# Demand Is Given By Pd = 120 0.2Q. Supply Is Given By Ps = 15 + 0.15Q If We Impose A Subsidy Of $7 Per

**Demand Is Given By Pd = 120 - 0.2Q. Supply Is Given By Ps = 15 + 0.15Q If We Impose A Subsidy Of $7 Per**

Understanding how government interventions such as subsidies influence market equilibrium is crucial for economists, policymakers, and businesses. In this article, we explore the impact of a $7 per-unit subsidy on the market characterized by the demand function Pd = 120 - 0.2Q and the supply function Ps = 15 + 0.15Q. We will analyze the initial equilibrium, how the subsidy shifts supply, and the resulting changes in prices, quantities, and welfare.

## Market Equilibrium Without Subsidy

### Demand and Supply Functions

The demand function is expressed as:

- **Demand (Pd):** Pd = 120 - 0.2Q

This indicates that as quantity (Q) increases, the price consumers are willing to pay (Pd) decreases linearly, reflecting typical downward-sloping demand.

The supply function is:

- **Supply (Ps):** Ps = 15 + 0.15Q

This suggests that as quantity increases, the price producers are willing to accept (Ps) increases linearly, indicating upward-sloping supply.

### Finding the Initial Equilibrium

In the absence of any government intervention, equilibrium occurs where the price consumers are willing to pay equals the price producers are willing to accept:

Pd = Ps

Substituting the functions:

120 - 0.2Q = 15 + 0.15Q

Solving for Q:

120 - 15 = 0.15Q + 0.2Q

105 = 0.35Q

Q = 105 / 0.35 = 300 units

To find the equilibrium price, substitute Q into either the demand or supply function:

Pd = 120 - 0.2(300) = 120 - 60 = 60

Similarly, supply:

Ps = 15 + 0.15(300) = 15 + 45 = 60

Initial Equilibrium Price (P) = $60

Initial Equilibrium Quantity (Q) = 300 units

This is the baseline from which we will analyze the effects of the subsidy.

# Impact of a $7 Per-Unit Subsidy

## Understanding the Subsidy Mechanism

A subsidy of $7 per unit effectively lowers the effective price producers receive for each unit sold. From the producers' perspective, the price they receive (including the subsidy) becomes:

$P_s^{effective} = P_s + 7$

Conversely, consumers pay the market price $P_d$, which may change due to shifts in supply.

## Adjusting the Supply Function

The subsidy shifts the supply curve downward (or to the right), because producers are now willing to supply the same quantity at a lower market price or supply more at the original price.

Mathematically, the new supply function becomes:

$P_s^{effective} = 15 + 0.15Q$

Since producers get an additional $7 per unit, the effective minimum price they are willing to accept is:

$P_s + 7 = 15 + 0.15Q + 7 = 22 + 0.15Q$

However, for market analysis, it is standard to model the subsidy as shifting the supply curve downward directly, which effectively reduces the price that consumers pay for each quantity by $7. Therefore, the new supply function (from the consumers' perspective) can be expressed as:

$P_d = P_s + 7$

Or equivalently, the supply function with the subsidy incorporated is:

$P_s = 15 + 0.15Q$

But the market price that consumers pay (P) satisfies:

$P = P_s - 7$

Alternatively, for clarity, the effective supply curve (what the market perceives) shifts downward by $7:

New supply function:

$P_s' = (15 + 0.15Q) - 7 = 8 + 0.15Q$

Thus, the supply curve shifts downward by $7, indicating that at each quantity, suppliers are willing to accept $7 less than before, because they receive the subsidy.

## Calculating the New Equilibrium

The new equilibrium occurs where the demand price equals the effective supply price:

$Pd = P_s'$

Recall:

$Pd = 120 - 0.2Q$

$P_s' = 8 + 0.15Q$

Set equal:

$120 - 0.2Q = 8 + 0.15Q$

Solve for Q:

120 - 8 = 0.15Q + 0.2Q

112 = 0.35Q

Q_{subsidy} = 112 / 0.35 ≈ 320 units

Now, find the market price consumers pay (Pd):

Pd = 120 - 0.2(320) = 120 - 64 = 56

The effective price producers receive (including subsidy):

P_s' + 7 = 8 + 0.15(320) + 7 = 8 + 48 + 7 = 63

Alternatively, since the market price consumers pay is $56, and producers receive $7 more per unit due to the subsidy:

Producer's effective price = 56 + 7 = 63

which aligns with the calculation above.

## Summary of New Equilibrium

- New Quantity (Q_{subsidy}) ≈ 320 units
- Market Price Paid by Consumers (P_d): $56
- Effective Price Received by Producers (including subsidy): $63

# Market Outcomes and Welfare Analysis

## Changes in Quantity and Price

The subsidy incentivizes producers to supply more, increasing the equilibrium quantity from 300 to approximately 320 units—a rise of about 20 units. The consumer price decreases from $60 to $56, making the product more affordable.

## Government Expenditure on the Subsidy

The government spends:

- **Total Cost:** Subsidy per unit × Quantity sold
- = $7 × 320 ≈ $2,240

This expenditure reflects the financial commitment required to support the increased production and consumption.

## Consumer and Producer Surplus

- **Consumer Surplus:** Increases due to lower prices and higher quantities.
- **Producer Surplus:** Also increases because producers receive higher effective prices and sell more units.

However, the overall welfare change must consider the government expenditure, which can lead to deadweight loss if the additional benefits are less than the costs.

# Graphical Interpretation

While graphical representations are beyond this text, the key points are:

- The original supply curve intersects demand at Q=300, P=60.
- The subsidy shifts the supply curve downward by $7, leading to a new intersection at Q≈320, P≈56.
- The area between the original and new supply curves, along with the change in demand, illustrates gains to consumers and producers.

# Conclusion

Imposing a $7 per-unit subsidy on a market with demand Pd = 120 - 0.2Q and supply Ps = 15 + 0.15Q results in:

- An increase in equilibrium quantity from 300 to approximately 320 units.
- A decrease in the consumer price from $60 to $56.
- An increase in the effective price received by producers from $60 to $63.
- A government expenditure of around $2,240 to support the increased output.

While subsidies can enhance market efficiency and welfare by reducing prices and increasing quantities, they also entail significant costs and potential deadweight losses. Policymakers should weigh these factors carefully when designing interventions.

In summary, a $7 per-unit subsidy shifts the supply curve downward, increases total market output, reduces consumer prices, and boosts producer revenues, illustrating how government support can influence market dynamics.

# Frequently Asked Questions

## What is the initial equilibrium quantity and price before the subsidy is imposed?

To find the initial equilibrium, set demand equal to supply: 120 - 0.2Q = 15 + 0.15Q. Solving for Q: 120 - 15 = 0.15Q + 0.2Q → 105 = 0.35Q → Q = 300. Substituting Q into either equation: Ps = 15 + 0.15 300 = 15 + 45 = 60. The initial equilibrium price is $60, and the quantity is 300 units.

## How does the $7 per unit subsidy affect the supply function?

The subsidy effectively lowers the supply price by $7 for each quantity, so the new supply function becomes Ps_subsidized = (15 + 0.15Q) - 7 = 8 + 0.15Q.

## What is the new equilibrium quantity after the subsidy is imposed?

Set demand equal to the subsidized supply: 120 - 0.2Q = 8 + 0.15Q. Solving for Q: 120 - 8 = 0.15Q + 0.2Q → 112 = 0.35Q → Q ≈ 320 units.

## What is the new equilibrium price consumers pay after the subsidy?

Plug Q = 320 into the demand function: Pd = 120 - 0.2 320 = 120 - 64 = $56. Consumers pay $56 per unit after the subsidy.

## How much does the subsidy increase the equilibrium quantity?

The quantity increases from 300 units to approximately 320 units, an increase of about 20 units due to the $7 subsidy.

## What is the total cost of the subsidy to the government?

Total subsidy cost = subsidy per unit new equilibrium quantity = $7 320 = $2,240.

## How does the subsidy impact consumer and producer surplus?

The subsidy lowers consumer prices from $60 to $56 and increases quantity demanded, leading to higher consumer and producer surpluses. The government expenditure on the subsidy is $2,240, which partially transfers surplus from taxpayers to consumers and

producers.

# Additional Resources

**Understanding the Impact of a $7 Subsidy on Market Equilibrium: An Analytical Perspective**

In the complex world of market dynamics, policies such as subsidies can significantly influence the interplay between supply and demand. When a government or authority introduces a subsidy—essentially a financial support to producers or consumers—it can alter prices, quantities, and overall market efficiency. This article delves into a specific scenario where the demand and supply functions are defined as $P_d = 120 - 0.2Q$ and $P_s = 15 + 0.15Q$, respectively, and a subsidy of $7 per unit is imposed. Through detailed analysis, we explore how this subsidy affects the equilibrium price and quantity, consumer and producer surpluses, and overall market welfare.

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# Understanding the Basic Market Functions

Before analyzing the impact of the subsidy, it’s crucial to comprehend the foundational demand and supply equations provided.

## Demand Function: $P_d = 120 - 0.2Q$

- Interpretation: This linear demand curve indicates that as the quantity (Q) increases, the maximum price consumers are willing to pay decreases.
- Slope: The coefficient of $Q$ is -0.2, indicating a relatively moderate rate of decline in demand as quantity increases.
- Intercept: When $Q=0$, $P_d = 120$, which is the highest price consumers are willing to pay when nothing is supplied.

## Supply Function: $P_s = 15 + 0.15Q$

- Interpretation: This linear supply curve reveals that as the quantity supplied increases, producers require a higher price to produce additional units.
- Slope: The positive coefficient of 0.15 indicates supply increases with price.
- Intercept: When $Q=0$, $P_s = 15$, the minimum price at which producers are willing to supply.

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# Determining the Market Equilibrium Without Subsidy

The first step in understanding the market impact of the subsidy is to find the baseline equilibrium—where the quantity consumers are willing to buy equals the quantity producers are willing to sell at a common price.

## Equilibrium Condition

Set $P_d = P_s$:
$$
120 - 0.2Q = 15 + 0.15Q
$$

## Solving for Equilibrium Quantity $Q^$

$$
120 - 15 = 0.2Q + 0.15Q
$$
$$
105 = 0.35Q
$$
$$
Q^ = \frac{105}{0.35} = 300
$$

## Calculating the Equilibrium Price $P^$

Plug $Q^ = 300$ into either the demand or supply function:
- Demand:
$$
P_d = 120 - 0.2 \times 300 = 120 - 60 = 60
$$
- Supply:
$$
P_s = 15 + 0.15 \times 300 = 15 + 45 = 60
$$

Result: The market equilibrium price is $60, and the equilibrium quantity is 300 units.

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# Introducing the $7 Subsidy: Concept and

# Mechanics

A subsidy of $7 per unit essentially means that for each unit sold, the government provides an additional $7 to the producer. This affects the supply side directly, effectively lowering the producer’s marginal cost or increasing the effective price received by producers.

## Impact on Supply Function

- Before subsidy: $P_s = 15 + 0.15Q$
- After subsidy: Producers receive $P_s + 7$ for each unit, so the new supply function becomes:

$$
P_s^{\text{effective}} = P_s - 7
$$

or equivalently, since the subsidy shifts the supply curve downward:

$$
P_s^{\text{new}} = (15 + 0.15Q) - 7 = 8 + 0.15Q
$$

Note: In typical analysis, the supply curve shifts downward by the amount of the subsidy, meaning that at each quantity, producers are willing to supply at a price $7 lower than before because they receive this amount from the government.

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# Recalculating Equilibrium with the Subsidy

With the subsidy in effect, the new supply function becomes:

$$
P_s^{\text{new}} = 8 + 0.15Q
$$

The demand function remains unchanged:

$$
P_d = 120 - 0.2Q
$$

## Setting the New Equilibrium

At equilibrium:

$$
P_d = P_s^{\text{new}}
$$

$$
120 - 0.2Q = 8 + 0.15Q
$$

## Solving for New Equilibrium Quantity $Q_{s}$

$$
120 - 8 = 0.2Q + 0.15Q
$$
$$
112 = 0.35Q
$$
$$
Q_{s} = \frac{112}{0.35} \approx 320
$$

## Finding the Consumer Price $P_d$ and Producer Price $P_s^{\text{effective}}$

- Consumer price:
$$
P_d = 120 - 0.2 \times 320 = 120 - 64 = 56
$$
- Producer’s received price (including subsidy):
$$
P_s^{\text{new}} = 8 + 0.15 \times 320 = 8 + 48 = 56
$$

Interpretation: The new market equilibrium occurs at Q ≈ 320 units and a consumer price of $56. The effective price received by producers (including the subsidy) is also $56, but the actual amount paid by consumers is slightly lower than the original equilibrium price of $60, indicating the subsidy's effect in increasing total quantity traded.

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# Analyzing the Effects of the Subsidy

The introduction of the $7 subsidy has multiple implications, which we explore through various economic metrics.

## 1. Change in Equilibrium Quantity

- Before subsidy: 300 units
- After subsidy: approximately 320 units
- Impact: The subsidy increases the equilibrium quantity by roughly 20 units, reflecting a typical effect where subsidies stimulate higher production and consumption.

## 2. Change in Consumer Price and Effective Price

- Before subsidy: $60 per unit
- After subsidy: $56 per unit paid by consumers
- Impact: Consumers now pay a lower price, increasing consumer surplus. This reduction in price makes the good more accessible, encouraging higher consumption.

## 3. Change in Producer Revenue and Surplus

- Producer’s effective price: remains at $56, but their marginal cost is effectively lowered due to the subsidy.
- Impact: Producers benefit from a higher quantity sold and the subsidy, which increases producer surplus.

## 4. Total Market Welfare and Deadweight Loss

- Consumer Surplus (CS): increases due to lower prices and higher quantities.
- Producer Surplus (PS): increases because producers receive more per unit (price plus subsidy) and sell more units.
- Government Expenditure: The government spends $7 \times 320 = 2240$ dollars.
- Deadweight Loss (DWL): The subsidy distorts the market, potentially leading to overproduction relative to the efficient outcome, creating deadweight loss. This arises because resources are allocated inefficiently if the marginal social benefit exceeds the marginal social cost.

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# Economic Implications and Policy Considerations

While subsidies can be instrumental in supporting certain industries or consumers, their broader economic implications warrant careful examination.

## Positive Effects

- Increased Consumption and Production: The subsidy encourages higher output and consumption, which can be beneficial during economic downturns or for promoting strategic industries.
- Consumer Welfare: Lower prices improve affordability, especially for essential goods.
- Producer Benefits: Producers enjoy higher revenues and market stability.

## Potential Downsides

- Market Distortion: Artificially increasing supply can lead to inefficiencies, overproduction, and misallocation of resources.
- Government Cost: The subsidy imposes fiscal burdens on the government and taxpayers.

- Deadweight Loss: The economic surplus lost due to market inefficiencies may outweigh the gains from increased consumption.
- International Trade Concerns: In global markets, subsidies can distort competitive balances, leading to trade disputes.

## Balancing Policy Goals

Policymakers must weigh the benefits of supporting consumers and producers against the costs of market distortions and fiscal expenditures. The choice to implement a subsidy should be aligned with broader economic objectives, such as promoting innovation, protecting vulnerable populations, or stabilizing markets.

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# Conclusion: The Final Takeaway

This analytical exploration underscores the significant influence a $7 per-unit subsidy exerts on market equilibrium. The key findings include:
- Increase in Quantity: The market responds to the subsidy with approximately 20 additional units traded.
- Price Dynamics: Consumers benefit from

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