



# Coalition-enhancing fiscal policies in an open economy: A CES framework of Gale's transfer paradox



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## ABSTRACT

The motivation of our paper comes from David Gale's seminal work in 1974. He constructed an example of the "transfer paradox" based on three Leontief functions. The transfer paradox is that when there is a set of agents in the home country and that the home country is trading with other countries, then certain public lump-sum tax transfer plans could make all agents in the home country better off. Our contributions are as follows. First, we show that such an example can be constructed with three smooth CES utility functions. Second, we establish the three crucial conditions for the existence of the transfer paradox: (1) the donor (a taxpayer) has stronger preference for the foreign good than the recipient; (2) the donor is ex-ante wealthier than the recipient; (3) the elasticity of substitution of the foreign country's preference is strictly less than one.

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## 1. Introduction

Coalition of certainty groups are known to affect market prices under a general equilibrium setting. These price changes affect agents' real wealth and consequently, their utility values. As early as 1939, Samuelson, while studying the benefit of government intervention in international trade, suggested the possibility of lump-sum transfers that are Pareto-improving for all agents within a coalition in an economy. Grandmont and McFadden (1972) prove the result for models with production. Assuming that there is a set of agents in our home country and that the home country is trading with other countries, then certain public lump-sum tax transfer plans could make all agents in the home country better off.

Despite this early fundamental insight, there is a paucity of examples that demonstrate this phenomenon. Gale (1974) led the effort, later followed by theoretical works by Guesnerie and Laffont (1978), Bhagwati et al. (1983, 1984), Yano (1983), Jones (1985), and others.<sup>1</sup> However, Gale confined his example to non-smooth preferences in general equilibrium frameworks. Gale utilized three

Leontief functions (two for the home country and one for the foreign country) to show Samuelson's insight. He pointed out that there had been several unsuccessful attempts to construct examples with smooth preferences. Léonard and Manning (1983) partially addressed this challenge by showing an example in general equilibrium with two Cobb–Douglas utility functions with specified preference parameter values in the home country and one smooth demand function in the foreign country.

Our paper builds on these works by constructing a theoretical framework with three smooth CES utility functions, which yields results that relate preferences, fiscal transfer, and welfare that the previous examples could not reflect. More specifically, for the home country with two representative consumers, we first maintain the use of two Cobb–Douglas functions but relax the preference parameters, allowing preference diversity between the two types of consumers to generate the incentive for utilizing a public lump-sum tax transfer plan. In addition, our example adopts a more general utility specification for a representative consumer in the foreign country, which shows how the foreign consumer's elasticity of substitution plays a crucial role in determining the magnitude of the fiscal transfer's effect. Most importantly, we derive a threshold value for the foreign consumer's elasticity of substitution such that coalition could only succeed below this value. The mechanism that allows wealth transfer from the foreign to the domestic country is the decrease in the price of the foreign good as a result of domestic fiscal policy. This result is similar in spirit to those derived from the literature on immiserizing growth (Bhagwati, 1958, 1968) and endowment manipulation (Aumann and Peleg, 1974; Postlewaite, 1979). The idea is that the real wealth

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<sup>1</sup> Bhagwati et al. (1983, 1984) and Yano (1983) utilized three-country frameworks. Gale (1974) studied the setting of two home country agents and one foreign country representative agent. These are two different interpretations of the three-agent transfer paradox. Mathematically, these two structures are no different. As Bhagwati et al. (1983) mention, the results from their setting of three independent countries can also be applied to Gale (1974)'s framework.

of the endowment loser is affected by both the endowment change and price change that work in opposite directions, and the latter effect will outweigh the former, generating a counterintuitive real wealth gain.<sup>2</sup>

Our paper proceeds as follows. First, we construct a model which can be analyzed in CES utility functions. By using two Cobb–Douglas utility functions for the home country and one Leontief function for the foreign country, we obtain closed form solutions for all equilibrium allocations and have utilities expressed in terms of lump-sum transfers. We derive preference parameter restrictions that allow coalitions as described above to succeed. Second, we demonstrate Samuelson’s insight with three perfectly smooth CES utility functions. Due to the Cobb–Douglas forms of the two home consumers’ preferences, we can use one aggregate utility form that altogether incorporates their preferences. This would lead to equivalent price changes as if there were two different consumers in the economy. The lump-sum tax affects the aggregator’s preferences, resulting in price changes, and subsequently, the wealth transfer from the foreign to the home country. Given these price changes, we show that the foreign country’s elasticity of substitution is a critical determinant of the magnitude of the wealth transfer. A more complementary-oriented elasticity of substitution implies that prices are more sensitive to endowment redistribution, and therefore coalition in the home country is more likely to succeed. Previously, Bhagwati et al. (1983, 1984) and Yano (1983) have also demonstrated that lower elasticity of substitution increases the likelihood of the transfer paradox. However, in contrast to these works, our model presents parametric examples with utility functions, and more importantly, with CES preferences, and as a result we are able to derive a precise relationship between the elasticity of substitution and the possibility of the transfer paradox. Lastly, we examine the distributional consequences of this wealth transfer on the home country’s two consumers. The agent who bears the tax burden will also receive wealth compensation through the international trade channel. We show that a coalition is more likely to succeed if the consumer whose wealth is taxed has greater ex-ante endowment.

Section 2 introduces the theoretical framework with CES utility functions. Section 3 analyzes the case in which the foreign country has Leontief preferences. Section 4 extends the framework to three smooth CES preferences. Section 5 concludes.

**2. Theoretical framework**

There are two agents, denoted by the subscripts *A* and *B*, in the home country, and one representative agent, *C*, in the foreign country. Agents in each country consume goods *x* and *y*, which denote the goods produced by the domestic and foreign country, respectively. The preferences of consumers in the home country are given by the utility specifications

$$U_A(x_A, y_A) = x_A^\alpha y_A^{1-\alpha},$$

$$U_B(x_B, y_B) = x_B^\beta y_B^{1-\beta} \text{ where } \alpha > \beta \text{ and } \alpha, \beta \in (0, 1).$$

In other words, agent *A*’s relative preference for the domestic good is higher than that of agent *B*.

The preference of agent *C* in the foreign country is given by

$$U_C(x_C, y_C) = \begin{cases} \left( x_C^{\frac{\varepsilon-1}{\varepsilon}} + y_C^{\frac{\varepsilon-1}{\varepsilon}} \right)^{\frac{\varepsilon}{\varepsilon-1}} & \text{if } \varepsilon \in (0, \infty) \setminus \{1\} \\ x_C y_C & \text{if } \varepsilon = 1 \\ \min(x_C, y_C) & \text{if } \varepsilon = 0 \end{cases}$$

where  $\varepsilon$  represents the elasticity of substitution of the foreign country.

<sup>2</sup> Analogously, Johnson (1953), Kennan and Riezman (1988), and Syropoulos (2002) have also shown that tariffs can be used as a tool for decreasing the value of the foreign good in order to increase welfare in the home country.

The endowment of each agent is given by

$$\omega_A = (\theta, 0), \quad \omega_B = (1 - \theta, 0) \quad \text{and} \quad \omega_C = (0, 1).$$

We can see that the home country and foreign country are specialized in goods *x* and *y*, respectively, but they both have the same amount of aggregate endowment,  $1$ .  $\theta \in (0, 1)$  represents the initial endowment distribution share in the domestic country. If the utility functions of the two domestic consumers are both strictly increasing in  $\theta$ , there would exist a lump-sum transfer plan in the domestic country that makes the two consumers better off. Thus, we will derive  $\theta$  for which agents *A* and *B*’s utilities are both strictly increasing. If there exists such a value or range of  $\theta$ , we can conclude that a Pareto-improving coalition in the home country is possible. Formally, we define coalition success as the following:

**Definition 1.** A coalition succeeds if there exists a set of endowment transfer from agent *B* to *A* such that  $\frac{dU_A}{d\theta} > 0$  and  $\frac{dU_B}{d\theta} > 0$ .

Definition 1 sets the case in which both the donor, agent *B*, and the recipient, agent *A*, can be better off through endowment transfers. Mathematically, if such a case exists, the endowment transfer in the opposite direction, in which agent *A* is the donor while agent *B* is the recipient, would make both of them worse off. It follows mathematically that since the utility change through transfer from *B* to *A* is  $\frac{dU_h}{d\theta}$ , where  $h \in \{A, B, C\}$ , then that from *A* to *B* is  $\frac{dU_h}{d(-\theta)}$ , which is the same as  $-\frac{dU_h}{d\theta}$ . This is the case of another “transfer paradox”, where even the recipient becomes worse off along with the donor.

**3. The case where the foreign country has Leontief preferences**

In this section, we will show that there exists a closed form solution in the special case in which the foreign agent has Leontief preferences. From the closed form solution, we derive important intuitions relating to the role of ex-ante wealth distribution and preference diversity in increasing the likelihood of Pareto-improving coalition.

We will use an aggregator’s utility function to represent the two Cobb–Douglas utility functions of the home consumers, which is useful to understand the changes in domestic aggregate demand for the foreign good after the tax policy is implemented. With the home country represented by the aggregator and the foreign country, we can derive the equilibrium prices for the domestic and foreign good after trade. In particular, we will examine how the price of the foreign good, denoting the domestic good as a numeraire, is affected by the lump-sum tax transfer.

The utility function of the aggregator of *A* and *B* is derived as<sup>3</sup>

$$U_{AG}(x_{AG}, y_{AG}) = x_{AG}^\eta y_{AG}^{1-\eta} \text{ where } \eta = \alpha\theta + \beta(1 - \theta) \tag{1}$$

$$\text{and } \omega_{AG} = (1, 0). \tag{2}$$

<sup>3</sup> Given  $p = (1, q)$ , the home country aggregate demand is the sum of two agents’ individual demands:

$$(x_A + x_B, y_A + y_B) = \left( \alpha\theta + \beta(1 - \theta), \frac{(1 - \alpha)\theta}{q} + \frac{(1 - \beta)(1 - \theta)}{q} \right).$$

Defining  $\eta$  as  $\alpha\theta + \beta(1 - \theta)$ , the aggregate demand is

$$(x_A + x_B, y_A + y_B) = \left( \eta, \frac{1 - \eta}{q} \right).$$

The demand function can be derived assuming that the utility and the endowment are of the following

$$U_{AG}(x_{AG}, y_{AG}) = x_{AG}^\eta y_{AG}^{1-\eta} \text{ and } \omega_{AG} = (1, 0).$$

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