

# 1 Introduction

Through the use of adequate mathematical tools, recent works have attempted to better adapt the theoretical general equilibrium framework to realities examined by different schools of thought in economics where conditions of imperfect competition are taken into account. In many situations, a benchmark device allowing for assessing deviation from the theoretical optimal equilibrium is the concept of market efficiency in the Pareto context<sup>59</sup>. Standard macroeconomic theory holds that the conditions leading to disequilibrium are market failure, market imperfections, the search for non-economic targets, and international business. Let us briefly describe these four factors. *Market failure* takes place in the presence of public goods or externalities in production or consumption or when some economic agents are in possession of imperfect information. The common attribute of these market anomalies is their ability to appear even in the presence of perfect competition over all markets. When these market distortions are not removed, the economy moves from a socially optimal trajectory of welfare in the sense of Pareto. Externalities, as a cause of market failure, will be examined later in the context of the environmental economy.

*Imperfect markets* are related to the supply-and-demand side of commodity and factors markets. It is generally admitted that the level of market concentration of a given business is a good indicator of market imperfection. In the case of commodity supply, imperfect competition will shift down production and consumer utility. In the case of factors markets, imperfections lead to lost productivity.

As far as *searching for non-economic targets* is concerned, the role of government, usually deemed to help in correcting market failures or imperfections, can have a distorting role. Thus, government will search for non-economic targets<sup>60</sup> of various attributes like ethical values, political agenda of politicians in connection with the political business cycle, and lobbying interests with the problem of rent seeking. The common attribute of these non-economic targets is of leading to social efficiency losses.

*International business* policy may lead to economic inefficiency on the side of commodity or production factor. Thus, one can point to, for instance, the impact of fiscal or monetary policies as regulators of relative prices and market competition. These policies would thus create market distortion and lead to disequilibrium.

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<sup>59</sup> However, J.M. Buchanan (Nobel Prize, 1986) presents a controversial point of view on the subject. See, e.g., Alain Marciano, "Why Markets Do Not Fail." Buchanan on voluntary cooperation and externalities (Nov. 2010) or A.H. Barnett and Bruce Yandle, "The End of the Externality Revolution" (2005).

<sup>60</sup> For this vast subject see: Downs, *Economics Theory of Democracy* (1957); T. Buchanan, *The Theory of Public Choice* (1972); W.D. Nordhaus, *political business cycle*(1975); Breton, A. and Wintrobe, R., *The Logic of Bureaucratic Conduct: An Economic Analysis of Competition, Exchange, and Efficiency in Private and Public Organizations*(1982); W.A. Niskanen, *Bureaucracy and Public Economics* (1971).

The next section presents the case of pollution as an externality exemplifying market failure in the economy. Later, we will balance an environmentally extended and unbalanced social accounting matrix. Let us first show, below, the impact of pollution on economic equilibrium.

**Economic efficiency, perfect competition, and externalities.** To show how externality generated by private activity disrupts the economy from equilibrium, let us take the case of two producers, the first generating pollution (for instance, industry) and the second being affected by it (for instance, agriculture).

First, let us rewrite below the definition of the marginal rate of transformation of products of the economy:

$$TmTP = \frac{\frac{\partial q_2}{\partial x_2}}{\frac{\partial q_1}{\partial x_1}} = \frac{Cm_1}{Cm_2}$$

where  $q_j$  explains a quantity produced by producer  $j$  ( $j=1,2$ ), and  $cm_j$  the marginal cost for each producer  $j$ .

Now, suppose producer 2 (industry) generates a negative externality that affects producer 1 (agriculture).

In this case, production function of producer 1 has to be rewritten as:

$$q_1 = f_1(x_1, q_2)$$

The marginal physical productivity of the input used by producer 1 is, therefore:

$$\frac{\partial q_1}{\partial x_1} + \frac{\partial q_1}{\partial q_2} \frac{\partial q_2}{\partial x_2}$$

The second side of the formula above represents externality and has, for this case, a negative value, since  $\partial q_1 / \partial q_2 < 0$ . Thus, from the above definition of  $TmTP$ , we see that:

$$Cm_1(E) > Cm_1$$

This shows that the negative externality from producer 2 increases the marginal cost of producer 1 to a new, higher level, that is:

$$TmTP(E) = \frac{\frac{\partial q_2}{\partial x_2}}{\frac{\partial q_1}{\partial x_1} + \frac{\partial q_1}{\partial q_2} \frac{\partial q_2}{\partial x_2}} = \frac{Cm_1(E)}{Cm_2}$$

with  $TmTP(E) > TmTP$ . We note that when  $\partial q_1 / \partial q_2 > 0$ , we then have positive externalities (e.g., public goods). This case will not be dealt with here.

In economic terms, if there is a negative externality on good 1 from good 2, for an increase in the production of unit 1 good, at the level of the total economy, we must accept losing more production of good 2. Thus, optimal conditions are no longer valid.