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IMPERFECT COMPETITION  
AND THE KEYNESIAN CROSS

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Imperfect Competition and the Keynesian Cross

ABSTRACT

This paper presents a simple general equilibrium model in which the only non-Walrasian feature is imperfect competition in the goods market. The model is shown to exhibit various Keynesian characteristics. In particular, as competition in the goods market becomes less perfect, the fiscal policy multipliers approach the values implied by the textbook Keynesian cross.

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## I. INTRODUCTION

Fiscal policy multipliers are central to Keynesian macroeconomics. In this paper I explore a possible microeconomic foundation for one fundamental theory of income determination, the "Keynesian cross." My model deviates from a Walrasian equilibrium model only by the assumption of imperfect competition in the goods market. I show that textbook fiscal policy multipliers arise as a limiting case.<sup>1</sup>

Under imperfect competition, firms are always eager to sell an additional unit of output, since price exceeds marginal cost. This profit margin creates the potential for the multiplier. An expansionary change in fiscal policy increases aggregate expenditure, which increases profits, which in turn increases expenditure, and so on.

The theme that imperfect competition may be crucial to macroeconomic issues is increasingly prevalent. See, for example, the work of Weitzman [1982], Hart [1982], Solow [1984], Blanchard and Kiyotaki [1985], and Startz [1986]. The purpose of the model presented here is partly pedagogical. I therefore do not hesitate making strong (yet not implausible) assumptions about the economic structure: Cobb-Douglas utility, constant marginal cost, and constant mark-up pricing. There is no reason to suppose, however, that the sorts of effects highlighted here are specific to these assumptions.

While the model is in some ways surprisingly similar to the standard Keynesian model, in other ways it differs greatly. In particular, it incorporates both an equilibrium labor market and a static environment. These features are chosen for simplicity rather than realism. The goal is not to provide a complete reformulation of Keynesian economics,

but only to illustrate what sort of Keynesian results one can obtain with a small movement away from Walrasian equilibrium in the direction of imperfect competition.

## II. THE ECONOMY

This section describes the economy. The following section discusses the economy's response to changes in fiscal policy.

### People

All people are the same. The representative person maximizes a Cobb-Douglas utility function over consumption of the single produced good (C) and leisure (L):

$$U = \alpha \log C + (1-\alpha) \log L. \quad (1)$$

Leisure is the numeraire. If  $\omega$  is the endowment of time, then  $\omega-L$  is labor income. Total after-tax income is  $(\omega-L) + \Pi - T$ , where  $\Pi$  is profits and  $T$  is the lump-sum tax levied by the government. The individual's budget constraint is therefore

$$PC = (\omega-L) + \Pi - T \quad (2)$$

$$PC + L = \omega + \Pi - T,$$

where  $P$  is the price of the consumption good.

The Cobb-Douglas utility function implies a constant share  $\alpha$  of "full income" is devoted to consumption. That is,

$$PC = \alpha(\omega + \Pi - T). \quad (3)$$

Equation (3) is the consumption function, and  $\alpha$  is the marginal propensity to consume.

### Government

The revenue raised by the government is used for two purposes. An amount  $G$  is used to purchase the produced good, and  $W$  government workers are hired. The government budget constraint requires that government spending equals revenue. That is,

$$T = G + W. \quad (4)$$

Total expenditure on the produced good is

$$Y = PC + G. \quad (5)$$

Using equation (3) to substitute into equation (5), we find

$$Y = \alpha(\omega + \Pi - T) + G. \quad (6)$$

Expenditure therefore depends positively on profits and government purchases and negatively on taxes.

### Firms

There are  $N$  firms producing the single good. The industry takes expenditure in the economy as given.<sup>2</sup> That is, the industry demand function is unit elastic:

$$Q = Y/P \quad (7)$$

where  $Q$  is total output.

The  $N$  firms have the same increasing returns to scale technology. The technology requires  $F$  units of overhead labor. After the plant is set up, one unit of output requires  $c$  units of labor. The cost function of each firm is therefore

$$TC(q) = F + cq, \quad (8)$$

where costs are measured in terms of the numeraire, leisure.

The  $N$  firms play some oligopoly game, the details of which I do not need to specify. This game determines the profit margin

$$\mu = (P - c)/P. \quad (9)$$

As an example, if the firms act as Cournot oligopolists, then  $\mu = 1/N$ . More generally, a conjectural variation equilibrium allows all possibilities between Bertrand competition ( $\mu = 0$ ) and perfect collusion ( $\mu \rightarrow 1$ ); in each case,  $\mu$  depends only on  $N$  and the conjectural variation. I therefore take the profit margin  $\mu$  as given for any fixed number of firms  $N$ .<sup>3</sup>

Note the relation between output and expenditure:

$$Q = [(1-\mu)/c] Y. \quad (10)$$

For given values of the profit margin  $\mu$  and marginal cost  $c$ , expenditure on the produced good and output are proportional. Government workers  $W$  are not included in expenditure  $Y$  or output  $Q$ ; hence, these measures are analogous to industrial production rather than GNP.

Total profits are revenue less costs:

$$\Pi = PQ - NF - cQ. \quad (11)$$

Using equations (7) and (9), aggregate profits can be expressed in terms in terms of expenditure  $Y$  and the profit margin  $\mu$ :

$$\Pi = \mu Y - NF. \quad (12)$$

Hence, higher aggregate expenditure implies higher aggregate profits.

### The Labor Market

The above discussion centers on the goods market. Walras's Law ensures that the labor market clears if the above relations are satisfied. To see that this is true, note that labor supply is the time endowment less the demand for leisure:

$$\begin{aligned} \text{Labor Supply} &= \omega - (1 - \alpha)(\omega + \Pi - T) \\ &= \alpha\omega - (1 - \alpha)(\Pi - T). \end{aligned} \quad (13)$$

Labor demand is the sum of firms' demand,  $NF + cQ$ , and government demand,  $W$ . Thus,

$$\begin{aligned}\text{Labor Demand} &= (NF + cQ) + W, & (14) \\ &= (Y - \Pi) + (T - G), \\ &= (\alpha(\omega + \Pi - T) + G - \Pi) + (T - G), \\ &= \alpha\omega - (1 - \alpha)(\Pi - T).\end{aligned}$$

Hence, goods market equilibrium (including the government budget constraint) implies that supply equals demand in the labor market as well.

### Summary

The two key equations are (6) and (12):

$$Y = \alpha(\omega + \Pi - T) + G, \quad (6)$$

$$\Pi = \mu Y - NF. \quad (12)$$

Expenditure depends on profits and the fiscal policy variables, while profits depend on expenditure.

### III. FISCAL POLICY

This section addresses the impact of fiscal policy. The analysis is short-run in that the number of firms  $N$  and thus the profit margin  $\mu$  are held fixed.

#### The Balanced Budget Multiplier

Consider first an equal increase in government purchases  $G$  and taxes  $T$ . Equations (6) and (12) imply that

$$\left. \frac{dY}{dG} \right|_{dT=dG} = \frac{1 - \alpha}{1 - \alpha\mu} \quad (15)$$

The multiplier thus depends on both the marginal propensity to consume  $\alpha$  and the profit margin  $\mu$ . Under perfect competition ( $\mu = 0$ ), the balanced budget

multiplier is  $1-\alpha$ . In the limiting case in which the revenue from the marginal unit goes entirely to profit ( $\mu = 1$ ), the balanced budget multiplier is unity.

The story that accompanies this multiplier is in many ways standard. Initially, the increase in government purchases of  $\Delta G$  raises expenditure by  $\Delta G$ , while the equal tax increase lowers private expenditure by  $\alpha\Delta G$ . The net increase in expenditure is thus  $(1-\alpha)\Delta G$ , which raises profits by  $\mu(1-\alpha)\Delta G$ . The increase in profits in turn raises expenditure by  $\alpha\mu(1-\alpha)\Delta G$ , which again raises profits, and so on. This multiplier process yields the infinite series,

$$(1-\alpha) + \alpha\mu(1-\alpha) + \alpha^2\mu^2(1-\alpha) + \alpha^3\mu^3(1-\alpha) + \dots,$$

which equals the balanced budget multiplier in equation (15). Imperfect competition plays a key role here, for if the profit margin were zero, the process would end after the initial increase in expenditure.

### The Tax Multiplier

Consider now an increase in taxes  $T$ , holding constant the level of government purchases  $G$ . The government budget constraint (4) implies that the amount of labor purchased by the government  $W$  must increase by  $\Delta T$ . The extra labor income received by government employees exactly equals the extra taxes paid; on net, individuals give up their time but receive no additional income. This policy intervention is thus equivalent to a reduction in the endowment  $\omega$  of  $\Delta T$ .

In standard analysis, tax increases are coupled with reductions in government debt. Government debt serves the function of transferring



resources from future generations to the current generation. Hence, a tax increase is an endowment reduction to the current generation. In this sense, a tax increase in the static model of this paper is analogous to a debt-financed tax increase in intertemporal (finite horizon) models.

Equations (6) and (12) imply that the tax multiplier is

$$\frac{dY}{dT} = \frac{-\alpha}{1 - \alpha\mu} \quad (16)$$

Under perfect competition ( $\mu = 0$ ), the tax multiplier is  $-\alpha$ . As competition becomes less perfect ( $\mu \rightarrow 1$ ), the tax multiplier approaches  $-\alpha/(1-\alpha)$ . Again, the multiplier process works through profits. The tax increase lowers expenditure, which lowers profits, which lowers expenditure, and so on.

#### The Government Purchases Multiplier

Consider now an increase in government purchases  $G$ , holding constant the level of taxes  $T$ . In standard analysis, future generations pay for a debt-financed increase in purchases. Here, the increase in purchases is financed by a reduction in  $W$ . In both cases, there is no immediate impact on the current individuals' budget constraint (2).

Equations (6) and (12) imply that the government purchases multiplier is

$$\frac{dY}{dG} = \frac{1}{1 - \alpha\mu} \quad (17)$$

Under perfect competition,  $dY/dG$  is unity. As the profit margin approaches one,  $dY/dG$  approaches the standard Keynesian value of  $1/(1-\alpha)$ .

Figure 1 shows how to demonstrate the multiplier graphically.

Expenditure  $Y$  is a linear function of profits  $\Pi$ , with a slope of the marginal propensity to consume  $\alpha$ . Profits are also a linear function of expenditure;

the slope of this line is  $1/\mu$ .<sup>4</sup> In the limiting case in which  $\mu = 1$ , this locus becomes the 45° line of the Keynesian cross. An increase in government purchases shifts the expenditure function upward by  $\Delta G$ , which causes a multiplied increase in total expenditure.

### Welfare Analysis

Here I examine the effect of fiscal policy on the welfare of the representative person, as judged by his utility function (1). Government purchases are assumed not to affect utility directly. A complete evaluation of fiscal policy would also take account of the benefit received from public expenditure. The analysis here is thus limited in scope.

An individual's utility increases only if his budget set, as defined by equation (2), is expanded. Since relative prices are constant, profits less taxes,  $\Pi - T$ , are sufficient for utility. The impacts of the fiscal policy changes on  $\Pi - T$  are

$$\left. \frac{d(\Pi - T)}{dG} \right|_{dT=dG} = \frac{-(1 - \mu)}{1 - \alpha\mu} \quad (18)$$

$$\frac{d(\Pi - T)}{dT} = \frac{-1}{1 - \alpha\mu} \quad (19)$$

$$\frac{d(\Pi - T)}{dG} = \frac{\mu}{1 - \alpha\mu} \quad (20)$$

A balanced budget fiscal stimulus in general reduces welfare. In the limiting case in which  $\mu = 1$ , however, a balanced budget increase has no impact on welfare. As the textbook Keynesian cross suggests, the increase in government purchases has no social cost. The increase in income (here, profits) exactly offsets the higher tax bill.

Both increases in government purchases and reductions in taxes increase welfare. In standard analysis, increases in  $G$  or reductions in  $T$  are

financed by future generations. Here, these changes are financed by reductions in government workers  $W$ . In neither case is it surprising that the welfare of current individuals increases.

#### IV. CONCLUSION

The model examined here is surprisingly similar to both Walrasian models of general equilibrium and Keynesian models of income determination. It deviates from a standard general equilibrium model only by the assumption of imperfect competition in the goods market. As competition in the goods market becomes less perfect, the fiscal policy multipliers approach the values implied by the Keynesian cross.

The model could be usefully extended in several directions. First, the labor market might be made less classical. One could posit imperfect competition among workers, for example. Some of the rents generated by expansionary fiscal policy would therefore accrue as labor income. The multiplier would thus work through both labor income and firm profits.<sup>5</sup>

Second, the model could be made intertemporal. The impact of debt-financed fiscal policy obviously cannot be studied in a static model. That saving and investment play an important role in standard Keynesian analysis also suggests extending this model to a dynamic setting.

NOTES

1. For an exposition of the Keynesian cross, see Samuelson [1948] or almost any introductory text.
2. One might object that this assumption is not reasonable because expenditure depends on industry profits. The model could easily be amended, however, to include a continuum of industries; the demand curve of each industry would depend on aggregate profits.
3. One could also imagine that each firm produces a differentiated product. In this case, the profit margin  $\mu$  depends on each firm's elasticity of demand, which could plausibly be assumed constant.
4. Note that the second line is always steeper than the first, since  $\alpha < 1 < 1/\mu$ .
5. Alternatively, the labor market could be characterized by efficiency wages.

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Figure 1  
A New Keynesian Cross

