Luxury for All: A Theory of In-kind Benefits and Inequality

Charles Labrousse* and Yann Perdereau[x†]

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Abstract

Much of the existing literature models in-kind benefits as an exogenous parameter G, implicitly relying on a missing market hypothesis, even though many of these goods have private counterparts. This paper develops a new theory of public spending based on two key features: government-provided goods are luxury goods, and they generate concave externalities. First, we show that these two conditions are necessary and sufficient for optimal public provision to be positive. Second, using household-level surveys and administrative data from multiple countries, we classify in-kind benefits and confirm their luxury status. Third, we embed these findings into a heterogeneous-agent model with multiple goods and both public and private consumption. We use the model to: (i) quantify the shape of externalities consistent with observed policies; (ii) examine how optimal provision responds to inequality; (iii) derive the optimal path of public debt reduction; and (iv) revise Distributional National Accounts methodology to account for in-kind benefits.

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*Insee/Paris School of Economics, charles.labrousse@psemail.eu

†Paris School of Economics, yann.perdereau@psemail.eu

Introduction

In-kind benefits constitute a significant share of government expenditure, yet most models treat it as an exogenous, fixed parameter, denoted as $\bar{G}$ in the government budget constraint. A common approach to rationalizing such spending is to assume that in-kind goods generate externalities, leading to an optimality formula that relates the marginal benefits of private and public consumptions and the marginal cost of financing. Thus, the government's role is to strike the right balance among transfers designed to correct heterogeneity, public spending intended to address externalities, and the efficiency costs imposed by associated taxes.

While this framework is clear, it implicitly grants the government a special ability: to provide goods – such as education and health – that agents value but cannot access on their own. This "missing market" rationale may be appropriate for defense, but is less convincing for goods like education, healthcare, culture, or transportation, where private alternatives are available. One way to address this is to allow agents to consume these goods privately. However, this assumption can render public provision and transfers close substitutes, raising the question of why governments would pursue both. Moreover, if transfers fully correct for inequality, the optimal provision of public goods becomes independent of redistributive concerns – a result that contrasts with the common view that public services disproportionately benefit lower-income households, who lack access to private substitutes.

In this paper, we propose a theoretical, empirical, and quantitative solution to this problem by assuming that state-provided goods, such as education and health, are luxury goods. This assumption has two key implications. First, some low-income agents are in a corner solution and do not consume these goods, which neutralizes the crowding-out effect and breaks the substitutability between transfers and public spending. Second, total private consumption of these goods now depends on the level of inequality, linking inequality to the optimal level of public spending.

We first show theoretically that modeling public goods as luxuries resolves both the "missing market critique" (*i.e.*, the unappealing assumption that only the government can produce certain goods) and the issue of perfect substitutability between transfers and public expenditures. Using an analytically tractable model with heterogeneous agents, we demonstrate that non-homothetic preferences interact with inequality to yield an optimal, interior solution for both transfers and public spending, each shaped by heterogeneity and externality considerations. This result crucially depends on the shape of externalities. If individual contributions to externality are perfect substitutes, for example if one person with 2 vaccines and one with 0 yield the same externality as two persons with 1 vaccine, then subsidy dominates in-kind benefits for externality, and the optimal level of G is null. However, if individual contributions to externality are imperfect substitutes, for example if the productivity is higher with two average-educated workers than with one very educated and one without education, then the optimal level of G is strictly positive, and increases with the complementary between contributions. Therefore, we show analytically that in-kind benefits are justified when the goods provided are luxury goods, and generate concave externalities.

Next, we provide empirical evidence supporting our claim that privately consumed goods also provided by the state, such as education, health, security, culture and transportation, are luxury goods. We first provide definitions for cash transfers, in-kind transfers and subsidies, and allocate public spending to these categories in various countries. We then focus on France and systematically categorize spending to different sectors. Second, we use cross-section country data to estimate the elasticity of country's sectoral private expenditures to country's income and obtain elasticities above 1 for health, education, culture and transportation, implying these goods are luxury goods at the cross-country level. Finally, using microdata from multiple countries, we show that the share of private spending on these goods rises with income, while public consumption declines – both due to high-income households opting out and targeted public programs benefiting low-income groups. Therefore, we use empirical evidence to justify that our key assumption – that goods provided by the government are luxury goods – is verified.

Finally, we develop a heterogeneous-agent model with multiple sectors, where households can purchase a pure private good, and seven other sectoral goods (education, health, security, housing, energy, culture and transportation). These goods are also provided by the government through in-kind benefits, or subsidized. We first compute for each good what is the externality function consistent with the observed public policies. Consistent with our analytical model, we show that the higher the recurse to in-kind benefits relative to subsidy in one sector, the lower the implied substitutability between individual contributions in the externality function. We then use our quantitative model and our estimates for the externality function to perform three applications. First, we find the optimal way of reducing public debt, using in-kind benefits, subsidies and taxes to generate government surpluses. As fiscal consolidation reduces private consumption of externality goods, the government must compensate the drop for poor people by providing more in-kind benefit. Therefore, the fiscal consolidation is achieved by reducing pure public good provision and subsidies, but increasing in-kind provision of education and health. Second, we use our theory to propose a new methodology for the Distributional National Account (DINA). While the DINA methodology imputes public spending to households without correcting for the utility provided by these goods, we correct it by taking into account poor people prefer cash transfer to in-kind transfers for goods they do not consume. This new imputation tends to increase the inequality measures: the Gini index in France goes from 0.18 for the usual methodology, to 0.21 for our imputation rule. Third, we consider a policy experiment where the government can target the in-kind provision of goods, based on individual's caracteristics. We first use micro-data to find the functional forms of the observed targeted in-kind provision in different sectors. Then, we compute the optimal rules for in-kind provision. We find that the optimal provision of free education and health is biased towards the poor, as rich people would pay for these goods even if they were not free. Allowing the government to discriminate the public provision of goods based on households' income generate a sizable increase in welfare.

1 Literature review

This paper contributes to three literatures: optimal public spending, fiscal policy under heterogeneity, and the marginal value of public funds.

Optimal public spending. The modern literature on the efficient provision of public goods originates with Samuelson (1954) seminal contribution, and his formula relating the marginal utility of private and public consumption G. Subsequent work has extended this framework to incorporate production inefficiencies (Diamond and Mirrlees (1971)), tax distortions (Stiglitz and Dasgupta (1971), Atkinson and Stern (1974)), political economy considerations(Meltzer and Richard (1981), Epple and Romano (1996)), and labor market frictions (Michaillat and Saez (2019)). We complement these papers by relaxing three key assumptions. First, we abandon the missing markets hypothesis, allowing private consumption of publicly-provided goods. Second, we allow cash transfers, making in-kind provision potentially dominated for the redistribution motive. Third, we allow subsidies, making G potentially dominated for the externality motive. Under these conditions, justifying public provision becomes substantially more challenging.

While Currie and Gahvari (2008) rationalize in-kind transfers through paternalistic preferences or interdependent utility, we provide a microfounded mechanism through non-homothetic preferences over government-provided goods. This creates an intrinsic link between inequality and optimal public consumption, similar to Besley and Coate (1991) opt-out mechanism for quality-differentiated public goods, though we also allow corrective transfers to address heterogeneity. Our framework necessitates systematic classification of transfers, subsidies, and in-kind provision across sectors. As Cox et al. (2024) departs from the "big G" modeling by documenting the granularity of public purchases, we focus on the distributive consequences of each sectoral spending. Our work complements the distributional national accounts (DINA) methodology of Piketty, Saez, and Zucman (2018). Inspired by the contributions of Aaron and McGuire (1970), Bergstrom and Goodman (1973) or Brennan (1976), DINA impute public spending to households based on individual's caracteristics (age, income, location,...). As the valuation of public spending by households lies at the core of our model, we revisit DINA methodology to account for the value households give to in-kind provision relative to cash transfers.

Optimal fiscal policies and inequalities. The optimal taxation with inequality literature, initiated by Mirrlees (1971) and refined by Saez (2001), establishes the efficiency-equity trade-off: while redistribution toward high-marginal-utility poor households is desirable, tax distortions create an interior optimum for transfers that increases with inequality and decreases with efficiency costs. Recent extensions have examined optimal policy under heterogeneous productivity shocks (Golosov, Troshkin, and Tsyvinski (2016)), human capital accumulation (Stantcheva (2017)), business cycles (McKay and Reis (2021)), and transfers (Ferriere, Grübener, et al. (2023)). While these papers have focused on the tax-and-transfer components of fiscal policy, we address the (sizable) remaining part: in-kind benefits and subsidies, and their redistributive role. Following the tractable heterogeneous-agent approaches of Benabou (2002) and Heathcote, Storesletten, and Violante (2017), we develop a framework to study the link between public spending and inequality, and compute the optimal provision of public spending in the quantitative version of the model. Unlike these contributions, which emphasize skill investment and its effects on aggregate efficiency, we focus on the interaction between government provision, private consumption, and distributional outcomes, providing realistic microfoundations for in-kind benefit provision.

Marginal value of public funds and externalities. Finally, we contribute to the literature on the marginal value of public goods (MVPF) and the estimation of externalities. In the same spirit of Hendren and Sprung-Keyser (2020), we propose a unified method to compute the value of each in-kind benefit. While their approach synthesizes empirical estimates across policies, we employ structural modeling to discipline externality parameters and welfare calculations. This offers three key advantages. First, it allows us to go "beyond the margin": whereas MVPF analysis often implies allocating all resources to the highest-yielding policy, our framework accounts for diminishing marginal returns. Second, we are not limited to evaluating existing policies; the structural model enables counterfactual analysis of hypothetical or proposed interventions. Third, general equilibrium modeling captures the full fiscal and behavioral feedback effects of each policy, allowing for a consistent welfare analysis.

2 Analytical results

In this section, we introduce a stylized model that highlights the typical implementation of public spending in macroeconomic models, its shortcomings, and our proposed solution. We first assume that households are heterogeneous in terms of their productivity z_i, such that $z_i \sim \text{log-Normal}\left(-\frac{\nu}{2}, \nu\right)$.[1] Households choose their consumption of the normal good c and of the luxury good g. We think as g as private education, health, security, transportation, cultural expenditures, which the government can also provide through in-kind benefits G or subsidized at rate s. Labor supply n is endogenous so that there is an efficiency cost of taxation.[2] Finally, there is an externality in the total consumption of these goods, which they cannot directly control. Each household i solves the following problem:

$$\max_{c_i, g_i, n_i} u_i = (1-\omega)\ln(c_i) + \underbrace{\omega \ln(g_i + G + \bar{g})}_{\text{Private consumption}} - \psi n_i + \underbrace{\frac{\chi}{\alpha}\ln\left(\int_j (g_j + G + \bar{g})^\alpha\right)}_{\text{externality}}$$

$$\text{such that } c_i + (1-s)g_i = (1-\tau)\underbrace{z_i}_{\text{heterogeneity}} n_i + T$$

$$\text{and } g_i, c_i, n_i \geq 0$$

For some households with a productivity lower than a threshold $\zeta(\bar{g}, G, T, \tau, s)$, the constraint $g_i \geq 0$ binds, meaning that they don't privately consume education and health. We assume that the government finances in-kind benefits G, subvention to private consumption s and transfers T using labor taxes, with the tax rate τ adjusting to balance the budget constraint:

$$G + T + s\int g_i = \tau \int z_i n_i$$

Finally, we assume a utilitarian planner with the following welfare function:

$$\mathbb{W} = \int u_i$$

In the following, we propose three versions of the model, and discuss the associated optimal transfers and in-kind benefits chosen by the planner.[3]

[1] We choose this specification because the mean is independent from ν, *i.e.* $\mathbb{E}[z] = 1$, and the variance is controlled by the inequality parameter ν.

[2] We assume a linear disutility of labor to have closed-form solutions with non-homothetic preferences. We will introduce more general preferences in the quantitative model.

[3] See Appendix for derivations.

Theorem 1: the "chicken model". *Suppose $\omega = \bar{g} = 0$: households cannot privately consume g. The welfare-maximizing public spending and transfer-to-GDP ratios are given by*

$$\frac{G^\star}{Y^\star} = \frac{\chi}{1+\chi}$$
$$\frac{T^\star}{Y^\star} = \frac{1}{1+\chi} - e^{-\nu}$$

In this model, $g_i = 0$ for everyone: households do not privately derive utility from education and health, but there is an externality associated to these goods, giving a "magical" ability to the government to satisfy households. There is a clear dichotomy in optimal fiscal policy: G addresses externality, and T addresses inequality (and there is obviously no subsidy). The optimal provision of in-kind benefits is independent from inequality, which seems at odds with the common wisdom that public services primarily benefit poorer populations. Therefore, we must allow households to privately consume education and health.

Theorem 2: perfect substitutes. *Suppose $\bar{g} = 0$: g is a normal good. Transfers and public spending are indeterminate ($\frac{\partial u_i}{\partial T} = \frac{\partial u_i}{\partial G}$) and their optimal sum is given by:*

$$\frac{G^\star + T^\star}{Y^\star} = \Gamma(\nu), \quad \textit{with } \Gamma'(\nu) > 0$$

As $g_i > 0$ for every households, transfers and in-kind benefits have the same welfare effect. If the government gives households a transfer T, they will allocate a share $1-\omega$ to increase c_i, and a share ω to increase g_i; and if the government gives households G, they will reduce by $1-\omega$ their private consumption of g_i and use this money to increase c_i by $1-\omega$, yielding the exact same welfare. T and G are perfects substitutes, thereby raising the question of why governments should engage in both. Finally, the welfare-maximizing subvention is given by

$$s^* = \frac{\chi}{\omega + \chi}$$

Theorem 3: luxury goods.
Lemme 3.1. *Suppose g is a luxury goods, i.e. $\bar{g} > 0$. In this case, there exists a threshold ζ such that $\forall z_i \leq \zeta, g_i = 0$. Therefore, we have two types of households:*

$$\begin{cases} \forall z_i \leq \zeta, g_i = 0 \implies \frac{\partial u_i}{\partial T} > \frac{\partial u_i}{\partial G} \\ \forall z_i > \zeta, g_i > 0 \implies \frac{\partial u_i}{\partial T} = \frac{\partial u_i}{\partial G} \end{cases}$$

T and G do not have the same direct welfare effects on households, hence they are not perfect substitutes anymore, and T dominates G for the redistributive motive.

Lemme 3.2. *Suppose $\alpha = 1$: the externality is strictly additive. In this case, the optimal in-kind benefit is equal to 0: $G^\star = 0$.*

In this case, the planner only cares about the total level of the good, *i.e.* $\int_j (g_j + G + \bar{g})$. To increase this level, the planner should use subsidy s, that will increase g_i for rich people, even if it does not increase g_i for poor. Therefore, s dominates G for the externality motive, implying with the Lemme 3.1 that $G^\star = 0$.

Lemme 3.3. *Suppose $\alpha < 1$: the externality is concave. In this case, the optimal in-kind benefit is strictly positive: $G^\star = 0$, and the derivative of welfare with respect to G is given by*

$$\frac{dW}{dG} = \underbrace{-\psi e^\nu \frac{1 - S^p\tau - S^r s}{1-\tau}}_{\substack{\text{Redistribution} \\ (\searrow \text{ with } \nu)}} + \underbrace{\psi \frac{1-s}{1-\tau}\int_{\text{rich}}\left[\frac{1}{z_i}\right]}_{\substack{\text{Labor supply for rich} \\ (\searrow \text{ with } \nu)}} + \underbrace{\frac{\omega}{G+\bar{g}} S^p}_{\substack{\text{Provision for poor} \\ (\nearrow \text{ with } \nu)}} + \underbrace{\frac{\alpha X'(G)}{(G+\bar{g})^{1-\alpha}} S^p}_{\substack{\text{Externality} \\ (\nearrow \text{ with } \nu)}}$$

with $S^p = \mathbb{E}[z_i \leq \zeta]$ the share of "poor" households with $g_i = 0$, and $S^r = \mathbb{E}[z_i > \zeta]$ the share of "rich" households with $g_i > 0$. The first term is the redistribution motive: the higher the inequality, the higher the need for transfer, and then the lower the optimal G. The second term is the labor supply effect for rich households: the higher the inequality, the lower the share of rich people, the lower the labor reduction when G increases, the lower the optimal G. The third term is the gain for poor people: the higher the inequality, the higher the share of poor people, the higher the utility gain when G increases (because they do not crowd-out), the higher the optimal G. Finally, the fourth term is the externality motive: the higher the inequality, the higher the share of poor people, the lower the crowding-out on private g_i of an increase in G, the higher the optimal G. In Appendix A, we run a numerical simulation of the optimal $(G^\star, T^\star, s^\star)$ for different values of $\nu, \alpha, \bar{g}$.

Calibrating the model. Finally, we propose a simple calibration of our analytical model, for 5 examples of luxury goods g_k also provided by the government: Health, Education, Transportation, Security and Culture. We focus on concave cases $\alpha_k < 1$ where inequality in the distribution of g_{ik} reduces the aggregate externality. To emphasize the substitutability between households contribution, we rewrite $\alpha_k = \frac{\epsilon_k - 1}{\epsilon_k}$ to obtain the externality function

$$X_k = \chi_k \frac{\epsilon_k}{\epsilon_k - 1} \ln\left(\int_j (g_{i,k} + G_k + \bar{g}_k)^{\frac{\epsilon_k - 1}{\epsilon_k}}\right)$$

This CES function is inspired by Acemoglu and Angrist (2000): when ϵ_k approaches 0, our CES becomes a Leontief function $X_k = \chi_k \min_i (g_{i,k} + G_k + \bar{g}_k)$. The intuition is the following: if one person has a very good health and the other is very sick, the total externality is lower than with two medium health person. Later in this paper and in

Appendix B.3, we review the literature on externality effects for all sectors considered in our framework, and discuss arguments in favor of this concave externality function.

For each good k, we have 4 parameters: the weight ω_k, the luxury parameter $\bar{g}_k$, the level of the externality χ_k, and the curvature ϵ_k. We identify ω_k with the share of the good k in total households expenditures and $\bar{g}_k$ with the share of households with zero expenditures. For χ_k and ϵ_k, we assume that the ratios of in-kind benefits-to-GDP and subsidy-to-GDP in France are optimal and maximize the utilitarian welfare. All these targets are discussed in Section 3. The results are reported in Table 1 below.

Table 1: Calibrating the externality functions

	Observed values (%)				Parameter values			
	$\frac{g_k}{E}$	Share $g_{ik}=0$	$\frac{s_k g_k}{Y}$	$\frac{G_k}{Y}$	ω_k	$\bar{g}_k$	χ_k	ϵ_k
Health	6.2	40	4.89	4.00	0.07	0.19	0.25	3.76
Education	2.3	70	1.00	4.01	0.12	0.22	0.14	0.57
Transportation	12.8	20	1.6	0.55	0.30	0.30	0.05	0.39
Security	2.2	70	0.17	1.54	0.17	0.24	0.06	0.07
Culture	6.6	40	0.44	1.03	0.24	0.26	0.04	0.15

The higher the share of good k in government budget, the higher the level of externality χ_k, as shown for Health and Education that are the two main expenditures in France. Moreover, the higher the subsidy relative to the in-kind provision, the higher the substitutability ϵ_k. Half of government Health expenditures in France are subsidies, implying a high ϵ_k, while most of Education expenditures are in-kind provision, implying a low ϵ_k. We will discuss precisely these categories in the next Section.

Therefore, our analytical model delivers two key insights. First, **both the luxury nature of the goods** provided by the government and the presence of **concave externalities** associated with these goods are necessary to generate a **positive level of optimal in-kind benefits**. Second, **the lower the substitutability between households' contributions, the greater the reliance on in-kind provision**. Consequently, it is essential to identify the luxury dimension of the goods provided by the government and to distinguish between government expenditures in the form of subsidies and those in the form of in-kind provision. We provide empirical evidence on these points in the next section.

3 Empirical evidence

Our theory of public spending posits that the government provides certain goods because they generate **concave externalities** (that is, the external benefit is greater when consumption is more equally distributed) and because these goods are **luxury goods** (meaning they are not consumed by some households). We therefore focus on goods typically provided by the government but for which private alternatives exist. In contrast, for public goods such as national defense, the missing market rationale is sufficient—households generally do not purchase their own aircraft carriers.

In this section, we justify these assumptions and clearly define what we consider as transfers, in-kind benefits, and subsidies. First, we decompose public spending between cash transfers and benefits in-kind. Second we allocate expenditures across our two categories of public policy. Third, we provide evidence of non-homothetic preferences in health, education, culture, transportation, and security.

3.1 Decomposing public spending

3.1.1 Global Trends in Public Spending: Cash vs. In-Kind Transfers

In western economies, public spending takes two forms: **direct transfers in cash to households** – such as unemployment or retirement benefits, which are conditional on individual status – and **transfers or benefits in-kind** – including services like defense, police, education or healthcare spending.[4] Using official datasets from Eurostat and the OECD, we systematically classify total public spending into both categories.

Table 2 reports our results for several countries. We find that in most countries, direct transfers to households account for a smaller share of total public spending compared to in-kind benefits. Among EU member States, an average of 76.5% of public spending is allocated to in-kind benefits. The share ranges from 72.8% in Portugal to 84.6% in the Netherlands. In the United States, in-kind benefits represent 53.6% of total public spending. Furthermore, we find that education and health benefits make up half of total in-kind benefits in European countries, whereas in the US, they represent two-third of it. When expressed as a share of total public spending, education and health account for 29.8% in Italy, 35.5% in the US, 37.5% in France, and 43.4% in the Netherlands.

[4] This category also include subsidies.

Table 2: Public spending: cash vs in-kind, 2022

	Public spending	**Cash**	**In-kind**
	share of GDP (%)	share of public spending (%)	
United States	38.1	46.4	53.4
France	58.3	25.2	71.7
Germany	49.5	23.2	75.9
United Kingdom	45.7	22.4	77.6
Spain	47.4	24.9	73.6
Italy	56.1	26.2	72.6
Netherlands	43.5	15.4	84.6
Portugal	44.1	26.3	72.8
EU27 (average)	49.4	23.5	75

Sources: We use Eurostat data for European countries, OECD data for the US (Federal level) and IFS Tax Lab data for the UK.

Notes: Transfers in cash: unemployment and retirement benefits. Transfers and benefits in-kind: education, health, general public services, defense, public order and safety, economic affairs, environmental protection, housing and community amenities, recreation, culture and religion, and R&D. Remaining public spending are related to public debt repayment.

3.1.2 Focus on France: free provision or subsidy?

We now focus on France and systematically review each type of public spending using Insee and Eurostat national accounts data, completed with detailed budgetary bills and documents. Total public spending in our database amounts to €1,610 billion, or 57% of GDP. First, we assign each expenditure item to categories that will be used in the quantitative model. Second, for each category, we allocate spending into transfers, in-kind benefits, and subsidies. Finally, we also investigate tax exemptions and foregone revenues, which are not included in the database but should be accounted for, either as subsidies (in the case of tax deductions) or as in-kind benefits (such as social housing offered below market prices). We present our results in Table 3.

We allocate 100% of French public spending into our three policy tools: T, G and s. In Eurostat data, there are 10 categories[5]. We reorganize these national accounts categories to make them consistent with our theory. We start with the simplest. *Debt repayment* accounts for 3.1% of total public spending, and is modeled as such ($r\bar{d}$). *Social protection in cash* accounts for 39.7%: it is mostly pension, unemployment, family allowances and sickness transfers (we exclude housing that is a separate category). It will be a cash transfer T in the model. *Public goods* is our last non-sectoral, non-

[5]General public services, Defence, Public order and safety, Economic affairs, Environmental protection, Housing and community amenities, Health, Recreation, culture and religion, Education, and Social protection

private category: it regroups all the goods provided by the government, for which there is no private substitute, and it accounts for 14.3% of total public spending. It includes Executive and legislative organs, Defense, Pollution and Biodiversity policies, and Street lighting. It is denoted G_p in our model, and is fully in-kind benefits, no subsidies.

We then create 7 sectoral categories k, for which there exists a private substitute g_k. For each category, the government does a mix between in-kind provision G_k and subsidies s_k. In general, we consider collective goods, public goods or goods offered for free as in-kind benefits. For subsidies, we consider all public spending that distort relative prices, including goods offered at a lower cost than usual, tax exemptions (VAT, income tax etc.), foregone revenues and public investments. The details of our imputation can be found in Appendix B.1. *Health* (15.6% of total public spending) is 45% in-kind benefits (public hospital, direct provision of medical supply, public health campaigns) and 55% subsidies (reimbursements through the mandatory health insurance system, pharmaceutical reimbursements, payments for private practices). *Education* (8.8% of total public spending) is 80% in-kind benefits (teach salaries, school infrastructure, research funding) and 20% subsidies (student financial aid, subsidies to private schools, housing subsidies for students). *Energy and other industries* (5.8%) is 30% in-kind (investments in public energy infrastructure and industrial research facilities) and 70% subsidies (financial aids for renewable energy production, energy consumption, and tax expenditures such as reduced VAT rates for energy-efficient renovations). *Transportation* (3.9%) is 25% in-kind (infrastructure investments and maintenance costs) and 75% subsidies (public transport services, subsidies and reduced taxes on vehicles, EV chargers and certain fuels). *Housing* (3.2%) is 40% in-kind (construction and maintenance of public housing units, renovation of public buildings) and 60% subsidies (housing assistance programs and tax reductions for private residences). *Security* (3%) is 90% in-kind (police, fire protection, law courts, prison) and 10% subsidies (legal aid for courts, victim assistance, tax rebates for security related goods). *Culture* (3%) is 70% in-kind (public museums, theaters, cultural institutions and events) and 30% subsidies (grants to support artistic creation or cultural projects, tax incentives for donations and sponsorships). Finally, we find that in-kind benefits make 37% of total public spending, while subsidies represent 20%.

Table 3: Public spending in-kind, France, 2023

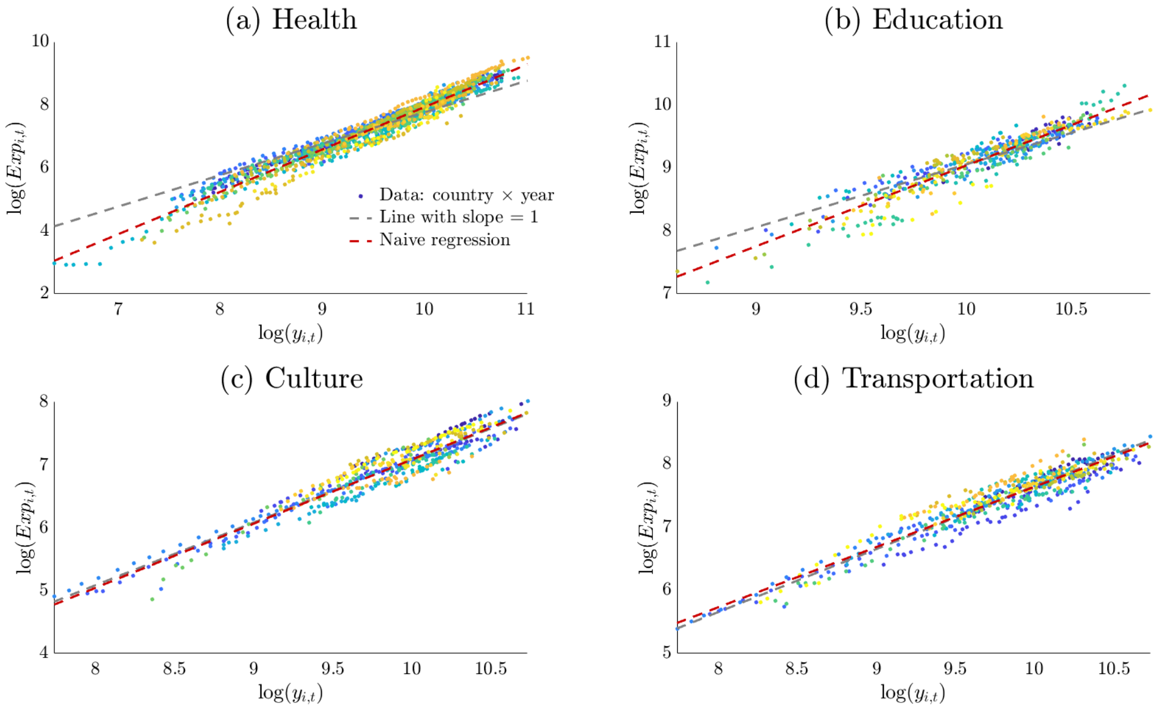
	Total	**In-kind benefits (G)**	**Subsidies (s)**
	%	**% sector**	
Public goods	14.3	100	0
Health	15.6	45	55
Education	8.8	80	20
Energy and other	5.8	30	70
Transportation	3.9	25	75
Housing	3.2	40	60
Security	3.0	90	10
Culture	2.6	70	30
Total in-kind	57.2	64.5	35.5
Transfer	39.7		
Debt	3.1		
Total	100		

3.2 In-kind benefits as luxury goods

3.2.1 Cross-country analysis

Aggregate data. Our aggregate data come from the OECD. We use actual individual consumption (AIC) in US$ PPP per capita as a proxi for real income. AIC measures the value of the bundle consumed by households whether the bundle items are bought in the market or provided by governments or non-profits. For health, we use health expenditure in US$ PPP per capita from the System of Health Accounts (SHA). For education, we use expenditure on educational institutions per full-time equivalent student, in PPP. For culture and transportation, we use annual household final consumption expenditure by purpose (COICOP 2018) in current prices that we normalize by population and annual PPP for household final consumption expenditure to get expenditures in US$ PPP per capita. Figure 1 plots our complete datasets. Running a naive regression, we find clear evidence that health and education expenditures increases more quickly than income. This evidence is not very clear for culture and transportation.

Figure 1: Cross-country evidence



Sources: OECD. All variables are expressed in US$ PPP per capita.

Empirical Strategy and Identification. We employ a strategy similar to Boppart (2014), except that we us panel data at the country level[6]. We estimate the income elasticity of demand of each good with the following equation:

$$\log(c_{i,t}) = \alpha + \theta \log(y_{i,t}) + \gamma X_{i,t} + \mu_i + \lambda_t + \epsilon_{i,t} \tag{1}$$

where $c_{i,t}$ is per capita real consumption in country i at time t, $y_{i,t}$ is per capita real income and $X_{i,t}$ are control variables. θ can be interpreted as the income elasticity of demand i.e. if $\theta > 1$, the good is a luxury good. We add both country μ_i and time λ_t fixed effects, controlling for all time-invariant country factors and global trends.

Cross-Country Aggregate-Level Results. Our results are presented in Table 4. Standard errors are clustered at the country level. Across all categories, the estimated income elasticities θ_i are statistically significant at the 1% level and greater than one, indicating that these types of expenditures are income-elastic and can be classified as luxury goods. The results provide empirical support for the presence of non-homothetic preferences in aggregate consumption behavior across countries: as national income rises, the composition of expenditure shifts toward these more elastic (luxury) categories.

[6] Boppart (2014) uses household-level surveys from the US (CEX and PSID)

Table 4: Fixed effects panel regression

	Dependent variable: log expenditures			
	(a) Health	(b) Education	(c) Culture	(d) Transportation
θ	1.305***	1.099***	1.403***	1.265***
	(0.085)	(0.098)	(0.190)	(0.079)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Clustered SEs	Country	Country	Country	Country
Observations	1,687	515	526	554
R^2	0.698	0.505	0.741	0.785
Adjusted R^2	0.679	0.445	0.701	0.753

*p<0.1; **p<0.05; ***p<0.01

3.3 Individual data analysis: US CEX

Empirical strategy and identification. In this section we estimate nonhomothetic CES demand using household-level data. We use the same data set and methodology as in Comin, Lashkari, and Mestieri (2021). The only difference is that we construct our consumption categories to match expenditure in 6 sectors: agriculture, manufacturing, health & education, transports, culture and other services. We precisely describe our methodology in Appendix. For each sector $i \in \mathcal{I}_{-m} = \{a, s, he, t, c\}$ we estimate the following equation:

$$\log\left(\frac{\omega_{it}^n}{\omega_{mt}^n}\right) = (1-\sigma)\log\left(\frac{p_{it}^n}{p_{mt}^n}\right) + (1-\sigma)(\epsilon_i - 1)\log\left(\frac{E_t^n}{p_{mt}^n}\right) + (\epsilon_i - 1)\log\left(\omega_{mt}^n\right) + \zeta_i^n + \upsilon_{it}^n \tag{2}$$

where ω_{it}^n and p_{it}^n denote the share of consumption and the price of sector-i goods of household n at time t, E_t^n denotes their total expenditure, ζ_i^n accounts for relative taste parameters, and υ_{it}^n for the error terms. Additional assumptions as the use of instruments and controls follows Comin, Lashkari, and Mestieri (2021) and are detailed in Appendix.

Equation (2) defines a system of log-linear equations for $i \in \mathcal{I}_{-m}$ with constraints in its coefficients. The parameters $\{\sigma, \epsilon_i, \zeta_i^n\}_{i\in\mathcal{I}_{-m}}$ are estimated via the generalized method of moments (GMM). We present our estimation results using the household weights provided in the CEX data. All regressions include household controls (described in Appendix). Standard errors are clustered at the household level.

Table 5: Estimates, CEX final-good expenditures, $\epsilon_m = 1$

	(1)	(2)	(3)	(4)	(5)	(6)
σ	0.346	0.360	0.377	0.373	0.283	0.277
	(0.024)	(0.025)	(0.024)	(0.025)	(0.032)	(0.035)
$\epsilon_{\text{agriculture}}$	0.371	0.356	0.420	0.355	0.406	0.312
	(0.076)	(0.084)	(0.103)	(0.102)	(0.087)	(0.091)
$\epsilon_{\text{other services}}$	1.888	1.995	2.917	2.758	2.733	2.767
	(0.157)	(0.179)	(0.304)	(0.289)	(0.264)	(0.280)
$\epsilon_{\text{health \& education}}$	1.339	1.227	1.775	1.626	1.487	1.458
	(0.162)	(0.182)	(0.240)	(0.229)	(0.179)	(0.184)
$\epsilon_{\text{transportation}}$	1.017	0.992	1.319	1.051	1.370	1.381
	(0.115)	(0.125)	(0.167)	(0.152)	(0.139)	(0.146)
$\epsilon_{\text{culture}}$	2.232	2.259	2.557	2.292	2.335	2.227
	(0.179)	(0.198)	(0.259)	(0.235)	(0.215)	(0.213)
Expenditure Re-Weighted	No	Yes	No	Yes	No	Yes
Region FE	No	No	Yes	Yes	Yes	Yes
Year $\times$ Quarter FE	No	No	No	No	Yes	Yes
Observations	36,281	36,281	36,281	36,281	36,281	36,281
# parameters	36	36	51	51	216	216
# moments	80	80	135	135	260	260

Empirical results. Table 5 report our results. Columns (1) report the estimates when we control only for household characteristics but we do not include any time or region fixed effects. The estimates show that the non-homotheticity parameter is lower for agriculture relative to manufacturing ($\epsilon_{\text{agriculture}} - 1 =$ -0.629) and higher for all other sectors, except for transportation. One can transform those non-homothetic parameters into expenditure elasticities[7] for the average household in the sample. We find those elasticities to be equal to 0.52, 0.80 and 1.21 for agriculture, manufacturing and other services, respectively. For health & education, transportation and culture, we find they are equal to 0.91, 0.81 and 1.37. This implies that, for the average U.S. household, agricultural, manufacturing, health & education and transportation goods are necessities, while other services and cultural goods are luxury goods. We remark that expendi-

[7] $\forall i \in \mathcal{I}$, $\eta_i = \frac{\partial \log(C_i)}{\partial \log(E)} = \sigma + (1-\sigma)\frac{\epsilon_i}{\bar{\epsilon}}$

ture elasticities of health & education, transportation and culture are stronger that for manufacturing. Therefore for lower-income households, latter goods are luxury goods relative to agricultural and manufacturing goods.

We subsequently add region and time fixed effects in columns (2) and (3). One can not that our estimate of relative income elasticities do not change significantly and stays close to benchmark estimates in Comin, Lashkari, and Mestieri (2021). In the last column, we find expenditure elasticities for agriculture and manufacturing to be equal to: 0.43 and 0.65. For health & education, transportation, culture and other services, we find they are equal to 0.84, 0.80, 1.16 and 1.31.

3.3.1 Individual data analysis

We consider both quantitative (e.g. share of total consumption) and qualitative (e.g. share of kids in private schools) variables. Using various consumption surveys from households and exhaustive administrative datasets, we suggest that our estimates hold in several countries.

Health spending: using various household-level surveys and administrative datasets from the US, France and other European countries, we find that health is a luxury good. The share of health-related increases with income. Moreover, low-income households are both less insured and more likely to report unmet needs.

Health – Data. To analyze health-related expenditures by income in the US, we use the Panel Study of Income Dynamics (PSID). Data on health insurance come from the 2024 Current Population Survey in the US (CPS), and administrative datasets from France[8]. To assess unmet medical needs across several European countries, we rely on the 2022 European Union Statistics on Income and Living Conditions household-level survey (EU-SILC).

Health – Empirical results. Our findings are summarized in Figure 2. In the PSID, we find that the share of health expenditures rises with income: from 4.4% in the bottom quintile (Q1) to 8.8% in the top quintile (Q5). Naturally, health spending may vary with other characteristics such as age, sex, race or geographic location, that are directly correlated with income. To address this, we examine additional indicators.

First, we find that the share of uninsured US households declines sharply with income, falling from 21.2% among Q1 households to 3.8% for Q5 households. In France, although universal medical insurance covers basic health care, some expenses are not fully reimbursed. To cover these additional costs, households can purchase supplementary insurance insurance.[9] Again, we find that the share of households without

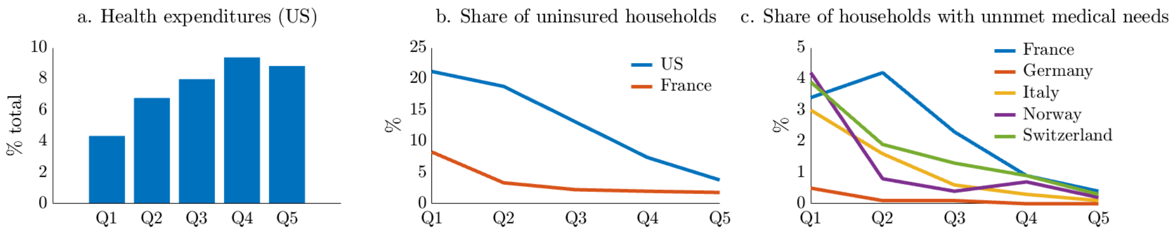
[8]The 2019 EHIS household-level survey combined with household income tax declarations.

[9]referred to as *complémentaires santé*.

supplementary coverage decreases with income: from 8.3% in the Q1, to 1.8% in the Q5.

Second, we analyze unmet medical needs due to cost barriers, which are strongly income-dependent. In France, nearly 4% of Q1 households report unmet medical needs in 2022 while no Q5 households report such issues. This trend exists even other high-income countries like Norway or Switerland, where respectively 4.2% and 3.9% of Q1 households report unmet needs. Germany or the Netherlands are notable exceptions, with almost no households reporting unmet needs.

Figure 2: Health: expenditures, insurance, needs and inequalities



Sources: *a.* PSID survey, *b.* US: CPS US Census, France: administrative data, *c.* EU-SILC

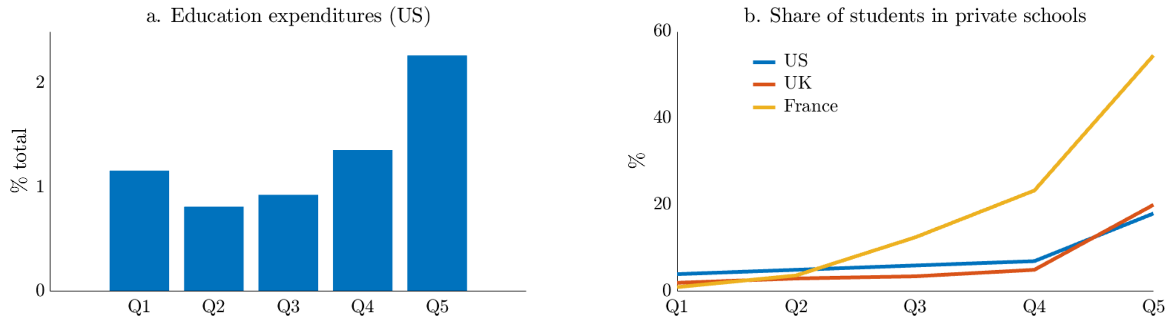
Education spending: using several household-level surveys and administrative datasets in the US, the UK and France, we also find that education is a luxury good. The share of education-related consumption increases with income, and high-income households are more likely to opt-out for privately provided educational services.

Education – Data. We use the PSID to measure education-related expenditures by income in the US. To analyze the prevalence of private school enrollment, we use the 2024 CPS survey, the 2021 UK Household Longitudinal Study (UKLHS) for the UK, and administrative datasets for France.

Education – Empirical results. Our results are summarized in Figure 3. First, we find that the share of education expenditures in total consumption increases with income, rising from 1.1% for Q1 households to 2.3% for Q5 households. More strikingly, the share of students enrolled in private schools increases sharply with income. In the UK, 20% of students among Q5 households attend private schools, ten times the rate of students within Q1 households. A similar pattern emerges in the US. In France, were private schools receive substantial public subsidies,[10] the overall share of students attending private schools is much higher than in the US or UK. However, the upward-sloping relationship between income and private school attendance persists. Indeed, only 1% of students from Q1 households attend private schools while 54.5% among Q5 households.

[10]between 75% and 80% of private schools costs are covered by the State.

Figure 3: Education: expenditures, private schools and inequalities



Sources: *a.* PSID survey, *b.* US: CPS US Census, UK: UKHLS, France: administrative data

Taken together, these empirical findings show that education and health are luxury goods. First, the share of total household consumption devoted to education and health increases with income. Second, higher-income households consume higher-quality healthcare and education services and are more likely to opt for private options. Importantly, we find that these facts hold consistently across several developed countries.

4 Quantitative model

In this section, we create a heterogeneous-agent model to quantify the optimal provision of public spending. The model features private consumption good c, private and public consumption of 7 goods (education, health, security, culture, transportation, housing, and energy/other industries), endogenous occupational choice between work and unemployment, and a complete set of fiscal instruments for the fiscal authority.

4.1 Households

Households consume 8 types of goods: a pure private good c, and seven goods g_k that have public counterpart and are subsidized: education, health, security, culture, transportation, housing, and energy/other industries. Each good k has a weight ω_k in the utility function (and $\omega_c = 1 - \sum \omega_k$), and a non-homothetic parameter $\bar{g}_k$. Households also choose their labor supply h and can save with asset a subject to a borrowing constraint, and an idiosyncratic productivity shock z. They receive a net labor income, a net capital income, profits and transfers (that may be contingent on their productivity z). Finally, an externality function $\mathbf{X}$ discussed later enters the utility function, but atomistic agents cannot influence it. Each household i solves the following problem:

$$\max_{c_i,\{g_{ik}\},h_i} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\omega_c \ln(c_i) + \sum_{k=1}^{7} \omega_k \ln(g_{ik} + G_k + \bar{g}_k) - \nu \frac{h_i^{1+\psi}}{1+\psi} + \mathbf{X} \right]$$

such that

$$\underbrace{(1+\tau^c)c_i + \sum_{k=1}^{7}(1-s_k)g_{ik}}_{\text{Consumption}} + \underbrace{a_i' - a_i}_{\text{Savings}} = \underbrace{\Gamma(z_i w_i h_i, r a_i + \Pi_i)}_{\text{Net labor and capital incomes}} + T_i$$

$$z_{it} = e^{x_{it}} \text{ , } x_{it} = (1-\rho_z)\mu_z + \rho_z x_{i,t-1} + \epsilon_t, \ \epsilon_t \sim \mathcal{N}(0, \sigma_z)$$

$$\text{and } \{g_{ik}\}, c_i, a_i \geq 0$$

4.2 Government

The government uses taxes on consumption (τ^c) and labor, asset and profit income (Γ) to finance debt repayment, in-kind benefits on pure public good (G_p), transfer T, and in-kind benefits and subsidies to the good k. The government budget constraint is the following:

$$(1+r)d + G_p + \sum_{k=1}^{7} (G_k + s_k g_k) + T = d' + \int_i [w z_i h_i + r a_i + \Pi_i - \Gamma(w z_i h_i, r a_i + \Pi_i) + \tau^c c_i] \tag{3}$$

We assume a progressive tax on labor income and a linear tax on capital income, so that

$$\Gamma(wzh, ra + \Pi) = \lambda (wzh)^{\tau^l} + (1-\tau^k)(ra + \Pi)$$

The government sets taxes τ^l, τ^k, subsidies s_k, in kind-benefits G_k, G_p, debt d and transfers T, and the budget constraint balances with λ.

4.3 Firms

Intermediate goods producers in monopolistic competition maximize their profit, choosing intermediate output y, price p and inputs n, k, subject to the production function and the demand schedule from the competitive representative final goods producer. The program of the firm j is the following:

$$\max_{\{y_j, n_j, p_j\}} p_j y_j - w_t n_j - (r+\delta) k_j$$

$$\text{such that} \quad \begin{cases} y_j = n_j^{\alpha} k_j^{1-\alpha} & \text{(Production function)} \\ y_j = \left(\frac{p_j}{P}\right)^{-\epsilon} Y & \text{(Demand)} \end{cases}$$

with ϵ the elasticity of substitution across goods and Y_t the aggregate output. Assuming a symmetric equilibrium in which all firms set the same price and choose the same amount of labor, and denoting the real marginal cost μ, we obtain the condition:

$$\mu = \frac{\epsilon - 1}{\epsilon}$$

Then a share $\frac{\epsilon-1}{\epsilon}$ of the output goes to production factors, and the remaining share goes to profit $\Pi = \frac{Y}{\epsilon}$. We assume that a share γ of this profit is distributed to households depending on their productivity z, so that

$$\Pi(z) = \frac{z^x}{\int_i z^x} \cdot \gamma\Pi$$

The rest of the profit $(1-\gamma)\Pi$ is held by a mutual fund delivering equity q in which households can invest. By no-arbitrage, the return on the equity must satisfy:

$$\frac{(1-\gamma)\Pi_t + q_{t+1} - q_t}{q_t} = r_t$$

If I invest in equity, it costs me q_t, I earn the profit distributed to the mutual fund $(1-\gamma)\Pi_t$, plus the capital gain $q_{t+1} - q_t$, yielding the left-hand side return: by no-arbitrage, it must be equal to the return r_t of investing in public debt.

4.4 Market clearing conditions

Labor:

$$N = \int_i z_i h_i$$

Asset:

$$K + \bar{d} + q = \int_i a_i$$

Goods:

$$Y = G_p + \sum_{k=1}^{7} G_k + I + c + \sum_{k=1}^{7} g_k$$

with the aggregation $x = \int_i x_i$ for $x = \{g_k, c, T, a\}$ and investment $I = K' - (1-\delta)K$.

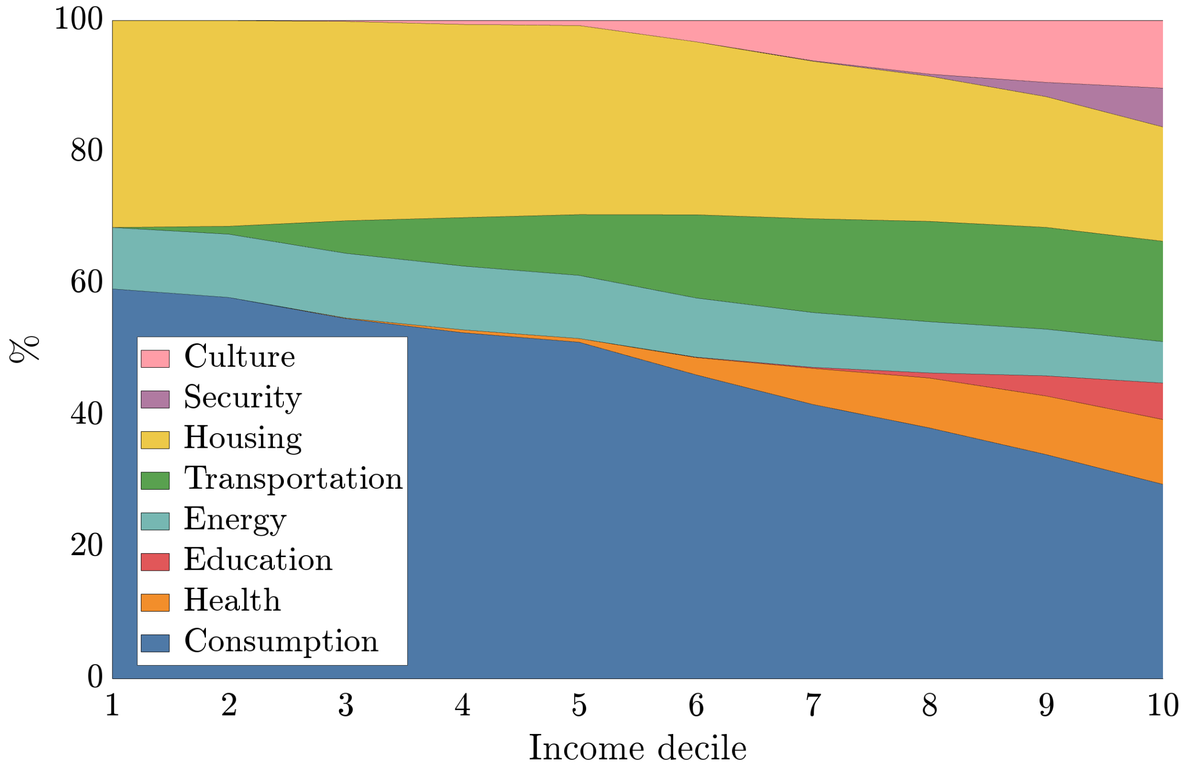
5 Calibration

Two two key ingredients in our model are the consumption basket for households, and the composition of government expenditures. The calibration of the externality function is discussed in Section 6.

5.1 Households

Expenditures: weights ω_k are used to calibrate the share of goods g_k in total expenditures (for example, health accounts for 6.2% of total households expenditures). Non-homotheticity parameter $\bar{g}_k$ is used to calibrate the share of households with zero private consumption of the luxury good g_k for education, health, culture and security; for necessity goods, such as housing and energy, $\bar{g}_k$ allows to obtain the right decreasing share of expenditures by income deciles.

Figure 4: Expenditures composition by income decile



Heterogeneity: variance of the idiosyncratic shock σ_z and persistence ρ_z are used to match French income heterogeneity.

5.2 Government

In France, public spending accounts for 57% of GDP and can be broken down into debt repayment (3.1% of total public spending), transfers (39.7%) and public provision of goods (57.2%, both in-kind and subsidies).

In-kind benefits and subsidies: we set the G_k and s_k to reproduce the Table 3. For example, output is 1, total public spending is 57% of output, and health expenditures account for 15.6% of total public spending, which induces government total health expenditures $Exp_{\text{health}} = 1 \cdot 0.57 \cdot 0.156 = 0.09$. Knowing 45% of these health expenditures are in-kind benefits, we have $G_{\text{health}} = Exp_{\text{health}} \cdot 0.45 = 0.04$, and as 55% are subsidies, we set s_{health} such that $s_{\text{health}} g_{\text{health}} = Exp_{\text{health}} \cdot 0.55 = 0.049$.

Debt: we choose $\bar{d}$ so that it is equal to 100% of GDP. We choose β so that the debt repayment is equal to 3.1% of public spending.

Transfer: transfers account for 39.7% of total public spending. As all our households are working (no retired), we exclude pensions (22.9% of total public spending), so that T is chosen to be equal to 16.8% of total public spending.

Other taxes: VAT tax is $\tau^c = 0.2$ and capital tax is $\tau^k = 0.3$; labor tax τ^l adjusts to clear the budget constraint.

Other parameters: we choose ν so that Y is equal to 1 in our initial steady state. The Frisch elasticity is set to 0.5, so that $\psi = 2$.

Table 6: Table of parameters

Parameter	**Description**	**Value**	**Notes and targets**
Households			
β	Discount factor	0.95	$r = 3\%$
ω_k	Weight of good g_k	see text	
$\bar{g}_k$	Luxury parameter g_k	see text	
ν	Labor disutility	1.46	$Y = 1$
ψ	Inverse Frisch elasticity	3	
ρ_z	Persistence z	0.97	Income heterogeneity, aggregate
σ_z	Variance z	0.2	Heterogeneity
$\underline{a}$	Borrowing constraint	0	Authors' choice
Government			
$G_p, \{G_k\}, \{s_k\}$	In-kind and subsidy	see text	
$\bar{T}$	Transfers	0.2	Share of T in income
$\bar{d}$	Initial debt	1	Debt/GDP=100%
τ^l	Labor tax progressivity	0.08	From Ferriere, Grübener, et al. (2023)
τ^k	Corporate income tax rate	9.02%	Effective rate in Auray et al. (2022)
τ^c	VAT tax rate	22.34%	Effective rate in Auray et al. (2022)
Firms			
α	Capital share	0.3089	$\frac{wl}{GDP}$ from Cette, Koehl, and Philippon (2019)
δ	Depreciation rate	0.1	$I/GDP = 20\%$
ϵ	Elasticity of substitution	7	$\Pi/GDP = 15\%$
γ	Share of dividend	0.3	Dividend/GDP=4%
x	Dividend distribution rule	2	Share of dividend for Q5

6 Revealed externalities and planner preferences

Our theory of public spending is grounded on two features: the luxury nature of the goods provided by the government, and the concave externalities associated to these goods. The first feature is justified by our empirical evidence in Section 3. The second is not easily identifiable: in this section, we use our quantitative model to retrieve the parameter of the externality functions that are consistent with observed policies, for different welfare functions.

6.1 The welfare function

We observe a given level of transfer T, in-kind benefits G_k and subsidies s_k. Assuming these policies are set at their optimal, welfare-maximizing levels, we reverse-engineer what is the welfare function consistent with the observed levels in France. We restrict our attention to luxury goods $K = \{$health, education, transportation, security, culture$\}$, transfer T and pure public goods G_p. We assume the externality function is the following:

$$\mathbf{X} = \sum_{k \in K} \left[\chi_k \frac{\epsilon_k}{\epsilon_k - 1} \ln \left(\int_j (g_{i,k} + G_k)^{\frac{\epsilon_k - 1}{\epsilon_k}} \right) \right] + \chi_p \ln(G_p)$$

Parameters χ_k control the level of the externality associated to the good k, and parameters ϵ_k control the curvature. As the pure public good G_p is not privately consumed by households, there is no associated curvature parameter.

We assume the planner maximizes the weighted sum of individual value function:

$$\mathbb{W} = \int \omega(z) V(a, z) d\mu(a, z)$$

with V the value function[11] of households with asset a and productivity z, μ the measure over the asset$\times$productivity state space, and $\omega(z)$ the weight of household with productivity z in planner welfare. The weight has the following form:

$$\omega(z) = \frac{e^{-\kappa z}}{\int e^{-\kappa z} d\mu(z)}$$

with κ the planner's taste for equality. When $\kappa = 0$, our welfare function reduces to the utilitarian case. If $\kappa > 0$, the planner places more weight on poorer households, thus favoring greater equality. Conversely, if $\kappa < 0$, the planner is biased towards richer households and favors greater inequality. Assuming a utilitarian planner by default would imply that the observed policy T is generally not optimal (except by coincidence).

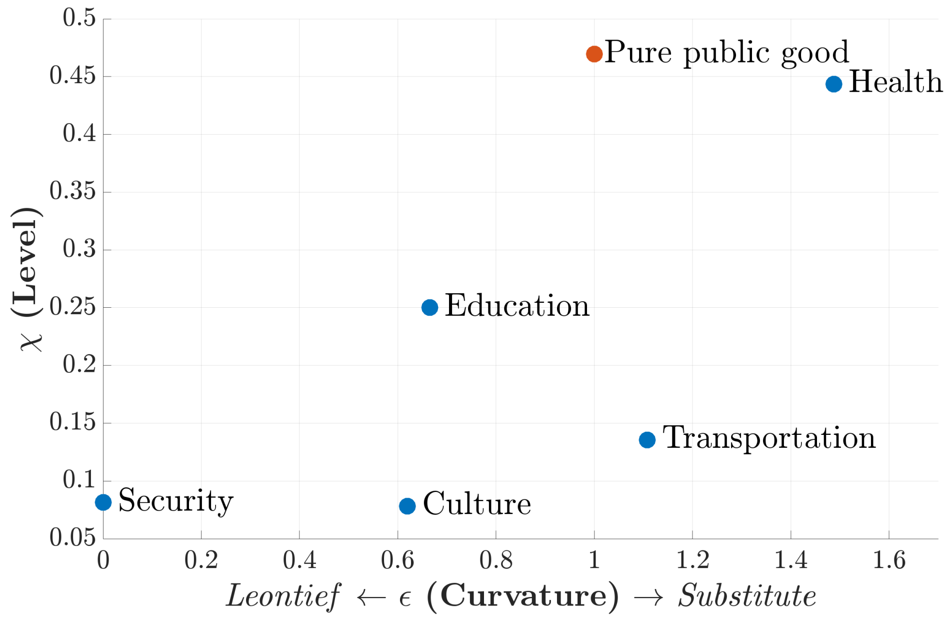
[11] $V(a, z) = \max \{u + \mathbf{X} + \beta \mathbb{E}_{z'} [V(a', z')|z]\}$.

As a result, our fiscal consolidation exercise, which is the main application of our theory, would essentially consist in adjusting the policy that is furthest from the optimum.

Then we have 12 parameters to find: the externality levels χ_k, the externality curvature ϵ_k, the externality level of pure public good χ_p and the planner's taste for externality κ, and 12 associated policies that must be at their optimal levels: in-kind benefits G_k, subsidies s_k, pure public good G_p, and transfer T. Then we jointly compute the 12 parameters $(\{\chi_k\}, \{\alpha_k\}, \chi_p, \kappa)$ to solve the following 12-equation system:

$$\forall k \in K, \frac{d\mathbb{W}}{G_k} = \frac{d\mathbb{W}}{s_k} = \frac{d\mathbb{W}}{G_p} = \frac{d\mathbb{W}}{T} = 0$$

We obtain the following results:



with $\kappa = 2.7$ and the pure public good aligned on $\epsilon = 1$ in the x-axis. The explanation for these results is straightforward. First, the higher the total expenditures in a sector (in-kind and subsidies), the higher the level of χ. Second, the higher the use of in-kind instead of subsidies, the higher the substitutability ϵ. This means that for culture, education, security and transportation, each household' contribution is a complement (you prefer two medium educated worker, instead of one very educated and the other without education), while it is relatively more substitutable for health. Finally, $\kappa = 2.7$ means the planner highly favors equality.

Of course, these results depend heavily on the assumptions that the government is running optimal policy, and that the welfare criterion is the integral of individual utilities. We relax these assumptions in the following sections, considering the median voter is choosing the policy (instead of the utilitarian planner), and considering that the externality parameters are taken from the literature.

6.2 Relation to literature

We compare our estimates to empirical literature. We run the opposite of our previous exercise: based on the literature estimate for externalities, we compute the optimal level of in-kind benefits and subdidies in each sector.

7 On the optimal design of fiscal consolidation

The main contribution of this paper is to propose a new theory of in-kind benefits, grounded in non-homothetic preferences and externalities. We estimate the externality parameters that render government policies optimal and compare them to values found in the literature. A natural application of our theory is now to use these parameters to determine the optimal strategy for fiscal consolidation. In this section, we assume the objective is to reduce the steady-state level of government debt and compute the optimal mix between increasing taxes and reducing in-kind benefits, transfers, and subsidies.

7.1 Analytical results

In this section, we use a reduced version of our analytical model to understand what is the optimal combination of transfer T, public spending G and labor tax τ to reduce public debt, or equivalently (as our analytical model is static) to finance an exogenous increase in government expenditures. Suppose households are heterogeneous in their productivity z_i, with $z_i \sim \text{log-Normal}\left(-\frac{\nu}{2}, \nu\right)$, and solve the following problem:

$$\max_{c_i, n_i} u_i = \ln(c_i) - \psi n_i + \chi \ln(G)$$

$$\text{such that } c_i = (1-\tau) z_i n_i + T$$

Suppose the government finances transfer T, public spending G (that enter the externality) and an exogenous expenditure E, according to the budget constraint

$$T + G + E = \int_i \tau z_i n_i$$

Suppose a utilitarian planner chooses (T, G, τ) in order to maximize the welfare $\mathbb{W} = \int_i u_i$. The optimal policies are the following:

$$\tau^\star = 1 - e^{-\nu}$$

$$\frac{G^\star}{Y^\star} = \frac{\chi}{1 + \chi + \psi E e^{\nu}}$$

$$\frac{T^\star}{Y^\star} = \frac{1}{1+\chi+\psi E e^{\nu}} - e^{-\nu}$$

As expected, both the government spending-to-GDP and transfer-to-GDP ratios are decreasing with expenditures E. To get a sense of the magnitude, we suppose we start with $E = 0$. We set $\chi = 1/3$ to have $\frac{G^\star}{Y^\star} = 25\%$, $\nu = 0.3$ to match the variance of labor earning in France, and $\psi = 0.99$ to have $Y^\star = 1$. Then, if we increase E, we obtain:

$$\frac{d(G^\star/Y^\star)}{dE} = -\frac{\psi\chi e^{\nu}}{(1+\chi+\psi E e^{\nu})^2} = -0.25$$

$$\frac{d(T^\star/Y^\star)}{dE} = -\frac{\psi e^{\nu}}{(1+\chi+\psi E e^{\nu})^2} = -0.75$$

Accordingly, 75% of the increase in unproductive expenditure E is financed by reducing transfers, while the remaining 25% is covered by cuts in productive public spending. This preliminary result offers an initial insight into the optimal path for reducing public debt, but it is subject to several limitations. First, it relies on a linear labor supply specification to yield a closed-form solution. Second, the static increase in E cannot be meaningfully compared to the dynamic process of debt reduction. Most importantly, it abstracts from the interactions between public spending and inequality that are at the core of this paper. Therefore, we must use our quantitative model to gain a deeper understanding of the optimal design of fiscal consolidation.

7.2 Quantitative results

We solve the following problem: suppose we start at a steady state where the public policies relative to goods (G_k, s_k, G_p) are set at their optimal level (for the level, see Section 5; for the associated externalities, see Section 6). Suppose the government must finance an exogenous, unanticipated spending choc $K_1 = 0.005$ of wasteful public spending in his budget constraint 3, with the AR(1) process $K_{t+1} = 0.5K_t$ for $t \geq 2$. Since the steady state output is equal to 1, this mean that the government must finance an additional spending equal to $\frac{\sum_{t=1}^{\infty} K_t}{Y_0} = 1\%$ of GDP. Absent the second-order effects of the reduction in available debt to households, this experiment is similar to the reduction by 1% of public debt-to-GDP ratio.

As we start at optimal level of public spending, there is no free lunch: financing this additional expenditure is costly, because it requires increasing distortive taxes or reducing public spending. For computational reasons, we focus on the three main government expenditures: Health, Education and Pure public good, so our set of optimization variables is $\mathbf{Q} = \{G_{\text{health}}, G_{\text{educ}}, s_{\text{health}}, s_{\text{educ}}, G_p\}$, and tax rate parameter λ adjusts to maintain the government budget constraint. Moreover, we look at policies of the form $\mathbf{Q}_t = \mathbf{Q} + \boldsymbol{\alpha} K_t$ with $\boldsymbol{\alpha} = \{\alpha_1, ..., \alpha_5\}$, which means we assume our policies are proportional to the expenditure shock, without restriction on the sign and magnitude of α_i. Therefore, the problem of the planner is the following:

$$\max_{\boldsymbol{\alpha}} \mathbb{W}^K = \int V(a_1, z_1) d\mu(a_1, z_1)$$

such that

$$Exp_t + G_{p,t} + \sum_{k=1}^{2} (G_{k,t} + s_{k,t} g_{k,t}) + K_t = \int_i \left[w_t z_{i,t} h_{i,t} - \lambda_t (w_t z_{i,t} h_{i,t})^{\tau^l} \right] + Rev_t$$

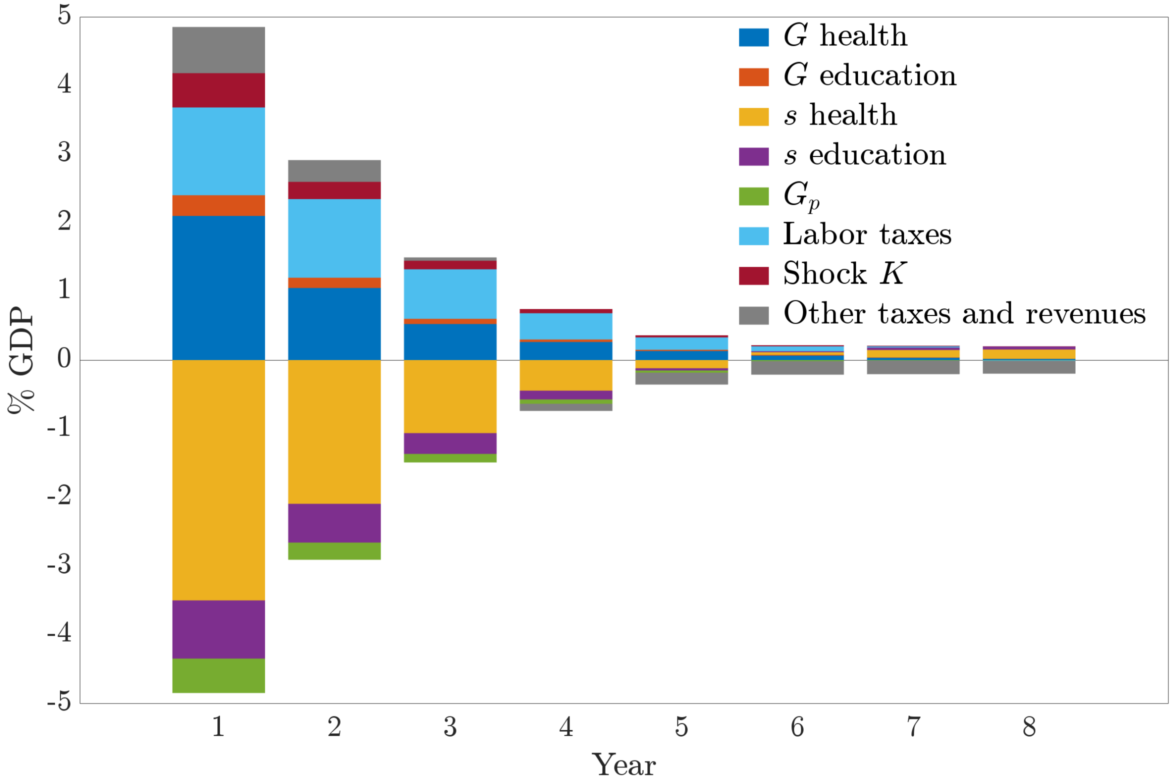
$$\mathbf{Q}_t = \mathbf{Q} + \boldsymbol{\alpha} K_t \text{ for } \mathbf{Q} = \{G_{\text{health}}, G_{\text{educ}}, s_{\text{health}}, s_{\text{educ}}, G_p\}$$

The notation are the following. $\mathbb{W}^K$ is the welfare during the transition between $t = 1$ and ∞, with V_1 the value function[12] at the first period of the transition of households with asset a_1 and productivity z_1, and μ_1 the measure over the asset$\times$productivity state space at period 1 (same as the steady state). The first constraint is the budget constraint of the government modified to include K_t and emphasize the policies we modify during the transition. Exp_t regroups the other expenditures (left-hand side of the budget constraint 3, excluding optimization policies), and Rev_t regroups the revenues (right-hand side, excluding labor income tax). The second constraint is the functional form for our optimization policies.

We obtain the following results: $\boldsymbol{\alpha} = \{21, 3, -140, -200, -5\}$ (corresponding to $\mathbf{Q} = \{G_{\text{health}}, G_{\text{educ}}, s_{\text{health}}, s_{\text{educ}}, G_p\}$). Moreover, labor tax rate decreases during the transition: parameter λ rises from 0.47 at the steady state to 0.50 at the first period, and return to the steady state with a persistence rate much higher than the 0.5 of the shock. Denoting $dX_t = X_t - X_0$ the variation of the variable X compared to its steady state value, we plot in Figure 5 the changes in the government budget constraint:

[12] $V_1(a_1, z_1) = \max \{u_1 + \mathbf{X}_1 + \beta \mathbb{E}_{z'} [V(a_2, z_2)|z_1]\}$.

Figure 5: Optimal path for government expenditures and revenues



The dark red bar is the exogenous change in expenditures K_t. The dark blue and orange bars are the respective changes in in-kind benefits $(G_{\text{health}}, G_{\text{educ}})$, and the yellow and violet bars are the changes in subsidy expenditure $(s_{\text{health}}, s_{\text{educ}})$. As we observe, the total expenditures in health and education decrease ($\sum_t (dG_{k,t} + ds_{k,t}g_{k,t}$ is equal to -1.2% for health and -0.6% for education), but the composition of these expenditures drastically change. While in-kind benefits usually account for 45% of health expenditures and 80% of education expenditures, this share increases to respectively 80% and 96% during the first year of the transition, due to the increase in G_k and the decrease in s_k. As the increase in K crowds out private expenditures in g_k and therefore reduce externalities, the government must increase G_k to compensate fall in individual contribution at the bottom of the income distribution. Therefore, **during fiscal consolidation, the government should reduce subsidies but not in-kind benefits**, in order to maintain a minimum level of individual education and health, necessary with concave externalities. Finally, the optimal provision of the pure public good G_p decreases, as it is not affected by the distribution, and the distortive labor tax decreases, as the government needs workers to produce the increase in K.

8 Distributional National Accounts revisited

8.1 A new imputation formula for in-kind benefits

As inequality has become a major research topic, an important body of literature has developed to estimate the progressivity of the tax and transfer system (see Heathcote, Storesletten, and Violante (2017) or Ferriere and Navarro (2025), among others). However, this approach does not account for the distribution of public spending: if the government provides schools and hospitals for everyone, it should reduce total consumption inequality. Piketty, Saez, and Zucman (2018) addresses this issue through the notion of Distributional National Accounts and allocates in-kind benefits to households.[13] Further research has refined this methodology, imputing in-kind benefits at a much finer level.

This method of converting in-kind benefits into monetary terms assumes that one dollar of monetary transfer is equivalent to one dollar of in-kind benefits. However, our analytical model shows that this is not the case. Since education and health are luxury goods, the poorest households do not consume them privately because the marginal utility they derive is lower than the marginal utility of direct consumption. This implies that one dollar of transfer provides more utility than one dollar of public goods for the bottom of the distribution.

Based on a simplified version of our analytical model[14], we propose a new rule for converting in-kind benefits into transfer equivalents:

$$\frac{\partial u_i/\partial G}{\partial u_i/\partial T} = \min\left\{\frac{y_i/y}{F^{-1}(S)}, 1\right\}$$

where y_i/y is the ratio of household i's disposable income to GDP per capita, F is the cumulative distribution function of disposable income, and S denotes the share of households with zero private expenditure on the publicly provided good. We assume that the distribution is normalized so that output equals 1, and we disregard externalities (identical for all households). Therefore, with only two statistics –the relative income of household i, and the share of households with zero private consumption of the luxury good–, we can allocate any good purchased by the government.

8.2 Application

A study by Insee on France (Germain, André, and Blanchet (2021)) provides a highly detailed distribution of national accounts, including a precise breakdown of in-kind

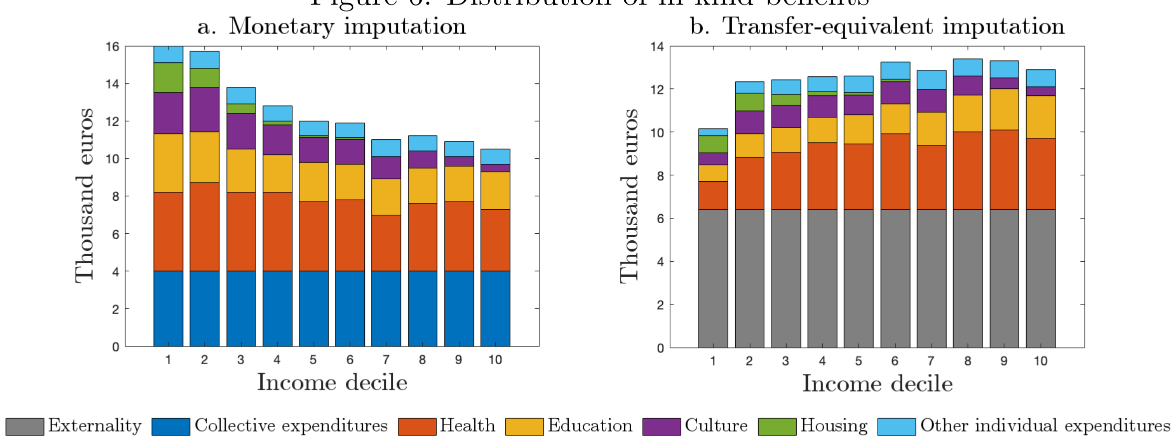
[13] For example, public education, defense, justice, and infrastructure are distributed proportionally to disposable income, while health expenditures are imputed based on age and income.

[14] See Appendix D for methodology and derivation.

benefits across the income distribution. In the left panel of Figure 6, we reproduce their "monetary imputation" across six categories: collective expenditures (such as police and justice, with uniform imputation), health, education and culture (based on survey data incorporating income, age, and geographic dimensions), housing (imputed using administrative data), and other categories that can be individualized.

In the right panel of Figure 6, we propose our "transfer equivalent" imputation, based on the methodology described above. We assume a Pareto income distribution with $\alpha = 2.1$ and use a public spending-to-GDP ratio from Insee data, which amounts to 11.5%, 11%, 6.2%, 4%, 1% and 2.4% for collective expenditures, health, education, culture, housing and other categories, respectively. We also consider the share of households with zero private expenditures in these categories to be: 100% (no one privately purchases defense and police), 70% (households that do not buy unreimbursed health services), 80% (students in public schools), 75% (a midpoint between health and education), 0% (everyone has accommodation), and 50% (for other expenditures). Since our imputation assigns only weights between 0 and 1, some euros are lost compared to the monetary imputation. We assume these lost euros can be recovered through the separable externality parameter, which is equal across households.

Figure 6: Distribution of in-kind benefits

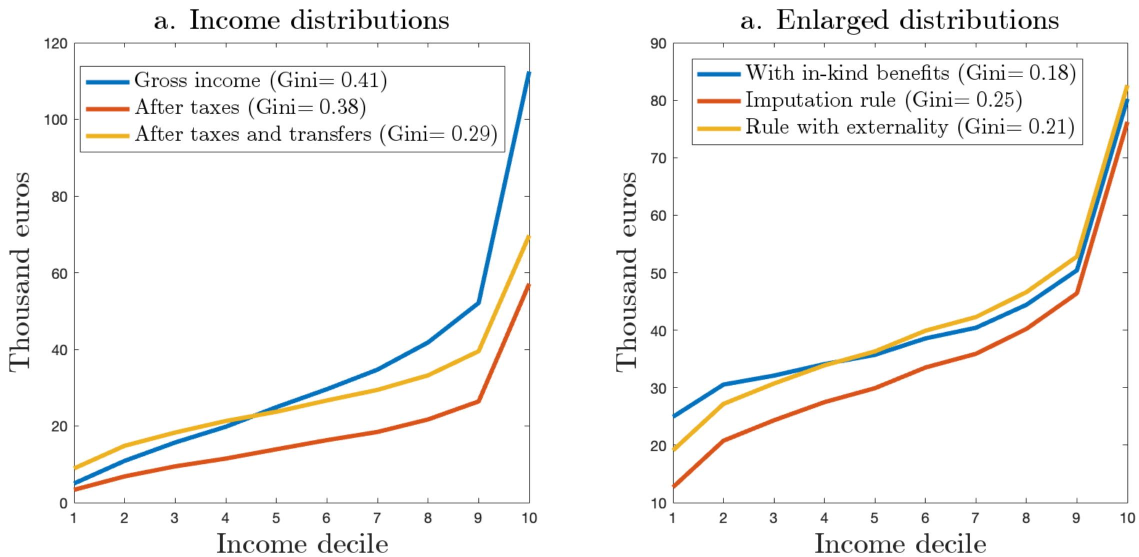


As explained above, our imputation rule provides a different perspective on the redistributive effects of in-kind benefits. While the monetary imputation is progressive and biased toward poorer households, our imputation is regressive, as poorer households do not value education, health, and other in-kind benefits as much as they value monetary transfers.

Since the purpose of distributional national accounts is not only to observe the positive distribution of GDP but also to discuss its normative implications for inequality, we use our imputed in-kind benefits to analyze their impact on inequality patterns. In the left panel of Figure 7, we present the distribution of gross income, net income (gross income minus taxes and social contributions), and disposable income (net income plus monetary transfers). This reflects the standard approach to assessing the redistributive effect of a fiscal system. In France, this process reduces the Gini coefficient from 0.41 to 0.29.

In the right panel of Figure 7, we add the distribution of in-kind benefits discussed above to the disposable income. The blue line represents the "usual" way of adding in-kind benefits, using the monetary imputation presented in Figure 6.a. Since this method is progressive, it significantly reduces the Gini coefficient from 0.29 to 0.18. The red line shows the distribution using our imputed rule without externalities. In this case, the Gini reduction is much smaller, from 0.29 to 0.25, as our imputation is regressive and excludes collective expenditures that households do not privately value. Finally, when accounting for externalities (yellow line), the Gini falls to 0.21—still higher than the 0.18 obtained with the standard monetary imputation.

Figure 7: Distribution with and without in-kind benefits



Therefore, we use the intuition provided in our analytical model to provide a new methodology to allocate in-kind benefits to households. We believe that the monetary allocation does not provide a clear picture of the households inequality, and show that our method yields a smaller reduction of inequality.

9 Targeted in-kind benefits

From the beginning of the paper, we have assumed a uniform in-kind benefit G_k for each sector k, implying that the government provides an identical level of these goods to all households. While this captures a large part of government intervention, it excludes the possibility of targeting in-kind benefits to specific households. In practice, some degree of targeting does occur—for example, more public teachers or schools in low-income areas, greater spending on rural roads, higher security expenditures in disadvantaged neighborhoods, housing or energy discounts, and subsidized public transportation or cultural activities for low-income households.

To account for this, we now introduce a more general rule for in-kind benefit provision that allows allocation to vary with household income. Specifically, each household i receives an in-kind benefit in sector k given by:

$$g_{i,k}^{\text{in-kind}} = \mu_k (y_i)^{\gamma_k}$$

With ω_k that determines the progressivity of in-kind transfers and μ_k a scaling parameter.[15] This leads to the following expression for aggregate spending in sector k:

$$G_{i,k} = \mu_k \int (y_i)^{\gamma_k}$$

In this section, we first provide the empirical estimate of our function in seven sectors of government intervention in France.[16] Our benchmark formula looks like Heathcote, Storesletten, and Violante (2017)[17] applied to in-kind benefits. We then compute the optimal structure of individual in-kind benefit rules across sectors and compare our results with the empirical distribution of benefits. Additionally, we assess the welfare implications of this targeted approach by comparing it to a counterfactual scenario with a uniform in-kind benefit of equivalent total size.

Table 7: In-kind benefit rule, power law

	Observed (France)		Optimal	
	μ_k	γ_k	μ_k	γ_k
Health	0.04	-0.16	0.03	-0.23
Education	0.04	-0.30	0.04	-0.10
Energy	0.01	-0.95	0.01	0.0
Transportation	0.003	-0.89	0.001	-0.59
Security	0.01	-0.25	0.01	-0.10
Culture	0.01	-0.68	0.002	-0.99
Housing	0.005	-1.97	0.01	-0.15

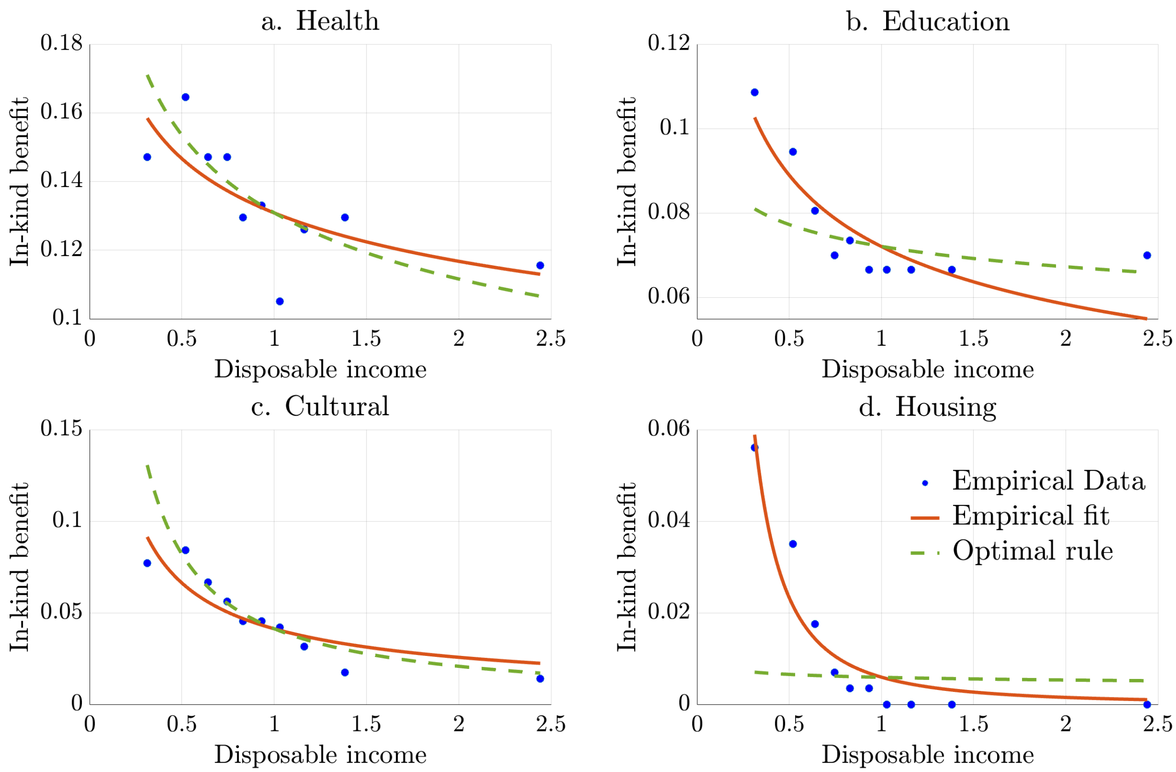
[15] μ_k is defined as: $\mu_k = \frac{G_k}{\int (y_i)^{\gamma_k}}$

[16] In Appendix E, we describe our empirical formula and alternative empirical fits. We keep the power law as our benchmark because it is the more parsimonious formula with only 2 parameters. We also provide the estimates for several countries: US, UK, Germany etc.

[17] Other seminal contributions include Feldstein (1973), Persson (1983), Benabou (2000), Benabou (2002) or Ferriere, Grübener, et al. (2023).

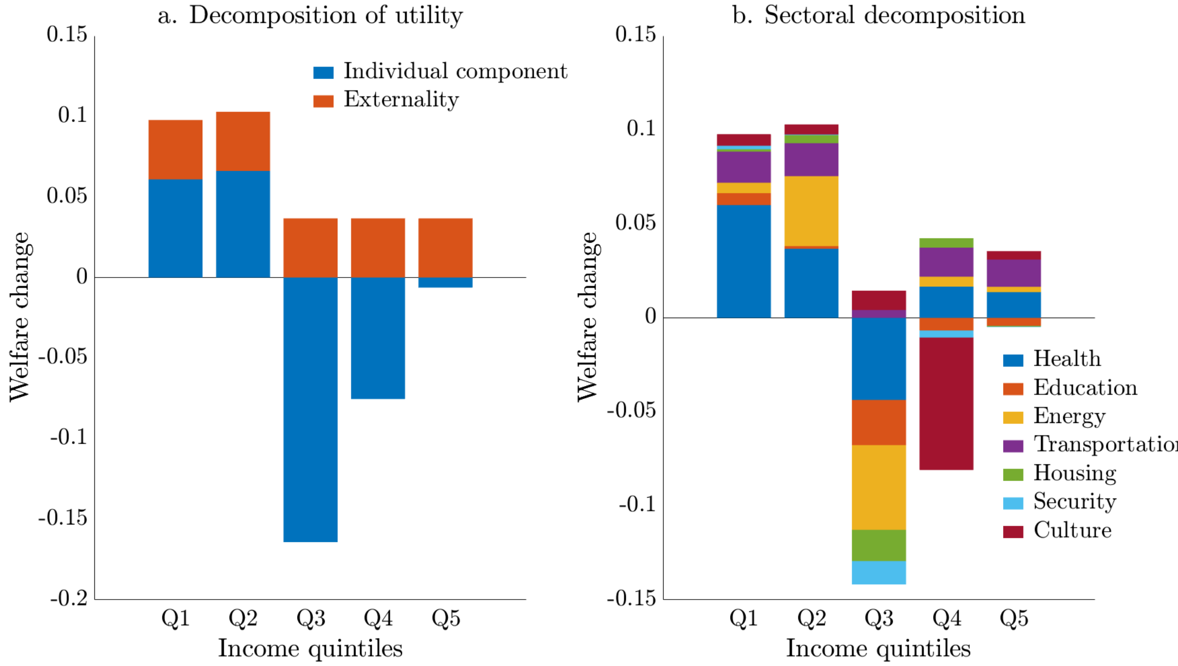
Table 7 presents our results. As expected, we find that $\gamma_k < 0$ for all sectors k, indicating a progressive pattern of in-kind benefits. A simple power law provides a good approximation of the French Distributional National Accounts. The corresponding empirical fits are shown in Figure 8. When aggregating across all sectors, we obtain an overall in-kind benefit function with estimated parameters $\mu = 0.397$ and $\gamma = -0.27$.

Figure 8: Empirical fit, power law



We implement these rules within our quantitative model and present our results in Figure 9. Implementing a progressive rule, keeping the level of sectoral public spending constant, increases aggregate welfare by 0.34%. This mainly stems from an increase in the externality component, while the effect of individual utility follows a U-shape–see panel a. Indeed, individual utility for middle-income households drops due to an increase in labor income taxation. Lower income households have an increase in individual utility thanks to an increase in public good provision. Higher-income households suffer less from income taxation because of asset accumulation. A sectoral decomposition of welfare effects shows that more progressive in-kind transfers for health, energy and transportation favor low-income households, and hurt middle-income households. More progressivity in culture in-kind transfers hurts a lot high-income households.

Figure 9: Welfare change, implementing French rules



Finally, we compute the optimal values of γ_k assuming that the planner cannot adjust the aggregate level i.e. putting a constraint on the μ_k's. We compare scenarios with the same aggregate level of sectoral public spending. In this scenario, the problem of the planner is the following:

$$\max_{\gamma_k} \mathbb{W} = \int V(a,z)d\mu(a,z)$$
$$\text{s.t. } \forall k,\ \mu_k \int_i g_{i,k} = G_k^{\text{benchmark}}$$

Our results are described in Table 7. The optimal progressivity in in-kind transfers increase aggregate welfare by 0.3 % with respect to the current situation. Notice that the optimal result is less progressive for all sectors, except for health and culture. Therefore, there are welfare gains to be found in optimizing redistribution through in-kind transfers.

10 Conclusion

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Appendix

Table of contents

A Analytical results

A.1 Proofs

A.1.1 Theorem 1

A.1.2 Theorem 2

A.1.3 Theorem 3

Welfare and optimal policies. The welfare from a utilitarian planner is given by:

$$\mathbb{W} = (1 + \omega S^r)\ln(1-\tau) - \omega\ln(\psi)S^r + \omega\int_{z>\zeta}\ln(z_i) \tag{a}$$

$$+\,\omega\ln(G+\bar{g})S^p + \omega\ln\left(\frac{\omega}{1-s}\right)S^r \tag{b}$$

$$+\,\frac{\psi T}{1-\tau}\int_{z<\zeta}\frac{1}{z_i} - \omega S^r + \psi\left(\frac{T+(1-s)(G+\bar{g})}{1-\tau}\right)\int_{z>\zeta}\frac{1}{z_i} \tag{c}$$

$$+\,\chi\ln\left(S^p(G+\bar{g})^\alpha + \left(\frac{\omega(1-\tau)}{(1-s)\psi}\right)^\alpha\int_{z>\zeta}(z_i)^\alpha\right) + t.i.p \tag{d}$$

The planner's welfare has 4 parts:

- (a) is the efficiency part and related to the consumption of standard goods by all households. This part is not directly affected by the provision of in-kind benefits (G) and all first order effects come from the aggregate level of taxation τ.

- (b) is the part related to private consumption of luxury goods. G directly increases the utility of low-income households but has no effect on high-income households since they can optimally adjust their behavior. With the same reasoning, subsidies s do not affect low-income households while they enhance welfare of high-income households.

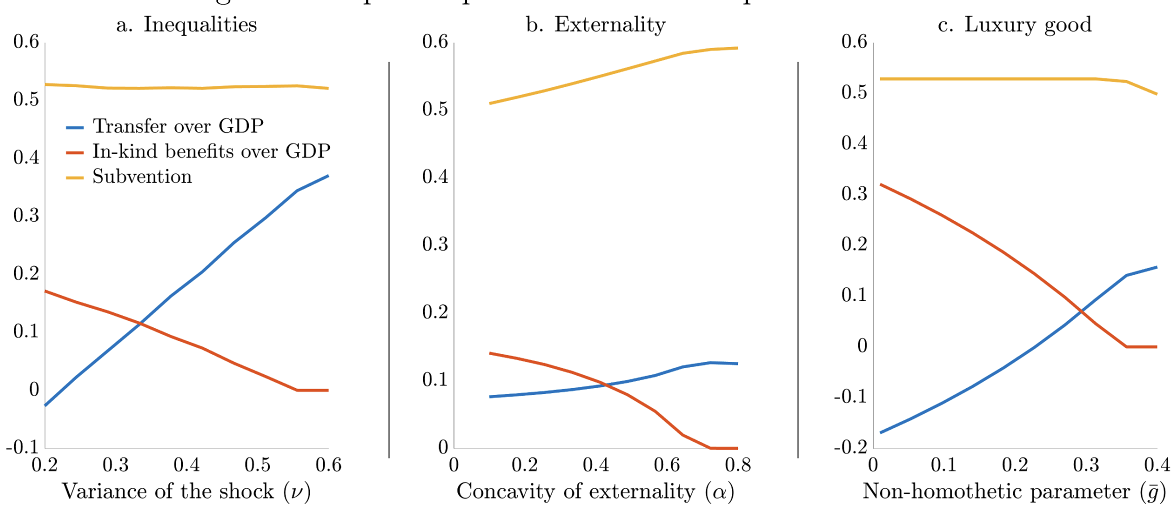
- (c) relates to labor supply distortions. In-kind benefits (G) only distort directly the labor supply of high-income households while low-income households are only affected by τ.

- (d) is the externality part. G increases welfare through external effects if and only if the share of households below ζ is positive (i.e. $S^p > 0$). If all households in the economy are rich enough so that $\forall i, g_i > 0$, then G has no positive external effects.

Numerical application for $\alpha < 1$.

When the externality function favors the equal distribution of the good, the optimal provision of in-kind benefits $G^{\star}$ is strictly positive. In panel *a.* from Figure 10, we show a simple numerical application of the optimal level of in-kind benefits G and transfers T with varying level of inequalities. The planner has to trade-off between two forces. In one hand, when inequalities increase, the redistribution motive is stronger, then the share of transfers in GDP should rise, and the share of public spending should decrease. On the other hand, more inequalities mean a higher share of households with $g_i = 0$. This increases the externality motive and therefore the need for in-kind benefits.

Figure 10: Optimal policies for different parameters' values



A.2 Toy model with discrete choice (opt-out)

Households' problem is defined as:

$$\max u_i = \omega \log(c_i) + (1-\omega)\log\left(\max\left(g_i, G\right)\right) - \psi n_i$$
$$c_i + (1-s)g_i = (1-\tau)z_i n_i + T$$
$$g_i \geq G$$

Homothetic preferences. Suppose g is a normal good, *i.e.* $\bar{g} = 0$. *Proposition 1: threshold.* if $G > 0$, we have the following results:

1. there exists a threshold ζ such that $\forall z_i \leq \zeta, g_i = 0$

$$\zeta = \frac{Ge\psi(1-s)}{\omega(1-\tau)}$$

2. we have two types of households:

$$\begin{cases} \forall z_i \leq \zeta, g_i = 0 \implies \frac{\partial u_i}{\partial T} > \frac{\partial u_i}{\partial G} \\ \forall z_i > \zeta, g_i > 0 \implies \frac{\partial u_i}{\partial T} = \frac{\partial u_i}{\partial G} \end{cases}$$

Proposition 2: welfare. Planner's welfare is given by:

$$\begin{aligned} \mathbb{W} &= (1-\omega)\log(1-\tau) && \text{(a)} \\ &+ \omega \log\left(\frac{1-\tau}{1-s} S^r + \omega \log(G) S^p\right) && \text{(b)} \\ &+ \frac{(1-\tau)}{(1-\tau+\tau\nu)}\left(S^r + (1-\omega)S^p + \frac{\psi G \nu}{1-\tau} + \frac{s\omega\nu}{1-s}\int_{z_i>\zeta} z_i\right) && \text{(c)} \\ &+ \chi \ln\left(S^p G^\alpha + \left(\frac{\omega(1-\tau)}{(1-s)\psi}\right)^\alpha \int_{z>\zeta} (z_i)^\alpha\right) + t.i.p && \text{(d)} \end{aligned}$$

Theorem 2bis: perfect substitutes. In this case, we find that: $G^* = 0$.

Non-homothetic preferences. Suppose g is a luxury good, *i.e.* $\bar{g} > 0$.

Proposition 1: threshold. there exists a threshold ζ such that $\forall z_i \leq \zeta, g_i = 0$

1. ζ is defined by the following relationship:

$$z_i > \zeta \Leftrightarrow g(z_i) = z_i e^{\frac{\psi(1-s)\bar{g}}{\omega(1-\tau)z_i}} > \frac{(G+\bar{g})e\psi(1-s)}{\omega(1-\tau)}$$

2. we have two types of households:

$$\begin{cases} \forall z_i \leq \zeta, g_i = 0 \implies \frac{\partial u_i}{\partial T} > \frac{\partial u_i}{\partial G} \\ \forall z_i > \zeta, g_i > 0 \implies \frac{\partial u_i}{\partial T} = \frac{\partial u_i}{\partial G} \end{cases}$$

Proposition 2: welfare. Planner's welfare is given by:

$$\begin{aligned} \mathbb{W} &= (1-\omega)\log(1-\tau) && \text{(a)} \\ &+ \omega \log\left(\frac{1-\tau}{1-s} S^r + \omega \log(G) S^p\right) && \text{(b)} \\ &+ \frac{(1-\tau)}{(1-\tau+\tau\nu)}\left(S^r + (1-\omega)S^p + \frac{\psi G \nu}{1-\tau} + \frac{s\omega\nu}{1-s}\int_{z_i>\zeta} z_i\right) && \text{(c)} \\ &+ \chi \ln\left(S^p G^\alpha + \left(\frac{\omega(1-\tau)}{(1-s)\psi}\right)^\alpha \int_{z>\zeta} (z_i)^\alpha\right) + t.i.p && \text{(d)} \end{aligned}$$

Theorem 3bis: luxury. In this case, we find that: $G^* > 0$ when α is low enough.

B Empirical evidence

B.1 Imputation of French Public Spending (preliminary)

In this section, we describe precisely how we decompose the universe of french public spending among cash transfers (T), in-kind benefits (G) and subsidies (s). We use all administrative datasets and budgetary bills available in order to make our imputation. The general idea goes as follows: (i) all cash transfers, conditional or not, are considered as transfers (T), (ii) we consider collective goods, public goods or goods offered for free as in-kind benefits (G), (iii) for subsidies (s), we consider all public spending that distort relative prices, including goods offered at a lower cost than usual, tax exemptions (VAT, income tax etc.), foregone revenues and public investments. As shown in Table 3, in-kind benefits represent roughly 64.5% of total transfers in-kind, and subsidies make around 35.5%.

Health

We consider as in-kind benefits (G) the following categories: public hospital operations and infrastructures, public health clinics and centers, healthcare worker salaries in public facilities, public health campaigns and preventive care programs, emergency medical services and direct provision of medical equipment and supplies.

We consider as subsidies (s): partial reimbursements through the mandatory health insurance system, subsidies for complementary health insurance, pharmaceutical reimbursements, provider payments for private practices, medical transport subsidies, long-term car subsidies, VAT exemptions for medical devices and medications, and income tax rebates for health related spending and investments

Education

We consider as in-kind benefits (G): teacher and staff salaries in public schools, operation of public schools and universities, educational materials and equipment, school infrastructure and maintenance, research funding for public universities.

We consider as subsidies (s): student financial aid (grants), housing subsidies for students, tax credits for education expenses, subsidies to private schools, voucher programs, VAT exemptions for education-related goods, and income tax rebates for education related spending and investments.

Energy and other industries

We consider as in-kind benefits (G): investments in public energy infrastructure and industrial research facilities, operating costs.

We consider as subsidies (s): VAT exemptions for energy-related goods, income tax rebates for energy or industrial related spending and investments, financial aids for renewable energy production and industrial production.

Transportation

We consider as in-kind benefits (G): public infrastructure development and operating costs: roads, railways etc.

We consider as subsidies (s): public transport services, incentives for purchasing electric vehicles, subsidies for installing EV chargers, and reduced taxes on certain fuels.

Housing

We consider as in-kind benefits (G): Construction and maintenance of public housing units and renovation of public buildings for energy efficiency.

We consider as subsidies (s): personal housing assistance programs and tax reductions for energy improvement works in private residences.

Security

We consider as in-kind benefits (G): police services, fire protection services, law courts and prisons operating costs, R&D Public order and safety, public order and safety n.e.c.

We consider as subsidies (s): VAT exemptions for security-related goods, and income tax rebates for security related spending and investments.

Culture

We consider as in-kind benefits (G): operation of public museums, theaters, cultural institutions, and organization of cultural events.

We consider as subsidies (s): Grants to support artistic creation, cultural projects, and tax incentives for cultural donations and sponsorships.

B.2 Non-homothetic preferences

Table 8: Estimates, CEX final-good expenditures, $\epsilon_m = 1$

	(1)	(2)	(3)
σ	0.346	0.377	0.283
	(0.024)	(0.024)	(0.032)
$\epsilon_{\text{agriculture}} - 1$	-0.629	-0.580	-0.594
	(0.076)	(0.103)	(0.087)
$\epsilon_{\text{other services}} - 1$	0.888	1.917	1.733
	(0.157)	(0.304)	(0.264)
$\epsilon_{\text{health \& education}} - 1$	0.227	0.775	0.487
	(0.162)	(0.240)	(0.179)
$\epsilon_{\text{transportation}} - 1$	0.01	0.319	0.370
	(0.115)	(0.167)	(0.139)
$\epsilon_{\text{culture}} - 1$	1.232	1.557	1.335
	(0.179)	(0.259)	(0.215)
Region FE	No	Yes	Yes
Year × Quarter FE	No	No	Yes
Observations	36,281	36,281	36,281
# parameters	36	51	216
# moments	80	135	260

Table 9: Estimates, 10-Sector regression, $\epsilon_m = 1$

	(1)	(2)	(3)
σ	0.10	0.13	0.07
	(0.03)	(0.05)	(0.04)
$\epsilon_{\text{agriculture}}$	0.32	0.34	0.38
	(0.05)	(0.05)	(0.06)
$\epsilon_{\text{other services}}$	1.90	1.97	1.81
	(0.157)	(0.179)	(0.304)
$\epsilon_{\text{health, education, defense}}$	1.59	1.32	1.61
	(0.03)	(0.04)	(0.03)
$\epsilon_{\text{transportation}}$	1.44	1.36	1.41
	(0.03)	(0.04)	(0.03)
$\epsilon_{\text{culture}}$	1.18	0.85	1.21
	(0.03)	(0.05)	(0.03)
Country × Sector FE	Yes	Yes	Yes
Observations	1,596	492	1,104

B.3 Externalities

In this section, we give examples of external effects estimated in the literature. We argue that previous studies, taken together, give strong arguments in favor of external effects that are concave in individual contributions.

Education

If Bob goes to school,

- He will transmit more human capital to his daughter Anna – Cunha and Heckman (2008)
- He will reduce his participation in criminal activities, improving the safety of Anna's neighborhood – Lochner and Moretti (2004)
- He may offer better opportunities to Anna through network effects – Calvo-Armengol, Patacchini, and Zenou (2009)
- He will increase growth, which will increase Anna's wage and living conditions – Bils and Klenow (2000)
- He will be a complement to Anna in the production function, increasing her wage – Abbott et al. (2019)

- He will have better health, reducing public health costs and disease transmission risk to Anna – Cutler and Lleras-Muney (2006)
- He will be more likely to participate in democratic and civic processes, improving local governance for Anna – Milligan, Moretti, and Oreopoulos (2004)

Health

If Anna has better health,

- Bob will face reduced risk of infectious disease transmission from Anna – Miguel and Kremer (2004)
- Bob will go to work instead of taking care of Anna, increasing his earnings – Bubonya, Cobb-Clark, and Wooden (2017)
- She will transmit good health behavior through network/peer effect – Christakis and Fowler (2007)
- Bob won't have to pay for Anna's medication – Colombo et al. (2011)
- Bob won't be stressed or sad due to Anna's condition – Pearlin et al. (1990)

Security

If Bob has a private alarm or bodyguard,

- It deters crime in the whole neighborhood – Ian and Steven (1998)
- Anna has improved psychological well-being and reduced stress from living in a safer environment – Stafford, Chandola, and Marmot (2007)
- Anna's property value is improved with neighborhood safety – Gibbons (2004)
- Little Anna won't be traumatized by seeing Bob's aggression, improving her cognitive performance – Sharkey (2010)
- Anna will pay less for public security expenditures – Chalfin and McCrary (2018)

Culture

If Anna has access to museum and culture,

- It creates a common frame of references with Bob, lowering the cost of their interactions – Guiso, Sapienza, and Zingales (2006)
- It creates a pole of attraction and tourism, benefiting to Bob's restaurant – Towse (2019)
- She may transmit knowledge to Bob

Transportation

Bob has access to public transportation:

- time travel decreases for Anna: Adler and Ommeren (2016)
- noise and accidents decrease for Anna: Parry and Small (2009)
- Anna is less polluted: De Borger et al. (1996)
- there are less carbon emissions: Almagro et al. (2024)
- urban decay decreases: Baumol (1967)
- operating costs decrease: Newbery (1988)

If Anna and Bob have access to new transportation infrastructures, it reduces trade costs, boosts productivity, generate network effects and dampens the impact of shocks

1. roads: Fernald (1999)
2. highways: Allen and Arkolakis (2022)
3. railroads: Donaldson (2018)
4. oceanic transports: Brancaccio, Kalouptsidi, and Papageorgiou (2020)

C Quantitative model: robustness

C.1 Earning risks in the public and private sectors

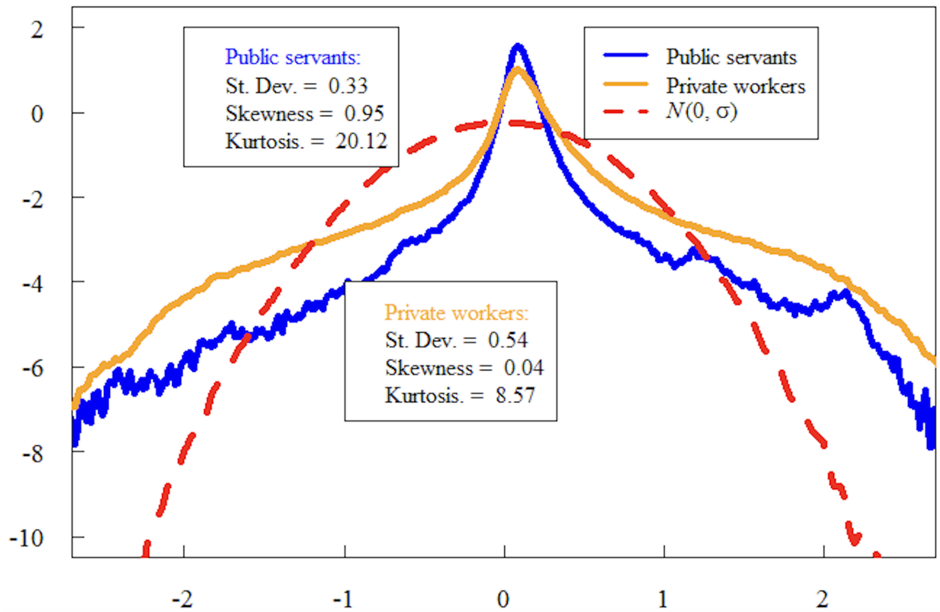
In this section, we extend our quantitative model to integrate a public sector. We estimate that this sector is characterized by a lower earning risk, and that this creates a stabilization channel for the public policies.

Data. We use administrative matched employer-employee data from France known as DADS[18], which has two advantages. First, it is highly representative, containing more than 3 million individuals in each cross-section. Second, it is a panel dataset that covers the entire work history of individuals, providing rich demographic, geographic, and firm-level information. The large sample size enables us to estimate idiosyncratic earning risks for several income level types and several occupation types.

Empirical results. To compute idiosyncratic earning risks we follow the methodology described in Guvenen et al. (2021). Our novelty is that we compute idiosyncratic risks for both private workers and public servants, that we are able to identify in our dataset

[18] DADS: *Déclarations Annuelles de Données Sociales.*

Figure 11: Log-density of 5-year earnings risks: public servants vs private workers



Sources: DADS.

We use this fact in an extension of our quantitative model and show that it increases the optimal level of public spending.

C.2 Top-up and max

Our paper introduces private consumption of good g_k as a "top-up", on top of the public provision G_k, with our utility function $u_i = ... + \omega_k \ln(g_{ik} + G_k + \bar{g}_k)$. While this works for private health, private alarm, private transportation, etc, in some cases, especially education, you have to choose between public and private options, as you cannot go simultaneously to two schools[19]. Therefore, we propose a robustness of our model where two options exists at the same time: topping-up and opting-out in the private sector. The key difference is that topping-up is limited by an upper bound $\bar{t}$. Household's problem is defined as:

$$\max u_i = \omega \log(c_i) + (1-\omega)\log\left(\max\left(g_i, G + t_i\right)\right) - \psi n_i$$
$$c_i + (1-s)(g_i + t_i) = (1-\tau) z_i n_i + T$$
$$g_i \geq 0,\ t_i \leq \bar{t}$$

[19]However, our "top-up" specification still works for some education cases. G_k can be free education until high-school, and you can add g_k to go to private university. g_k can also be seen as evening classes: in South Korea, participation rates in after-school programs are around 75 percent Kim, Tertilt, and Yum (2024).

D Distributional National Accounts revisited

D.1 Proofs

D.2 Methodology

Suppose we want to compute the monetary equivalent of one euro of public education provided to household i in a given country. We proceed as follow.

1. Denote G the public education expenditures over GDP. Example: $G = 5\%$ in France.
2. Suppose a distribution F for disposable income y, with one parameter calibrated so that $\mathbb{E}[y] = 1 - G$. Example: Pareto distribution with density $f(y) = \frac{\alpha((1-G)(\alpha-1))^{\alpha}}{\alpha^{\alpha} y^{\alpha+1}}$, with $\alpha = 2.1$ in France.
3. Let S be the share of households with zero private education expenditures. Example: the share of students in public school is equal to 80% in France.
4. The weight of public education for household i is given by $\mu_i = \min\left\{\frac{y_i/\bar{y}}{F^{-1}(S)}, 1\right\}$, with d_i the ratio between disposable income and GDP per capita. Example: our Pareto distribution yields $\mu_i = \min\left\{\frac{y_i/\bar{y}}{(1-G)(\alpha-1)}\alpha(1-S)^{\frac{1}{\alpha}}, 1\right\}$, and substituting values for France with GDP per capita $\bar{y} = 36000$ euros, we obtain $\mu_i = \min\left\{\frac{y_i}{38552}, 1\right\}$.

E Targeted in-kind benefits: robustness

Herein, we detail our empirical procedure and propose additional functional forms for targeted in-kind transfers. We compare their relative performances in Table 10.

Simple power rule. Our benchmark formula from Section 9 is equivalent to a pure power function:

$$g_{i,k}^{\text{in-kind}} = \mu_k y_i^{\gamma_k}$$

This is the simpler formula and only needs 2 parameters: γ_k a non-linear parameter, and μ_k a scaling parameter. When $\gamma_k < 0$, this means that targeted transfers favor low-income households. To estimate jointly both parameters, we use data from French Distributional National Accounts and run the following regression:

$$\log(g_{i,k}^{\text{in-kind}}) = \beta_0 + \beta_1 \log(y_i) + \epsilon_i$$

where y_i denote normalized disposable income. One can interpret estimators as $\beta_0 = \log(\mu_k)$ and $\beta_1 = \log(\gamma_k)$.

Logistic Drop-off. Then, we propose another formula using a logistic function:

$$g_{i,k}^{\text{in-kind}} = \frac{\mu_k}{1 + (y_i/(\zeta_k \bar{y}))^{\gamma_k}}$$

This function provides a smoother decay than the simpler power law, at the cost of adding one parameter: ζ_k.

Softer Cutoff. Finally, our most complex formula uses the tanh functional form:

$$g_{i,k}^{\text{in-kind}} = \frac{\mu_k y_i^{\gamma_k}}{2} \left(1 - \tanh\left[\xi_k (y_i - \zeta_k \bar{y})\right]\right)$$

This functional form gives the best empirical fit but has 4 parameters: μ_k, γ_k, ζ_k and ξ_k.

Table 10: MSEs relative to power law by sector

	Health	Education	Culture	Housing
Logistic Drop-off	0.98	1.02	0.27	0.01
Softer Cutoff	0.90	0.23	0.27	0.01

Note: The first line presents the MSE of the logistic function divided by the MSE of the power law. If the ratio is close to 1, then it means that the fits are close to identical.

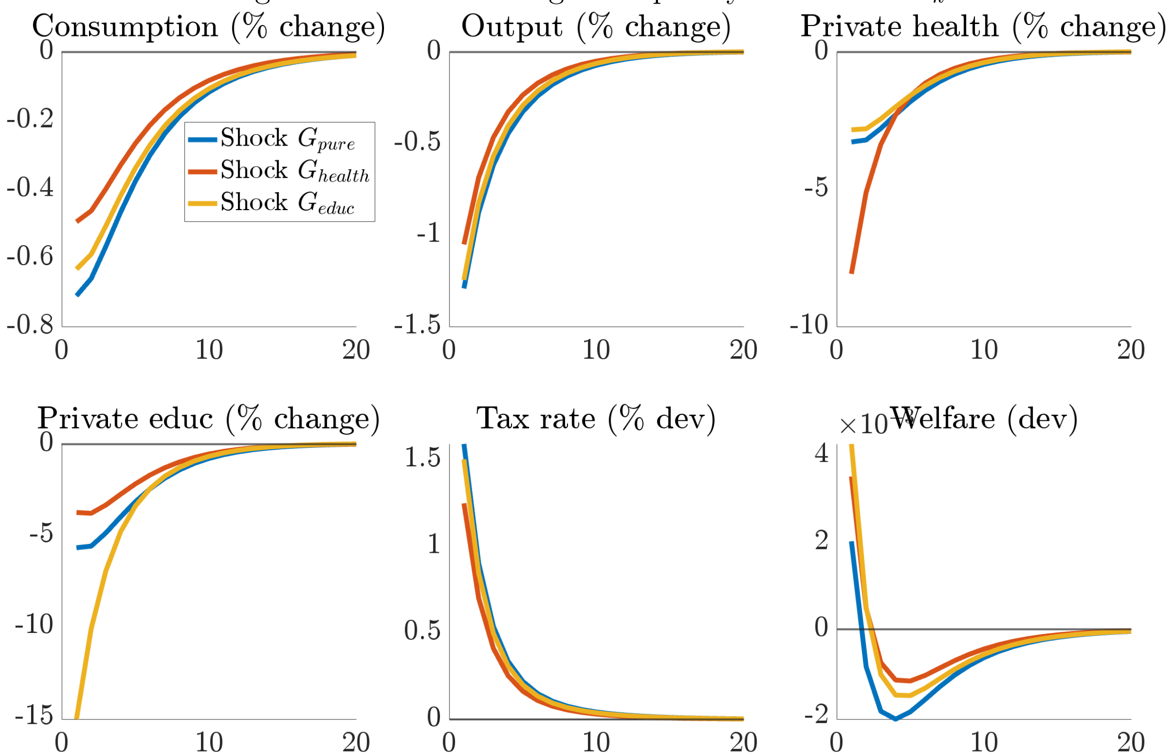
F Additional results

F.1 Keynesian multipliers

Our model allows us to revisit the Keynesian multipliers literature. We assume a temporary increase[20] in the in-kind benefit G_k for $k = \{$pure public good, health, education$\}$. We obtain the following impulse response functions:

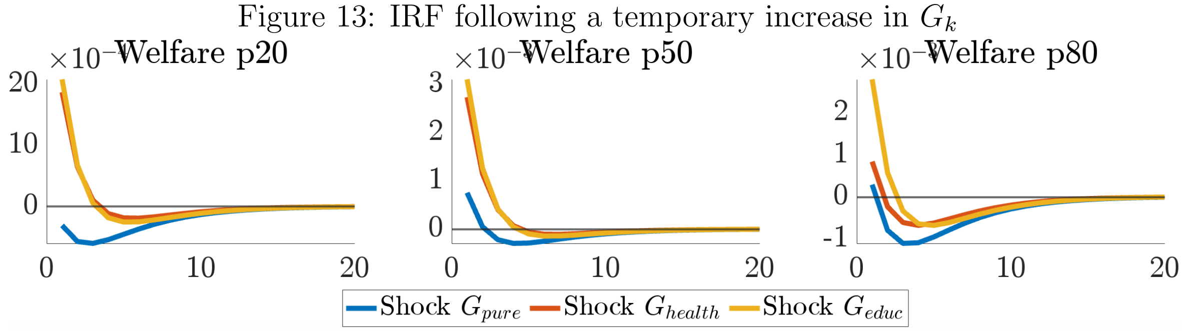
[20] following a AR(1) process $G_{k,t} = \bar{G}_k + e_{k,t}$ and $e_{k,t} = 0.5 e_{k,t-1}$, with $e_{k,1} = 0.01$.

Figure 12: IRF following a temporary increase in G_k



We can also compute the welfare for the 20$^{\text{th}}$, 50$^{\text{th}}$ and 80$^{\text{th}}$ percentile of the income distribution. As illustrated by the figure below, education being more a luxury good than health (in the sense that less people consume private education), the

Figure 13: IRF following a temporary increase in G_k



F.2 Optimal public spending along the business cycle

In this section, we compute the transition between a steady state calibrated on 1980 level of inequality, and today. We compute the optimal provision of in-kind benefits along the transition.

F.3 Optimal public spending and changes in inequalities

In this section, we compute the transition between a steady state calibrated on 1980 level of inequality, and today. We compute the optimal provision of in-kind benefits along the transition.

F.4 In-kind benefits and optimal progressivity

Public spending have distributive effects. Therefore, how does public spending modify optimal progressivity in the HSV?

We use a modified version of our theory to study this point:

$$\max_{c_i, g_i, n_i} u_i = (1-\omega)\ln(c_i) + \underbrace{\omega \ln(g_i + G + \bar{g})}_{\text{Private consumption}} - \psi n_i$$

$$\text{such that } c_i + g_i = (1-\tau) \underbrace{z_i}_{\text{heterogeneity}} n_i + T$$

$$\text{and } g_i, c_i, n_i \geq 0$$