

SOLUTION KEY

The University of Chicago
Department of Economics

ECON 17100: Introduction to International Trade

Practice Final

Spring 2026

Instructor: Sasha Petrov

Name:

Student ID:

Instructions

- This practice exam is intended to help you prepare for the **cumulative** in-class final.
- The actual final will be **closed-book, closed-notes**.
- The exam consists of **4 problems** worth a total of **100 points**: Problem 1 (20 pts), Problem 2 (40 pts), Problem 3 (34 pts), Problem 4 (6 pts).
- The final is **cumulative**: any topic from Weeks 1–9 is fair game.
- Attempt the problems under exam-like conditions before consulting your notes or the solutions.
- Show all your work. Partial credit is awarded for correct approaches even if the final answer is incorrect.
- When a question imposes a **length limit** on the response (e.g., “in one sentence”), exceeding the limit will be penalized regardless of whether the answer is correct.
- Most questions emphasize **graphical analysis and economic intuition** rather than algebraic derivation. Calculators will not be permitted on the actual exam; leave answers in simplified form.

Problem 1: True, False, or Uncertain**[20 points]**

For each of the following statements, argue whether it is true, false, or uncertain. Use economic reasoning, a graph, or a counterexample to support your answer. Full credit requires both correct classification **and** correct justification.

- (a) A common argument heard from globalization skeptics: “After adjusting for productivity differences, China is probably no more competitive overall than are high-income economies like Hong Kong or Singapore.” **[10 pts]**

Solution:

True. This is the Ricardian **unit-labor-cost** equality. In the Ricardian equilibrium, labor mobility forces wages to track productivity: for the good a country produces, $w = p/a$, where a is the unit labor requirement. Equivalently, the **unit labor cost** $w \cdot a$ equals the world price for every active producer. Countries with low wages have correspondingly low productivity (high a), so the productivity-adjusted cost gap is much smaller than the raw wage gap.

Concretely: China’s nominal wage is a small fraction of Hong Kong’s or Singapore’s, but Chinese labor productivity is also a small fraction. The product $w \cdot a$ – what producers actually compete on – is similar across the three, so the claim holds. The **opposite** inference – reading China’s far lower wages alone as making it **more** competitive overall – is the **pauper-labor fallacy**: it counts the low wage but ignores the equally low productivity that wage reflects.

- (b) For the 787 Dreamliner program, Boeing outsourced the most specialized, custom-engineered components – fuselage sections, wing assemblies, and major systems requiring relationship-specific investments by suppliers – rather than producing them in-house. This was a sound cost-minimization strategy for developing such a complex new product.¹ **[10 pts]**

Solution:

False. The claim inverts the **cost–coordination trade-off**. Relationship-specific investments – those that lose most of their value outside the specific firm–supplier relationship – expose both sides to a **hold-up problem**. Once the supplier has invested in the buyer’s proprietary design, the buyer can demand price concessions; symmetrically, the buyer is exposed to the supplier’s leverage after the order is committed. Complex, custom-engineered work is hard to specify and verify ex ante, so arm’s-length contracts cannot easily resolve this.

The standard prediction (Williamson; Antràs–Helpman) is the **opposite** of the claim: firms vertically integrate the production of relationship-specific inputs – bringing them in-house – and outsource standardized inputs, where multiple substitutable suppliers and easily verifiable quality let market discipline work.

The Boeing 787 program is a textbook illustration of the failure mode, not a counterexample. Outsourcing custom-engineered fuselage sections, wing assemblies, and major systems to a global supplier network exposed Boeing to exactly the hold-up and coordination failures the theory predicts.

¹Zhao, Y. (2013). “Why 787 Slips Were Inevitable?” Rutgers Business School working paper, <http://zhao.rutgers.edu/787-paper-12-02-2013.pdf>.

The 787 was 26 months late and billions over budget; Boeing has since pulled significant work back in-house.

Problem 2: Monopolistic Competition and Horizontal FDI [40 points]

In 1980, imported passenger cars held about 27% of the US market, with foreign brands rising from there over subsequent decades; by the mid-2020s, foreign-branded vehicles capture more than half of US light-vehicle sales.² But most of those “foreign” cars are not actually shipped from abroad — they roll out of foreign-owned plants located in the US. Volkswagen’s Chattanooga, Tennessee plant produced about 175,000 vehicles in 2023, BMW’s Spartanburg, South Carolina plant assembled 396,117 in 2024, and Toyota’s Kentucky plant has annual capacity of about 550,000 vehicles — all examples of horizontal FDI.³ This problem uses a Krugman-style model with trade costs to rationalize that pattern.

Setup. Two symmetric economies — the United States (US) and Germany (Ger) — each have L identical consumers who spend a fixed share of income on differentiated cars. Each **variety** is produced by a single firm at constant marginal cost c per car plus a fixed plant cost F per location. Entry is free: firms enter until profits are competed to zero. In a country with n varieties and market size S , the Krugman model gives a downward-sloping **PP** (pricing) curve and an upward-sloping **CC** (cost / break-even) curve in (n, p) space:

$$\text{PP: } p = c + \frac{1}{nb}, \quad \text{CC: } p = c + n \frac{F}{S},$$

where $b > 0$ is a demand parameter.

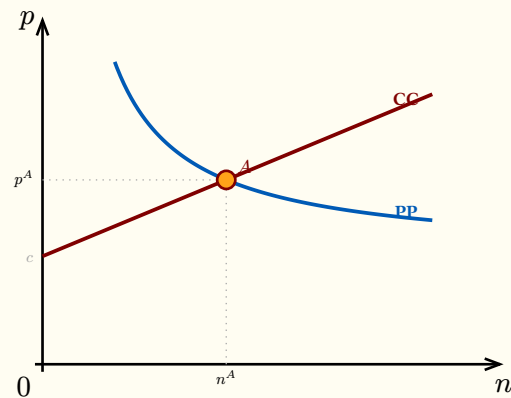
- (a) Sketch the CC and PP curves in (n, p) space. Label each curve, and mark the autarky equilibrium A with corresponding values n^A and p^A . In one sentence each, state the economic intuition for the slope of PP and the slope of CC. [6 pts]

Solution:

PP slopes down: more competitors (n rises) make each firm’s residual demand more elastic, forcing markups (and hence p) down. **CC slopes up:** as more firms enter, each firm sells a smaller quantity S/n , spreading the fixed cost F over fewer units — so the break-even price rises.

²Atkinson, R. (2026). “Explaining the Relative Competitive Decline of America’s Automotive Industry.” Information Technology and Innovation Foundation, <https://itif.org/publications/2026/04/20/explaining-the-relative-competitive-decline-of-americas-automotive-industry/>.

³Chattanooga: Volkswagen Newsroom, *Volkswagen Group of America Chattanooga* (as of November 2023), <https://www.volkswagen-newsroom.com/en/volkswagen-group-of-america-chattanooga-4071>. Spartanburg: BMW Group, “BMW Manufacturing Continues as the Largest Automotive Exporter by Value in the U.S.” (May 2026), <https://www.press.bmwgroup.com/global/article/detail/T0448301EN/>. Kentucky: Toyota USA Newsroom, “30 Years After Groundbreaking, Toyota Kentucky Proves Age is Only a Number,” <https://pressroom.toyota.com/toyota-kentucky-30th-anniversary/>.

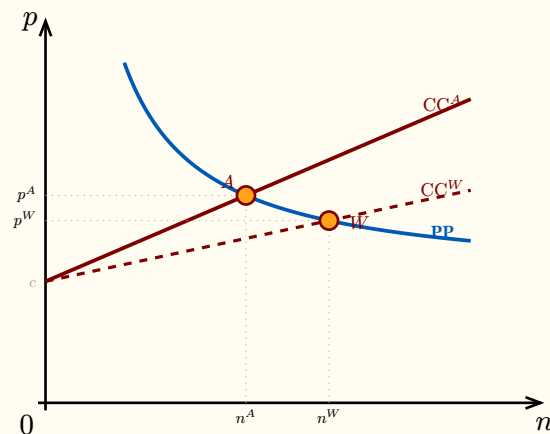


(b) The US and Germany open to **costless** trade. Since the countries are symmetric, the [12 pts] effective market each firm sells into is $2S$ rather than S .

1. On your diagram from part (a), show which curve(s) shift; mark and label the new equilibrium W with corresponding values n^W and p^W .
2. Describe the two channels of welfare gain that arise from opening to trade.

Solution:

1. **PP is unchanged** (it depends only on b , not on market size). **CC shifts down:** when S doubles, nF/S falls by half at every n . The new intersection is at higher n and lower p ($n^W > n^A$, $p^W < p^A$).
2. Two channels of welfare gain:
 - **Love-of-variety channel.** $n^W > n^A$: trade gives consumers access to varieties produced abroad. CES preferences value diversity, so a larger set of available varieties at any given price raises consumer utility.
 - **Pro-competitive channel.** $p^W < p^A$: with more firms competing for each consumer's spending, residual demand becomes more elastic and markups shrink. Consumers pay less per variety.



(c) Now introduce a **per-unit trade cost**: shipping one car from one country to the other costs an additional $t > 0$ dollars per car. Let q_h denote a firm's domestic sales and q_f its foreign sales. [6 pts]

1. Write the profit of a representative firm that operates **one** plant at home and serves both markets by **exporting** to the foreign market.
2. State the effective marginal cost of one car sold in the foreign market under this mode.

Solution:

1. The firm produces $q_h + q_f$ at home (one plant), pays an additional t per unit on foreign sales, and earns prices p_h, p_f in the two markets:

$$\pi_{\text{ex}} = (p_h - c) q_h + (p_f - c - t) q_f - F.$$

2. The effective marginal cost of one car sold abroad is $c + t$. Exporting “wastes” t per foreign unit relative to local production – the wedge the firm could save by building a second plant.

(d) The firm can alternatively operate **two** plants – one in each country – and serve each market locally. Each plant incurs fixed cost F . [9 pts]

1. Write the firm's profit under this mode.
2. Derive the indifference foreign-sales volume q_f^* at which exporting and operating two plants yield the same profit.
3. State which mode dominates for $q_f > q_f^*$ and for $q_f < q_f^*$, and give a one-sentence intuition.

Solution:

1. With two plants the firm pays F in each country and avoids the trade cost on foreign sales:

$$\pi_{\text{FDI}} = (p_h - c) q_h + (p_f - c) q_f - 2F.$$

2. Subtracting:

$$\pi_{\text{FDI}} - \pi_{\text{ex}} = t q_f - F.$$

Setting this to zero gives

$$q_f^* = \frac{F}{t}.$$

3. For $q_f > q_f^*$, **operating two plants dominates**: the trade-cost saving tq_f exceeds the extra plant cost F . For $q_f < q_f^*$, **exporting dominates**: foreign sales are too low to amortize a second plant. This is the **proximity-concentration** trade-off.

(e) **Calibration.** For tractable arithmetic, take the stylized values $F = \$1$ billion (greenfield auto-assembly plant), $c = \$20,000$ per vehicle, and $t = \$2,000$ per car (trans-Atlantic trade cost). [7 pts]

1. Compute q_f^* from part (d).

1. Identify which of Volkswagen's Chattanooga plant ($\approx 175,000$ vehicles in 2023) and Volkswagen's Puebla plant ($\approx 510,000$ vehicles at its 2011 production peak) the simple model rationalizes and which it does not.⁴
2. For the plant the model fails to rationalize, name one specific real-world factor (not in the model) that could close the gap.

Solution:

1. $q_f^* = F/t = \$1B / \$2,000 = 500,000$ vehicles/year.
2. **Puebla** ($\approx 510,000$ at its 2011 peak) is just above the cutoff — at that scale the simple model rationalizes producing locally rather than exporting. **Chattanooga** ($\approx 175,000$) is well below the cutoff — the simple model does **not** rationalize it (VW should serve those 175,000 vehicles by exporting from Germany or Mexico instead).
3. Factors that could close the gap for Chattanooga:
 - **Tariff or policy risk.** A US plant insures VW against future US trade restrictions (e.g., 2018 steel tariffs, USMCA disputes).
 - **US-specific product design.** US buyers want larger SUVs; a US plant lets VW produce US-tailored models efficiently.
 - **Local-sourcing or political-economy value.** “Made in USA” branding, lobbying access, and government incentives raise the effective payoff to a US plant.
 - **Currency-risk hedging.** Producing in the US matches Euro costs to Dollar revenues.

⁴Puebla production figure: Volkswagen UK Press, *Volkswagen de México: Puebla and Silao*, <https://www.vwpress.co.uk/assets/documents/original/18707-VolkswagenMexico2018.pdf>.

Problem 3: From Free Trade to Tariff Policy [34 points]

In March 2018, the United States imposed **Section 232 tariffs** on imported steel at a uniform 25% ad valorem rate, citing national-security justifications.⁵ We will analyze the welfare effects in a small-open-economy partial-equilibrium framework, approximating Section 232 as a **specific** (per-unit) tariff t .

Setup. Take the US hot-rolled-steel market as a small open economy. Let p denote the domestic price in dollars per ton; quantities are in millions of tons per year. The domestic demand and supply schedules are

$$D(p) = 50 - \frac{p}{50}, \quad S(p) = \frac{p}{100}.$$

The world price is $p^* = \$1,000$ per ton, and the specific tariff is $t = \$200$ per ton.

(a) Free-trade benchmark. Sketch the partial-equilibrium (Q, p) diagram. Mark and label [6 pts] the free-trade quantities S^{FT} , D^{FT} , and the import volume M^{FT} .

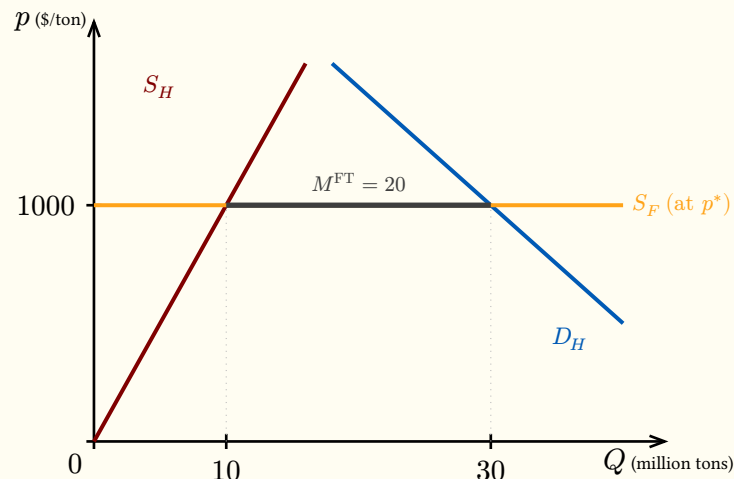
Solution:

Plugging in $p^* = 1000$:

$$S^{\text{FT}} = 1000/100 = 10 \quad (\text{million tons}), \quad D^{\text{FT}} = 50 - 1000/50 = 30 \quad (\text{million tons}),$$

$$M^{\text{FT}} = D^{\text{FT}} - S^{\text{FT}} = 30 - 10 = 20 \quad (\text{million tons}).$$

The horizontal foreign-supply line S_F at p^* pins the domestic price; the gap between D^{FT} and S^{FT} at that price is the import volume.



(b) Impose the tariff. On a fresh diagram, show the new equilibrium. Mark S^T , D^T , M^T , [16 pts] and **shade and label** the four welfare regions a , b , c , d .

⁵U.S. Presidential Proclamation 9705 of March 8, 2018, “Adjusting Imports of Steel Into the United States,” *Federal Register* 83 FR 11625, <https://www.federalregister.gov/documents/2018/03/15/2018-05478/adjusting-imports-of-steel-into-the-united-states>.

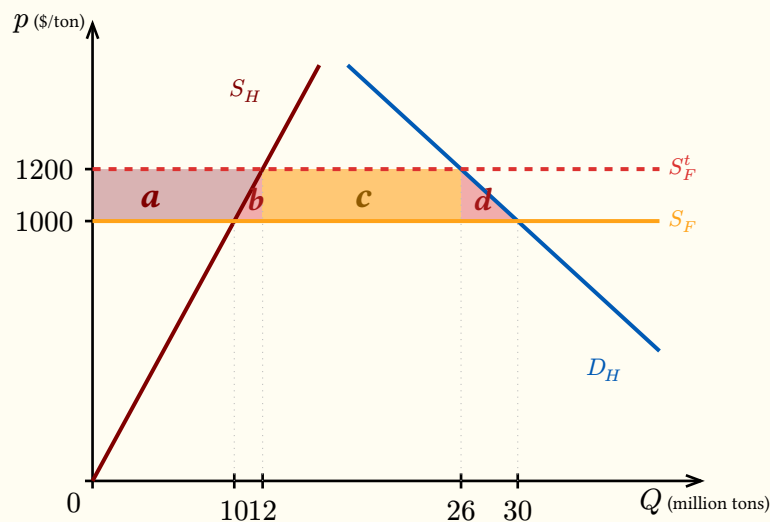
Solution:

Plugging in $p_H = 1200$:

$$S^T = 1200/100 = 12, \quad D^T = 50 - 1200/50 = 26, \quad M^T = 26 - 12 = 14 \quad (\text{million tons}).$$

Imports shrink from 20 to 14 million tons. The four regions:

- **a** – trapezoid between p^* and p_H , to the left of S_H : producer surplus gain on the $S^{\text{FT}} = 10$ million tons already produced and the $S^T - S^{\text{FT}} = 2$ million new tons.
- **b** – triangle between S_H , the p_H line, and the vertical at S^T : production-distortion deadweight loss (resource misallocation, since the marginal cost of the last domestic ton exceeds p^*).
- **c** – rectangle between S^T and D^T , from p^* up to p_H : tariff revenue, $(p_H - p^*) M^T$.
- **d** – triangle between D_H , the p_H line, and the vertical at D^T : consumption-distortion deadweight loss (consumers priced out).



(c) Factor-market consequences. Reinterpret the analysis in the **Specific Factors Model**: [6 pts]
 steel uses sector-specific capital K_S , the rest of the economy uses sector-specific capital K_O , and labor L is mobile between sectors. Identify the winners and losers among K_S , K_O , and L in terms of **real** returns.

Solution:

- **K_S (steel-specific capital): unambiguous winner.** The steel price rises while labor reallocates **into** steel, raising the marginal product of steel-specific capital. The nominal return r_S rises by more than the price of any one good (the SFM magnification result), so the real return of K_S rises in **both** numeraires.
- **K_O (other-sector-specific capital): unambiguous loser.** Labor flows **out** of the rest of the economy, lowering the marginal product of K_O . The nominal return r_O falls while the price of other goods is unchanged – so K_O 's real return falls in both numeraires.
- **L (mobile labor): ambiguous.** The nominal wage w rises (drawn by the higher steel price) but by **less** than the price of steel. So:

- real wage in terms of **steel**, w/p_{steel} , **falls**;
- real wage in terms of **other goods**, w/p_{other} , **rises**.

Whether labor's **consumption basket** is better or worse off depends on how much steel labor consumes — the standard SFM ambiguity.

(d) Real-world critique. Name **one specific feature** of the 2018 Section 232 steel tariff [6 pts] episode that the small-open-economy framework in parts (a)–(b) **misses**. State **which step** of the analysis (the diagram in part (b) or the factor-market conclusion in part (c)) would need to be modified, and **in what direction**.

Solution:

Several acceptable answers; full credit requires (i) a specific feature and (ii) which step would change. Examples:

- **Downstream input-cost spillovers.** The model treats D_H as a generic demand curve, but most US steel is bought by **downstream** industries — autos, construction, machinery — not by final consumers. The tariff raised input costs and contracted output in those sectors, destroying more downstream jobs than it created in steel. **Which step changes:** the welfare areas in part (b) understate the loss — the b and d triangles only capture the marginal distortion in the **steel** market, not the contraction of the sectors that buy steel.
- **Foreign retaliation.** China and the EU retaliated with tariffs on US exports (soybeans, motorcycles, whiskey). The small-open framework treats foreign supply S_F as exogenous and ignores spillovers to US **export** sectors. **Which step changes:** the factor-market conclusion in (c) — US export sectors and the factors specific to them are now hit on top of any steel-side effect.
- **Terms-of-trade effects.** The US is large enough in the world steel market that some of the tariff wedge could be pushed onto foreign exporters as a lower export price (“Foreign band” in the lecture’s *Who absorbs the tariff?* diagram). **Which step changes:** S_F in the diagram in (b) would need to slope upward rather than be horizontal, and a positive terms-of-trade transfer area would partially offset the $b + d$ losses.
- **Tariff exclusions and substitution across sources.** Many products and countries received exemptions, and importers substituted toward non-tariffed sources. **Which step changes:** the effective tariff wedge in (b) is smaller than the headline rate, shrinking all four areas a, b, c, d .
- **Investment and capacity dynamics.** Sector-specific capital K_S is fixed in the SFM, but US steel firms (US Steel, Cleveland-Cliffs) made multi-year investment decisions in response to the tariff. **Which step changes:** the factor-market conclusion in (c) treats K_S as fixed; in a dynamic version, labor’s real-wage ambiguity may resolve depending on whether the tariff is expected to persist.

A “the model is too simple” / “real life is messier” answer without identifying both a specific feature **and** the corresponding step earns no credit.

Problem 4: Case-Study Questions

[6 points]

These short questions test recall and interpretation of **case studies** covered in lectures and problem sets. A concise answer — a few sentences identifying the relevant empirical patterns or trends — is expected. You do **not** need to cite specific numerical values; describing the general pattern or direction is sufficient.

- (a) What evidence suggests that the United States can reasonably be treated as a **small open economy** in the world washing-machine market? [3 pts]

Solution:

Evidence. When the US imposed the 2018 Section 201 washing-machine safeguard, the tariff passed through to US retail washer prices almost **completely** — domestic prices rose by nearly the full tariff wedge, while the price foreign exporters received net of the duty barely moved. Near-complete pass-through is precisely the behavior a price-taking small open economy exhibits (the safeguard analyzed in *pset 5, Problem 2*).

Why this signals a small open economy. In the small-open-economy tariff model the foreign export supply X_F is perfectly elastic (horizontal) at the world price: the US cannot bid the world price down by importing less, so the entire tariff wedge lands on domestic consumers and there is **no terms-of-trade transfer** from foreign exporters.

- (b) What empirical trend in labor-abundant developing countries (e.g., Mexico, Colombia, India) following trade liberalization in the early 1990s contradicted the predictions of the Heckscher–Ohlin / Stolper–Samuelson framework? [3 pts]

Solution:

Trend. In Mexico, Colombia, and India after their early-1990s trade reforms, **wage inequality rose**: the college / skilled-labor wage premium **widened** and Gini coefficients **increased**.

Why this contradicts H–O / S–S. The Stolper–Samuelson theorem predicts that opening to trade raises the real return of the factor used **intensively** in the country's exported good. Labor-abundant developing countries should — under H–O — export low-skill-intensive goods, raising the relative wage of unskilled workers and **narrowing** the skill premium. The observed **widening** is the opposite, the so-called **H–O paradox** (Week 4 Heckscher–Ohlin lecture, *Globalization and Inequality* case study).

Candidate explanations (any one suffices for full credit): skill-biased technological change embedded in newly imported capital goods; competition from even more labor-abundant exporters (China) bidding away low-skill production; offshoring of **intermediate**-skill rather than the most labor-intensive tasks.

Scratch Paper

This page is for rough work only. Work on this page will not be graded.

— END OF EXAM —

Please review your answers before submitting.