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The political economy of the public/private mix in healthcare: assessing the decongestion effect argument *

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Abstract

This paper examines the "decongestion effect" argument, which suggests that the expansion of the private healthcare sector can reduce pressure on the public healthcare system, thereby improving access and quality of care for public sector patients. To this purpose, we develop a probabilistic voting model that endogenizes the public healthcare budget and incorporates a private sector where agents, differentiated by income, can opt out of the public system while still contributing to it fiscally. Our findings indicate that a higher proportion of individuals opting out leads to lower political support for public healthcare and a decline in public healthcare quality, ultimately negating the decongestion effect argument. Using data from 26 European countries, we empirically test our model by examining the relationship between unmet medical needs -used as a proxy for the quality of public healthcare sector- and private health insurance coverage. After controlling for individual and country-level characteristics, our results indicate that as private insurance coverage expands, income disparities in unmet medical needs widen: wealthier individuals benefit more, while poorer individuals face increased unmet needs, providing no evidence supporting the decongestion effect.

Keywords: *public/private healthcare mix, voluntary health insurance, unmet medical needs, probabilistic voting, bivariate probit model*

JEL Classification: I13, I14, H51, P35, C35

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1 Introduction

In recent years, the interplay between public and private healthcare sectors, particularly in terms of financing and service provision, has gained increasing attention in developed countries. One argument for expanding the private healthcare sector, even where a public health insurer is already established, is that greater private financing and provision of services can reduce the strain on public healthcare budget. This, in turn, could improve access to and quality of care for those who continue to rely on the public sector. In the academic literature, this phenomenon is referred to as the "decongestion effect", a concept introduced by Besley and Coate (1991).[1] They posited that permitting or encouraging the private provision of goods that are also supplied publicly—such as healthcare, education, and transportation—can lead to a more efficient and equitable distribution of resources.

Applied to healthcare, this argument implies that encouraging the adoption of (duplicate) Voluntary Healthcare Insurance (VHI) could strengthen the redistributive role of publicly funded healthcare systems, like those provided by National Health Services (NHS) or Statutory Health Insurance (SHI) plans.[2] If wealthier individuals are more likely to purchase duplicate insurance, they would depend less on public services, freeing up resources within the public system. This could lead to better service delivery for those who rely solely on public healthcare, often lower-income individuals, thereby enhancing the equity and efficiency of the healthcare system. In this context, easing regulations on VHI access or offering tax deductions for VHI premiums and/or private health expenditures — a practice common in many OECD countries — could support this process.

The decongestion effect implicitly relies on several hypotheses. First, the services

[1] Before Besley and Coate (1991), Stiglitz (1974) and Ireland (1990) put forth similar arguments, assuming that the private sector offers alternatives that allow individuals to opt out of the public sector.

[2] OECD (2023) defines a private health insurance "duplicate" (or "supplementary") if it offers coverage for health services already included under government health insurance, acting as substitute for public healthcare, and "complementary" if it complements the public health insurance by offering services not covered by the latter.

offered by the two sectors are equivalent so that patients can substitute publicly provided healthcare services with private ones (Mou (2013)). Second, those who substitute public healthcare services with private healthcare do not opt out financially from the public system, i.e. they continue to contribute to finance it (Propper and Green (2001); Thomson and Mossialos (2006)). Third, the expansion of the private sector has no consequences on the capacity and the costs of the public sector.

The alternative perspective argues that the expansion of the private sector can deplete resources from the public sector, resulting in diminished access to and quality of care (Iversen (1997); Vaithianathan (2002); Eckermann et al. (2015)). Several factors contribute to this outcome. First, increased competition for inputs can drive up the costs of publicly provided services, thereby negating the advantages of reduced demand. Second, the generosity of fiscal benefits offered to the private sector may outweigh the gains from decreased reliance on public services. Finally, political support for publicly financed healthcare may decline, leading to budget cuts and a further reduction of service quality (Besley et al. (1999); Costa-Font and Font-Vilalta (2004)).

Therefore, the question of whether, and under what conditions, a shift towards a healthcare system with a significant private insurance component is beneficial for patients remaining within the public system necessitates further rigorous theoretical and empirical investigation.

To address this issue, we develop a probabilistic voting model to investigate the endogenous determination of the public healthcare budget. Our model accounts for the presence of a private healthcare sector, allowing agents — differentiated by income levels— to purchase private health insurance and thereby to opt out of the public healthcare system, while still contributing to its funding. Prior to the voting process, agents decide whether to enrol in VHI schemes and withdraw from the public system, based on their expectations regarding the quality of public healthcare, which is ultimately determined by the voting process.[3] The decision to opt in or out of the public system endogenously divides users of public and private healthcare according to the income level, consistent with the characterization of healthcare as a normal good. The two resulting groups exhibit divergent preferences regarding public healthcare spending; specifically, those who opt out, yet continue to finance the public system, tend to favour minimizing public healthcare expenditure. Within this framework, we establish the existence of a unique equilibrium. A mixed public/private equilibrium arises if preferences are sufficiently dispersed, meaning that income inequality is sufficiently pronounced. Conversely, a fully public equilibrium arises when preferences are more uniform, reflecting either low income inequality or a situation in which agents place relatively low importance on healthcare consumption in their utility function.

Rising income inequality leads to a growing number of individuals opting out of the public healthcare system, generating resource-saving benefits for the public sector through reduced demand. However, due to the inherent features of the probabilistic voting framework, a higher proportion of individuals opting out results in a lower equilibrium level of taxation. This, in turn, reduces the public healthcare budget and we demonstrate that this decline outweighs the resource-saving benefits, ultimately causing a deterioration in the quality of public healthcare provided in equilibrium. Consequently, this negates the intended decongestion effect. This outcome is derived under the assumptions of constant returns to scale and tax deductibility of insurance premiums.[4] The result would be even more pronounced if we assumed economies of scale in public healthcare provision.

Our theoretical framework provides predictions about the overall extent of both private and public healthcare and how the quality of public healthcare is influenced by the expansion of the private sector. To bring predictions to data, we use

[3] The model places substantial emphasis on the expected quality of public healthcare, in line with empirical evidence indicating that anticipated quality is a pivotal factor influencing the decision to opt for either private or public healthcare (Costa-Font and Font-Vilalta (2004)).

[4] We assume tax deductibility of VHI premiums, because in many OECD countries the expansion of the private healthcare sector has been incentivized through fiscal benefits for VHI uptake or for out-of-pocket private expenses (see `https://www.missoc.org/`).

self-assessed individual unmet medical needs (UMN) as a proxy for the quality of public healthcare and we investigate the relationship between this variable and duplicate VHI coverage. Our data sample includes 26 European countries. The results broadly confirm our theoretical predictions: after controlling for individual and country-level characteristics, we find that UMN among the population in the lower end of the income distribution increase as VHI coverage expands. Thus, we find no evidence supporting the decongestion argument.

Our results suggest that encouraging the expansion of VHI through fiscal incentives, with the aim of alleviating pressure on the public system, might not be an effective strategy for improving access to and quality of public healthcare services.

The structure of the paper is as follows: Section 2 briefly reviews the related literature; Section 3 outlines the theoretical model; Section 4 details the empirical analysis; Section 5 presents the estimation results; Section 6 offers concluding remarks.

2 Related literature

Our theoretical model builds upon the framework established by Gouveia (1997). However, in contrast to Gouveia's model, we posit that public and private healthcare services function as substitutes rather than complements. As a result, individuals may choose to opt out of the public healthcare system, despite remaining financially responsible for its maintenance. The decision to opt out is modeled using the framework developed by De la Croix and Doepke (2009), originally applied to private education choices. Furthermore, unlike Gouveia, who employs a majority voting approach, we adopt a probabilistic voting framework, as used by De la Croix and Doepke (2009). This approach allows us to account for the potential decline in political support for public healthcare as the proportion of the population purchasing VHI increases.[5]

As for empirical contributions looking at the decongestion effect, a significant portion of this literature has concentrated on assessing whether individuals enrolled in private insurance plans replace public healthcare consumption with private care, or whether they simply augment their private consumption without reducing their reliance on public services. The findings across studies are heterogeneous. In Australia, Doiron and Kettlewell (2018), looking at the impact on public hospital admissions of an increase in VHI take-up, identify relevant substitution effects, although they observe that the reduction in public service usage is insufficient to counterbalance the fiscal costs associated with incentives for private expenditure, a result confirmed by Cheng (2014). The evidence for the United Kingdom and Spain is more ambiguous. Some research suggests that public services are used complementarily with private services (Propper (2000) for the UK; Nicolás and Vera-Hernández (2008) for Spain), while other studies report significant substitution effects. Notably, Besley et al. (1999) and Bíró and Hellowell (2016) find that longer waiting times for medical treatment in British public hospitals positively influence the decision to purchase VHI. This finding suggests that individuals who purchase VHI intend to substitute private treatment for public services. Similar results have been observed in Spain (Jofre-Bonet (2000); Costa-Font and Font-Vilalta (2004); Cantarero-Prieto et al. (2017)) and in Ireland (Harmon and Nolan (2001)). In Italy, Fabbri and Monfardini (2016) indicate that wealthier individuals, upon acquiring VHI, tend to increase their consumption of private healthcare services while simultaneously reducing their use of publicly provided services. Søgaard et al. (2013) find that employer-funded insurance holders in Denmark exhibit a 10% reduction in public hospital use compared to non-holders.

These studies examine admissions to public hospitals and the influence of public

[5] De la Croix and Doepke (2009) investigate the consequences on the quality of public education of the expansion of the private education sector. They consider the potential for diminishing political support for the public sector, but do not account for the impact of fiscal deductibility of private education expenditure on the public budget, concluding that educational segregation can enhance the welfare of poorer individuals who remain within the public system, due to the decongestion effect.

sector waiting times on the decision to purchase VHI to identify a substitution effect. However, this approach does not directly address the impact of increased VHI coverage on the quality of the public healthcare system. To the best of our knowledge, Yang et al. (2024) is the first study to directly investigate the decongestion effect by examining the causal impact of VHI uptake on waiting times in Australian public hospitals. Their findings suggest that the practical significance of the decongestion effect is limited, if not negligible.

The issue of political support for public healthcare is also of critical importance. If there is diminished pressure to maintain the quality of publicly provided healthcare services in countries where a significant proportion of the population holds private insurance, this could undermine the argument for the decongestion effect. Hall and Preston (1998), using data from the British Social Attitudes Survey, provide evidence that individuals' uptake of private medical insurance significantly diminishes their support for public health sector funding. Conversely, Kullberg et al. (2022) and Martinussen and Magnussen (2019), examining respectively the Sweden and the Norwegian healthcare systems, find no relationship between holding VHI and support for public healthcare service provision, once other factors are controlled for.

Against this background, this paper contributes to the literature on the political economy of healthcare systems and to the debate on the impact of the expansion of the private sector on the quality of publicly provided services. Theoretically, we model the effects of increased private healthcare provision on the quality of public services, simultaneously considering the tax deductibility of private healthcare expenditure and the potential decline in political support for the public sector. Empirically, to the best of our knowledge, this is the first study to investigate the decongestion effect argument by examining the causal impact of increased VHI coverage at country level on individual unmet medical needs.

3 The model

3.1 Basic assumptions

The economy has a continuum of agents of mass one. They are characterized by different endowments of a general consumption good x (income) that serves as numeraire. We assume that income is uniformly distributed in the interval $(1-\delta, 1+\delta)$, with $\delta \in [0,1]$. Accordingly, the associated density function is given by $g(x) = \frac{1}{2\delta}$ for $1-\delta \leq x \leq 1+\delta$ and $g(x) = 0$ otherwise. The parameter δ measures income inequality.[6]

There are two states of nature: sick (1) and healthy (0). The probability of becoming sick is exogenous, homogeneous across agents, and it is denoted by p, with $p \in (0,1)$. Agents have state–dependent preferences on consumption and healthcare, which can be privately provided (h_m) or publicly provided (h_g). We assume that public and private healthcare are mutually exclusive and that the price of one unit of healthcare—whether public or private—is the same and normalized to 1.[7]

In the healthy state (0), utility is defined as follows:

$$U_0 = \log(c_0). \tag{1}$$

In the sick state (1), utility is defined as follows:

$$U_1 = \log(c_1) + \gamma \log(h), \tag{2}$$

[6]For simplicity, a uniform distribution of income is used, though other distributions would result in comparable outcomes. Notably, in the probabilistic voting model outlined below, the position of the median and mean income does not carry special importance.

[7]We are implicitly assuming, for simplicity, that the private and public healthcare supply curves are infinitely elastic (see Gouveia (1997) for a similar assumption).

where $\gamma \in R+$ and $h \in \{h_g, h_m\}$.[8]
Government finances public health expenditure by a proportional income tax τ.[9] We assume that, although agents opting for private healthcare do not use public services, they have nonetheless to pay taxes to finance them. However, they can deduct the premium paid for private health insurance from their taxable income.

3.2 Timing and opting out

Timing. The economy lasts two periods. In the first, before the state of nature realizes, agents decide whether to purchase private health insurance and opt out of the public system. In the second period, the tax rate τ is determined within a probabilistic voting framework. Then, the state of nature realizes and agents consume. When deciding whether to acquire private health insurance, agents base their decisions on the anticipated electoral outcome and the corresponding expectation regarding the per capita level of publicly provided healthcare.
Opting out. Agents opting out of public healthcare buy I units of VHI and pay a unit premium π. Assuming perfect information, the unit premium is equal to the probability of sickness: $\pi = p$. In the second period, if the bad state occurs, agents receive a pay out I from the insurance company and purchase h_m units of private healthcare. Agents choose the insurance coverage I and the amount of private healthcare h_m maximizing the following expected utility with respect to I and h_m:

$$EU = (1-p)U_0 + pU_1, \tag{3}$$

where U_0 and U_1 are given by (1) and (2), under the following budget constraints:

$$c_0 = (1-\tau)(x - pI) \tag{4}$$

$$c_1 = (1-\tau)(x - pI) + (I - h_m). \tag{5}$$

[8]The logarithmic utility function is selected for its simplicity; however, any utility function that reflects homothetic preferences would yield equivalent outcomes.

[9]This tax is meant to represent the incremental impact of healthcare financing needs on the overall tax system.

Hence, substituting (4) and (5) into (3), their maximization problem becomes:

$$\max_{(I,h_m)} (1-p)\log\Big[(1-\tau)(x-pI)\Big] + p\Big[\log\Big((1-\tau)(x-pI)+(I-h_m)\Big) + \gamma\log(h_m)\Big]. \tag{6}$$

It is easy to show that the optimal insurance coverage I^* allows agents to consume the same amount of the numeraire good in both states of nature, therefore $I^* = h_m^*$.[10] Deriving (6) and solving the first order condition w.r.t. h_m, we get the level of private healthcare acquired by agents who opt out of public healthcare:

$$h_m^*(x) = \frac{\gamma}{1+\gamma p}x.$$

Private healthcare expenditure increases with income x, as well as with the relative importance of healthcare in the utility function γ, while it decreases with the probability of illness p. The latter relationship is due to the fact that insurance premiums rise as the probability of sickness p increases.

When deciding whether to opt out of public healthcare, agents base their decisions on the expected per capita level of healthcare provided by the government, h_g^e. To determine the agents' choice between private and public healthcare, we compute agents indirect utility if choosing VHI and use privately provided healthcare, $EV(h_m^*)$, and agents indirect utility if using publicly provided healthcare, $EV(h_g^e)$:

$$EV(h_m^*) = \log\left(\frac{(1-\tau)x}{1+\gamma p}\right) + \gamma p\log\left(\frac{\gamma}{1+\gamma p}x\right),$$

$$EV(h_g^e) = \log\Big((1-\tau)x\Big) + p\gamma\log(h_g^e).$$

By imposing the condition $EV(h_m^*) = EV(h_g^e)$, it is possible to show that there exists a threshold income level $\hat{x}(h_g^e)$ such that an agent with income $x = \hat{x}(h_g^e)$ is

[10] This is obtained from the first order condition of the optimization problem (6) w.r.t. I.

indifferent between public and private healthcare. The threshold is given by the following expression:

$$\hat{x}(h_g^e) = \frac{(1+\gamma p)^{\frac{1+\gamma p}{\gamma p}}}{\gamma} h_g^e. \tag{7}$$

Given h_g^e, agents strictly prefer private healthcare if and only if $x > \hat{x}(h_g^e)$.[11]
Note that the threshold increases with the expected level of public healthcare and with morbidity risk p, while it decreases with γ.
The share of agents not buying VHI and thus using public healthcare, denoted by $\Omega(h_g^e)$, is given by the following expression:

$$\Omega(h_g^e) = \begin{cases} 0 & \text{if } \hat{x}(h_g^e) < 1-\delta \\ \frac{\chi h_g^e - (1-\delta)}{2\delta} & \text{if } 1-\delta \leq \hat{x}(h_g^e) < 1+\delta \\ 1 & \text{if } \hat{x}(h_g^e) \geq 1+\delta \end{cases} \tag{8}$$

where $\chi = \frac{(1+\gamma p)^{\frac{1+\gamma p}{\gamma p}}}{\gamma}$.
The share of population opting for the public system weakly increases with the expected level of public healthcare h_g^e. Moreover, by deriving (8) w.r.t. to δ, it is possible to show that if $h_g^e > \frac{1}{\chi}$, so that $\Omega(h_g^e) > 1/2$, then $\Omega(h_g^e)$ decreases with income inequality δ. Hereinafter, we denote the share of population using public healthcare simply by Ω omitting its dependence on h_g^e.

3.3 Public healthcare

The resources available for public healthcare derive from tax revenues, so the government's healthcare budget can be written as follows:

$$B(\tau,\Omega,\delta) = \int_{1-\delta}^{1+\delta} \tau x \frac{1}{2\delta}\, dx - \int_{\hat{x}}^{1+\delta} \tau \left(\frac{\gamma p}{1+\gamma p}\right) x \frac{1}{2\delta}\, dx, \tag{9}$$

[11] If $x = \hat{x}(h_g^e)$, we assume that agents opt for the public system.

where the second term on the right-hand side is due to the tax deductibility of the insurance premiums and $\hat{x} = (1-\delta) + 2\delta\Omega$ is the income threshold level as a function of Ω, computed from (8).
Solving the integral, we obtain

$$B(\tau, \Omega, \delta) = \tau \left[1 - \frac{\gamma p}{1+\gamma p}(1-\Omega)(1+\delta\Omega)\right]. \tag{10}$$

Assuming a balanced budget rule, tax revenues must cover public expenditure on healthcare.[12] Therefore, we can write the government's healthcare budget constraint as follows:

$$B(\tau, \Omega, \delta) = p h_g \Omega. \tag{11}$$

Therefore, the per capita level of public healthcare delivered is:

$$h_g = \frac{B(\tau, \Omega, \delta)}{p\Omega}. \tag{12}$$

Given τ, an increase in the share of agents who buy VHI and use private healthcare has two effects: on one hand, the budget shrinks, due to the tax deductibility of the premiums paid; on the other hand, as Ω decreases, the total cost of delivering public healthcare falls.

3.4 Political equilibrium

We now consider the political process in which agents vote on the income tax τ to finance public healthcare.
Based on the decision to purchase VHI or not, the population is divided into two groups: the non-insured (**N**) with income $x \leq \hat{x}(h_g^e)$ and the insured (**I**) with income $x > \hat{x}(h_g^e)$.

[12] Recall that we are assuming that, as in the private sector, the unit cost of public healthcare is equal to one and does not vary with the size of the population served. We will discuss later the implication of this assumption.

We assume a probabilistic voting framework in which two parties compete in an election. Before the election, each party proposes an income tax rate to finance healthcare in an attempt to win votes. Voters in groups **N** and **I** have different preferences regarding the economic policy, but they may also have ideological preferences, meaning they could be biased in favour of one of the two parties. Given this bias, the probability that a given voter chooses a party increases as that party's platform becomes more appealing. It can be shown that the two parties converge to the same policy platform, as demonstrated by Lindbeck and Weibull (1987); Lindbeck and Weibull (1993). Assuming that the distribution of party-neutral voters (those with no ideological bias) is the same in the two groups, the common platform corresponds to the economic policy that maximizes a weighted utilitarian social welfare function, where the weight of each group is proportional to its size. In our framework, the policy chosen by the two parties maximises:

$$\Omega\left[\log(1-\tau)x+\gamma p\log\left(\frac{B(\tau,\Omega,\delta)}{p\Omega}\right)\right]+(1-\Omega)\left[\log\left(\frac{(1-\tau)}{1+\gamma p}x\right)+\gamma p\log\left(\frac{\gamma}{1+\gamma p}x\right)\right]. \tag{13}$$

Given h_g^e, and thus given Ω, deriving (13) w.r.t. τ and solving the first order condition, we obtain the tax rate proposed by both parties:

$$\tau^*(\Omega)=\frac{\gamma p\Omega}{1+\gamma p\Omega}. \tag{14}$$

Note that $\tau^*(\Omega)$ is increasing in Ω, with $\tau^*(0)=0$ and $\tau^*(1)=\frac{\gamma p}{1+\gamma p}$. This implies that the political support for public healthcare decreases as a greater share of the population opts for private healthcare provision.

In this framework, we define a political equilibrium where the decision to purchase VHI must be optimal, and expectations regarding the level of publicly provided healthcare must be rational.

Definition. Political equilibrium.

A political equilibrium comprises:

i) an income threshold $\hat{x}(h_g^e)$ satisfying eq. (7);

ii) private healthcare spending decisions: $h_m^* = 0$ for $x \leq \hat{x}(h_g^e)$ and $h_m^*(x) = \frac{\gamma}{(1+\gamma p)}x$ for $x > \hat{x}(h_g^e)$;

iii) aggregate variables $\tau^*(\Omega)$ and Ω, where Ω is defined by (8) and $\tau^*(\Omega)$ by (14).

iv) a level of public healthcare spending, denoted by $h_g^* = \frac{B(\tau^*, \Omega(h_g^e), \delta)}{p\Omega(h_g^e)}$, such that the perfect foresight condition $h_g^* = h_g^e$ must hold (rational expectations).

Combining (14) and (10), and using (12), we can define a continuous mapping from h_g^e into actual public healthcare spending:[13]

$$\Delta(\Omega) = \begin{cases} \frac{\gamma}{1+\gamma p\Omega}\left[1 - \frac{\gamma p}{1+\gamma p}\left((1-\Omega)(1+\delta\Omega)\right)\right] & \text{if } 0 < \Omega < 1 \\ \frac{\gamma}{1+\gamma p} & \text{if } \Omega = 0 \text{ or } \Omega = 1 \end{cases} \tag{15}$$

This mapping has a unique fixed point h_g^* characterised by the following proposition. Hereinafter Ω^* stands for $\Omega(h_g^*)$.

Proposition 1. Political equilibrium

There exists a unique political equilibrium.

i) If $\gamma p > 1$ and $\delta > (1+\gamma p)^{\frac{1}{\gamma p}} - 1$, then the equilibrium features a public/private mix: $\Omega^* < 1$ and $h_g^e = h_g^* < \frac{\gamma}{1+\gamma p}$; moreover if $\gamma p\left(2 - (1+\gamma p)^{\frac{1}{\gamma p}}\right) < 4$ then $\frac{1}{2} < \Omega^* < 1$.

ii) If $\gamma p < 1$ or $\delta < (1+\gamma p)^{\frac{1}{\gamma p}} - 1$, then the equilibrium is fully public: $\Omega^* = 1$ and $h_g^e = h_g^* = \frac{\gamma}{1+\gamma p}$.

Proof: see Appendix 1

[13] Remind that Ω stands for on $\Omega(h_g^e)$.

In the public/private mix equilibrium affluent agents opt out of the public system. This equilibrium arises when preferences for healthcare are sufficiently dispersed (high income inequality) and agents put high weight on healthcare ($\gamma p > 1$). In the fully public equilibrium all agents consume public healthcare.This equilibrium arises if the income distribution is sufficiently compressed, reflecting low income inequality, or in a situation in which agents place relatively low importance on healthcare consumption in their utility function ($\gamma p < 1$).
Note that a fully private regime cannot be an equilibrium because when participation is very low (i.e. $\Omega \to 0$), so production cost are negligible, high quality public healthcare can be provided at very low τ as $\Delta(\Omega) \to \frac{\gamma}{1+\gamma p}$. Consequently, the quality of public healthcare becomes sufficiently high to ensure that some individuals prefer public over private providers ($\Omega > 0$).
The effect of income inequality on the public/private mix equilibrium is established in the next proposition, where we focus on parameters' values such that at least half of the population utilizes public healthcare. This seems reasonable as it is in line with real-world healthcare systems.

Proposition 2. Income inequality and public healthcare

If $\frac{1}{2} < \Omega^* < 1$, i.e. if $\gamma p \left(2 - (1+\gamma p)^{\frac{1}{\gamma p}}\right) < 4$, an increase in income inequality leads to a lower equilibrium level of public healthcare $\left(\frac{dh_g^*}{d\delta} < 0\right)$.
Proof: see Appendix 1.

When at least half of the population opts for public healthcare, increasing inequality leads to a decline in public healthcare participation (see (8)), which in turn lowers the tax rate (see (14)). Consequently, the overall public healthcare budget contracts, driven by the reduced tax rate and the growing number of individuals deducting private healthcare expenses from taxable income. Simultaneously, the total cost of public healthcare provision decreases as fewer people use the service. However, the reduction in the budget exceeds the savings in healthcare costs, leading to a net decline in per capita publicly provided healthcare. Therefore, rising inequality reduces the availability of public healthcare.

Our analysis suggests that in a mixed public/private equilibrium, the expansion of the private sector does not result in a decongestion effect that benefits those remaining in the public system. On the contrary, as inequality grows and a larger share of the population exits the public system, the quality of public healthcare declines. This outcome accounts for both the fiscal incentives for private healthcare expenditure and the potential decrease in political support for public healthcare as more individuals opt for private services.[14] Moreover, we have assumed constant returns to scale in healthcare production, implying that the cost per unit of public healthcare remains unchanged regardless of the number of people served. If economies of scale existed—where unit costs decrease as the number of users grows—our findings would be even more pronounced. Conversely, if diseconomies of scale prevailed—where unit costs increase with a larger population served—the conditions would be more favourable for the decongestion effect to emerge.[15]

In summary, the presence of a decongestion effect depends on the extent of fiscal incentives for private healthcare expenditure, the degree to which political support for public healthcare shifts with private sector expansion, and the cost structure of healthcare provision.

In the next section, we conduct an empirical analysis to assess whether the decongestion effect argument holds in real-world healthcare systems. Specifically, we investigate how individual unmet medical needs — used here as a proxy for

[14] Public subsidies can be explicit and implicit; implicit subsidies may arise from public funding of medical education, the failure to charge VHI the full economic cost for the use of public hospital beds, and the reliance on publicly funded systems as a backup (Sagan and Thomson (2016)).

[15] A growing body of research has investigated the costs of providing public health services. Most studies focus on scale economies either at the hospital level (e.g., Marini et al. (2009); see Giancotti et al. (2017) for a recent survey) or at the level of specific patient conditions (e.g., Gaughan et al. (2012)). There is a general consensus that economies of scale are influenced by the range of services offered. With regard to the number of beds, studies consistently find evidence of economies of scale for hospitals with 200–300 beds. Conversely, diseconomies of scale are generally observed in hospitals with fewer than 200 beds or more than 600 beds (Giancotti et al. (2017)).

the quality of public healthcare— change with increasing VHI coverage, while controlling for individual and country-level variables.

4 Empirical analysis

The goal of this section is to examine the relationship between private health insurance and unmet medical needs, with the aim of determining whether increased utilization of private healthcare can produce a ”decongestion effect.” A rise in the proportion of individuals opting for private healthcare over public services should, in theory, free resources for those remaining within the public healthcare system, thereby reducing the incidence of UMN. To investigate this idea, our empirical strategy involves constructing a model that, in addition to focusing on our variable of interest— duplicate VHI coverage at country level—also incorporates other potential determinants of UMN. Specifically, beyond individual characteristics, we account for country-level factors such as out-of-pocket (OOP) expenditure, public healthcare spending per capita, complementary VHI coverage and healthcare supply variables, all of which are likely to influence access to healthcare and affect patterns of use or avoidance.

4.1 Data and descriptive statistics

In our empirical analysis, we use different data sources.
Information about individual characteristics come from the 2014 and 2019 waves of the European Health Interview Survey (EHIS).[16] Under the coordination of Eurostat, EHIS is a harmonised survey which provides comparable information on health status, healthcare use, health determinants, and socioeconomic background variables, targeting individuals who are at least 15 years old and and live in private households. The 2014 wave was conducted in all 28 Member States of the EU, as well as in Norway and Iceland while France and United Kingdom did not participate in the 2019 wave. Hence, the initial overall sample is composed by

[16] See EHIS (2013) for detailed information.

614,540 respondents.

OECD database is used for collecting data on healthcare systems' characteristics and healthcare expenditure variables (distinguished in "Public expenditure", "Prevention expenditure" and "OOP expenditure").

Data on VHI coverage have been retrieved combining information from the OECD database and Sagan and Thomson (2016) (see Appendix 2 for a description of the collecting procedure). Finally, data about countries' GDP come from the World Bank database.

In EHIS, access to healthcare is addressed through questions on perceived unmet needs for healthcare due to three main reasons such as financial burden, long waiting times or distance issues. The questions are phrased in the following way: "Was there any time in the past 12 months when you needed medical care, but could not afford it?", "Have you experienced delay in getting healthcare in the past 12 months because the time needed to obtain an appointment was too long?" and "Have you experienced delay in getting healthcare in the past 12 months due to distance or transport problems?". The options available to the interviewed are: "Yes", "No" or "Not in need of medical treatment".[17] Table 1 shows the incidence of UMN in the overall sample: long waiting times appear to be the primary factor inducing people to forgo the care they need (13.78% equal to 80,015 positive answers), followed by financial reasons (5.08% equal to 29,013 positive answers) while distance and transportation issues seem to have minor impact on foregoing medical treatments. Hence, we do not consider the latter variable, focusing only on the other two, hereinafter called *Unmet_cost* and *Unmet_waiting*. They represent our two outcome variables and are re-coded as binary with value 1 if the answer is "Yes" and 0 if they replied "No". Furthermore, building upon the aforementioned questions, we also create two additional variables, namely

[17] Most of the existing empirical works on unmet needs draw data on access to healthcare from another European database, the European Survey on Income and Living Conditions (EU-SILC) (see Cavalieri (2013); Chaupain-Guillot and Guillot (2015); Brezzi and Luongo (2016), Elstad (2016) and Fiorillo (2020)). Instead, we rely upon EHIS, following OECD report (2020) which compares these two surveys, highlighting strengths and weaknesses in the methodologies used by both.

	Yes(%)	No(%)	No need(%)
Due to costs	5.08	71	23.92
Due to waiting lists	13.78	62.21	24.01
Due to distance	2.90	72.55	24.55

Table 1: Main reasons for unmet medical needs (overall sample)

In_need_cost and *In _need_waiting*, shown in Table 2, which are assigned a value of 0 if the individuals reported no need for medical treatment, and a value of 1 if they experienced a medical need, regardless of whether that need was met or not. In this way, we are able to distinguish between those who reported to be in need and did not receive the examination they needed and those, instead, that did not require medical assistance. We create these two variables based on the two distinct questions.

	Yes(%)	No(%)
In need (cost analysis)	76.09	23.91
In need (waiting analysis)	75.99	24.01

Table 2: Condition of requiring medical care (overall sample)

4.2 Econometric methodology

Since UMN are observed only for people who reported a necessity for a medical examination/treatment, we refer to a well-established literature stating that individuals' health status is not-randomly determined but rather it is influenced by personal and contextual factors, leading to the existence of the so-called "social gradient in health", a phenomenon whereby people who are less advantaged in terms of socioeconomic position have worse health and shorter lives than those who are more advantaged.[18] Hence, to take into account this source of potential

[18] See Lindahl (2005); Litaker et al. (2005); Lleras-Muney (2005); Thorp et al. (2011); Marmot et al. (2013); Bonaccio et al. (2020).

selection bias, we investigate the probability of reporting unsatified medical needs by implementing the Heckman Bivariate Probit model which requires the estimation of a selection and outcome equations, assumed to be determined by common factors in observed and unobserved characteristics and hence to be dependent. A bivariate probit model assumes a normally distributed latent variable specification for both equations, specified as follows:

$$\left.\begin{aligned} In\_need_i &= 1(In\_need_i^* > 0) \\ In\_need_i^* &= \alpha x_i + \gamma z_i + \theta v_j + u_i \end{aligned}\right\} \text{Selection equation}$$

$$\left.\begin{aligned} Unmet_i &= 1(Unmet_i^* > 0) \\ Unmet_i^* &= \beta x_i + \delta h_j + \varepsilon_i \end{aligned}\right\} \text{Outcome equation}$$

$$\varepsilon_i, u_i \sim \mathscr{N}(0, \Sigma)$$

Here, $In\_need_i^*$ is an unobserved latent variable that determines the probability of being in need of medical treatment, and depends on a vector of observed individual characteristics x_i, on two vectors of additional individual and country variables, respectively z_i and v_j, influencing the likelihood of requiring medical assistance and on a random error u_i. Being in need of medical care In_need_i is either 0 or 1, depending on whether $In\_need_i^*$ is below or above zero.

$Unmet_i^*$ is an unobserved latent variable that determines the likelihood of a respondent to report UMN, and depends on the same vector x_i of observed individual characteristics considered in the selection equation, on a vector of observed country features h_j and on a random error ε_i. Unmet medical needs $Unmet_i$ is either 0 or 1, depending on whether $Unmet_i^*$ is below or above zero and it is observed only when $In\_need_i = 1$ i.e. when an individual is in need.

Vector x_i comprises gender, age, working status, household income quintile, education level and the existence of chronic diseases (as proxy of health status), individual factors that influence the probability of both requiring medical care and reporting unsatisfied medical needs.

Vector z_i incorporates lifestyle variables such as smoking habits, nutritional status, and physical activity. These factors, known to significantly affect individuals' health, inherently shape the likelihood of requiring medical assistance. We exclude alcohol consumption from our analysis due to its substantial prevalence of missing data.

Vector v_j comprises country-level attributes such as expenditure on preventive care and the density of generalist practitioners (GPs). This choice is motivated by the assumption that nations, characterized by greater investment in preventive care and a larger number of GPs, are likely to demonstrate a higher prevalence of healthy citizens who seek less often medical care. We also control for GDP per capita which can have a twofold impact. Indeed, richer countries may display a greater need of medical assistance because healthcare can be considered a normal good, so, as per-capita income increases, the demand for healthcare increases as well; besides, these countries are characterized by aging populations which are more likely to develop age-related health issues that require higher medical intervention. Nevertheless, wealthier countries may exhibit better living conditions and greater financial stability which can translate into overall better physical and mental health, reducing the likelihood of illnesses.

Vector h_j collects country-level attributes that influence the likelihood of reporting UMN. In particular, the density of specialist practitioners captures the supply side of the healthcare system. Public healthcare expenditure per capita and OOP expenditure are indicators of the composition of healthcare financing. Indeed, a higher share of OOP is expected to be correlated with higher incidence of unmet needs due to costs because individuals may experience a greater financial fragility, having to pay for healthcare, and this may result into not being able to afford necessary assistance. Conversely, when the government's investments in the public healthcare sector increase (as measured by the public healthcare expenditure per-capita), individuals are expected to report UMN less frequently since they can access necessary healthcare services without facing OOP costs. Duplicate and complementary coverage are indicators of the extension of healthcare insurance market. We consider both types because they provide different services and hence they may have a different impact on on UMN. While duplicate VHI offers coverage for health services already included under government health insurance but from different providers (e.g., private hospitals) or at different levels of service (e.g., faster access to care), complementary VHI complements coverage of government/compulsory insured services by covering all or part of the residual costs not otherwise reimbursed (e.g., cost-sharing, co-payments). Finally, only in the analysis of UMN due to waiting times, we also control for the waiting times to get specific treatments through the accessibility score from the European Consumer

Health Index to capture inefficiencies of the healthcare system.[19]

Table 3 provides a detailed description of these variables and also indicates in which equation they are considered.[20]

We begin by estimating the direct effect of these covariates on the dependent variables, with particular emphasis on duplicate coverage. Then, to assess the validity of the decongestion argument, we examine whether the impact of duplicate VHI coverage differs across income levels. Specifically, if the decongestion effect is operative, we would expect that, as higher-income individuals increase their uptake of private health insurance, the strain on the public healthcare system is reduced, thereby freeing up resources and improving access and quality of healthcare for lower-income individuals. This latter group is presumed to be uninsured, lacking the financial capacity to purchase private coverage, and thus to be reliant on public healthcare services. Finally, to evaluate the overall impact of the private healthcare sector, we also analyze the effects of complementary coverage and OOP expenditure across income groups.

At this stage, it is important to note that, although at the individual level experiencing unsatisfied needs could lead to a higher VHI take-up, our estimation procedure is not affected by this reverse causality issue because the dependent variables are at individual level whereas VHI coverage expresses the aggregate share of population with an insurance scheme in a specific country.

In all the analyses, we exclude Ireland (17944 observations) to prevent potential distortion of results, as it exhibits outlier behaviour in the duplicate coverage and the incidence of UMN, with exceptionally high values in both aspects. Disregarding observations with missing values in any of the variables considered, our final sample is composed by 464278 observations in 25 countries and 471076 observa-

[19]This weighted score refers to 6 macro-areas: Patient Rights and Information, Access to Care, Treatment Outcomes, Range and Reach of Services, Prevention and use of Pharmaceuticals. To the purpose of this study, we focus only on Access to Care score to control for waiting times. It is based on the following questions: "Can patients count on seeing a primary care doctor today?", "Can patients see a specialist without first having to gain a referral from a primary-care doctor?", "Is the time to get radiation/chemotherapy after decision to treat below 21 days?", "Is the time to get major elective surgery below 90 days?", "Is the time to get a CT scan below 7 days?" and "Is the time to get first appointment in Paediatric Psychiatry below 30 days?" (see https://healthpowerhouse.com/ for more details). To ensure that it is bounded between 0 and 1, we re-scale this indicator dividing it by 225, the maximum theoretical weighted score attainable in this macro-area.

[20]The values of country-level regressors are referred to years 2014 and 2019, in order to be consistent with the two waves of EHIS.

tions in 26 countries respectively in *Unmet_cost* and *Unmet_waiting* analyses.[21] We compute standard errors clustered at country level and we check if multicollinearity is an issue with our data, being some country-level variables highly correlated among each other (cfr. Table A1 and Table A2 in Appendix 2). For each equation, we calculate the adjusted generalized standard error inflation factor (aGSIF) coefficients (cfr. Table A3 and Table A4 in Appendix 2).[22] All coefficients are below the critical cut-off; therefore we conclude that multicollinearity does not affect the reliability of our results.

Table 3: Explanatory variable descriptions [i=individual, j=country]

	Variable	**Description**	**Equation**
x_i	Sex_i	Binary; 0 if male, 1 if female.	BOTH
	Age_i	Binary; 0 if <65 years, 1 otherwise.	BOTH
	$\text{Education}_\text{i}$	Categorical; level of education achieved.	BOTH
	Income_i	Categorical; household income quintile.	BOTH
	$\text{Work\_status}_\text{i}$[23]	Categorical; occupational status.	BOTH
	$\text{Chronic\_diseases}_\text{i}$	Binary; 0 if no existence of long-standing illnesses, 1 otherwise.	BOTH
z_i	Smoking_i	Binary; 0 if never smoked, 1 if current/former smoker.	SELECTION
	BMI_i[24]	Categorical; nutritional status.	SELECTION
	$\text{Physically\_active}_\text{i}$[25]	Binary; 1 if sufficiently physically active in general, 0 otherwise.	SELECTION

Continued on next page

[21]The difference in the number of countries is due to the fact that Belgium has missing values for all observations in the question regarding unmet needs due to costs and is therefore excluded from this analysis.

[22]Fox and Monette (1992) recommend using the aGSIF because, for categorical predictors with more than two levels, it adjusts for the number of levels allowing comparability with the other predictors. Critical threshold for the aGSIF is $\sqrt{10}$ (3.2).

[23]This variable has 5 categories: Employed, Unemployed, Student, Retired and Other. The latter includes: permanently disabled individuals, those in compulsory military or community service, people fulfilling domestic tasks and any other inactive person.

[24]In EHIS there are questions about the height and weight of the respondent. So, we compute the Body Mass Index (weight(kg)/height(m^2)) and, following the WHO definitions, we classify the nutritional status of each individual.

[25]To construct this variable, we follow Finger et al. (2015) who calculate different indicators of physical activity based on the EHIS questionnaire.

Table 3 – Continued from previous page

	Variable	Description	Equation
v_j	GDP_percapita$_j$	Continuous; GDP per capita (PPP), log-transformed.	SELECTION
	Prevention_exp$_j$	Continuous; preventive care expenditure as share of current health expenditure.	SELECTION
	Generalist_doctors$_j$	Continuous; density of generalist medical practitioners per 1000 inhabitants.	SELECTION
h_j	Specialist_doctors$_j$	Continuous; density of specialist medical practitioners per 1000 inhabitants.	OUTCOME
	Public_health_exp$_j$	Continuous; public healthcare expenditure per capita (PPP), log-transformed.	OUTCOME
	OOP_exp$_j$	Continuous; out-of-pocket expenditure as share of current health expenditure.	OUTCOME
	Duplicate_cov$_j$	Continuous; percentage of population covered by duplicate health insurance schemes.	OUTCOME
	Complement_cov$_j$	Continuous; percentage of population covered by complementary health insurance schemes.	OUTCOME
	Accessibility_score$_j$	Continuous; indicator of accessibility of healthcare system (**only in waiting-time analysis**).	OUTCOME

5 Estimation Results

In the following, we discuss the estimation results distinguishing for the type of equation (selection or outcome) and type of variable (individual or country-level). Table 4 presents the coefficient signs from the two-stage Heckman model for the two dependent variables.

Selection equations

Individual variables. The likelihood of requiring medical assistance is higher among females, individuals over 65, retirees, and those with chronic health conditions in both selection equations. These findings align with the existing literature, as these groups are generally more susceptible to health problems. Women are more frequent users of healthcare services due to a combination of biological factors and a greater tendency to seek medical care. Older adults and retirees often experience age-related health issues, making medical assistance indispensable. Additionally, individuals with long-term health conditions naturally require continuous medical care to manage their illnesses. Higher levels of education are associated, though not significantly (with the exception of tertiary education in the waiting time analysis), with a greater probability of needing medical treatment. This result may reflect a heightened awareness among individuals with higher educational attainment, who may be more knowledgeable about health issues, symptoms, and the importance of prevention, leading them to seek medical care more frequently. A similar rationale can be applied to income: in the cost analysis, wealthier individuals may undergo more medical examinations because they have the financial means to engage in routine check-ups and screenings, as well as access to basic and specialized healthcare services. Obesity, a well-known risk factor for various cardiovascular and pulmonary comorbidities, plays a significant role in increasing the likelihood of seeking medical care in both analyses, as does a sedentary lifestyle. Besides, interestingly, smoking appears to reduce the need for healthcare, which may seem counterintuitive given its association with poorer health outcomes. However, in our sample, the majority of smokers are young (87% are under 65), and thus may not yet be experiencing the full range of adverse health effects from smoking.

Country level variables. Regarding the country-level variables, in the selection equation of the cost analysis, the probability of requiring medical assistance decreases in countries with a higher density of general practitioners. This result can be explained by their key role in preventive care and early diagnosis which contributes to avoid more severe conditions from developing thus reducing the demand for emergency care and hospitalization. Similarly, the negative (though not statistically significant) coefficient for preventive care expenditure is consistent with its primary objective: allocating a greater share of current health expenditure to preventive measures reduces the likelihood of needing medical care. Finally, GDP per capita does not significantly influence the probability of requiring additional medical assistance, a finding that can be explained by the arguments outlined in Section 4. In the waiting analysis, differently, none of the country-level variables is statistically significant.

Outcome equations

The predicted probabilities of reporting unmet medical needs due to costs or waiting times are presented in Table 5.

Individual variables. Females encounter greater barriers to accessing medical care compared to males, with differences of 1.2 and 3 percentage points (p.p.), respectively, in terms of financial and time-related constraints. Individuals aged 65 and older have a lower probability of reporting UMN due to costs (-1.6 p.p.) and waiting times (-2.6 p.p.) compared to those under 65. This may be explained by better access to healthcare for the elderly, possibly due to prioritized services or age-based exemptions. Higher levels of education are associated with a reduced likelihood of reporting unmet medical needs due to costs. For example, individuals with tertiary education have a lower probability of experiencing UMN due to financial constraints compared to those with only primary education (-2.1 p.p). In contrast, education does not significantly influence the probability of UMN related to waiting times, suggesting that higher educational attainment does not help individuals overcome time-related barriers to healthcare. Being unemployed increases the probability of reporting UMN due to costs (by 2.8 p.p.) compared to employed individuals, underscoring the financial vulnerability of those without employment. However, unemployment does not have a significant effect on UMN related to waiting times. Students have a lower probability of reporting UMN due to costs (-1.8 p.p.), while retirees face a lower probability of UMN related to waiting times (-2.6 p.p.), likely reflecting prioritized access within public health systems for the elderly. As expected, chronic illnesses significantly increase the likelihood of experiencing UMN, both in terms of costs (+4.1 p.p.) and waiting times (+10.4 p.p.). This can be explained by the fact that long-term health conditions necessitate more frequent and expensive medical care. Lower-income individuals, particularly those in the bottom income quintile, are more likely to experience UMN due to costs (+4.6 p.p.) and, to a lesser extent, due to waiting times (+1.3 p.p.) compared to median-income individuals. In contrast, higher-income individuals have significantly lower probabilities of facing UMN, underscoring the protective effect of income against both financial and time-related barriers to healthcare access.

Country level variables. Contrary to expectations, the availability of specialist physicians does not appear to significantly influence the likelihood of experiencing UMN for either of the analysed reasons (cost or waiting times). Conversely, an increase in public healthcare expenditure per capita reduces the probability of experiencing UMN related to both cost and waiting times, suggesting that greater public investment in healthcare improves access to services. However, this effect is statistically significant only in the cost analysis (-3.4 p.p). OOP payments are positively and significantly correlated with UMN due to cost, but exhibit no significant correlation with UMN arising from waiting times. This finding is consistent with ~~theoretical expectations. In the healthcare~~ the existing literature where OOP payments are widely regarded as an indicator of the fragility of the public healthcare system, reflecting its inability to protect individuals from unexpected health events and the financial burdens they impose.[26]

Turning to our primary variable of interest, VHI coverage, we find that the expansion of duplicate VHI coverage is positively and significantly associated with UMN related to waiting times, while it does not exhibit statistical significance in relation to UMN due to costs. This differential impact can be explained noting

[26]Notably, although at country-level OOP payments correlate with disparities (e.g. Di Gioacchino et al. (2024)), we unexpectedly observe that at the individual level the income gradient is not statistically significant— a finding consistent with previous studies (see Chaupain-Guillot and Guillot (2015) for similar evidence).

that duplicate VHI coverage is specifically intended to address shortcomings in publicly provided healthcare services, while UMN arising from cost-related issues generally concern services outside the public healthcare package.

The interpretation of the positive coefficient for duplicate VHI coverage in the waiting-time analysis is complex. Given the quality of publicly provided healthcare services, one might expect that duplicate VHI coverage would reduce UMN due to waiting times, particularly among wealthier individuals who are more likely to hold private insurance. Furthermore, if the decongestion effect hypothesis were valid, even lower-income individuals (those without private insurance) should benefit from reduced waiting times as public healthcare services become less congested. Contrary to these expectations, our findings indicate that, on average, the expansion of duplicate coverage is associated with an increase in UMN.[27]

This positive association can be explained by two key factors. First, the literature on VHI uptake suggests that perceived deficiencies in public healthcare drive the expansion of VHI coverage, indicating a context of increasing inadequacies in public services (see, e.g., (Costa-Font and Font-Vilalta (2004)).[28] Second, our model suggests that the expansion of VHI coverage itself may lead to a deterioration in the quality of public services due to factors such as fiscal incentives to private expenditure and decreasing political support for public healthcare. While we cannot distinguish between these two explanations for the positive sign of the coefficient, our primary objective is to test the decongestion effect argument, particularly regarding the effect of duplicate VHI expansion on lower-income in-

[27] Chaupain-Guillot and Guillot (2015) find that higher VHI coverage reduces the probability of UMN. While their result contrasts with ours, there are important differences to consider. Firstly, they do not distinguish between the different types of VHI, which, as previously mentioned, can have distinct impacts on UMN. Additionally, their dependent variable is represented by overall unmet needs, without accounting for the specific underlying causes. Finally, for individual data they rely on the 2009 wave of the EU-SILC survey, which presents significant methodological differences compared to the EHIS.

[28] Although our regression analysis on UMN due to waiting times includes controls for public healthcare expenditure and an accessibility indicator to capture potential inefficiencies in the public system, these controls are not statistically significant, even though the public expenditure coefficient has the expected sign. Therefore, we cannot rule out the possibility that the increase in VHI coverage reflects inadequacies in the public system that, on average, exacerbate unmet needs.

dividuals. To this end, we introduce an interaction term between income quintiles and duplicate VHI coverage. If the decongestion effect hypothesis were valid, we would expect the expansion of VHI coverage to reduce the marginal effect of income on UMN for individuals in the lower income quintiles.

The results, presented in Table 6, show that the coefficient of the interaction term is negative and significant for the highest income quintiles, but positive and significant for the lowest one. This indicates that, as VHI coverage expands, the impact of income on UMN becomes more pronounced: as VHI coverage grows, the likelihood of experiencing UMN marginally decreases for wealthier individuals while marginally increases for the poorer ones. To sum up, our findings suggest that the expansion of duplicate VHI coverage exacerbates disparities between lower- and higher-income individuals rather than mitigating them, as illustrated in Figure 1. This evidence contradicts the decongestion effect argument.

Regarding complementary VHI, our findings indicate that this type of coverage does not significantly affect UMN related to waiting times, which aligns with expectations. Complementary VHI primarily covers services and expenses that are not included in the public healthcare system, and thus it should not have direct impact on UMN for publicly funded services. However, it should be negatively related to UMN due to costs. Conversely, our results reveal that an increase in complementary VHI coverage actually raises the likelihood of experiencing unmet needs due to costs. This counterintuitive result may suggest that the expansion of such coverage signals growing gaps in the basic public healthcare coverage or package.

To investigate the differential impact of complementary VHI expansion across income groups, we incorporate interaction terms between this variable and income quintiles into our regression analysis. In this case, we do not expect a decongestion effect, as complementary VHI is not intended to provide substitutive services. However, we would expect a negative and significant sign of the interaction term for higher income quintiles, given that VHI uptake is more common among wealthier individuals. Contrarily, the results show that none of the interaction terms across income quintiles are statistically significant. This lack of significance may be attributed to the structure of complementary VHI markets in countries such as France, Croatia, and Slovenia, which are the largest markets for complementary VHI in our sample. In these countries, this type of insurance predominantly covers user charges and is accessible to a broad segment of the population, including lower-income individuals, also due to government policies aimed at promoting inclusivity (Sagan and Thomson (2016)).

6 Concluding remarks

The ”decongestion effect” argument (Besley and Coate (1991)) suggests that the expansion of the private healthcare sector can reduce pressure on the public healthcare system, thereby improving both access and quality of care for public sector patients. This conclusion, however, is contingent upon several strong assumptions. First, it assumes that individuals who leave the public system continue to fully contribute to public tax revenues. In practice, the growth of the private healthcare sector in many countries has been incentivized by fiscal benefits, such as tax deductions for private insurance premiums or out-of-pocket medical expenses. As a result, for a given level of taxation, increased private healthcare spending could reduce the overall public healthcare budget. Second, the argument presumes that political support for publicly funded healthcare remains unchanged, even as more individuals opt for private services. Finally, it rests on the assumption that the expansion of the private sector has no significant impact on the capacity and costs of the public healthcare system.

In our model, we account for both the fiscal incentives that drive private healthcare expenditure and the potential decline in political support for public healthcare, as the proportion of the population using private services grows. Our findings reveal that,in a mixed public-private equilibrium, the decongestion effect is insufficient to offset the reduction in public healthcare funding caused by fiscal benefits for private expenditures and diminished tax contributions. Consequently, as a larger share of the population exits the public system, the quality of public healthcare declines.

To empirically test our theoretical predictions, we use self-reported unmet medical needs as a proxy for the quality of public healthcare. We explore the relationship between this variable and duplicate voluntary health insurance coverage, controlling for individual and country characteristics, in a sample of 26 European countries. Contrary to the decongestion effect argument, our results indicate that as private insurance coverage expands, income disparities in unmet medical needs widen: wealthier individuals benefit more, while poorer individuals face increased unmet needs.

In conclusion, our empirical findings align with theoretical predictions, suggesting that the expansion of duplicate private insurance coverage exacerbates inequalities rather than alleviating pressure on public healthcare. This casts doubts about the effectiveness of using fiscal incentives to promote private insurance as a means to improve public services.

	In need_cost	In need_waiting		Unmet_cost	Unmet_waiting
Sex (ref: Male)			Sex (ref:Male)		
Female	$+^{***}$	$+^{***}$	Female	$+^{***}$	$+^{***}$
Age (ref: Under 65)			Age (ref: Under 65)		
Over 65	$+^{*}$	$+$	Over 65	$-^{**}$	$-^{**}$
Education level (ref: Primary)			Education level (ref: Primary)		
Secondary and post-secondary	$+$	$+$	Secondary and post-secondary	$-^{**}$	$-$
Tertiary	$+$	$+^{**}$	Tertiary	$-^{***}$	$+$
Job status (ref: Employed)			Job status (ref: Employed)		
Unemployed	$-^{*}$	$-^{**}$	Unemployed	$+^{***}$	$-$
Student	$-^{***}$	$-^{***}$	Student	$-^{***}$	$-^{*}$
Retired	$+^{***}$	$+^{***}$	Retired	$-$	$-$
Other	$+$	$+$	Other	$+^{***}$	$+$
Household income (ref: Betw 2nd and 3rd)			Household income (ref: Betw 2nd and 3rd)		
Below 1st	$+$	$-$	Below 1st	$+^{***}$	$+^{**}$
Betw 1st and 2nd	$+$	$+$	Betw 1st and 2nd	$+^{***}$	$+^{**}$
Betw 3rd and 4th	$+$	$+$	Betw 3rd and 4th	$-^{***}$	$-^{***}$
Betw 4th and 5th	$+^{***}$	$+$	Betw 4th and 5th	$-^{***}$	$-^{***}$
Chronic diseases (ref: No)			Chronic diseases (ref: No)		
Yes	$+^{***}$	$+^{***}$	Yes	$+^{***}$	$+^{***}$
Smoking (ref: No)			Specialist_ doctors	$+$	$+$
Yes	$-^{**}$	$-^{**}$	Public_exp per capita	$-^{***}$	$-$
BMI (ref: Normal weight)			OOP_exp	$+^{**}$	$-$
Underweight	$+$	$+$	**Duplicate_cov**	$+$	$+^{***}$
Overweight	$+^{***}$	$+^{***}$	Complementary_cov	$+^{*}$	$+$
Obesity	$+^{***}$	$+^{***}$	Accessibility_score	/	$+$
Physically active (ref: Yes)			**athrho**	$+^{***}$	$+^{*}$
No	$+$	$+$	N° of obs	464278	471076
GDP_percapita	$+$	$+$	N° of obs select	350582	358912
Prevention_exp	$-$	$-$	N° of obs non select	113696	112164
Generalist_doctors	$-^{**}$	$+$	N° of clusters	25	26
			Wald test of indep. eqns.(rho = 0)	***	***

Table 4: Estimated coefficients of Heckman selection models

	Unmet_cost	Unmet_waiting
Sex (ref: Male)		
Female	.012***	.030***
	(.002)	(.003)
Age (ref: Under 65)		
Over 65	−.016**	−.026***
	(.004)	(.01)
Education level (ref: Primary)		
Secondary and post-secondary	−.010**	−.01
	(.006)	(.014)
Tertiary	−.021***	−.001
	(.007)	(.019)
Job status (ref: Employed)		
Unemployed	.028***	.01
	(.006)	(.011)
Student	−.018***	−.011
	(.005)	(.011)
Retired	−.005	−.026***
	(.004)	(.009)
Other	.018***	.001
	(.004)	(.01)
Chronic diseases (ref: No)		
Yes	.041***	.104***
	(.006)	(.014)
Household income (ref: Betw 2nd and 3rd)		
Below 1st	.046***	.013**
	(.006)	(.005)
Betw 1st and 2nd	.015***	.006**
	(.003)	(.003)
Betw 3rd and 4th	−.015***	−.008***
	(.002)	(.002)
Betw 4th and 5th	−.026***	−.020***
	(.003)	(.005)
Specialist_doctors	.001	.020
	(.0001)	(.023)
Public_exp per capita	−.034***	−.015
	(.009)	(.055)
OOP_exp	.002**	−.001
	(.001)	(.004)
Duplicate_cov	.001	.005***
	(.001)	(.002)
Complementary_cov	.001**	.001
	(.0001)	(.001)
Accessibility_score	/	.013
		(.10)
N° of obs	464278	471076
N° of clusters	25	26

Table 5: Estimated predicted probabilities of unmet medical needs

	Unmet_waiting
Duplicate coverage	$+^{***}$
Income#Duplicate cov.	
Below 1st	$+$
Between 1st and 2nd	$+^{*}$
Between 3rd and 4th	$-^{**}$
Between 4th and 5th	$-^{***}$

Table 6: Differentiated impact of duplicate coverage on income levels

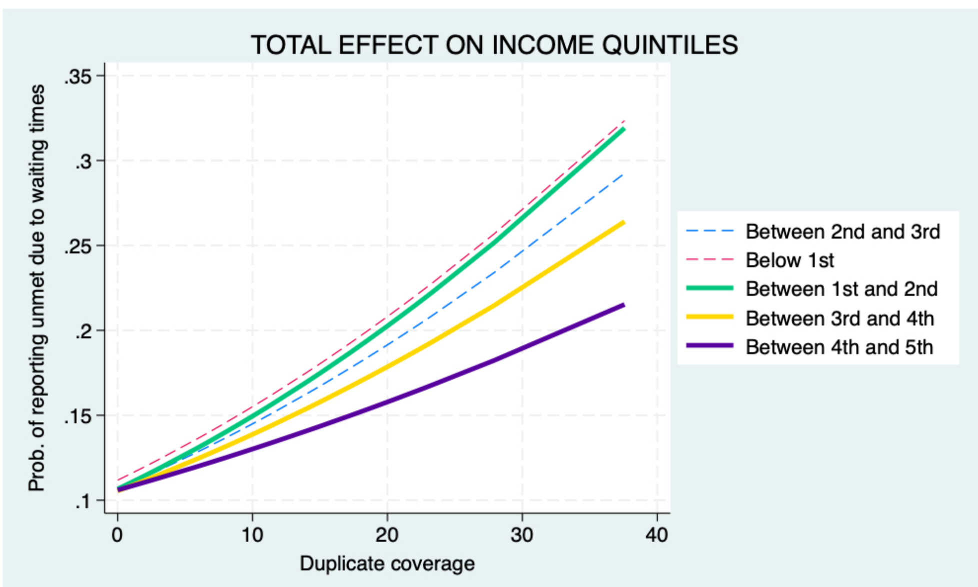

Figure 1: Overall effect of duplicate coverage on income quintiles

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APPENDIX 1

Proof of Proposition 1

Our aim is to find an equilibrium such that expected and realised public healthcare spending are equal. Accordingly, we will proceed considering expected and realised public healthcare spending as function of Ω.

By substituting (14) into (10) and using (12), we define a continuous function $\Delta(\Omega)$, mapping the share of population using publicly provided healthcare into realised public healthcare spending:

$$\Delta(\Omega) = \begin{cases} \frac{\gamma}{1+\gamma p\Omega}\left[1 - \frac{\gamma p}{1+\gamma p}\left((1-\Omega)(1+\delta\Omega)\right)\right] & \text{if } 0 < \Omega < 1 \\ \frac{\gamma}{1+\gamma p} & \text{if } \Omega = 0 \text{ or } \Omega = 1 \end{cases} \tag{16}$$

By computing the first derivative when $0 < \Omega < 1$, it is possible to see that $\Delta(\Omega)$ has a minimum $\Omega_{min} = \frac{\sqrt{1+\gamma p}-1}{\gamma p} \in (0, \frac{1}{2})$.

Using equation (8), we can write expected public healthcare as a function of Ω. Expected public healthcare spending is given by:

$$h_g^e = \begin{cases} \leq \frac{1-\delta}{\chi} & \text{if } \Omega = 0 \\ \frac{2\delta\Omega+1-\delta}{\chi} & \text{if } 0 < \Omega < 1 \\ \geq \frac{1+\delta}{\chi} & \text{if } \Omega = 1 \end{cases} \tag{17}$$

An equilibrium must be such that expectations are fulfilled, which requires (16)=(17). For $0 < \Omega \leq 1$ this gives a second order equation in Ω: [29]

$$a\Omega^2 + b\Omega + c = 0 \tag{18}$$

with

$$a = \gamma p\delta\left((1+\gamma p)^{\frac{1}{\gamma p}} - 2\right)$$

[29] For $\Omega = 0$ to be an equilibrium, it would require $\frac{\gamma}{1+\gamma p} \leq \frac{1-\delta}{\chi}$ which is impossible.

$$b = (1-\delta)\gamma p\left((1+\gamma p)^{\frac{1}{\gamma p}} - 1\right) - 2\delta$$

$$c = (1+\gamma p)^{\frac{1}{\gamma p}} - (1-\delta) > 0$$

If $a < 0$, namely if $\gamma p > 1$ then (18) has two real solutions: $\Omega_1 > 0$ and $\Omega_2 < 0$. We only consider the positive solution. We can have two cases:

i) if for $\Omega = 1$, $\Delta(\Omega = 1) = \frac{\gamma}{1+\gamma p} > \frac{1+\delta}{\chi}$, namely if $\delta < (1+\gamma p)^{\frac{1}{\gamma p}} - 1$, then $\Omega_1 > 1$. If it is was not the case, we should have two positive solutions in $0 < \Omega < 1$. This is not possible because if $a < 0$ the solutions have opposite sign.[30] It follows that (16) intersects (17) when $\Omega = 1$, and the political equilibrium is the fully public equilibrium: $\Omega^* = 1$, and $h_g^e = h_g^* = \frac{\gamma}{1+\gamma p}$ (see Fig. 2a);

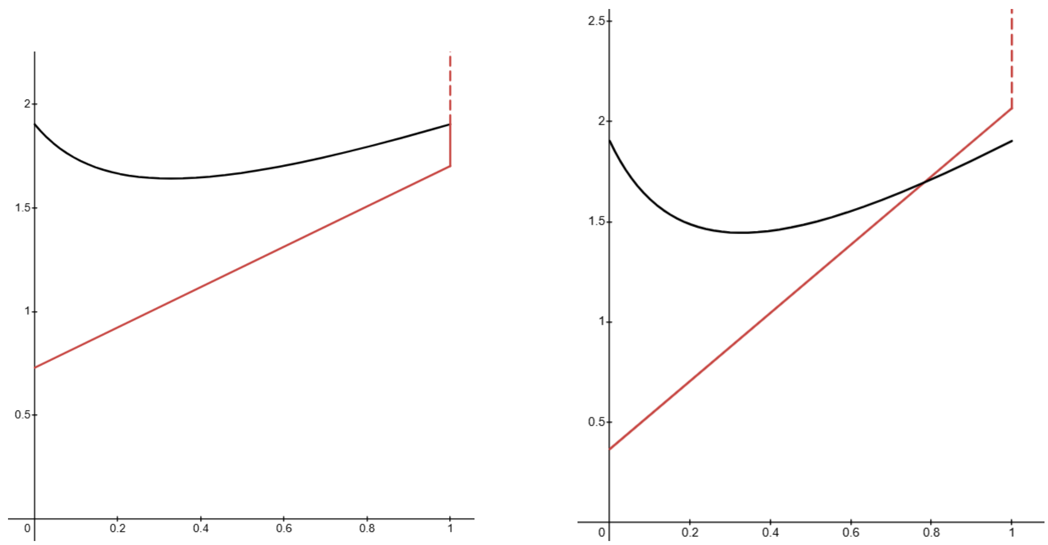
ii) if for $\Omega = 1$, $\Delta(\Omega = 1) = \frac{\gamma}{1+\gamma p} < \frac{1+\delta}{\chi}$, namely if $\delta > (1+\gamma p)^{\frac{1}{\gamma p}} - 1$ then $\Omega_1 < 1$ and the political equilibrium exhibits a public/private mix, i.e. $\Omega^* = \Omega_1 < 1$, with $h_g^e = h_g^* < \frac{\gamma}{1+\gamma p}$ (see Fig. 2b). Moreover, since $\Omega_1 = \frac{-b-\sqrt{b^2-4ac}}{2a}$, substituting for a, b and c their expressions, it is easy to verify that $\gamma p\left(1-(1+\gamma p)^{\frac{1}{\gamma p}}\right) < 4$ is a sufficient condition for $\Omega_1 > \frac{1}{2}$. Note that since $\Omega_{min} \in (0, \frac{1}{2})$, if $\Omega^* > \frac{1}{2}$, it falls in the region where $\frac{d\Delta}{d\Omega} > 0$.

If $a > 0$, namely if $\gamma p < 1$ then (18) either does not have real solutions (if $b^2 - 4ac < 0$) or it has two real solutions (Ω_1 and Ω_2) either both positive or both negative. If there are no real solutions or both are negative, (16) intersects (17) when $\Omega = 1$, and the political equilibrium is fully public, i.e. $\Omega^* = 1$, and $h_g^e = h_g^* = \frac{\gamma}{1+\gamma p}$. If there are two positive solutions, it is possible to show that the smallest positive solution is always bigger than one.[31] Again equation (16) intersects (17)

[30] Specifically, (16) would intersect (17) twice in $0 < \Omega < 1$.

[31] To see that this is the case, let $\Omega_1 = \frac{-b-\sqrt{b^2-4ac}}{2a}$ and substituting for a, b and c their expressions, it is easy to verify that $\Omega_1 > 1$.

when $\Omega = 1$, and the political equilibrium is the fully public equilibrium.



(a) Fully public
($\gamma = 8; p = 0.4; \delta = 0.4$)

(b) Public-private mix
($\gamma = 8; p = 0.4; \delta = 0.7$)

Figure 2: Political equilibrium

Proof of Proposition 2

To compute $\frac{dh_g^*}{d\delta}$, define the following implicit function of h_g: [32]

$$H(\Omega(h_g, \delta), \delta) = \Delta(\Omega(h_g, \delta), \delta) - h_g = 0 \tag{19}$$

From the implicit function theorem,

$$\frac{dh_g^*}{d\delta} = -\frac{\frac{\partial H(\Omega(h_g,\delta),\delta)}{\partial \delta}}{\frac{\partial H(\Omega(h_g,\delta),\delta)}{\partial h_g}} = -\frac{\frac{\partial \Delta}{\partial \Omega}\frac{\partial \Omega}{\partial \delta} + \frac{\partial \Delta}{\partial \delta}}{\frac{\partial \Delta}{\partial \Omega}\frac{\partial \Omega}{\partial h_g} - 1} \tag{20}$$

[32] The implicit function in (19) is the same as the function in equation (18), but in (19) we do not substitute the expression for $\Delta(\cdot)$ given by (16). The use of the implicit function theorem is advantageous because it enables the determination of the sign of $\frac{dh_g^*}{d\delta}$ without requiring the explicit computation of the derivative.

The numerator is negative. In fact, $\frac{\partial\Delta}{\partial\Omega} > 0$, because the equilibrium level of Ω falls in the increasing part of Δ, as we assumed $\Omega > \frac{1}{2}$, and for the same reason $\frac{\partial\Omega}{\partial\delta} < 0$; in addition, it is easy to show that $\frac{\partial\Delta}{\partial\delta} = -\frac{\gamma^2 p\Omega(1-\Omega)}{(1+\gamma p)(1+\gamma p\Omega)} < 0$.
The denominator is also negative because $\frac{\partial\Delta}{\partial\Omega}\frac{\partial\Omega}{\partial h_g} < 1$. In fact, $\frac{\partial\Delta}{\partial\Omega} > 0$, because the equilibrium level of Ω falls in the increasing part of Δ; $\frac{\partial\Omega}{\partial h_g} = \frac{\chi}{2\delta} > 0$; and $\frac{\partial\Delta}{\partial\Omega} < \frac{2\delta}{\chi}$, because the slope of the mapping (see (16)) is positive but lower than the slope of the line representing the expected public healthcare spending (see (17)). If this were not the case, equation (18) would yield two positive solutions, which we have ruled out in the context of the public/private mix equilibrium (see the proof of Proposition 1.
It follows that for $\Omega^* > \frac{1}{2}$, $\frac{dh^*}{d\delta} < 0$.

APPENDIX 2

Voluntary health insurance coverage data

In collecting data on VHI coverage, a major challenge is the absence of a standardized definition for various types of health insurance. Firstly, we consider all the 2014 and 2019 available data from the OECD's database, following its distinction between *duplicate* and *complementary VHI*.[33] Then, we use Sagan and Thomson (2016) as an auxiliary source to gather 2014 data for those countries for which information on the OECD database is missing. Finally, missing data for 2019 are reconstructed as the ratio of the variation in VHI expenditure between 2019 and 2014, multiplied by the VHI coverage of 2014. Figure 3 shows VHI coverage, distinguished by type, for European countries in 2014.

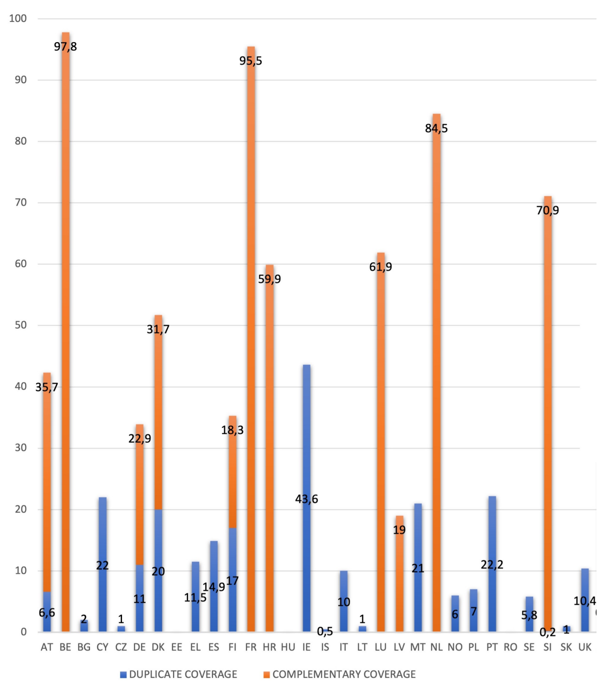


Figure 3: Duplicate and complementary coverage in EU countries in 2014

[33] See OECD Health Statistics 2023 (www.oecd.org/health/health-data.htm).

Multicollinearity analysis

Table A1: Correlation matrix of continuous regressors (Selection equation)

	GDP_percapita	Prevention_exp	Generalist_doct.
GDP_percapita	1.000		
Prevention_exp	0.254	1.000	
Generalist_doct.	0.225	−0.186	1.000

Table A2: Correlation matrix of continuous regressors (Outcome equation)

	Public_exp	OOP_exp	Spec_doct.	Duplic_cov	Comp_cov	Access_scor
Public_exp	1.000					
OOP_exp	-0.686	1.000				
Spec_doct.	-0.054	0.330	1.000			
Duplic_cov	0.140	0.206	0.213	1.000		
Comp_cov	0.375	-0.470	-0.323	-0.422	1.000	
Access_scor	0.358	0.368	0.092	-0.127	0.508	1.000

Table A3: VIF coefficients (cost analysis)

(a) Selection equation

Variable	aGSIF
Sex	1.049
Job status	1.174
Education	1.091
Age	1.693
Income	1.025
Chronic_diseases	1.071
Smoking	1.035
BMI	1.022
Physically active	1.027
GDP percapita	1.123
Prevention exp	1.114
Generalist doctors	1.093

(b) Outcome equation

Variable	aGSIF
Sex	1.019
Job status	1.150
Education	1.122
Age	1.603
Income	1.025
Chronic_diseases	1.066
Specialist doctors	1.114
Public healthexp.	1.762
OOP exp.	1.700
Duplicate cov.	1.360
Complement. cov.	1.225

Table A4: VIF coefficients (waiting analysis)

(a) Selection equation

Variable	aGSIF
Sex	1.049
Job status	1.174
Education	1.082
Age	1.692
Income	1.025
Chronic_diseases	1.060
Smoking	1.035
BMI	1.022
Physically active	1.025
GDP percapita	1.106
Prevention exp.	1.081
Generalist doctors	1.073

(b) Outcome equation

Variable	aGSIF
Sex	1.016
Job status	1.161
Education	1.119
Age	1.662
Income	1.027
Chronic_diseases	1.067
Specialist doctors	1.123
Public healthexp.	1.808
OOP exp.	1.832
Duplicate cov.	1.298
Complement cov.	1.401
Access_score	1.277