

Taxes and Subsidies in Input-Output Modelling: Lloyd Metzler Revisited

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Extended abstract

More than half a century ago Lloyd Metzler (1951) claimed that the outcomes of a tax and subsidization policy aimed at influencing product prices might surprise us. Suppose a certain group of commodities is taxed and another group subsidized: might there be surprises such as a decrease in the prices of taxed goods and an increase in the prices of subsidized goods? If so, one reason might be that taxed and subsidized goods can be used as inputs in the same or in related processes. For example, in producing cars steel is being used, and in producing steel cars are used. Now let us suppose that policy makers wish to tax the use of cars and subsidize the production of steel. Because steel and cars are inputs in each other's production processes, it is not a-priori clear what might happen. This led to the question if we can prove that prices, in the context of a tax/subsidy policy, always move in the expected direction.

The first formulation of an answer dates back to a study by Metzler (1944), which looked at the problem in the context of the international transfer of funds. However, the problem could not be satisfactorily solved at the time, and it was postponed for a later occasion. Metzler came back to the issue in his 1951 paper, in which he formulated it as a problem in input-output (IO) economics. However, also in this new context the problem proved hard to solve, and Metzler was only able to provide a solution if the coefficients matrix had a very particular form. Later on the topic was picked up by other scholars such as Allen (1972), Atsumi (1981) and Kimura (1983). However, also these contributions only succeeded in addressing certain partial problems and did not offer a general solution.

Actually, the matter is still open, with only some partial results having been obtained in later years. In this paper we would like to return to Metzler's question, because it concerns more than just a problem of an isolated nature. Taxation and subsidization problems play an important role in many policy areas and there should be a good theoretical foundation in place for addressing such problems.

In this contribution we first outline our interpretation of the problem. What the tax/subsidy scheme is supposed to do is to *change* certain commodity prices in a specific direction. IO, of course, has an established price theory that is based on the notion of so-called 'embodied' or 'imputed' quantities of primary factors such as labour or capital. It therefore seems evident, as attempted by earlier contributors, to look for a theoretical

foundation for a tax/subsidy theory first in that direction. However, as we shall show, this approach does not work, the main reason being the lack of distinctive features of the multiplier matrix.

Against this background, this paper explores possibilities for finding a *different* foundation for a price theory for IO modeling, a foundation that, preferably, then could also serve as a basis for a tax/subsidy theory. We show in a number of steps that such a foundation can indeed be found. We thereby focus, as a core concept, on the role of the real wage and the distribution of this real wage over the various sectors. On this basis a consistent framework can be built that allows statements both of a quantitative nature (what is the new price?) and a qualitative nature (is a certain price going up or down?) in a tax/subsidy policy context.

We show in particular that quantitative statements are always possible. That is, we can always calculate the post tax/subsidy price changes. However, qualitative statements (as asked for by Metzler) can only be obtained in a specific setting which requires close attention from modelers and policy makers. Throughout we have included a number of numerical illustrations.