

Useful Government Consumption and the Long-Run Effect of Aid on Output

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Abstract

Foreign aid finances both public consumption and investment in developing countries. However, its long-run impact on output in recipient countries remains ambiguous. We show in a tractable general equilibrium model that when public consumption substitutes for private consumption in an Edgeworth Pareto sense, aid earmarked for public consumption decreases the marginal utility of private consumption and raises the marginal disutility of labor. This induces a simultaneous fall in private consumption and labor supply thereby diminishing and potentially, outweighing the positive effect that aid-financed public investment has on output. In contrast, Edgeworth complementarity between private and public consumption reinforces the positive effect of aid-financed public investment. This is because aid allocated to public consumption raises the marginal utility of private consumption and reduces the disutility of labor. These results have important implications for policies regarding aid allocation as well as ongoing studies that examine aid effectiveness in general equilibrium models.

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1 Introduction

“That reconfiguration of aid, and the design and implementation of effective aid, requires a deeper understanding of aid’s impact and the overall funding and policy environment in which it operates. There are many dimensions to this understanding, and no single individual, nor any one organization, can claim to have all the answers. Aid is far too multi-dimensional and complex for that.” [Addison and Tarp, 2015]

Foreign aid remains an important source of finance for both government consumption and investment in developing countries. However, the impact of aid on real GDP in these economies has long been difficult to pin down. On the empirical front, an extensive literature attempts to quantify the effect of aid on output. The results from these studies spans a large spectrum with studies finding positive (Juselius, Møller, and Tarp, 2014), negative (Herzer and Morrissey, 2013), insignificant (Doucouliagos and Paldam, 2009), and mixed (Gyimah-Brempong, Racine, and Gyapong, 2012) effects. Several factors including but not limited to institutional quality, geographic location, and absorptive capacity of recipient countries have been cited as key determinants of aid effectiveness (Herzer and Morrissey, 2013, for a review). Theoretical contributions toward understanding the channels/mechanisms through which foreign aid may affect real GDP and why the effect may vary across recipient countries remain sparse (Chatterjee, Giuliano, and Kaya, 2012). Consequently, there is still much work to be done, theoretically and empirically, to understand *what* the long-run aid-output relationship is, and more importantly, the mechanisms that drive this relationship (Addison and Tarp, 2015).

Against this backdrop, this paper complements and contributes to the theoretical literature by illustrating in a tractable general equilibrium model that Edgeworth substitutability/complementarity between private and public consumption is a crucial determinant of the sign and size of the long-run effect of aid on output. More precisely, in the presence of Edgeworth substitutability, an increase in aid allocated to public consumption induces a simultaneous fall in the marginal utility of private consumption and a rise in disutility of labor. This leads to a fall in private consumption and labor supply. The latter erodes the positive

impact of aid on output induced by aid earmarked for public investment. More importantly, if this offsetting effect is large enough, it can potentially outweigh the overall positive effect of aid on output. On the other hand, the positive effect of aid on output generated by public investment is augmented if public consumption complements private consumption in the Edgeworth Pareto sense. Here, the marginal utility of private consumption rises and disutility of labor decreases thereby generating a contemporaneous rise in private consumption and labor supply.

The relationship between private and public consumption is important in the foreign-aid arena for three primary reasons. First, approximately one third of foreign aid is designated to finance aggregate government consumption (i.e. social expenditure) other than public investment ([Chatterjee et al., 2012](#)). Interestingly, most studies focus on public investment, supporting the argument that as long as aid finances public investment, its impact on domestic output in the long-run will be positive ([Chatterjee et al., 2012](#); [Herzer and Morrissey, 2013](#)). This is based on the argument that investment is a fundamental factor of growth as in [Mankiw, Romer, and Weil \(1992\)](#). While this conclusion may be innocuous, failing to explicitly account for aid allocated to government consumption means the relationship between private and government consumption in the recipient country is excluded as a potential determinant of aid effectiveness.¹ Second, there is evidence that public consumption substitutes for private consumption (in the Edgeworth Pareto sense) in many aid-recipient economies and that the degree of substitutability can vary greatly across countries ([Dawood and Francois, 2018](#); [Karras, 1994](#)). This strongly suggests that aid earmarked for government consumption can directly alter the marginal utility of private consumption. Third, this relationship is not easily captured in empirically studies as it is relegated to unobserved fixed effects—precluding it as an explicit determinant of aid effectiveness in empirical studies. Together, these points imply that one cannot discount the relationship between private and

¹In cases where the role of government consumption has been accounted for, the rhetoric has been that government consumption complements public investment ([Morrissey, 2015](#)).

public consumption in shaping the long-run effect of aid on output. Thus, by employing a simple theoretical framework, we bring to bare, the importance of how the relationship between the private and government consumption can impact aid effectiveness in a clear and intuitive manner.

The model in this paper draws on the model considered in [Dawood and Francois \(2018\)](#) who specifically focus on studying the effect of general fungibility of aid – a situation where aid earmarked by donors for public investment is diverted into financing government ([McGillivray and Morrissey, 2004](#)) – on its effectiveness. However, it is important to note that their model assumes *a priori* that aid only finances public investment and that any aid allocated to government consumption is due to general fungibility. For them, in the absence of general fungibility aid has an unambiguous positive effect on output. In this paper, we do not make any of these assumptions. Moreover, rather than using a specific utility function, we employ a general utility function for our model. In a similar vein, this paper differs from the one in [Chatterjee et al. \(2012\)](#) in that it assumes aid has no effect on domestic revenues in the long-run (i.e. the recipient government of aid does not reduce its own expenditures in response to aid flows). Moreover, rather than working in growth rates as in [Chatterjee et al. \(2012\)](#) and others, this paper considers the aid-output relationship in levels as advocated by [Herzer and Morrissey \(2013\)](#).

Finally, it is worth mentioning that the focus on the long-run impact of aid on output allows us to abstract from among other things price/wage rigidities and domestic macroeconomic policies that may interact with aid in the short-run. This is because in the long-run prices/wages are flexible and macroeconomic policy variables are likely to return to their long-run steady-state values. In summary, the primary focus here is to show that in the absence of the well-known channels that may impact aid effectiveness (ineffectiveness), the structural relationship between private and public consumption in private utility can interact with aid allocated to public consumption to impact aid effectiveness. The paper therefore

complements the existing aid literature by providing a simple, yet plausible, channel that can help expand the understanding of the long-run impact of foreign aid on output of recipient economies.

The rest of the paper is organized as follows. Section 2 introduces the model and analyzes the derived aid-output relationship. Section 3 employs a linear effective consumption function to provide a numerical example, through calibration, of the analytical results. Section 4 discusses the implications of our results. Section 5 concludes.

2 The Model

In this section, we layout a parsimonious general equilibrium model which allows for both productive government spending and useful government spending. The latter allows us to capture the mechanism of interest– Edgeworth substitutability (complementarity) between private and public consumption– via useful government spending. Thus, government consumption is allowed to directly enter private utility as in Evans and Karras (1996), Ganelli and Tervala (2009), Ercolani and e Azevedo (2014), and Dawood and Francois (2018). Unlike these specific instances, however, we keep the analysis flexible by assuming a general utility function.² Later, we consider a specific functional form, calibrating it to the data for a deeper understanding of the mechanism. The rest of the model is kept simple to allow for a straightforward analysis.

2.1 Households

The representative household maximizes lifetime utility function U , which which is a function of private consumption, c_t , hours worked, n_t , and a given level of government consumption,

²Fiorito and Kollintzas (2004) discusses the theoretical and empirical restrictions imposed by a specific effective consumption function such as the CES, linear and quadratic function.

$g_{c,t}$

$$U = \sum_{t=0}^{\infty} \beta^t \left\{ u(c_t, g_{c,t}) - \frac{n_t^{1+\psi}}{1+\psi} \right\}$$

subject to the flow budget constraints with $t \geq 0$, subject to the budget constraint

$$c_t = w_t n_t - \tau_t + \pi_t,$$

where, $\beta \in (0, 1)$ is the discount factor; $\psi > 0$ is the inverse Frisch elasticity of substitution; and w_t , π_t , and τ_t are real the labor wage rate, profits accrued from the representative firm, and lump-sum taxes collected by the fiscal authority, respectively. The instantaneous utility function $u(\cdot)$ satisfies standard preference properties such that $u_c > 0$ and $u_{cc} < 0$. The marginal utility of government consumption is strictly positive, $u_{g_c} > 0$, ensuring that $g_{c,t}$ is a good. The cross-partial $u_{c g_c}$ governs the relationship between private and public consumption. Specifically, if $u_{c g_c}$ is greater (less) than zero, an increase in government consumption increases (decrease) the marginal utility of private consumption, suggesting that the two are Edgeworth complements (substitutes). When $u_{c g_c} = 0$ then these two goods are unrelated and changes in government consumption do not directly affect the marginal utility of private consumption.

The first order conditions for household yields:

$$c_t : u_c(c_t, g_{c,t}) = \lambda_t \tag{1}$$

$$n_t : n_t^\psi = \lambda_t w_t \tag{2}$$

Combining (1) and (2) yields the intratemporal Euler equation that relates labor to the marginal utility of private consumption and real wages,

$$n_t^\psi = u_c(c_t, g_{c,t}) w_t. \tag{3}$$

It clear from Eq. (3) that changes in government consumption can directly impact disutility of labor and hence, labor supply away from the traditional wealth effect channel.

2.2 Firms

The representative firm in the economy produces a final good y_t using labor supplied by households and the flow of services from a public investment good, such as infrastructure, g_I , through the production function

$$y_t = n_t g_{I,t}^\alpha, \quad (4)$$

where $\alpha > 0$ measures the productivity of government spending as in [Linnemann and Schabert \(2006\)](#) and [Tervala \(2009\)](#).³ The presence of productive public investment allows for aid to impact output through funding public investment. This captures the standard productive capacity argument that aid the funds public investment can directly raise real GDP in aid-recipient countries (See for instance, [Herzer and Morrissey, 2013](#), for detailed discussion). Given prices and the wage rate the firm maximizes profits

$$\max_{n_t} \pi_t = n_t g_{I,t}^\alpha - w_t n_t$$

which results in the standard price-marginal cost relationship

$$w_t = g_{I,t}^\alpha. \quad (5)$$

The government maintains a balanced budget for each time period t

$$g_{I,t} + g_{c,t} = \tau_t + a_t$$

³ For simplicity and tractability, we set investment in the economy to be equal to public investment.

where a_t is foreign aid that is disbursed through the recipient government's budget by donors to co-finance public expenditure in the economy. Since the focus is on the long-run effect analysis, no explicit assumptions on the process of a_t are made, except that aid is taken as given by the recipient country and is equal to its steady state (i.e., $a_t = a$) in the long run.⁴ The real lump-sum tax follows the fiscal policy rule as in [Adam et al. \(2006\)](#)

$$\tau_t = \tau(a_t/a)^{-\rho_\tau} \exp(\mu_t)$$

where, $0 \leq \rho_\tau \leq 1$, $\mu_t \sim N(0, \sigma_\xi^2)$ is an i.i.d. Importantly, the tax rule states that although taxes may be reduced following an inflow of aid in the short-run, in the long-run any increase in aid does not reduce the tax effort in the recipient country (i.e. $\tau_t = \tau$).⁵

2.3 Allocation of Foreign Aid

Government consumption and government investment are co-financed with foreign aid and domestic revenue (i.e. taxes).

$$g_{I,t} = \omega_1 a_t + \zeta \tau_t \tag{6}$$

$$g_{c,t} = \omega_2 a_t + (1 - \zeta) \tau_t \tag{7}$$

where ω_1 and ω_2 govern the share of aid that finances government investment and consumption respectively with $\omega_1 + \omega_2 = 1$ and $\omega_1 \geq \omega_2$. The latter condition is consistent with the fact that aid that goes into government investment is typically larger than aid that goes into government consumption. The former condition suggest aid is not fungible in the aggregate sense. Finally, the disbursement of aid by foreign donors to the described economy means

⁴ It is important to note that, this is not a simplifying assumption in that even if we should model aid such that it responds to the recipient country's output in the short-run, this endogenous term will not be present in the long-run.

⁵For detailed discussion on the fiscal effects of aid, see [Chatterjee et al. \(2012\)](#); [Leiderer \(2012\)](#); [McGillivray and Morrissey \(2000\)](#); [Morrissey \(2015\)](#); [Morrissey et al. \(2010\)](#), and [Feyzioglu et al. \(1998\)](#) to mention a few.

that the feasible allocation satisfies the aggregate resource constraint in the economy

$$y_t + a_t = c_t + g_{c,t} + g_{I,t} \quad (8)$$

By combining the household's first order condition on labor (3) and the profit maximization of the firm (5),

$$y^\psi = u_c(c_t, g_{c,t})g_{I,t}^{\alpha+\alpha\psi} \quad (9)$$

Thus, the complete equilibrium system of the economy described above consists of (6)–(9). With focus on the long-run effect of aid on output, we drop the time subscripts and focus on the steady state dynamics of the system. To see the relative contribution of public investment and consumption in impacting output, y in (9), we totally differentiate the long-run system to get,

$$\psi y^{\psi-1} dy = u_{cc}(c, g_c) g_I^{\alpha+\alpha\psi} dc + u_{cg} g_I^{\alpha+\alpha\psi} dg_c + (\alpha + \alpha\psi) u_c g_I^{\alpha+\alpha\psi-1} dg_c \quad (10)$$

Employing (10) and using the differentiated aid allocation equations while setting $d\tau/da = 0$ (no aggregate fungibility), we obtain

$$\frac{\Delta y}{\Delta a} = \frac{s_c}{\psi s_c + \phi_0} \left[\frac{\phi_1}{s_{g_I}} \omega_1 + \frac{\phi_2}{s_{g_c}} \omega_2 \right]. \quad (11)$$

where, $s_{g_c} = \frac{g_c}{y}$, $s_{g_I} = \frac{g_I}{y}$, $\phi_0 = -c \frac{u_{cc}}{u_c} > 0$, $\phi_1 = \alpha + \alpha\psi > 0$, and $\phi_2 = g_c \frac{u_{cg}}{u_c}$. As explained earlier, a positive (negative) value of ϕ_2 captures the Edgeworth complementarity (substitutability) of private and public consumption.

2.4 Aid-Output Relationship

Given Eq. (11) we have the following aid-output definition:

Definition 1. The long-run effect of aid on output, denoted by \bar{y}_a , is the increase in steady-

state output y following an increase in steady-state foreign aid a , formally given as:

$$\bar{y}_a \equiv \frac{\Delta y}{\Delta a} = \frac{s_c}{\psi s_c + \phi_0} \left[\frac{\phi_1}{s_{gI}} \omega_1 + \frac{\phi_2}{s_{gc}} \omega_2 \right]. \quad (12)$$

where ω_1 and ω_2 are the shares of aid that goes into public investment and consumption, respectively.

The size of \bar{y}_a depends on the shares of foreign aid that goes into investment and consumption expenditure, the steady state ratio of private consumption to output, the productivity of public investment, elasticity of labor supply. For convenience, we drop the scaling term in (12) $\frac{s_c}{\psi s_c + \phi_0} > 0$, though it is included in later analyses. This means the effect of aid on output critically depends on the terms in the square brackets. More importantly, as can be seen from (12), the sign of the effect of aid output depends critically on the elasticity of substitution between private and government consumption governed by ϕ_2 . In particular, while the effect of aid earmarked to government investment, $\frac{\phi_1}{s_{gI}} \omega_1$ is unambiguously positive, $\frac{\phi_2}{s_{gc}} \omega_2$ on the other hand can assume negative and non-negative values depending on the relationship between private and public consumption. Consequently, from the definition of aid effectiveness and the assumption that a fraction of aid finance government consumption $\omega_2 > 0$, the following propositions arise:

Proposition 1. *Edgeworth complementarity ($\phi_2 > 0$) or substitutability between private and public consumption with $-\phi_1 \frac{\omega_1 s_{gc}}{s_{gI} \omega_2} < \phi_2 \leq 0$ in the aid-recipient country is sufficient for aid to have a positive long-run effect on output (i.e. $\bar{y}_a > 0$) and $\bar{y}_a \Big|_{\kappa < \phi_2 \leq 0} < \bar{y}_a \Big|_{\phi_2 > 0}$ where $\kappa = -\phi_1 \frac{\omega_1 s_{gc}}{s_{gI} \omega_2}$*

Proof. Part 1: Let $\phi_1 \frac{\omega_1}{s_{gI}} > 0$ and suppose Edgeworth complementarity, $\phi_2 > 0$. This implies

$$\frac{\phi_1}{s_{gI}} \omega_1 + \frac{\phi_2}{s_{gc}} \omega_2 > 0.$$

Part 2: Let $\phi_1 \frac{\omega_1}{s_{gI}} > 0$ and assume Edgeworth substitutability with $-\phi_1 \frac{\omega_1 s_{gc}}{s_{gI} \omega_2} < \phi_2 \leq 0$.

It is straightforward to show that $-\frac{\phi_1}{s_{gI}}\omega_1 < \frac{\phi_2}{s_{gc}}\omega_2 \leq 0$. Adding through by $\frac{\phi_1}{s_{gI}}\omega_1 >$ yields $0 < \frac{\phi_1}{s_{gI}}\omega_1 + \frac{\phi_2}{s_{gc}}\omega_2 \leq \phi_1 \frac{\omega_1}{s_{gI}}$.

Combining Parts 1 and 2 completes the proof. \square

Corollary 1.1. $\phi_2 > -\phi_1 \frac{\omega_1 s_{gc}}{s_{gI} \omega_2}$ is a necessary and sufficient condition for aid to have a positive long-run effect on output.

Proof. The proof follows easily from Proposition 1 \square

Proposition 2. Substitutability between private and government consumption with $-\phi_1 \frac{\omega_1 s_{gc}}{s_{gI} \omega_2} \geq \phi_2$ in the aid-recipient country is sufficient for aid to have a non-positive (negative or no) long-run effect on output (i.e. $\bar{y}_a \leq 0$)

Proof. Let $\phi_1 \frac{\omega_1}{s_{gI}} > 0$ and assume Edgeworth substitutability with $-\phi_1 \frac{\omega_1 s_{gc}}{s_{gI} \omega_2} \geq \phi_2$. From the latter condition we get $0 \leq \frac{\phi_1}{s_{gI}}\omega_1 + \frac{\phi_2}{s_{gc}}\omega_2$. \square

3 A Numerical Example

In the manner of Barro (1981), Aschauer (1985), Ganelli and Tervala (2009), and more recently Fève, Matheron, and Sahuc (2013), we specify effective consumption to be $c_t^* = (c_t + \theta g_{c,t})$. Employing a simple constant relative risk aversion (CRRA) utility function we have the instantaneous household utility function for effective consumption $u(c_t^*) = \frac{(c_t + \theta g_{c,t})^{1-\sigma}}{1-\sigma} + V(g_{c,t})$. The function $V(g_{c,t})$ ensures that government consumption is a good and that $u_{g_c} > 0$ even when θ is negative. With this formulation, θ governs the Edgeworth substitutability between c_t and $g_{c,t}$ so that $\theta > 0$ means public consumption substitutes (complements) for private consumption, respectively. When θ is zero, the two goods are unrelated. Under these assumptions, (12) becomes

$$\bar{y}_a = \frac{1}{s_{gI}(\sigma + \psi(s_c + \theta s_{g_c}))} [(\alpha + \alpha\psi)(s_c + \theta s_{g_c})\omega_1 - \theta s_{gI}\sigma\omega_2] \quad (13)$$

See Appendix A for a detailed derivation of (13).

3.1 Calibration and Simulation

In this section, we calibrate the parameters of (13). We then illustrate numerically how different degrees of Edgeworth substitutability between public and private consumption can impact the long-run impact of aid on output \bar{y}_a when a fraction of aid is intended to finance government consumption.

Table 1: Calibration of Parameters and Steady States

Description	Parameter	Calibration	Source
Elasticity of sub. between c and g_c	θ	$[-2, 5]$	Evans and Karras (1996)
Inverse intertemporal elasticity of substitution	σ	2.94	Shen et al. (2018)
Productivity parameter	α	0.1	Linnemann and Schabert (2006)
Frisch Elasticity of substitution	ψ	1	Standard calibration
Share of aid into gov't consumption	ω_2	0.30	Chatterjee et al. (2012)
Steady-state gov't consp. output ratio	s_{g_c}	0.14	Alter et al. (2017)
Steady-state gov't investment. output ratio	s_{gI}	0.6	Alter et al. (2017)
Steady-state private consp. output ratio	s_c	0.838	Alter et al. (2017)

Additionally, sensitivity analysis carried out on how different levels of aid allocated to government consumption interacts with this marginal utility channel to influence aid's impact on output. Table 1 provides summary information of the calibrated parameters.

Figure 1 reports the baseline simulation. Generally, the figure reveals that for a given level of ω_2 the long-run effect of aid is decreasing in θ . Specifically, all else equal, Edgeworth complementarity between the two goods guarantees an overall long-run positive impact of aid on output. This positive effect, however, gets smaller for lower levels of Edgeworth complementarity. In contrast, depending on the degree of substitutability between private and public consumption, the overall effect of aid can be positive, zero, or negative. More

precisely, as shown in the figure as long as Edgeworth substitutability exists between private and government consumption, an increase in aid earmarked to public consumption generates a concurrent fall in marginal utility of private consumption and rise in disutility of labor.

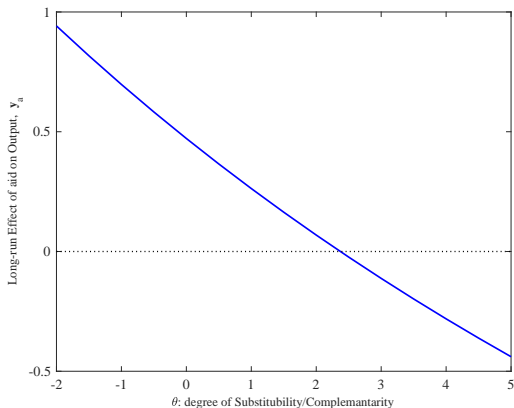


Figure 1: Baseline Simulation

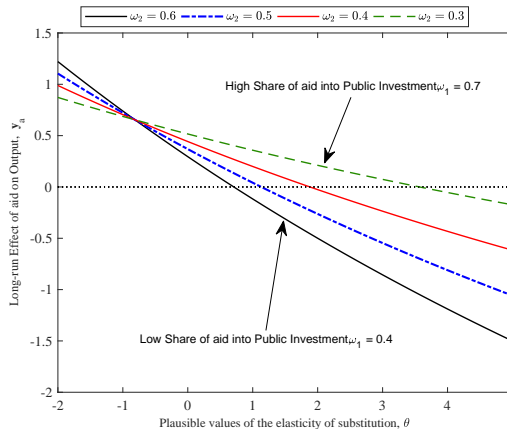


Figure 2: Sensitivity analysis, ω_2

This leads to a fall private consumption and labor supply and subsequently, erodes the effectiveness of aid induced by aid earmarked for public investment. More importantly, if this offsetting effect is large enough, it can potentially outweigh the overall positive effect of aid on output. However, the positive effect of aid induced by government investment is augmented when public consumption complements private consumption in the Edgeworth Pareto sense. In this scenario, marginal utility of private consumption rises and disutility of labor falls leading to a contemporaneous rise in private consumption and labor supply. These results generally support the findings from the analytical results in section 2.

Figure 2 reports the same exercise as in Figure 1 with the share of aid allocated to government consumption ω_2 allowed to vary. Factors such a changes in donor priorities may lead to variations in the share of aid allocated to government consumption overtime or across different recipient countries. Thus, the figure shows how the shares of aid into government consumption may interact with Edgeworth substitutability (complementarity) between the two goods to influence aid effectiveness in the long-run. An interesting finding emerge: at higher levels of Edgeworth complementarity, a smaller (larger) shares of aid allocated to

public consumption yields a smaller (larger) positive impact of aid on output. This effect is reversed for lower levels of complementarity. For the case of Edgeworth substitutability between the goods in question, lower degrees of substitutability, a positive effect of aid on output becomes bigger with smaller allocation of aid to public consumption. More importantly, a negative effect of aid on output for higher levels of Edgeworth can be mitigated and potentially, turned positive if aid earmarked for public consumption is reduced.

4 Discussion

The results that emerge from the simple model presented in Section 3 has useful implications for: (1) policy discussion on aid effectiveness and (2) ongoing studies that examine aid effectiveness in medium to large scale general equilibrium models. From a policy perspective, since a considerable component of aid is earmarked for government consumption, policymakers must account for the structural relationship between government and private consumption in the recipient country as it is central to aid's effect on output.

To elucidate further on the importance of this channel we consider estimates of the elasticity of substitution between private and public consumption from [Evans and Karras \(1996\)](#).⁶ We will focus on two countries Egypt and Bolivia where θ is estimated to be 0.81 and 1.21 ([Evans and Karras, 1996](#), Table A1). In the our baseline scenario in Figure 1, all else equal, foreign aid will still have a positive effect on output in both countries. However, because of the high degree of substitutability in Bolivia, this positive effect is expected to be smaller relative to Egypt. Applying the result in Figure 2 to these two cases further suggests that any change in donor policy that allocates more aid to public

⁶Although this estimates are from an older study we remain agnostic in adopting them for our discussion for the following reason. The parameter of interest is has a properties of a deep parameter as it is a preference parameter. Moreover, a more recent study [Dawood and Francois \(2018\)](#) focus on African economies and use a more general utility function as well as different estimation procedure than [Evans and Karras \(1996\)](#). They conclude that even for countries in the same region, the relationship between private and government consumption varies across the countries considered in the study.

consumption in Bolivia can offset any positive effect of aid on output and likely induce a net negative effect. The effect of aid may still remain positive in Egypt but smaller. In these two countries, however, reallocating aid away from public consumption to government investment will crowd in private consumption thereby increasing the long-run effect of aid on output. The implication here is that the relationship between private and government consumption is an important determinant to aid effectiveness and should be accounted for when allocating aid to recipient countries.

A more subtle relevance of the result is its importance to the ongoing studies that examine aid effectiveness in general equilibrium models. There is a burgeoning literature that examines the macroeconomic effect of aid on output in developing countries ([Adam et al., 2006](#); [Mwabatwa et al., 2013](#); [Shen et al., 2018](#), to list a few). However, these studies do not include the mechanism discussed in this paper in their analysis. The simple model presented in this paper strongly suggests that an exclusion of the Edgeworth substitutability (complementarity) between private and government consumption will preclude an important mechanism in any general equilibrium model that studies the effect of aid on output.

5 Conclusion

This paper has illustrated in a parsimonious general equilibrium model that when a fraction of aid is allocated to government consumption, the relationship private and public consumption is an important determinant of the long-run impact of aid on domestic output. Specifically, when public and private are Edgeworth complements, an increase in aid earmarked for public consumption increase the marginal utility of private consumption and reduces disutility of labor. This increase private consumption and labor supply, both of which augments the positive effect of aid earmarked for public investment on output. On the other hand, when public consumption substitutes for private consumption, an increase

in aid allocated to government consumption reduces the marginal utility of private consumption and increases the disutility of labor. This generates a fall in private consumption and labor supply in the recipient country, eroding the positive effect of aid earmarked for public investment. Moreover, when the degree of substitutability is large enough, it can completely offset and even outweigh the positive impact of public investment.

In the context of policy, the results suggests that policymakers should internalize the relationship between private and public consumption in the recipient country when allocating aid to public consumption. This is because in countries where public consumption substitutes for private consumption, aid allocated to public consumption will offset any positive effect of aid on output. In contrast, allocating foreign to public consumption can reinforce any long-run positive effects of aid in a recipient country where public consumption complements private consumption in the Edgeworth pareto sense. Additionally, given the growing literature that studies the effect of aid on output in general equilibrium models, the results strongly suggest a need to include, explicitly, the relationship between private and public consumption in private utility. Precluding this mechanism from these general equilibrium models can bias the effect of aid on key macroeconomic variables in the models. Finally, the results advocate for a comprehensive empirical investigation in to the relationship between public and private consumption in private utility in aid-recipient economies.

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A Derivation of the Numerical Example

By adopting the utility function in section 3, the marginal utility of privation consumption given in Eq. (1) becomes:

$$c_t : (c_t + \theta g_{c,t})^{-\sigma} = \lambda_t \quad (\text{A.1})$$

By combining the household's first order condition on labor (3) and the profit maximization of the firm (5),

$$y_t^\psi = \frac{g_{I,t}^{\alpha+\alpha\psi}}{(c_t + \theta g_{c,t})^\sigma} \quad (\text{A.2})$$

Thus, the complete equilibrium system of the economy described above consists of Eq. (6), Eq. (7), Eq. (A.1), and Eq. (A.2).

With focus on the long-run effect of aid on output, we focus on the steady state dynamics of the system. Here, we drop the time subscripts, hence, the steady state economic variable in model is $x_t = x$

$$F = y^\psi - g_I^{\alpha+\alpha\psi} (c + \theta g_c)^{-\sigma} \quad (\text{A.3})$$

totally differentiating Eq. (6), Eq. (7), Eq. (8) and Eq. (A.3) we arrive at:

$$dy = \frac{1}{s_{g_I}(\sigma + \psi(s_c + \theta s_{g_c}))} [(\alpha + \alpha\psi)(s_c + \theta s_{g_c})dg_I - \theta\sigma s_{g_I}dg_c] \quad (\text{A.4})$$

$$dg_I = \omega_1 da + \zeta d\tau \quad (\text{A.5})$$

$$dg_I = \omega_2 da + (1 - \zeta)d\tau \quad (\text{A.6})$$

$$dy + da = dc + dg_I + dg_c \quad (\text{A.7})$$

$$\frac{dy}{da} = \frac{1}{s_{g_I}(\sigma + \psi(s_c + \theta s_{g_c}))} [(\alpha + \alpha\psi)(s_c + \theta s_{g_c})\omega_1 - \theta\sigma s_{g_I}\omega_2] \quad (\text{A.8})$$