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Unit versus ad valorem taxes: Monopoly in general equilibrium ☆

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Abstract

We show that if a monopoly sector is imbedded in a general equilibrium framework and profits are taxed at one hundred percent, then unit (specific) taxation and ad valorem taxation are equivalent on the set of Pareto optima.

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1. Introduction

It is well-known that, in a competitive environment, unit (or specific) taxation and ad valorem taxation are equivalent. Cournot (1838, 1960) realized that the two tax systems needed different treatment in the case of monopoly. Wicksell (1896, 1959) argued that ad valorem taxes dominate unit taxation in a monopoly; a complete demonstration of this dominance was given by Suits and Musgrave (1953). More specifically they demonstrated, if the consumer price and quantity of the monopoly good remained unchanged, that the government tax yield is higher with ad valorem taxes than under a regime of unit taxes. This is possible because typically the profit-maximizing price of the monopolist is lower under ad valorem taxation than under unit taxation. Recently Skeath and Trandel (1994; p. 55) state, more explicitly, that "in the monopoly case, given any unit excise tax, it is possible to find an ad valorem tax that Pareto dominates it." It is this issue of the

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dominance that we investigate in this paper. We pursue this question in the context of a general equilibrium model and ask if ad valorem taxes Pareto dominate units taxes (or conversely).

More specifically, we take a standard general equilibrium model in which a single monopoly sector has been imbedded. In particular we adapt the model of Guesnerie and Laffont (1978) (hereafter GL) to pose this question assuming as in GL that the government taxes profits at 100%. We first characterize the set of Pareto optima in the economy with unit taxation. We then convert the associated equilibria with unit taxes to an equivalent set of equilibria with ad valorem taxes and ask if there exist any feasible ad valorem tax Pareto improvements from this equilibrium. We show that there are none. We then reverse this procedure and characterize the set of Pareto optima with ad valorem taxes, convert these equilibria to unit tax equilibria, and then show that there are no possible Pareto improvements using unit taxes.

2. Notation

The preferences of each of the H consumers are represented by an indirect utility function, $u_h = V^h(q_0, q, m)$ for $h=1, \ldots, H$ where $q_0 \in \mathbf{R}_{++}$ is the consumer price of the monopoly good, $q \in \mathbf{R}^N_{++}$ is the vector of consumer prices of the competitively supplied goods. The demogrant – a transfer that is common to all consumers – is given by m.[1] The demands are given by Roy's Theorem and the aggregate demand for the monopoly good is $x_0 = \sum_h x_0^{*h} = x_0^*(q_0, q, m)$ and the aggregate demand vector for the competitively supplied commodities is given by $x = \sum_h x^h(q_0, q, m)$. The consumer prices and producer prices are related by unit taxes, that is, $q_0 = p_0 + t_0$ and $q = p + t$, where p_0 and p are the producer prices of the monopoly good and competitive goods respectively. Following GL we assume that the solution to monopolist's profit maximization problem is locally unique and smooth. For the monopoly let

$$P_0^u(p, t_0, t, m) = \operatorname{argmax}_{p_0^u}\{p_0 y_0^u - C(y_0^u, p) \mid y_0^u \geq x_0^*(q_0, q, m)\} \tag{2.1}$$

We assume that P_0^u is single-valued and smooth and that $\nabla t_0 P_0^u \neq -1$; that is, the monopolist cannot undo all changes by the tax authority of t_0. The input demands by the monopolist from the competitive sector is given by $y^m = \nabla_p C(y_0^u, p)$. The profit function of the competitive sector is $\Pi^c = p^T y^c(p)$. Assume also that rank $[\nabla_p y^c(p) - \nabla_p y^m(p)] = N-1$. In addition the government produces a public good g from inputs y^g purchased from the competitive sector by $g \leq F(y^g)$. Equilibrium in this unit-tax economy is given by

$$-x + y^c - y^m - y^g \geq 0, \tag{2.2}$$

$$-x_0^*(q_0, q, m) + y_0^u \geq 0, \tag{2.3}$$

$$p_0^u - P_0^u(p, t_0, t, m) = 0 \quad \text{and} \quad F(y^g) - g \geq 0. \tag{2.4}$$

3. Unit-tax Pareto optima

In order to characterize the set of Pareto optima with unit taxation, we assume first that the equilibrium conditions, (2.2)–(2.4) hold with equality. From this equilibrium we calculate the directions of change in prices, taxes, and demogrant that could generate strict Pareto

[1] There is also a public good g but, as it remains constant throughout the analysis, it is suppressed in the utility function.