INTERNATIONAL COMPETITIVENESS, MARKET CONCENTRATION, AND BARRIERS TO FOREIGN ENTRY

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Abstract

If barriers to foreign entry are removed, increased market participation by internationally competitive firms can reduce market concentration and benefit consumers. We develop an industry-focused simulation model that estimates the economic effects of reducing market concentration in a specific industry and country. To illustrate the analytical approach, we apply the model to firm-level data on new motor vehicle sales in Malaysia in 2022.

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1 Introduction

When there are barriers to foreign entry, there can be significant market concentration in national markets and firms' market shares may not reflect the firms' international competitiveness within an industry. In some cases, increased competition from foreign producers can significantly reduce market concentration and benefit consumers.

In this paper, we develop an economic simulation model that estimates how prices, sales, market concentration, and profits would change if additional firms were to supply a national market. The model is calibrated to firm-level market shares in the liberalizing market and in other comparison markets. We experiment with different approaches to calibrating the cost competitiveness of the additional firms.

To illustrate the model, we apply it to the market for new light motor vehicles in Malaysia in 2022. We simulate how the Malaysian market would have looked if we added several globally competitive vehicle manufacturers who were absent or had trivial market shares in Malaysia in 2022. The simulations indicate that increasing competition, for example by removing barriers to foreign entry, would have reduced market concentration, the market shares of incumbents, and average prices faced by Malaysian consumers. The model estimates these economic effects at the firm level. The signs of these effects are not sensitive to the comparison market used to calibrate the marginal costs of the additional suppliers, but the magnitudes of these effects are fairly sensitive to the choice of comparison market.

Section 2 introduces the modeling framework. We describe the basic assumptions of the model, the method for calibrating prices and marginal costs, the counterfactual scenarios considered in the simulations, and the method for estimating firms' fixed costs of additional suppliers. Section 3 reports the model simulations. Section 4 concludes.

2 Modeling Framework

In this section, we describe the industry-focused, partial equilibrium model.

2.1 Assumptions of the Model

Industry demand in a specific national market has the constant elasticity of substitution (CES) form in equation (1), with elasticity σ.[1]

$$q_j = E\ (P)^{\sigma\ -\ 1}\ (p_j)^{-\sigma} \tag{1}$$

q_j is the quantity sold by firm j, p_j is the firm's price, and E is aggregate expenditure on the products of the industry. Equation (2) defines the industry's CES price index P.

$$P = \left(\sum_j\ (p_j)^{1\ -\ \sigma} \right)^{\frac{1}{1\ -\ \sigma}} \tag{2}$$

Equations (3) and (4) are the revenues and variable profits of firm j.

$$R_j = p_j\ q_j \tag{3}$$

$$\pi_j = (p_j\ -\ m_j)\ q_j \tag{4}$$

m_j is the firm's marginal costs of production. Each firm also faces fixed costs of supplying the national market, f_j, that might include barriers to entry. There is Bertrand-Nash competition in prices: firm j chooses its price p_j to maximize π_j, taking the prices of its competitors in the national market as given.

[1] Anderson, de Palma and Thise (1988) show that the CES demand structure can be derived from a specific logit model in which consumers face idiosyncratic extreme value-distributed costs associated with each source of supply and each individual chooses a single, preferred source of supply.

2.2 Model Calibration

The imperfect competition model is calibrated to firm-level data for the specific industry and national market. The first step in the calibration normalizes the initial price of firm i, p_i^0, to one and use relative market shares to calibrate prices for all firms $j \neq i$ according to equation (5).

$$p_j^0 = \left(\frac{s_j^0}{s_i^0}\right)^{-\frac{1}{\sigma}} \; p_i^0 \tag{5}$$

s_i^0 and s_j^0 are the initial quantity market shares of firms i and j. If available market share data were stated in dollar values rather than quantities, then the exponent $-\frac{1}{\sigma}$ on the right-hand side of equation (5) would be replaced by $\frac{1}{1 \; - \; \sigma}$. Firms with large relative market shares have low relative prices.

The second step calibrates initial marginal costs using the first order condition for the profit-maximizing pricing of firm j in equation (6).

$$1 = \frac{\sigma \; (p_j^0 \; - \; m_j^0)}{p_j^0} \; + \; \frac{(1 \; - \; \sigma) \; (p_j^0 \; - \; m_j^0) \; (p_j^0)^{-\sigma}}{\sum_k (p_k^0)^{1 \; - \; \sigma}} \tag{6}$$

Equation (6) links firm j's marginal cost of supplying the market to its initial price and the prices of its competitors. Firms with low relative prices have low relative marginal costs. This first order condition assumes that each firm has constant marginal costs with respect to its own output.

The third step calibrates relative prices in another, comparable national market. Again, we normalize the price of firm i by setting p_i^* in the comparison market equal to one.[2] For other, internationally competitive firms $j \neq i$ that have $s_j^* > 1\%$ but are absent or have a trivial share in the initial equilibrium in the liberalizing market ($s_j^0 < 1\%$), p_j^* is defined in

[2]Overlapping firm i participates in both markets. It has a significant share in the liberalizing national market and also a significant share in the comparable national market.

terms of p_i^* and relative market shares in the comparable market:

$$p_j^* = p_i^* \left(\frac{s_j^*}{s_i^*}\right)^{-\frac{1}{\sigma}} \tag{7}$$

Firms with large relative market shares in the comparison market have low relative prices and relative marginal costs.

The final step calibrates the marginal costs of adding suppliers to the liberalizing market using p_i^* and p_j^*, the firms' prices in the comparison market. Equation (8) is also derived from the firms' first order conditions for profit-maximizing prices.

$$\frac{p_j^* - \sigma\,(p_j^* - m_j^*)}{(p_j^* - m_j^*)\,(p_j^*)^{1-\sigma}} = \frac{p_i^* - \sigma\,(p_i^* - m_i^*)}{(p_i^* - m_i^*)\,(p_i^*)^{1-\sigma}} \tag{8}$$

Equation (8) implicitly defines $m_{j\neq i}^*$ in terms of m_i^*. It is a relative form of the first order condition that only requires data for firms j and i. This final step in the calibration does not require data on the market shares of all firms in the comparison market. It only requires data for the market shares of firm i and the suppliers that will be added in the simulation.

These steps calibrate the cost competitiveness of internationally competitive firms $j \neq i$ that have $s_j^* > 1\%$ but are absent or have a trivial share in the initial equilibrium in the liberalizing market ($s_j^0 < 1\%$), relative to firm i, assuming that $\frac{m_j}{m_i}$, which we do not observe, will be equal to $\frac{m_j^*}{m_i^*}$, which we do observe.

2.3 Simulation: Reducing Market Concentration

We can use the calibrated model to simulate the economic effects of adding suppliers, for example by removing fixed costs that create barriers to foreign entry.[3] The simulation is not predicting whether additional foreign suppliers will enter the liberalizing market, and

[3]The model could easily be extended to also consider changes in variable costs of entrants or reductions in variable subsidies to incumbents that would incentivize new entry.

it is not specifying the form of any barriers to entry. Instead it is estimating changes in prices, sales, and profits *conditional on* the addition of the foreign suppliers. We calculate new equilibrium prices in the liberalizing national market using the first order condition of additional supplier j in equation (9), again assuming that the firm has constant marginal costs with respect to its own output.

$$1 = \frac{\sigma\ (p_j\ -\ m_j^*)}{p_j}\ +\ \frac{(1\ -\ \sigma)\ (p_j\ -\ m_j^*)\ (p_j)^{-\sigma}}{\sum_k (p_k)^{1\ -\ \sigma}} \tag{9}$$

For incumbent firms in the liberalized market with non-trivial market shares ($s_i^0 > 1\%$), the simulation sets counterfactual m_i equal to m_i^0, which is calibrated from the initial equilibrium. For vehicle manufacturers j who are internationally competitive ($s_j^* > 1\%$) but are basically absent from the liberalizing market in the initial equilibrium ($s_j^0 < 1\%$), the simulation sets counterfactual m_j equal to m_j^*, the firm's marginal cost is calibrated from its market share in the comparison market.

We calculate new equilibrium quantities using these new equilibrium prices and equations (1) and (2). Then we calculate average industry prices using the CES index in equation (2), and we calculate market concentration using the Herfindahl-Hirschman Index (HHI) in equation (10).[4]

$$HHI = 10,000\ \sum_j \left(\frac{p_j\ q_j}{\sum_k p_k\ q_k} \right)^2 \tag{10}$$

2.4 Lower Bound on Fixed Costs of Market Participation

We also can use the model to calculate a lower bound on the fixed costs of supplying the market for a non-incumbent firm, one that is internationally competitive but is initially absent from the liberalizing market. Equation (11) is the first-order condition for the firm's

[4]The sums in the HHI include all firms that supply the liberalizing national market.

profit-maximizing price if it deviates from its decision to not supply the market in the initial equilibrium, $\tilde{p_j}$.[5]

$$1 = \frac{\sigma\ (\tilde{p_j}\ -\ m_j^*)}{\tilde{p_j}}\ +\ \frac{(1\ -\ \sigma)\ (\tilde{p_j}\ -\ m_j^*)\ (\tilde{p_j})^{-\sigma}}{(\tilde{p_j})^{1\ -\sigma}\ +\sum_{k\neq j}(p_k^0)^{1\ -\ \sigma}} \tag{11}$$

Equation (12) is the industry's CES price index associated with this deviation.

$$\tilde{P_j} = \left((\tilde{p_j})^{1\ -\ \sigma}\ +\ \sum_{k\neq j}\ (p_k^0)^{1\ -\ \sigma}\right)^{\frac{1}{1\ -\ \sigma}} \tag{12}$$

Equation (13) is the variable profits if firm j were to deviate from the initial equilibrium.

$$\tilde{\pi_j} = E\ (\tilde{p_j}\ -\ m_j^*)\ (\tilde{p_j})^{-\sigma}\ (\tilde{P_j})^{\sigma\ -\ 1} \tag{13}$$

Equation (14) is the level of fixed costs at which firm j would just break even if it deviated and supplied the market.

$$\tilde{f_j} = \frac{\tilde{\pi_j}}{E} \tag{14}$$

$\tilde{f_j}$ is the lower bound on the fixed cost of non-incumbent firm j, expressed as a fraction of total market expenditures on the products of the industry. Firm j's fixed cost f_j would have to be less than $\tilde{f_j}$ for the firm to profitably deviate from the initial equilibrium and supply the market.

3 Application to the Malaysian Vehicle Market

Next, we apply the model to the market for new light vehicles (cars and passenger trucks) in Malaysia in 2022. Two large national vehicle manufacturers, Perodua and Proton, together

[5]This is closely related to the approach in Riker (2020b), which uses a similar model to estimate an upper bound on the effects of new foreign entry on the prices and quantities of domestic producers.

accounted for over 60 percent of vehicle sales in the Malaysian market in that year. Several internationally competitive vehicle manufacturers who had significant market shares in other ASEAN countries had no sales in Malaysia or trivial shares that did not exceed one percent of the market in 2022. These include Daihatsu, Daimler, Ford, General Motors, Hino, Isuzu, Kia, MG Motors, Suzuki, and Truong Hai Auto Company (THACO). The initial absence from the Malaysian market or trivial market shares of these key international competitors suggest that they may have faced barriers to supplying the Malaysian market.

In this section, we present a pair of simulations of the economic effects of adding suppliers to the Malaysian market. In the first simulation, Vietnam is the comparison market. It is comparable to Malaysia because it is located close to Malaysia and is also classified as a middle income country by the World Bank. On the other hand, the market for light vehicles in Vietnam is more open to trade than the Malaysian market: there is a Vietnamese manufacturer, THACO, but it only accounted for 2.23% of light vehicle sales in Vietnam in 2022. In the second simulation, an aggregate of ASEAN countries is the comparison market. Toyota, which was a significant supplier in all of these market in 2022, is the model's overlapping firm i.

In these two simulations, some firms that were initially absent from the Malaysian market or had trivial market shares in 2022 are added to the market with marginal costs that are calibrated to their shares in the comparison market. The simulations do not include a direct effect on the costs of Perodua and Proton, but these two incumbents are affected indirectly by the increase in competition that they face in the Malaysian market.

3.1 Data Inputs and Parameter Values

The data inputs for the simulations are quantity market shares by national market and vehicle manufacturer from Wards Automotive.[6] Table 1 reports the quantities of vehicles sold in Malaysia, Vietnam, and a group of the five largest ASEAN countries other than Malaysia.[7] By aggregating across the five ASEAN countries, we are averaging the national market shares of each firm, and these averaged shares are less affected by the idiosyncratic performance of Kia and THACO in the Vietnamese market.

Table 1: Quantity Market Shares in 2022

Manufacturer	Malaysia (%)	Vietnam (%)	ASEAN 5 (%)
BMW	1.82	0.00	0.98
Daihatsu	0.17	0.00	7.78
Daimler	1.35	0.00	2.20
Ford	0.83	8.21	3.73
General Motors	0.00	0.00	1.17
Hino	0.00	1.60	1.00
Honda	11.40	8.72	10.08
Hyundai	0.19	0.00	1.57
Isuzu	1.31	3.16	10.15
Kia	0.04	20.12	3.08
Mazda	2.08	10.26	2.85
MG Motors	0.00	0.00	1.44
Mitsubishi	3.41	11.34	9.32
Nissan	1.96	0.00	1.84
Perodua	40.04	0.00	0.00
Proton	19.31	0.00	0.00
Stellantis	0.06	3.26	0.58
Subaru	0.35	0.00	0.16
Toyota	14.34	26.35	34.39
THACO	0.00	2.23	0.30

Using the econometric trade cost approach in Riker (2020a), we estimate that the elas-

[6]The Wards data for Asian light vehicles sales in 2022 are at `https://wardsintelligence.informa.com/WI967088/Asia-Vehicle-Sales-by-Country-and-Company-2022`.

[7]The five ASEAN countries are Indonesia, Philippines, Singapore, Thailand, and Vietnam.

ticity of substitution within the light vehicle industry is equal to 7.6.[8] We use this estimate as the value of σ in the model simulations.

3.2 Estimates from the First Simulation

In the first simulation, Vietnam is the comparison market. Ford, Hino, Isuzu, Kia, Suzuki, THACO, and Stellantis are internationally competitive firms that did not sell in the Malaysian market in 2022, or had trivial market shares, but are added to the Malaysian market in the counterfactual.[9]

The model estimates that the industry's HHI measure of market concentration declines from 2,052 to 1,526, and the industry's CES price index declines by 3.91%. Table 2 reports the estimated changes in quantity sold, revenues, and variable profits for each of the 19 vehicle manufacturers that supply the Malaysian market in the simulated equilibrium when Vietnam is the comparison market. There is a decline in the number of vehicles sold, revenue, and variable profits of all of the incumbent firms with initial market share greater than one percent and an increase in vehicles sold, revenue, and profits of firms that are added to the market (Hino, Suzuki, and THACO) or significantly expanded from trivial initial market shares (Ford, Kia, and Stellantis). The magnitudes of the changes in the number of vehicles sold vary significantly with the relative cost competitiveness of the firms, which we calibrated from their market shares in the Malaysian and Vietnamese markets in 2022. There is less variation in the percent changes in revenues, and even less in the percent changes in their variable profits.

[8] Equation (1) includes an implicit assumption that there is unit elasticity of substitution between products from industries, and therefore each industry received a fixed share of aggregate expenditure.

[9] For firms with trivial initial market shares ($s_j^0 < 1\%$), we assume that m_j^0 based on the firm's market share in Malaysia in 2022 is not representative of the firm's international competitiveness, and use m_j^* in the counterfactual.

Table 2: Simulated Effects using Vietnam as the Comparison Market

Manufacturer	Actual 2022 2022 Sales (Vehicles)	Change in 2022 Sales (Vehicles)	Change in 2022 Revenues (%)	Change in 2022 Profits (%)
BMW	12,833	-1,076	-8.41	-8.58
Daihatsu	1,190	-102	-8.56	-8.58
Daimler	9,534	-804	-8.45	-8.58
Ford	5,827	-58	-2.02	-2.04
Honda	80,290	-6,036	-7.66	-8.48
Hino	0	934	∞	∞
Hyundai	1,310	-112	-8.56	-8.58
Isuzu	9,211	-777	-8.46	-8.58
Kia	311	31,049	5,330.71	5,585.64
Mazda	14,644	-1,224	-8.39	-8.58
Mitsubishi	24,017	-1,978	-8.28	-8.57
Nissan	13,785	-1,154	-8.40	-8.58
Perodua	282,019	-13,319	-5.24	-7.43
Proton	136,026	-9,231	-7.02	-8.30
Stellantis	446	1,430	244.1	245.07
Subaru	2,484	-212	-8.54	-8.58
Suzuki	0	3,010	∞	∞
THACO	0	1,332	∞	∞
Toyota	101,034	-7,324	-7.43	-8.42

Figure 1 reports each firm's actual quantity share of the Malaysian market in 2022 and its counterfactual share in the first simulation.

Figure 1: Market Shares, Actual and Counterfactual from the First Simulation

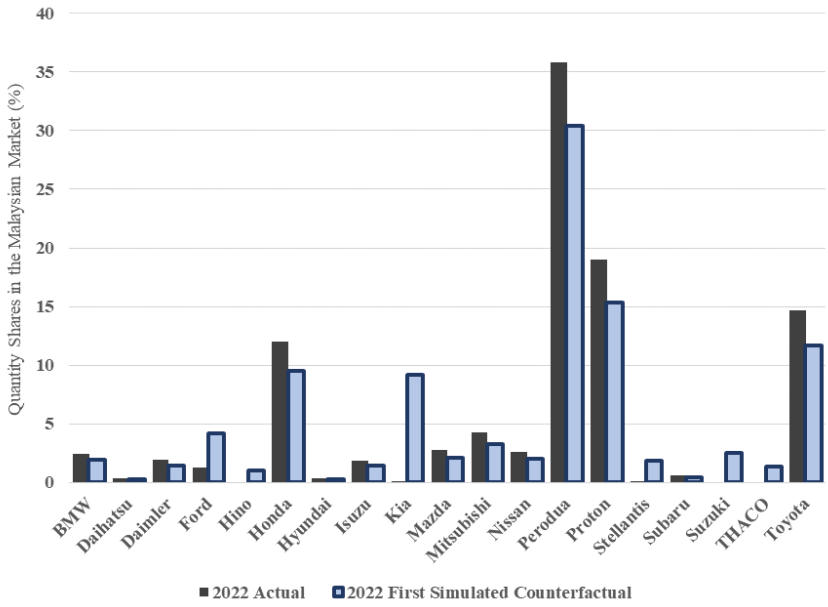


Table 3 reports the estimated lower bound on the fixed costs, $\tilde{f}_j$ in equation (14), of the three firms that supply the Malaysian market in the counterfactual but were absent in 2022. This is an estimate of the variable profits that each firm would earn if it deviated from the initial equilibrium and supplied the Malaysian market, as a fraction of the total size of the Malaysian market of new light vehicles in 2022. The estimates in table 3 are all below 0.1 percent. They indicate that variable profits would be so small that even relatively small fixed costs made it unprofitable for these three firms to supply the Malaysian market in 2022.

Table 3: Lower Bound of Fixed Costs in the First Simulation

Manufacturer	Fixed Cost as a Share of Total Expenditure (%)
Hino	0.03
Suzuki	0.09
THACO	0.05

3.3 Estimates from the Second Simulation

In the second simulation, an aggregate of the five other ASEAN countries is the comparison market. Daimler, Ford, General Motors, Hino, Isuzu, Kia, MG Motors, and Suzuki are internationally competitive firms that did not sell in the Malaysian market in 2022, or had trivial market shares, but are added to the Malaysian market in this second counterfactual.

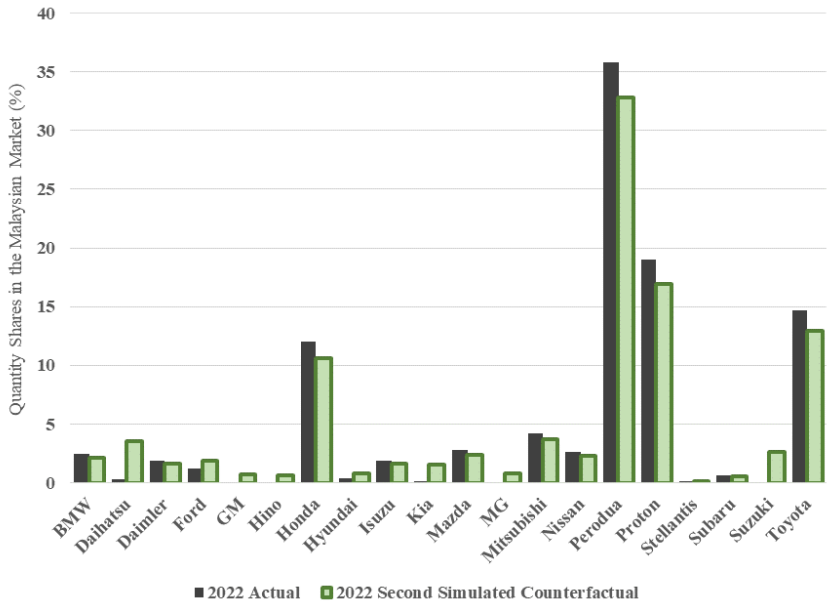
In this case, the estimated economic effects are smaller but still economically significant. The model estimates that the HHI measure of market concentration declines from 2,052 to 1,704, and the industry price index declines by 2.17%. Table 4 reports the estimated changes in quantity sold, revenues, and variable profits for each of the 20 vehicle manufacturers that supply the Malaysian market in the simulated equilibrium when the aggregate of five other ASEAN countries is the comparison market. Again, there is a decline in the number of vehicles sold, revenue, and variable profits of all of the incumbent firms and an increase in vehicles sold, revenue, and profits of firms that are added to the market (General Motors, Hino, MG Motors, and Suzuki) or significantly expanded from trivial initial market shares (Daihatsu, Ford, and Kia). Again, the magnitudes of the changes in the number of vehicles sold varies greatly depending on the relative cost competitiveness of each of the firms.

Table 4: Alternative Simulated Effects using the ASEAN 5 as the Benchmark

Manufacturer	Actual 2022 2022 Sales (Vehicles)	Change in 2022 Sales (Vehicles)	Change in 2022 Revenues (%)	Change in 2022 Profits (%)
BMW	12,833	-1,689	-13.20	-13.45
Daihatsu	1,190	18,704	1,032.33	1,064.83
Daimler	9,534	-1,261	-13.26	-13.45
Ford	5,837	3,675	49.94	50.76
General Motors	0	3,364	∞	∞
Hino	0	2,875	∞	∞
Honda	80,290	-9,528	-12.08	-13.30
Hyundai	1,310	2,220	132.09	-132.99
Isuzu	9,211	-1,219	-13.26	-13.45
Kia	311	7,540	1,519.57	1,540.54
Mazda	14,644	-1,922	-13.17	-13.45
MG Motors	0	4,141	∞	∞
Mitsubishi	24,017	-3,108	-13.01	-13.44
Nissan	13,785	-1,812	-13.18	-13.45
Perodua	282,019	-21,469	-8.40	-11.75
Proton	136,026	-14,647	-11.13	-13.04
Stellantis	446	-60	-13.44	-13.45
Subaru	2,484	-332	-13.39	-13.45
Suzuki	0	16,295	∞	∞
Toyota	101,034	-11,583	-11.73	-13.22

Figure 2 reports each firm's actual quantity share of the Malaysian market in 2022 and their counterfactual share for this second simulation.

Figure 2: Market Shares, Actual and Counterfactual from the Second Simulation



Finally, table 5 reports the estimated lower bound on the fixed costs of the four firms that supply the Malaysian market in the second counterfactual but were absent from the market in 2022. The estimates in table 5 are all below 0.5 percent. They indicate that variable profits would be so small that even relatively small fixed costs made it unprofitable for these four firms to supply the Malaysian market in 2022.

Table 5: Lower Bound of Fixed Costs in the Second Simulation

Manufacturer	Fixed Cost as a Share of Total Expenditure (%)
General Motors	0.10
Hino	0.09
MG Motors	0.12
Suzuki	0.40

4 Conclusions

The simulation model has practical data requirements and can be used to estimate the economic effects of a reduction in market concentration. We apply the model to firm-level data on light motor vehicle sales in Malaysia in 2022. We estimate that adding the sales of several internationally competitive vehicle manufacturers to the Malaysian market could have significantly reduced market concentration and consumer prices. The two simulations indicate that the magnitudes of the estimated effects are sensitive to the comparison market used to calibrate the marginal costs of the additional suppliers. The effects in Malaysia are larger when the comparison market is Vietnam rather than a more diversified aggregate of five ASEAN countries.

There are several important limitations of this analysis that could be addressed in future extensions of the model. First, the model does not take into account the large variety of vehicle models sold by each manufacturer and the complex pattern of product differentiation across vehicle models. Ideally, the model would be disaggregated to the level of individual vehicle models, as in U.S. International Trade Commission (2019). Second, the model only provides an indirect quantification of the effects of barriers to foreign entry, by conditioning on the addition of foreign suppliers. It would be preferable to directly measure these barriers and then estimate their economic effects.

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