Chapter 3: a simple Keynesian CGE model

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Abstract

This chapter investigates the impact of a Keynesian closure on the properties of a CGEM model especially in terms of the multiplier of public expenditures.

Key words: macroeconomic modeling, microeconomic behavior, CGE, Walrasian closure, Keynesian closure

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Contents

1 Introduction

With a Keynesian closure, prices are rigid and therefore do not clear (at least instantaneously) supply and demand. In coherence with Keynes' views, the equality between supply and demand is satisfied by assuming that demand defines supply . The main idea behind it is that producers will not produce if there is no demand. In other words, the law of Say does not hold: the stock of production factor does not define the level of demand but the contrary holds.
Section 2 presents the model's Keynesian closure while Section 3 displays the simulation results.

2 Model closure

2.1 Production

In the Keynesian closure, the equation that defines production is the one introduced in Chapter 1. Production is endogenously determined as the sum of households consumption, investment and public spendings 4.1

$$Y = CH + I + G \tag{4.1}$$

Contrarily to the Keynesian model, the equation of production determines investment in the Walrasian closure instead of determining production.

2.2 Price

As production is determined by4.1, equation 4.2 determines prices.

$$p.Y = w.L + p.\left(\delta + r\right).K^n \tag{4.2}$$

In the equation of price, capital (K) is replaced by notional capital (K^n), defined in 4.5. Contrarily to the Keynesian closure, the equation of price determines production in the Walrasian closure.

2.3 Household's consumption

As in the Walrasian closure, we consider that households supply labor and capital, for which they get their total income $(w.L + p.r.k)$. We assume that households wish to use a fixed share of their total income for consumption. The equation determining household's consumption 4.3 is the same as the one defined in Chapter 1.

$$CH = \left(1 - \sigma\right).\frac{(w.L + p.r.K)}{p} \tag{4.3}$$

2.4 Labor demand

For Walras, since conditional factor demands define wages and interest rates , capital and labor are exogenous. In the Keynesian framework, these conditional factor demands define labor and capital, which are hence endogenous. The equation defining labor demand 4.4 is the same than the Walrasian model.

$$L = \left(\frac{Y}{PROG^L}\right) \cdot \left(\left(\varphi^L\right)^\rho\right) \cdot \left(\frac{w}{(p.PROG^L)}\right)^{(-\rho)} \tag{4.4}$$

2.5 Capital demand (notional level)

Contrarily to the Walrasian framework, where perfect flexibility (of interest rate and wages, for example) ensures that markets (for example capital and labor market) clear instantaneously and hence constitute immediately an efficient outcome, the Keynesian framework introduces "stickiness". According to the latter, variables are no longer perfectly flexible. This results in a situation where the effective or "actual" value of a variable will not equal to the one that would be efficient, which we will call "notional". For this reason, we distinguish between the effective capital K derived from cost minimization and the notional capital K_n.

The equation defining notional capital (4.5) is the same as the one defining capital from a CES function in the Walrasian closure.

$$K^n = \left(\frac{Y}{PROG^K}\right) \cdot \left(\left(\varphi^K\right)^\rho\right) \cdot \left(\frac{(\delta + r)}{PROG^K}\right)^{(-\rho)} \tag{4.5}$$

2.6 Capital demand (effective level)

Capital demand 4.6 in the Keynesian model is defined by the capital accumulation equation defined in the Walrasian model.

$$\Delta (K) = I_{t-1} - \delta.K_{t-1} \tag{4.6}$$

2.7 Investment

In the Walrasian model investment is determined by savings. In the Keynesian closure, investment is endogenously defined as the sum of two terms 4.7:
- past notional capital
- an adjustment term between notional and effective capital

$$\Delta (\log I) = \Delta \left(\log K^n_{t-1}\right) + alpha^{I,Kn}. \log \frac{K^n_{t-1}}{K_{t-1}} \tag{4.7}$$

3 Simulation results

We present below some main results regarding the impact on public spending of one GDP point. We assume a long term steady state where the growth rate of volume and price variables is zero. This requires the assumptions that in the long term the growth rate of technical progress and of the population is zero.
Increasing public spending result on the following effects:

- Positive multiplier (Crowding in effect): the increase in public spending has an immediate positive effect on the economy (Figure 1), contrarily to the Walrasian model where the impact of an increase in public spending leads to a negative multiplier

- The supply constraint is no more held: production is no more predetermined by labor and capital (implicit assumption of non used production)

- As production increases, more factors are needed which increases demand for labor and capital (Figure 2). Increasing labor and capital rises production which increases consumption and investment

- Prices, wages and interest rate remain constant (Figure 3)

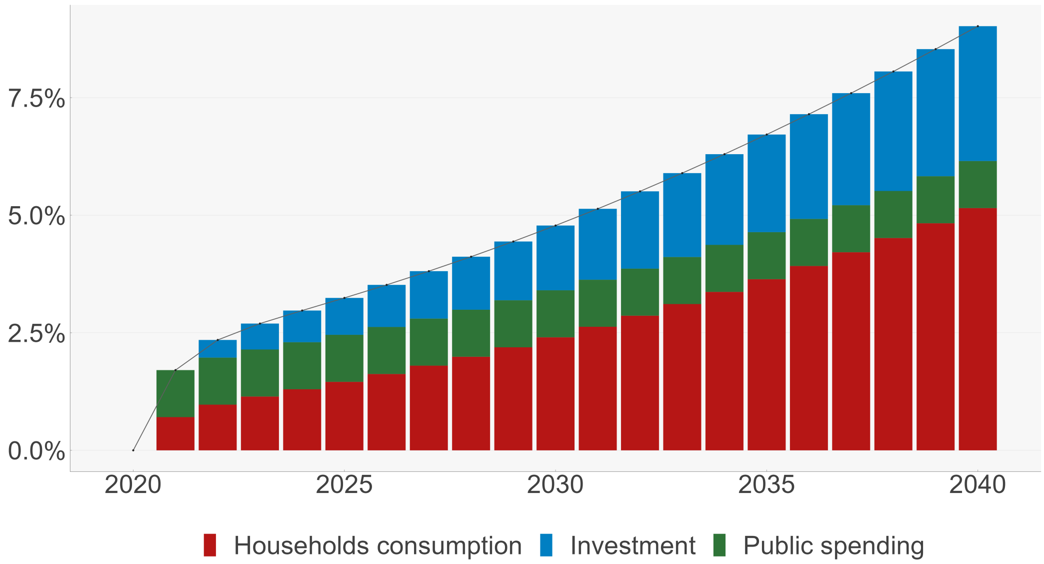

Figure 1: Contribution to GDP in relative difference from baseline

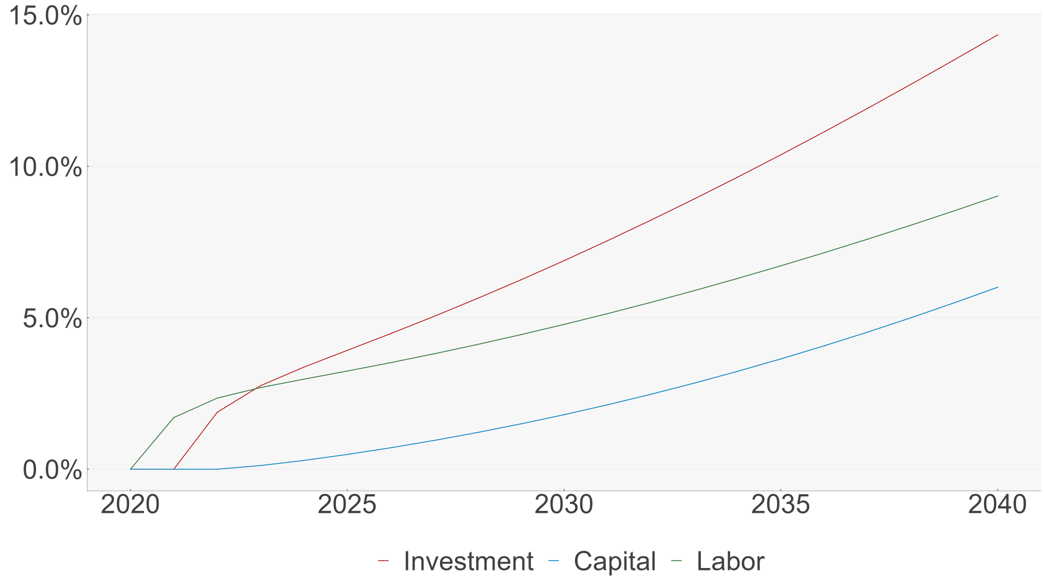

Figure 2: Capital, labor and investment (in relative difference from baseline)

Figure 3: Prices and wages (in relative difference from baseline) and interest rates (in absolute difference)

4 Endogenous variables' equations

Production (GDP)

$$Y = CH + I + G \tag{4.1}$$

Price

$$p.Y = w.L + p.\left(\delta + r\right).K^n \tag{4.2}$$

Households'consumption

$$CH = \left(1 - \sigma\right).\frac{\left(w.L + p.r.K\right)}{p} \tag{4.3}$$

Labor demand

$$L = \left(\frac{Y}{PROG^L}\right).\left(\left(\varphi^L\right)^\rho\right).\left(\frac{w}{\left(p.PROG^L\right)}\right)^{(-\rho)} \tag{4.4}$$

Capital demand (notional level from cost minimization assuming a CES function)

$$K^n = \left(\frac{Y}{PROG^K}\right).\left(\left(\varphi^K\right)^\rho\right).\left(\frac{(\delta + r)}{PROG^K}\right)^{(-\rho)} \tag{4.5}$$

Capital (effective level from accumulation equation)

$$\mathit{\Delta}\left(K\right) = I_{t-1} - \delta.K_{t-1} \tag{4.6}$$

Investment

$$\mathit{\Delta}\left(\log I\right) = \mathit{\Delta}\left(\log K^n_{t-1}\right) + alpha^{I,Kn}.\log\frac{K^n_{t-1}}{K_{t-1}} \tag{4.7}$$

5 Exogenous variables

5.1. $Delta$ – **Capital depreciation ratio**

5.2. φ^K – **Capital share (CES function)**

5.3. φ^L – **Labor share (CES function)**

5.4. $PROG^K$ – **Capital technical progress (CES function)**

5.5. $PROG^L$ – **Labor technical progress (CES function)**

5.6. ρ – **Elasticity of substitution between capital and labor (CES function)**

5.7. σ – **Households' propensity to save**

5.8. G – **Public spendings**

5.9. w – **Wage**

5.10. r – **Interest rate**

5.11. $alpha^{I,Kn}$ – **Adjustment parameter of investment to notional capital**

6 Glossary

$alpha^{I,Kn}$	Adjustment parameter of investment to notional capital	5.11,	8
CH	Households'consumption	4.3,	7
$Delta$	Capital depreciation ratio	5.1,	8
G	Public spendings	5.8,	8
I	Investment	4.7,	7
K	Capital (effective level from accumulation equation)	4.6,	7
K^n	Capital demand (notional level from cost minimization assuming a CES function)	4.5,	7
L	Labor demand	4.4,	7
p	Price	4.2,	7
φ^K	Capital share (CES function)	5.2,	8
φ^L	Labor share (CES function)	5.3,	8
$PROG^K$	Capital technical progress (CES function)	5.4,	8
$PROG^L$	Labor technical progress (CES function)	5.5,	8
r	Interest rate	5.10,	8
ρ	Elasticity of substitution between capital and labor (CES function)	5.6,	8
σ	Households' propensity to save	5.7,	8
w	Wage	5.9,	8
Y	Production (GDP)	4.1,	7

Bibliography