Econ 101 Midterm Review

Key Concepts & Practice Problems

Katelynn Lewallen

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Contents

1 Module 6: When Governments Intervene in Markets

This module is about how government policies disrupt the market equilibrium. The hardest parts are the welfare analysis (who wins, who loses, and what is the Deadweight Loss) and tax incidence.

1.1 Challenging Concept 1: Binding vs. Non-Binding

This is a frequent mistake. A control that does nothing is "non-binding."

- **Price Ceiling ($P_{\max}$):** To be **binding**, it must be set *below* the equilibrium price (P^*). A ceiling above P^* is non-binding because the market (P^*) is already legal.
- **Price Floor ($P_{\min}$):** To be **binding**, it must be set *above* the equilibrium price (P^*). A floor below P^* is non-binding because the market price is already legal.

Key takeaway: A binding control *always* reduces the quantity transacted (to the "short side" of the market) and *always* creates deadweight loss (DWL).

1.2 Challenging Concept 2: Tax Incidence & Elasticity

Tax incidence has *nothing* to do with who legally pays the tax. It is determined entirely by the relative elasticities of supply and demand.

- **The Rule:** The burden of a tax falls more heavily on the **more inelastic** (steeper curve) side of the market.
- **Intuition:** If buyers are inelastic (e.g., medicine), they "need" the good and will pay most of the tax. If sellers are inelastic (e.g., rental housing in the short run), they "need" to sell and will "eat" most of the tax.
- **Graphically:** The total tax is the vertical distance between the new supply curve and the old one. The buyer's burden is $(P_{\text{buyers}} - P^*)$. The seller's burden is $(P^* - P_{\text{sellers}})$.

1.3 Challenging Concept 3: Welfare Analysis (CS, PS, DWL)

For *any* intervention (tax, ceiling, floor, quota), you must be able to identify the new Consumer Surplus (CS), Producer Surplus (PS), Government Revenue (or Cost), and Deadweight Loss (DWL).

- **CS:** Area *below* the Demand curve, *above* the price buyers pay (P_b), out to the quantity transacted (Q_{new}).
- **PS:** Area *above* the Supply curve, *below* the price sellers receive (P_s), out to the quantity transacted (Q_{new}).
- **Gov't Revenue:** $(\text{Tax}) \times (Q_{\text{new}})$. This is a rectangle. (For a subsidy, this is a negative cost).
- **DWL:** The triangle of lost total surplus. It points to the efficient quantity (Q^*) and its base is the wedge (tax, or gap from P_c to P_f) at the new quantity.

Module 6 Practice Questions

1. The market for widgets is given by:

$$Q_D = 200 - 2P$$

$$Q_S = 3P - 50$$

   (a) Find the equilibrium price (P^*) and quantity (Q^*).

   (b) The government imposes a \$5 per-unit tax on sellers. Find:

   - The new quantity sold (Q_{tax}).
   - The price buyers pay (P_b).
   - The price sellers receive (P_s)

   .

   (c) Calculate the tax burden on buyers and sellers. Who pays more? Does this match the rule of elasticity? (Hint: $E = \frac{dQ}{dP} \times \frac{P}{Q}$).

2. Draw a supply and demand graph for a binding **price floor**. Label the areas of CS, PS, and DWL. Is there a shortage or a surplus?

2 Module 7: Welfare and Efficiency

This module is the "why" behind free markets. The challenging part is understanding *why* the equilibrium is efficient and how to calculate the cost of *in*efficiency (DWL).

2.1 Challenging Concept: Efficiency, MB, and MC

The key to efficiency is understanding what the S and D curves represent.

- The **Demand Curve** is the **Marginal Benefit (MB)** curve. It shows the maximum willingness to pay for one more unit.
- The **Supply Curve** is the **Marginal Cost (MC)** curve. It shows the minimum cost of producing one more unit.

The market equilibrium (Q^*) is where $D = S$, which means $MB = MC$. This is the **efficient quantity**.

- At any $Q < Q^*$, we have $MB > MC$. This means buyers value the next unit *more* than it costs to make. We are "missing out" on surplus. This is **underproduction**.
- At any $Q > Q^*$, we have $MC > MB$. This means it costs *more* to make the last unit than buyers value it. We are creating "waste." This is **overproduction**.

Deadweight Loss (DWL) is the total surplus lost from under- or over-producing. It's the area of the triangle formed by the MB and MC curves between Q_{new} and Q^*.

Module 7 Practice Questions

1. Using the S/D equations from the Module 6 problem ($Q_D = 200 - 2P$, $Q_S = 3P - 50$), calculate the total surplus (CS + PS) at the free-market equilibrium ($P^* = 50, Q^* = 100$).
2. Now, calculate the CS, PS, Government Revenue, and DWL from the \$5 tax (where $Q_{\text{tax}} = 94$, $P_b = 53$, $P_s = 48$).
3. Verify that your DWL calculation from (2) is correct using the triangle formula: DWL $= 0.5 \times (\text{Tax}) \times (Q^* - Q_{\text{tax}})$.

3 Module 8: Gains from Trade

This module has two very challenging parts: (1) Opportunity Cost and Comparative Advantage, and (2) The welfare analysis (graphing) of international trade and tariffs.

3.1 Challenging Concept 1: Absolute vs. Comparative Advantage

- **Absolute Advantage:** Who can produce *more* of a good (output method) or use *fewer* resources (input method). It's just about being "better."
- **Comparative Advantage:** Who has the *lower opportunity cost* to produce a good. **This is the only thing that matters for specialization.**

3.2 Challenging Concept 2: Calculating Opportunity Cost

This is the #1 point of error. Be careful.

- **Output Method (e.g., "per day"):**

	Laptops	Phones
USA	100	80
China	60	120

  To find the OC, divide giving up by doing

  - USA: OC of 1 Laptop = 80/100 = 0.8 Phones.
  - USA: OC of 1 Phone = 100/80 = 1.25 Laptops.
  - China: OC of 1 Laptop = 120/60 = 2 Phones.
  - China: OC of 1 Phone = 60/120 = 0.5 Laptops.

  Conclusion: USA has C.A. in Laptops ($0.8 < 2$). China has C.A. in Phones ($0.5 < 1.25$).

- **Input Method (e.g., "hours to make one"):**

	1 Laptop	1 Phone
USA	10 hours	8 hours
China	20 hours	5 hours

  To find the OC, you divide doing by giving up

  - USA: OC of 1 Laptop = 10 hrs/8 hrs = 1.25 Phones.
  - China: OC of 1 Laptop = 20 hrs/5 hrs = 4 Phones.

  Conclusion: USA has C.A. in Laptops ($1.25 < 4$). China has C.A. in Phones (OC of 1 Phone = 5/20 = 0.25 Laptops, vs USA's 8/10 = 0.8).

3.3 Challenging Concept 3: Welfare Analysis of Tariffs

When a country imports, $P_{\text{world}} < P_{\text{domestic}}$. A tariff is a tax on imports, raising the price to $P_{\text{tariff}} = P_{\text{world}} + \text{tariff}$.

The graph for a tariff is complex. When you draw it, you will see:

- **CS shrinks** (consumers lose).
- **PS grows** (domestic producers are protected and win).
- **Gov't Revenue** is created (a rectangle = tariff $\times$ quantity of imports).
- **Two DWL triangles** are created:
    1. **Production DWL:** The cost of letting inefficient domestic firms produce units that could have been bought more cheaply from the world.
    2. **Consumption DWL:** The loss from consumers who are priced out of the market by the tariff.

Module 8 Practice Questions

1. Using the "Input Method" table above:
    (a) Who has the *absolute advantage* in laptops? In phones?
    (b) Who has the *comparative advantage* in laptops? In phones?
    (c) Propose a "terms of trade" (a price) that would be mutually beneficial for both countries. (e.g., "1 Laptop for...").
2. Draw the Supply and Demand graph for a country that **exports** a good ($P_{\text{world}} > P_{\text{domestic}}$). Clearly label the areas of CS and PS *before* trade and *after* trade. Who wins and who loses from exporting?

4 Module 9: Externalities and Public Goods

This module is about "market failure"—when the market Q^* is *not* the efficient Q. The key is graphing the "social" curves.

4.1 Challenging Concept 1: Graphing Negative Externalities

(e.g., pollution)

- The market only cares about **Private Cost (MPC)**, so $S = MPC$.
- Society cares about **Social Cost (MSC) = MPC + External Cost**.
- Therefore, the MSC curve is **above** the S curve.
- The **Market Quantity** ($Q_{\textbf{market}}$) is where $S = D$.
- The **Efficient Quantity** ($Q_{\textbf{efficient}}$) is where $MSC = D$.
- **Result:** $Q_{\text{market}} > Q_{\text{efficient}}$. The market **overproduces** the good.
- **DWL:** The triangle pointing to $Q_{\text{efficient}}$, showing the "waste" from producing units where $MSC > MB$.
- **Solution:** A **Pigouvian Tax** equal to the external cost.

4.2 Challenging Concept 2: Graphing Positive Externalities

(e.g., vaccines, education)

- The market only cares about **Private Benefit (MPB)**, so $D = MPB$.
- Society cares about **Social Benefit (MSB) = MPB + External Benefit**.
- Therefore, the MSB curve is **above** the D curve.
- The **Market Quantity** ($Q_{\textbf{market}}$) is where $S = D$.
- The **Efficient Quantity** ($Q_{\textbf{efficient}}$) is where $S = MSB$.
- **Result:** $Q_{\text{market}} < Q_{\text{efficient}}$. The market **underproduces** the good.
- **DWL:** The triangle pointing to $Q_{\text{efficient}}$, showing the "missed opportunities" from not producing units where $MSB > MC$.
- **Solution:** A **Pigouvian Subsidy** equal to the external benefit.

4.3 Challenging Concept 3: Public Goods & The Free-Rider Problem

This is a different kind of market failure.

- **The 2 Characteristics:**
  - **Non-rival:** My use does not diminish your use (e.g., national defense, a lighthouse).
  - **Non-excludable:** I cannot stop you from using it (e.g., national defense, street lights).
- **The Free-Rider Problem:** Because it's non-excludable, people can benefit *without paying*. This removes the profit incentive for any private firm.
- **The Result:** The private market will **not provide** (or will severely under-provide) public goods, even if $MSB > MSC$. This is a justification for government provision.

Common Trap: A "common resource" (e.g., fish in the ocean) is **rival** but **non-excludable**. This leads to the *Tragedy of the Commons* (over-use), which is a type of negative externality.

Module 9 Practice Questions

1. The market for loud stereos has $Q_D = 100 - P$. The private supply is $Q_S = P$. Each stereo imposes a \$20 noise-pollution cost on neighbors.
   (a) Find the *market* equilibrium P and Q.
   (b) Find the *socially efficient* P and Q. (Hint: The MSC curve is $P = Q + 20$, or $Q_S^{\text{social}} = P - 20$).
   (c) What per-unit tax would achieve the efficient outcome?
2. For each of the following, identify if it is rival/non-rival and excludable/non-excludable. What type of good is it (Public, Private, Common, Club)?
   - A) A slice of pizza.
   - B) Uncongested (empty) toll road.
   - C) A city park with no fence.
   - D) A missile defense system.

5 Module 10: Inequality, Social Insurance, & Redistribution

This module is less graphical and more conceptual. The hard parts are understanding the Gini coefficient, tax structures, and the equity-efficiency trade-off.

5.1 Challenging Concept 1: Gini Coefficient

- **Gini Coefficient:** A measure of inequality from 0 to 1.
  - $Gini = 0$: Perfect equality.
  - $Gini = 1$: Perfect inequality (One person has 100% of the income).

  The *larger* the Gini coefficient, the *more* unequal the income distribution.

5.2 Challenging Concept 2: Types of Taxation

This is about the **average tax rate** (Total Tax / Total Income), *not* the marginal rate.

- **Progressive:** Average tax rate *increases* as income increases. (e.g., US Federal Income Tax).
- **Regressive:** Average tax rate *decreases* as income increases. (e.g., A sales tax on food. Poor households spend a *larger percent* of their income on food, so the tax hits them harder as a % of income).
- **Proportional (Flat):** Average tax rate is *constant* for all incomes.

5.3 Challenging Concept 3: The Equity vs. Efficiency Trade-Off

This is the "big idea" of the module.

- We can make society *more equitable* (less unequal) by redistributing income (e.g., taxes and welfare).
- However, the *act* of redistributing (e.g., high taxes on income) can distort incentives, create DWL, and shrink the "total economic pie."
- **The "Leaky Bucket":** Moving money from the rich to the poor is like moving water with a leaky bucket. The act of transferring (taxes, admin costs, DWL) causes some of the "water" (total surplus) to be lost.
- **Rawlsian Justice:** A specific viewpoint. It argues we should design policies to *maximize the well-being of the worst-off person* in society. This often justifies significant redistribution, even if the "bucket" is a bit leaky.

Module 10 Practice Questions

1. Country A has a Gini coefficient of 0.25. Country B has a Gini coefficient of 0.55. Which country has a more *equitable* distribution of income?

2. A town imposes a $100 "per-person" fee on every resident to pay for parks.

   - What is the *average tax rate* of this fee for a person earning $1,000/year?
   - What is the *average tax rate* for a person earning $50,000/year?
   - Is this tax progressive, regressive, or proportional?

3. Explain, using the concept of incentives and deadweight loss, why a 100% tax on all income above $1,000,000 would be "inefficient."

6 Module 6: Answer Key

1. Market for Widgets ($Q_D = 200 - 2P$, $Q_S = 3P - 50$)

a) **Find equilibrium P^* and Q^*.**

- Set $Q_D = Q_S$: $200 - 2P = 3P - 50$
- $250 = 5P$
- $\mathbf{P^* = \$50}$
- Plug in P: $Q = 200 - 2(50) = \mathbf{100}$.
- **Answer:** $P^* = 50$, $Q^* = 100$.

b) **\$5 tax on sellers. Find Q_{tax}, P_b, P_s.**

- The new supply curve is based on $P_s = P_b - 5$.
- $Q_S = 3(P_b - 5) - 50 \implies Q_S = 3P_b - 15 - 50 \implies Q_S = 3P_b - 65$.
- Set new $Q_S = Q_D$: $3P_b - 65 = 200 - 2P_b$
- $5P_b = 265$
- $\mathbf{P_b = \$53}$.
- $\mathbf{P_s} = P_b - 5 = 53 - 5 = \mathbf{\$48}$.
- $\mathbf{Q}_{\text{tax}} = 200 - 2(53) = 200 - 106 = \mathbf{94}$.
- **Answer:** $Q_{\text{tax}} = 94$, $P_b = \$53$, $P_s = \$48$.

c) **Calculate tax burden. Who pays more? Does this match elasticity?**

- **Buyer Burden:** $P_b - P^* = \$53 - \$50 = \mathbf{\$3}$.
- **Seller Burden:** $P^* - P_s = \$50 - \$48 = \mathbf{\$2}$.
- **Who pays more?** The **buyers** pay more.
- **Elasticity:** At equilibrium ($P = 50, Q = 100$):
- $E_D = \frac{dQ}{dP} \times \frac{P}{Q} = (-2) \times \frac{50}{100} = -1.0$.
- $E_S = \frac{dQ}{dP} \times \frac{P}{Q} = (3) \times \frac{50}{100} = 1.5$.
- Since $|E_D| = 1.0 < E_S = 1.5$, demand is **more inelastic**.
- **This matches the rule:** The more inelastic side (buyers) pays a larger share of the tax.

2. Graph a binding price floor.

- A binding price floor (P_f) is set **above** the equilibrium price (P^*).
- At P_f, $Q_S > Q_D$, which creates a **Surplus**.

- The quantity transacted is the "short side" of the market, which is $\mathbf{Q_D}$.
- **CS:** Area *below* D curve, *above* P_f, out to Q_D.
- **PS:** Area *above* S curve, *below* P_f, out to Q_D.
- **DWL:** The triangle pointing to Q^*, formed by the D and S curves between Q_D and Q^*.

7 Module 7: Answer Key

1. Calculate total surplus at equilibrium ($P^* = 50, Q^* = 100$).

- Demand Intercept (set $Q = 0$): $0 = 200 - 2P \implies P = 100$.
- Supply Intercept (set $Q = 0$): $0 = 3P - 50 \implies P \approx 16.67$.
- **CS:** $0.5 \times Q^* \times (P_{\text{D-int}} - P^*) = 0.5 \times 100 \times (100 - 50) = \$\mathbf{2500}$.
- **PS:** $0.5 \times Q^* \times (P^* - P_{\text{S-int}}) = 0.5 \times 100 \times (50 - 16.67) = \$\mathbf{1666.67}$.
- **Total Surplus:** $\$2500 + \$1666.67 = \$\mathbf{4166.67}$.

2. Calculate CS, PS, Gov't Revenue, and DWL from the $5 tax.

($Q_{\text{tax}} = 94, P_b = 53, P_s = 48$)

- **CS (new):** $0.5 \times Q_{\text{tax}} \times (P_{\text{D-int}} - P_b) = 0.5 \times 94 \times (100 - 53) = \$\mathbf{2209}$.
- **PS (new):** $0.5 \times Q_{\text{tax}} \times (P_s - P_{\text{S-int}}) = 0.5 \times 94 \times (48 - 16.67) = \$\mathbf{1472.51}$.
- **Gov't Revenue:** Tax $\times Q_{\text{tax}} = \$5 \times 94 = \$\mathbf{470}$.
- **DWL:** Total Surplus$_{\text{old}}$ $-$ (CS$_{\text{new}}$ + PS$_{\text{new}}$ + Gov Rev) $= \$4166.67 - (2209 + 1472.51 + 470) = \$\mathbf{15.16}$. (Difference due to rounding; see next problem).

3. Verify DWL with the triangle formula.

- DWL $= 0.5 \times$ (Tax) $\times (Q^* - Q_{\text{tax}})$
- DWL $= 0.5 \times (\$5) \times (100 - 94)$
- DWL $= 0.5 \times 5 \times 6 = \$\mathbf{15}$.

8 Module 8: Answer Key

1. Input Method Table (Hours to make one)

	1 Laptop	1 Phone
USA	10 hours	8 hours
China	20 hours	5 hours

a) **Absolute Advantage (fewer hours):**

- Laptops: **USA** (10 hrs $<$ 20 hrs)
- Phones: **China** (5 hrs $<$ 8 hrs)

b) **Comparative Advantage (lower opportunity cost):**

- **OC of 1 Laptop:**
  - USA: 10 hrs/8 hrs = 1.25 Phones
  - China: 20 hrs/5 hrs = 4 Phones
  - **USA** has C.A. in Laptops ($1.25 < 4$).
- **OC of 1 Phone:**
  - USA: 8 hrs/10 hrs = 0.8 Laptops
  - China: 5 hrs/20 hrs = 0.25 Laptops
  - **China** has C.A. in Phones ($0.25 < 0.8$).

c) **Terms of Trade:**

- A mutually beneficial trade price must be between the two opportunity costs.
- 1.25 Phones $<$ 1 Laptop $<$ 4 Phones
- **Example Answer:** Any price such as "1 Laptop for 3 Phones" or "1 Laptop for 2 Phones" would be mutually beneficial.

2. Graph an exporting country.

- An exporting country has $P_{\text{domestic}} < P_{\text{world}}$.
- When trade opens, the price **rises** to P_{world}.
- **Before Trade:** CS is large, PS is small.
- **After Trade:** CS **shrinks** (area above P_{world}). PS **grows** (area below P_{world}).
- **Who wins/loses?** Domestic **consumers lose** (pay higher price). Domestic **producers win** (get higher price). The country as a whole gains because the gains to producers outweigh the losses to consumers.

9 Module 9: Answer Key

1. Loud Stereos ($Q_D = 100 - P$, $Q_S = P$, $20 external cost)

a) **Find market equilibrium P and Q.**

- Set $Q_D = Q_S$. Since $Q_S = P$, substitute P for Q_S. And $P = 100 - Q_D$.
- Set $P = P$: $100 - Q = Q \implies 100 = 2Q$
- $\mathbf{Q = 50}$.
- Since $P = Q$, $\mathbf{P = \$50}$.

b) **Find socially efficient P and Q.**

- This is a negative externality, so $MSC > MPC$.
- $MPB = D : P = 100 - Q$
- $MPC = S : P = Q$
- $MSC = MPC + \text{Ext. Cost} = \mathbf{Q + 20}$.
- Set $MSB = MSC$: $100 - Q = Q + 20$
- $80 = 2Q \implies \mathbf{Q_{\text{efficient}} = 40}$.
- Find the price buyers pay (from D curve): $P = 100 - 40 = \mathbf{\$60}$.

c) **What per-unit tax would achieve this?**

- The tax should equal the marginal external cost.
- **Answer:** $\mathbf{\$20}$.

2. Classify Goods

- **A) A slice of pizza:** Rival and Excludable. **Private Good**.
- **B) Uncongested (empty) toll road:** Non-rival and Excludable. **Club Good**.
- **C) A city park with no fence:** Rival (can get crowded) and Non-excludable. **Common Resource**.
- **D) A missile defense system:** Non-rival and Non-excludable. **Public Good**.

10 Module 10: Answer Key

1. Gini coefficients (A=0.25, B=0.55). Which is more equitable?

- A Gini of 0 is perfect equality.
- **Answer: Country A** (0.25) is closer to 0 and has a more equitable distribution.

2. $100 per-person fee.

a) **Avg. tax rate for $1,000 income:**

- $(\$100/\$1,000) \times 100 = \mathbf{10}\%$.

b) **Avg. tax rate for $50,000 income:**

- $(\$100/\$50,000) \times 100 = \mathbf{0.2}\%$.

c) **Progressive, regressive, or proportional?**

- The average tax rate *decreases* as income *increases*.
- **Answer: Regressive.**

3. Explain the inefficiency of a 100% tax.

- A 100% marginal tax rate on income above $1,000,000 creates a powerful **disincentive to work** or earn more.
- Once a person earns $1,000,000, their take-home pay from any additional work is $0.
- This would cause high-income individuals to stop working, work less, retire early, or find ways to avoid the tax (legally or illegally).
- This leads to a massive **Deadweight Loss (DWL)**, as society loses the productive value (the output) that these individuals would have created. The "economic pie" shrinks, which is the definition of inefficiency.