Economic Efficiency Government Price Setting and Taxes

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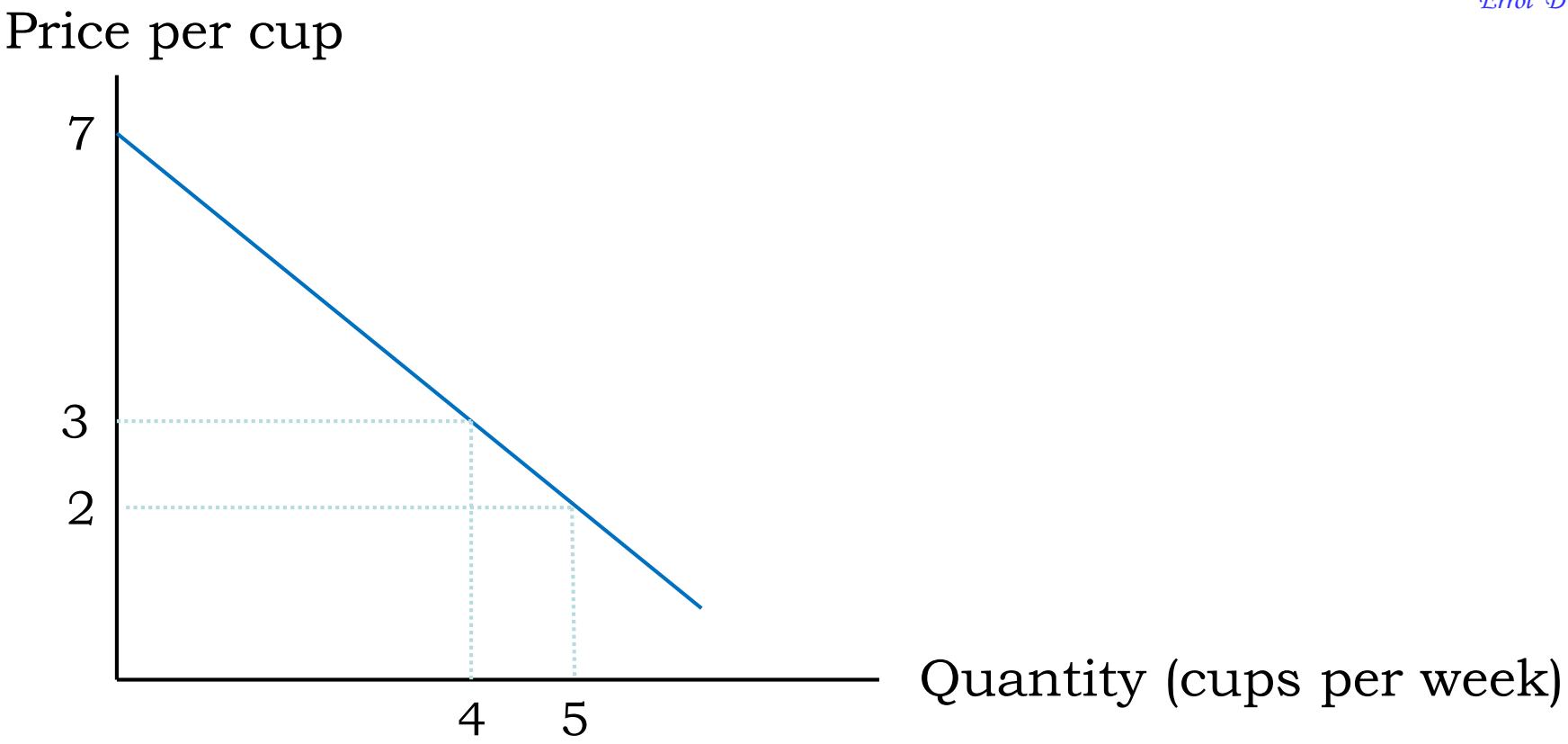
The effects of government intervention in markets, such as price ceilings and price floors, is analyzed using the concepts of consumer surplus, producer surplus, and economic surplus.

Consumer Surplus

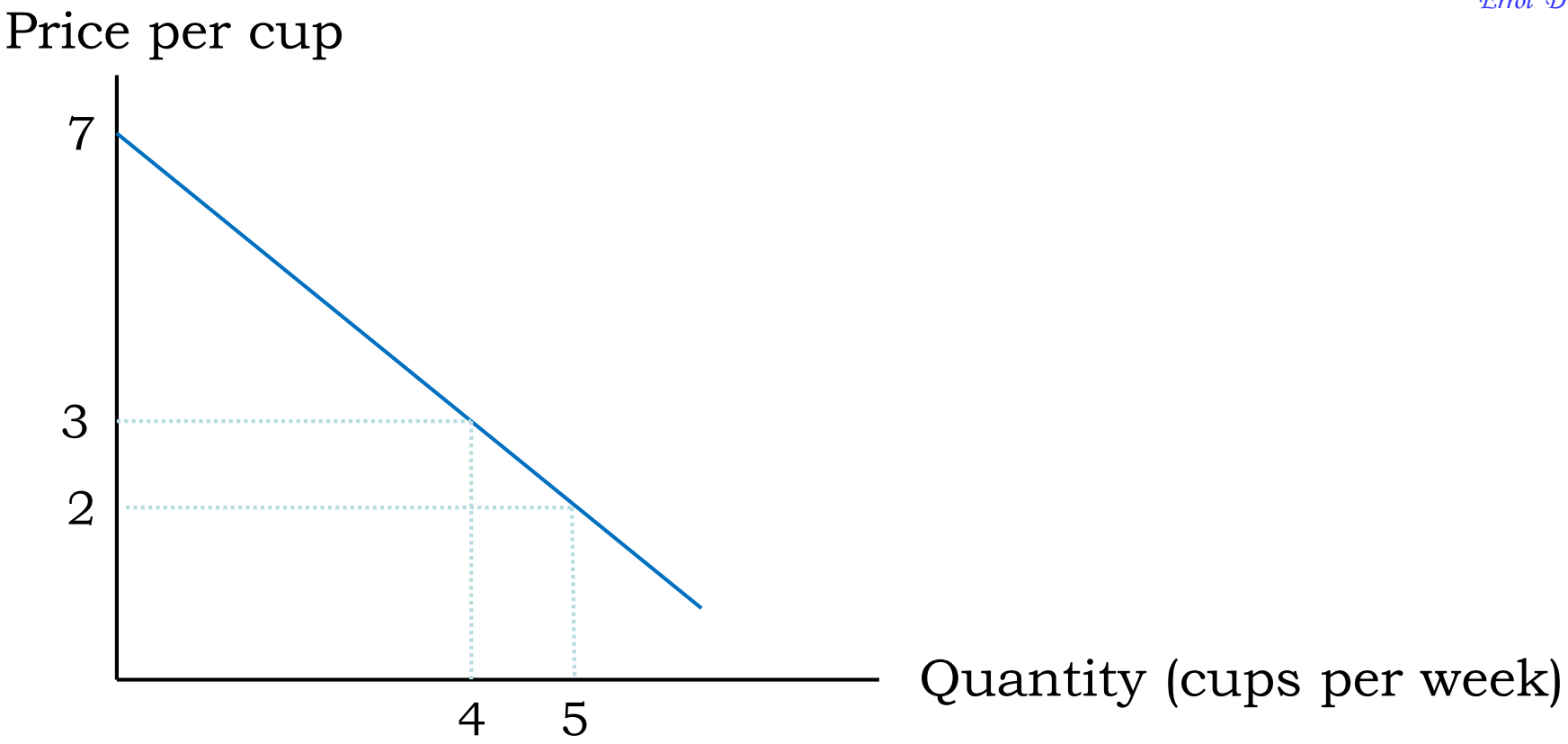
Demand curves show the willingness of consumers to pay a product at different prices. – In the next figure an individual's demand curve for chai is shown ⟹

If the price is Re 3 per cup, Ishan will buy 4 cups of chai per week. If the price is Rs 2 per cup he will buy 5 cups per week. The fact that Ishan is willing to pay Rs 3 for the 4^{th} cup means that the *marginal benefit* to him from the fourth cup is Rs 3. Similarly since he is willing to pay Rs 2 for the 5^{th} cup means the marginal benefit to him from that cup is Rs 2.

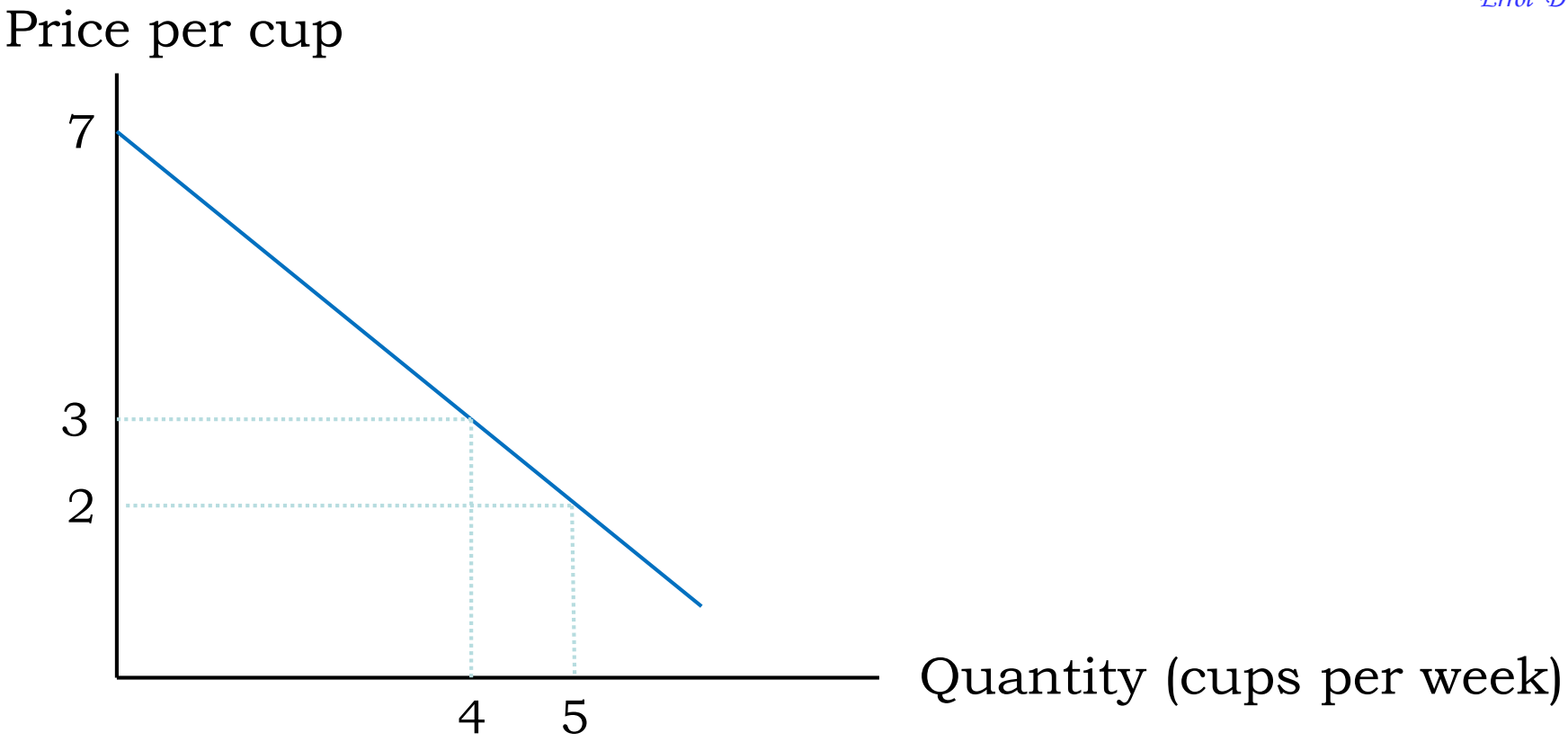


The **marginal benefit** is the additional benefit to a consumer from consuming one more unit of a good or service.

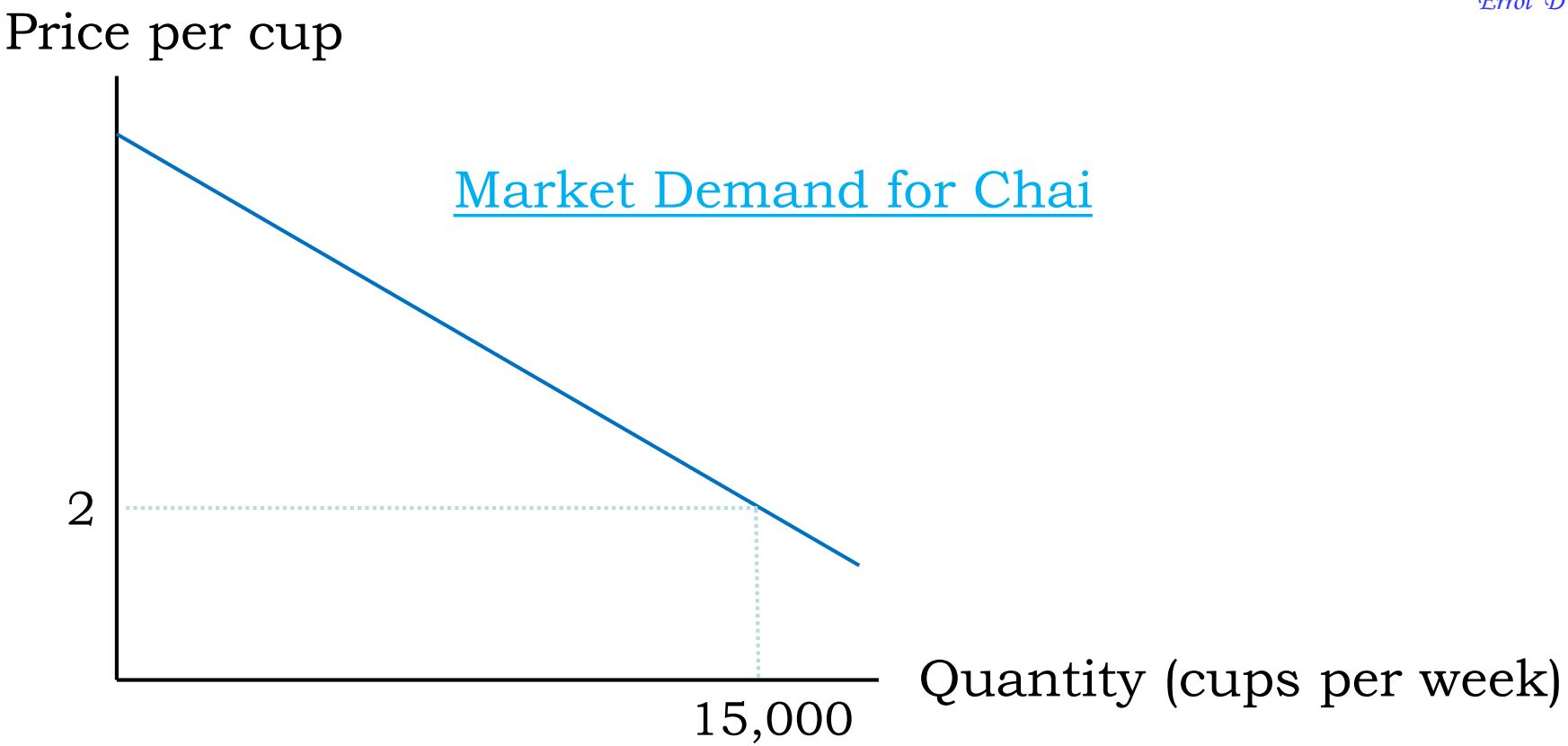
Another way to think of the demand curve is as a representation of Ishan's marginal benefit curve for chai.



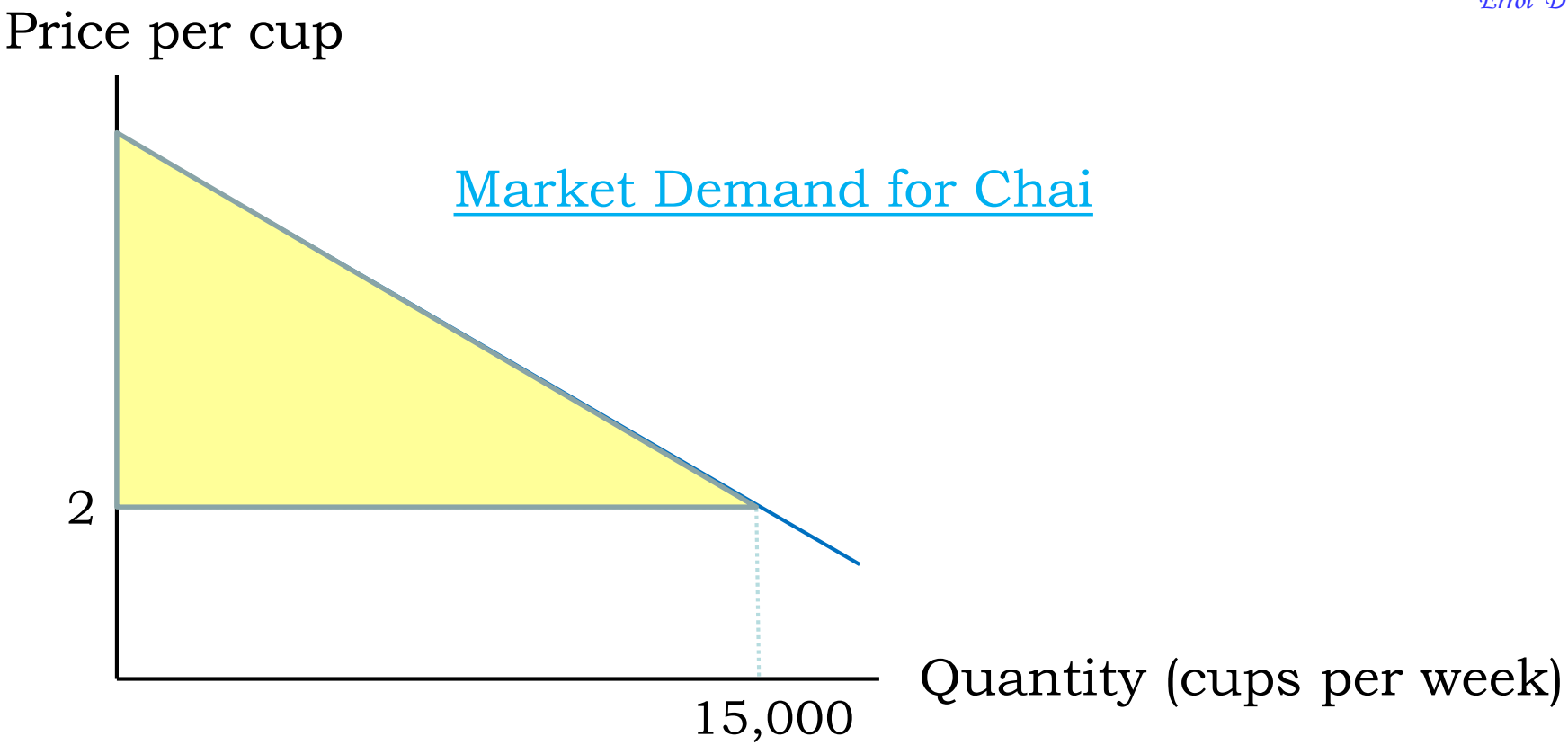
If the market price is Rs 2 per cup. Then for the 5th cup that Ishan buys in the week his marginal benefit equals the price. – For the other 4 cups purchased, however, the marginal benefit is greater than the price he pays. He is thus paying less than the maximum price he would have been willing to pay for the first 4 cups of tea bought in the week.



The difference between the highest price a consumer is willing to pay and the price the consumer actually pays is called the **consumer surplus**.



In the market the quantity demanded at a price of Rs 2 is 15,000 cups per week. – The only consumers who would receive no consumer surplus are those who would not have purchased any chai if the price had been higher than Rs. 2.



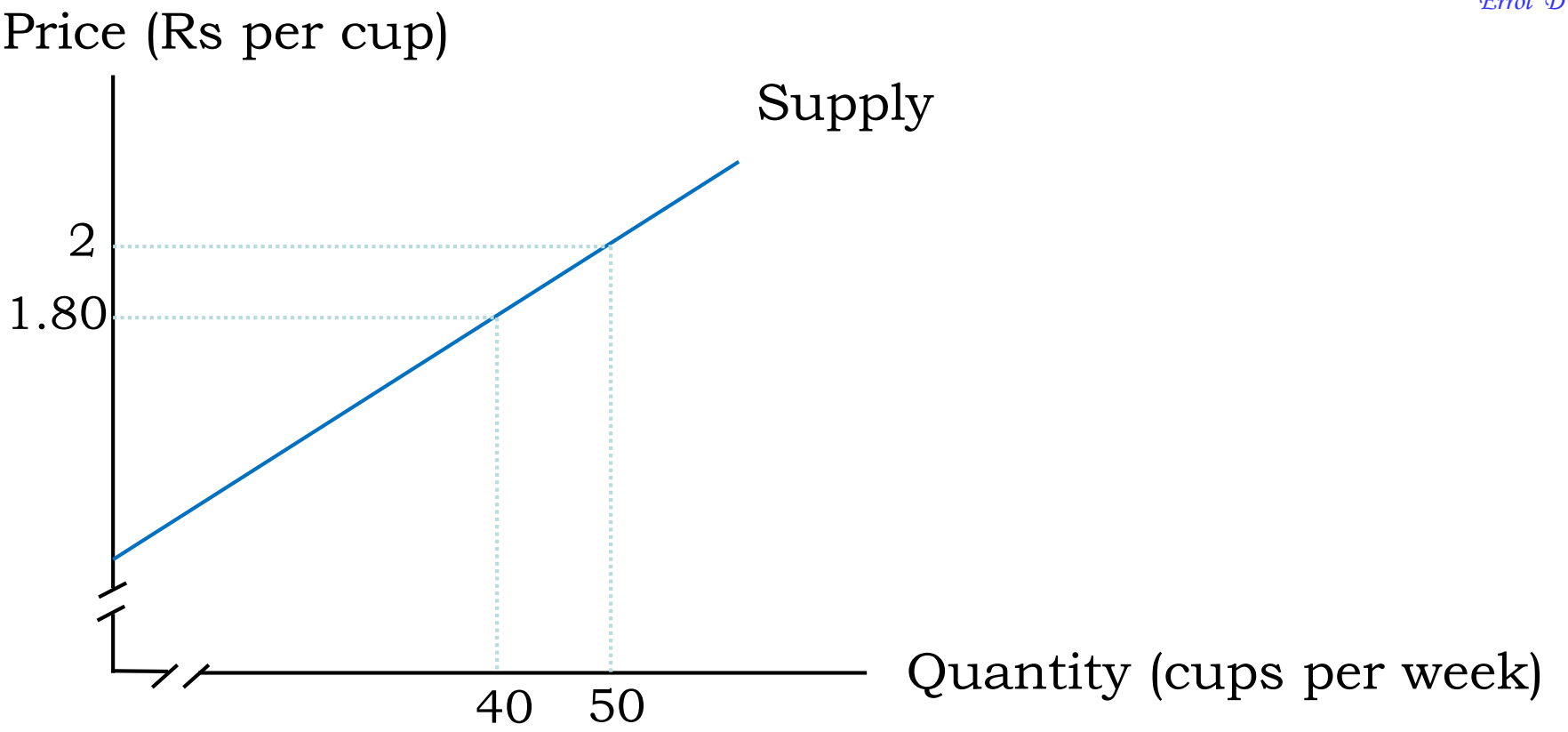
We calculate the total consumer surplus in the market by adding up the consumer surplus received on each unit purchased. As the demand curve measures the marginal benefit received by consumers, the *total consumer surplus is equal to the area below the market demand curve and above the market price*. Consumer surplus is the shaded yellow area.

Producer Surplus

Supply curves show the willingness of firms to supply a product at different prices. The willingness to supply a product depends on the cost of producing it. Firms will supply an additional unit of a product only if they receive a price equal to the additional cost of producing it.

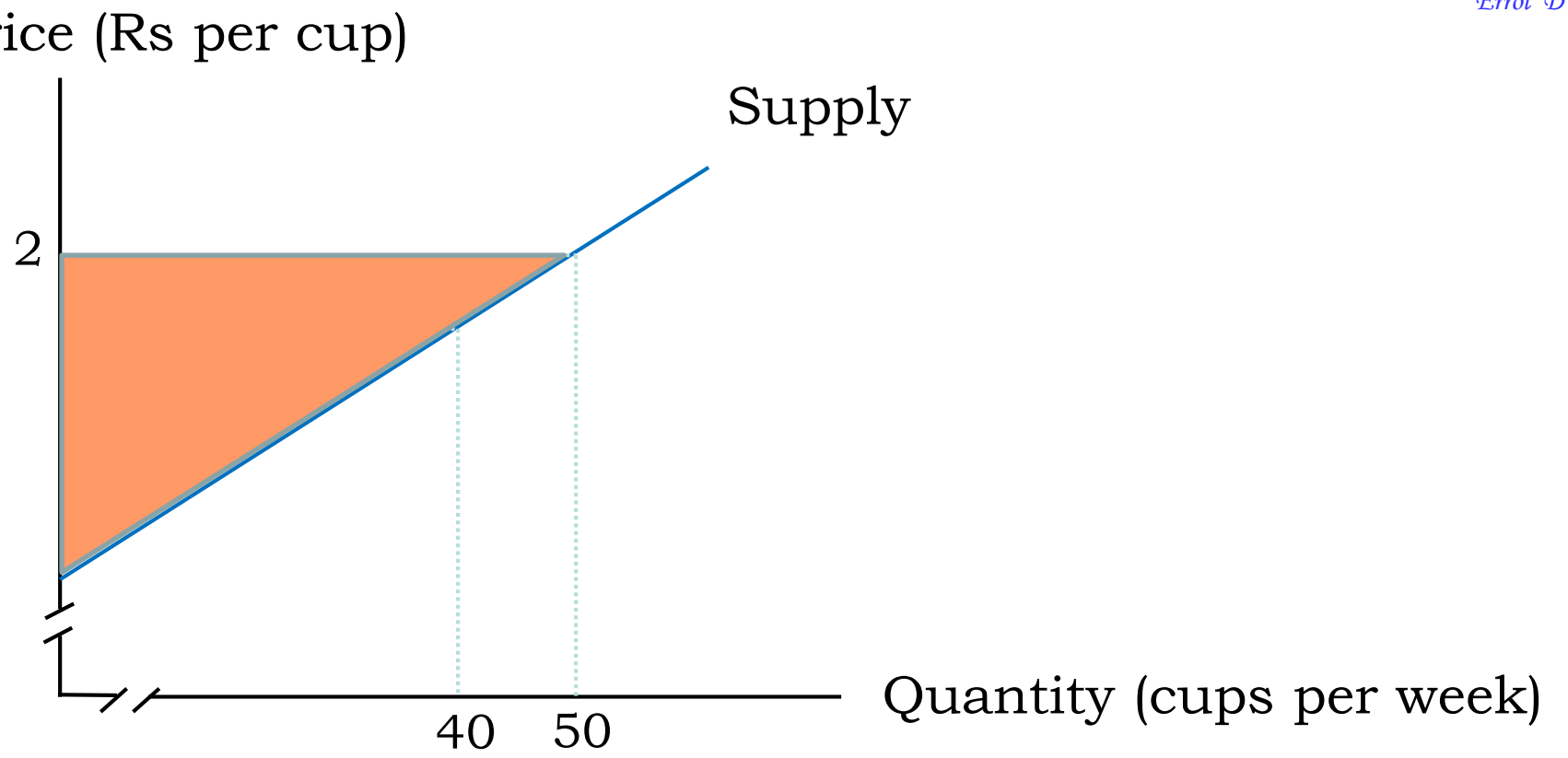
Marginal cost is the additional cost to a firm of producing one more unit of a good or service.

In the next figure Chaiwala is willing to supply 50 cups of tea at a price of Rs 2 per cup – the 50th cup must have a marginal cost of Rs 2. The supply curve also shows that Chaiwala is willing to supply 40 cups at a price of Rs 1.80 per cup. The marginal cost of the 40th cup is Rs 1.80. The supply curve, then, is also a marginal cost curve.



If the market price of chai is Rs 2 Chaiwala is able to sell the 40th cup for Rs 0.20 more than the lowest price – which is Rs 1.80 – he would have been willing to accept. This Rs 0.20 is the producer surplus on that particular cup of tea.

Producer surplus is the difference between the lowest price a firm would have been willing to accept and the price it actually receives.



The total amount of producer surplus tea sellers receive from selling chai can be calculated by adding up the producer surplus received on each cup sold. – Hence *the total producer surplus in a market is the area above the market supply curve and below the market price*. – This is shown as the orange shaded area in the figure.

The Meaning of Consumer and Producer Surplus

Consumer surplus measures the benefit to consumers from participating in a market, and producer surplus the benefit to producers from participating in a market.

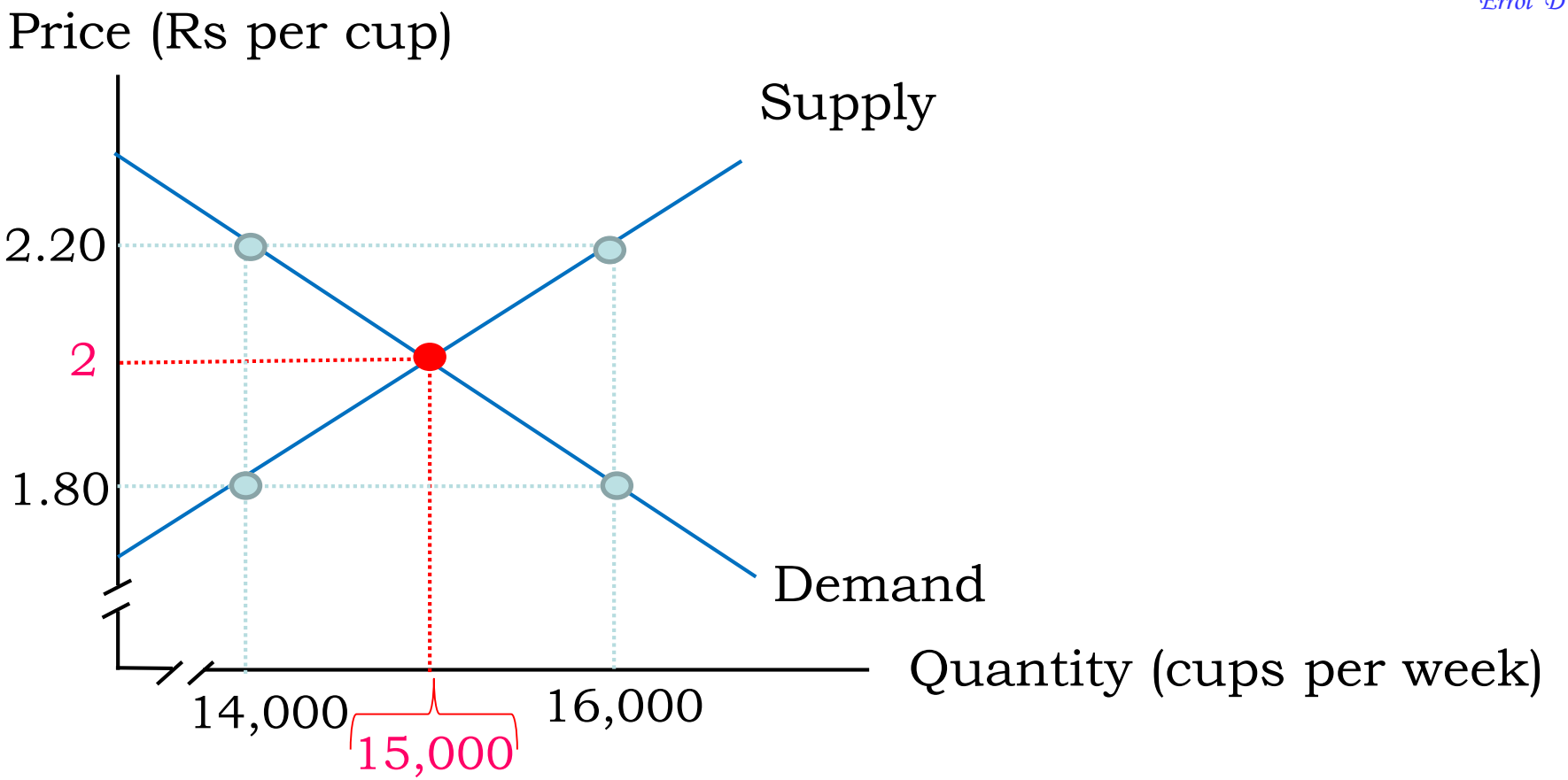
Consumer surplus measures the net benefit to consumers from participating in a market, rather than the total benefit. When the price of a product is zero, the consumer surplus would be all of the area under the demand curve. When the price is non-zero, consumer surplus is the total benefit received by consumers minus the total amount they would have to pay to buy the good.

Anologously producer surplus is the total amount firms receive from consumers minus the cost of producing the good.

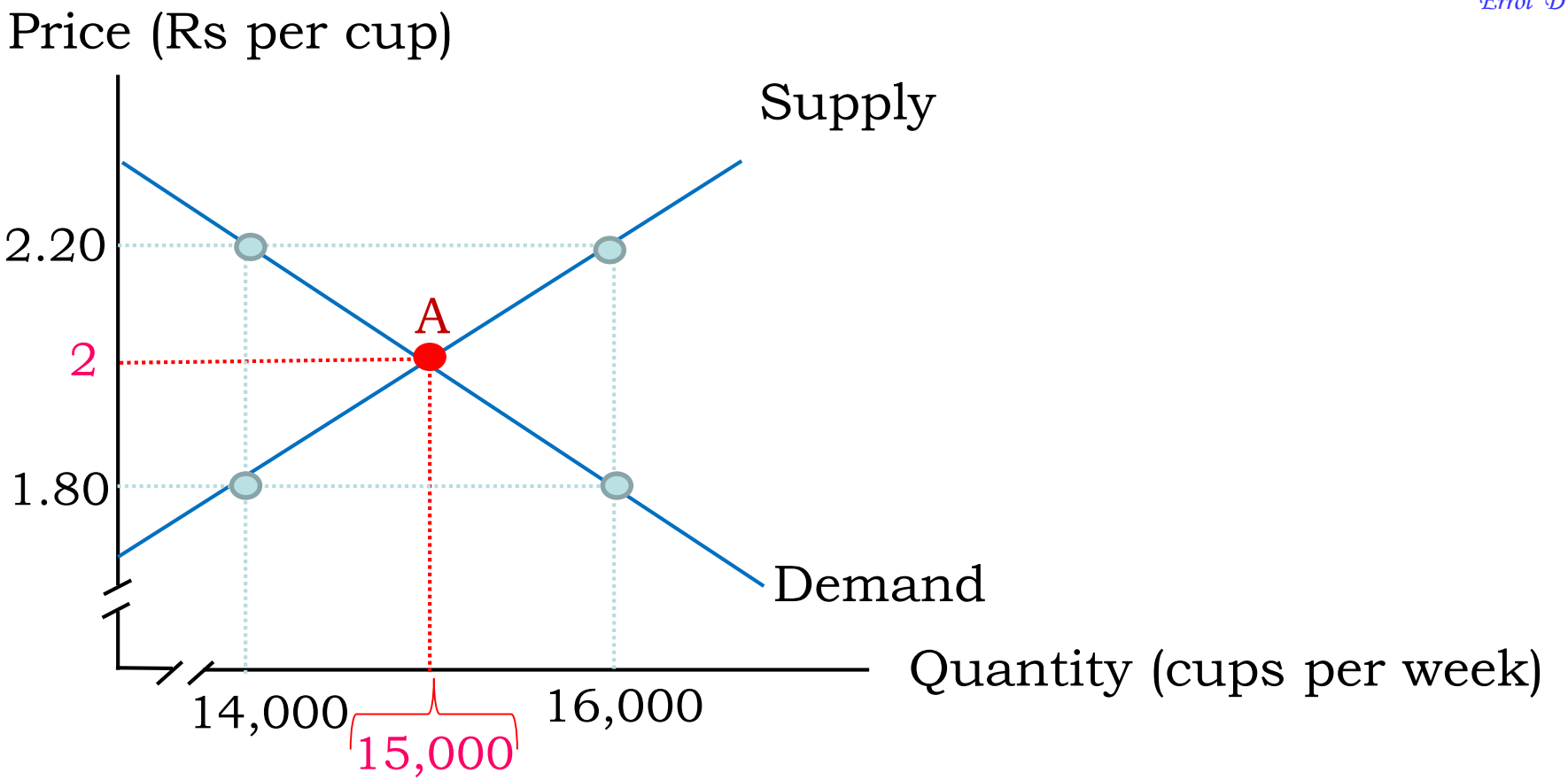
We have introduced the terms marginal benefit and marginal cost.

We have also introduced the terms consumer surplus and producer surplus.

We shall now see that the two sets of concepts lead to the same outcome and that using both we can increase our understanding of economic efficiency.

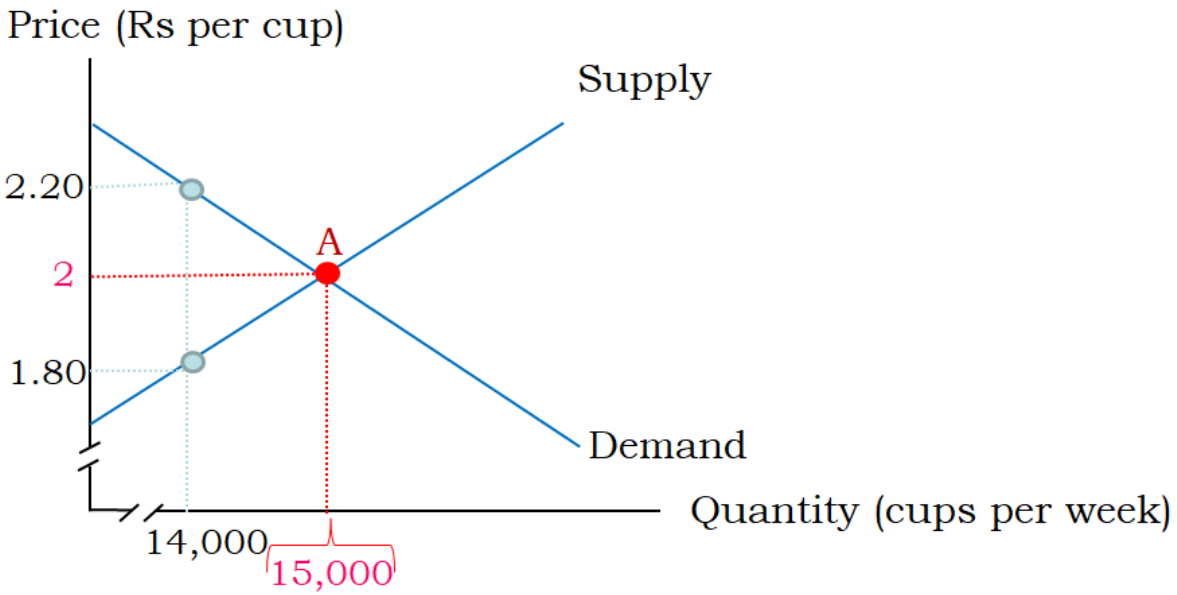


The demand curve shows the marginal benefit received by consumers and the supply curve the marginal cost of production. – **Economic efficiency** is when the marginal benefit from the last unit sold equals the marginal cost of production. This occurs at 15,000 cups per week of production.



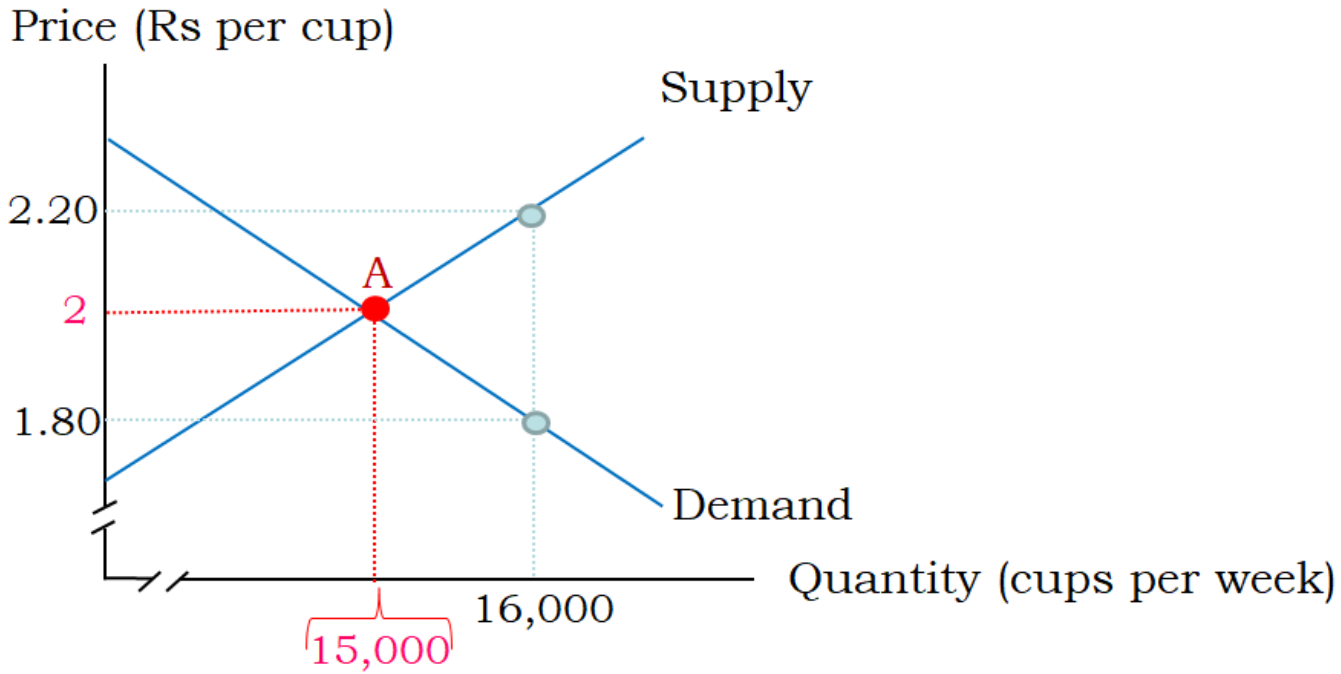
Why is the outcome at point A economically efficient?

Because every cup of chai has been produced where the marginal benefit to buyers is greater than or equal to the marginal cost of production.



Suppose that output of chai were 14,000 cups per week. At this output the marginal benefit from the last cup of chai sold is Rs 2.20 whereas the marginal cost is only Rs 1.80. – This level of output is not efficient because 1,000 cups more could be produced for which the additional benefit to consumers is greater than the additional cost of production.

Consumers would willingly purchase those cups, and chai sellers would willingly supply them, making both consumers and sellers better off.



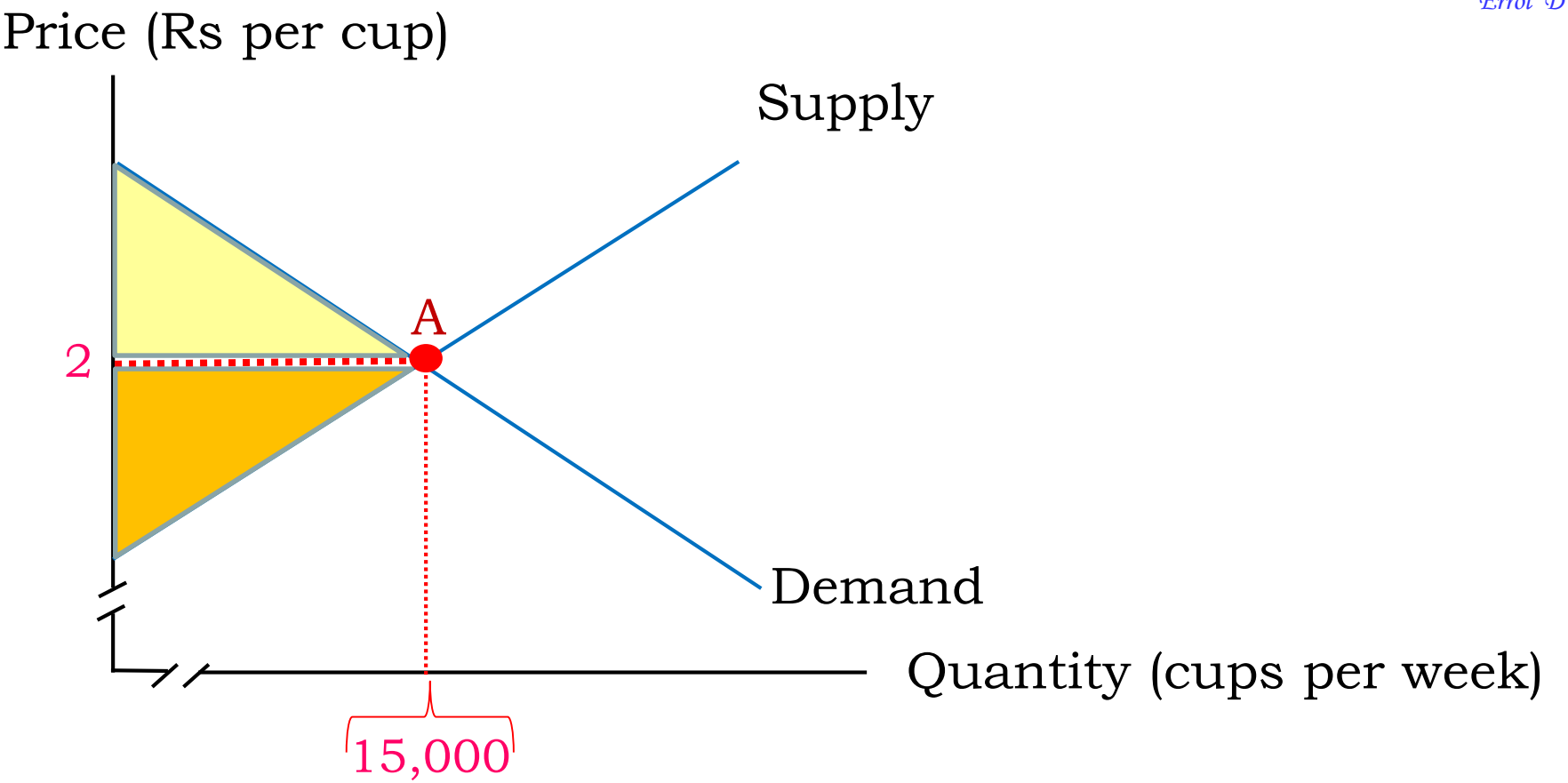
Similarly if the output of chai were 16,000 cups per week the marginal cost of the 16,000th cup is Rs 2.20 and the marginal benefit is only Rs 1.80. Consumers would not be willing to pay the price tea sellers would need to receive for any cup beyond the 15,000th.

To summarize: *Equilibrium in a competitive market results in the economically efficient level of output, where marginal benefit equals marginal cost.*

Economic surplus in a market is the sum of consumer surplus and producer surplus. – In a competitive market with many buyers and sellers and no government restrictions, economic surplus is at a maximum when the market is in equilibrium.

To see this look at the market for chai ⟹

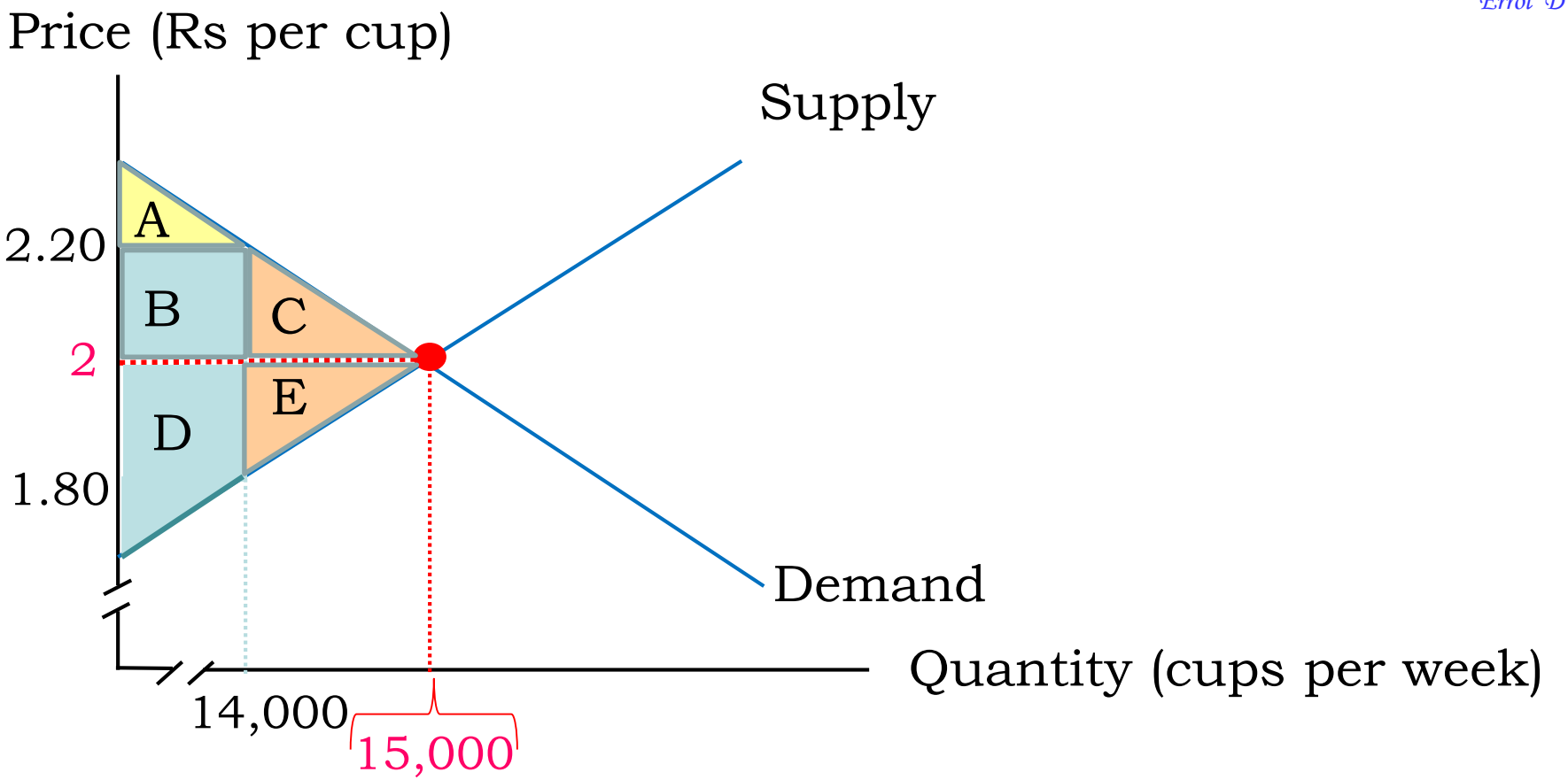
The consumer surplus is the yellow area under the demand curve and above the line indicating the equilibrium price of Rs 2.00. The producer surplus is the orange area above the supply curve and below the price line.


Price (Rs per cup)
Supply
A
2
Demand
Quantity (cups per week)
15,000

Deadweight loss

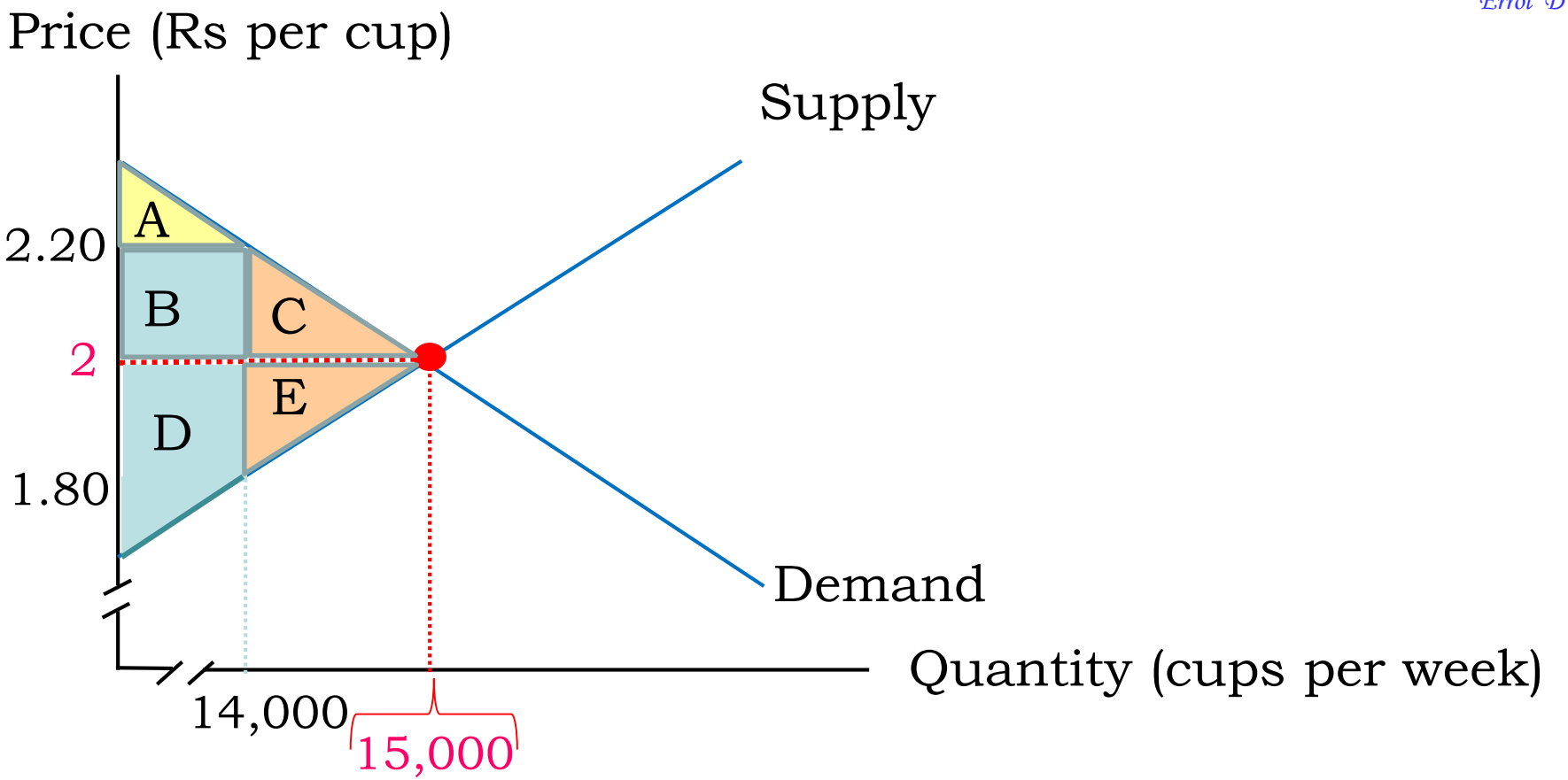
To show that economic surplus is maximized at equilibrium, consider the situation where the price of chai is above the equilibrium price as shown in the following figure ⇨

At a price of Rs 2.20 per cup, the number of cups consumers will be willing to buy per week drops from 15,000 to 14,000. At competitive equilibrium, consumer surplus is equal to the sum of areas A, B, and C. – Fewer cups are sold at the higher price and the consumer surplus has declined to just the area of A when the price is Rs 2.20. ⇨



At competitive equilibrium producer surplus is the sum of areas D and E. At the higher price of Rs 2.20, producer surplus changes to be equal to the sum of areas B and D.

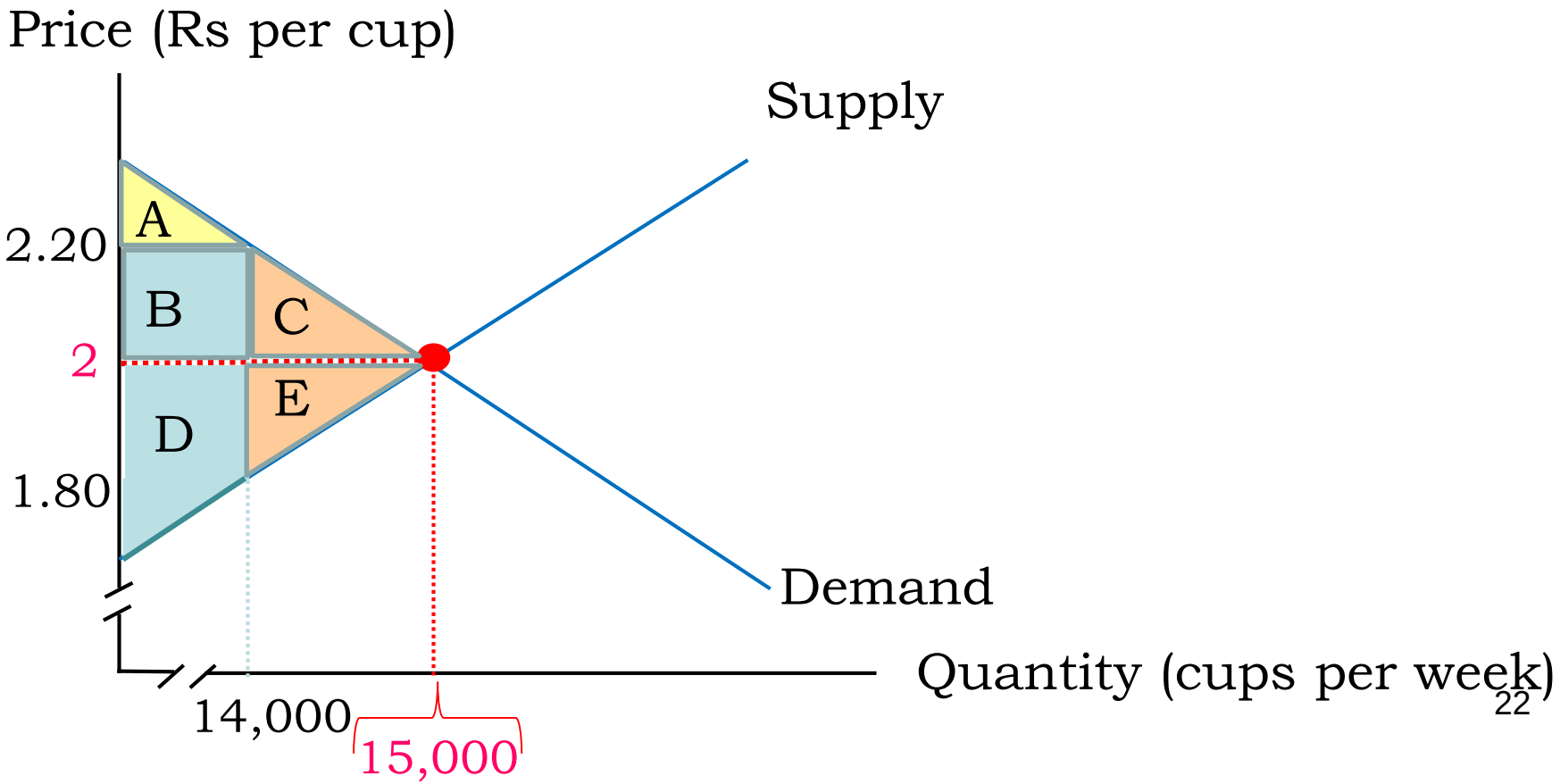
The **sum of consumer & producer surplus – economic surplus - has been reduced** to the sum of areas A, B, and D.



Economic surplus has declined because at a price of Rs 2.20 all the cups between the 14,000th and the 15,000th which would have been produced in competitive equilibrium, are not being produced. These "missing cups" are not providing any consumer or producer surplus, so economic surplus has declined.

The reduction in economic surplus from a market not being in competitive equilibrium is called the **deadweight loss**.

This is equal to the sum of areas C and E in the figure.



Economic surplus and economic efficiency

Consumer surplus measures the benefit to consumers from buying a product. Producer surplus measures the benefit to firms from selling a product.

Therefore, economic surplus – the sum of the benefit to firms plus the benefit to consumers – is the best measure of the benefit to society from the production of a particular good or service.

This gives us a second way of characterizing efficiency of a competitive market: *Equilibrium in a competitive market results in the greatest amount of economic surplus or total net benefit to society, from the production of a good or service.*

Anything that causes a market for a good or service not to be in competitive equilibrium reduces the total benefit to society from the production of that good or service.

Therefore, **economic efficiency** is a market outcome in which the marginal benefit to consumers of the last unit produced is equal to its marginal cost of production, and in which the sum of consumer surplus and producer surplus is at a maximum.

Note that we have *not* concluded that every *individual* is better off if a market is at competitive equilibrium.

We have only concluded that economic surplus, or the *total* net benefit to society, is greatest at competitive equilibrium.

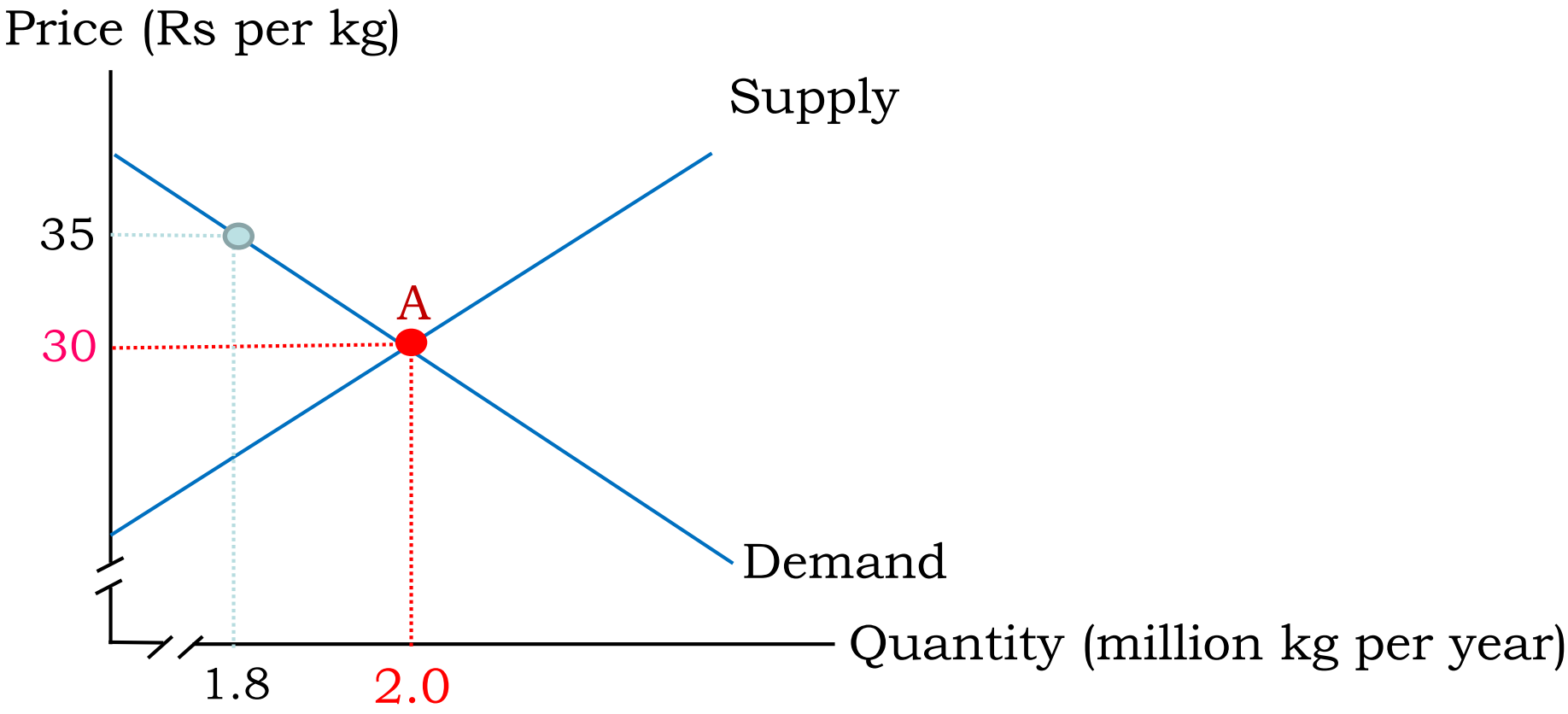
Any individual producer would rather charge a higher price, and any individual consumer would rather pay a lower price, but usually producers can sell and consumers can buy only at the competitive equilibrium price.

Producers or consumers who are dissatisfied with the competitive equilibrium price can lobby the government to legally require that a different price be charged.

When the government does intervene, it can either attempt to aid sellers by requiring that a price be above equilibrium – a price floor – or to aid buyers by requiring that a price be below equilibrium – a price ceiling.

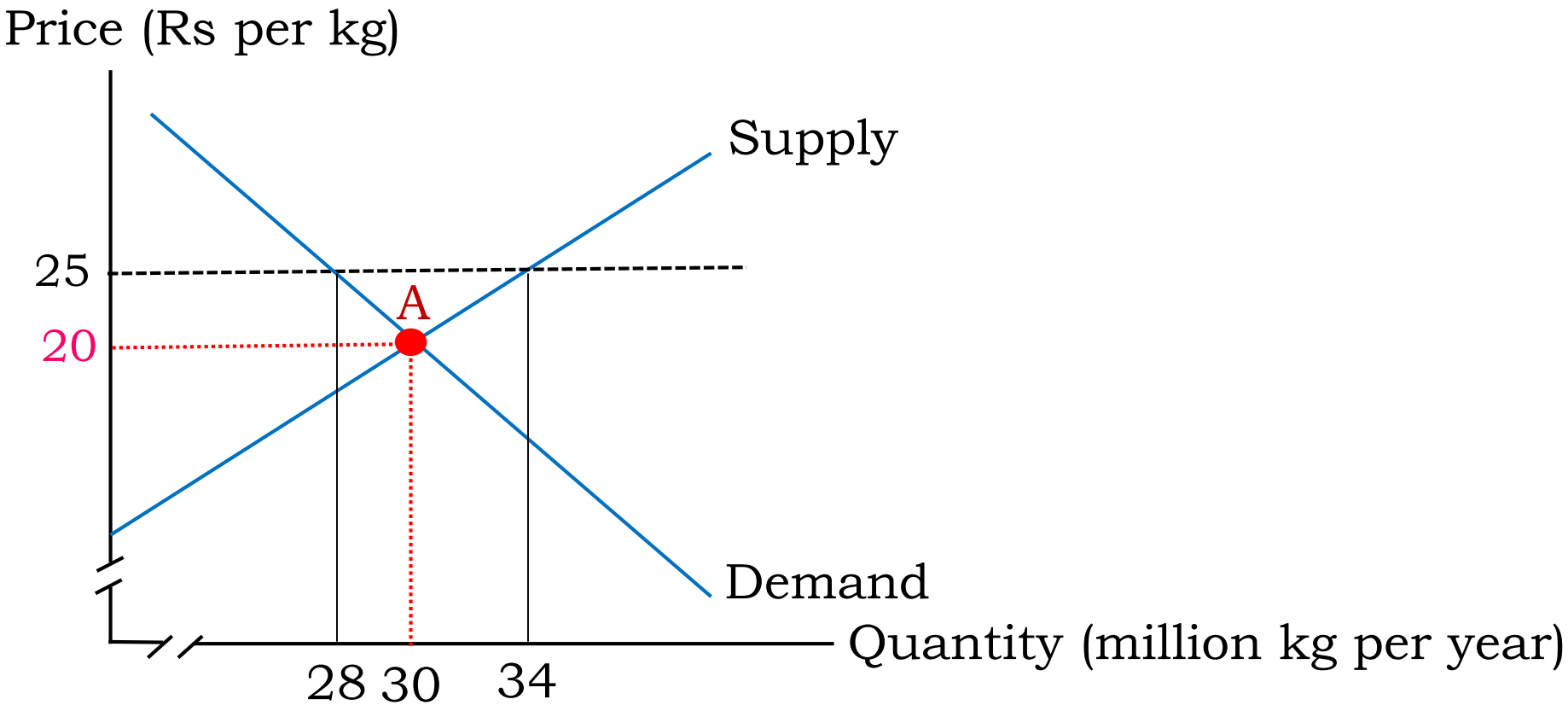
We now use the concepts of producer and consumer surplus and deadweight loss to see the economic inefficiency of binding price floors and price ceilings.

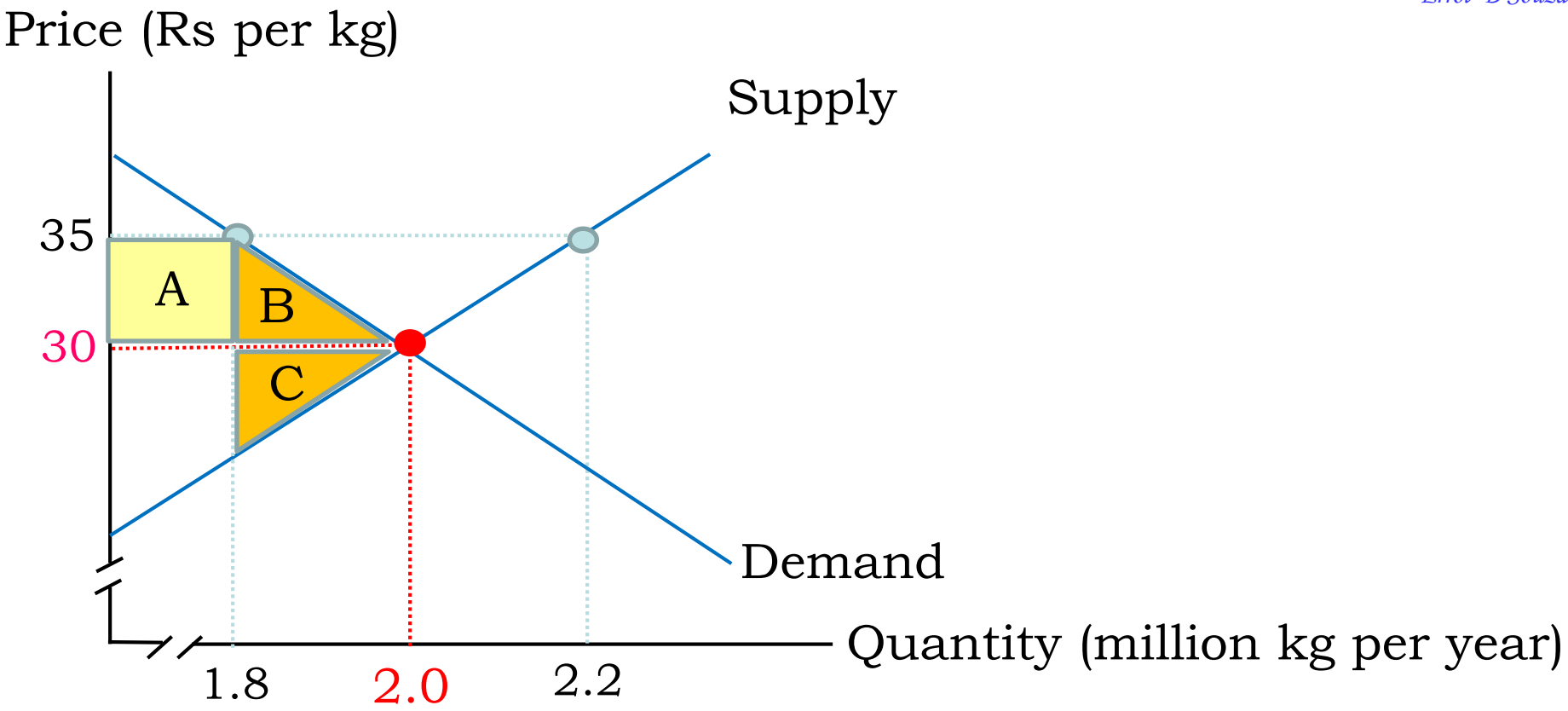
Price supports to Agriculture



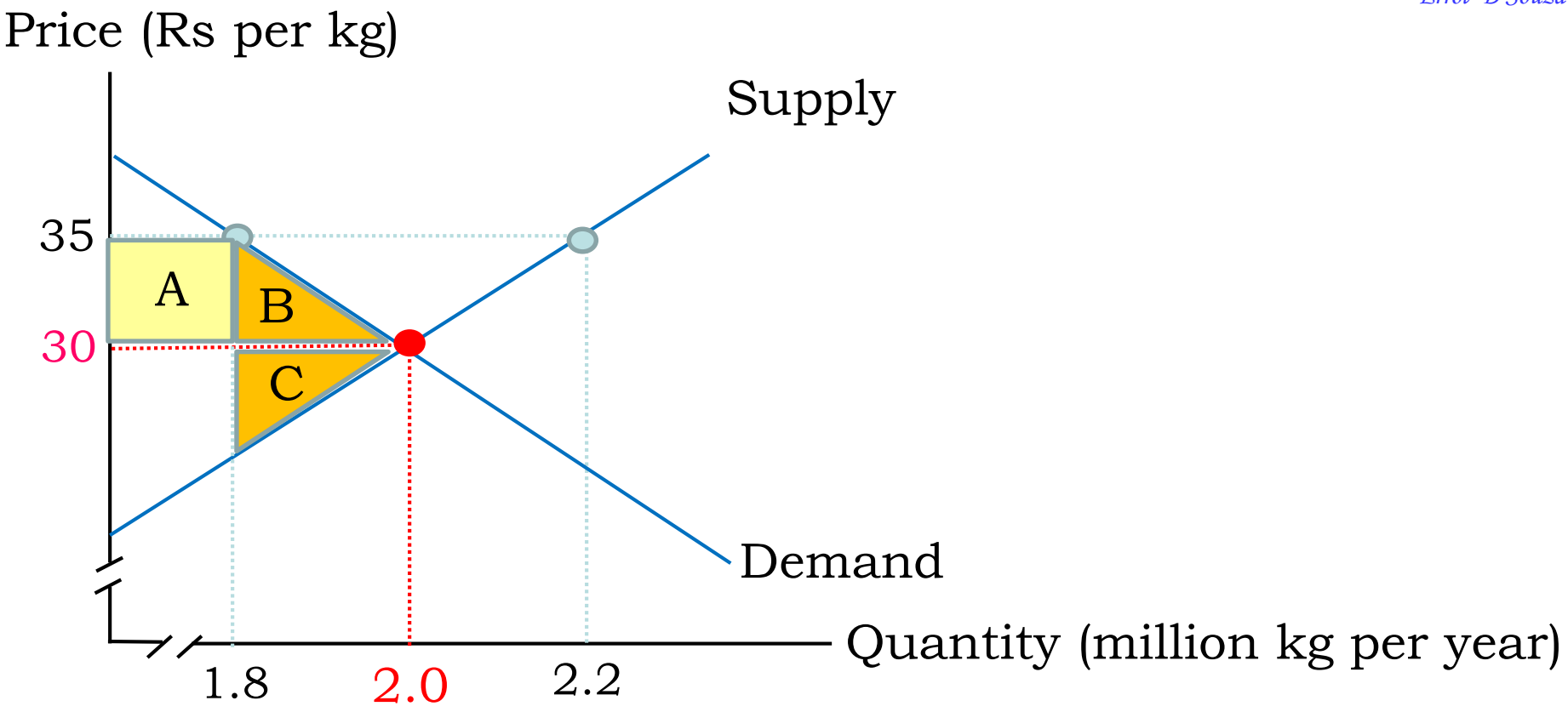
Suppose equilibrium price is Rs 30 per kg. in the wheat market. – On the lobbying of farmers government decides to set a price floor of Rs 35 per kg.

The quantity of wheat sold then falls from 2 to 1.8 million kg per year.


Price (Rs per kg)
Supply
25
A
20
Demand
Quantity (million kg per year)
28 30
34



Suppose initially the production of wheat also falls to 1.8 mn. kg. per year. – The producer surplus received by farmers increases by an amount equal to the area of rectangle A and falls by an amount equal to area of triangle C. – The triangle B represents a loss of consumer surplus.



Total fall in consumer surplus = Area of rectangle A + Area of triangle B.

Total gain in producer surplus = Area of rectangle A — Area of triangle C.

Deadweight loss = Area of triangle B + Area of triangle C.

There is a deadweight loss because the price floor has reduced the amount of economic surplus in the market.

The price floor has caused the marginal benefit of the last kg of wheat to be greater than the marginal cost of producing it. Thus the price floor reduces economic efficiency.

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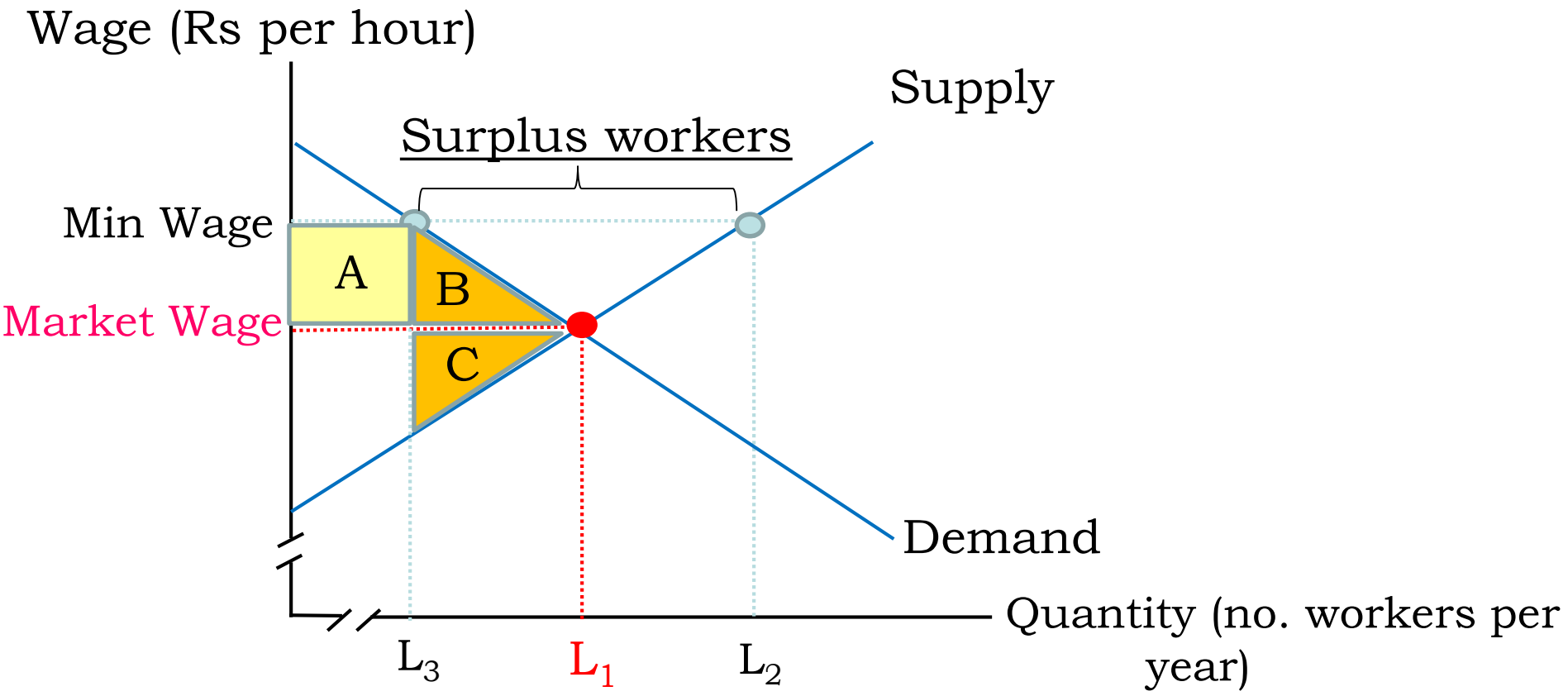
So far we have assumed that farmers reduce their output of wheat to the amount consumers are willing to buy.

However at the price floor established farmers want to supply 2.2 mn. kg. The result is a surplus of 0.4 mn. kg of wheat.

The government then purchases the surplus or pays farmers a subsidy to take some land out of cultivation.

The Minimum Wage – Another Price floor



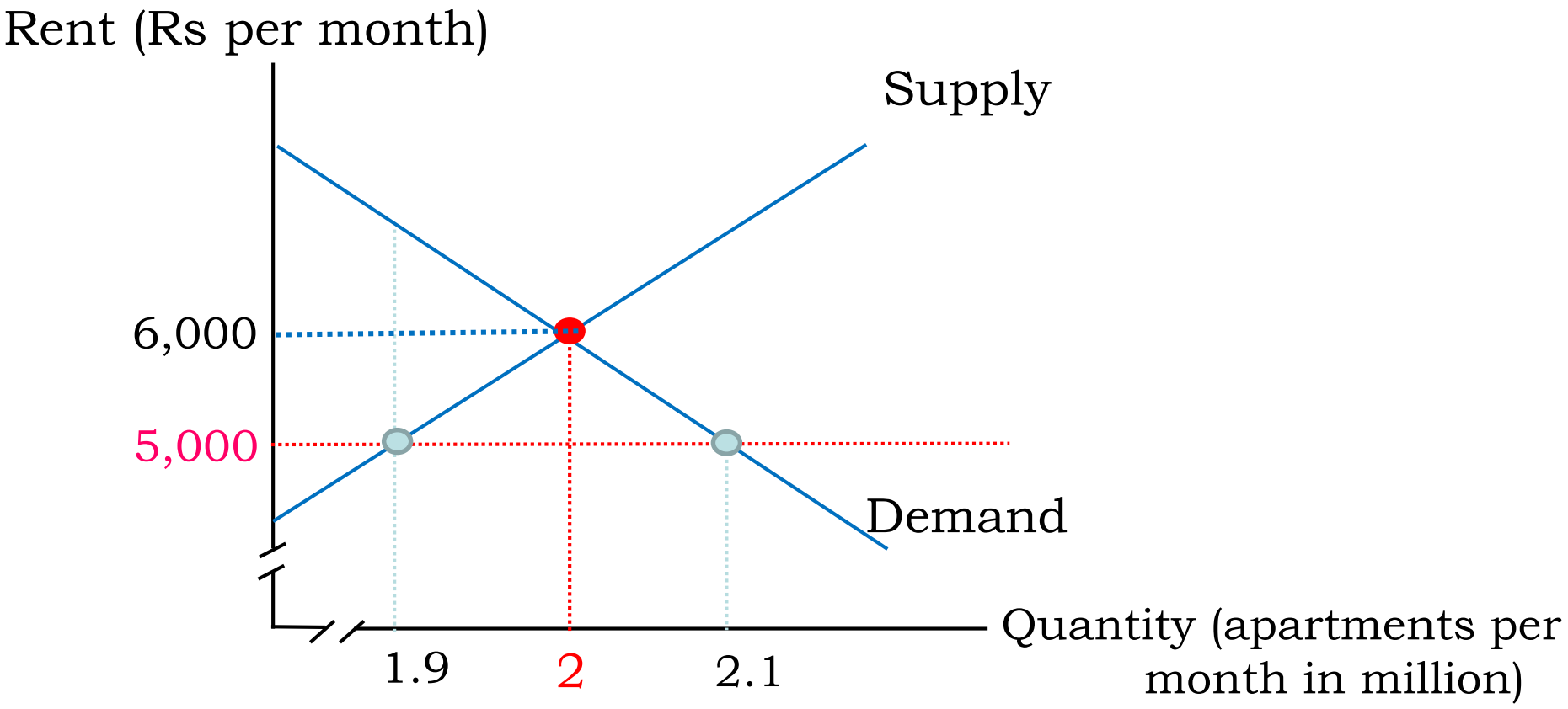
The minimum wage is above the equilibrium market wage. The quantity of workers demanded by employers falls to L_3 and the quantity supplied increases to L_2. There is a surplus of workers equal to $L_2 - L_3$ who are not able to find jobs.

Whatever the extent of employment losses from the minimum wage, it will cause a deadweight loss just as a price floor in the wheat market does.

Price Ceilings

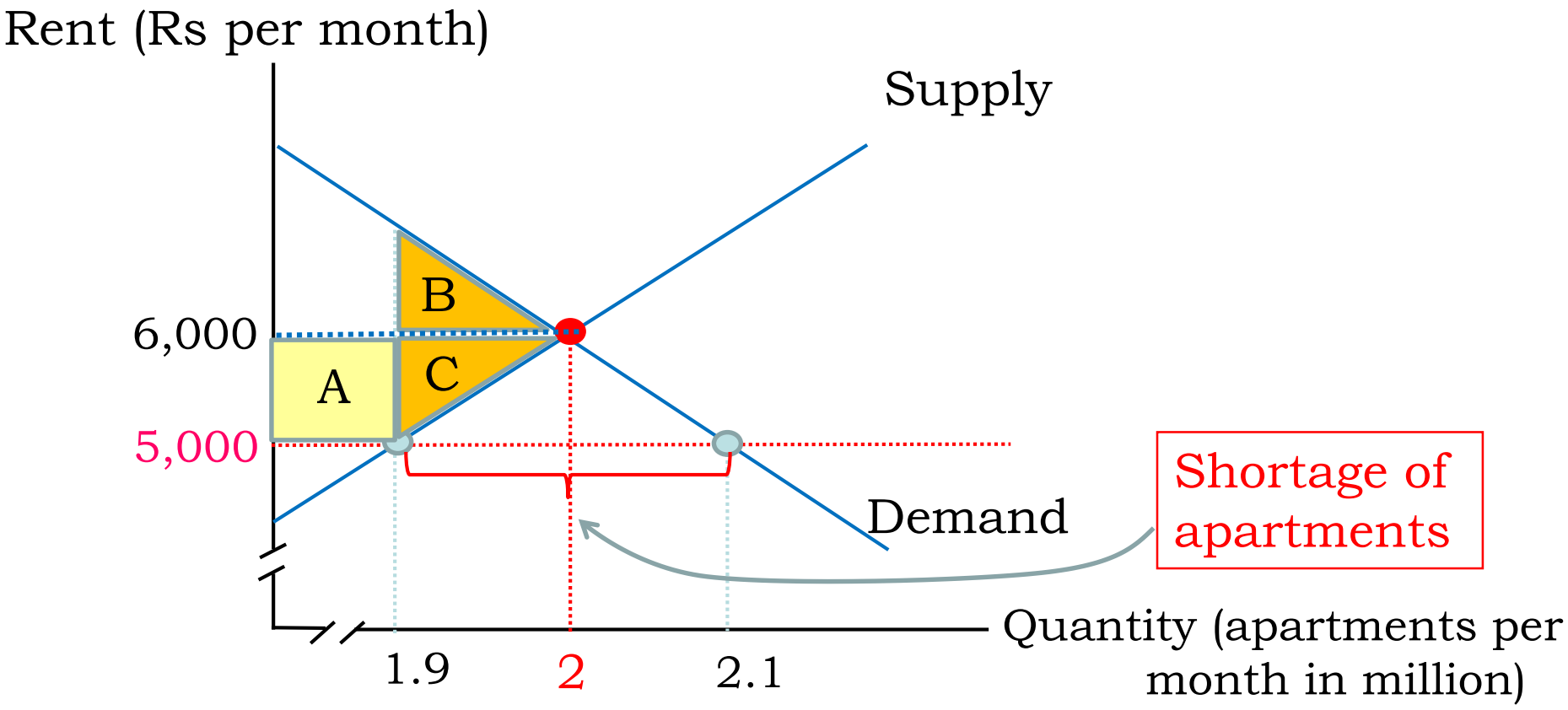
Support for price floors typically comes from sellers but support for governments setting price ceilings typically comes from consumers. – For e.g. when there is a sharp increase in oil prices, there will often be proposals for the government to impose a price ceiling on the market for petrol and diesel.

Price Ceiling – Rent Control



Without rent control the equilibrium rent would be Rs 6,000 per month and 2 million apartments would be rented.

With rent control landlords reduce the quantity of apartments supplied to 1.9 million.



With a rent ceiling the quantity of apartments demanded rises to 2.1 mn. There is a shortage of 200,000 apartments.

Consumer surplus increases by rectangle A and falls by triangle B.

Producer surplus to landlords falls by rectangle A plus triangle C.

Total gain in consumer surplus = Area of rectangle A — Area of triangle B.

Total fall in producer surplus = Area of rectangle A + Area of triangle C.

Deadweight loss = Area of triangle B + Area of triangle C.

There is a deadweight loss because rent control has reduced the amount of economic surplus in the market.

Rent control has caused the marginal benefit of the last apartment rented to be greater than the marginal cost of supplying it.

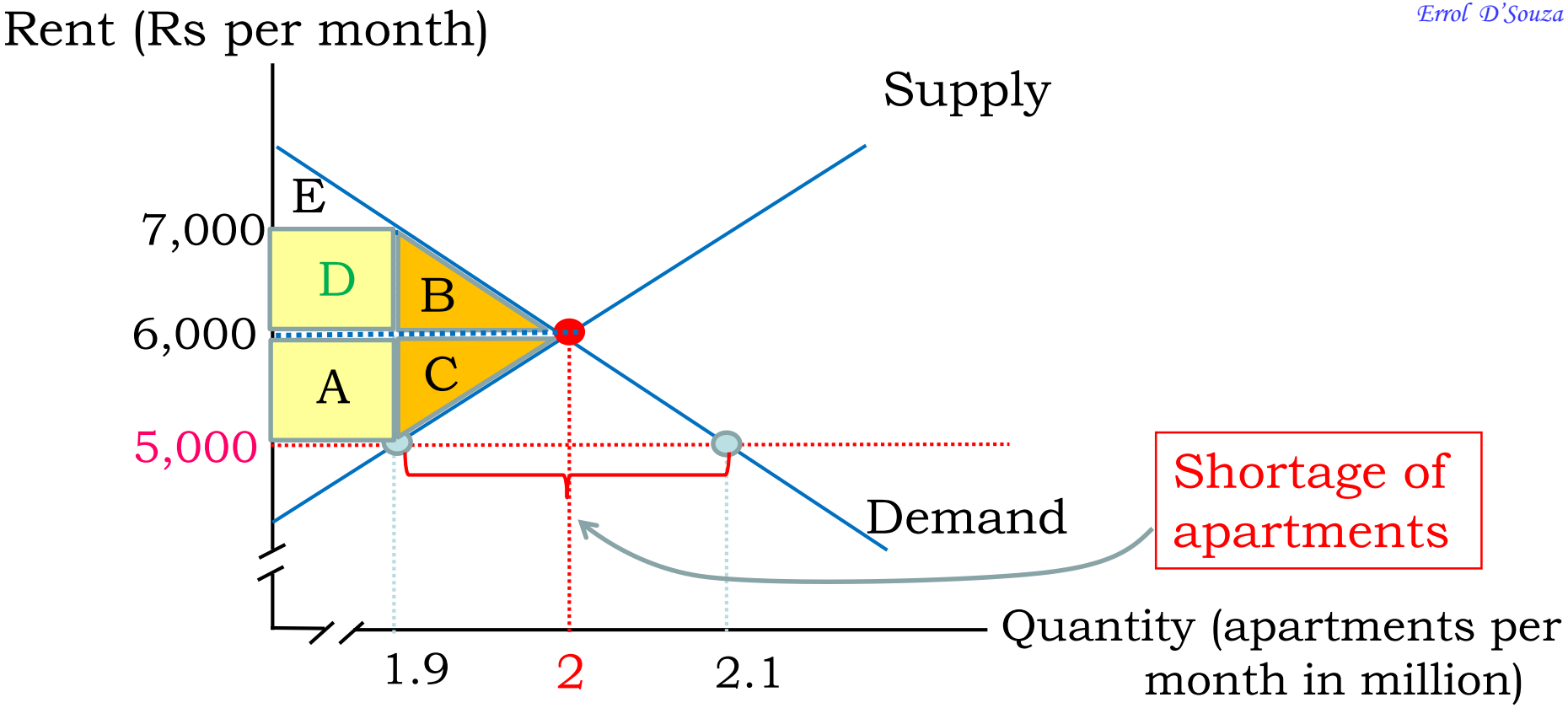
Though renters as a group benefit, the number of renters is reduced so some renters are made worse off by rent controls because they are unable to find an apartment at the legal rent.

Suppose renters and landlords do not abide by the price ceiling. As there is a shortage of apartments, renters who would otherwise not be able to find apartments have an incentive to offer landlords rents above the legal maximum.

The result is a **black market** where buying and selling takes place at prices that violate price regulations.

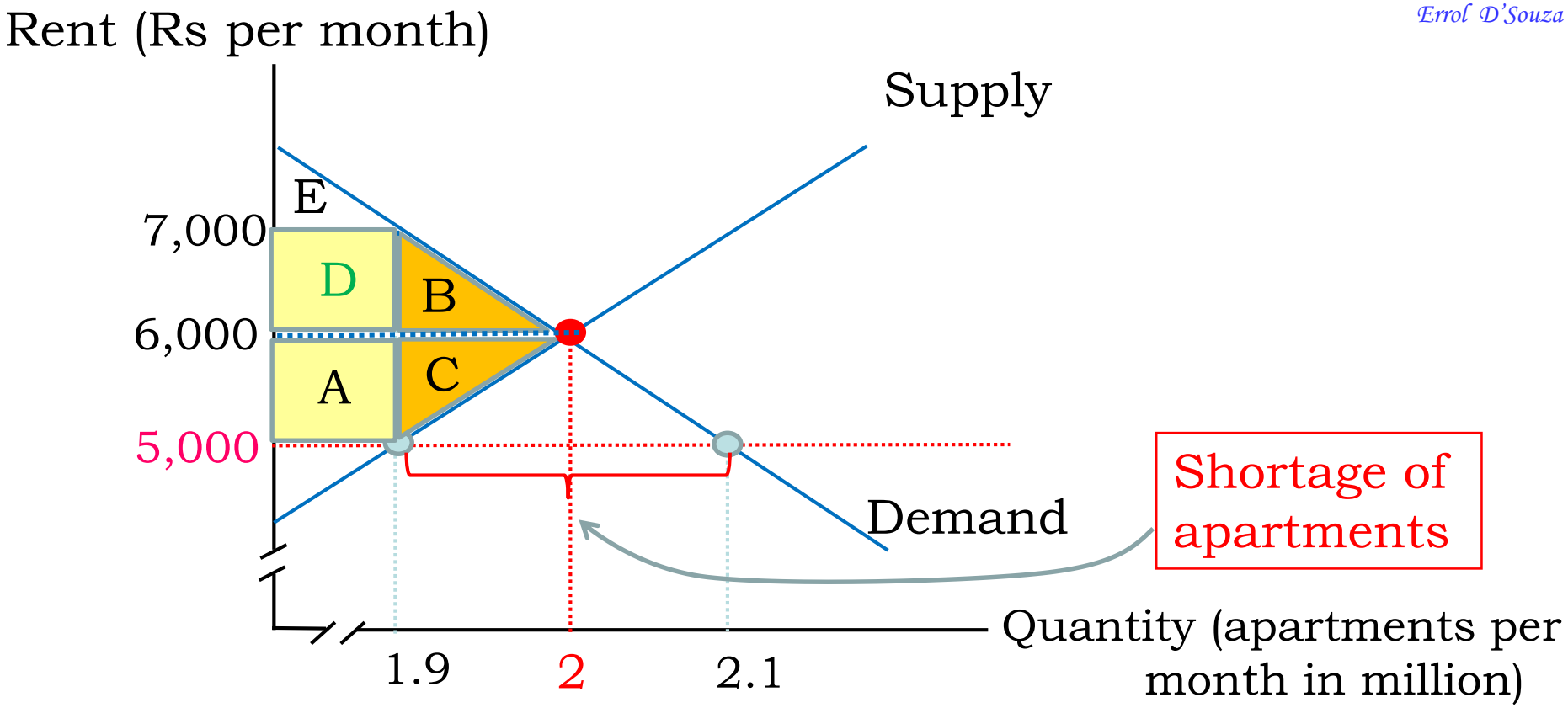
Tenants will write a check for the legally allowed rent and pay an additional amount in cash.

Black market rent would rise to Rs 7,000 per month as there would be competition among tenants.



The black market rent being Rs 7,000 – higher than the competitive rent of Rs 6,000 – consumer surplus declines by an amount equal to rectangle D.

Producer surplus has increased by an amount equal to rectangles A and D and consumer surplus has declined by the same amount.

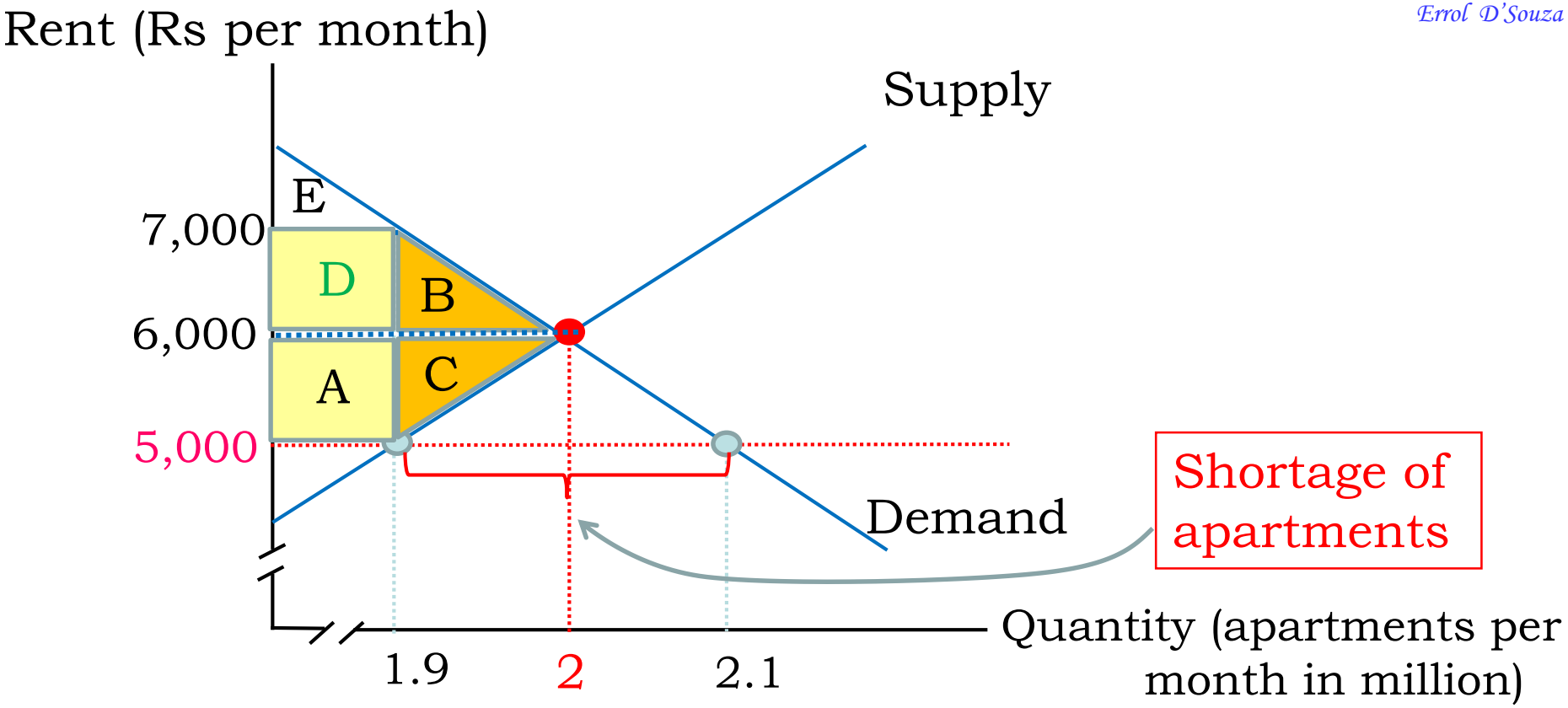


Comparison with Equilibrium Situation (before rent controls)

Total fall in consumer surplus = Area of rectangle D + Area of triangle B

Total increase in producer surplus = Area of rectangle D — Area of triangle C

Deadweight loss = Area of triangle B + Area of triangle C.



With an active black market rent control leaves renters as a group worse off – with less consumer surplus – than if there were no rent control.

When governments impose price ceilings or price floors three important results occur:

- Some people win
- Some people lose
- There is a loss of economic efficiency

The winners with rent control are the people who are paying less for rent. Landlords may also gain if they break the law by charging rents above the legal maximum and also higher than the competitive equilibrium rents would have been.

Losers are landlords who abide by the law and renters who are unable to find apartments to rent at the controlled price.

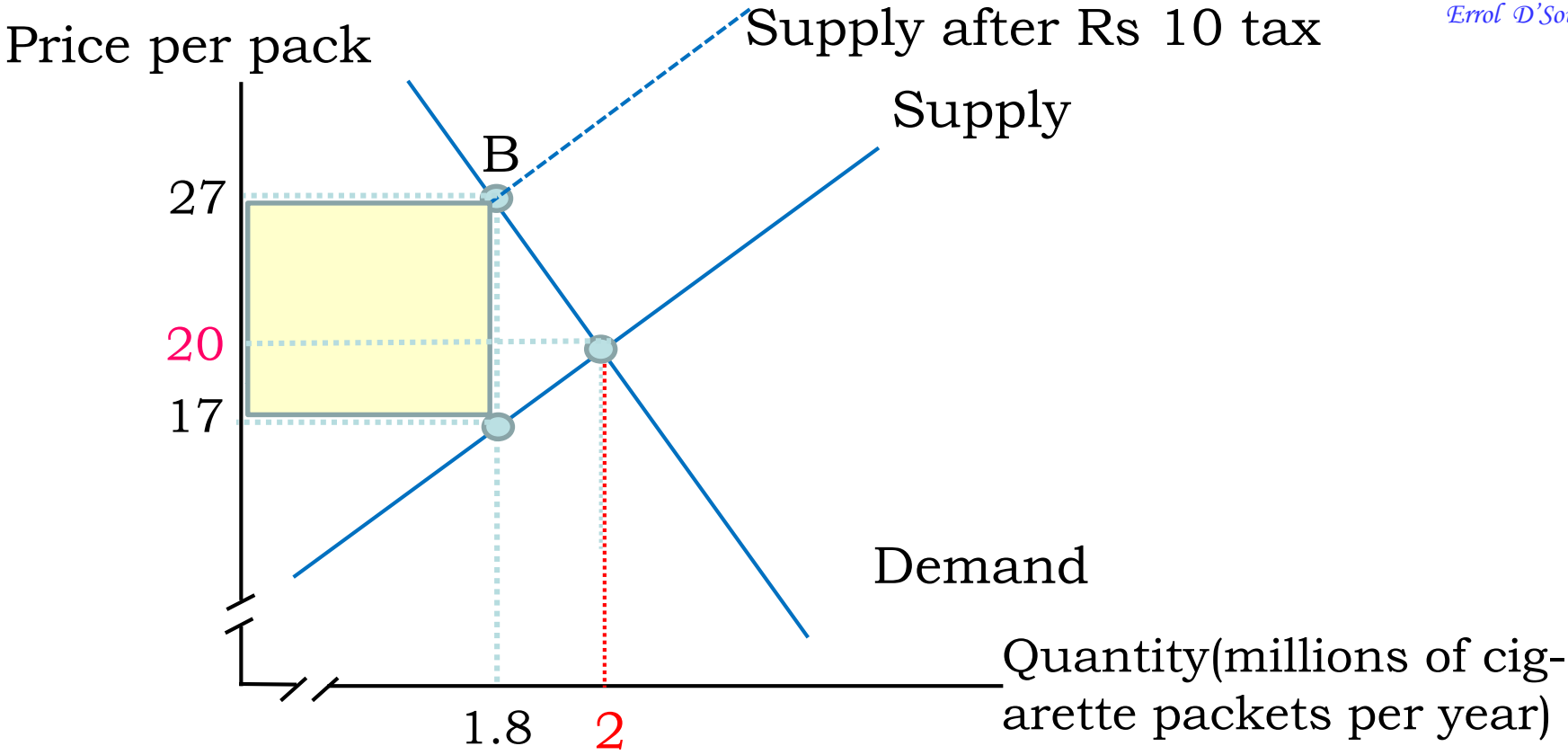
Rent control reduces efficiency because fewer apartments are rented than would be in a competitive market. – The deadweight loss measures the loss in efficiency.

The Economic Impact of Taxes

Whenever a government taxes a good or service, less of that good or service is produced. For e.g., a tax on cigarettes will raise the cost of smoking and reduce the quantity of smoking that takes place.

With the tax, let the equilibrium price of cigarettes be Rs 20 per pack and 4 mn. packs of cigarettes would be sold per year. ⟹

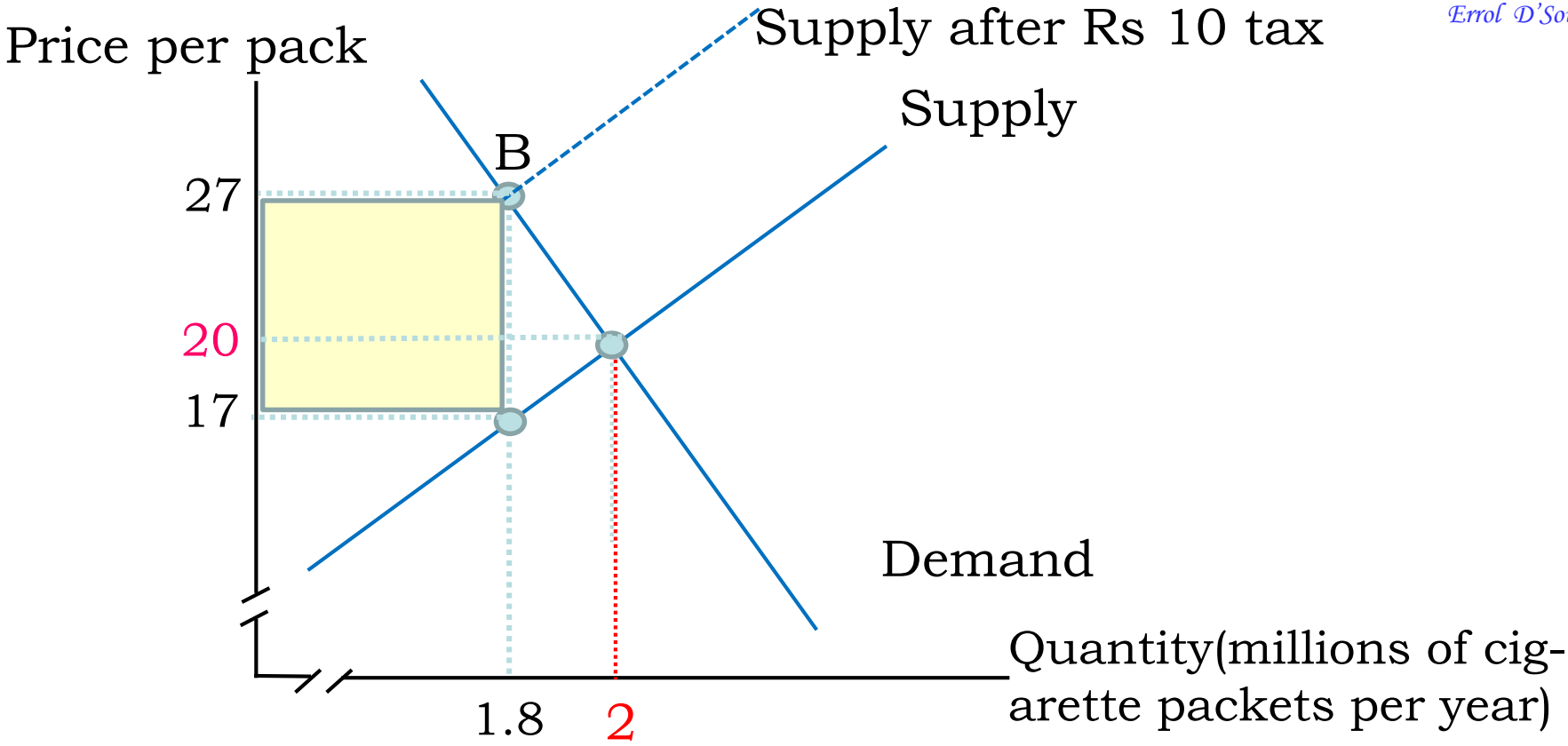
If the government requires sellers to pay Rs 10 per pack as tax, their cost of selling cigarettes would increase by Rs 10 per pack. This causes the supply curve to shift up by Rs 10.



The shift in supply will result in a new price of Rs 27 and a new equilibrium quantity of 1.8 mn. packs – point B.

The government will collect tax revenue equal to the tax per pack multiplied by the no. of packs sold or Rs 1.8 mn.

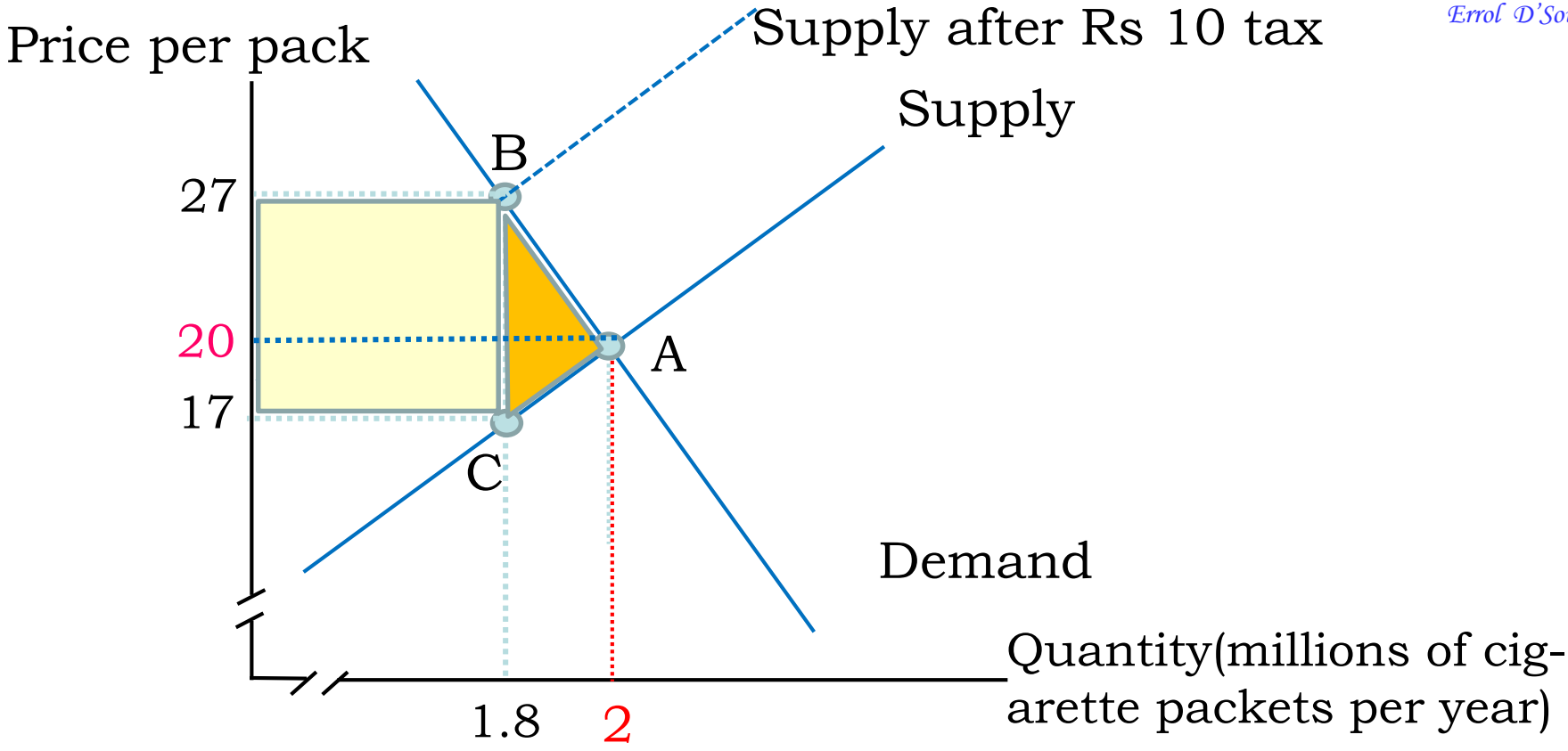
The area that is shaded represents the government's tax revenue.



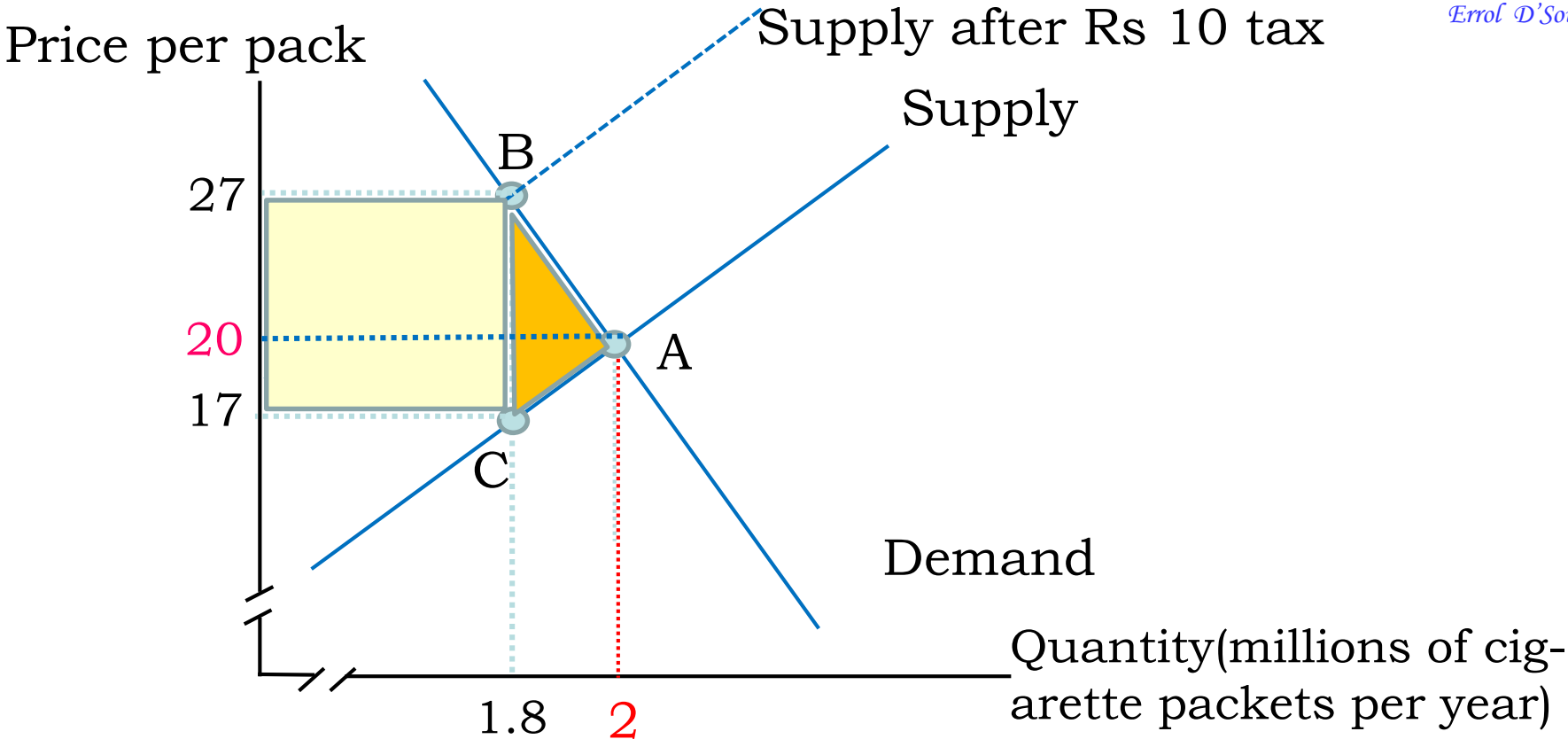
Consumers pay a higher price of Rs 27 per pack.

Since sellers pay the tax the price they receive falls from Rs 20 per pack to Rs 17 per pack.

There is a loss of consumer surplus because they are paying a higher price. The price producers receive falls and there is also a loss of producer surplus.



Some of the loss in consumer and producer surplus becomes tax revenue for the government. The rest of the loss from consumer and producer surplus is equal to the deadweight loss from the tax, shown as the shaded orange triangle in the figure – triangle ABC.



The burden of a tax then is not just the amount paid to the government by consumers and producers, but also includes the deadweight loss.

The deadweight loss from a tax is referred to as the *excess burden* of a tax. A *tax is efficient if it imposes a small excess burden relative to the tax revenue it raises.*

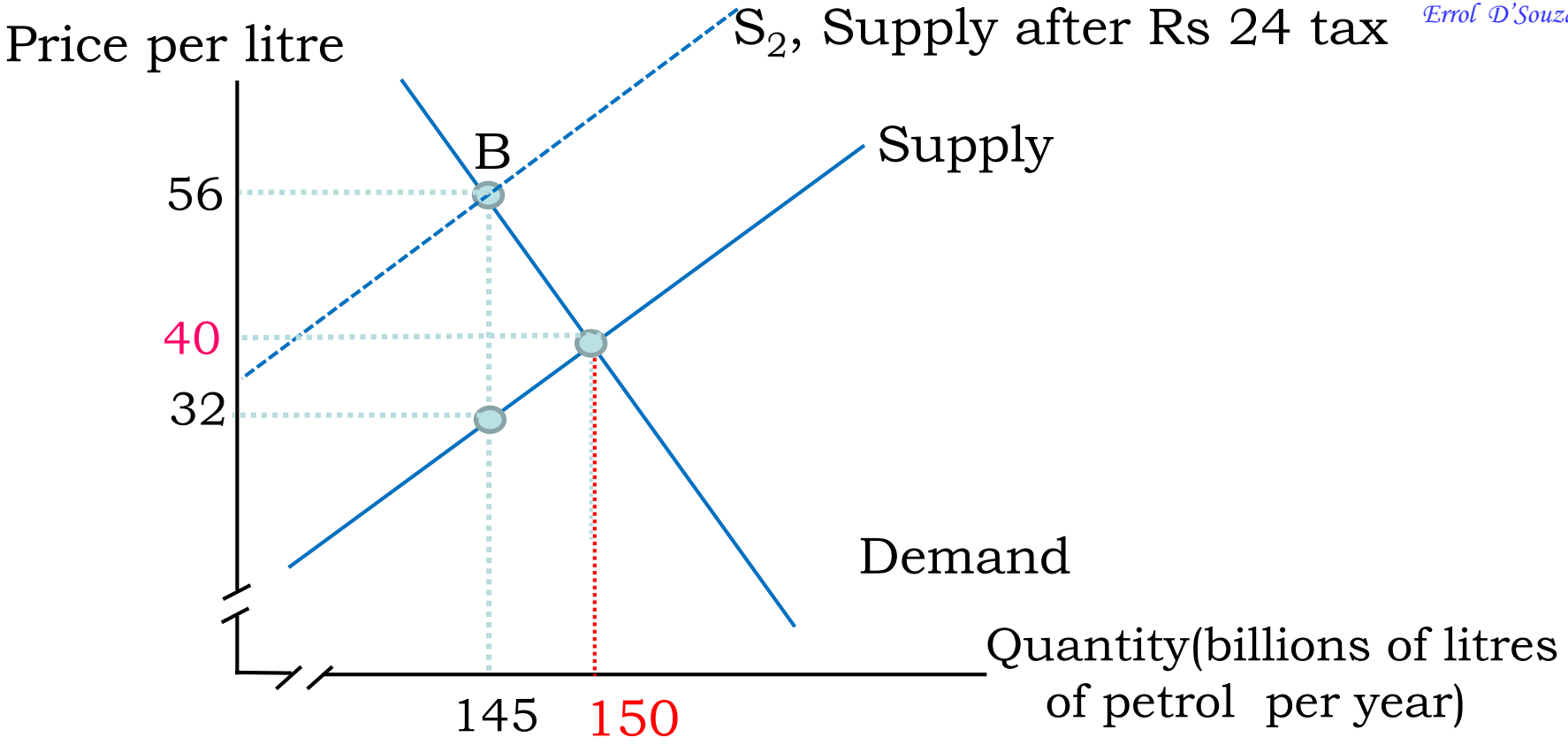
Tax Incidence: Who Actually pays a tax?

There is an important difference between who is legally required to pay a tax and who actually bears the burden of the tax. The actual division of the burden is referred to as tax incidence.

For instance, the government currently levies a tax of say 60 per cent on petrol sold. This tax is collected by petrol station owners and forwarded to the government. But who actually bears the burden of the tax?

Suppose the retail price of petrol inclusive of the excise tax levied is Rs 56 per litre, 150 billion litres of petrol are sold per year, and the excise tax is Rs 24 per litre.

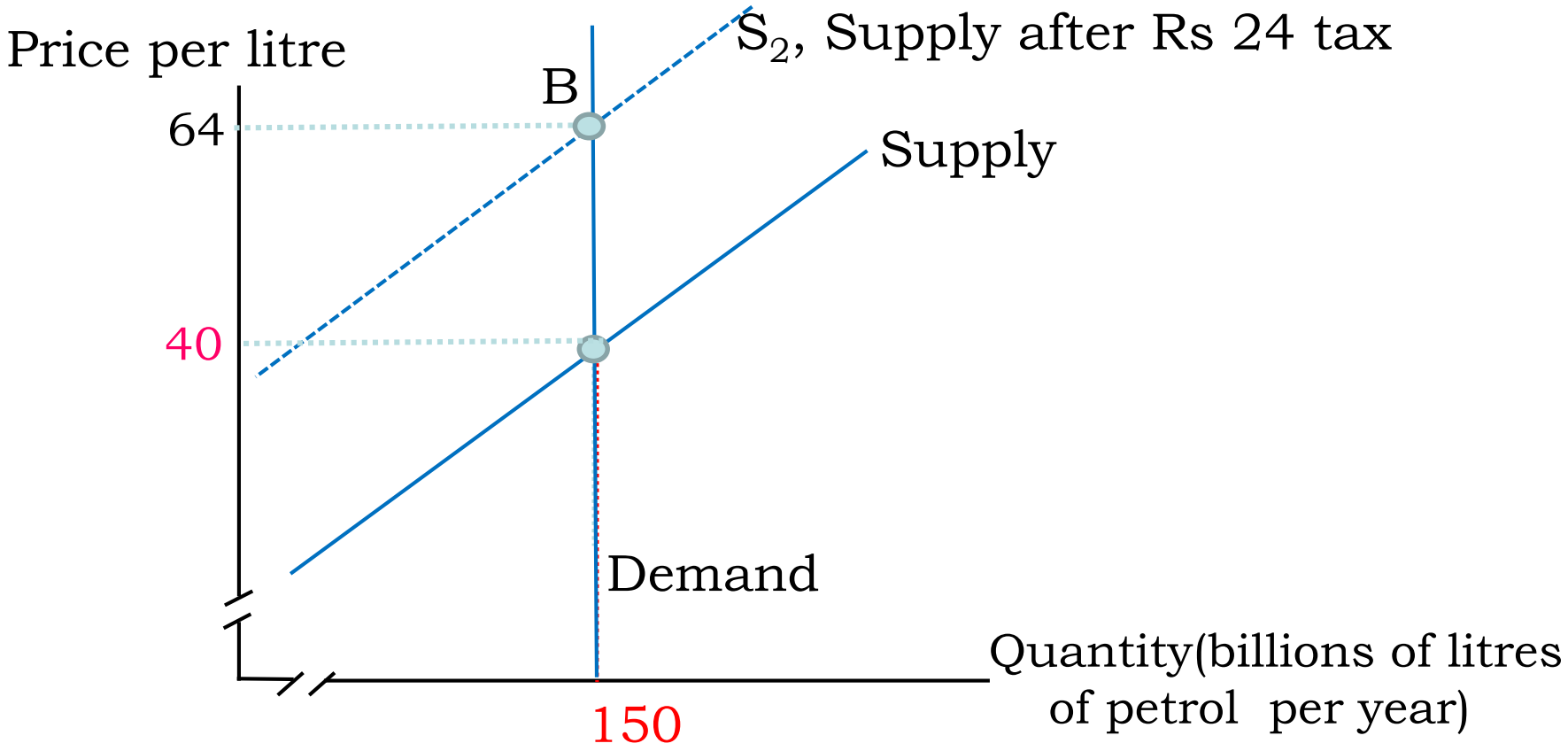
At the equilibrium inclusive of the tax where demand equals supply S_2, the price has risen from Rs 40 to Rs 56.



The price has risen by Rs 16 per litre from Rs 40 to Rs 56. Sellers are receiving a new price of Rs 56 but after paying the Rs 24 per litre tax, they are left with Rs 32, or, Rs 8 less than they had been receiving.

The consumers pay 16/24 = $\frac{2}{3}^{rds}$ of the tax and sellers pay 8/24 = $\frac{1}{3}^{rd}$ of the tax.

When do consumers pay all of the sales tax increase?



Consumers will pay all of an increase in a sales tax only if the demand curve is a vertical line.

Does it matter whether the tax is on buyers or on sellers?

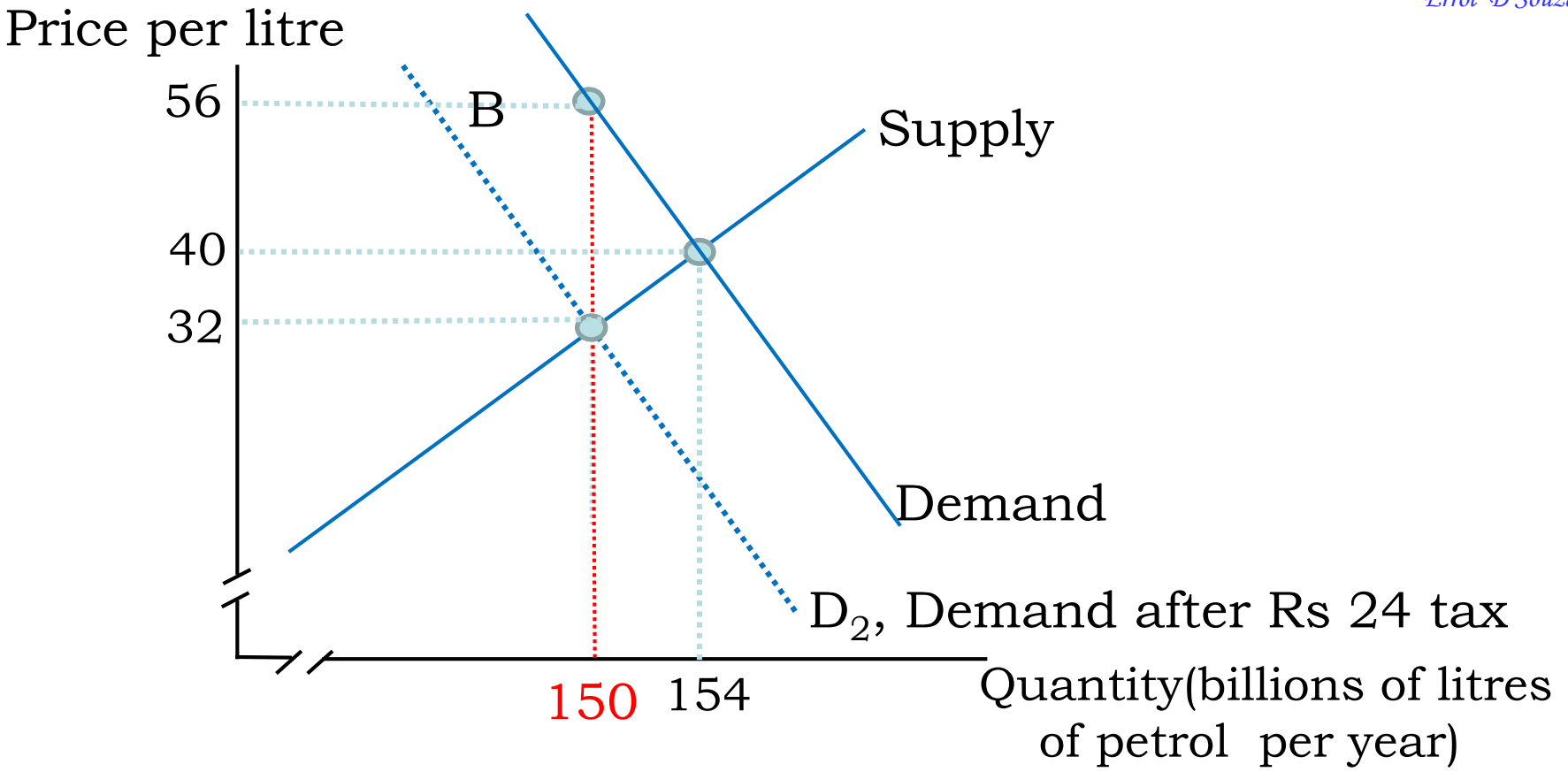
The incidence of a tax does not depend on whether a tax is collected from the buyers of a good or the sellers.

Suppose the tax on petrol is imposed on buyers rather than on sellers. Buyers have to report their purchases of petrol and send the tax to the government.

Since consumers now have to pay a Rs 24 tax on every litre of petrol they buy they are willing to pay a price of Rs 24 less than they would have without the tax.

The demand curve now shifts down by Rs 24 to D_2.

After the demand curve shifts down with the imposition of the tax the new equilibrium quantity of petrol is 150 mn. litres, as before.



The new equilibrium price appears to be different. But it is a pre-tax price of Rs 32. If we include the tax, then buyers will pay the same price of Rs 56 and sellers will receive the same Rs 32 as before.

The incidence of the tax does not depend on whether the tax is collected from the buyers or the sellers.