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Abstract

The effects of foreign aid on a decentralised health system are analysed in a theoretical framework where the donor has imperfect information about the local health needs while the central and local governments do not engage in self-interested efforts upon receiving aid. I discuss the implications of conditionality of aid on local health expenditures, intergovernmental transfers and social welfare. I then examine these consequences in a health system with two levels of care when the donor restricts aid on Primary Health Care.

JEL classification: F35, H42, H75, I10, I15, I18, O19.

Keywords: Conditionality, Decentralisation, Fiscal transfer, Foreign aid, Fungibility

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1 Introduction

The debate over foreign aid as an instrument to promote economic growth is controversial. Whilst the foreign aid sector has become larger and more institutionalised, empirical studies have failed to consistently identify a positive effect of aid on growth (Boone, 1994; Burnside and Dollar, 2000). On the other hand, foreign aid to the health sector (also known as Development Assistance for Health, DAH) has been shown to have substantial effects on health outcomes (Mishra and Newhouse, 2009, Wilson, 2011) but which remain below the expected health improvements set by the Millennium Development Goals.

In the related literature, the causes of aid ineffectiveness have been mostly attributed to the recipient's behavioural response. Whether under the form of poor quality of institutions and governance, lack of political accountability, rent-seeking behaviour or interest group pressures, the failure of foreign aid is often ascribed to the recipient's unreliability to tackle development issues as intended by the donor (Svensson, 2000a; Svensson, 2000b; Burnside and Dollar, 2004). To address this moral hazard problem, the common solution consists of introducing incentives to the recipient to commit to the intended objectives (Azam and Laffont, 2003). Attempts to reform aid delivery have incorporated these recommendations by shifting from stand-alone projects to conditionality for policy reforms and selectivity of recipients.

The underlying assumption of the aid conditionality approach is that the donor has perfect information (or full observability) about the multiple components of the needs in the country, which includes the identification of sub-populations with the highest disease burden, their geographic locations and the severity of the disease. This information is then used by the donor to enforce an aid contract with the recipient and achieve the intended develpment objectives. Yet in the absence of reliable data, as it is mostly the case in developing countries, identifying and finding the beneficiaries of the funded programmes can be a challenging exercise (Niehaus et al., 2013). Furthermore, targeting may exhibit different levels of efficiency depending on whether the decisions are taken by the central government or at the community level (Galasso and Ravallion, 2005, Banerjee et al., 2009) that can ultimately affect aid effectiveness.

In this study, I explore the consequences of the donor's imperfect information about local health needs when the donor chooses whether to impose aid conditionality or not. More specifically, when the donor has the choice to administer health funding at the central or sub-national level while only local governments have perfect information about the local needs, what are the consequences of aid conditionality on the allocation of local health

resources?

To my knowledge, this is the first attempt to formally examine how foreign aid affects the distribution of federal transfers in a decentralised health care system. Is aid diversion coming from the central government's decision to reduce intergovernmental transfers or is it rather the consequence of sub-national entities changing their fiscal policy (as frequently observed in the fiscal federalism literature)? How does DAH affect the allocation of health care resources across local jurisdictions and the financing of the healthcare system? This paper intends to address this knowledge gap by exploring the optimal allocation of health resources in a federal government in the presence of foreign aid. I start by developing a model based on the standard fiscal federalism literature. I then introduce DAH in the model and discuss the implications of aid conditionality on local health expenditures and intergovernmental grants. I find that when the local government is committed to maximise the social welfare of the neediest and the donor has imperfect information about which group in the local community has the highest health need, unconditional aid generates the maximum welfare gain for the neediest health group. I also find that conditional aid increases local health expenditures more than unconditioned aid. This is because when the donor unsuccessfully targets the high-need group, the local government attempts to compensate for the misallocation of resources by increasing domestic health expenditures on the high-need individuals.

The second part of the paper presents the comparative statistic effects of DAH on the health system of a country with two levels of health care provision. I show that donor preference for primary health care, as commonly observed, may lead to a reallocation of central government resources to the secondary health care level when the marginal health benefit of the neediest is high enough in this level of care. On the other hand, donor mistargeting and aid conditionality may reduce resources allocated to secondary health care, creating an unbalanced situation in the health system. The implications of under-funding the secondary level on aid effectiveness depend on the marginal health benefit of the neediest for this level of health services. While the assumptions of this model purposely excluded the existence of local corruption in some developing countries (Reinikka and Svensson, 2004;Bardhan and Mookherjee, 2005; Bardhan and Mookherjee, 2006), the results, nonetheless, indicate the potential hazards of aid conditionality. In particular, conditionality with poor targeting may undermine the ability of the recipient country to manage health resources at the different levels of the federal system and exacerbate health inequalities within the country. Furthermore, even if local corruption does exist, through the elite capture for example, the use of unconditional funds might still be more efficient than conditional aid with poor targeting

(Basurto et al., 2017).

This work makes several contributions to the literature. First, I introduce a model with a decentralised economy and discuss how DAH can affect the allocation of health resources at the different levels of the federal system. The emphasis on aid conditionality and its consequences on local expenditures reveal that donor's imperfect information can have adverse effects on aid effectiveness. In addition, the introduction of an incentive compatibility constraint, as found in an aid conditionality contract, could divert the recipient's country from targeting the highest needs or even lead the donor to select "bad" government when the needs are not fully observable.

Second, introducing a decentralised health system reveals that different sub-national entities in a recipient country may have conflicting targeting decisions when local information does not circulate perfectly. When both the central government and the donor mistarget the need, the local government may not have the financial and structural capacity to reallocate funds to the intended beneficiaries. Furthermore, by adding a second level of health care services, I show that donor's preferences to achieve immediate and measurable results through the primary health level may poorly reflect the need of local communities when their marginal health benefit for second or tertiary health services is higher.

These findings also provide a new theoretical explanation for the empirical evidence of aid fungibility in the health sector (Howard Pack, 1990; Howar Pack, 1993; Feyzioglu et al., 1998; Swaroop et al., 2000; McGillivray and Morrissey, 2001; Farag et al., 2009; Van de Sijpe, 2013). Whilst aid fungibility is a factor for reducing aid effectiveness in the traditional approach, my results, on the contrary, reveal that fungibility could have positive health impact when the different levels of the federal government commit to maximising the welfare of the neediest and the donor mistargets its funds. Pettersson (2007) finds no evidence that aid fungibility is associated with a reduction in economic or health outcomes, suggesting that it might not necessarily be detrimental. My findings also closely relate to Wagstaff (2011) who estimates the consequences of fungibility on the productivity of the recipient government's spending. The author shows that spillovers effects might not be limited to aid project areas and that government reallocation to non-project areas might also benefit from productivity gains. My theoretical setting offers an alternative plausibility for the resource reallocation that relies on marginal health gains. In particular, marginal productivity is not a driver of government's spending when the latter commits to maximise the welfare of the neediest. Finally, the results of this model supports the evidence on intrasectoral fungibility (Walle and Mu, 2007, Wagstaff, 2011): when external funding does not reach the intended

beneficiaries, local governments reallocate their own resources only within the health sector to achieve higher health impact.

The remainder of the paper is organised as follows. The next section reviews the related theoretical and empirical literature. In section 3, I formulate the resource allocation problem in a decentralised economy and introduce the presence of the donor in primary health care. Section 4 contains further theoretical analysis with the introduction of another level of care. The last section contains concluding remarks.

2 Recipient's Public behaviour and fiscal federalism

The impact of foreign aid on the recipient government's behaviour has triggered a vivid literature. A common theoretical approach relies on agency theory to analyse the incentive problems that may occur in foreign aid delivery leading to aid ineffectiveness. The donor (Principal) is assumed to be fully altruistic: it cares only about the welfare of the poor. On the other hand, the recipient government is assumed to be only partly altruistic and has other incentives than meeting the need of the poor. The recipient may then have incentives to attract a high share of aid disbursement, deviate from the donor decision and follow its own objectives, creating adverse selection and moral hazard (Svensson, 2000a). From the donor's perspectives, the solution is therefore to implement an aid contract that incentivises the recipient to comply with its poverty reduction objectives. When the donor is only able to observe the outcomes, the optimal aid contract is the payment conditional on the aid having been spent on the intended outputs, also known as *ex post* conditionality (Martens et al., 2002; Azam and Laffont, 2003). However, when the donor only observes some inputs, conditionality (on inputs) may distort project choice (Cordella and Dell'Ariccia, 2007). In the presence of lobby groups in the recipient country, Lahiri and Raimondos-Møller (2004) show that the optimal strategic behaviour of the donor is to announce its reaction function in order to eliminate the issue of fungibility while maximising the general welfare at the expense of the lobbyists. On the other hand, if the donor behaves as a leader, increased corruption will diminish the amount of aid. In this scenario, conditionality leads simply to no aid to the recipient. But the opposite can also happen as illustrated by the "Samaritan dilemma": the recipient maximises its own utility at the expense of the donor who decides to allocate aid on the basis of poverty criteria. The recipient government has then incentives to exploit donor's altruism by maintaining a level of poverty qualifying for aid. As the donor cannot commit not to help

the poor, aid is counter productive as long as the recipient can adjust its policy accordingly (Svensson, 2000b). Arguably, the limit of this approach is that repeat offenders will likely discourage donors who will be encouraged ultimately to find alternative solutions. The "Samaritan dilemma" might then exist only for a limited period of time. More globally, this criticism can be extended to the agency theory approach. Repeat offenders tend to reveal their inefficiency in spending aid on the intended items, inciting the donor to target new beneficiaries. Ultimately, "bad" recipients simply drive out of the aid market, removing moral hazard and adverse selection issues. The examination of aid fungibility relies entirely on the assumption made in these studies of a misbehaving recipient. The derived results from their analytical approaches follow logically the mechanism design of an optimal contract where the recipient is incentivised to maximise the altruistic objectives of the donor.

One way to circumvent these limits is relax the "bad" government assumption that prevails in this related literature and examine the consequences of asymmetric information on the optimal resource allocations. The source of aid fungibility is consequently not limited to the moral hazard problem of the recipient but can also reflect the lack of adequate information available to the donor who is no longer to fully observe the needs. If the recipient has perfect information about the health needs in its country, diverting aid funds can be optimal. Naturally, the question raises little interest in this simple case if the local government and the donor have aligned preferences. The donor should simply transfer its aid funds to the recipient which uses it to maximise the poverty alleviation objective that it shares with the donor. However examining this approach is more relevant in a federal structure, where the central government does not necessarily have perfect information about the local health needs, contrary to local communities. The latter is supposed to have better information about local needs. This approach, known as the community-driven development, is known as a mechanism already largely adopted among policy makers, which consists of empowering community groups through higher control over planning decisions and investment resources for local projects. Surprisingly, no studies attempted to use it in a theoretical model.

3 The model with primary health care

This section presents a simple model of optimal health resource allocation between the donor, the central government and the local authority. It aims at examining the comparative statics effects of foreign aid and intergovernmental grant on local health expenditures, either when these funds are transferred through budget support to the local government (unconditional aid), or restricted to a specific intervention (for example, funds conditioned to be spent on a specific project, or vertical programmes funded and delivered by international agencies and non-profit organisations[1]). The objective is to shed light on the mechanisms that are driving the effectiveness of foreign aid related particularly to the public health sector behaviour.

A federal economy consists of m communities denoted $i = 1, ..., m$. In each community, there is a population of N_i citizens divided into two groups: ill and healthy. For simplicity and without loss of generality, let $N_i = 1$. Each community has a proportion π_i of ill (P) and $(1 - \pi_i)$ of healthy members (R). All members of community i are characterized by a local health need θ_{ik} ($k \in \{P, R\}$) that is either high or low with $\theta_{iP} > \theta_{iR}$. Hence, θ_{ik} reflects the community characteristics that account for the intercommunity differences in healthcare preferences for a given provision of healthcare services.

All individuals derive utility from the provision of a public good, that I refer as healthcare services. I denote g_i the amount of health benefits package per capita in community i and individual's valuation of the good is given by $h(\theta_{ik}, g_i)$. The function $h(\theta_{ik}, .)$ is assumed to be increasing, smooth and strictly concave in g (for all θ_k and g_k, $h_2(\theta_k, g_k) = \partial h(\theta_k, g_k)/\partial g_k > 0$ and $h_{22}(\theta_k, g_k) = \partial^2 h(\theta_k, g_k)/\partial g_k^2 < 0$). In addition, the marginal benefit of consumption is increasing in individual's type: $h_{12}(\theta_k, g_k) = \partial^2 h(\theta_k, g_k)/\partial g_k \partial \theta_k > 0$.

Individuals differ also in endowed income y_i, with $y_{iR} > c_i > y_{iP}$. The high-need individuals (who are poor and sick) are not able to pay the user fees to receive primary care services. For simplicity and without loss of generality, y_{iP} is set equal to zero among high-need members [2].

[1]Note that vertical programmes such as immunization are usually financed through funds that do not go through the government budget. However, since I assume that the local government allocates the funds in accordance to the donor's decision, I do not need to distinguish this particular case. The funds will be similarly spent on the intended targeted area whether they are transferred under conditional form to the local government or directly targeted by the donor.

[2]The assumption that wealthy people are also healthy is employed to focus on the main interest of the model, foreign aid and the financial constraint of the poor. In as much as wealthy people can afford the health expenditures to be cured, their health status is only temporary and does not motivate for donor

Healthcare provision is decentralized to local governments. These governments are responsive to the welfare of both subgroups in the community, high-need and low-need. Within each community, health services are supplied at a unit cost q, such that $q'(.) < 0$ and $q''(.) > 0$. I assume that there is no private market for health care. As it happens in most low-income countries, local governments are not able to collect local taxes but finance the provision of healthcare through fiscal grants and foreign aid (Bardhan, 2002). To part-fund the universally available health benefits package g, local communities impose user fee c_i per unit of health services. Since y_{iP} is set equal to zero, only wealthy people are charged the user fee. Since this financing system is non-coercive, the local government problem of optimal health resource provision has to respect the voluntary participation constraint of the low-need (wealthy) members, $h(\theta_{iR}, g_{iR}) \geq cg_{iR}$. Therefore, local governments face challenges in raising local revenues to support health expenditures when the share π of high-need is high.

The central government is responsible for raising revenues and allocating health resources to each community through a lump-sump grant, a_i. In the presence of the donor, I assume that this grant is restricted to the high-need subgroup in each community, as is foreign aid d. Therefore, the central government and the donor have fully aligned objectives. They both have information about the level of total needs among each community through information provided by local governments. Therefore, the central government and the donor determine respectively the optimal fiscal grant a_i and aid d to transfer based on the need within each community i, depending on π and θ_{iP}. However, they do not know how needs are distributed within each community, except with a probability p_1 for the central government and p_2 for the donor, that the need in a local group k of the community i is θ_{ik}, with $p_1, p_2 \in [0, 1]$. Hence, if either the central government or the donor decides to identify a subgroup within community i, its probability of success is p_i, and with probability $1 - p_i$, it identifies the high-need (low-need) subgroup as being the low-need (high-need). In addition, the central government adapts its fiscal grant transfer to the existing health care resources. When there is only the local government resources, the central transfer a grant $a_i^g = a_i^g(g_i, \pi\theta_{iP})$ that depends on local health care expenditures and local needs in community i. However, in the presence of the donor, the central government transfers $a_i = a(d, \pi\theta_{iP})$ to the community i, with d the foreign aid resources[3]. On the contrary, the local government has

funding.

[3]Note that a_i^g and a_i are different functions since I allow for the existence of a different effect of a change of local government spending and a change of foreign aid on the central government's fiscal grant. Indeed,

perfect information about the distribution of the needs in the community, but it can have different preferences over high and low-need members. Specifically, the local government assigns a weight μ_{ik} to each group within community i with $\mu_{ik}, \in [0, 1]$. If $\mu_{ik} = 1$, the local government only cares about its high-need members and its preferences are then fully aligned with those of the central government and the donor. However, I will not restrict the following analysis to this specific case and I will rather let $\mu_{ik}, \in [0, 1]$. I also assume that the local government seeks to achieve horizontal and vertical equity. That is, individuals with the same needs receive equal amount of health care, and those with higher needs receive higher amount of health care. Therefore, health care resources distribution are based on need and financed by the nonpoors (Wagstaff and Van Doorslaer, 2000).

In this analysis, fungibility is examined under the assumption that neither the local government nor the the central government diverts aid for their private benefit. Likewise, there is no form of capture by local elites or group pressure. These conditions posit assumptions that lead *de facto* to fungibility. This study focuses on assessing the extent of diversion of funds (fungibility of aid) when only the local government (fund's recipient) has perfect information about local health needs. In the first section, there is no donor and I examine how conditional grant affects the optimal allocation decision for local health resources. In the second section, I introduce the donor and analyse the effects of conditional grant and aid local health expenditures and social welfare.

3.1 Determination of fiscal grant

I start by assuming that in absence of the donor, both central and local governments maximize their social welfare function with respect to their own preferences for the sick. However, when the donor will be introduced in the second part, the central government will only care about the sick to fully align its objective function with the donor. The fiscal grants are financed by a national income tax τ that is common to every community. The central government determines the optimal fiscal grant a_i from the following objective function

$$\underset{a_{ip},a_{iR}}{Max} \sum_i N_i\{\pi_i\lambda_{ip}\theta_{ip}h(g_{ip}+a_{ip}) + (1-\pi_i)\lambda_{iR}\theta_{iR}h(g_{iR}+a_{iR}) + y_i(1-\tau)]\}$$

under the assumption of the central government's imperfect information of local health needs, an increase in the level of foreign aid in community i could have stronger effects on the fiscal grant than a change in local spending

where λ_{ik} is the weight given by the central government for group k in community i. The central government's budget constraint is given by

$$\sum_{i=1}^{m} N_i(1-\pi_i)y_i\tau \geq \sum_{i=1}^{m} N_i q_i a_i \tag{1}$$

where $a_i = \pi_i a_{ip} + (1-\pi_i)a_{iR}$.

Since the budget constraint (1) must bind, the fiscal grant transferred to community i is determined by

$$h'(g_i + a_{ip}) = \frac{\lambda_R \left(q_i'(G_i)a_i + q_i(G_i)\right)}{\lambda_{ip}\theta_{ip}} \tag{2}$$

and

$$h'(g_i + a_{iR}) = \frac{q_i'(G_i)a_i + q_i(G_i)}{\theta_{iR}} \tag{3}$$

where the total provision of the private good in community i is $G_i = g_i + a_i$. In this setting, the first-order conditions determine the quantity of health care services provided by the central government. The grant received by the high-need subgroup is a function of local price of health services, local health needs, the share of high-need members in community i, the local health expenditures and the weight assigned by the central government to the low and high-need group within each community. Hence, it follows that the marginal rate of substitution between a_{ip} and a_{iR} is

$$\frac{h'(g_i + a_{ip})}{h'(g_i + a_{iR})} = \frac{\theta_{iR}}{\theta_{ip}} \frac{\lambda_R}{\lambda_{ip}} \tag{4}$$

3.2 Determination of local public provision of health care with domestic resources

I assume that the local government of community i maximizes its social welfare function with respect to its own preferences for the sick. The central government has the choice to transfer the fiscal grant as an unrestricted budget support to community i or to impose the grant to being spent on a specific group within the community. In both cases, the central government allocates resources $a_i^g q_i$ that pay for the price of health care services to reach a given level of health care per capita a_i^g. For simplicity, I assume that the central government only targets the poor who are also the high-need individuals.

Unconditional fiscal grant

If the central government decides to transfer an unconditional (without use restrictions) lump sum grant per capita a_i to community i, the optimal local expenditures for the provision of health services selected by the local government solves

$$\underset{G^c_{iP},G^c_{iR}}{Max}\ \{\pi_i\mu_{iP}h(\theta_P,G^c_{iP})+(1-\pi_i)\mu_{iR}[h(\theta_R,G^c_{iR})-c_ig_{iR}]\}$$

subject to the budget constraint:

$$q_i(G^c_i)G^c_i \leq (1-\pi_i)c_ig_{iR}+a^g_iq_i(G^c_i)$$

where the total provision of health services for group k is denoted by $G^c_{ik}=g_{ik}+a^g_i$ with $g_i=\pi_ig_{ip}+(1-\pi_i)g_{iR}$. Note that the budget constraint requires $g_{iR}\leq a^g_i$ to hold (which correspond to the case where $\pi_i=1$). Then, the total provision of health resources in the community i is

$$\begin{aligned}G^c_i &= \pi G^c_{iP}+(1-\pi)G^c_{iR}\\ &= g_i+a^g_i\\ &= \pi g_{iP}+(1-\pi)g_{iR}+a^g_i\end{aligned}$$

For ease of notation, I drop the subscript i. The social welfare function of the local government is given by the utility function of the high and low need, as well as the weight that it attributes to each group. The local government's budget constraint is obtained from the funds locally raised on the wealthy and the fiscal grant transfer. Since the budget constraint must bind, the total public provision of health care services is given by:

$$h_2(\theta_P,G^c_P)=\frac{\mu_R}{\mu_P}(q'(G^c)g+q(G^c)) \tag{5}$$

$$h_2(\theta_R,G^c_R)=q'(G^c)g+q(G^c) \tag{6}$$

The optimal expenditure quantity depends on the relative weight assigned by the local government to the sick and the marginal cost for producing the good. As the preferences of the local government for the low-need diminishes in favour of the high-need, the ratio μ_R/μ_P decreases and the provision of the health benefits package for the sick increases. As expected, health care expenditures depend positively on the local needs and negatively on the local price.

The slope of the social welfare contour is given by the marginal rate of substitution between the public provision of health care to the high and low-need individuals

$$\frac{h_2(\theta_P, G_p^c)}{h_2(\theta_R, G_R^c)} = \frac{\mu_R}{\mu_P} \tag{7}$$

Given the parameters (μ_k, θ_k), the optimal public provision of health care to the high-need members is maximal when the low-need members receive no share of the fiscal and the local government gives no weight to the welfare of the low-need members ($\mu_R = 0$). Consequently, the marginal rate of substitution in (7) can be interpreted as an "equity weight" related to the two subgroups (Dolan and Tsuchiya, 2009). An increase (decrease) in this ratio would decrease (increase) the level of healthcare of the high need relative to the low need group. Note that if the local government has equal preferences between low and high-need members of its community (utilitarian approach), (7) leads to $h_2(\theta_R, G_R^c) = h_2(\theta_P, G_P^c)$ which implies that $g_P > g_R$ since the marginal benefit of consumption is increasing in individual's type: $h_{12}(\theta_k, g_k) > 0$ and $\theta_{ip} > \theta_{iR}$. The marginal rate of substitution of the provision of health care between high and low need group is only a function of their relative local needs. Higher marginal health benefit of individuals results in a higher allocation of public good under the utilitarian approach. When the local government only cares about the high-need members (Rawlsian approach) the latter receives the maximum amount $\bar{G_P^*}$ of health care defined by $h_2(\theta_P, \bar{G_P^*}) = q'(G^c)g + q(G^c)$.

There exists a threshold $\theta_k^*(q, G_k, \mu_k)$ that depends on the total provision of health service, the marginal cost, and the weight on group k such that local government is financially constrained when the local need exceeds θ_k^*. Assume from now on that it is the case.

Conditional grant

Suppose now that the central government decides to restrict the grant to the poor members in the local community i. That is, the local government has to allocate the fiscal grant according to the central government's decision. This kind of grant is also known as earmarked grant. The central earmarks the fiscal grant on the high-need group of the community with probability p_1, but can also incorrectly designate the low-need group as the fiscal grant receiver. As bin the previous case, the central government uses the grant a. Therefore, the

maximization's problem of the local government becomes:

$$\underset{g_P,g_R}{Max}\{\left[\mu_P\pi h(\theta_P, G_p^c) + \mu_R(1-\pi)h(\theta_R, g_R)\right] p_1 + \left[\mu_P\pi h(\theta_P, g_p) + \mu_R(1-\pi)h(\theta_R, G_{pR}^c)\right](1-p_1) - \mu_R(1-\pi)cg_R\}$$

subject to the new budget constraint:

$$q(G^c)g \leq (1-\pi)cg_R \tag{8}$$

where $G_{pR}^c = g_R + a^g$ and $G_p^c = g_p + a^g$. The first-order conditions for this problem yield:

$$h_2(\theta_P, G_p^c)p_1 + h_2(\theta_P, g_P)(1-p_1) = \frac{\mu_R}{\mu_P}(q'(G^c)g + q(G^c)) \tag{9}$$

$$h_2(\theta_R, g_R)p_1 + h_2(\theta_R, G_{pR}^c)(1-p_1) = q'(G^c)g + q(G^c) \tag{10}$$

The optimal provision of health benefits packages to the high-need subgroup are then to be compared with the case of unconditional grant to determine if conditional grant can benefit the welfare of the sick. Consider now the difference between (5) and (9). The comparison between the two results can only be done when the local government preferences are aligned with the central government: the local government would only care about the sick. By letting the ratio $\mu_R/\mu_P = 0$ in the two equations, it appears that if $q'(.) < 0$, the expected health care provision transferred to high-need individuals under conditional grant is lower than the certain provision they receive under unconditional grant. The conditionality imposed by the central government affects negatively the amount of health public goods allocated to the high-need subgroup. When the central government does not have perfect information, it gives some probability weight to allocate health resources out of high-need individuals to the low-need members in the community. Combining (9) and (10) yields the marginal rate of substitution between the level of health of high and low-need individuals

$$\frac{h_2(\theta_P, G_p^c)}{h_2(\theta_R, g_R)} = \frac{\mu_R}{\mu_P} - \frac{1-p_1}{p_1}\frac{1}{h_2(\theta_R, g_R)}\left(h_2(\theta_P, g_P) - \frac{\mu_R}{\mu_p}h_2(\theta_R, G_{pR}^c)\right) \tag{11}$$

Assuming that $g_k \leq a^g$, if $\mu_P > \mu_R$, then the second term on the right hand side is positive. The comparison of (11) with the marginal rate of substitution under unconditional grant (7) (and letting $\mu_R/\mu_P = 0$), it results that conditional grant reduces the health resource allocation gap between high and low-need individuals in the community that was prevailing

under unconditional grant. The high-need members are then worse off and the low-need better off.

Consider now the effects of fiscal grants on local expenditures. Totally differentiating (9) gives the marginal propensity to spend on the sick out of conditional grant

$$\frac{\partial g_P^*}{\partial a^g} = -\left(1 - \frac{1 - p_1 + \frac{\mu_R}{\mu_P}\frac{\kappa_c(1-\pi) - q'(G^c)}{h_{22}(\theta_P, g_P)}}{p_1 \frac{h_{22}(\theta_P, G_P^c)}{h_{22}(\theta_P, g_P)} + 1 - p_1 - \pi \frac{\mu_R}{\mu_P}\frac{\kappa_c}{h_{22}(\theta_P, g_P)}}\right) \tag{12}$$

where $\kappa_c = q''(G^c)G^c + 2q'(G^c)$. A straightforward result from (12) is that the highest increase in local health expenditures is reached when $p_1 = 0$ as the local government seeks to compensate for the excessive grant allocated to the low-need individuals. On the contrary, an increase in the probability of the central government to successfully determine the local need reduces the only positive term of the equation. As expected, the share of high-need members in the community also negatively affects the propensity of the local government to spend on the ill out of conditional grant.

3.3 Public provision of health care resources with foreign aid

I introduce in this section the intervention of a donor which cares only about the high-need members in the community. The donor can decide to give aid as an unconditional fund transfer to the local government, or finance directly a subgroup of its choice within the community. If aid is given to the local government, the latter simply adds the external fund on top of the total amount of public provision. However, if the donor decides to fund directly a local area of its choice (vertical programme), it can only identify the high-need group with a probability p_2 that the need θ_{ik} of the group P is θ_{iP}. That is, p_2 is the probability that foreign aid reaches the sick. Because the donor cares only about the sick, both the central and local government align their preferences with the donor to cooperate. Therefore, the fiscal grant a is restricted to benefit the high-need subgroups in each community. Notice an important implication of this theoretical setting. The local government follows the decision of both the donor and the central government when they decide to transfer conditional funds. That is, there is no distinction between the case where the local government receives grants to be spent on a specific group in the community by directly contracting with the donor (this restricted budget support is also known as earmarked aid) and the case where the donor or the central government directly finances the intended group. In both cases, the local government has only a decision-making power over its own resources and funds

received as unrestricted budget support. Similarly, whether the donor transfers funds at the central or local level makes no difference on the examination of local health resources. This is because this analysis does not focus on factors related to a misbehaving recipient that would directly explain aid diversion. I rather assume a collaborative partnership between the donor and the recipient at the central and local levels and I examine the implications of imperfectly informed donor and central government and local health expenditures. Therefore the factor of interest is only the decision of the donor to allocate its funds to a specific group within the community or to provide an unrestricted budget support to the local government. I also assume that the central government knows about the donor's intervention (whether through unrestricted budget support or conditional aid) and has the possibility to adapt accordingly the intergovernmental grant $a(d)$. A straightforward source of aid diversion appears if the central government decides to reduce its fiscal grant accordingly. In addition to this possibility, I will also examine other conditions under this theoretical setting that could lead to reallocation of health care resources.

There are four cases to consider for this comparative statics analysis reflecting the possibility that both aid d and grant a can be transferred directly or indirectly to the high-need group in the community. In both cases, the donor and the central government have to include the local price of health care services to reach the sick with the intended level of health care resources d and a respectively. In all four cases, the local authority maximises the community aggregate welfare function of high-need and low-need individuals subject to the total health care amount available (G^P, G^R) to each group and the probability that national government and/or the donor successfully target the high-need group. Since individuals have the same welfare level within groups, the aggregate welfare function of each group is defined as

$$W^P(G^P) = h(\theta_p, G^P)$$
$$W^R(G^R) = h(\theta_R, G^R) - cG^R$$

In the following four cases, the aggregate welfare functions will differ only with respect to (G^P, G^R). The benefit of health resource allocation is measured by the variation in welfare for each subgroup.

Case 1. Unconditional grant a and aid d

Consider the case where the local government receives unconditional grant and aid. It means that it can use grant and aid on top of its own revenue to determine the per capita level of health care expenditures that it seeks to achieve for the high (G_P^d) and the low-need individuals (G_R^d). The local government then solves

$$\underset{G_P^d, G_R^d}{Max} \{\pi \mu_P W^P(\theta_P, G_P^d) + (1-\pi)\mu_R W^R(\theta_R, G_R^d)\}$$

subject to the aggregate budget constraint:

$$q(G^d)G^d \leq (1-\pi)cg_R + (a(d)+d)q(G^d)$$

where G^d is the total provision of health resources and each subgroup in the community receives $G_k^d = g_k + a(d) + d$ with $k \in \{P, R\}$. Then it follows that

$$\begin{aligned} G^d &= \pi G_P^d + (1-\pi)G_R^d \\ &= g + a(d) + d \\ &= \pi g_P + (1-\pi)g_R + a(d) + d \end{aligned}$$

Define the price elasticity of health care expenditures is defined as

$$e(G^d) = \frac{q}{G^d}\frac{dG^d}{dq}$$

As in (5), if both aid and fiscal grant are transferred to the budget of the local government, the optimal resource allocation is given by the marginal change in social welfare of the high-need with respect to total health care expenditures

$$\frac{\partial W^P(\theta_P, G_p^d)}{\partial G_P^d} = \frac{\mu_R}{\mu_P}\left(q'(G^d)g + q(G^d)\right) = \frac{\mu_R}{\mu_P}q(G^d)\left(1 + \frac{1}{e(G^d)}\frac{g}{G^d}\right) \tag{13}$$

and the second-order condition is

$$h_{22}(\theta_P, G_p^d) - \frac{\mu_R}{\mu_P}\kappa_d < 0$$

where $\kappa_d = q''(G^d)G^d + 2q'(G^d)$. The first-order condition indicates that welfare benefits for the high-need individuals depend on the relative preferences of the local government between high-need and low-need subgroups and the price elasticity of health expenditure.

The maximum marginal welfare of the high-need is reached when the local government gives no weight to the welfare of the low-need members (Rawlsian case) or when the price elasticity of health care expenditures is equal, in absolute value, to the share of local government health expenditures to the total health expenditures in the community ($\left|e(G^d)\right| = g/G^d$). Because of the limited financial capacity of the local government revenue in low-income countries, it is reasonable to assume that the share of local government health expenditures to the total health expenditures is low as well. Consequently, the marginal welfare of the sick is maximal only if total health care expenditures are highly price-inelastic. Yet, the lack of empirical evidence on the price elasticity in low-income countries precludes from asserting that this condition holds.

Recall that the threshold $\theta_k^*(q, G_k, \mu_k)$ characterises the maximum local need above which the local government is financially constrained. As this threshold increases with aid and fiscal grant, the local government can reach a larger share of high-need members in the community when aid or grant increases. The concern about aid fungibility requires that $\partial G_P^d/\partial d \geq 1$. If the local government is financially constrained, avoiding fungibility of aid requires that neither local government's spending nor fiscal grant decreases in the presence of aid. However since this condition is only related to total health expenditures G_P^d, it is insufficient to inform us about the impact of foreign aid on local health care expenditures nor about the critical role of local government in analysing fungibility of aid. Therefore, I analyse the effects of aid on the optimal local expenditures by totally differentiating (13) to obtain the following:

$$\frac{\partial g_P^*}{\partial d} = -(a'(d)+1)\left(1 - \frac{1-\pi-\frac{q'(G^d)}{\kappa_d}}{\widetilde{\pi}^d - \pi}\right) \tag{14}$$

where $\widetilde{\pi}^d = \frac{h_{22}(\theta_P, G_p^d)}{\kappa_d}\frac{\mu_P}{\mu_R}$ and $\kappa_d = q''(G^d)g + 2q'(G^d)$. The optimal local health expenditures increase with foreign aid, provided that fiscal grant does not decline.

Proposition 1. *Unconditional foreign aid increases local government spending on the sick when $\kappa_d > 0$ and sufficiently close to 0 and $a'(d) > -1$.*

Proof. Assuming $a'(d) \geq -1$, the condition under which $\frac{\partial g_P^*}{\partial d} > 0$ is

$$1 - \frac{1-\pi-\frac{q'(G^d)}{\kappa_d}}{\widetilde{\pi}^d - \pi} < 0$$
$$1 < \frac{1-\pi-\frac{q'(G^d)}{\kappa_d}}{\widetilde{\pi}^d - \pi}$$

If $\kappa_d < 0$, the second-order condition implies that

$$h_{22}(\theta_P, G_p^d) - \frac{\mu_R}{\mu_P}\kappa_d < 0$$
$$\widetilde{\pi}^d > 1$$

This yields to the following

$$\widetilde{\pi}^d - \pi < 1 - \pi - \frac{q'(G^d)}{\kappa_d}$$
$$\frac{q'(G^d)}{\kappa_d} < 1 - \widetilde{\pi}^d < 0$$

which is in contradiction with $\frac{q'(G^d)}{\kappa_d} > 0$ since $q'(G^d) < 0$ and $\kappa_d < 0$.
Assume now that $\kappa_d > 0$. The second-order condition then leads to

$$\widetilde{\pi}^d < 1$$

which implies that

$$\widetilde{\pi}^d - \pi > 1 - \pi - \frac{q'(G^d)}{\kappa_d}$$

if $\widetilde{\pi}^d < \pi$. One condition for this last inequality to hold is κ_d sufficiently close to 0. Note that

$$\kappa_d = q''(G^d)g + 2q'(G^d)$$
$$= q'(G^d)\left(\frac{q''(G^d)}{q'(G^d)} + 2\right)$$

The term in the parenthesis refers to the convexity (or curvature) of the inverse demand function. Note also that if the need θ_P of the sick is very high, this last inequality always holds and the marginal propensity to spend aid received on the sick can be positive even if the local government has a higher relative preference for the low-need group. □

The optimal allocations of health resources critically depend on the share of the high-need group in the community: given the preferences of the local government for each subgroup in the community, μ_P and μ_R, high-need members receive a lower share of health care services as π increases. Consider the condition under which $\partial g_P^*/\partial d > 0$, requiring $\widetilde{\pi}^d < 1$. As the share of poor individuals in the community gets closer to $\widetilde{\pi}^d$, the marginal propensity to

spend out of aid increases. Nonetheless when the share of the poor gets too high ($\pi > \widetilde{\pi}^d$), foreign aid has negative effects. This is because $\widetilde{\pi}^d$ is a function of the relative preferences of high-need and low-need individuals as well as the local health needs. Therefore, if the local government's preferences for low-need increase or if the local health needs decrease, $\widetilde{\pi}^d$ will decrease and the additional external fund of the donor becomes an opportunity to reallocate the local government's resources away from the high-need to the low-need group within the community. However these considerations are valid when the local government attributes the weights $\mu_p P$ and μ_R to the high-need and low-needs subgroups respectively. It means that the local government's preferences are misaligned with those of the donor (and the central government) who cares only about the high-need subgroup. Hence, a special attention should be devoted on the effects of aid on local health expenditures when the ratio μ_R/μ_P tends to zero. Equation (14) becomes

$$\left.\frac{\partial g_P^*}{\partial d}\right|_{\frac{\mu_P}{\mu_R}=0} = -(a'(d)+1) \tag{15}$$

As a consequence, foreign aid affects negatively local health expenditures unless the central government reduces its fiscal grant by more than one. When the donor, the central and local government's preferences are fully aligned, there is no rationale for the local government to increase its health expenditures following foreign aid.

Case 2. Unconditional Grant a and conditional aid d

Consider the situation where the donor targets its aid to a specific subgroup in the community while the central government transfers an unconditional grant to the local government. The local government maximises the following objective function

$$\begin{aligned}\underset{G_P^c, G_R^c}{max}\ &\left[\pi\mu_P W^P(\theta_P, G_P^d) + (1-\pi)\mu_R W^R(\theta_R, G_R^c)\right] p_2 \\ &+ \left[\pi\mu_P W^P(\theta_P, G_P^c) + (1-\pi)\mu_R W^R(\theta_R, G_{pR}^d)\right](1-p_2)\end{aligned}$$

s.t. $q(G^d)G^c \leq (1-\pi)cg_R + a(d)q(G^d)$

where $G_{pR}^d = G_R^d + d$. The change in the budget constraint reflects the impact of conditional aid on the local government's new budget: the local government is now only able to allocate G^c in the community while the price remains a function of the total health expenditures G^d. The local government gets its funding from the user fee collected on the

low health-need group as well as from the transfer from the central government. The total marginal welfare of the high-need individuals is given by

$$\frac{\partial W^P(\theta_P, G_p^d)}{\partial G_P^c} p_2 + \frac{\partial W^P(\theta_P, G_P^c)}{\partial G_P^c}(1-p_2) = \frac{\mu_R}{\mu_P} q(G^d)\left(1 + \frac{1}{e(G^d)}\frac{g}{G^d}\right) \tag{16}$$

Sufficient conditions for this to be the unique maximum are

$$h_{22}(\theta_P, G_P^d)p_2 + h_{22}(\theta_P, G_P^c)(1-p_2) - \frac{\mu_R}{\mu_P}(q''(G^d)g + q'(G^d)) < 0 \tag{17}$$

As expected, if the donor has perfect information about local needs in the community ($p_2 = 1$), the marginal social welfare of the high-need is unchanged whether there is aid is conditional or not. However if $p_2 < 1$, since $G_P^d > G_P^c$ the social welfare of the high-need individuals is lower under conditional aid. Indeed, the total marginal welfare (right-hand side of the equation) is similar to case 1, while the change in social welfare is now split between a "high" state of welfare where the high-need individuals receive a quantity of health care services equal to G_p^d with a probability p_2 and a "low" state of welfare where they receive a quantity G_P^c with probability $1 - p_2$ which corresponds to the level of health expenditures where there is no donor.

Proposition 2. *If the donor has imperfect information about the local health need, conditional aid decreases the social welfare of the high-need individuals.*

How does an exogenous increase in conditional aid affect the local government spending on high-need individuals? Using the Implicit Function Theorem on (16), I obtain:

$$\frac{\partial g_P^*}{\partial d} = -(a'(d)+1)\left(1 - \frac{\frac{\widetilde{\pi}^c(1-p_2)}{a'(d)+1} + 1 - \pi - \frac{q'(G^d)}{\kappa_d}}{\widetilde{\pi}^d p_2 + \widetilde{\pi}^c(1-p_2) - \pi}\right) \tag{18}$$

where $\widetilde{\pi}^k = \frac{h_{22}(\theta_P, G_p^k)}{\kappa^d}\frac{\mu_P}{\mu_R}$ and $\kappa_d = q''(G^d)g + 2q'(G^d)$.
Consider now the effects of conditional aid with those arising from the situation when both aid and grant are unconditional (14).

Proposition 3. *Conditional aid decreases the marginal propensity to spend on the sick relatively to unconditional aid and increases fungibility when* $\pi < \widetilde{\pi}^c$, $a'(d) > -1$ *and* p_2 *is close to* 1.

When the donor targets its funding to the high-need group in the community but mistakenly reaches the low-need, high-need individuals get under-allocated compared to the

situation where aid is unconditional. As a consequence, the local government increases its spending on health services to the high-need group to compensate for the misallocation of foreign aid.

Proof. Subtracting (18) to (14) gives

$$\left.\frac{\partial g_P^*}{\partial d}\right|_{\text{unconditional-aid}} - \left.\frac{\partial g_P^*}{\partial d}\right|_{\text{conditional-aid}} = \frac{1-\pi-\frac{q'(G^d)}{\kappa_d}}{\widetilde{\pi}^d-\pi} - \frac{\frac{\widetilde{\pi}^c(1-p_2)}{a'(d)+1}+1-\pi-\frac{q'(G^d)}{\kappa_d}}{\widetilde{\pi}^d p_2+\widetilde{\pi}^c(1-p_2)-\pi}$$

Assume that $a'(d) > -1$ and $\kappa_d < 0$. Then $1-\pi-\frac{q'(G^d)}{\kappa_d} < \frac{\widetilde{\pi}^c(1-p_2)}{a'(d)+1} - \frac{q'(G^d)}{\kappa_d} + 1 - \pi$ under the condition that

$$\frac{\widetilde{\pi}^c(1-p_2)}{a'(d)+1} > 0$$

which holds under the present assumptions ($a'(d) > -1$ and $\kappa_d < 0$).

In addition, since $G_P^d > G_p^c$, $\widetilde{\pi}^d > \widetilde{\pi}^d p_2 + \widetilde{\pi}^c(1-p_2)$. Now if $\pi \leq \widetilde{\pi}^c < 1$, then

$$\frac{1-\pi-\frac{q'(G^d)}{\kappa_d}}{\widetilde{\pi}^d-\pi} - \frac{\frac{\widetilde{\pi}^c(1-p_2)}{a'(d)+1}+1-\pi-\frac{q'(G^d)}{\kappa_d}}{\widetilde{\pi}_d^d p_2+\widetilde{\pi}^c(1-p_2)-\pi} < 0$$

$$\left.\frac{\partial g_P^*}{\partial d}\right|_{\text{unconditional-aid}} < \left.\frac{\partial g_P^*}{\partial d}\right|_{\text{conditional-aid}}$$

□

In addition, note under the particular case where the donor targets the high-need group with perfect information ($p_2 = 1$), (18) becomes

$$\frac{\partial g_P^*}{\partial d} = -(a'(d)+1)\left(1 - \frac{1-\pi-\frac{q'(G^d)}{\kappa_d}}{\widetilde{\pi}^d-\pi}\right)$$

which is lower than the same partial effect in case 1 where aid and grant are unconditional (14). It means that the increase in local government health expenditures on the high-need group is lower when aid is conditional, even if the donor has perfect information about local health needs. On the opposite, the maximum increasing effect of foreign aid on local

government's expenditures is reached when $p_2 = 0$.

$$\frac{\partial g_P^*}{\partial d} = -(a'(d)+1)\left(1 - \frac{\frac{\widetilde{\pi}^c}{a'(d)+1} + 1 - \pi - \frac{q'(G^d)}{\kappa_d}}{\widetilde{\pi}^c - \pi}\right)$$

In this case, the partial effects of aid on local health expenditures on the high-need group are higher when aid is conditional. This corresponds to the maximum of health resources the local government can reallocate when the donor targets entirely the low-need group at the expenses of the high-need group and $\pi < \widetilde{\pi}^c$. Consequently, the misallocation of the donor's resources entirely dictates the effects of aid on local health expenditures on high-need individuals.

The case 3 where grant is conditional and aid is unconditional is left in the Appendix. The next and final case will then focus on conditional grant and aid.

Case 4. Conditional grant a and aid d

Consider now the final case where both the donor and the central government impose restriction on the funds they transfer to the local government. The donor decides where aid should be allocated within the community. As the donor does not know the need of the local community, it can only make a guess with probability p_2 that an identified group in the community correspond to a high-need group. The level of fungibility is then given by $dG_P^d = (a'(d)p_1 + p_2)dd$. It follows that $dG_P^d/dd \geq 1$ if $a'(d) \geq (1-p_2)/p_1$. In this setting, fungibility is avoided if the central government's response to foreign aid is higher than the right hand term which depends on the probability of successful targeting of both the donor and the central government. Therefore, imperfect information of the donor and the central government is likely to increase the level of aid fungibility. The maximization's problem of the local government becomes :

$$\begin{aligned}
\underset{g_P, g_R}{max} \left[\pi\mu_P W^P(\theta_P, G_p^d) + (1-\pi)\mu_R W^R(\theta_R, g_R)\right] p_1 p_2 \\
+ \left[\pi\mu_P W^P(\theta_P, G_P^s) + (1-\pi)\mu_R W^R(\theta_R, G_{pR}^c)\right](1-p_1)p_2 \\
+ \left[\pi\mu_P W^P(\theta_P, G_P^c) + (1-\pi)\mu_R W^R(\theta_R, G_{pR}^d)\right] p_1(1-p_2) \\
+ \left[\pi\mu_P W^P(\theta_P, g_P) + (1-\pi)\mu_R W^R(\theta_R, G_R^d)\right](1-p_1)(1-p_2)
\end{aligned}$$

subject to: $q(G^d)g \leq (1-\pi)cg_R$
with $G_R^d = g_R + a(d) + d$. Note how the change in the budget constraint of the local government reflects the conditional aid and fiscal grant: the local government is left with its own funding raised from the user fee on the low-need group to provide health services g at the price $q(G^d)$ that is determined by the total provision of health services, including conditional aid and grant. The derived optimal allocation to the high-need members is expressed as follows

$$\frac{\partial W^P(\theta_P, G_P^d)}{\partial g_P} p_1 p_2 + \frac{\partial W^P(\theta_P, G_P^s)}{\partial g_P}(1-p_1)p_2 + \frac{\partial W^P(\theta_P, G_P^c)}{\partial g_P} p_1(1-p_2) + \frac{\partial W^P(\theta_P, g_P)}{\partial g_P}(1-p_1)(1-p_2) = \frac{\mu_R}{\mu_P} q(G^d)\left(1 + \frac{1}{e(G^d)}\frac{g}{G^d}\right) \quad (19)$$

Comparing the optimal allocations for high-need individuals with the three other cases, it is straightforward that combining conditional aid and grant reduces the amount of health care services to the high-need group, if p_1 and p_2 are lower than one. The extent of welfare loss is once again related to the welfare difference between $W(\theta_P, G_P^d)$ and $W(\theta_P, g_P)$, provided that the last term corresponds to the lowest social welfare of the high-need. Consequently, the higher the probability weight attributed to the marginal welfare of the high-need group, the higher is the welfare loss of conditional grant and aid compared to unrestricted budget support as in case 1. Whilst the local government cannot prevent the misallocation of conditional aid and grant, it can mitigate the unintended increase in the welfare of the low-need relatively to the high-need by reallocating a higher share of its own health expenditures. However, the local government also faces a higher price ($q(G^d)$) compared to the absence of conditional grant and aid ($q(g)$) while remaining with the same fixed budget. Therefore, the local government's capacity to divert its local funds may be insufficient to compensate for the misallocated resources of the central and the donor.

I now characterize the marginal propensity of local health spending on high-need out of aid and compare it with the previous cases.

Proposition 4. *Conditional aid causes the marginal propensity of spending on the sick out of aid to increase, provided that $p_2 < 1$ and $a'(d)$ is negative or close to 0.*

The misallocation of the donor's fund related to its willingness to target the high-need group forces the local government to increase its own health expenditures to the high-need individuals, under the condition that the fiscal grant remains unchanged. Intuitively, an increase in fiscal grant to the local community would attenuate the increase in local health

spending on the sick.

Proof. I use the Implicit Function Theorem to derive the marginal effect of foreign aid on the optimal local health expenditures.

$$\frac{dg_P^*}{dd} = -(a'(d)+1)\left(1 - \frac{\frac{a'(d)}{a'(d)+1}p_2(1-p_1)\widetilde{\pi}^s + \frac{1}{a'(d)+1}p_1(1-p_2)\widetilde{\pi}^c + (1-p_1)(1-p_2)\widetilde{\pi}^{g_P} + 1 - \pi - \frac{q'(G^d)}{\kappa_d}}{p_1p_2\widetilde{\pi}^d + p_2(1-p_1)\widetilde{\pi}^s + p_1(1-p_2)\widetilde{\pi}^c + (1-p_1)(1-p_2)\widetilde{\pi}^{g_P} - \pi}\right) \tag{20}$$

where $\widetilde{\pi}^k = \frac{h_{22}(\theta_p, G_p^k)}{\kappa_d}\frac{\mu_p}{\mu_R}$. I analyse the marginal propensity to spend on high-need individuals out of foreign aid by comparing the case where aid is conditional (20) with unconditional aid and conditional grant (31 in the Appendix). If $p_2 = 1$, the effects are similar to case 3 where only aid is unconditional. However, if $p_2 < 1$ conditional aid has larger impact on local government expenditures than unconditional aid. Analysing the difference between (20) and (31) boils down to examining the sign of the following

$$\frac{\frac{a'(d)}{a'(d)+1}\widetilde{\pi}^s(1-p_1) + 1 - \pi - \frac{q'(G^d)}{\kappa_d}}{\widetilde{\pi}^d p_1 + \widetilde{\pi}^s(1-p_1) - \pi} - \frac{\frac{a'(d)}{a'(d)+1}p_2(1-p_1)\widetilde{\pi}^s + \frac{1}{a'(d)+1}p_1(1-p_2)\widetilde{\pi}^c + (1-p_1)(1-p_2)\widetilde{\pi}^{g_P} + 1 - \pi - \frac{q'(G^d)}{\kappa_d}}{p_1p_2\widetilde{\pi}^d + p_2(1-p_1)\widetilde{\pi}^s + p_1(1-p_2)\widetilde{\pi}^c + (1-p_1)(1-p_2)\widetilde{\pi}^{g_P} - \pi}$$

Notice that $\widetilde{\pi}^d p_1 + \widetilde{\pi}^s(1-p_1) - \pi > p_1p_2\widetilde{\pi}^d + p_2(1-p_1)\widetilde{\pi}^s + p_1(1-p_2)\widetilde{\pi}^c + (1-p_1)(1-p_2)\widetilde{\pi}^{g_P} - \pi$ and $\frac{a'(d)}{a'(d)+1}\widetilde{\pi}^s(1-p_1) > \frac{a'(d)}{a'(d)+1}p_2(1-p_1)\widetilde{\pi}^s + \frac{1}{a'(d)+1}p_1(1-p_2)\widetilde{\pi}^c + (1-p_1)(1-p_2)\widetilde{\pi}^{g_P}$, provided that $a'(d)$ is negative or close to 0. As a consequence,

$$\left.\frac{\partial g_P^*}{\partial d}\right|_{\text{case3}} - \left.\frac{\partial g_P^*}{\partial d}\right|_{\text{case4}} < 0$$

□

It should be specified that these results also hold when $(\mu_R/\mu_P = 0)$: the local government only seeks to maximise the welfare of the high-need subgroup in the community. This special scenario is an important consideration since the donor and the central government only cares about the sick. Therefore, even when the donor, the central and local government have fully aligned objective, conditional aid increases local health expenditures. These results should be weighted against those obtained under unconditional aid and grant (case 1). When preferences are aligned, conditionality increases local health

expenditures at the expenses of the local government's efforts to compensate for the misallocation of aid and grant. However, as the probability of rightly targeting the high-need group get close to one, the increase of local health expenditures to the sick subgroup reduces.

The marginal propensity of health expenditures to sick out of conditional grant is obtained by totally differentiating (19)

$$\frac{\partial g_P^*}{\partial a} = -\left(1 - \frac{\widetilde{\pi}^s(1-p_1)p_2 + \widetilde{\pi}^{g_P}(1-p_1)(1-p_2) + 1 - \pi - \frac{q'(G^d)}{\kappa_d}}{p_1p_2\widetilde{\pi}^d + p_2(1-p_1)\widetilde{\pi}^s + p_1(1-p_2)\widetilde{\pi}^c + (1-p_1)(1-p_2)\widetilde{\pi}^{g_P} - \pi}\right) \quad (21)$$

When the donor does not have perfect information about the distribution of local health needs, fiscal grants transferred to local communities are reduced. The fungibility of foreign aid can then be avoided only at the expenses of an increased burden on local fiscal policy. The examination of (21) and (35) (case 3 in the Appendix) demonstrates that conditional aid and grant reduce the marginal propensity of spending out of conditional grant.

Proposition 5. *Conditional aid increases the marginal propensity of the local government to spend on the high-need individuals out of the conditional grant when* $0 < p_1 < 1$ *and* $0 < p_2 < 1$.

Proposition 5 is proven in the Appendix.

The final question of interest concerns the varying of p_1 and p_2. From (19) I obtain

$$\frac{\partial g_p}{\partial p_1} = -\frac{p_2(h''(g_p^d) - h''(G_p^s)) + (1-p_2)(h''(G_p^c) - h''(g_p)}{h''(G_p^d)p_1p_2 + h''(G_p^c)p_1(1-p_2) + h''(G_p^s)(1-p_1)p_2 + h''(g_p)(1-p_1)(1-p_2) - \pi\frac{\mu_R}{\mu_p}\kappa_d} < 0$$

$$\frac{\partial g_P}{\partial p_2} = -\frac{p_1(h''(g_P^d) - h''(G_P^c)) + (1-p_1)(h''(G_P^s) - h''(g_P)}{h''(G_P^d)p_1p_2 + h''(G_P^c)p_1(1-p_2) + h''(G_P^s)(1-p_1)p_2 + h''(g_P)(1-p_1)(1-p_2) - \pi\frac{\mu_R}{\mu_P}\kappa_d} < 0$$

As the probabilities of successful targeting decrease, the local government has to increase its health expenditures to avoid a reduction in the welfare of the high-need relative to the low-need members. Therefore, the local government reallocates its health resources to target subgroups characterized by higher marginal health benefits. Nonetheless, the imperfect information setting creates a financial burden on the budget of the local government whose limited capacity may not permit it to reach its desired welfare level of the high-need relative to the low-need individuals.

The role of conditionality of health resources and its associated probability of successful

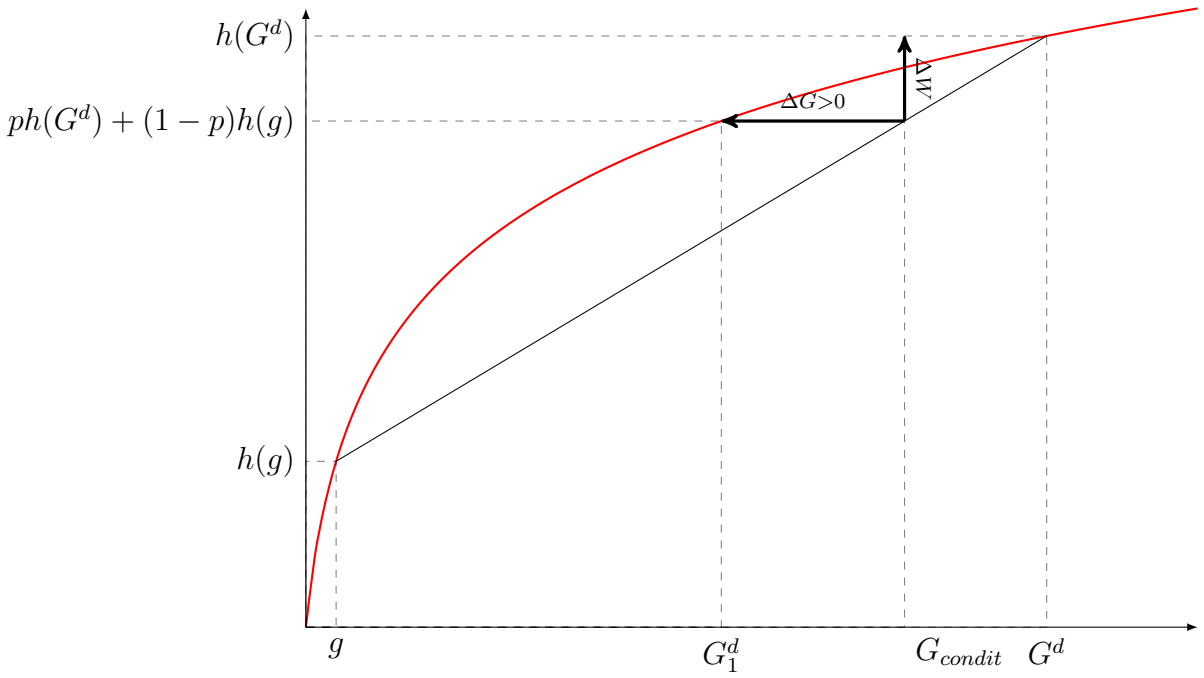

Figure 1: *Health Benefits Based on Conditional and Unconditional Health Resources*

targeting can be described as follows. If either fiscal grant or foreign aid is conditional, the probability weight of misallocating the health resources reduces the welfare of the high-need, as illustrated in fig. 1. The welfare loss of the sick, denoted $\triangle W$ is a decreasing function of the probability of successful target and is decreasing with $h(g)$, the minimum health benefit obtained by the sick in the absence of foreign aid and fiscal grant. Notice that when the total health expenditures are conditioned ($G_{condit} = pG^d + (1-p)g$), the level of welfare derived from this health care provision is similar to the welfare level obtained from the unconditional health provision G_1^d which is lower than G_{condit}. Consequently, the imperfect information setting generates a loss in external health resources $\triangle G$ that corresponds to the ineffectiveness of grant or foreign aid. In particular, the extent of health expenditure loss is given by $\triangle G = -(p(1-p)/2h''(G_{condit})/h'(G_{condit})$. This inefficiency increases with the concavity of the valuation function $h(.)$ and decreases with the probability of successful target.

These comparative statics results reveal some specific features about the response of the local government expenditures to different modalities of transfer of funds. When the donor (or the central government) has imperfect information about the local needs, conditional aid is only benefiting the low-need group. Reducing aid diversion through targeted programs

mostly improves the welfare of high-need individuals if the donor and the central government have perfect information or if the donor has perfect information and the central government transfers an unconditional grant to the local government. Other cases will necessarily lead to higher fungibility of aid.

4 Introducing two levels of health care

The examination of aid diversion and the effects of aid on local health expenditures and intergovernmental transfers was conducted in the last section in a simple theoretical framework, with only one level of health care services. In this section, I present the comparative statics effects of foreign aid when the health care sector is characterized by two level of health care, the primary and secondary health care. The motivation behind this introduction is to explore another source of aid fungibility. Indeed, donors tend to prioritize primary care services to respond to high-need individuals that do not have the financial capacity to use these services (such as the poor living in rural areas with limited access to health facilities). But it also refers to the donor's imperfect information about the whole health sector, creating discrepancies between the decision of the donor and the central government to allocate health resources optimally. Consequently, the optimal response of the recipient government could be to divert health resources to higher level of care leading to fungibility of aid.

Suppose that the central government is responsible for financing a higher level of care (e.g. national public hospital). The consumption of this service is valued $v(\theta_k, a_k^h)$ by individuals of type k. The function $v(\theta_k, .)$ is assumed to be increasing, smooth and strictly concave in its second argument. Denote m_i the unit cost of providing secondary health care services per capita in community i. I assume that in each community i, the unit cost of secondary care is higher than the unit cost of primary care, $m_i > q_i$.

For simplicity, I assume that the primary and secondary health care services are only used by the poor and ill subgroup in each community[4]. However, the federal government uses an income tax τ on the rich to finance its health expenditures. As before, local health expenditures G_i (which are now referred to as primary care) are financed by local governments through user fees, fiscal grant, a^g, and possibly foreign aid, d. Individuals value the two goods differently depending on each level of consumption. In particular,

[4]This assumption only simplifies the calculations but does not affect the overall findings detailed below insofar as the donor only cares about the poor.

$h'(0) > v'(0) > h'(\bar{G}_i)$ where $\bar{G}_i$ represents the minimum amount of primary care services such that $v'(\theta_{ik}, a_k^h) > h'(\theta_{ik}, G_i)$ for all $G_i > \bar{G}_i$. As before, I assume that $d_i > a_i^g$ in every community.

Unconditional aid

Given its preferences for the ill and healthy individuals, the central government solves the following problem

$$\underset{a^g, a^h}{max} \sum_i N_i \{\pi_i \mu_{ip}^c [h(\theta_{iP}, g_{iP} + a_i^g + d_i) + v(\theta_{iP}, a_i^h)]\}$$

subject to the central government budget constraints

$$\sum_i q_i a_i^g + \sum_i m_i a_i^h \leq \sum_i N_i (1 - \pi_i) y_i \tau \tag{22}$$

$$g_i + d_i + a_i^g \leq \bar{G}_i \tag{23}$$

The last constraint denotes the central government willingness to invest in the higher level of care once the primary health care facilities have reached the investment threshold. Under the assumption that the donor solely focuses on primary health care, the optimal public provision of the federal government is to allocate the minimum health resources to reach this threshold. If the donor's resources, d_i, in community i, do not exceed $\bar{G}_i - g_i - a_i^g$, the constraint never binds. Hence, for the sake of interest, I assume that $g_i + d_i = \bar{G}_i - \epsilon$. Consequently, the central government only needs to transfer a minimum health resource a^g to reach the primary health care threshold.

At community i level, the optimal provision of health resources between primary care and higher level of care is determined by the following first-order conditions:

$$N_i \pi_i \mu_{iP}^c h_2(\theta_{iP}, g_{iP} + a_{ip}^g + d_i) - \lambda_1 q_i - \lambda_2 = 0 \tag{24}$$

$$N_i \pi_i \mu_{iP}^c v_2(\theta_{iP}, a_{ip}^h) - \lambda_1 m_i = 0 \tag{25}$$

where λ_1 and λ_2 denote the Lagrange multiplier attached to the constraints (22) and (23) respectively. Combining (24) and (25), I obtain the marginal rate of substitution between

the consumption of the primary care good and the secondary health care good:

$$MRS_i^{a^g a^h} = \frac{h_2(\theta_{iP}, g_{iP} + a_{iP}^g)}{v_2(\theta_{iP}, a_{iP}^h)} = \frac{1}{m_i}(q_i + \frac{\lambda_2}{\lambda_1}) \tag{26}$$

The absence of the donor ($d = 0$) implies that the constraint (23) is non-binding and $MRS_i^{a^g a^h} = q_i/m_i < 1$. Consequently, the optimal resource transfer from the central government is such that $a^g > a^h$. This inequality reflects the higher investment of the federal government in primary health care in absence of foreign aid. On the other hand, the presence of the donor ($d > 0$) results in the binding constraint (23) and $MRS_i^{a^g a^h} > 1$, provided that $q_i + \lambda_2/\lambda_1 > m_i$. The optimal transfer of health resources from the central government is characterized by a higher allocation of resources to secondary health care services ($a^g < a^h$). Notice that λ_2 is the marginal utility of total health expenditures when they meet the threshold $\bar{G}_i$. Hence, a surge in foreign aid generates a reallocation of central government resources from primary to secondary health care if the marginal health benefit of the sick at $\bar{G}_i$ is large enough.

So far, the optimal allocation analysis within the health sector has been treated only under of the donor's unrestricted budget support to the local government, and I shall now turn to examine the implication of conditional aid.

Conditional aid

As before, the donor targets successfully the high-need subgroup with community i with a probability p_2. Consequently, the donor's misallocation of funds may reduce the level of primary care services for the high-need individuals while the overall total primary care expenditures in the community is unchanged. The central government solves the following maximisation problem:

$$\underset{a^g, a^h}{max} \sum_i N_i \{\pi_i \mu_{ip}^c [h(\theta_{iP}, g_{iP} + a_i^g + d_i)p_2 + h(\theta_{iP}, g_{iP} + a_i^g)(1 - p_2) + v(\theta_{iP}, a_i^h)]\}$$

subject to the same constraints of the unconditional problem, (22) and (23) respectively. From the first-order conditions, the derived optimal health resources are given by:

$$N_i \pi_i \mu_{iP}^c (h_2(\theta_{iP}, g_{iP} + a_{ip}^g + d_i)p_2 + + h_2(\theta_{iP}, g_{iP} + a_i^g)(1 - p_2) - \lambda_1 q_i - \lambda_2 = 0 \tag{27}$$

$$N_i \pi_i \mu_{iP}^c v_2(\theta_{iP}, a_{ip}^h) - \lambda_1 m_i = 0 \tag{28}$$

This yields to the marginal rate of substitution between the consumption of the primary care and the secondary health care good:

$$MRS_i^{a^g a^h} = \frac{h_2(\theta_{iP}, g_{iP} + a_{ip}^g + d_i)p_2 + +h_2(\theta_{iP}, g_{iP} + a_i^g)(1 - p_2)}{v_2(\theta_{iP}, a_{iP}^h)} = \frac{1}{m_i}(q_i + \frac{\lambda_2}{\lambda_1}) \tag{29}$$

In the presence of foreign aid, the constraint (23) is binding and $MRS_i^{a^g a^h} > 1$. However the comparison of (29) with (26) indicates that the marginal rate of substitution between the consumption of primary care and secondary care services is lower in the case of conditional aid (because the marginal utility of health care services consumption is lower for the low-need group). This result implies that the conditionality of aid reduces the ability of the central government to transfer health resources from primary care to secondary care services when the probability of the donor to target the low-need group increases.

Proposition 6. *Conditional aid reduces health resources to secondary health care services transferred from the central government when the probability of the donor to target successfully the high-need group is lower than one.*

Hence, conditional aid limits the reallocation of the central government's funding from primary to secondary health care.

5 Conclusion

The issue of fungibility of aid has been widely explored in the related theoretical literature through the lens of the Principal-Agent model. Within this approach, the donor can write a contract that specifies where the funds are to be spent based on the observable consequences of the recipient's actions (outcomes produced or inputs used). The objective of the donor is then to restrain the recipient from self-interested efforts. The use of this setting is justified on the basis that the donor has perfect information about the needs in the recipient country but is unable to observe the recipient's actions. However, I show in this work that these results might be sensitive to the information structure.

I develop a model that departs from the analytical approach used in the Principal-Agent setting by assuming (1) that the donor does not have perfect information about the local needs in the recipient country, and (2) that the recipient country does not engage in self-interested efforts upon receiving foreign aid. The novelty of my approach is to examine how

foreign aid affects the intergovernmental transfers of health resources in a federal structure system and to assess its implications on local health expenditures. Asymmetric information is characterized by the donor and central government's imperfect observation of the local needs while the local government has full observability. In this theoretical setting, the assumptions of the contract theory no longer hold, and I employ a comparative statics analysis of the effects of foreign aid on local health expenditures and intergovernmental transfers.

I distinguish among several cases characterised by the existence of conditionality of foreign aid and fiscal grants. Intuitively, one might expect that funds transferred as unrestricted budget support to the local government contribute to the fungibility issue and the ineffectiveness of aid, compared to the case where aid is conditional or used to finance directly a specific program. However, when the local government is committed to maximising the social welfare of the ill (and poor) individuals and the donor has limited information about which group in the local community has the highest health need, I find that unconditional aid generates the maximum welfare gain for the high-need group. I also find that conditional aid has more of an increasing effect on the local health expenditures than unrestricted budget support. However, this increase in local government spending on the high-need individuals is the result of the local government's efforts to compensate for the inappropriate allocation of the donor's funding to the low-need group in the community. As the probability of the donor to successfully target the high-need group raises, the expansionary effect of foreign aid on the local government expenditures diminishes. This result suggests that conditionality of aid could have disruptive effects on the recipient's health system when the donor has imperfect information and the local government is committed to reducing the burden of disease of the high-need group. In this setting, the apparent decrease of aid fungibility associated with conditional aid is the result of local government attempts to compensate for the donor's misallocation.

When there are two levels of health care provision and the donor earmarks aid to primary care services, the central government is forced to reduce health resources dedicated to the secondary level in order to increase those of the primary health care sector. This situation gives rise to suboptimal health outcomes when the secondary health sector is under-allocated and the marginal health benefit of secondary health services is higher than that of primary health services. This result highlights the potentially disruptive effects of conditionality of aid on the recipient health system.

Limited data on the source of most new infections in a given country and which inter-

ventions are most effective in which settings reduces the ability of the donors to allocate health resources most strategically. These findings illuminate the need for engaging the recipient country in health strategies. When local communities have perfect information about the distribution of health need, country ownership of foreign aid increases the efficiency of aid. One challenge is the presence of multiple donors with different objectives and preferences that make it practically impossible for the recipient government to use the whole external resources optimally. It is likely that the multitude of aid assistance creates externalities even within the health sector that give raise to inefficiencies. Measuring the impact of one specific program by ignoring the presence of other donors or interventions is likely to produced biased results. Ownership of health priorities by low-income countries and collaborative partnership among the various global health partners should be key priorities. An interesting future research would be to incorporate the externalities generated by program interventions among multiple donors in a specific community to evaluate the overall health outcome with respect to the donors' objectives. Empirical research could also provide support on the model developed in this research by estimating the effects of conditional aid and unconditional budget support on domestic health expenditures at sub-national levels (district and community level).

Appendix

A Local public provision of health care with domestic resources

Proofs of Unconditional fiscal grant

If the central government decides to transfer an unconditional (without use restrictions) lump sum grant per capita a_i to community i, the optimal local expenditures for the provision of health services selected by the local government solves

$$\underset{G^c_{iP},G^c_{iR}}{Max}\{\pi_i\mu_{iP}h(\theta_P,G^c_{iP})+(1-\pi_i)\mu_{iR}[h(\theta_R,G^c_{iR})-c_ig_{iR}]\}$$

subject to the budget constraint:

$$q_i(G^c_i)G^c_i\leq(1-\pi_i)c_ig_{iR}+a^g_iq_i(G^c_i)$$

where the total provision of the private good for group k is denoted by $G^c_{ik}=g_{ik}+a^g_i$ with $g_i=\pi_ig_{ip}+(1-\pi_i)g_{iR}$.

Note that $G^c_i=\pi_iG^c_{iP}+(1-\pi_i)G^c_{iR}$. Inserting the budget constraint into the objective function of the local government by replacing c_ig_{iR} and the first-order condition writes:

$$\pi_i\mu_{iP}h_2(\theta_P,G^c_{iP})-\mu_{iR}\pi_i[q'_i(G^c_i)G^c_i+q_i(G^c_i)]+\mu_{iR}\pi_ia^g_iq'_i(G^c_i)=0$$

$$\begin{aligned}h_2(\theta_P,G^c_{iP})&=\frac{\mu_{iR}}{\mu_{iP}}q'_i(G^c_i)(G^c_i-a^g_i)+q(G^c_i)\\&=\frac{\mu_{iR}}{\mu_{iP}}q'_i(G^c_i)g_i+q(G^c_i)\end{aligned}$$

since $G^c_i=g_i+a^g_i$. Likewise, the FOC with respect to the second argument lead to:

$$(1-\pi_i)\mu_{iR}h_2(\theta_P,G^c_{iR})-\mu_{iR}(1-\pi_i)[q'_i(G^c_i)G^c_i+q_i(G^c_i)]+\mu_{iR}(1-\pi_i)a^g_iq'_i(G^c_i)=0$$

Hence,

$$\begin{aligned}h_2(\theta_P,G^c_{iR})&=q'_i(G^c_i)(G^c_i-a^g_i)+q(G^c_i)\\&=q'_i(G^c_i)g_i+q(G^c_i)\end{aligned}$$

Proofs of Conditional fiscal grant

The marginal propensity to spend on the sick out of conditional grant is obtained by applying the implicit function theorem on the first order-condition (9) gives:

$$\begin{aligned}
\frac{\partial g_P^*}{\partial a^g} &= -\frac{h_{22}(\theta_P, g_P)p_1 - \frac{\mu_R}{\mu_P}(q''(G^c)g + q'(G^c)}{h_{22}(\theta_P, G_P^c)p_1 + h_{22}(\theta_P, g_P)(1-p_1) - \pi\frac{\mu_R}{\mu_P}(q''(G^c)g + 2q'(G^c))} \\
&= -\left(1 - \frac{h_{22}(\theta_P, g_P)(1-p_1) + \frac{\mu_R}{\mu_P}(q''(G^c)g + q'(G^c) - \pi\frac{\mu_R}{\mu_P}(q''(G^c)g + 2q'(G^c)}{h_{22}(\theta_P, G_P^c)p_1 + h_{22}(\theta_P, g_P)(1-p_1) - \pi\frac{\mu_R}{\mu_P}(q''(G^c)g + 2q'(G^c))}\right) \\
&= -\left(1 - \frac{1-p_1 + \frac{\mu_R}{\mu_P}\frac{q''(G^c)g + 2q'(G^c)(1-\pi) - q'(G^c)}{h_{22}(\theta_P, g_P)}}{p_1\frac{h_{22}(\theta_P, G_P^c)}{h_{22}(\theta_P, g_P)} + 1 - p_1 - \pi\frac{\mu_R}{\mu_P}\frac{q''(G^c)g + 2q'(G^c)}{h_{22}(\theta_P, g_P)}}\right) \\
&= -\left(1 - \frac{1-p_1 + \frac{\mu_R}{\mu_P}\frac{\kappa_c(1-\pi) - q'(G^c)}{h_{22}(\theta_P, g_P)}}{p_1\frac{h_{22}(\theta_P, G_P^c)}{h_{22}(\theta_P, g_P)} + 1 - p_1 - \pi\frac{\mu_R}{\mu_P}\frac{\kappa_c}{h_{22}(\theta_P, g_P)}}\right)
\end{aligned}$$

with $\kappa_c = q''(G^c)g + 2q'(G^c)$.

B Public provision of health care resources with foreign aid

Proof of case 1: Grant a and aid d unconditional

Totally differentiating (13) yields the following marginal propensity to spend out of aid:

$$\begin{aligned}
\frac{\partial g_P^*}{\partial d} &= -(a'(d)+1)\frac{h_{22}(\theta_P, G_P^d) - \frac{\mu_R}{\mu_P}(q''(G^d)g + q'(G^d)}{h_{22}(\theta_P, G_P^d) - \pi\frac{\mu_R}{\mu_P}(q''(G^d)g + 2q'(G^d)} \\
&= -(a'(d)+1)\left(1 - \frac{\frac{\mu_R}{\mu_P}(q''(G^d)g + q'(G^d) - \pi\frac{\mu_R}{\mu_P}(q''(G^d)g + 2q'(G^d)}{h_{22}(\theta_P, G_P^d) - \pi\frac{\mu_R}{\mu_P}(q''(G^d)g + 2q'(G^d)}\right) \\
&= -(a'(d)+1)\left(1 - \frac{\frac{\mu_R}{\mu_P}(1-\pi)\kappa_d - \frac{\mu_R}{\mu_P}q'(G^d)}{h_{22}(\theta_P, G_P^d) - \pi\frac{\mu_R}{\mu_P}\kappa_d}\right) \\
&= -(a'(d)+1)\left(1 - \frac{1-\pi - \frac{q'(G^d)}{\kappa_d}}{\widetilde{\pi}^d - \pi}\right)
\end{aligned}$$

with $\widetilde{\pi}^d = \frac{h_{22}(\theta_P, G_p^d)}{\kappa_d}\frac{\mu_P}{\mu_R}$ and $\kappa_d = q''(G^d)g + 2q'(G^d)$.

Case 3. Conditional grant a and unconditional aid d

In this situation, the local government allocates its local resources g as well as the external funding that it receives from the donor. However, it has no control over the allocation of the federal grant a. The optimal resource allocations solve the problem:

$$\underset{G_P^{gd},G_R^{gd}}{max} \left[\pi\mu_P W^P(\theta_P, G_P^d) + (1-\pi)\mu_R W^R(\theta_R, g_R)\right] p_1 + \left[\pi\mu_P W^P(\theta_P, G_P^s) + (1-\pi)\mu_R W^R(\theta_R, G_{pR}^c)\right](1-p_1)$$

s.t. $q(G^d)G^s \leq (1-\pi)cg_R + dq(G^d)$

where $G_P^s = g_P + d$ and $G^s = g + d$. The local government's first-order conditions yield to:

$$\frac{\partial W^P(\theta_P, G_p^d)}{\partial G_P^s} p_1 + \frac{\partial W^P(\theta_P, G_P^s)}{\partial G_P^s}(1-p_1) = \frac{\mu_R}{\mu_P} q(G^d)\left(1 + \frac{1}{e(G^d)}\frac{g}{G^d}\right) \tag{30}$$

Sufficient conditions for the existence of a unique maximum are

$$h_{22}(\theta_P, G_P^d)p_1 + h_{22}(\theta_P, G_P^s)(1-p_1) - \frac{\mu_R}{\theta_P\mu_P}(q''(G^d)g + q'(G^d)) < 0$$

Unconditional aid transfer to the local government coupled with a conditional grant leads to similar results to the previous case. The welfare loss of conditional grant is given by the probability of the central government to misallocate its funds (targeting the low-need) and the social welfare difference between $W(G_P^d)$ and $W(G_P^s)$. In particular, if the share of foreign aid on total health expenditures is high and close to unity, the welfare loss of conditional grant becomes marginal. Totally differentiating (30), the effects of aid on local

health expenditures are given by:

$$\frac{\partial g_P^*}{\partial d} = -\frac{(a'(d)+1)h_{22}(\theta_P, G_P^d)p_1 + h_{22}(\theta_P, G_P^s)(1-p_1) - (a'(d)+1)\frac{\mu_R}{\mu_P}(q''(G^d)g + q'(G^d)}{h_{22}(\theta_P, G_P^d)p_1 + h_{22}(\theta_P, G_P^s)(1-p_1) - \pi\frac{\mu_R}{\mu_P}(q''(G^d)g + 2q'(G^d))} \tag{31}$$

$$= -(a'(d)+1)\left(1 - \frac{h_{22}(\theta_P, G_P^s)(1-\frac{1}{a'(d)+1})(1-p_1) + \frac{\mu_R}{\mu_P}(\kappa_d - q'(G^d) - \pi\kappa_d)}{h_{22}(\theta_P, G_P^d)p_1 + h_{22}(\theta_P, G_P^s)(1-p_1) - \pi\frac{\mu_R}{\mu_P}\kappa_d}\right) \tag{32}$$

$$= -(a'(d)+1)\left(1 - \frac{h_{22}(\theta_P, G_P^s)\frac{a'(d)}{a'(d)+1}(1-p_1) + \frac{\mu_R}{\mu_P}\left(\kappa_d(1-\pi) - q'(G^d)\right)}{\theta_P, G_P^d)p_1 + h_{22}(\theta_P, G_P^s)(1-p_1) - \pi\frac{\mu_R}{\mu_P}\kappa_d}\right) \tag{33}$$

$$= -(a'(d)+1)\left(1 - \frac{\frac{a'(d)}{a'(d)+1}\widetilde{\pi}^s(1-p_1) - \frac{q'(G^d)}{\kappa_d} + 1 - \pi}{\widetilde{\pi}^d p_1 + \widetilde{\pi}^s(1-p_1) - \pi}\right) \tag{34}$$

where

$$\widetilde{\pi}^k = \frac{h_{22}(\theta_P, G_p^k)}{\kappa^d}\frac{\mu_P}{\mu_R}$$

The effects of foreign aid on local health expenditures critically depend on the sign of $a'(d)$. If the central government decides to tie its fiscal grant to the presence of foreign aid ($a'(d) > 0$), then local expenditures increase.

Comparing (31) with the case of unconditional aid and grant (14), the impact of an conditional grant on the partial effect of aid on local government spending depends on the sign of $a'(d)/(a'(d)+1)\widetilde{\pi}^s(1-p_1) - q'(G^d)/\kappa_d$ [5]. When this term is positive, conditional grant increases the effects of aid on local health expenditures to the high-need. However the positivity condition cannot hold if the central government has almost perfect information about local health need (p_1 close to 1) or if the effect of aid on fiscal grant is insignificant ($a'(d)$ close to 0). In such cases, conditional grant reduces the effect of aid on the local health expenditures to the high-need group.

In addition, since conditional grant funding increases with foreign aid, the local government can reduce its own health expenditures. Nonetheless, this effect is mitigated by the probability that the central government incorrectly assesses the local needs of each subgroup.

[5] The case where $a'(d) < 0$ is omitted as it constitutes a straightforward source of fungibility of aid. However, this case can be easily included in the reasoning below, and will be mostly the opposite of the results obtained when the marginal effect of aid on fiscal grant is positive.

Consequently, the maximum effect of external aid on local expenditures is reached when $p_1 = 0$ and decreases with p_1 increasing.

The comparison of case 2 (18) and case 3 (31) leads to more ambiguous results and depends on the probabilities of the donor and the central government to successfully target the high-need group, as well as the central government's response to foreign aid. When both the central government and the donor have perfect information ($p_1 = p_2 = 1$), the case where fiscal grant is conditional (case 2) has lower increasing effect on the local health expenditures propensity to spend out of aid than the case where aid is conditional (case 3), provided that $d > a$. The logic behind this mimics the proof in case 2 (conditional aid and unconditional grant): since the local government increases its health care spending to compensate the misallocation of resources from either the donor or the central government, the marginal propensity to spend out of aid depends directly on probability that local needs are correctly assessed and on the quantity of health resources transferred.

The effects of an conditional grant on local government spending in the presence of unconditional aid are obtained from totally differentiating the first-order condition:

$$\frac{\partial g_P^*}{\partial a} = -\frac{h_{22}(\theta_P, G_P^d)p_1 - \frac{\mu_R}{\mu_P}(q''(G^d)g + q'(G^d)}{h_{22}(\theta_P, G_P^d)p_1 + h_{22}(\theta_P, G_P^s)(1-p_1) - \pi\frac{\mu_R}{\mu_P}(q''(G^d)g + 2q'(G^d)} \tag{35}$$

$$= -\left(1 - \frac{h_{22}(\theta_P, G_P^s)(1-p_1) + \frac{\mu_R}{\mu_P}(q''(G^d)g + q'(G^d) - \pi\frac{\mu_R}{\mu_P}(q''(G^d)g + 2q'(G^d)}{h_{22}(\theta_P, G_P^d)p_1 + h_{22}(\theta_P, G_P^s)(1-p_1) - \pi\frac{\mu_R}{\mu_P}(q''(G^d)g + 2q'(G^d)}\right) \tag{36}$$

$$= -\left(1 - \frac{(1-p_1) + \frac{\mu_R}{\mu_P}\frac{\kappa_d(1-\pi) - q'(G^d)}{h_{22}(\theta_P, G_P^s)}}{\frac{h_{22}(\theta_P, G_P^d)}{h_{22}(\theta_P, G_P^s)}p_1 + 1 - p_1 - \pi\frac{\mu_R}{\mu_P}\frac{\kappa_d}{h_{22}(\theta_P, G_P^s)}}\right) \tag{37}$$

$$= -\left(1 - \frac{(1-p_1)\widetilde{\pi}^s + 1 - \pi - \frac{q'(G^d)}{\kappa_d}}{p_1\widetilde{\pi}^d + (1-p_1)\widetilde{\pi}^s - \pi}\right) \tag{38}$$

with $\widetilde{\pi}^s = \frac{h_{22}(\theta_P, G_p^s)}{\kappa^d}\frac{\mu_P}{\mu_R}$.

Comparing the case where the donor is absent (12) with (35) reveals that these effects are ambiguous. Assuming $\kappa_j < 0$, the comparative effects of an conditional grant in the presence and the absence of foreign aid depends on the difference in the marginal rate of substitution between conditional grant with unconditional aid and conditional aid alone. It

means that the level of local health expenditures critically depends on the effects of aid on the marginal health benefit of high-need individuals.

Proposition 7. *If the donor's intervention has a significantly large effect on the marginal health benefit of the high-need members or when p_1 is large enough, the local government's marginal propensity to spend out of conditional grant is higher with foreign aid than without it.*

Proof. Compare the effects of conditional grant with (35) and without (12) foreign aid. The condition under which foreign aid negatively affects the marginal propensity to spend out of conditional grant is

$$\frac{h_{22}(\theta_P, G_P^d)}{h_{22}(\theta_P, G_P^s)} p_1 + 1 - p_1 - \pi \frac{\mu_R}{\mu_P} \frac{\kappa_d}{h_{22}(\theta_P, G_P^s)} > \frac{h_{22}(\theta_P, G_P^c)}{h_{22}(\theta_P, g_P)} p_1 + 1 - p_1 - \pi \frac{\mu_R}{\mu_P} \frac{\kappa_c}{h_{22}(\theta_P, g_P)}$$

$$p_1 \left(\frac{h_{22}(\theta_P, G_P^c)}{h_{22}(\theta_P, g_P)} - \frac{h_{22}(\theta_P, G_P^d)}{h_{22}(\theta_P, G_P^s)} \right) < \pi \frac{\mu_R}{\mu_P} \left(\frac{\kappa_c}{h_{22}(\theta_p, g_p)} - \frac{\kappa_d}{h_{22}(\theta_p, G_p^s)} \right)$$

In addition, $\kappa_c > \kappa_d$ (if $\kappa_j < 0$) and $g_P < G_P^s = g_P + d$. Hence one of the condition under which this last inequality is satisfied is when p_1 is close enough to 0.
The other condition comes from the comparison of the numerators between (35) and (12). In particular, foreign aid deteriorates the marginal propensity to spend out of conditional grant if

$$\frac{\kappa_c(1-\pi) - q'(G^c)}{h_{22}(\theta_P, g_P)} > \frac{\kappa_d(1-\pi) - q'(G^d)}{h_{22}(\theta_P, G_P^s)}$$

This last inequality is ambiguous as $\kappa_c > \kappa_d$ and $h_{22}(\theta_P, g_P) < h_{22}(\theta_P, G_P^s)$. Therefore, this inequality holds if the effect of foreign aid on the marginal health benefit of the high-need groups is small enough. □

Provided that foreign aid has significant impact on the marginal health benefit of the high-need, local government expenditures rise with external funding. However, when the probability of the central government to rightly target the high-need group is low or when the amount of foreign aid d is small enough, this result does not hold and the donor funds exacerbate the reduction in local expenditures. This result holds even if the local government cares only about high-need individuals ($\mu_R = 0$). On the other hand, if the local government only maximizes the welfare of the low-need group, then the presence of

foreign aid increases the local government's expenditures for health care services toward the sick when the fiscal grant is conditional.

Proofs of Case 4. Conditional grant a and aid d

I use the Implicit Function Theorem to derive the marginal effect of foreign aid on the optimal local health expenditures.

$$\frac{dg_P^*}{dd} = -\frac{(a'(d)+1)h_{22}(\theta_P, G_P^d)p_1p_2 + a'(d)h_{22}(\theta_P, G_P^c)p_1(1-p_2)}{h_{22}(\theta_P, G_P^d)p_1p_2 + h_{22}(\theta_P, G_P^c)p_1(1-p_2) + h_{22}(\theta_P, G_P^s)(1-p_1)p_2 + h_{22}(\theta_P, g_P)(1-p_1)(1-p_2) - \pi\frac{\mu_R}{\mu_P}\kappa_d}$$
$$-\frac{h_{22}(\theta_P, G_P^s)(1-p_1)p_2 - (a'(d)+1)\frac{\mu_R}{\mu_P}(\kappa_d - q'(G^d)}{h_{22}(\theta_P, G_P^d)p_1p_2 + h_{22}(\theta_P, G_P^c)p_1(1-p_2) + h_{22}(\theta_P, G_P^s)(1-p_1)p_2 + h_{22}(\theta_P, g_P)(1-p_1)(1-p_2) - \pi\frac{\mu_R}{\mu_P}\kappa_d}$$

Define $\widetilde{\pi}^k = \frac{h_{22}(\theta_p, G_p^k)}{\kappa_d}\frac{\mu_P}{\mu_R}$. Then,

$$\frac{dg_P^*}{dd} = -\frac{(a'(d)+1)\widetilde{\pi}^d p_1p_2 + a'(d)\widetilde{\pi}^c p_1(1-p_2) + \widetilde{\pi}^s(1-p_1)p_2 - (a'(d)+1)(1-\frac{q'(G^d)}{\kappa_d})}{\widetilde{\pi}^d p_1p_2 + \widetilde{\pi}^c p_1(1-p_2) + \widetilde{\pi}^s(1-p_1)p_2 + \widetilde{\pi}^{g_P}(1-p_1)(1-p_2) - \pi}$$
$$= -(a'(d)+1)\left(1 - \frac{\frac{a'(d)}{a'(d)+1}p_2(1-p_1)\widetilde{\pi}^s + \frac{1}{a'(d)+1}p_1(1-p_2)\widetilde{\pi}^c + (1-p_1)(1-p_2)\widetilde{\pi}^{g_P} + 1 - \pi - \frac{q'(G^d)}{\kappa_d}}{p_1p_2\widetilde{\pi}^d + p_2(1-p_1)\widetilde{\pi}^s + p_1(1-p_2)\widetilde{\pi}^c + (1-p_1)(1-p_2)\widetilde{\pi}^{g_P} - \pi}\right)$$

I should then examine the special case when the local government only cares about the sick ($\mu_R/\mu_P = 0$). In this scenario, equation (20) becomes

$$\frac{\partial g_P^*}{\partial d}\Big|_{\frac{\mu_P}{\mu_R}=0} = -(a'(d)+1)\left(1 - \frac{\frac{a'(d)}{a'(d)+1}p_2(1-p_1)h_{22}(\theta_P, G_P^s) + \frac{1}{a'(d)+1}p_1(1-p_2)h_{22}(\theta_P, G_P^c) + (1-p_1)(1-p_2)h_{22}(\theta_P, g_P)}{p_1p_2h_{22}(\theta_P, G_P^d) + p_2(1-p_1)h_{22}(\theta_P, G_P^s) + p_1(1-p_2)h_{22}(\theta_P, G_P^c) + (1-p_1)(1-p_2)h_{22}(\theta_P, g_P)}\right)$$

Proof of Proposition 5:

Consider the difference in equations (35) and (21). It follows that:

$$\left.\frac{\partial g_P^*}{\partial a}\right|_{\text{case3}} - \left.\frac{\partial g_P^*}{\partial a}\right|_{\text{case4}} =$$
$$\frac{(1-p_1)\widetilde{\pi}^s + 1 - \pi - \frac{q'(G^d)}{\kappa_d}}{p_1\widetilde{\pi}^d + (1-p_1)\widetilde{\pi}^s - \pi} - \frac{\widetilde{\pi}^s(1-p_1)p_2 + \widetilde{\pi}^{g_P}(1-p_1)(1-p_2) + 1 - \pi - \frac{q'(G^d)}{\kappa_d}}{p_1p_2\widetilde{\pi}^d + p_2(1-p_1)\widetilde{\pi}^s + p_1(1-p_2)\widetilde{\pi}^c + (1-p_1)(1-p_2)\widetilde{\pi}^{g_P} - \pi}$$

Define the difference in the numerator as

$$A = (1-p_1)\widetilde{\pi}^s - (\widetilde{\pi}^s(1-p_1)p_2 + \widetilde{\pi}^{g_P}(1-p_1)(1-p_2)) = (1-p_1)(1-p_2)\,(\widetilde{\pi}^s - \widetilde{\pi}^{g_P}) > 0$$

if $0 < p_1 < 1$ and $0 < p_2 < 1$ since $\widetilde{\pi}^s > \widetilde{\pi}^{g_P}$. In addition, define B as the difference in the denominators:

$$\begin{aligned} B &= p_1\widetilde{\pi}^d + (1-p_1)\widetilde{\pi}^s - \left(p_1p_2\widetilde{\pi}^d + p_2(1-p_1)\widetilde{\pi}^s + p_1(1-p_2)\widetilde{\pi}^c + (1-p_1)(1-p_2)\widetilde{\pi}^{g_P}\right) \\ &= p_1(1-p_2)\widetilde{\pi}^d + (1-p_1)(1-p_2)\widetilde{\pi}^s - (p_1(1-p_2)\widetilde{\pi}^c + (1-p_1)(1-p_2)\widetilde{\pi}^{g_P}) \\ &= (1-p_1)(1-p_2)\left(\widetilde{\pi}^s - \widetilde{\pi}^{g_P} + \frac{p_1}{1-p_1}(\widetilde{\pi}^d - \widetilde{\pi}^c)\right) > 0 \end{aligned}$$

if $0 < p_1 < 1$ and $0 < p_2 < 1$ since $\widetilde{\pi}^d > \widetilde{\pi}^c$ and $\widetilde{\pi}^s > \widetilde{\pi}^{g_P}$. It follows that $B > A$, then

$$\left.\frac{\partial g_P^*}{\partial a}\right|_{\text{case3}} < \left.\frac{\partial g_P^*}{\partial a}\right|_{\text{case4}}$$

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