure of income inequality, attendance at the same public school equalizes human capital formation across agents, which reduces both total income inequality and the share of income inequality due to differences in skills and decision rules. In a low tax environment where public school attendance is limited, income inequality is mostly attributed to varying levels of human capital across households as a result of diverse private education choices. In this regime which displays a high degree of total income inequality, the share of income variation due to investment in human capital, competence, and labor supply, i.e. the "fair" variation, is high relative to the "luck" variation, thereby justifying American perceptions in the decisive role of effort and skills. In contrast, in a high tax environment where predominant public education attendance limits variation in human capital due to differences in idiosyncratic competence levels, luck shocks account for a higher share in total income variation, which is in line with European perceptions in a pivotal role of luck.

This paper contributes to the literature also by being the earliest calibration attempt to deliver economic and behavioral Transatlantic differences simultaneously. Further, the calibrated U.S. and European economies, which differ only in regards to their tax policies, are located on the left and right arms of the U-shape respectively, which gives rise to the phenomenon that large measures of the electorates of the targeted economies have comparable welfare levels, thereby providing insight into how the two regimes can be politically sustainable at the same time.

The rest of the paper is organized as follows: In section 2, I describe the model environment, in section 3, I report and discuss about my findings, and section 4 concludes.

2 Model

2.1 Model Environment

The model I propose is a heterogeneous-agent OLG model with two cohorts, young and middle-aged, both with the same measure normalized to unity, and there is no population growth. The young are born with an exogenous stochastic level of cognitive competence, which can be thought of as an IQ draw.[12] The young accumulate human capital as a function of competence, as well as private education bequests from parents (if any), the level of public education consumed, economy-wide human capital and the parental human capital. Human capital is used to earn income when middle-aged. The young do not optimize, and only abide by the law of motion for human capital. The middle-aged decide how much to work, consume and bequeath for the offspring's private education given his altruistic preference towards the young.

There is a single distortionary income tax, which is the only instrument to finance public education and government transfers. For simplicity, the model assumes the constant long-run tax rate to be exogenous to the economy, although welfare implications of different tax rates are analyzed as part of the analysis of political stability. Therefore, the tax rate and fiscal policy rule (i.e. what fraction of the government spending to be allocated on the provision of public education vs. government transfers), together with the level and distribution of human capital and labor supply, determine the level of public education provision and government transfers.

The primary focus of the paper is to study the long-run properties of the variables of interest. Therefore the model assumes there are no aggregate shocks, which in turn induces the economy to remain at its stationary equilibrium at all periods where all aggregate variables, as well as their distributional properties, are constant at their steady-state values.[13]

In terms of the model's timing, the middle-aged agent i enters period with a human capital endowment $h \in \mathcal{H}$ and observes his child's inborn competence $\xi \in \Xi$. Next, for the given tax rate τ, public education provision $\overline{E}$ and government transfer $\overline{Tr}$, the middle-aged agent i decides whether to choose the public or a different level of private education e for his offspring, along with what fraction of the period to devote to work. Public education is provided in a rival and non-excludable way, yet is offered in a somewhat take-it-or-leave-it fashion: the private school students, regardless of education bequest levels from their parents, cannot fully enjoy public

[12] For the ease of discussion, I use education as model's "good". Alternatively, one could model genetic health draws in lieu of cognitive competence shocks and health care expenditure as a form of productive investment that can improve health, accordingly human capital. Therefore, it is possible to extend the framework to address other forms of goods provisions that contribute to human capital.

[13] Note that in the absence of aggregate shocks, a stationary-equilibrium model in which agents vote every period features constant endogenous taxes. Therefore, the constant tax assumption of this model can be considered as a reduced-form extension of a voting model, as welfare implications of the suggested U.S. and European equilibria are shown to be in accordance with household preferences in the following subsections.

education benefits as they have to incur an opportunity cost of forgoing at least some fraction of the public education benefits. Middle-aged agents who choose private education for their children incur out-of-pocket costs, but these parents have the flexibility to pick their desired level of education bequests for their children as long as they incur their respective pecuniary costs.

When solving for optimal decisions, middle-aged agents can optimize only over contemporaneous *expected* consumption due to an additively-separable idiosyncratic "luck" shock that affects income and *actual* consumption. In other words, the middle-aged agent i chooses optimal labor and education *after* observing his offspring's inborn competence draw, but before the realization of his idiosyncratic luck shock, which in turn requires him to maximize life-time utility over *expected*, and not *actual* consumption. The intuition behind this way modeling is to clarify the distinction between fair versus luck variation in income: while the middle-aged agent can alter his labor and education choices in order to respond optimally to the state of the nature, thereby giving rise to the formation of cross-sectional "fair" variation in income due to abilities and actions, he cannot respond to or insure himself against orthogonal income shock draws which induce the "luck" variation in income.[14]

Output is produced using a labor and human capital augmented technology, along with an additively-separable the luck component.

Formally, middle-aged i at time t solves:

$$V(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau)=\max_{\{l,e\}}\left\{\sum_{\eta}\pi_{\eta}(\eta)u(c(\eta))+v(1-l)+\rho\sum_{\xi'}\pi_{\xi}(\xi',\xi)V(h',\xi';\overline{H},\overline{E},\overline{Tr},\tau)\right\} \tag{1}$$

subject to

$$y=\Theta l^{(1-\lambda)}h^{\lambda}+\eta \tag{2}$$

$$c=(1-\tau)y+\overline{Tr}-e \tag{3}$$

$$e\geq 0 \tag{4}$$

[14]Note that alternatively if middle-aged agents were to decide on optimal education and labor decisions *after* observing the realization of the income shock, the resultant human capital and labor choices of the young would have been affected both by their inborn competence draws *and* income shocks of their parents, which would clearly obscure the distinction between the fair and luck components of income.

$$h' = \begin{cases} \xi(\overline{E})^{\varepsilon} h^{(1-\varepsilon)\gamma} \overline{H}^{(1-\varepsilon)(1-\gamma)} & e = 0 \\ \xi(e + \nu\overline{E})^{\varepsilon} h^{(1-\varepsilon)\gamma} \overline{H}^{(1-\varepsilon)(1-\gamma)} & e > 0 \end{cases} \tag{5}$$

$$\log(\xi) \sim N(\mu_\xi, \sigma_\xi^2) \tag{6}$$

$$\eta \sim N(0, \sigma_\eta^2) \tag{7}$$

for given income tax rate τ, aggregate human capital $\overline{H}$, public education provision $\overline{E}$, government transfer $\overline{Tr}$, and other model parameters, where c denotes consumption, l denotes labor, h denotes individual-specific human capital at period t (h' denotes individual-specific human capital at period $t+1$, as do other variables with prime notation), e denotes private education bequest, ρ denotes the altruistic discount rate, Θ denotes the level of constant productivity, ξ denotes the inborn cognitive competence of the offspring, $\pi_\xi(\cdot)$ denotes the Markov chain transition probability matrix of the inborn competence process, and π_η denotes probability distribution of the luck shock, which is independent and identically distributed across agents and time, hence does not depend on the realization of last period's luck draw for a given dynasty.

Equations (2) and (3) constitute the standard budget constraint of the household. Output requires the use of labor and human capital as factors of production, and tax is paid to the government proportional to income. Education and consumption decisions are made out of disposable income, i.e. net of taxes and transfers. As shown in Equation (4), private education bequests cannot take negative values, and the private education choice of zero units implies the attendance to public schools.[15] Human capital evolves according to Equation (5), so that there are economy-wide complementarities and limited transmission of skills across generations.[16] Given the role of parental human capital in the determination of individual-specific human capital, middle-aged agents solve a dynamic optimization problem with human capital being the endogenous and inborn competence the exogenous state. Aggregate-human capital in the

[15] As it can be inferred from Equation (4), the price of education is normalized to unity, which is also the price of the consumption good. This simplification is not central to the results, and does not change qualitative conclusions of the model for a reasonable range of relative prices. In the case of very adverse realizations of luck shocks which would otherwise force the middle-aged to consume in negative quantities, I restrict actual consumption to be infinitesimal above zero. This assumption has negligible general equilibrium consequences, and is intended for computational purposes.

[16] Persistent dynastic human capital is a common modeling approach in the literature. Schuetz et al. (2008) empirically verify the presence of intergenerational skill-passing across countries at different rates. For a detailed discussion on family background effects of educational performance and list of studies concentrating on the dynastic human capital transmission, see Hanushek and Woessmann (2010).

economy facilitates the accumulation of individual-specific human capital, thereby serving as economy-wide externalities in middle-aged agents' constrained maximization.

The inborn competence shock is log-normally distributed as shown in Equation (6). While households know the distribution of the competence shock, they cannot foresee or insure against unfavorable competence draws of future generations. Finally, the luck shock η is normally distributed with zero mean and a constant variance as shown in Equation (7), and it is orthogonal to decision rules and inborn competence shocks, i.e. $\text{cov}(\xi, \eta) = 0$.

ν in Equation (5) denotes the fraction of public education benefits to private school students, or the "public education spillover". In other words, if ν takes a non-zero value, students who attend private education can still enjoy a fraction of the public education provision, and ν is less than 1 private school students cannot enjoy public education benefits as much as those who attend public schools.[17]

Let $\tilde{e}(h, \xi; \overline{H}, \overline{E}, \overline{Tr}, \tau)$ be the optimal education decision rule to middle-aged agents' problem, and $\tilde{h}(h, \xi; \overline{H}, \overline{E}, \overline{Tr}, \tau)$ be the individual-specific human capital for next period implied by the optimal education rule. Then, the stationary distribution of the economy $\mu(\cdot)$ satisfies:

$$\mu(h', \xi'; \overline{H}, \overline{E}, \overline{Tr}, \tau) = \sum_{\xi'} \int_{\mathcal{H}\times\Xi} \chi_{\{\tilde{h}(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau)=h'\}} \pi(\xi', \xi) d\mu(h, \xi; \overline{H}, \overline{E}, \overline{Tr}, \tau) \tag{8}$$

where $\chi(\cdot)$ denotes the indicator function. The middle-aged agents have rational expectations, so the aggregate human capital level they take as given in their optimization problems must indeed be economy's resultant aggregate human capital induced by the decision rules and distribution of the agents:

$$\overline{H}(\tau, \psi) = \int_{\mathcal{H}\times\Xi} h \; d\mu(h, \xi; \overline{H}, \overline{E}, \overline{Tr}, \tau) \tag{9}$$

Further, government runs a balanced budget so that sum of funds allocated on public education and government transfers does not exceed total tax revenue:

$$\overline{E}(\tau, \psi) + \overline{Tr}(\tau, \psi) = \overline{\mathcal{T}}(\tau, \psi) = \int_{\mathcal{H}\times\Xi} \tau y \; d\mu(h, \xi; \overline{H}, \overline{E}, \overline{Tr}, \tau) \tag{10}$$

For simplicity, the model assumes government spends a fixed fraction of its funds in the form

[17] The intuition behind the introduction of public education spillovers is to provide the model flexibility to investigate alternative school systems. Implications of different spillover rates are discussed in detail in the following sections.

of public education and the rest as transfers while satisfying its budget constraint.[18]

$$\overline{Tr}(\tau,\psi) = \psi\overline{\mathcal{T}}(\tau,\psi) \tag{11}$$

$$\overline{E}(\tau,\psi) = (1-\psi)\overline{\mathcal{T}}(\tau,\psi) \tag{12}$$

For the purpose of decomposing variations in income, let total income inequality be defined as follows:

$$\sigma_y^2(\tau,\psi) = \int_{\mathcal{H}\times\Xi}(y-\overline{Y}(\tau,\psi))^2 d\mu(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau) \tag{13}$$

Then, given the additively-separable nature of the luck shock and its orthogonality to decision rules, variance of income due to luck is determined only by the stochastic luck process:

$$\sigma_l^2 = \sigma_\eta^2 \tag{14}$$

Therefore, fair variation is the residual variance in income defined as follows:

$$\sigma_f^2(\tau,\psi) = \sigma_y^2(\tau,\psi) - \sigma_l^2 \tag{15}$$

Accordingly, the share of fair and luck variation can be defined as follows respectively:[19]

$$\iota_f(\tau,\psi) = \frac{\sigma_f^2(\tau,\psi)}{\sigma_y^2(\tau,\psi)} \tag{16}$$

$$\iota_l(\tau,\psi) = 1-\iota_f(\tau,\psi) = \frac{\sigma_l^2(\tau,\psi)}{\sigma_y^2(\tau,\psi)} \tag{17}$$

[18] I investigate the implications of different fiscal policy rules in the comparative statics subsection.

[19] For the purpose of studying post-tax income inequality, let $\tilde{y} = (1-\tau)y + \overline{Tr}$ denote disposable income of y after taxes and transfers. Then, post-tax income inequality equals $\tilde{\sigma}_y^2(\tau,\psi) = \int_{\mathcal{H}\times\Xi}(\tilde{y}-\tilde{\overline{Y}}(\tau,\psi))^2 d\mu(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau)$, where $\tilde{\overline{Y}} = (1-\tau)\overline{Y} + \overline{Tr}$ denotes the average disposable income after taxes and transfers. The post-tax income inequality due to luck then follows $\tilde{\sigma}_l^2(\tau) = (1-\tau)^2\sigma_\eta^2$, which implies the fair variation in income to be the residual variance as before: $\tilde{\sigma}_f^2(\tau,\psi) = \tilde{\sigma}_y^2(\tau,\psi) - \tilde{\sigma}_l^2(\tau)$. Accordingly, the share of fair variation in post-tax income can be defined as $\tilde{\iota}_f(\tau,\psi) = \frac{\tilde{\sigma}_f^2(\tau,\psi)}{\tilde{\sigma}_y^2(\tau,\psi)}$ and share of variation due to luck can be defined as $\tilde{\iota}_l(\tau) = 1-\tilde{\iota}_f(\tau,\psi) = \frac{\tilde{\sigma}_l^2(\tau)}{\tilde{\sigma}_y^2(\tau,\psi)}$.

2.2 Recursive Competitive Equilibrium

The recursive competitive equilibrium under constant taxes and fiscal policy rule is a set of value functions, decision rules, allocations and stationary distribution, such that

1. Given $\overline{H}$, $\overline{E}$, $\overline{Tr}$ and τ, $\tilde{l}(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau)$ and $\tilde{e}(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau)$ are optimal decision rules to household agent i's problem, $\tilde{h}(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau)$ is the implied human capital rule by optimal education decision, $V(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau)$ is the resultant value function, and inborn competence and luck shocks follow their exogenous law of motions:

$$V(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau)=\max_{\{l,e\}}\left\{\sum_{\eta}\pi(\eta)u(c(\eta))+v(1-l)+\rho\sum_{\xi'}\pi(\xi',\xi)V(h',\xi';\overline{H},\overline{E},\overline{Tr},\tau)\right\} \tag{18}$$

subject to

$$y=\Theta l^{(1-\lambda)}h^{\lambda}+\eta \tag{19}$$

$$c=(1-\tau)y+\overline{Tr}-e \tag{20}$$

$$e\geq 0 \tag{21}$$

$$h'=\begin{cases}\xi(\overline{E})^{\varepsilon}h^{(1-\varepsilon)\gamma}\overline{H}^{(1-\varepsilon)(1-\gamma)} & e=0\\ \xi(e+\nu\overline{E})^{\varepsilon}h^{(1-\varepsilon)\gamma}\overline{H}^{(1-\varepsilon)(1-\gamma)} & e>0\end{cases} \tag{22}$$

$$\log(\xi)\sim N(\mu_{\xi},\sigma_{\xi}^{2}) \tag{23}$$

$$\eta\sim N(0,\sigma_{\eta}^{2}) \tag{24}$$

2. Aggregate variables stay constant at all periods, and the time-invariant stationary distri-

bution satisfies:

$$\mu(h',\xi';\overline{H},\overline{E},\overline{Tr},\tau)=\sum_{\xi'}\int_{\mathcal{H}\times\Xi}\chi_{\{\tilde{h}(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau)=h'\}}\pi(\xi',\xi)d\mu(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau) \quad (25)$$

3. Variable definitions and expectations hold:

$$\overline{H}(\tau,\psi)=\int_{\mathcal{H}\times\Xi}h\ d\mu(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau) \quad (26)$$

$$\overline{Y}(\tau,\psi)=\int_{\mathcal{H}\times\Xi}y\ d\mu(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau) \quad (27)$$

4. Government runs a balanced budget and follows its predetermined fiscal rule:

$$\overline{E}(\tau,\psi)+\overline{Tr}(\tau,\psi)=\overline{\mathcal{T}}(\tau,\psi)=\int_{\mathcal{H}\times\Xi}\tau y\ d\mu(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau) \quad (28)$$

$$\overline{Tr}(\tau,\psi)=\psi\overline{\mathcal{T}}(\tau,\psi) \quad (29)$$

$$\overline{E}(\tau,\psi)=(1-\psi)\overline{\mathcal{T}}(\tau,\psi) \quad (30)$$

5. Aggregate resource constraint holds:

$$\overline{Y}(\tau,\psi)=\overline{C}(\tau,\psi)+\overline{E}(\tau,\psi)+\int_{\mathcal{H}\times\Xi}e\ d\mu(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau) \quad (31)$$

6. Total variation, fair variation and luck variations satisfy rational expectations:

$$\sigma_y^2(\tau,\psi)=\int_{\mathcal{H}\times\Xi}(y-\overline{Y}(\tau,\psi))^2d\mu(h,\xi;\overline{H},\overline{E},\overline{Tr},\tau) \quad (32)$$

$$\sigma_l^2=\sigma_\eta^2 \quad (33)$$

$$\sigma_f^2(\tau,\psi)=\sigma_y^2(\tau,\psi)-\sigma_l^2 \quad (34)$$

7. Share of fair and luck variation satisfy:

$$\iota_f(\tau,\psi) = \frac{\sigma_f^2(\tau,\psi)}{\sigma_y^2(\tau,\psi)} \tag{35}$$

$$\iota_l(\tau,\psi) = 1 - \iota_f(\tau,\psi) = \frac{\sigma_l^2}{\sigma_y^2(\tau,\psi)} \tag{36}$$

2.3 Calibration

Deriving analytical solutions to middle-aged agent's optimization problem is not feasible due to non-trivial corner solutions in the extensive-margin decision in education. The nature of the model necessitates the use of global approximation methods. Accordingly, I employ value function iteration technique as a part of my computational solution strategy. Further, due to the absence of aggregate shocks Huggett (1993) algorithm is suitable in solving for the stationary competitive equilibrium computationally, details of which I discuss in the Appendix.

The parameter values I employ in my benchmark computation are displayed in Table 2. Following Bénabou (2002), I set the value of the share of human capital (λ) to 0.625 and labor to 0.375. Following Zhang (2005), I set the elasticity of human capital with respect to parental human capital (γ) to 0.2, and the altruism rate (ρ) to 0.8. In the literature, as the elasticity of human capital with respect to education (ϵ) varies between 0.15-0.4, I assign a value in between 0.3. Heathcote et al. (2010) decompose the U.S. wage inequality, and distinguish whether inequality arises from observables or residuals. They show that post-2000 variance is fairly stable in the U.S., especially regarding the residual income inequality. I take their estimate for the variance of residuals for the luck shock σ_η^2 after distributional adjustments.[20]

Regarding the value of the benchmark fiscal rule parameter, I use OECD's estimate for the U.S. $\psi = 0.370$ on the share of sum of education and health care spending in total government spending comprised of education, health care and social protection expenditure only.[21]

For utility, I use the following balanced-growth consistent contemporaneous utility function

[20] In particular, as their estimates are of log-normal wage earnings and the luck shock in my model is normally distributed, I calculate the variance of the luck shock as $\sigma_w^2 = (e^{\sigma_\eta^2} - 1)(e^{\mu+\sigma_\eta^2})$, where σ_w^2 refers to the residual wage variance with zero mean.

[21] As mentioned in the introduction section, primary and secondary education expenditure levels and compositions of the U.S. and European economies are very similar, which rules out the possibility that the Transatlantic differences are due to the differences in the early stages of education. Therefore in the benchmark parametrization, I include only the tertiary education expenditure and health care spending to proxy for the public good. Inclusion of primary and secondary education does not alter results of the paper qualitatively.

of the form:

$$u(c) + v(1-l) = \log(c) - \phi \frac{l^{1+\omega}}{1+\omega} \tag{37}$$

I set $\omega = 0.5$ so that Frisch elasticity of labor supply equals 2 as in the mainstream macro literature. I calibrate the multiplier before disutility of labor to $\phi = 0.513$ so that average hours worked by the model for the calibrated the U.S. economy coincides with the data.

Due to the absence of earlier studies and data on the public good spillover rate, I take a neutral stance from the two polar scenarios and set the spillover rate to $\nu = 0.5$, while I also report the results with alternative parameter values $\nu = 0$ and $\nu = 1$ so as to clarify its implications.

The model with no public education spillover $\nu = 0$ can be considered an environment where agents can benefit only from one of the two types of education, or in other words the public education is offered in a perfectly take-it-or-leave-it fashion. The model with full public good spillover model $\nu = 1$ can be thought of as an environment where all agents, regardless of their public vs. private good choices, attend public schools and enjoy full benefits of public education, and those who want to attain further education beyond the publicly provided level can choose to do so, only at its respective cost. In other words while agents who choose to attain private education have to incur its nominal costs, they do not have to forgo public educations benefits at all. The benchmark model where the spillover is set to $\nu = 0.5$ is tagged as the "limited public good spillover model", and it is intended to proxy for the environment where agents choosing private education can still benefit from the public education, yet not as much as the those who choose public education. In reality, neither of the two extreme scenarios is very likely and the limited public good spillover specification is employed for the sake of neutrality, as discussed in detail in the Results section.

The inborn competence variance $\sigma_\xi^2 = 0.769$ and production technology $\Theta = 3.345$ parameter values are chosen so as to target for belief statistics on the share of luck in total income inequality both for the U.S. and European economies.

Finally, in the computational exercises to target for the U.S. and the European economies, all parameter values are kept the same except for the tax rate, which is used for calibration purposes. This parametrization intends to show that without introducing any unorthodox elements, or relying on variations in "deep" parameter values, the model can deliver the aforementioned Transatlantic differences just by relating to tax rate differentials and their endogenous implications.

3 Results

In this section, I first report my findings on the behaviors of micro and macro variables under different tax regimes. Next, I discuss comparative statics with alternative parameter values in order to illustrate how different channels affect variables of interest. Then, I compare model's predictions with the data and discuss how well the model fits not only for the calibration targets, but also for remaining developed economies. Finally, I analyze the behavior of agents' welfare over taxes so as to provide insight on how calibrated economies can gain politically consent.

3.1 Benchmark Results

3.1.1 Value Functions and Decision Rules

First, I derive value functions and optimal decision rules of households at different individual-specific human capital and inborn competence state pairs $\{h, \xi\} \in \mathcal{H} \times \Xi$, the former being the endogenous and the latter being the exogenous state from the household's point of view. Value functions are verified to be smooth, concave and increasing in both dimensions.[22,23]

Households who are endowed with high levels of human capital and have offsprings with high inborn competence draws are better off under the *laissez-faire* economy compared to a high tax environment, and agents with low human capital and inborn competence levels are better off under a high enough tax environment (e.g. $\tau = 20\%$) compared to the zero-tax regime. In economies with a tax rate in-between the two extremes, life-time utilities of agents are typically lower compared to the two polar tax regimes the reasons of which are discussed in detail in the following subsections.

In the *laissez-faire* economy, there is clearly neither any public education provision nor government transfers, which induces all households to choose private education, yet at different levels due to their of their human capital endowments and inborn competence draws. As economy's tax rate goes up, agents with low human capital and inborn competence states start to leave the private education pool so as to attend public schools that do not require any out-of-pocket costs. Figure 10 and 11 display this pattern in education decision rules under two tax regimes. First, except for minor irregularities due to computational limitations, education choices are observed to be concave and smooth for both tax regimes. Second, the flat surfaces in

[22] Given that inborn competence shocks are mean-reverting and not persistent, life-time utility values vary only moderately across inborn competence states. Individual-specific human capital, however, persists in a dynasty as a result of limited intergenerational skill-transmission, which increases the elasticity of the value function to human capital state.

[23] The value function and decision rules reported in this section are calculated at the equilibria of the model economies at different tax rates, i.e. the aggregate human capital $\overline{H}$, public education provision $\overline{E}$ and government transfer $\overline{Tr}$ arguments of optimal education rules $\tilde{e}(h, \xi; \overline{H}, \overline{E}, \overline{Tr}, \tau)$ and value functions $V(h, \xi; \overline{H}, \overline{E}, \overline{Tr}, \tau)$ are the resultant recursive competitive equilibrium objects.

these figures refer to the optimal public education choices of agents, whereas the monotonically-increasing concave parts refer to the private education decisions. It is easy to notice that the flat surface in the higher tax regime in Figure 11 is larger than that of the lower tax regime in Figure 10, which exemplifies that higher taxes and accordingly higher levels of public education provision incentivize a larger measure of households to optimally choose public education over the private one. Also, as the tax rate goes up, in addition to a lower measure of households choosing private education, optimal private education expenditures diminish in magnitude, as well, i.e. parents choose lower private education levels in the intensive margin because of their lower disposable income and less return on education. Hence, it can be summarized that higher taxes monotonically disincentivize private education both in the extensive and intensive margin.

Regarding optimal labor supply decisions, Figure 12 and 13 reveal that while the number of hours worked do not differ considerably among middle-aged workers whose human capital exceeds a certain threshold, agents with low human capital states do not supply as much labor as their productive counterparts. This result holds as long as economy's tax rate is high enough so that the middle-aged agents with very low productivity levels can attain sufficient government transfers that enable them to enjoy benefits from extra units of leisure that can outweigh benefits from labor. Further, number of hours worked at different state pairs typically decrease over taxes as it can be seen by comparing Figure 12 and 13, yet differences in labor supplied as a result of tax rate differentials are much milder compared to cross-sectional dispersion for a given tax regime.

3.1.2 Behavior of Aggregate Variables

I compute the recursive competitive equilibria under different tax rates, and show how aggregate variables change over taxes in Table 3. Last five columns of Table 3 except for the very last one reveal that levels of public education and government transfers, as well as the share of public education in total education and fraction of students attending public schools are all monotonically increasing over tax rates, as expected. Yet, the first five columns of Table 3 display a different pattern in macro variables: as economy's tax rate increases, average human capital, output, consumption, and education first all decrease, and after a threshold they start to increase.[24] The U-shaped pattern of the aggregate variables can be observed more explicitly in Figure 14.

A brief explanation for the U-shaped pattern of aggregate variables over taxes is as follows: starting from the *laissez-faire* economy, as economy's tax rate goes up, four factors are in effect, three of which work in favor of and one of which works against macro variables. First, as

[24] Average number of hours worked, being the only exception, monotonically decreases over taxes, in accordance with economic theory due to the distortionary role of proportional income taxes.

taxes lower their disposable incomes, middle-aged agents reduce their optimal private education decision in the intensive margin. This effect is valid only for those middle-aged agents who still choose to bequest private education to their kids, and do not leave private education to join for the public school pool.[25]

Second, public education provision has a disincentivizing effect in the extensive margin. To exemplify this effect, suppose that in the absence of a public education level of 1 unit, a middle-aged agent chooses to bequest 2 units of private education to his offspring, which allows the offspring to enjoy a total benefit level of 2 units. In the presence of public education, instead of paying the full private education cost of 2 units and benefit from a total of $2+1\times\nu(=0.5)=2.5$, the middle-aged agent optimally chooses to go with the lower public education level of 1 unit so as not to bear any private financing costs, and still enjoy a reasonable amount of education benefits. Hence, public education provision causes a decrease in the level of total education attained for the individuals whose optimal private education choices would have been in the close neighborhood from *above*.

Third effect is the distortions in human capital investment as a result of lower returns on education: in a high tax rate regime, while the level of education as in a low tax environment generates the same pre-tax output, respective post-tax disposable income in the high tax regime is clearly lower than that of the low tax regime, which discourages private education attainment of the middle-aged. These three effects, by lowering private education bequests, cause aggregate education to decrease, which in turn reduces the level of aggregate human capital, and output since production technology uses human capital and labor, and finally consumption due to lower disposable income.

The fourth effect, which is the only one working in favor of aggregate variables is due to the extensive margin decision of the less endowed and limited or full public education benefits to a certain fraction or all of the population: those who would choose a private education level below the public education provision in the absence of public education optimally choose to attend free public schools when they are available, which induces agents with low human capital and inborn competence states to be better off by allowing them to attain higher levels of education, thereby increasing economy's aggregate education, human capital, output and consumption. Also, note that while those in the public education pool fully benefit from an increase in taxes due to higher public education provision, those who choose to attend private schools can enjoy partial spillover benefits conditional on the presence of public education spillovers, as well. All these four effects are amplified by the presence of economy-wide aggregate human capital complementarities.

[25] When there are no public education spillovers, and government transfers, one can show that $\frac{\partial e}{\partial \tau} = -\frac{\lambda\rho\varepsilon\Theta h^{\lambda}\bar{l}^{1-\lambda}}{1-\rho(1-\varepsilon)\gamma} < 0$ as long as skill transmission and discount factor coefficients are lower than 1.

3.1.3 Fairness of Income Inequality

After investigating the behavior of aggregate variables over taxes, I decompose income inequality and analyze whether it arises from foreseeable actions and abilities of agents, or from pure luck. The last column of Table 3 displays the share of luck variation it total pre-tax income inequality.[26] While the share of inequality due to luck accounts only for 16.87% under the *laissez-faire* economy, it monotonically increases over taxes up to 43.22% at $\tau = 12.5\%$, and starts to decrease beyond this tax rate. The intuition behind the inverted U-shape of the share of luck in total income variation can be summarized as follows: starting from the zero-tax environment where all students attend only public schools, as taxes increase two factors affect the level and composition of income inequality. First, since macro variables such as human capital and output decrease over taxes, the additively-separable luck shock accounts automatically for a larger share in total variation in income, which can be thought of as a level effect. Second and more importantly, as taxes increase, both the provision of public education and government transfers increase, and so does the the measure of agents choosing to attend public schools. The fact that agents receive the same public education equalizes human capital across agents after a threshold tax rate, thus reducing total income inequality. Less income inequality in the presence of a constant luck variance translates into a higher share of luck in total inequality, or a less "fair" inequality. Between the tax rates 0% and 10%, both the left arm of the U-shape of macro variables and the moderating effect of taxes together amplify the share of luck, and beyond this tax rate, increasing macro variables and moderating role of taxes act in opposite directions. Between the rates 10% to 12.5%, the latter effect dominates the former, thereby lowering fair inequality and total inequality, and beyond the rate 12.5%, the former effect dominates in the presence of an already large body of students attending public schools.

3.1.4 Distributional Properties of Variables

Next, I study the distributional properties of the variables by focusing on gini coefficients under different tax regimes. Table 4 shows that starting from the zero-tax environment, as tax rate increases, inequalities in human capital, pre-tax and post-tax output, education and labor all increase up to a threshold tax rate of slightly more than 7%, and then decrease beyond this rate, thereby displaying an inverted U-shape pattern over taxes.

Highest variation over taxes in inequality measures is observed in educational attainment, the gini coefficient of which starts from 0.30, peaks up to 0.366 and then decreases down to 0 when all students choose to attend public schools. This result is not documented in the earlier literature,

[26] Note that since the variance of luck is constant and independent of the variance of output, a high number for the share of luck variation implies lower cross-sectional income inequality.

and is mainly due to the distortionary role of public education provision in the extensive margin, which could not have been observed unless the coexistence of both of the education types is studied. As discussed earlier, as long as the tax rate is not sufficiently large, the fraction of students who choose to attend public schools is limited; and these students, because they do not want to bear private education costs, attain less schooling than they would otherwise in the absence of public school provision. Accordingly, that these students are content with lower levels of education magnifies cross-sectional disparity in education, thereby translating into higher gini coefficients in education in low tax regimes. When tax rate and public education provision get high enough so that a large measure of agents leave private education pool, taxes moderate inequality in education, human capital and output, similar to the findings in the literature.

Human capital is distributed more unequally than hours worked, which creates a less unequal distribution of income than that of human capital. Due to co-movement of output and education, gini coefficient of consumption does not display a marked U-shaped pattern but decreases monotonically over taxes, although the variation is relatively milder. The patterns in the distributional properties of variables can be observed more explicitly in Figure 15.

3.1.5 Model Fit with the Data

As mentioned earlier, I use tax rates to calibrate the model to match the targets, U.S. and the European average. The predictions of the model, along with the respective figures in the data are displayed in Table 5. At the tax rate of 7.13%, the model endogenously generates a public-to-total-good expenditure ratio of 44.83% as in the U.S., and at the tax rate of 11.96%, the expenditure ratio is 78.54% as in the Europe average. Also, at the tax rate of 7.13% the share of luck in income variation is endogenously 29.88%, whereas at the tax rate of 11.96% the correspondent number is 42.75%, which are the respective perception figures according to the WVS data. The model predicts the high tax regime to have an average output of 0.910 times that of the low-tax regime, while the data suggests a slightly lower ratio of 0.815.[27] The normalized actual hours worked in the U.S. is 0.287 of a unit period, whereas this number is only 0.257 in Europe. Model predicts similar numbers, 0.283 and 0.270 for the respective economies. The gini coefficients of both the pre-tax and the post-tax income in the U.S. is higher than those of Europe in the data, and due to the moderating role of taxes and transfer, the gini coefficient of the pre-tax income is higher than that of the post-tax income. Although not up to scale, the model also suggests similar qualitative prediction on pre-tax and post-tax income inequality measures. Finally, anecdotal evidence suggests that education and health care inequality in

[27] Note that the model locates the calibrated U.S. economy on the left arm of the U-shape, whereas the calibrated European economy is on the right arm. The importance of the locations of the targets with regards to U-shape of the aggregate variables is discussed in detail in the following welfare sections.

the U.S. is higher than that of the European countries, and the distributional predictions of the model are in accordance with such evidence. Overall, it is reasonable to conclude that the model can deliver the Transatlantic differences on several accounts fairly well.

Another merit of the model is in its ability to mimic the U-shape of per-capita output over public-to-total-good expenditure ratio, as seen in the data, not only for the calibration targets, but also for the other developed economies. In order to illustrate this feature, first I sort OECD economies with respect to their public-to-total-good ratios in an ascending order, and then graph public good ratios jointly with real GDP (PPP) per-capita data. I also include total tax revenues of these countries as a percentage of their GDPs, and display the resultant graphs in Figure 16.[28] It is easy to detect the slightly-distorted U-shape of per-capita output of countries over their public-to-total-good expenditure ratios, especially when the filtered per-capita output values are considered.[29] Further, the tax trend reveals that aside from some minor fluctuations, total tax revenue to GDP ratio goes hand-in-hand with public-to-total-good expenditure ratio.[30] Hence, it would be fair to conclude that the U-shaped pattern generated by the model over taxes and public good shares is observable in the data as well.

Next, I analyze how well results generated by the model fit to country-specific data. In order to do so, first I interpolate the predictions by the model over the tax rate to get finer measures, and then I match the interpolated results to the developed Western European economies with respect to their public-to-total good expenditure shares. I also do the same exercise for the country-specific WVS belief statistics, as well as for the average tax shares allocated to the financing of social protection, education and health care expenditures, as calculated in the fiscal policy parameter calculation. In Figure 17, I show that tax rate predictions by the model moves in the same direction as the data, and their co-movement is more evident when the non-linear trend of the tax rate in the data is considered. Despite the co-movement, however, the two series are not up to scale due to the parsimonious design and calibration of the model. In Figure 18, I show that the non-linear trend of the WVS belief statistics match the predictions by the model almost one-to-one. In Figure 19, I normalize the per-capita output by the model

[28] Given that developed countries differ substantially in regards to their tax systems which consist of several complicated non-linear instruments including tax brackets, tax deductable definitions, progressivity of different magnitudes, etc., instead of ranking countries with respect to their tax rates, I sort them with respect to their public-to-total good expenditure shares, which is a simpler yet more objective and standardized measure across countries, and is an endogenous outcome of alternative fiscal policies.

[29] One can see in Figure 19 that when only the more homogenized subset of Western European economies are studied (so that the transition economies and non-European countries are excluded) the U-shape pattern of per-capita income is clearer.

[30] A simple ordinary least squares regression of public good share on total tax revenue to GDP ratio unveils that public good ratio is positively and significantly predicted by taxes for the linear equation of the form: $\frac{\overline{E_i}}{\overline{\mathcal{E}_i}} = 0.398 + 0.957\tau_i$ with a probability value of $p = 0.0001$ for the coefficient before total taxes, and this result is robust to the exclusion of transition and non-European economies.

to the U.S. per-capita output at its correspondent public-good-expenditure rate, and graph it jointly with the filtered per-capita output in the data. Figure 19 unveils that both per-capita output predictions by the model and the filtered per-capita output in the data initially decreases over public-to-total-good expenditure ratio, and starts to increase after a threshold. Both of the series are minimized at a public-to-total good share of roughly 77%, although the minimum generated by the model is considerably higher in magnitude, and model's predicted output displays significantly less variation over taxes relative to the data. The noticeable parts of the right arm of the U-shape by the model are more evident at higher public share rates, and it can be concluded that while the model succeeds to mimic the patterns in the data well qualitatively, quantitative performance of the model for country-specific cases could be improved with a different calibration and parametrization strategy.[31]

3.2 Comparative Statics

In the following subsections, I report and discuss results with alternative parameter values so as to illustrate the role of different channels in model's predictions.

3.2.1 Public Good Spillover

3.2.1.1 No Public Good Spillover I start my comparative statics analysis by studying the role of the public good spillover parameter, ν, which is taken equally distant from the two polar cases in the benchmark specification. Keeping the discussion still on education, first I display the results of the model when there is no public education spillover, i.e. the environment where private school students cannot benefit from the provision of public education at all.

Value functions and optimal decision rules are confirmed to be smooth and concave as in the benchmark case, yet the jumps in the extensive margin decisions for education are observed to be higher in magnitude relative to the benchmark model. This finding is due to even higher opportunity costs of private education in the absence of public education spillovers: in this environment, when students attend private schools, their parents not only have to bear full private education costs, but also incur the cost of giving up all benefits from the public education provision. Accordingly, for middle-aged agents who choose private education for their offsprings, benefits from the choice of private education must exceed the greater sum of two costs, thereby causing even more marked jumps in in the extensive margin of education choices.

[31] Note that the calibration strategy and parameter values of the model are independent of the individual European observations, and despite the choice of only dual targets for calibration, the model succeeds to mimic the U-shape of per-capita output, qualitatively. As discussed in the Comparative Statics section, alternative choices for parameter values, especially on the public good spillover rate, can improve the goodness of fit of the model in terms of country-specific observations.

Table 6 summarizes the behaviors of aggregate variables under different tax regimes. As before, aggregate variables display a U-shaped pattern over tax rates. However, without the public education spillovers especially the left arm is steeper and the depth of the U-shape is greater in magnitude compared to the benchmark model. This result is again due to the fact that as the cost of education is higher due to greater forgone benefits of public education when private education is chosen, education is now less attractive and hence students attain relatively lower *de facto* education at all tax rates unless either all students attend only public or only private schools.[32]

Another observation from Table 6 is that while at all tax rates aggregate education, human capital, output and consumption are less than or equal to the values from the limited-spillover model, public-to-total education ratio and the fraction of students attending public schools are higher at all tax rates except for the ones at which students uniformly attend public or private schools so that the equilibria under the two specifications are identical. As a result of greater reliance on public schools and its moderating role on human capital inequality, together with the level effect in output, the share of luck in income inequality is higher than the benchmark model for the tax regimes, except for the ones at which the two economies are identical.

Next, I focus on the distributional properties of the model with no public education spillover and summarize my findings in Table 7. Similar to results from the benchmark model, starting from the zero-tax economy education, human capital, labor, pre-tax and post-tax output inequalities all increase initially over taxes, and after a threshold of approximately 7.5% the gini coefficients start to decrease, as in the benchmark model. Also, consumption inequality decreases over the tax rate as in the former specification. Contrary to the former results, however, gini coefficients vary more in magnitude relative to the benchmark model, and the reason is essentially due to higher variation in education, and accordingly human capital and output as discussed. Overall, it can be concluded that distributional properties from the no-spillover model mimic findings from the limited-spillover model closely, although the latter model generates more pronounced variations in magnitude.

3.2.1.2 Full Public Good Spillover In this subsection, I report and discuss the results when there is full spillover from public education to private school students, i.e. the environment where all students, regardless of their education choices, can fully benefit from the available public education provision. As discussed earlier, an alternative way to interpret this specification is that in this environment all students uniformly attend public schools, and those who are interested in further schooling choose to attend private education of their choice.

[32]Note that the deeper U-shape of the variables in the model with no public education spillover implies that for a better country-specific match, a lower public good spillover rate for at least for some subset of countries could improve the goodness of fit of the model.

First, I verify the value functions and optimal decision rules to be smooth and concave as in the two former models. However, under this specification I document that there are no distinct jumps but smooth transitions in the extensive margin for education, contrary to the former models featuring opportunity costs of forgoing public education when private education is chosen. This finding is due to the fact that the choice of an infinitesimal higher level of private education compared to the public school provision does not require giving up public education benefits at all, and the only opportunity cost of private education in this set-up is the *actual* expenditure spent on schooling.

Table 8 summarizes the results for aggregate variables. Similar to the limited and no spillover models, macro variables display a U-shaped pattern over the tax rate, however the trough points of aggregate variables are far greater in magnitude compared to those from the two former specifications. Starting from the *laissez-faire* economy, incremental drops in aggregate variables as a result of higher taxes are much smaller in magnitude. As a result, at any tax rate macro variables are higher in levels relative to those from the former two models featuring less-than-full public education spillovers. These findings are in accordance with economic theory since under this specification the young attain higher *de facto* education at any tax regime compared to the limited or the no-spillover models. Moreover, as a result of the fact that a lower fraction of the population attends solely public schools compared to the former two models and that higher private education amplifies fair income inequality, model's predicted share of inequality due to luck is relatively lower at all rates.

Further, while the level of public education at any tax rate beyond zero is greater in magnitude compared to the former models, the share of public sources in overall education expenditure and the fraction of population attending *only* public schools are significantly lower than those from the former two models. Also, while the tax rate at which the whole population attends only public schools is 20% in the benchmark model, only 83.70% of the population finds it optimal to choose only public education when there is full public education spillover, which again can be attributed to the lower opportunity cost of private education.

Table 9 displays the distributional properties of variables. Although the gini coefficients display the inverted U-shape as before, the variation in these coefficients are considerably smaller in magnitude. The most marked difference compared to the former two models is in the inequality of education, the gini coefficient of which is only halved in magnitude at the tax rate 20% relative to the *laissez-faire* economy, whereas there is no cross-sectional dispersion in education at this tax rate in the former two specifications.

In Figure 20, I highlight the behavior of per-capita output by the three models over the tax rate. As discussed briefly, the *laissez-faire* economies of the three spillover specifications are identical, since alternative ways of modeling public education spillover has no effect under

the tax regimes at which no one attends public schools. As tax rate goes up, the no-spillover model generates the minimum and the full-spillover model generates the maximum per-capita output since *de facto* education attainment increases over the spillover rate. The benchmark model with partial spillover generates output levels that are in-between the predictions by the two polar scenarios, yet this result holds only up to the tax rate $\tau \approx 20\%$ at which equilibrium the whole population attends only public schools. At this tax rate and beyond, since all students choose only public schools both in the no-spillover and the limited-spillover environments, the two models converge. The intuition behind this result is comparable to that of the *laissez-faire* case: given that there are no private school students in either of the two equilibria, modeling how public education provision affects private school students has no real effect. At this tax rate, less than three-fourths of the young attend solely public education under the full-spillover set-up, and the three models converge when the whole population in the full-spillover model chooses to attend only public schools, which happens at an unrealistically high tax rate.

3.2.2 Other Comparative Statics

3.2.2.1 Absence of Inborn Productivity Shocks In the absence of idiosyncratic inborn competence shocks, i.e. $\sigma_\xi^2 = 0$, middle-aged agents become *ex-ante* identical, and the only variation across households is due to the realizations of luck shock, which does not influence optimal decision rules, as discussed earlier. Therefore, the absence of inborn productivity shocks transforms the model into an *ex-ante* representative-agent model. Table 10 summarizes results in the absence of inborn competence shocks, and shows that macro variables decrease substantially at all tax rates when there is no uncertainty in regarding ability draws. In essence, this result is comparable to the "precautionary saving" phenomenon seen in models with physical capital: when there is uncertainty in inborn competence draws of future generations, middle-aged agents find it optimal to accumulate "precautionary human capital" some fraction of which they pass to the next generations in the absence of physical capital. Accordingly, when there is no possibility of unfavorable future competence draws, middle-aged agents find it optimal to devote less resources to education, which results in lower human capital accumulation, and hence output and consumption. Since the absence of competence shocks eliminates *ex-ante* heterogeneity, the fraction of the population attending public schools is either zero or unity, depending on level of the tax rate. The U-shape of the aggregate variables is preserved since the same competing effects are still in act. Finally, as the only source of variation across agents is due to luck shocks, the share of luck in total income inequality is 100%.[33]

[33] If agents have lasting productivity types, i.e. if all agents in a dynasty have the same inborn competence draws at all times so that heterogeneity is preserved but future uncertainty is eliminated, the absence of precautionary human capital saving still causes a negative level shift in macro variables while agents are non-degenerately distributed. The absence of luck shocks does not alter the qualitative conclusions on the U-shape.

3.2.2.2 Persistent Inborn Productivity Shocks While economists generally model inborn competence shocks having log-normal distributions for general equilibrium purposes, geneticists show that heritability of intelligence in the U.S. is measured to differ between 0.40 to 0.80.[34] In order to show the effects of intergenerational persistence of inborn competence shocks, I model the idiosyncratic competence stochastic shock as a first-order autoregressive process as follows:

$$\log \xi^i_{t+1} = \kappa \log \xi^i_t + u_{t+1}$$

where $u_{t+1} \sim N(0, \sigma^2_u)$ and $\sigma^2_u = \frac{\sigma^2_\xi}{1-\kappa^2}$ so that both this specification and the benchmark model have the same mean and variance. I set the value of the autoregressive coefficient to a positive constant, $\kappa = 0.40$, and I report consequent results in Table 11. My findings show that while the U-shape of the macro variables is preserved, there is a mild drop in the levels of aggregate variables at all tax rates despite a higher variance of the shock, σ^2_u. When the inborn competence shocks are persistent, a middle-aged agent with a low competence draw knows that his offspring is likely to have a low competence draw as well. If his disposable income is also low due to limited human capital endowment, he would not be motivated to bequest high levels of private education since next generations' low competence draws will likely hinder their human capital accumulation anyway. For the middle-aged agents with high human capital endowments and better inborn competence draws, since future generations are also likely to have decent inborn competence levels, too much education is not extremely essential, which reduces the incentive for precautionary human capital accumulation. Therefore, information on future shocks by the autoregressive specification reduces the incentive for educational attainment, which in turn dampens aggregate human capital; and together with economy-wide complementarities, return on education gets even lower, further amplifying the negative level shift in aggregate variables at all tax rates.[35]

3.2.2.3 Higher Complementarity Effect of Aggregate Human Capital In the presence of higher economy-wide externalities by aggregate human capital, i.e. $\gamma = 0$, return on education gets higher, which in turn encourages middle-aged agents to bequest more education, thereby inducing even higher aggregate human capital accumulation in the economy, and pushing up returns on education even further. Moreover, higher economy-wide aggregate human capital complementarities imply less pronounced intergenerational skill-transmission, which am-

[34] For discussions on general equilibrium concerns of productivity shocks, see Bénabou (2000), Bénabou (2005); Zhang (2005), and for discussion on heritability of intelligence, see Plomin et al. (1994).

[35] Note that persistent inborn competence shocks imply a stronger intergenerational transmission channel, since parental transmission of human capital is still present.

plifies future uncertainty that boosts precautionary human capital savings. As a result, macro variables at all tax rates get higher in magnitude in the presence of higher aggregate human capital complementarities, as shown in Table 12. While the U-shape of macro variables is preserved, the aforementioned forces induce the U-shape to have steeper arms, which causes the aggregate-variable-minimizing tax rate to be lower than the benchmark case, and the share of public education expenditure and the fraction of population attending public schools to be higher than the benchmark results.[36]

3.2.2.4 Higher Return on Education When the elasticity of human capital with respect to education increases by 10%, i.e. $\varepsilon = 0.330$, there is an upward level shift in the values of macro variables at all tax rates, as shown in Table 13. Education is a choice variable from a middle-aged agent's point of view, as opposed to intergenerational skill transmission or economy-wide complementarities which he takes as given in his optimization problem. Thus, higher return of education encourages middle-aged agents to bequest more education to offsprings, which boosts aggregate human capital and accordingly the remaining macro variables. Further, as education contributes more to human capital accumulation in the presence of higher returns on education, an increase in the tax rate does not discourage the middle-aged agents to reduce their private education decisions as much as in the benchmark case, which in turn causes a lower measure of students to choose public education over the same incremental tax increase. Thus, while the U-shape of the variables is still preserved, the threshold tax rate at which everyone attends public schools is observed to be slightly above 20%.

3.2.2.5 Higher Share of Redistribution in Fiscal Spending As discussed in detail in the model environment section, tax revenue raised by the government is used both for the provision of public education and for government transfers. While the former form of government spending, by contributing to the accumulation of human capital, can boost aggregate variables, the latter expenditure is not internalized by the atomistic middle-aged agents and is used only for consumption purposes. Accordingly, raising the share of transfers in government's budget reduces the level of aggregate variables for the tax regimes other than the *laissez-faire* economy at which equilibrium there is no tax revenue raised and fiscal rule is thereby irrelevant.[37]

[36] For this and the next exercise, note that the law of motion for human capital is homogenous of degree one in education, intergenerational skill transmission and economy-wide complementarity, which implies that an increase in one of the parameters would induce a decrease in the values of the remaining ones. In the absence of the complementarity effect of aggregate human capital, i.e. $\gamma = 1$, opposite results relative to the higher complementarity exercise are documented.

[37] Note that, despite its adverse affects on the level of aggregate variables, a higher share of redistribution can still be desirable among a subset of the agents with low very low human capital endowments and inborn competence draws, who are in the immediate risk of hitting zero bound for consumption.

For the remaining parameters, I verify that increasing the share of human capital in the production function λ, and the altruism (discount) rate ρ boost the level of aggregate variables at all tax rates while preserving the U-shaped pattern, which can be seen in the Appendix section.

3.3 Welfare Analysis

After studying the behavior of aggregate variables and comparative statics, next I analyze how agents' *ex-ante* welfare vary under different tax regimes. For this purpose, first I display the distribution of households over individual human capital and inborn productivity states for the calibrated U.S. and European economies. Then, I report and discuss the preferences of agents over taxes so as to provide insight on political sustainability of the targeted economies.

In Figure 21 and 22, I display the distribution of middle-aged agents over human capital and inborn productivity state pairs for the calibrated U.S. and European economies. I also add respective average human capital levels of the calibrated economies as the transparent light purple surfaces. It is evident from the figures that predominant majorities in both simulated economies are endowed with human capital endowments less than the economy averages. Also, due to the symmetric stochastic specification of inborn competence shocks, agents are distributed symmetrically with respect to inborn productivity states. Therefore, log-normal distribution of the inborn productivity shock, together with optimal education decisions yield such results that majorities of households in both economies are endowed with human capital levels less than the country averages, and when optimal labor decisions are also taken into consideration, it is easy to show that the same majorities earn less pre-tax incomes compared to economy averages.

In Figure 23, I display how aggregate consumption and an egalitarian welfare measure which I calculate as the sum of life-time *ex-ante* welfare of agents weighted by their respective population densities vary over taxes. It can be seen that the welfare metric mimics average consumption closely, and also displays the U-shaped pattern over the tax rate with the exception of a noticeable local peak on the left arm . However, it would be erroneous to immediately conclude from this graph that the *laissez-fair* tax policies or very high tax regimes Pareto-dominate policies in between the two polar cases. In fact, I show in Figure 24 and 25 that this is indeed not the case by studying the behavior of value functions of agents over taxes at agent-specific state pairs.[38]

Figure 24 shows how *ex-ante* utility of middle-aged households with the same median inborn productivity but different individual human capital states vary over taxes. It is easy to see that *ex-ante* welfare of agents increases over the human capital state, since middle-aged agents who

[38]Because there are four dimensions associated with welfare analyses, i.e. individual human capital and inborn productivity states, economy's tax rate and the correspondent value of *ex-ante* life-time utility, first I keep the inborn productivity state constant in Figure 24, then the individual human capital state constant in Figure 25 to be able to report results using three-dimensional graphs.

are endowed with higher levels of human capital are inherently more productive, thereby they can earn higher pre-tax incomes than those with lower human capital endowments levels with the same amount of labor.

Another noticeable pattern in Figure 24 is the slightly-distorted U-shape of life-time utility of most of the households except for the ones endowed with very limited human capital levels. Especially, *ex-ante* welfare levels of households who are endowed with high human capital levels and inborn productivity draws initially decrease over taxes and start to increase after a threshold tax rate, with a U-shape comparable to that of aggregate variables.

Regarding the distortions in the U-shape, first it is evident from Figure 24 that agents with the lowest human capital endowments prefer higher tax regimes to the lower ones monotonically, and that they are ones with most pronounced welfare gains over taxes. It is not surprising that these households who contribute lowest to the tax revenue base and benefit no less than others prefer high levels of public education provision and government transfers, thereby higher tax rates.[39] Perhaps, more interesting is another deviation from the U-shape that is also present in Figure 23: middle-aged agents whose human capital states are low but not on the very lowest end of human capital distribution are better off at a tax rate close to 5% relative to the *laissez-faire* economy. Beyond this tax rate, *ex-ante* welfare of all middle-aged agents but those with the lowest human capital endowments first decrease up of a tax rate of approximately 10.5% and then start to increase beyond this threshold. While minor differences across states are observable, the spike on the left arm of the U-shape is evident for a non-trivial measure of states. Figure 25 magnifies this pattern from an another angle: keeping individual human capital state constant at $h = 0.200$, i.e. the level around which the largest measure of households are populated in both of the calibrated economies, I display how *ex-ante* welfare of agents vary over taxes for different inborn productivity draws. First, it is easy to notice that *ex-ante* welfare of middle-aged agents increase over inborn productivity draws as expected, since higher draws facilitate the accumulation of human capital of the offsprings, which they uses next period when middle-aged. Second, Figure 25 makes it clear that agents with moderate levels of human capital, especially the ones with low inborn productivity draws, are better off in a tax regime around 5% relative to the *laissez-faire* economy. As mentioned earlier, while middle-aged agents with low human capital endowments prefer high tax regimes to the lower ones monotonically, households with high levels of human capital have smooth U-shaped preferences over taxes, as the spike on the left arm of the U-shape in *ex-ante* welfare first diminishes and then disappears over human

[39]The careful reader may notice the striking differences in *ex-ante* welfare between the agents with lowest human capital endowments and those who own moderately higher human capital. In essence, this is due to the fact that the middle-aged agents at the very low end of the human capital distribution are the ones who are more likely to be pushed to the zero bound for consumption in the event of adverse luck shock realizations, which therefore reduces their expected *ex-ante* welfare levels considerably.

capital states.

Although contrary to the canonical Meltzer and Richard (1981) preferences over taxes, the idea of double-peaked preferences in education types is not novel.[40] The intuition behind the double-peaked preferences over taxes can be summarized as follows: Middle-aged agents endowed with limited but not extremely low human capital levels prefer non-zero taxes up to a rate on the left arm such that gains from redistribution and public education provision, a variant of the Meltzer-Richards effect, are not offset by the distortionary effects of taxes on aggregate human capital, a factor pivotal in determining the effectiveness of education on the accumulation of human capital.

Beyond the threshold tax rate of $\tau = 5\%$, further increases in the tax rate have adverse effects on the level of aggregate human capital, and benefits from higher public education provision and government transfers are more than offset by the drops in aggregate human capital. Once the economy reaches a sufficiently high tax regime at which majority of students optimally chooses to attend public schools, positive complementarity effects of aggregate human capital are pronounced again and the *ex-ante* welfare of middle-aged agents starts to increase over taxes.[41]

When economy's tax rate is close enough to 5%, as in the case for the calibrated U.S. economy featuring $\tau = 7.13\%$, agents with low human capital endowments who constitute the majority of the electorates as shown in Figure 21, would object to a significant reduction in the tax rate since they would be worse off in a very low tax regime. Further, if the economy could not switch immediately from a tax rate of 5% to a sufficiently high tax regime beyond $\tau = 10.5\%+$ for reasons such as institutional restrictions, physical or social adjustment costs, history-dependent preferences, etc., electorates might have to incur non-trivial welfare losses throughout the transition process, and if such costs exceed benefits from switching to the new equilibrium, high-tax regime supporters may not be able to form a winning coalition. Therefore, in the neighborhood of the calibrated economy, majority of the electorates could be content with

[40] For the micro-foundations of single-dipped/double-peaked preferences in the presence of public and private education, see Stiglitz (1974), Barzel and Deacon (1975), Flowers (1975), and for a recent discussion on single-dipped/double-peaked preferences over the provision of public goods, see Barbera et al. (2009). Note that all these papers concentrate on the micro-foundations of preferences in endowment economies, and do not study the interaction of preferences with endogenous general equilibrium outcomes.

[41] Clearly, single-crossing property does not hold globally, yet a weaker *local* version is observed to hold around the two peaks: numerically, if a middle-aged agent with the individual human capital state (h^1, ξ^j) prefers $\tau = 5\%$ over $\tau = 0$, so does the agent with (h^2, ξ^j) pair where $h^1 > h^2$. Similarly, if the middle-aged agent with (h^1, ξ^j) prefers $\tau = 10.5\%+$ to $\tau = 10.5 - \%$, so does the middle-aged with (h^2, ξ^j). Also, while tax rates below 5% give more life-time utility than 10.5% for most of the individuals, such comparison is not immediately applicable for the higher tax regimes.

the present tax rate, and the economy could stay inertial at this equilibrium.[42]

Electorates in the calibrated European economy almost uniformly object to a lower tax rate in the close neighborhood of the targeted rate of $\tau = 11.96\%$, since their welfare would decrease as a result of a drop in the tax rate due to consequent decreases in the provision of public education, government transfers, and aggregate human capital. If the economy cannot move swiftly from a high tax regime to a significantly lower one around 5%, possibly due to the aforementioned reasons, electorates would not vote in favor of the regime-switch in order not bear the non-negligible transition costs, and would be content staying at the targeted tax regime.[43]

In light of these results, the proposed model can provide insight on why large measures of households could prefer the targeted tax regimes, thus how the calibrated economies can stay inertial at the two distinct equilibria.

4 Conclusions

In this paper, I concentrate on the differences between the U.S. and Europe in the levels of taxation, redistribution, provision of public goods, and perception of fairness in income inequality. I propose a heterogeneous-agent OLG model in which agents can choose either public or private education, and public education confers positive externalities but requires distortionary taxation. To study the Transatlantic differences in perceptions, I decompose income inequality with respect to its "fairness" by defining whether inequality arises from foreseeable actions and abilities of individuals, or from pure luck. The model I propose features two different types of shocks: an inborn competence shock which affects optimal consumption, labor and education decision rules together with parental and economy-wide human capital, and an additively-separable income shock which is orthogonal to decision rules and competence draws of agents. I show that low taxes and low public education provision in the U.S. induce a large impact of inborn competence on schooling and labor supply, which in turn implies that a large share of U.S. income differences are due to ability, education and effort. In Europe, by contrast, high taxes and high public education minimize differences due to inborn competence, and magnify the impact of luck on income differences, as in accordance with existing beliefs. I also show that, due to the

[42] The deviation of the calibrated economy from the the politically-favored tax regime of 5% could be attributed to the calibration strategy, as well as to other democratic imperfections, such as "status-quo bias". For instance, Gilens (2012) shows that the probability of adopting of a new policy in the U.S. is only 50% even when up to 90% of Americans favor policy changes, especially regarding redistributive policies.

[43] If the model was enriched in a way that the punitive role of taxes were incorporated (for instance by relaxing the closed-economy, or absence of physical capital assumptions), predictions that a higher tax rate than the calibrated European equilibrium is favored by electorates could be revised. Further, note that the higher *de facto* redistributive share of government spending in Europe, which was not taken into consideration in model's predictions, also puts a limit on the benefits from very high tax regimes.

U-shaped behavior of macro variables over tax rates as seen in the data, both the U.S. and European economies can be preferred by large measures of electorates, providing insight into how the two different regimes can be politically sustainable at the same time. The intuition behind the U-shape of macro variables is that at low tax rates an increase in taxes and public education provision dampens human capital accumulation due to drops in private education attainment, while at high tax rates, public education provision gets large enough that the majority of the population prefers public education over the private one, and further increases in the tax rate boost public education attainment more than they dampen private education.

Aside from its merits, admittedly the model has some limitations. First, most parameter values employed in the model are set in accordance with the previous literature, which is yet very limited. The values of some of these parameters, such as the public good spillover rate, are challenging to link to the data. Further research, especially on the micro-level estimation of these parameter values could improve the reliability of model's predictions.

Second, while the model can provide insight into how the U.S. and European systems gain support from their respective electorates, it does not address how developed countries with predominant mixture of public and private goods systems are sustainable for the same parameter sets. Therefore, further research on micro-foundations of the model parameters would contribute to the comprehension of country-specific cases better, as well.

Finally, although the model can provide insight on how the two different equilibria can gain political support and persist, it does not put forward the sources of the divergence in the last one and a half centuries, which is beyond the scope of this paper.[44] Future work on transitional dynamics of the Transatlantic divergence, as well as transitional properties of the presented model would contribute to the literature noticeably.

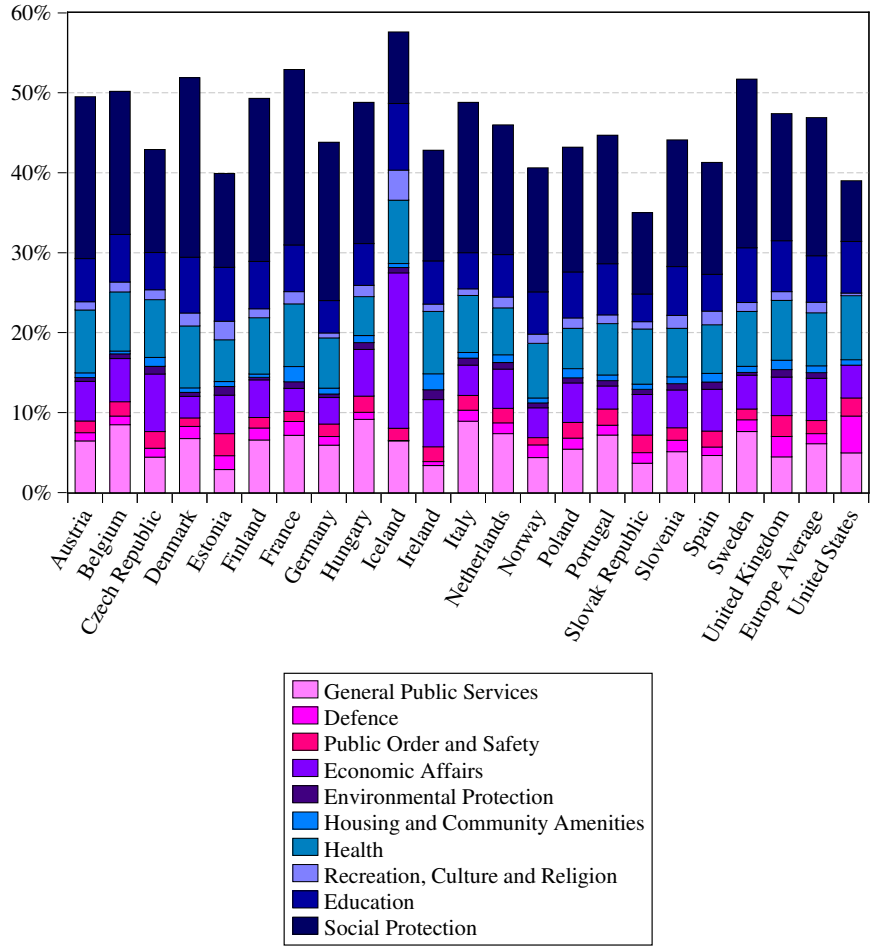
Despite these limitations, this paper succeeds to shed light on the role of taxes and fiscal policies in the determination of Transatlantic differences in economic and behavioral variables, implications of the coexistence of public and private goods, as well as different complementarity and spillover channels in a general equilibrium design. Further, by proposing a simple yet powerful heterogeneous OLG model, this paper opens a gate to the study of Transatlantic differences within the neoclassical economic framework, thereby providing guidance to future studies with general equilibrium focus.

[44] Alesina and Glaeser (2004) document that there were not substantial differences between the U.S. and the continental European countries in terms of taxation and redistributive policies back in 1870s. Only a limited number of studies concentrate on endogenizing the evolution of institutions, and the exceptions do not particularly concentrate on the public vs. private good compositions or differences in beliefs. For the literature on the endogenous evolution of institutions, see Aghion et al. (2004), Acemoğlu and Robinson (2000), and Acemoğlu et al. (2012).

Figures and Tables

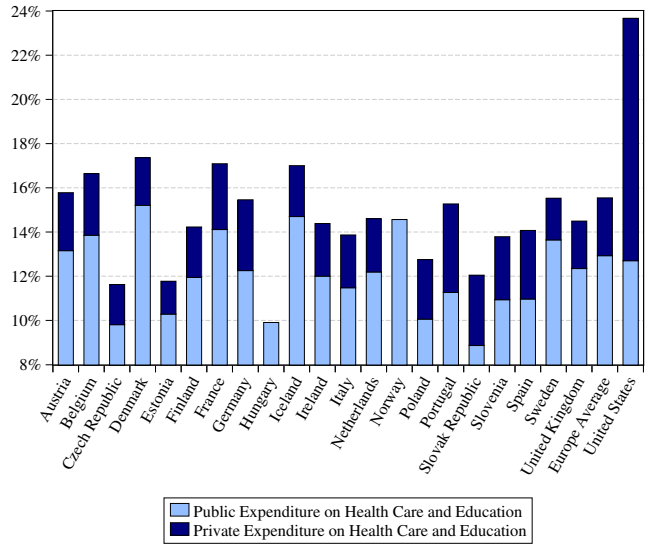
Figures

Figure 1: Level and Composition of Government Spending by Country (% of GDP)



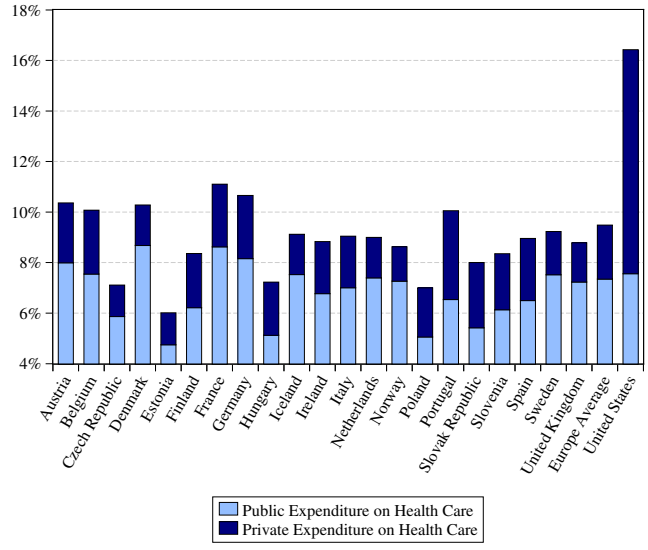
Source: OECD Database (2004-2008)

Figure 2: Public vs. Private Health Care & Education Expenditure by Country (% of GDP)



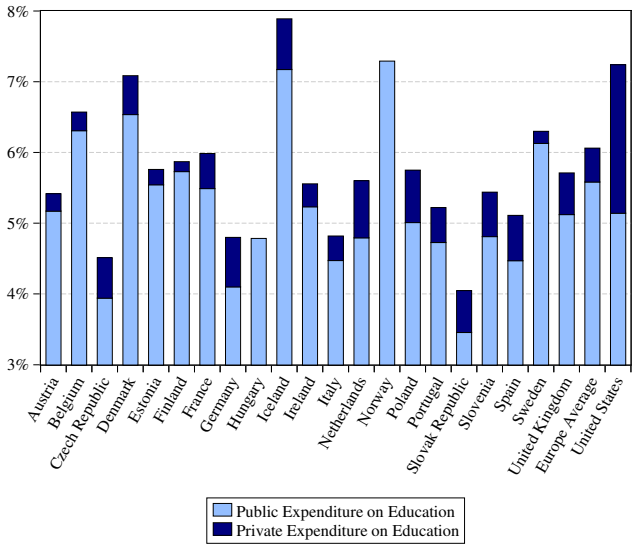
Source: OECD Database (2004-2008)

Figure 3: Public vs. Private Health Care Expenditure by Country (% of GDP)



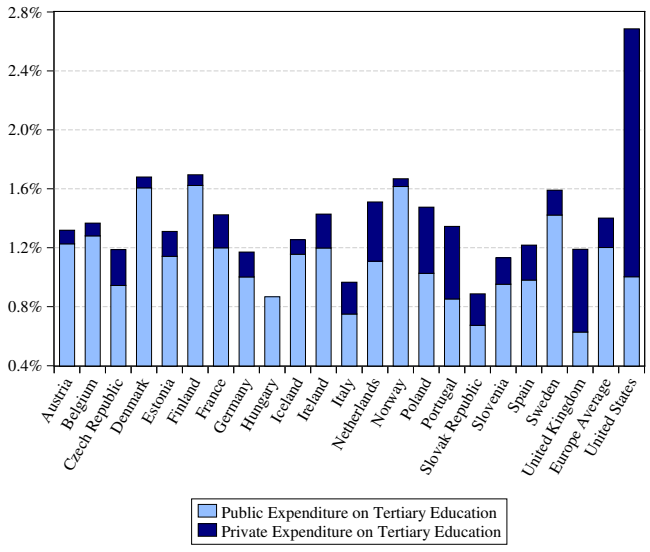
Source: OECD Database (2004-2008)

Figure 4: Public vs. Private Education Expenditure by Country (% of GDP)



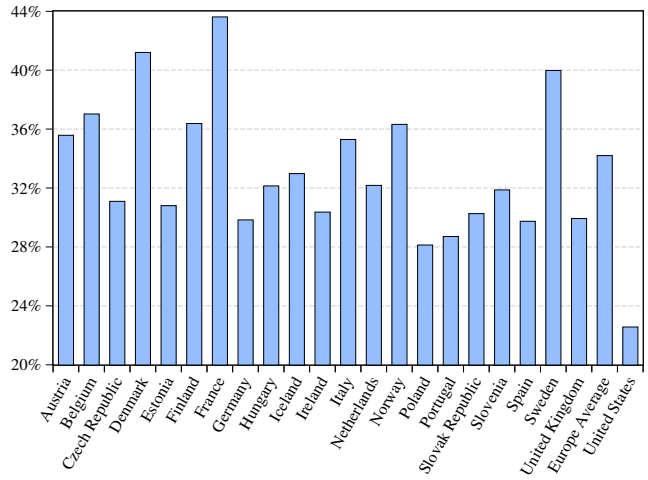
Source: OECD Database (2004-2008)

Figure 5: Public vs. Private Tertiary Education Expenditure by Country (% of GDP)



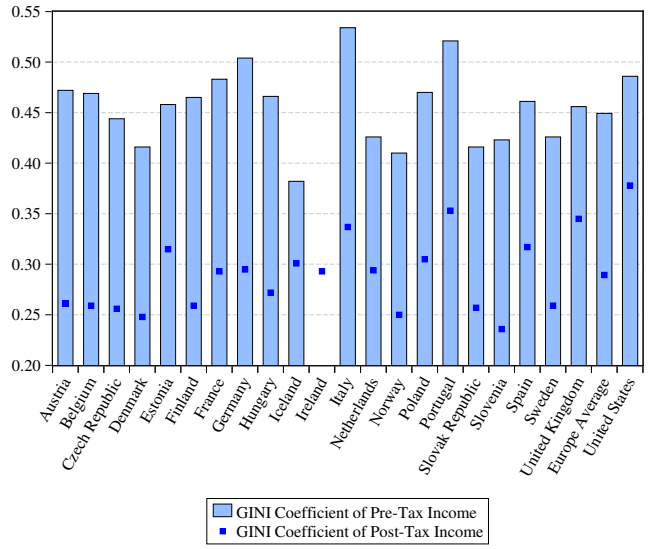
Source: OECD Database (2004-2008)

Figure 6: Total Tax Revenue by Country (% of GDP)



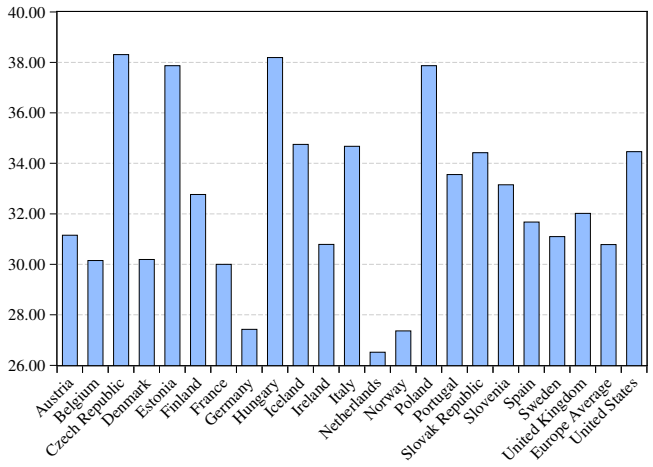
Source: OECD Database (2004-2008)

Figure 7: Pre-Tax & Post-Tax Income Inequality by Country



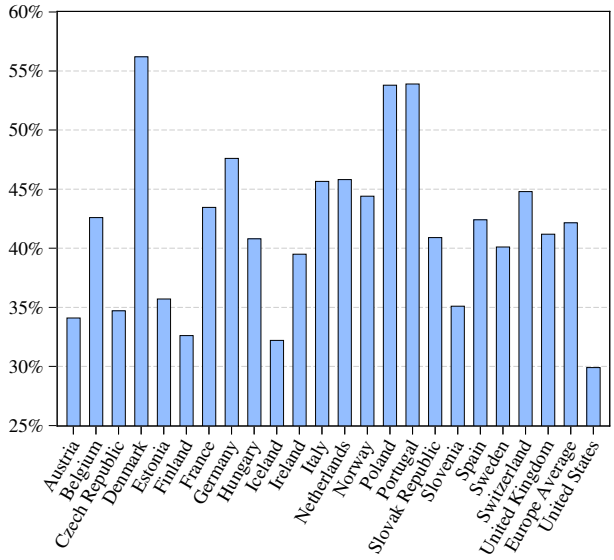
Source: OECD Database (2004-2008)

Figure 8: Average Weekly Hours Worked by Country



Source: OECD Database (2004-2008)

Figure 9: Fraction of the Population with the Belief that Luck Determines Income



Source: World Values Survey (1981-2008)

Figure 10: Education Decision Rule When $\tau = 7.13\%$

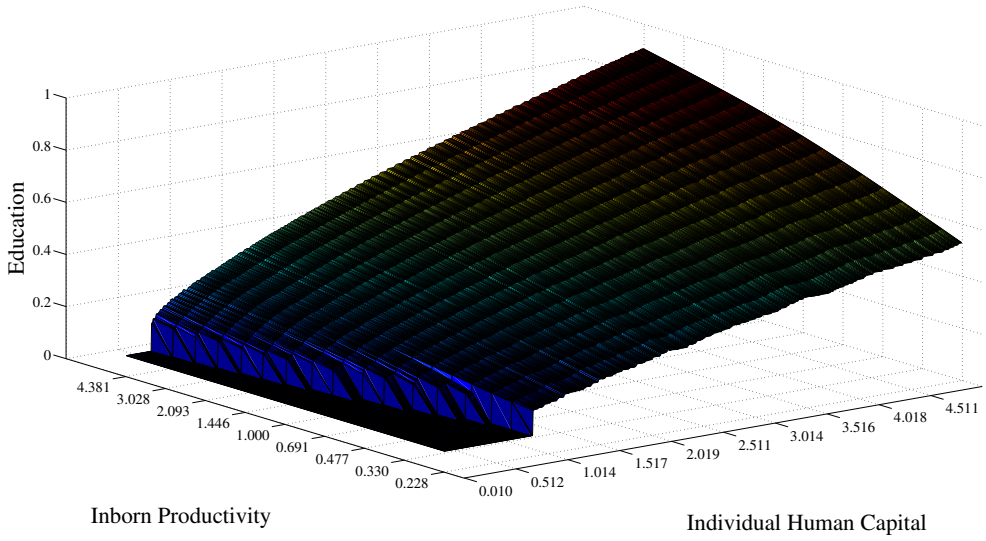


Figure 11: Education Decision Rule When $\tau = 11.96\%$

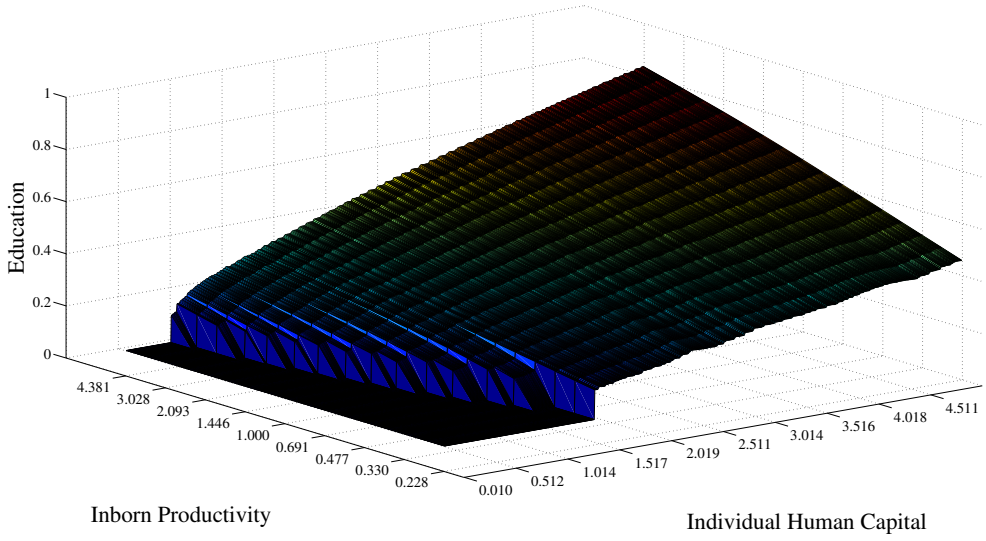


Figure 12: Labor Decision Rule When $\tau = 7.13\%$

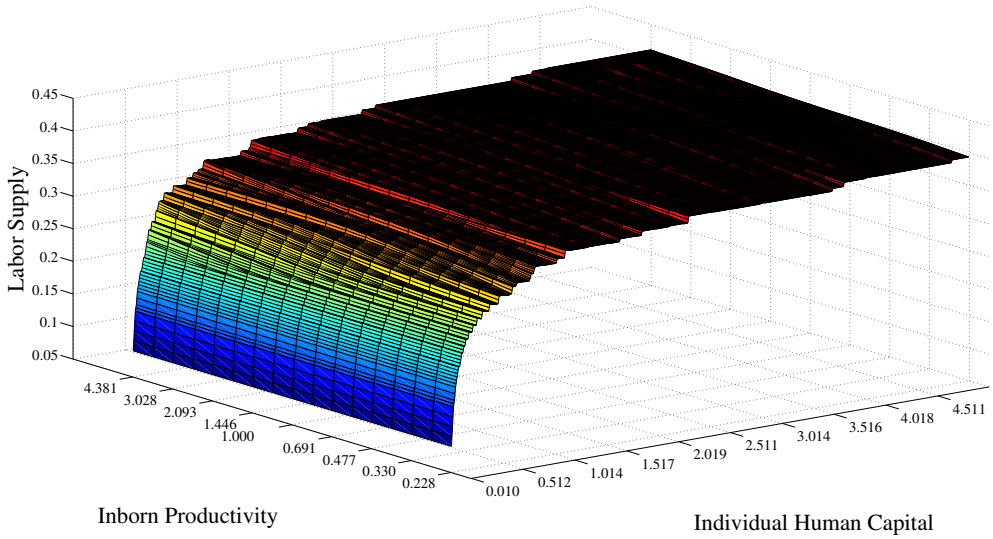


Figure 13: Labor Decision Rule When $\tau = 11.96\%$

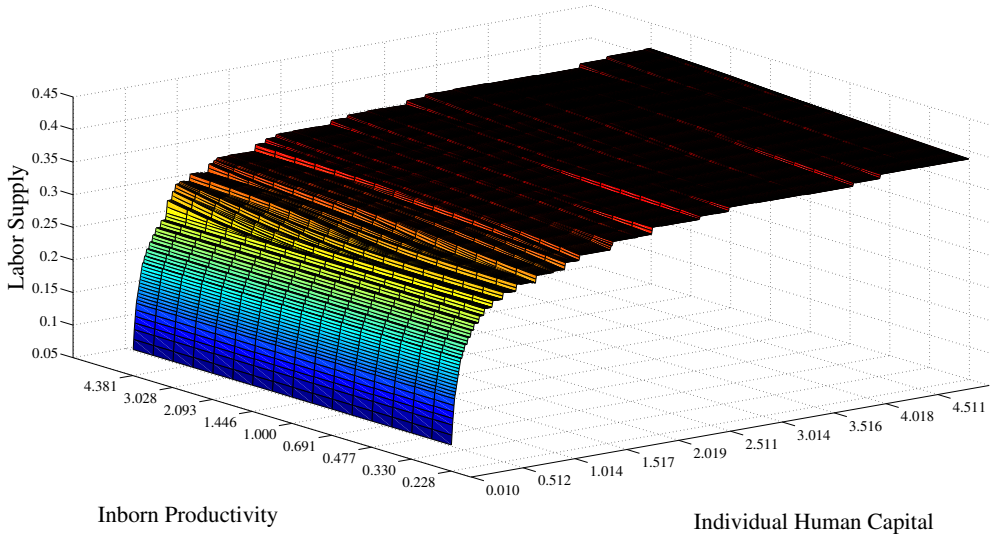


Figure 14: Benchmark Results

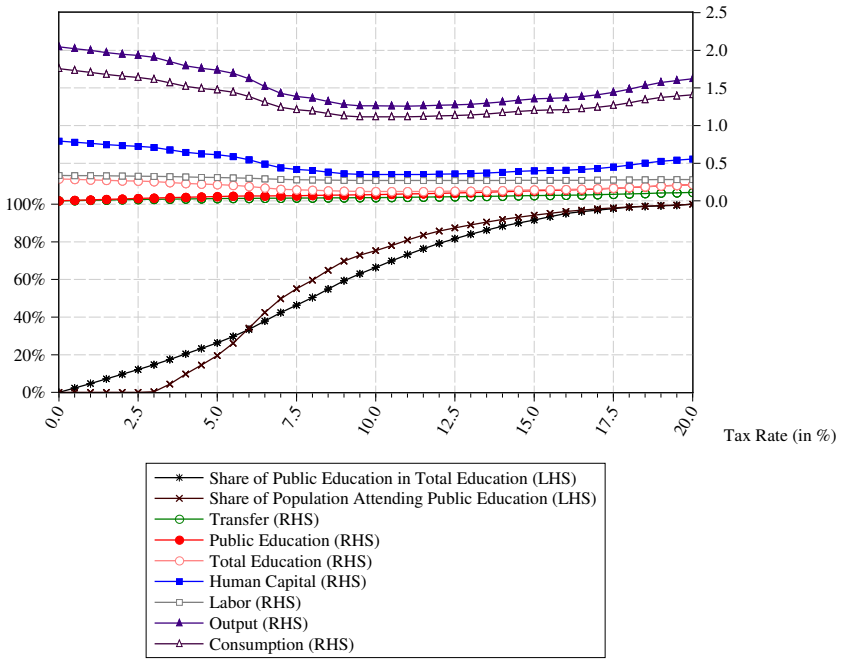


Figure 15: Distributional Properties

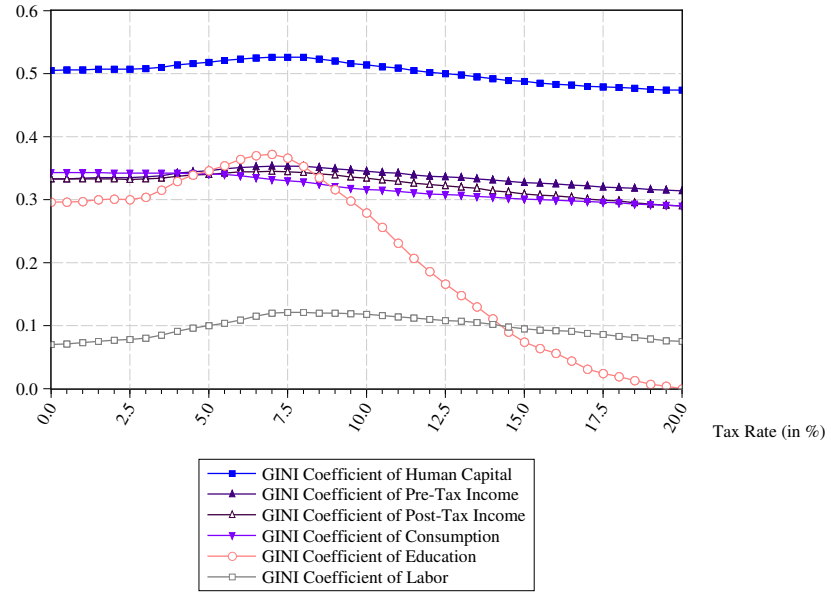
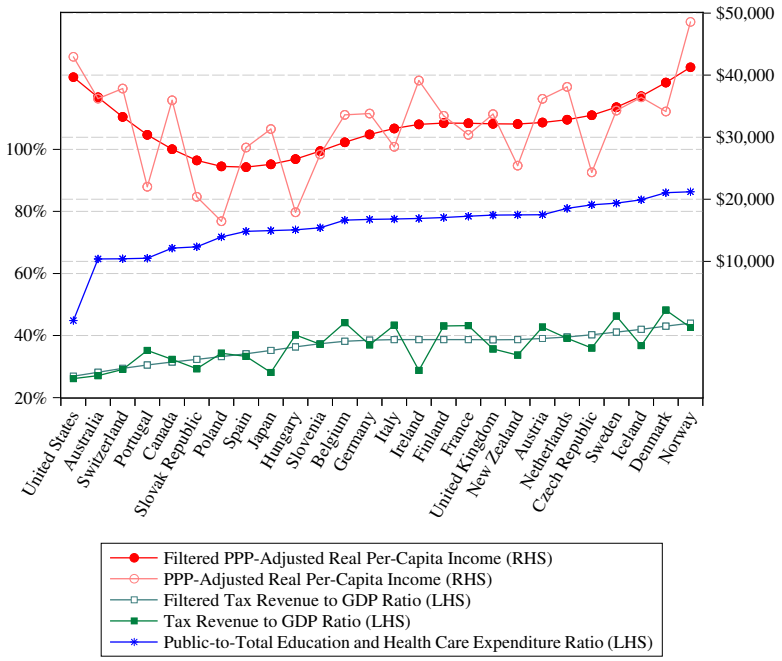


Figure 16: Tax, Output and Public Education Share by Country



Source: OECD Database (2004-2008)

Figure 17: Model Fit of Taxes by Country

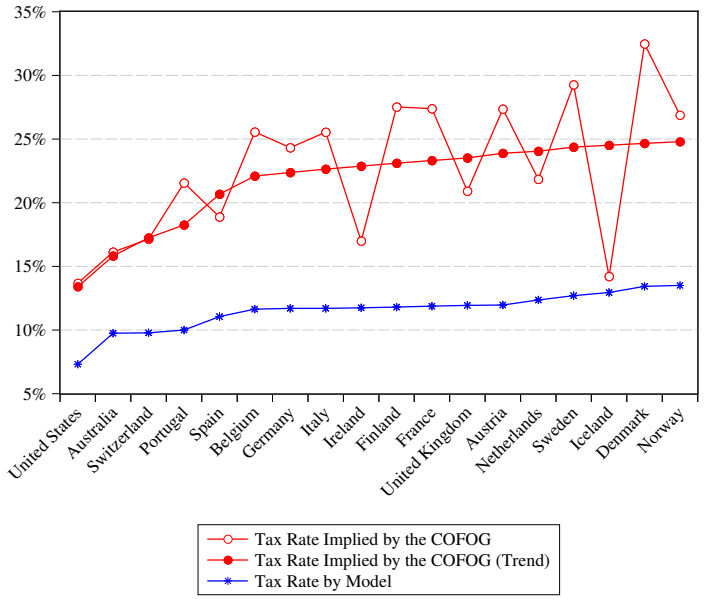


Figure 18: Model Fit of Beliefs in Decisiveness of Luck by Country

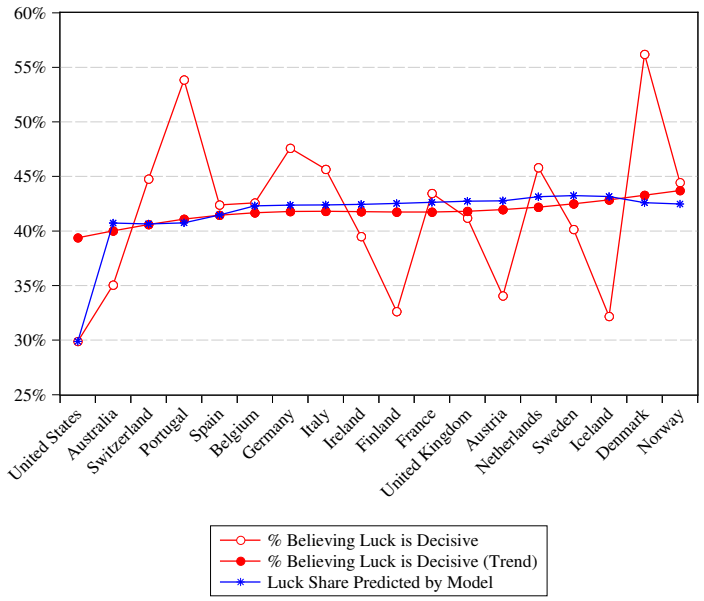


Figure 19: Model Fit of Output by Country

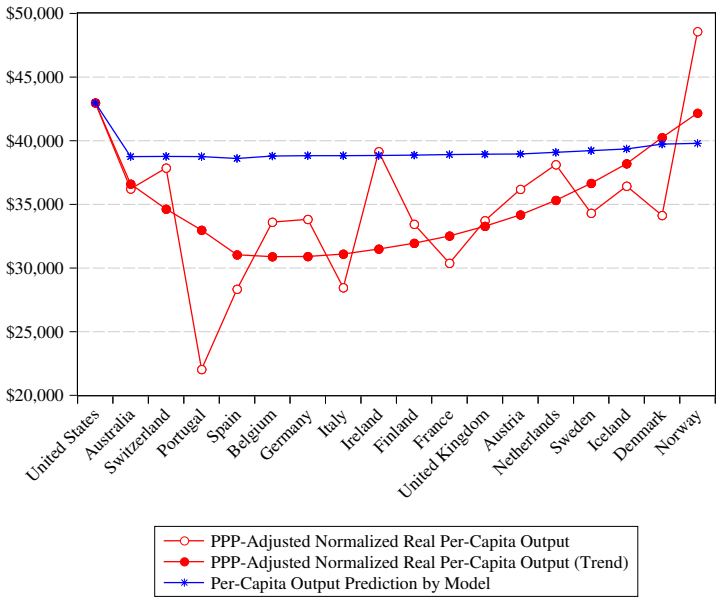


Figure 20: Per-Capita Output with Different Spillover Rates

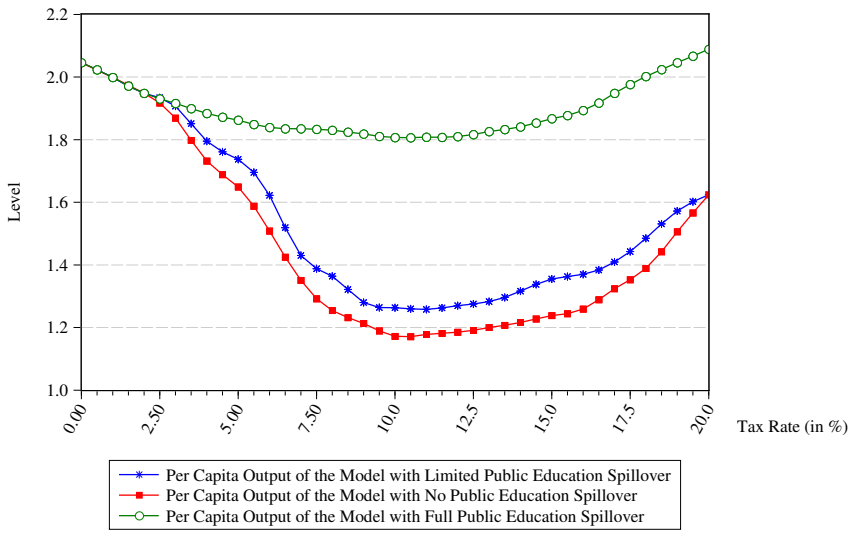


Figure 21: Stationary Distribution for Calibrated the U.S. Economy

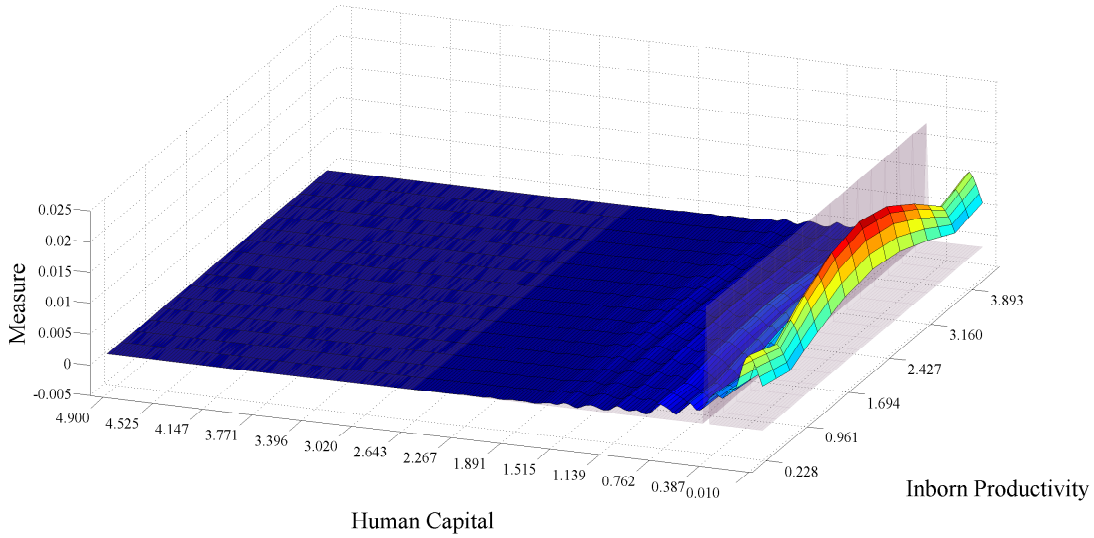


Figure 22: Stationary Distribution for the Calibrated European Economy

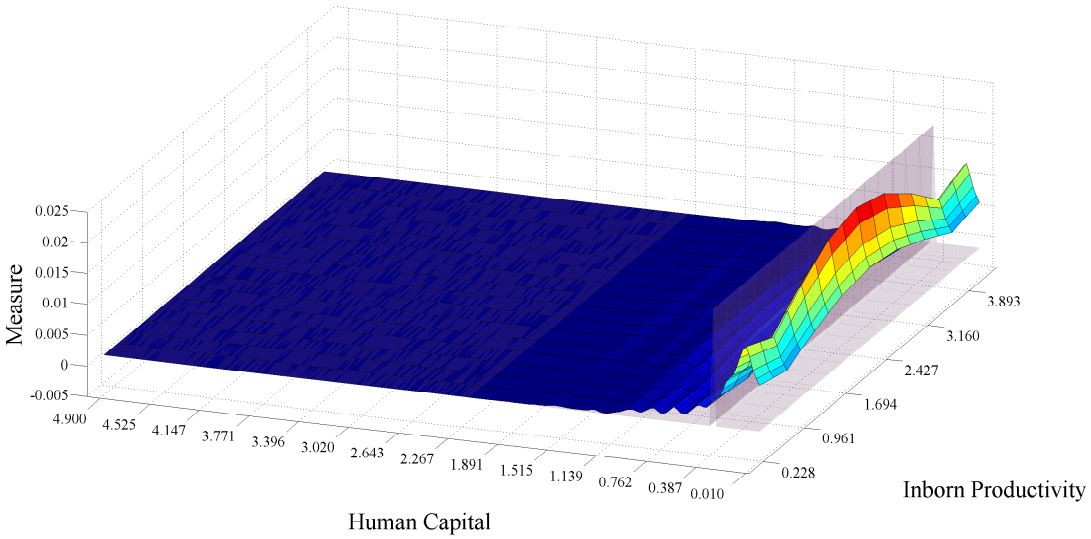


Figure 23: Average Egalitarian Welfare and Consumption

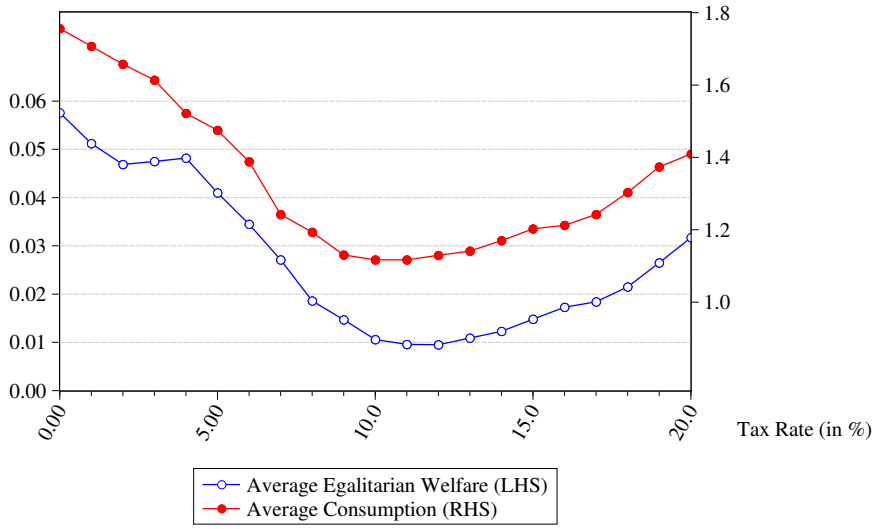


Figure 24: Lifetime Welfare with Median Productivity

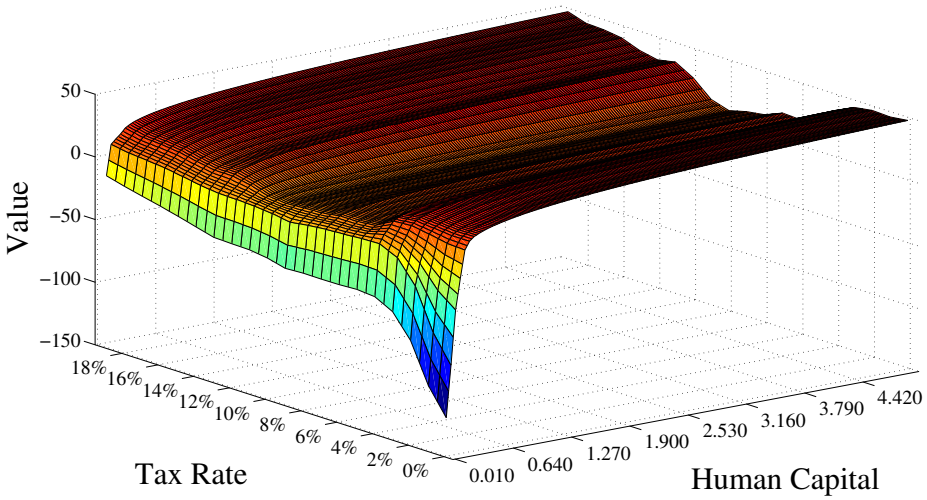
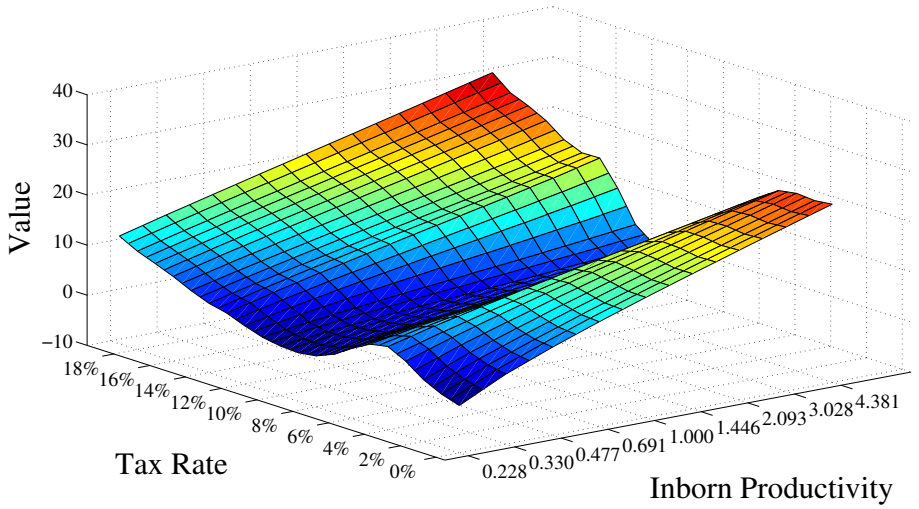


Figure 25: Lifetime Welfare with $h = 0.20$



Tables

Table 1: Descriptive Statistics from International Adult Literacy Survey

Male				
	Mean	**Standard Deviation**	**Differential**	
			50-10 Percentile	90-50 Percentile
Denmark	296.44	38.00	51.44	38.92
Finland	296.75	40.19	54.14	45.82
Italy	251.86	56.58	88.74	52.48
Netherlands	294.07	40.43	55.88	41.12
Norway	300.09	38.62	57.96	40.00
Sweden	311.60	46.37	57.63	52.03
Switzerland	283.36	51.19	64.12	44.18
Europe Average	290.60	44.48	61.42	44.94
United States	288.97	61.43	80.67	59.98
Female				
	Mean	**Standard Deviation**	**Differential**	
			50-10 Percentile	90-50 Percentile
Denmark	292.86	35.01	56.05	36.49
Finland	296.45	39.18	54.49	42.82
Italy	259.75	50.31	75.07	49.32
Netherlands	300.53	34.17	52.80	36.54
Norway	306.02	37.51	51.33	40.36
Sweden	308.54	43.08	51.01	50.93
Switzerland	278.51	47.53	53.17	43.16
Europe Average	291.81	40.97	56.28	42.81
United States	289.56	58.79	73.01	58.34

Based on Blau and Kahn (2005).

Table 2: Benchmark Parameter Values

λ	0.625	Bénabou (2002)
γ	0.200	Zhang (2005)
ρ	0.800	Zhang (2005)
ε	0.300	Bénabou (2002) & Zhang (2005)
σ_η^2	0.259	Heathcote et al. (2010)
ν	0.500	Neutral Stance from Two Polar Cases
ψ	0.370	US Redistribution Share (OECD Database, 2008)
ω	0.500	Frisch Elasticity=2
ϕ	0.513	Calibrated to Match US Labor=0.287
σ_ξ^2	0.769	Calibrated to Match US $\iota_l = 29.88\%$
Θ	3.345	Calibrated to Match Europe $\iota_l = 42.75\%$
τ^{US}	7.13%	Calibrated to Match US $\overline{E}/\overline{\mathcal{E}} = 44.83\%$
τ^{EU}	11.96%	Calibrated to Match Europe $\overline{E}/\overline{\mathcal{E}} = 78.54\%$

Table 3: Stationary Distribution Results over Taxes

τ	$\overline{Y}$	$\overline{C}$	$\overline{H}$	$\overline{L}$	$\overline{\mathcal{E}}$	$\overline{E}$	$\overline{Tr}$	$Pop._{\overline{E}}$	$\overline{E}/\overline{\mathcal{E}}$	ι_l
0.00%	2.046	1.756	0.793	0.338	0.290	0.000	0.000	0.00%	0.00%	16.87%
2.50%	1.933	1.640	0.725	0.328	0.262	0.032	0.019	0.00%	12.09%	18.50%
5.00%	1.737	1.475	0.612	0.310	0.217	0.057	0.034	19.56%	26.35%	21.49%
7.13%	1.401	1.220	0.424	0.283	0.150	0.067	0.040	53.03%	44.83%	29.88%
7.50%	1.387	1.210	0.417	0.281	0.147	0.068	0.040	55.04%	46.38%	31.37%
10.00%	1.263	1.117	0.351	0.271	0.125	0.083	0.049	75.32%	66.42%	40.76%
11.96%	1.268	1.128	0.355	0.270	0.126	0.099	0.058	85.25%	78.54%	42.75%
12.50%	1.275	1.134	0.357	0.270	0.128	0.105	0.062	87.47%	81.67%	43.22%
15.00%	1.355	1.202	0.400	0.264	0.146	0.134	0.079	94.20%	91.63%	40.08%
17.50%	1.442	1.268	0.448	0.257	0.169	0.166	0.097	98.04%	97.70%	36.89%
20.00%	1.624	1.409	0.557	0.251	0.213	0.213	0.126	100.00%	100.00%	29.99%

Note: $\overline{Y}$ denotes average output, $\overline{C}$ denotes average consumption, $\overline{H}$ denotes average human capital, $\overline{C}$ denotes average labor, $\overline{E}$ denotes public education expenditure, $\overline{\mathcal{E}}$ denotes total expenditure on education, $\overline{Tr}$ denotes government transfers, $Pop._{\overline{E}}$ denotes the fraction of population who attend public education, and ι_l denotes the share of income inequality due to luck.

Table 4: Distributional Properties of the Benchmark Model

τ	$GINI_y$	$GINI_{\widehat{y}}$	$GINI_c$	$GINI_h$	$GINI_l$	$GINI_e$
0.00%	0.333	0.333	0.343	0.505	0.070	0.296
2.50%	0.335	0.332	0.342	0.507	0.078	0.300
5.00%	0.346	0.340	0.341	0.518	0.100	0.346
7.13%	0.353	0.345	0.330	0.527	0.121	0.369
7.50%	0.353	0.344	0.330	0.526	0.121	0.366
10.00%	0.345	0.334	0.316	0.514	0.118	0.279
11.96%	0.338	0.324	0.309	0.503	0.111	0.190
12.50%	0.336	0.322	0.308	0.500	0.108	0.166
15.00%	0.327	0.309	0.301	0.488	0.095	0.074
17.50%	0.320	0.299	0.296	0.479	0.086	0.024
20.00%	0.314	0.290	0.290	0.474	0.075	0.000

Table 5: Comparison of Model with Data

	Country	$\overline{\tau}$	$\overline{E}/\overline{\mathcal{E}}$	ι_L	$\overline{Y}/\overline{Y}^{US}$	$\overline{L}$	GINI(y)	GINI($\widehat{y}$)	GINI(e)
Data	U.S.	12.02%	44.83%	29.88%	1.000	0.287	0.486	0.378	N/A (+)
	Europe	21.19%	78.54%	42.75%	0.815	0.257	0.449	0.290	N/A (−)
Model	U.S.	7.13%	44.83%	29.88%	1.000	0.283	0.353	0.345	0.369
	Europe	11.96%	78.54%	42.75%	0.910	0.270	0.338	0.324	0.190

Table 6: Stationary Distribution Results over Taxes with Zero Spillover

τ	$\overline{Y}$	$\overline{C}$	$\overline{H}$	$\overline{L}$	$\overline{\mathcal{E}}$	$\overline{E}$	$\overline{Tr}$	$Pop._{\overline{E}}$	$\overline{E}/\overline{\mathcal{E}}$	ι_l
0.00%	2.046	1.756	0.793	0.338	0.290	0.000	0.000	0.00%	0.00%	16.87%
2.50%	1.916	1.630	0.714	0.327	0.258	0.030	0.018	2.20%	11.89%	18.83%
5.00%	1.649	1.412	0.550	0.312	0.190	0.053	0.031	25.54%	29.52%	24.69%
7.50%	1.305	1.158	0.360	0.294	0.125	0.065	0.038	59.00%	52.63%	39.30%
10.00%	1.172	1.063	0.299	0.285	0.107	0.077	0.045	82.18%	72.24%	46.18%
12.50%	1.191	1.084	0.308	0.278	0.110	0.097	0.057	93.94%	87.81%	45.65%
15.00%	1.238	1.127	0.330	0.272	0.125	0.122	0.072	98.56%	97.91%	43.97%
17.50%	1.363	1.226	0.397	0.263	0.158	0.158	0.093	100.00%	100.00%	38.83%
20.00%	1.624	1.409	0.557	0.251	0.213	0.213	0.125	100.00%	100.00%	29.99%

Table 7: Distributional Properties of the Model with Zero Spillover

τ	$GINI_y$	$GINI_{\widehat{y}}$	$GINI_c$	$GINI_h$	$GINI_l$	$GINI_e$
0.00%	0.333	0.333	0.343	0.505	0.070	0.296
2.50%	0.337	0.334	0.339	0.510	0.082	0.317
5.00%	0.349	0.344	0.324	0.526	0.114	0.407
7.50%	0.355	0.348	0.313	0.533	0.143	0.435
10.00%	0.348	0.339	0.304	0.521	0.145	0.337
12.50%	0.328	0.315	0.295	0.489	0.137	0.112
15.00%	0.324	0.309	0.293	0.484	0.132	0.047
17.50%	0.319	0.299	0.291	0.475	0.110	0.001
20.00%	0.314	0.290	0.290	0.474	0.075	0.000

Table 8: Stationary Distribution Results over Taxes with Full Spillover

τ	$\overline{Y}$	$\overline{C}$	$\overline{H}$	$\overline{L}$	$\overline{\mathcal{E}}$	$\overline{E}$	$\overline{Tr}$	$Pop._{\overline{E}}$	$\overline{E}/\overline{\mathcal{E}}$	ι_l
0.00%	2.046	1.756	0.793	0.338	0.290	0.000	0.000	0.00%	0.00%	16.87%
2.50%	1.935	1.672	0.729	0.325	0.263	0.030	0.018	1.64%	11.65%	18.49%
5.00%	1.862	1.617	0.696	0.297	0.240	0.061	0.036	16.13%	25.59%	19.53%
7.50%	1.832	1.596	0.672	0.269	0.234	0.091	0.054	31.58%	39.03%	19.96%
10.00%	1.807	1.574	0.655	0.249	0.233	0.119	0.070	43.12%	50.89%	20.74%
12.50%	1.816	1.580	0.658	0.251	0.236	0.148	0.087	53.97%	62.65%	20.52%
15.00%	1.867	1.605	0.696	0.249	0.263	0.184	0.108	62.21%	70.06%	19.18%
17.50%	1.980	1.675	0.768	0.244	0.305	0.229	0.135	67.63%	75.05%	17.43%
20.00%	2.089	1.761	0.849	0.244	0.328	0.274	0.161	72.47%	83.70%	15.41%

Table 9: Distributional Properties of the Model with Full Spillover

τ	$GINI_y$	$GINI_{\widehat{y}}$	$GINI_c$	$GINI_h$	$GINI_l$	$GINI_e$
0.00%	0.333	0.333	0.343	0.505	0.070	0.296
2.50%	0.336	0.333	0.342	0.508	0.079	0.298
5.00%	0.341	0.335	0.343	0.510	0.093	0.284
7.50%	0.344	0.336	0.343	0.510	0.107	0.268
10.00%	0.342	0.330	0.337	0.509	0.100	0.254
12.50%	0.335	0.318	0.321	0.500	0.068	0.200
15.00%	0.332	0.312	0.313	0.492	0.060	0.188
17.50%	0.327	0.303	0.300	0.479	0.048	0.173
20.00%	0.323	0.296	0.285	0.471	0.041	0.154

Table 10: Absence of Idiosyncratic Productivity Shocks ($\sigma_\xi^2 = 0$)

τ	$\overline{Y}$	$\overline{C}$	$\overline{H}$	$\overline{L}$	$\overline{\mathcal{E}}$	$\overline{E}$	$\overline{Tr}$	$\overline{E}/\overline{\mathcal{E}}$	$Pop._{\overline{E}}$	ι_l
0.00%	0.818	0.622	0.200	0.342	0.197	0.000	0.000	0.00%	0.00%	100.00%
7.13%	0.586	0.472	0.124	0.311	0.113	0.026	0.015	23.24%	0.00%	100.00%
11.96%	0.253	0.234	0.034	0.287	0.019	0.019	0.011	100.00%	100.00%	100.00%
20.00%	0.421	0.368	0.080	0.268	0.053	0.053	0.031	100.00%	100.00%	100.00%

Table 11: Persistent Inborn Productivity Shocks ($\kappa = 0.40, \sigma_\xi = 0.915$)

τ	$\overline{Y}$	$\overline{C}$	$\overline{H}$	$\overline{L}$	$\overline{\mathcal{E}}$	$\overline{E}$	$\overline{Tr}$	$\overline{E}/\overline{\mathcal{E}}$	$Pop._{\overline{E}}$	ι_l
0.00%	2.012	1.736	0.759	0.351	0.276	0.000	0.000	0.00%	0.00%	16.99%
7.13%	1.318	1.177	0.378	0.290	0.141	0.059	0.035	41.98%	49.12%	33.12%
11.96%	1.135	1.018	0.311	0.256	0.117	0.083	0.049	71.16%	77.84%	46.36%
20.00%	1.537	1.339	0.508	0.224	0.197	0.196	0.135	100.00%	100.00%	32.14%

Table 12: Higher Complementarity Effect of Aggregate Human Capital ($\gamma = 0.00$)

τ	$\overline{Y}$	$\overline{C}$	$\overline{H}$	$\overline{L}$	$\overline{\mathcal{E}}$	$\overline{E}$	$\overline{Tr}$	$\overline{E}/\overline{\mathcal{E}}$	$Pop._{\overline{E}}$	ι_l
0.00%	2.361	2.039	0.996	0.345	0.321	0.000	0.000	0.00%	0.00%	11.71%
7.13%	1.442	1.281	0.444	0.285	0.133	0.068	0.040	50.74%	58.56%	31.30%
11.96%	1.388	1.251	0.416	0.277	0.127	0.110	0.064	86.31%	90.41%	37.47%
20.00%	1.936	1.682	0.759	0.293	0.254	0.254	0.149	100.00%	100.00%	21.44%

Table 13: Higher Return on Education ($\varepsilon = 0.33$)

τ	$\overline{Y}$	$\overline{C}$	$\overline{H}$	$\overline{L}$	$\overline{\mathcal{E}}$	$\overline{E}$	$\overline{Tr}$	$\overline{E}/\overline{\mathcal{E}}$	$Pop._{\overline{E}}$	ι_l
0.00%	2.111	1.783	0.835	0.343	0.328	0.000	0.000	0.00%	0.00%	15.64%
7.13%	1.555	1.322	0.511	0.295	0.192	0.073	0.043	38.06%	42.14%	24.94%
11.96%	1.321	1.186	0.367	0.274	0.135	0.100	0.059	74.39%	82.01%	36.68%
20.00%	1.697	1.492	0.591	0.288	0.206	0.206	0.121	99.50%	99.50%	25.15%

Table 14: Higher Share of Redistribution in Government Budget ($\psi = 0.407$)

τ	$\overline{Y}$	$\overline{C}$	$\overline{H}$	$\overline{L}$	$\overline{\mathcal{E}}$	$\overline{E}$	$\overline{Tr}$	$\overline{E}/\overline{\mathcal{E}}$	$Pop._{\overline{E}}$	ι_l
0.00%	2.046	1.756	0.793	0.338	0.290	0.000	0.000	0.00%	0.00%	16.87%
7.13%	1.159	1.043	0.403	0.270	0.116	0.054	0.080	46.55%	53.45%	31.48%
11.96%	1.018	0.912	0.337	0.256	0.106	0.090	0.073	85.09%	89.62%	44.02%
20.00%	1.537	1.370	0.525	0.273	0.197	0.196	0.135	100.00%	100.00%	31.50%

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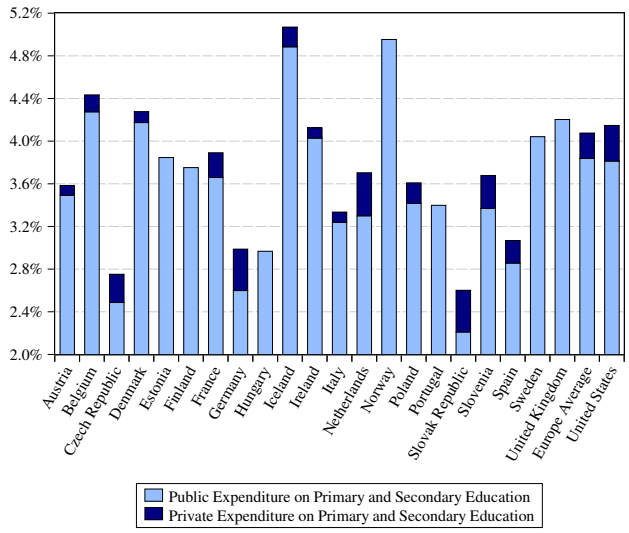
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Appendix

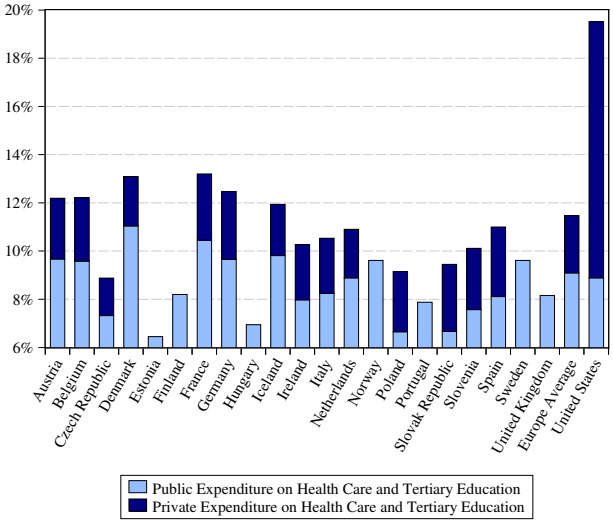
A: Figures

Figure: Public vs. Private Primary & Secondary Education Exp. by Country (% of GDP)



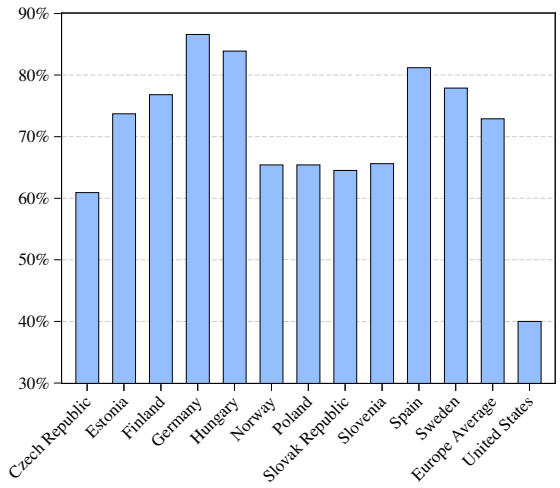
Source: OECD Database (2004-2008)

Figure: Public vs. Private Health Care & Tertiary Education Exp. by Country (% of GDP)



Source: OECD Database (2004-2008)

Figure: Fraction of the Population with the Belief that People are in Need due to an Unfair Society



Source: World Values Survey (1981-2008)

B: Tables

Higher Share of Human Capital in Production ($\lambda = 0.686$)

τ	$\overline{Y}$	$\overline{C}$	$\overline{H}$	$\overline{L}$	$\overline{\mathcal{E}}$	$\overline{E}$	$\overline{Tr}$	$\overline{E}/\overline{\mathcal{E}}$	$Pop._{\overline{E}}$	ι_l
0.00%	2.111	1.783	0.835	0.343	0.328	0.000	0.000	0.00%	0.00%	15.64%
7.13%	1.555	1.322	0.511	0.295	0.192	0.073	0.043	38.06%	42.14%	24.94%
11.96%	1.321	1.186	0.367	0.274	0.135	0.100	0.059	74.39%	82.01%	36.68%
20.00%	1.697	1.492	0.591	0.288	0.206	0.206	0.121	99.50%	99.50%	25.15%

Higher Altruism Rate ($\rho = 0.880$)

τ	$\overline{Y}$	$\overline{C}$	$\overline{H}$	$\overline{L}$	$\overline{\mathcal{E}}$	$\overline{E}$	$\overline{Tr}$	$\overline{E}/\overline{\mathcal{E}}$	$Pop._{\overline{E}}$	ι_l
0.00%	2.355	1.978	1.000	0.353	0.377	0.000	0.000	0.00%	0.00%	12.99%
7.13%	1.743	1.465	0.620	0.307	0.225	0.080	0.047	35.53%	39.28%	20.54%
11.96%	1.415	1.233	0.433	0.280	0.157	0.111	0.065	70.62%	79.25%	32.03%
20.00%	1.663	1.439	0.581	0.286	0.220	0.215	0.126	97.93%	98.42%	27.62%

C: Computational Strategy

The computational strategy I employ to solve for recursive competitive equilibrium is a modified heterogeneous-agent economy with incomplete markets algorithm *à la* Huggett (1993). The proposed algorithm works as follows: for a given tax rate, first I make initial joint guesses for aggregate human capital $\overline{H}$, public education $\overline{E}$ and government transfers $\overline{Tr}$. Second, taking these values given, I solve for optimal decision rules of agents in all possible idiosyncratic human capital h and inborn productivity ξ state pairs by the use of value function iteration technique. Third, I perform Monte Carlo simulations for sufficiently large number of periods and households (11000 periods and 1000 households), discard some initial number of periods (1000 periods), and using the generated data, I calculate averages of the simulated aggregate human capital, public education and government transfer levels, i.e. $\sum_{t=1}^{T} \frac{H_t^{sim}}{T} = \overline{\widehat{H}}$, $\sum_{t=1}^{T} \frac{E_t^{sim}}{T} = \overline{\widehat{E}}$, and $\sum_{t=1}^{T} \frac{Tr_t^{sim}}{T} = \overline{\widehat{Tr}}$. If any of the simulated values is different than the initial guess for the variables at a reasonable tolerance level, i.e. if $\max\{|\overline{\widehat{H}} - \overline{H}|, |\overline{\widehat{E}} - \overline{E}|, |\overline{\widehat{Tr}} - \overline{Tr}|\} > \epsilon^{tol}$, I update my initial guesses and go over the same steps until convergence is achieved. For robustness check, I also derive the theoretical stationary distribution employing decision rules and exogenous law of motion for the inborn productivity shocks, and using the stationary distribution I calculate the implied theoretical aggregate human capital, public education and government transfers, and compare them against the simulated values. I verify that the implied human capital, public education and government transfer values are the same convergent ones from the Monte Carlo simulations. Throughout these steps, I also ensure that the grids and interpolations are fine enough so that computational errors are kept at a minimal level. For each tax rate I go over the same steps and derive the respective stationary equilibrium.

D: World Values Survey

The World Values Survey (WVS) is a wave of surveys conducted by the non-profit The World Values Survey Association seated in Stockholm, Sweden. The WVS aims to investigate beliefs, perceptions, values and motivations of people throughout the world for the purpose of better serving social scientists and policy-makers. In order to keep track of the trends, the WVS (jointly with European Values Survey, EVS) has executed six waves of surveys, from 1981 to 2012, and the findings from the earlier five waves, covering up to 2007 are available online. In my analyses, I make use of all the publicly-available data. The wording and structure of the questions I and earlier studies employed are as below:

- Hard work brings success (WVS Code E040)

How would you place your views on this scale? 1 means you agree completely with the statement

on the left; (10) means you agree completely with the statement on the right; and if your views fall somewhere in between, you can chose any number in between.
Agreement: Hard work brings success.
Possible Answers
(1) In the long run, hard work usually brings a better life
(10) Hard work doesn't generally bring success - it's more a matter of luck and connections

I rescale the responses coded on a scale of 1 to 10 to range between 0 and 1, and calculate the relevant statistics.

- Why are people in need (WVS Code E131):

Why, in your opinion, are there people in this country who live in need? Here are two opinions: Which comes closest to your view?
Possible Answers
(1) Poor because of laziness and lack of will power
(2) Poor because of an unfair society
(3) Other answer

I exclude the observations with the "other answer", and rescale the responses coded on a scale of 1 to 2 to range between 0 and 1.