GST: Basics and Model

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Lectures 3-4

Brief Overview of GST in India

- Introduced by 101st Amendment Act, 2016
- Subsumes a variety of state and central indirect taxes, including Service Tax, Additional Duty on Customs, State Sales Tax etc
- Divided into CGST, SGST, IGST
- It is a Value Added Tax, final tax paid by the consumer
- Brings in a single tax rate for any product across all states- One Nation, One Tax
- Multiple tax rates for different goods and services
- Alcohol and Petroleum products currently excluded from GST
- GST Network (GSTN) set up to provide e-filing of returns and reduce interface with tax authorities

The Composition Scheme

- Tax payers have to file a summarised return on a quarterly basis, instead of 37 returns every month.
- Threshold for availing the Scheme currently stands at Rs. 1.5 crore annual turnover.
- No input tax credit (ITC) facility available.
- Available only for goods, not for services
- Detailed records need not be kept. Lower compliance costs.

Composition Scheme: Possible Inefficiency?

- Suppose tax rates under GST and Composition Scheme are t^g and t^c respectively.
- Suppose there is only one input, say l to produce the output using the production function $f(x) = x^\theta$ where $0 < \theta < 1$
- Let π^c and π^g be the profits under Composition Scheme and GST respectively.
- Assume: The firm operates in a perfectly competitive set up and takes prices as given.
- Therefore, profits are given by:

$$\pi^c = (1 - t^c)pf(x) - cx \tag{0.1}$$

$$\pi^g = (1 - t^g)[pf(x) - cx] - F \tag{0.2}$$

where p is the final price of output, w is the price of inputs and F is the fixed cost of GST compliance.

Composition Scheme Model Continued 1

- Let x^c and x^g be the optimal inputs used under the Composition Scheme and GST respectively.

$$x^c = [\frac{(1 - t^c)\theta p}{w}]^{\frac{1}{1-\theta}} \tag{0.3}$$

$$x^g = [\frac{\theta p}{w}]^{\frac{1}{1-\theta}} \tag{0.4}$$

- Clearly, $x^c < x^g$ for any θ, p, w, and t^c
- Let π^{*c} and π^{*g} be the optimal profits:

$$\pi^{*c} = (1 - t^c)pf(x^c) - cx^c$$

$$\pi^{*g} = (1 - t^g)[pf(x^g) - cx^g] - F$$

Composition Scheme Model Continued 2

- Since cutoff for joining the Composition Scheme is based on revenue threshold, it depends on $pf(x)$.
- But p and f are fixed. So, the revenue threshold is decided by input l.
- Let R^* be the revenue threshold, and x^* solve

$$pf(x) = R^*$$

- So the revenue threshold can be described as: x^*
- Assume: $x^* > x^g$. Small firm case. Since $x^c < x^g$, so both x^c and x^g possible.
- **Case A**: $\pi^{*c} < \pi^{*g}$. Then firms continue to pay GST and x^g is used.
- **Case B**: $\pi^{*c} \geq \pi^{*g}$. Then firm chooses x^c over x^g.
- Since $x^c < x^g$, so, $f(x^c) < f(x^g)$. The jump occurs at $\pi^{*c} = \pi^{*g}$.
- The inefficiency is the lower level of output produced under the Composition Scheme.

Composition Scheme Model Continued 3

- Taking values $\theta = \frac{1}{2}$, $p = 1$, $w = 1$, $t^g = \frac{1}{2}$ and $t^c = \frac{1}{4}$
- Inefficiency occurs due to the fixed cost F
- Inefficiency also occurs due to the Composition Scheme
- There is trade-off

Monopoly Set-up

- Consider a firm facing inverse demand curve $P(x)$, where x is the quantity of output sold by the firm.
- Following the arguments given in previous slides, the profits are:

$$\pi^c = (1 - t^c)P(f(x))f(x) - cx \tag{0.5}$$

$$\pi^g = (1 - t^g)[P(f(x))f(x) - cx] - F \tag{0.6}$$

- $f(x)$ is the production function,
- w is the price of inputs and
- F is the fixed cost of GST compliance.

Monopoly 2

- The First Order Conditions (FOCs) are given by:

$$(1 - t^c)MR(x^c)f'(x^c) = w \tag{0.7}$$

$$MR(x^g)f'(x^g) = w \tag{0.8}$$

- Comparing the two FOCs, we get:

$$MR(x^c)f'(x^c) > MR(x^g)f'(x^g)$$

- $MR(x)f'(x)$ can be written as $A(x)$ where $A'(x) < 0$ as both MR and $f'(x)$ are decreasing in l.
- So, $A(x^c) > A(x^g)$ and hence, $x^c < x^g$
- Thus, the inefficiency remains even when we move to a monopoly setting.

Observations

- The inefficiency stems from fixed costs of GST compliance F and Composition Scheme
- Efficiency requires reducing of F
- In monopoly, the inefficiency can even be higher as $MR(x)$ is downward sloping, while it is constant in the perfect competition case.

GST Evasion by Firms

- Reports suggest that firms are evading GST.
- But self policing feature of VAT should prevent evasion.
- So, what explains this evasion?
- The catch lies in understanding the value chain dynamics.
- If all firms in the value chain evade taxes, it is possible to evade the tax at every stage of the value chain.
- However, if at any stage of the value chain, a firm decides not to evade any tax, theoretically, it is not possible to evade the tax.

A Model to Explain Evasion

- Since it is easiest to evade VAT at the final point of sale, we begin our analysis from there.
- Consider a firm facing inverse demand curves $P(x)$ and $P_e(e)$
- $P(x)$ is the demand for goods in the formal economy (so, taxes need to be paid) and $P_e(e)$ is the demand for goods in the informal economy (so, taxes do not have to be paid).
- The monopolist procures its inputs from an upstream supplier. The cost of producing any unit x or e of output is constant c
- Since producing in the informal economy is evasion of taxes, a cost $g(e)$ has to be incurred to hide this evasion from tax authorities. $g'(e) > 0$, $g''(e) > 0$

Suppose

- There are two types of consumers
- Formal-consumers - who insist on a sale receipt
- Informl-consumers - who can buy without receipt provided they pay a lower price

Assumption 1

The monopolist firm can perfectly differentiate between the formal and informal economy consumers.

Assumption 2

A fraction α of the consumers come from the formal economy and rest $1 - \alpha$ come from the informal sector.

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- $P(X)$ is the demand for goods in the formal economy (so, taxes need to be paid) and
- $P_e(E)$ is the demand for goods in the informal economy (so, taxes do not have to be paid).
- The monopolist procures its inputs from an upstream supplier who is also a monopolist.
- The production functions for X and E are given by $f(x)$ and $f_e(e)$, where x and e are the inputs to produce X and E respectively.
- Production (sales) in the informal economy is evasion of taxes, a cost $g(e)$ has to be incurred to hide this evasion from tax authorities. $g(0) = 0$, $g'(e) > 0$, $g''(e) > 0$

Model Continued 1

- Consider a case where both downstream and upstream monopolist collude or
- a single monopolist owns both the upstream and downstream plants. Thus, the objective of the firm is to maximise the joint profits of the two plants.
- Consider first the case where the downstream firm does not evade any tax. It only serves a fraction α of the entire market.
- From the downstream firm, they get a profit given by $\alpha(1-t)[P(f(x))f(x) - zx]$,
- while from the upstream firm, they a profit given by $\alpha[(1-t)zx - c(x)]$.
- For the upstream plant, it is using inputs which were not taxed at an earlier stage, it cannot claim (ITC) .
- So the optimization problem of the downstream firm in this case is given by:

$$\Pi \equiv \max_{x} \alpha[(1-t)P(f(x))f(x) - c(x)]$$

Evasion Model: Formal Sector Only

- Let x^* be the optimum input used. Clearly, x^* satisfies the First Order Condition (FOC) given by:

$$x^* : (1-t)MR(f(x^*))f'(x^*) = c_x(x^*) \tag{0.9}$$

where MR stands for the Marginal Revenue.

Evasion Model: Informal Sector Only

- Consider the case where the two firms cater only to the informal sector consumers. Thus, it faces only the fraction $1 - \alpha$ of the market demand.
- By adding up the two profits, the optimization problem of the firm is given by:

$$\Pi_e \equiv \max_e (1 - \alpha)[P_e(f_e(e))f_e(e) - c(e)] - 2g(e)$$

- Let e^* be the optimal quantity of input produced in the informal sector respectively. The First Order Condition (FOC) for the above problem is given by:

$$e^* : (1 - \alpha)[MR(f_e(e^*))f_e'(e^*) - c_e(e^*)] = 2g'(e^*) \tag{0.10}$$

Evasion Model: Both Sectors

- Consider the case where the firm decides to cater to both the sets of consumers. In that case, the profit $\Pi*$ optimization problem is given by:

$$\max_{x,e} \alpha[(1-t)P(f(x))f(x) - c(x)] + (1-\alpha)[P_e(f_e(e))f_e(e) - c(e)] - 2g(e)$$

- Let x^* and e^* be the optimal quantities of input produced in the formal and informal sector respectively. The First Order Conditions (FOCs) for the above problem are given by:

$$x^* : (1-t)MR(f(x^*))f'(x^*) = c_x(x^*) \quad (0.11)$$

$$e^* : (1-\alpha)[MR(f_e(e^*))f_e'(e^*) - c_e(e^*)] = 2g'(e^*) \quad (0.12)$$

Evasion Model: Both Sectors

- From Equations 0.9 to 0.12, it is clear that:

$$\Pi^* = \Pi + \Pi_e$$

- Thus, $\Pi^* \geq \Pi$ and $\Pi^* \geq \Pi_e$. Hence, the firm produces for both the formal and informal sector consumers, that is, it caters to the demand for the entire continuum of consumers $[0, 1]$.
- Thus, it is optimal for the firm to evade an amount e^* from the tax authorities.

Different Owners

- Consider the case where the upstream and downstream plants have different owners. Therefore, the two plants act as two different firms.
- In this case, if they act strategically or act independently of each other, they cannot maximize their joint profits. Thus, they earn individually low profits as compared to the joint profits which can be divided amongst themselves through effective bargaining.
- Hence, the upstream and downstream firms collude with each other to maximize the joint profits. The resultant profits are divided between the two firms through some form of bargaining process.
- For a setting involving a single stage game, collusion between firms cannot be sustained. However, in a repeated game setting, collusion can be sustained if firms are sufficiently patient.
- The input prices z and z_e charged by the upstream firm to the downstream firm will be negotiated prices, used mainly for accounting purposes. The optimal inputs produced continue to be x^* and e^* respectively.

Observations

- In both these cases, the upstream firm produces a positive quantity of inputs for both the formal and informal sectors. Thus, even the upstream firm evades a fraction of its output.
- In order for this to be possible, both the firms need to commit to same level of illegality. This is done through negotiations and joint sharing of maximized profits.
- Further, this model clearly illustrates the role of tax authorities in changing the incentives for firms to evade by altering g- the cost of evasion- through better and smarter enforcement mechanisms.
- The analysis can be further extended to include multiple stages in the value chain.