Did US Safeguards Resuscitate
Harley-Davidson in the 1980s?

Taiju Kitano
National Graduate Institute for Policy Studies

Hiroshi Ohashi
University of Tokyo

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Abstract

This paper examines US safeguards applied to the motorcycle market in the 1980s. After receiving temporary protection by means of a maximum tariff of over 45%, Harley-Davidson sales recovered dramatically. Simulations, based on structural demand and supply estimates, indicate that while safeguard tariffs did benefit Harley-Davidson, they only account for a fraction of its increased sales. This is primarily because consumers perceived that Harley-Davidson and Japanese large motorcycles were poorly matched substitutes for each other. Our results provide little evidence that safeguard provisions triggered restructuring in Harley-Davidson.

Keywords: Safeguard; Tariff; Random Coefficient Discrete Choice Model; Motorcycles

JEL: F13; F14; L13; L68

1   Introduction

Ronald Reagan signed a recommendation from the US International Trade Commission (ITC) calling for five years of new tariffs on heavyweight motorcycles in the period over the 1983–1988 period. This tariff relief, called a safeguard or the escape clause, was intended to protect Harley-Davidson Motor Co. (hereafter, "H-D"), the last remaining US motorcycle manufacturer, against Japanese imports. At that time, H-D was in financial distress, with merely four percent of the market it had dominated in the early 1970s. The new tariffs were scheduled to start at 49.4% of the wholesale price and decrease to 14.4% in the fifth year, while Japanese manufacturers were allowed to ship the first 6000 cycles per year under the old 4.4% tariff, an allowance that rose by 1000 units a year. After receiving temporary import relief starting in 1983, H-D came back stronger than ever. Its sales increased dramatically at an annual rate of 10% from 1983 to 1990.

Indeed, H-D recovered so swiftly that it even requested that the final year of tariff protection be cancelled. The H-D motorcycle case is now heralded as a great success of safeguard protection.

Some, however, are more skeptical of the role of import relief in H-D's turnaround. H-D produced mostly heavyweight motorcycles with engine displacements of over 900 cc in the 1980s. Irwin (2002) argues that, since the motorcycles imported from Japan were mostly medium-weight bikes in the range from 700—850 cc range, they did not directly compete with H-D products. Reid (1990) documents how H-D saved itself from bankruptcy. When H-D was under the ownership of AMF Incorporated,[1] its bikes had a reputation for unreliable mechanics: they leaked oil, vibrated, and could not match the performance of the smoothly running Japanese bikes (Purkayastha, 1987). After H-D was bought by its management team and began operating independently of AMF in 1981, it quickly overhauled its styles, spent more on research and development to create new and more reliable models, and strengthened its marketing and distribution channels. In the critics' view, these managerial efforts, not the import relief, had much to do with H-D's turnaround. As safeguard policy has attracted renewed attention amid the current surge of antidumping cases, it is imperative to empirically resolve these conflicting views of the effectiveness of one of the most famous safeguard cases in US history.[2]

This paper performs quantitative analyses to assess the extent to which US safeguard protection improved H-D's performance in the oligopolistic US motorcycle market in the 1980s. Since there seems no obvious way to conduct controlled experiments regarding the motorcycle safeguard policy, we instead conduct counterfactual simulations in the following two steps. First, use observed data along with an economic model to recover estimated parameters of underlying economic primitives that are invariant to policy environment. In this application, we estimate parameters of consumer demand and derive firm marginal costs. The second step involves using the model to simulate change in equilibrium outcomes resulting from change in the availability of safeguard policy. Using the simulation method, we evaluate the effects of safeguard tariffs on the US motorcycle market.

Our simulation results demonstrate that safeguard tariffs explain six percent on average, or thirteen percent at most, of H-D's sales and profit recovery. The finding of such a tiny safeguard effect is largely due to estimates obtained from a random-coefficient demand model, indicating that American and Japanese motorcycles were a poorly matched substitutes for each other. The estimated small cross-price elasticities appear consistent with the observation in our data that both H-D's prices and sales increased at faster rates than those of the Japanese motorcycles. Thus it is not surprising that safeguard tariffs would have had little effect on shifting consumers from Japanese motorcycles to American ones. It is rather motorcycle non-price attributes that must have played a major role in H-D's turnaround. Indeed, this finding is corroborated by information reported in industry trade journals during the study period.

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[1] AMF (formerly American Machine and Foundry) Incorporated acquired Harley-Davidson in 1969.

[2] Unlike antidumping and countervailing duties, safeguards do not require a finding of an unfair trade practice, and generally must be applied on a most-favored nation basis (see Bown, 2002, for details).

The topic of safeguards has received little attention in the empirical literature evaluating trade policy. The three exceptions to this pattern of neglect are Grossman's (1986) study of the ITC's investigation of the steel industry, Pindyck and Rotemberg's (1986) study of the US copper investigation, and Kelly's (1988) study of wood products in the United States. These three papers are all concerned with the final phase of the ITC decision process, in which the ITC determines whether or not imports are the substantial cause of injury to an industry. Since this paper conducts an ex post analysis of the effectiveness of the motorcycle safeguard relief, it does not directly consider whether H-D was entitled to the relief; Such an analysis should examine the period prior to safeguard implementation. Nevertheless, it is reasonable for us to infer from the paper's short-term simulation results that increased imports were unlikely a major cause of injury to H-D. Indeed, the ITC's protective actions may not have been warranted, because our demand estimates demonstrate that the large Japanese motorcycles were not "like or directly competitive products"[3] with H-D's, indicating that American and Japanese motorcycles were poorly matched substitutes for each other in the eyes of US consumers. Since H-D was not entitled to the escape clause, it would not have been plausible that safeguard protection gave H-D breathing room in which to innovate, or upgrade its new motorcycles; in fact, H-D upgraded its new motorcycles even in the absence of safeguard protection. This finding suggests that the coincidence between the period of safeguard relief and that of H-D's recovery does not constitute sufficient evidence of the effectiveness of the safeguard policy.

The rest of the paper is organized as follows. The next section presents an overview of the US motorcycle market, and presents descriptive statistics from our dataset. Examination of market-level data reveals a distinctive feature of the market, namely, that H-D experienced increases in both the sales price and the quantity sold in the safeguard period, whereas its Japanese counterparts increased their sales prices much slower, while their quantities sold substantially decreased. The finding that motorcycle prices played a small role in H-D's sales expansion casts doubt on the effectiveness of safeguard protection in promoting H-D's recovery. To quantitatively assess the extent to which US safeguard protection promoted H-D's recovery, subsequent sections present structural supply and demand model that describes the US motorcycle market, and conduct counterfactual analyses. Section 3 employs a random-coefficient discrete choice model to estimate motorcycle demand in the US market. The methodology controls for endogeneity of price, and allows for heterogeneity in individual consumer tastes. Combined with a supply-side model, Section 4 conducts simulation analyses by asking what would have happened to H-D's sales in the absence of safeguard protection. For this simulation approach to be successful, the model used for the exercise must closely approximate the economic environment under study, and the policy of interest must be exogenous to the environment. The section examines several sensitivity analyses and discusses the robustness of our obtained results to alternative specifications, including supply-side behavior. Section 5 concludes, followed by data

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[3]Cited from Section 201 of the Trade Act of 1974. The similar phrase can also be found in Article XIX, paragraph 1a of the GATT.

appendix.

2   Overview of the US Motorcycle Market

Through the 1950s, H-D was the traditional leader in the US motorcycle market. The situation changed, however, with the entrance of Japanese motorcycle manufacturers in the 1960s, selling only motorcycles of 250 cc or smaller engines. These lightweight bikes quickly gained a reputation for high quality and advanced technology. By 1965, the US market was dominated by lightweight motorcycles, with Honda controlling 85% of the market. Indeed, Honda's sales leapt from USD 500,000 in 1960 to USD 77 million by 1965. Initially, this dramatic shift in the market was not perceived as a threat by H-D, the sole surviving American-owned motorcycle firm: its heavyweight motorcycle segment was left uninvaded, and the segment was moreover expanding. However, when the lightweight market was successfully under their control, Japanese producers then ventured into the market with larger engine capacities, thereby competing directly with H-D in the United States. Japanese launching of heavyweight bikes grew intense as Kawasaki and Honda opened plants in Nebraska in 1974 and Ohio in 1979, respectively, to produce heavyweight motorcycles. By the end of 1981, H-D fell to a distant fifth place with a mere five percent of the US motorcycle market, following Honda (38%), Yamaha (25%), Kawasaki (16%), and Suzuki (14%); the remaining market share belonged, for example, to BMW.

H-D had long attributed its declining sales to lower-priced Japanese imports. Sharp increases in Japanese imports in the early 1980s, along with the 1981–1982 recession, led to the accumulation of a large stockpile of inventory for both the American and Japanese companies. As a result, H-D sought tariff protection in 1982, claiming that the inventories caused by the substantial increases in Japanese imports threatened serious injury to the American company. This was H-D's second attempt to seek tariff protection, following its failed antidumping complaint filed in 1978. Note that antidumping protection is designed to respond to actions deemed improper, and therefore a less rigorous standard of injury is thought appropriate than in the case of safeguards. Given that H-D's antidumping petition had been rejected four years earlier and that the situation had changed little since then, the chance of safeguards being granted was regarded as slim. To the surprise of H-D, however, the ITC approved the safeguard petition, and the Reagan administration accepted the ITC's recommendation that a tariff-rate quota be imposed on imports of motorcycles with 700 cc and larger engines from April 1983 to March 1988. Reid (1990: 89) explained that the Reagan administration intended this safeguard measure to be a warning to Japanese carmakers that they were vulnerable to similar actions. Since the safeguard under study had not really been expected by the motorcycle companies, including H-D, it is natural to regard it as exogenously imposed on the US motorcycle market.

The safeguard was implemented in the form of a tariff-rate quota, which allowed a certain number of motorcycles to be imported under the normal tariff rate of 4.4 percent, while imports above the number had

to pay the higher protective tariffs.[4] The quotas in 1983 were set at 6000 units for Japan, 5000 units for West Germany (where BMW was located), and 4000 units for imports from all other countries: these levels were scheduled to increase each year of the relief period. The new tariff rates were set at 49.4 percent for the initial year, declined over the five years, and then returned to the normal level.

As indicated in Figure 1, US imports of larger motorcycles, against which H-D sought protection dropped by half when the highest tariff was implemented in 1983. Interestingly, these imports continued to decline over the safeguard period as the tariff-rate quota eased toward 1987. While the decline in the number of imported motorcycles was largely due to the decrease in US motorcycle sales in this period, two other events may also account for it. One is that the Japanese may have exported more motorcycles with smaller engine displacements, to evade the tariff-rate quota and be able to import under the normal duty. Table 1 presents US motorcycle sales of H-D and Japanese motorcycles broken down by engine displacement. The data are from R. L. Polk, archived in the US Library of Congress, and the coverage is limited to the 1983–1987 period. The table indicates that Japanese manufacturers indeed appear to have responded to the safeguard action, as the sales share of Japanese motorcycles with engines 699 cc or smaller jumped from 43 percent to over 60 percent in 1983. The increase in sales mostly represents substitution for the decrease in sales of Japanese medium-sized motorcycles in the 700–1099 cc range, while overall Japanese sales declined. The change in the sales composition by engine displacement cannot be entirely accounted for by motorcycle prices, given that average prices of Japanese medium-sized motorcycles dropped more than those of the smaller-sized ones.

Another factor that may have contributed to the decrease in US imports is that, since the higher tariffs did not apply to domestic production, foreign producers, namely Honda and Kawasaki, gradually shifted production to the United States. While the availability of data on US domestic production by Japanese motorcycle companies is limited [5], in Section 3 we discuss an implication of such local production for our estimation results.

The tariff-rate quota affected not only on the quantities of imports and sales, but also motorcycle prices. Figure 2 shows the average prime retail prices of H-D and Japanese motorcycles. Prime retail prices are known to closely reflect transaction prices, and thus differ from manufacturer's suggested prices. The data are available from the National Automotive Dealers Association for the 1977–1987 period. The price data in the figure are in constant 1983 USD. For each of the three motorcycle categories, we averaged the model prices, weighting by the numbers of each model sold each year. Notably, the prices of the Japanese motorcycles subject to higher tariffs did not increase, but appeared to have decreased, in the first two years of the safeguard period. In fact, H-D's prices remained more than 80% higher and increased at a rate much faster than did those of its Japanese counterparts. This observation might have been accounted for by

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[4]Prior to 1994 when the Uruguay Round was concluded, quantitative restrictions, including quotas and tariff-rate quotas, were a common safeguard measure.

[5]The only information we are aware of is that US production capacity of Honda's Ohio plant increased from 40,000 units in 1977 (Global and Mail, 28 September 1978) to 70,000 units in 1983 (New York Times, 10 January 1984).

the aftermath of the large inventories accumulated by the Japanese manufacturers in 1981 and 1982, as mentioned earlier in this section. According to the USITC (1984), the inventory of Japanese motorcycles with engine displacements larger than or equal to 700 cc was 130,000 units at the beginning of 1983 — a substantial volume, given that Japanese motorcycle sales were only 170,000 units that year. This supply glut would have had an even greater impact on larger-sized Japanese motorcycles. Japanese prices began to increase in 1985 when the Plaza Accord was signed. Prices of Japanese motorcycles in both size categories increased with the devaluation of USD, the rate of price increase averaging 10 percent, over 50 percent faster than that of H-D's. This observation indicates that Japanese motorcycle prices in the 1980s were largely determined by the prices of imports, and probably less by the local US production of Honda and Kawasaki.

Combining the findings presented in Figure 2 and Table 1, we found that H-D experienced increases in both sales prices and quantities in the safeguard period. In the meantime, the Japanese companies increased their prices much more slowly than did H-D, while their sales quantities substantially decreased in 1983 and thereafter. These market-level data indicate that H-D's recovery was not entirely due to safeguard tariffs, because motorcycle prices did not appear to play a major role in H-D's sales expansion. It is rather more natural to think that non-price characteristics of H-D's motorcycles, for example, quality and reliability, may have played a larger role in the recovery. Indeed, after it was bought by its management and became independent of AMF in 1981, H-D quickly overhauled and renovated its production system. It implemented a statistical control system that prompted employees to judge the quality of their own output, and a just-in-time inventory program (which H-D called the "material-as-needed program") that improved production efficiency; in addition, there were massive layoffs that halved the workforce. As a result, H-D reduced the percentage of defective bikes from approximately 50% to less than 2% (*Advertising Age*, August 10, 1987: S-27). H-D also created a new engine—"Evolution"—which was more reliable than its old V-twin engine. Reid (1990) documents how the introduction of this new engine helped expand sales of H-D's large motorcycles, particularly those with an engine displacement of 1340 cc, the H-D's best-selling motorcycle category.

One simple indicator that may reflect the degree of H-D's innovativeness in management and production aspects is the number of new motorcycle models it introduced. Since the outcome of such innovation is normally embodied in new goods, it seems reasonable to regard this indicator as related to some aspects of the innovation we just described. A casual observation of the indicator presented in Figure 3 reveals that H-D appeared to become innovative during the safeguard period. Prior to safeguard protection, H-D rolled out half the number of new models of similar engine sizes of its Japanese counterparts; once the protection was in place, however, the number of new H-D models doubled in three years, while the number of new Japanese models stagnated.

In the next section, we examine consumer transaction behavior in the US motorcycle market, and seek further insight into the structure of motorcycle demand and its role in H-D's recovery.

3   Choice Model of the US Motorcycle Market

This section describes the estimation model we use to explain the US motorcycle market. In Section 3.1, we introduce a demand system, derived from a random-coefficient discrete choice model of consumer behavior. We estimate American demand for motorcycles at the model level, incorporating important dimensions of motorcycle attributes. Since we do not observe the individual purchasing behavior, we aggregate across individual buyers to obtain the demand for a motorcycle model, while still allowing for heterogeneity across consumers. Section 3.2 addresses the endogeneity issue and introduces instruments used in the estimation, and Section 3.3 discusses the estimation results of the demand model presented here. The demand model and its estimates provide a basis for the analyses in Section 4, in which we assess the effectiveness of the safeguard policy implemented in the 1983–1987 period.

3.1   Discrete Choice Model

This subsection describes a random-coefficient discrete choice model of new motorcycle demand. In any particular year, we take the existing owner of a 450 cc or larger engine size motorcycle as the purchasing entity, where each owner has a unit demand for a new motorcycle model. We denote the market size by M.[6] Each consumer i is assumed to maximize the following indirect utility function at time t by choosing motorcycle model j among J_t+1 alternatives, one of which is the option of not purchasing a new motorcycle:[7]

$$
\begin{aligned}
u_{ijt} &= \left(x_{jt}\overline{\beta} + \xi_{jt}\right) + \left[\sum_k \sigma_k x_{jkt}\nu_{ik} + \alpha_i p_{jt}\right] + \epsilon_{ijt} \\
&\equiv \delta_{jt} + \mu_{ijt} + \epsilon_{ijt},
\end{aligned}
\tag{1}
$$

where u_{ijt} is consumer i's utility from consuming the model j at time t. The vector x_{jt} is motorcycle model j's observed attributes at time t, including the constant and time-control variables. The k-th component of this vector is denoted by x_{jkt}. Motorcycle characteristics are incorporated in x_{jt}. We use in this vector the variables of engine displacement, dry weight (that is, motorcycle weight with an empty gasoline tank), the number of forward speeds, and the number of cylinders. The model age variable, which counts the years elapsed after the market introduction of the model, is also included to separate the effects of new and older motorcycles. We include a dummy variable specific to H-D, in an attempt to control for unmeasured characteristics, such as perceived reliability or prestige attached to H-D, but not to foreign motorcycles. We

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[6] We tested an alternative measure of market size to use U.S. households as the possible market size. Note that the motorcycle owners accounted for less than 10 percent of U.S. households in our study period. We used the Current Population Survey to construct an income variable. The demand estimates reported in Section 4 are robust to this alternative definition of the market size.

[7] Note that more than 90 percent of the existing owners chose the outside option.

interact this H-D dummy with the trend variable to allow for the taste on H-D to change with time. The utility function contains ξ_{jt}, an unobserved (to an econometrician) product quality of motorcycle model j with the property that $E\left(\xi_{jt}\right) = 0$. In Section 3.2, we discuss the econometric endogeneity problem generated by ξ_{jt}. Note that $x_{jt}\overline{\beta} + \xi_{jt}$, where $\overline{\beta}$ is a set of parameters to be estimated, is common to all consumers. The sum of the first two terms on the right-hand side of (1) reflects the mean level of utility across consumers who purchase model j and are denoted by δ_{jt}.

To enable richer substitution patterns, we follow Berry, Levinsohn and Pakes (1999) and allow different consumers to have different intensities of preferences for different motorcycle characteristics.[8] We rely on a random-coefficient utility specification and include the third and fourth terms on the right-hand side of (1). These terms can be considered as the deviation of the mean utility, and are denoted by μ_{ijt}. For each characteristic of x_{jt}, consumer i has a taste ν_{ik}, which is assumed to be drawn from an i.i.d. standard normal distribution. The parameter to be estimated, σ_k, captures the variance in the consumer taste for characteristic x_{jkt}.

The term α_i is consumer i's sensitivity to changes in real price, p_j (in 1983 constant USD). Using the idea from Berry, Levinsohn and Pakes (1999), we assume that the distribution of α_i varies with income, and takes the form of $\alpha_i = \alpha/y_i$, where y_i is the i-th component of consumer income, y, and α is a parameter to be estimated. Price sensitivity is thus modeled as inversely related to income. While we lack data on individual consumer income, the income distribution for US motorcycle owners is well approximated by the log-normal density distribution, $dG\left(y\right)$, with the mean and variance of the distribution being estimated based on data available a 1985 publication of the Motorcycle Industry Council (MIC). [9] Consumers with similar demographic attributes tend to have similar rankings of products and thus similar substitution patterns. The inclusion of μ_{ijt} in (1) allows for correlation between motorcycles with similar characteristics, and thus presumably for realistic substitution patterns relative to the traditional logit model.

The outside good in our model, the consequence of not purchasing a motorcycle, includes alternatives such as buying used motorcycles and using public transport. Although it is not possible to distinguish between changes in the constant term in (1) or between changes in the mean and variance in consumer tastes for the outside good, the constant term in μ_{ijt} does allow us to control for possible bias due to the existence of the outside good. Let ϵ_{ij} represent the idiosyncratic taste of consumer i for product j, and follow the type-I extreme value. This distributional assumption yields the following closed-form probability of consumer i's choosing brand j;

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[8] Other papers that applies a discrete choice model on aggregate market-level data to assess the effectiveness of trade policies include Brambilla (2004), Clerides (2008), and Ohashi (2005). Unlike this paper, these three papers do not allow for random coefficients in the demand specification.

[9] The mean and variance of the log-normal distribution of motorcycle owner income are estimated as 24,487 and 15,434 (in terms of 1983 constant USD), respectively. Those of U.S. households, estimated from the Current Population Survey, take similar values of 26,996 and 18,144, respectively.

$$s_{ijt} = \frac{\exp\left(\delta_{jt} + \mu_{ijt}\right)}{1 + \sum_{l=1}^{J} \exp\left(\delta_{lt} + \mu_{ilt}\right)}.$$

The market share of motorcycle model j, denoted by s_{jt}, is obtained by

$$s_{jt} = \int_{y} \int_{\nu} s_{ijt} dF\left(\nu\right) dG\left(y\right), \tag{2}$$

where $dF\left(\nu\right)$ represents the joint normal density of taste shocks, ν, the (i, k)-th component of which is ν_{ik} introduced in (1). We make the independence assumption in $dF\left(\nu\right)$ and $dG\left(y\right)$, and follow the estimation methods detailed in Berry, Levinsohn and Pakes (1995); we use an inversion routine to solve for the vector of unobserved quality, ξ_{jt}, and form a generalized method of moment (GMM) estimator. The population moment condition is a product of ξ_{jt} and instrumental variables introduced in the next subsection. We numerically compute the market shares and δ_{jt} by means of the inversion. Using instruments discussed below, we compute the estimates from the two-step GMM estimation. We follow Nevo (2000) for the numerical search technique and for the construction of standard errors.

3.2   Instruments

Following the literature (see, for example, Berry, 1994), we assume that x_j and ξ_j are not correlated with one another (we omit the time subscript unless there is confusion). This is a central identification assumption for the demand estimation. This assumption may not be accurate in that observed characteristics may be positively correlated with brand image or other attributes for which we lack data. Nevertheless, the assumption helps greatly by reducing the number of instruments needed in the estimation.

We are concerned that the variable of price may possibly be correlated with the error, ξ_j. It is likely that the observed characteristics may not capture all important motorcycle functions; indeed, ξ_j is often interpreted as the unobserved quality error. If ξ_j is correctly perceived by consumers and sellers in the market, this unobserved quality error is likely correlated with price: Better-quality motorcycles may induce higher willingness to pay, and sellers may be able to charge higher prices due to higher marginal costs or oligopolistic market power.

In a product differentiation model with exogenous characteristics, the characteristics of other firms are appropriate instruments. With market power in supply, the markup of each model depends on the distance from its neighbors in the characteristics space. The characteristics of other products are thus related to p_j, but since characteristics are assumed to be exogenous, they are valid instruments. We include in the set of instruments the sum of the characteristics of other motorcycle models offered by the firm, and that of models offered by competing firms; These variables may be negatively correlated with the price.[10]

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[10] The same set of instruments are used by Berry, Levinsohn and Pakes (1999) and Ohashi (2002, 2003), among others.

Traditionally, cost variables excluded from x_j are used as an instruments in homogeneous-goods models, and this practice is still appropriate here. For such an instrument, we employ JPY-USD exchange rates from *International Financial Statistics Yearbook* (1988). Since many motorcycles sold in the USA were imports, the US motorcycle price should have been affected by the JPY-USD exchange rate. Note, however, that the instrument is an industry aggregate, and does not vary by motorcycle model: the use of the instrument thus only helps identify the motorcycle demand through the variation of the instrument over time.

3.3   Demand Estimates

This subsection presents estimation results of the demand model. The data used for the estimation cover the 1983–1987 period on a tri-annual basis; data on motorcycle units sold are available only for this period and at this frequency. We describe the data sources in detail in Data Appendix. Table 2 shows three estimation results. Models 2-1 and 2-2 are based on a logit model, in which we allow for no heterogeneity in individual preferences. Thus, in these models, μ_{ijt} in (1) becomes αp_{jt}. The model 2-1 uses the ordinary least squared (OLS) method, whereas model 2-2 employs the set of instruments discussed in the previous section. The two-stage least squared (2SLS) method is used to control for possible endogeneity of the motorcycle price. Finally, model 2-3 estimates the full random-coefficient model discussed in Section 3.1.

It is known that the 2SLS method can produce severely biased estimates if the instruments are weak. We thus check the explanatory power of the instruments, conditional on the included exogenous variables in the first stage of the method. We obtain an F-statistic for the endogenous variable and report this in the table. We find that the instruments used in the paper are not weak at the 99% confidence level of F-statistics. The coefficients estimated under model 2-2 are obtained by regressing the dependent variable onto the exogenous and fitted value of the price variable.

Model 2-1 does not fit the data well; the R-squared measure indicates that 35% of the variation is explained by the model. The price coefficient is both economically and statistically significant. Although many coefficients are estimated to be significantly different from zero, we are concerned that endogeneity in prices may lead to a correlation between the price and the unobserved error. If the price is responsive to the unobserved quality, the resulting bias in the price coefficient could be severe. The rest of the specifications account for this bias. We use the instruments introduced in Section 3.2 to control for endogeneity of the motorcycle price. Since we have more instruments than we need to identify an equation, we can test whether the additional instruments are uncorrelated with the error by using the J-statistic (i.e., the statistic for overidentifying restrictions). The J-statistic reported in model 2-3 does not allow us to reject the orthogonality condition between some of the instruments and the error at the 90 percent confidence level. The price estimate reported under model 2-2 indicates the successful elimination of endogeneity in the positive correlation with the unobserved quality.

Engine displacement and dry weight are major characteristics of a motorcycle, as they represent the

degree of stability in riding. The two variables are closely related, with the correlation coefficient being 0.845. The significance in the estimated mean coefficients appear to reflect the consumer perception of engine size and dryweight. These variables also serve as a proxy for motorcycle luxuriousness, including the seat comfort. Consumers also seem to care for the number of forward speeds, which is considered as another dimension of motorcycle quality. As an unmeasured quality could presumably make certain models survive in the market, the age coefficient may partially capture this unmeasured quality difference among the surviving models. Being conditioned by ξ_j, the age coefficient may be appropriately interpreted as the rate of obsolescence. The estimated coefficient indicates that one more year of obsolescence is the loss of USD 114 (in 1983 constant prices), approximately three percent of the average motorcycle price in the study period. The coefficients of the seasonal (more precisely, tri-annual) dummy variables (not reported in the table) indicate that summer is high season and winter is low.

The estimated coefficients of the H-D dummy, including the interaction terms with the trend variable, are found not statistically significant, but economically indicate that consumers became more attracted to H-D over time. The sum of the mean value in consumer perception on both observed and unobserved characteristics (i.e., δ_{jt}, where j is H-D) generally increased from 2.96 in 1983 to 3.44 in 1987.[11] This finding appears to be consistent with the information shown in Figure 1: H-D's sales expanded among the declining US motorcycle market over the 1983–1987 period.

Model 2-3 reports the estimates of the random-coefficient demand model, derived from (1). We allow for the variables for engine displacement, the H-D dummy, and the constant term to have random coefficients. We also incorporate an income effect by dividing price by sampled individual income, as described in Section 3.1. Thus, the magnitude of the estimated price coefficient is not comparable to those found in the previous two models. Based on the finding of the endogenous price coefficient in model 2-1, we apply the instruments in the estimation of this model. The estimated own-price elasticities in the mean take values similar to those found in model 2-2.

It is reasonable that the random coefficient of engine displacement is estimated to be significant. The estimate might indicate that individual consumers had different tastes regarding different engine displacements. This finding seems to make sense for consumer purchases of motorcycles: some consumers buy heavyweight motorcycles intended for long trips, while others prefer medium-sized motorcycles for getting around the city. The estimated random coefficient of the constant term, though statistically insignificant, might imply that consumers' heterogenous responses to the outside good may play a role in the demand for new motorcycles.

Notably, the coefficient of the H-D dummy is estimated to be statistically significant in the standard deviation. The estimate indicates that consumers had diverse tastes regarding different H-D models, leading us to infer that the demand substitution between H-D and Japanese motorcycles was not large.

Using the obtained price estimate from model 2-3, we present in Table 3 a sample of estimated own-

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[11] We calculate the values on the basis of model 2-3. The finding is much stronger when we use the estimates from model 2-2.

and cross-price elasticities. The table lists two bestselling models from 1983 for each of the five engine-displacement categories shown in Table 1. Note that, since H-D had no small-size motorcycles, this table shows four H-D and six Japanese motorcycle models. The (m, n) element in the elasticities matrix indicates the elasticity of model n with respect to a change in the price of m. While the logit model restricts all elasticities within a row of the matrix to be equal, a random coefficient model allows these elasticities to differ according to differences in the price sensitivity between consumers that purchase the various motorcycles. The table indicates that while own elasticities for all models take more than one in absolute values, cross-price elasticities are found generally small, and asymmetric between American and Japanese motorcycles. The estimated elasticities of H-D sales with respect to Japanese motorcycle prices tend to be larger than those of Japanese sales with respect to H-D prices. Indeed, Table 3, which lists only the selected models, shows that the average value of the former is 0.032, whereas the value of the latter is 0.006. The finding of small and asymmetric cross-price elasticities between American and Japanese motorcycles corroborates our observations using the market-level data presented in Table 1 and Figure 2: H-D experienced increases in both prices and sales in the safeguard period, while the Japanese manufacturers increased their prices much more slowly and their sales quantities substantially decreased. The finding in the estimated elasticities is also consistent with anecdotal evidence found in external sources. In 1983, customers loyal to H-D led to form a motorcycle club called HOG (namely, Harley Owners Group), and organized events to promote H-D motorcycle use and encouraged its executives to participate. As reported in New York Times, "Harley enjoyed the advantage of an especially loyal following among motorcycle aficionados who often regard the lower-cost Japanese models as imitations, however advanced they are technically" (March 18, 1987).

Based on the findings in Table 3, we anticipate that safeguard protection played an essential role in H-D's recovery in 1983, at least from a short-term perspective. In the next section, we conduct simulation analyses and assess the extent to which safeguard protection promoted H-D's sales.

4   Measuring the Effect of the Safeguard Protection

Did the import relief implemented in the 1983–1987 period rescue H-D from the brink of bankruptcy? Or did H-D save itself on its own without much help from the relief? This section answers the question. Based on the demand estimates reported in the previous section, this section measures the impact of safeguard protection on H-D by asking what would have happened to the company's sales had no such provision been provided. We examine the price effect of tariffs, leaving long-term strategies, such as changes in motorcycle characteristics, constant. This exercise requires a supply model in order to analyze the equilibrium responses in motorcycle competition in the United States. This section first introduces such a model, and then describes the simulation strategy.

4.1 Supply Model of the US Motorcycle Market

Calculating the equilibrium under counterfactual scenarios requires a supply model describing the behavior of motorcycle companies in the United States. We construct a motorcycle company's profit maximization problem, and solve the first-order condition. We assume that American and Japanese companies compete over price in supplying US customers with motorcycles of differentiated attributes. As indicated in Table 1, the companies manufactured over 30 models in a given year. We thus consider a multi-product differentiated Bertrand model. We examine the robustness of our estimates to this supply-model assumption in the next section.

As seen in Figure 2, the maximum protective tariff of 49.4 percent was implemented during the safeguard period. As discussed in Section 2, however, some Japanese motorcycles of over 700 cc engine size escaped the high safeguard tariff rates in at least three ways. One way was by the quota: since the safeguard was in the form of a tariff-rate quota, a certain number of large motorcycles were subject to the normal tariff of 4.4 percent. The second was domestic production. Honda and Kawasaki began independently shifting production to the USA in the 1970s: domestically produced motorcycles were free of customs duties, and thus of safeguard tariffs. Finally some motorcycles, especially those sold at the beginning of the safeguard period, were likely to have been imported before the safeguard tariffs were applied.[12]

An accurate description of the behavior of Japanese motorcycle companies entails incorporating their responses to the tariffs described above. While it is evident from Figure 1 that the import volume was large enough for the safeguard protection to be effective, the available information contained in our dataset is insufficient for us to examine the mechanism by which Japanese makers allocated their distribution channels between quota, domestic production, and inventory. In this paper, we thus forgo a complete characterization of supplier behavior; instead, we assume that all Japanese models with engine displacements exceeding 699 cc were subject to the higher safeguard tariff rates shown in Figure 2. This treatment clearly overstates the effect of safeguard protection, because we assume that US production of Japanese models was subject to safeguard tariffs, though it was actually exempt from them. To anticipate the result in Section 4.2., we find that safeguard provisions had little effect on H-D's sales, even if we ignore the existence of quota, local production, and inventory accumulated by the Japanese.

Consider the situation where firm f $(= 1, ..., F)$ chooses prices for a set of its motorcycles, J_f, in order to maximize the ensuing profit with respect to the set of prices, $\{p_j\}_{j \in J_f}$. The time script is omitted here if there is no confusion. We focus on the seller's pricing decision, and regard as exogenous to the analysis the decision as to which motorcycles (i.e., bundles of characteristics) are produced each year.

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[12] As discussed in the previous section, the accumulation of inventory prior to safeguard imposition was not likely prompted by anticipation of the policy introduction.

$$\sum_{j \in J_f} \left[\frac{p_j}{1+\tau_j} - mc_j \right] \cdot M \cdot s_j,$$

where the tariff rate on model j is denoted by τ_j, and the constant marginal cost of model j is denoted by mc_j. Note that under our assumption, the safeguard tariff rates are applied to Japanese motorcycles of the 700 cc or larger engine size, and the normal tariff rate of 0.044 to other Japanese motorcycles. No tariffs are applied to H-D. The quantity sold for model j is represented by $M \cdot s_j$, already defined in the previous section. A solution to firm f's maximization problem for model j ($= 1, ..., J$) is given by:

$$\begin{pmatrix} \frac{s_1(p)}{1+\tau_1} \\ \vdots \\ \frac{s_J(p)}{1+\tau_J} \end{pmatrix} + D \begin{bmatrix} \frac{\partial s_1(p)}{\partial p_1} & \frac{\partial s_2(p)}{\partial p_1} & \cdots & \frac{\partial s_J(p)}{\partial p_1} \\ \frac{\partial s_1(p)}{\partial p_2} & \frac{\partial s_2(p)}{\partial p_2} & \cdots & \frac{\partial s_J(p)}{\partial p_2} \\ \vdots & \vdots & \cdots & \vdots \\ \vdots & \vdots & \cdots & \frac{\partial s_J(p)}{\partial p_J} \end{bmatrix} \cdot \begin{pmatrix} \frac{p_1}{1+\tau_1} - mc_1 \\ \vdots \\ \frac{p_J}{1+\tau_J} - mc_J \end{pmatrix} = 0, \tag{3}$$

or

$$(1+\tau)^{-1} \cdot s(p) + D \cdot B(p) \cdot \left((1+\tau)^{-1} \cdot p - mc \right) = 0,$$

where $p \equiv (p_1, \ldots, p_J)'$, $s \equiv (s_1, \ldots, s_J)'$, and $mc \equiv (mc_1, \ldots, mc_J)'$. The tariff-rate vector, $(1+\tau)^{-1}$, is defined as $diag(\frac{1}{1+\tau_1}, \ldots, \frac{1}{1+\tau_J})$. The ownership matrix is D, in which the (a,b) element takes a value of 1 if models a and b are marketed by the same firm and 0 otherwise. For example, under the assumption of collusion, all the models are supposed to be marketed by a single firm, and thus the ownership matrix becomes the identity matrix. Note that s_j is presented as a fraction of the total number of motorcycle owners, including non-purchasers.

The entry and exit of models make the size of B change over time. Each element of B is calculated from the probability formula defined in (2). Note that the cross derivatives differ, depending on consumer attributes v and y. Each component of B can be computed by the demand estimates. Thus, using the data and the obtained demand estimates presented in Table 2, we simply solve (3) to obtain marginal costs of motorcycle models.

The marginal costs for all motorcycle models recovered from (3) are found positive. Based on the limited information available in the trade journal, we consider that these estimates are within a reasonable range. Our marginal-cost estimates for motorcycles sold in 1987 indicate that H-D cost USD 6,008 on average, while Japanese models of corresponding engine sizes cost USD 3,440. These estimates are comparable to the information found in an article of the New York Times, reporting "Harley's cycles cost from $4,000 to more than $10,000 and are up to 50 percent more expensive than competitive Japanese models," (March 18, 1987). This evidence would provide us with additional credence on our marginal-cost estimates.

In the following counterfactual analysis sections, we use the demand equation (2) and supply equation (3) along with the obtained marginal costs to solve for equilibrium prices and market shares at the level of

motorcycle model by time t. Model sales are calculated by multiplying the market share by the potential market size, M.

4.2   Impact of Safeguard Policy

In this section, we examine the impact of the motorcycle safeguard policy. We assume that all Japanese motorcycles with 699 cc or larger engines were imported at the normal tariff rate of 4.4 percent, the same tariff rate that applied to motorcycles below 700 cc in engine size, and calculate firm sales and prices using the new equilibrium for each period. This assumption should not change the nature of the supply and demand equations described in the previous sections, because, as discussed in Section 2, safeguard protection appeared exogenous to the evolution of the US motorcycle market in the 1983–1987 period.

In the simulation exercise, we replace, with the normal tariff rate, all occurrences of τ_{jt} in equation (3) that receive the values of high safeguard tariffs. Since some Japanese motorcycles were either imported under quota or domestically manufactured, the simulation result is likely to overstate the short-term impact of the motorcycle safeguard protection. We use the estimates of Model 2-3 shown in Table 2 to compute the equilibrium sales volume and price by model for each period t of the study period. Estimated values are used for the model error, ξ_{jt}, on the right-hand side of (1).

Table 4 presents annual comparison between the simulated and actual prices by make and engine size. The simulated prices are calculated under the assumption of multi-product differentiated Bertrand competition described in the previous subsection. The prices are then aggregated by year, weighting by sales volume. The table indicates that, as intended, safeguard protection would have increased the prices of Japanese motorcycles of large engine displacement: the actual prices in 1983 were over 20 percent higher on average than the simulated prices assuming no safeguards. The differences between the actual and simulated prices of the large Japanese motorcycles declined in general, as the safeguard tariffs were phased out toward 1987.[13] Note that the prices would not have increased by the magnitude of the safeguard tariff rates shown in Figure 2, as the own-price elasticities presented in Table 3 are found to be elastic. Motorcycles unsheltered by protection were influenced little by the tariffs: the calculated price changes are as small as merely a fifth of one percent for H-D's and small Japanese motorcycles. The small spillover effect of the tariffs may have been reflected by our finding of small cross-price elasticities reported in Table 3. In comparison with the values of the own-elasticities, the cross-price elasticities are estimated to be small, in particular, of H-D demand with respect to Japanese motorcycle prices.

Table 5 presents the effects of safeguard tariffs on sales and profits of the motorcycle companies by year: the upper half of the table shows the results of H-D, and the bottom half presents those of the Japanese makers. Actual sales in the table are taken from Table 1, while actual profits are calculated based on the

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[13]The effect on prices appears smaller in 1983 than in 1984, because the safeguard was implemented in the second quarter of 1983, so its effect was not fully reflected in the 1983 prices.

marginal cost estimates obtained in Section 4.1. The fourth and fifth columns of Table 5 present the price effect of safeguard protection on sales and profits. We assume that American and Japanese companies competed in the Bertrand fashion, and we construct the standard error for the policy effect using a Monte Carlo method: we have generated 1000 draws from the asymptotic normal distribution for the demand estimates and standard errors, and then computed 1000 pairs of sales and profits for Bertrand competition. The table indicates that the safeguard tariffs would have reduced Japanese sales and profit by 48 and 50 percent, respectively, but at marginal significance levels. Notably, H-D does not appear to have benefitted much from safeguard protection, even though its sales recovered dramatically in 1983. Indeed, our simulation results reveal that safeguard tariffs accounted for merely six percent of H-D's sales and profits, or 13 percent of them on the basis of the upper bound of 95% confidence interval.

This simulated effect is obtained under the assumption of Bertrand-type competition. We investigate the robustness of our results to an alternative assumption that the safeguard protection induced Japanese firms to collude. This thought experiment changes the first-order condition in equation (3), in that all the Japanese firms instead act like a single multiproduct supplier. The marginal costs are obtained based on this alternative supply-side assumption. The sixth and seventh columns in Table 5 show that the estimated impact of the policy on H-D is quite similar to the base estimates reported in the fourth and fifth columns. The difference is indeed within the range of one-standard deviation of the base estimates.

The findings reported in Table 5 provide us with an intriguing insight into whether the safeguard protection of H-D was warranted. Section 201 of the Trade Act of 1974 sets out the conditions under which safeguard actions can be implemented in the United States. Under Section 201, after receiving a petition from a domestic industry, the ITC is required to conduct an investigation to "determine whether an article is being imported into the United States in such increased quantities as to be a substantial cause of serious injury, or the threat thereof, to the domestic industry producing an article like or directly competitive with the imported article."

The paper's finding of the small short-term tariff effect leads us to doubt whether imports caused "serious injury" to H-D in the 1980s. This is primarily because our demand estimation results reported in Section 3.3 indicate that H-D motorcycles were unlikely to be in a "directly competitive" relationship with Japanese motorcycles, when restricting our focus to larger engine displacement. The small cross-price elasticities between American and Japanese motorcycles indicate that safeguard tariffs would have had little effect on shifting consumers from Japanese motorcycles to American ones. Nevertheless, as shown in Table 5, H-D did have a pecuniary incentive to seek for safeguards, if H-D's filing cost for the petition was not too excessive.

It is often argued that trade protection provides firms with time and resources, stimulating their innovation and thereby letting them compete effectively with foreign rivals. Any such trade measures should be temporary, because permanent protection reduces incentives for domestic firms to invest in new technologies and products. This line of reasoning has been cited in favoring protection for infant as well as senescent

industries, and explained by theoretical research, including that of Miyagiwa and Ohno (1999). Our finding on the cross-price elasticities also implies that it was not the four-year safeguard protection that would have likely stimulated H-D to upgrade its motorcycle models. As detailed in Section 2, according to Reid (1990), H-D changed its management and committed itself to research and development activities in 1981. At that time, given the results of its antidumping petition, H-D was unlikely to foresee that safeguard protection would be in place two years later. The product development efforts led H-D to its successful launch of new motorcycles with 883-cc engines, and its swift sales recovery as shown in Figure 1.

Rigorous examination of whether H-D was entitled to the escape clause should use data from before the implementation of the safeguard policy and examine factors other than imports that might have caused injury to H-D.[14] Although such ex ante data are unavailable in this analysis, the ex post analysis made in this section illustrates that the coincidence of higher imports and lower domestic activity may not constitute sufficient evidence that imports have caused injury, even though "increased imports" and "serious injury" are observed facts in Figure 1. The ITC presumably failed to ascertain the lack of demand substitutability between American and Japanese motorcycles.

5 Conclusion

Safeguard tariffs allow a country to raise trade barriers that are otherwise bound by trade agreements, in order to provide temporary protection to an industry harmed by foreign competition. Safeguarding does not require a finding of unfair practices, as do antidumping and countervailing duties, and is supposed to apply to imports from all countries.[15] Two arguments have been put forth justifying safeguard actions (see Johnston, 1997). On the one hand, safeguards yield to the idea of limited import barriers for specific industries as a way to diminish protectionist pressure for a more drastic departure from liberalized trade. On the other, since trade liberalization might force difficult economic adjustments on particular sectors of the economy, safeguards give industry some breathing room in which to become more efficient. Despite many examples, including those of the steel and apparel industries in the United States, indicating the inefficacy of safeguard protection in promoting the structural adjustment of industries, the H-D case is heralded as a success of the escape clause. When H-D sought tariff protection in 1982, the sole surviving American motorcycle company was on the verge of bankruptcy: it held only five percent of the US market, lagging behind four Japanese newcomers. In 1983, after receiving temporary import relief covering imports of heavy motorcycles, H-D's sales drastically recovered. Indeed, H-D recovered so swiftly that it even requested that the final year of

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[14]Grossman (1986), Pindyck and Rotemberg (1987), and Kelly (1988) propose using econometric techniques to identify causes of injury in safeguard cases. There are subtle differences between US trade law and WTO obligations regarding how to interpret increased imports as "serious injury"; see Irwin (2003) for details.

[15]The safeguard studied in this paper is in fact discriminatory in that quantitative restriction is applied. An analysis of the optimal safeguard tariff-quota structure, though interesting, is beyond the scope of this paper.

tariff protection be cancelled.

In this paper, we examined the effects of US safeguard duties on heavy motorcycles in the 1983–1987 period. We performed quantitative analyses to assess ex post the extent to which the motorcycle safeguards improved H-D's performance. Our simulation results revealed that safeguard tariffs explained at most 13 percent of H-D's sales recovery. The finding of this tiny safeguard effect was largely due to estimates obtained from a random-coefficient demand model, indicating that American and Japanese motorcycles were poorly matched substitutes for each other. The estimated small cross-price elasticities appeared consistent with the observation in our data that both H-D's prices and sales increased faster than did the Japanese. Therefore, safeguard tariffs would have had little effect in terms of shifting consumers from Japanese motorcycles to American ones: rather, it must have been motorcycle non-price attributes that were effective in H-D's turnaround. Indeed, after it was bought by its management and became independent of AMF in 1981, H-D quickly overhauled and renovated its production system. It implemented a statistical control system that prompted employees to judge the quality of their own output, a just-in-time inventory program that improved its production efficiency, and massive layoffs that halved its workforce.

It is not difficult to infer from the paper's analysis that the welfare consequence of the safeguard tariffs to the US economy. While the safeguards increased sales profit for H-D and tariff revenues on Japanese imports, the total amount is summed up to be at USD 345 million in the study period, on the basis of the information shown in Table 5. The above estimate, which must overstate the benefits from the safeguards policy, appears to be smaller than the loss of consumer welfare arising from the price effect found in Table 4. [16] This result is contrary to the result based on the back-of-the-envelop calculations in Feenstra and Taylor (2008: 336-339), which infers that the safeguard tariffs on H-D improved welfare.

The paper provides us with an interesting lesson: that the coincidence between the period of safeguard relief and that of H-D's recovery does not constitute sufficient evidence of the effectiveness of the safeguard policy. The argument for safeguard protection, that temporary relief from imports provides a breathing space that allows domestic industries adversely affected by increased imports to revitalize, is thrown further into doubt.

A   Data Appendix

Motorcycle designs depend on the uses for which particular models are intended. Off-road machines, used most extensively for recreation, have more robust frames with higher ground clearance, studded tires to increase traction in mud and sand, various engine modifications to ensure maximum torque rather than

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[16]We use compensating variation to measure changes in consumer welfare from the safeguard protection. Compensating variation is the amount a consumer would need to be just indifferent between the equilibrium with the safeguard tariffs and the one without them. The annual loss of consumer surplus is estimated approximately at USD 2 billion, but with a large standard error of USD 1.2 billion (in 1983 prices).

speed, and unmuffled exhaust to increase power. On-road machines incorporate required safety equipment, such as lights, rear-view mirrors, and signals: they are designed for high cruising speeds, rider comfort, and good handling at high speeds. Combination or enduro machines are supposed to serve both functions, some models being designed with a bias toward on-road use, others toward off-road.

The safeguard tariffs implemented in 1983 applied to the on-road motorcycles on which this paper focuses. The motorcycles with an engine displacement of 450 cc or larger are classified as on-road motorcycles. The sources of data regarding such motorcycles are described below.

Sales quantity data (i.e., the number of new registrations) are obtained from the *Motorcycle Statistics by Make and Model* published by R.L. Polk. To the best of our knowledge this publication is available only for the 1983—1987 period, and is archived at the US Library of Congress. This publication breaks down sales quantity by make and model.

Motorcycle price and characteristics data are from the *Motorcycle & Moped Appraisal Guide*, a tri-annual magazine published by the National Automotive Dealers Association. These data are available from 1977 to 1987. For the price variable, we employ the prime retail price, known to reflect transaction prices. Listed prices, or manufacturers suggested prices, could be another candidate, but they did not change over our study period. To construct a representative data set, we focus on those motorcycles whose sales exceeded 200 units per period.

The motorcycle population is used in calculating the market size, and the income distribution of motorcycle owners is used in estimating motorcycle demand. Both types of data are obtained from the back issues of *Motorcycle Statistical Annual* published by the Motorcycle Industry Council (MIC). The quantity data by make (but not by model) for the 1977—1995 period are also available from the MIC, and are used in Figures 1 and 4. The exchange rate data are from *International Financial Statistics*. The values and quantities of US motorcycle imports are available from FT246 published by the US Census Bureau.

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TABLE 1
U.S Motorcycle Sales by Engine Displacement

Harley-Davidson

	1100cc-			700-1099cc				Total Sales
	Sales (%)	Price (USD)	No. Models	Sales (%)	Price (USD)	No. Models		(Unit)
1983	72.11	6831	15	27.89	4395	4		26675
1984	66.79	6636	19	33.21	4198	5		26636
1985	71.51	6771	18	28.49	3890	4		27564
1986	76.41	7128	31	23.59	3626	3		29940
1987	72.42	7115	44	27.58	3535	8		33426
Average	71.85	6896	25	28.15	3929	5		28848

Japanese firms

	1100cc-			700-1099cc			450-699cc			Total Sales
	Sales (%)	Price (USD)	No. Models	Sales (%)	Price (USD)	No. Models	Sales (%)	Price (USD)	No. Models	(Unit)
1983	2.64	4628	7	53.98	3187	42	43.38	2139	42	324652
1984	9.31	5089	8	27.74	2743	12	62.95	1970	28	305399
1985	14.60	5136	9	21.68	3011	12	63.72	2052	34	231966
1986	15.18	5347	13	22.77	3263	14	62.05	2161	33	186820
1987	14.50	5500	12	24.59	3355	11	60.91	2287	26	191496
Average	11.25	5140	10	30.15	3112	18	58.60	2122	33	248067

Notes:
 Harley-Davidson made no motorcycle below 700cc in the period studied in the paper.
 Price is CPI-deflated in the year of 1983.
 Sales are the number of motorcycles newly registered in a particular year, and price is the quantity-weighted average by engine-displacement size.

TABLE 2
Demand Estimates

Variables	(2-1) OLS Logit		(2-2) 2SLS Logit		(2-3) Random-Coefficients Logit	
	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Price	-1.23 [a]	0.06	-12.60 [a]	0.48	-56.04 [b]	22.96
Mean Parameters (β)						
Engine Displacement	-0.89 [a]	0.29	1.41	1.04	4.52 [b]	2.09
Dryweight	1.96 [b]	0.76	10.78 [a]	4.18	14.21 [a]	4.73
Forward Speeds	0.36 [a]	0.07	0.60 [a]	0.10	0.63 [a]	0.11
Cylinder	0.05	0.07	0.02	0.08	-0.08	0.10
Age	-0.03 [a]	0.004	-0.06 [a]	0.01	-0.08 [a]	0.02
Constant	-9.05 [a]	0.46	-12.05 [a]	1.37	-12.59 [a]	1.66
Harley-Davidson	-0.58 [b]	0.24	1.11	0.72	-0.17	1.26
Harley-Davidson * Trend	0.49 [b]	0.22	0.52 [c]	0.31	0.55	0.47
Harley-Davidson * (Trend)^2	-0.03	0.04	-0.02	0.06	-0.05	0.08
Std. Deviations (σ)						
Engine Displacement	-	-	-	-	3.20 [b]	1.35
Constant	-	-	-	-	1.00	0.67
Harley－Davidson	-	-	-	-	2.61 [a]	0.62
First-stage F-stats	-		446.90 [a]		446.90 [a]	
R-squared	0.38		-		-	
J-statistics (D.F)			37.24 [a] (12)		19.41 [c] (12)	
Number of observations	785		785		785	

Notes:
  The superscripts, a, b, and c indicate significance at the 99-, 95-, and 90-confidence levels.
  The variables of engine displacement and dryweight are divided by 1000. The price variable in
(2-1) and (2-2) are divided by 10000. Note that the price variable in (2-3) is divided by simulated
 individual income. We include a seasonal dummy variable, and yearly trend and its squared variables
in the model, but not reported in the table.

TABLE 3
Own and Cross Elasticities
for Selected Models

Models	Engine Displacement (cc)	FXSB	FXWG	XLH1000	XLX1000	KZ550	CB650	VF750	VT750	VF1100	GL1100
H-D FXSB	1340	-9.476	0.046	0.036	0.032	0.006	0.006	0.006	0.006	0.005	0.008
H-D FXWG	1340	0.050	-9.452	0.039	0.035	0.006	0.007	0.007	0.006	0.006	0.009
H-D XLH1000	1000	0.025	0.026	-7.395	0.027	0.005	0.005	0.006	0.005	0.006	0.006
H-D XLX1000	1000	0.018	0.019	0.022	-7.437	0.005	0.005	0.005	0.005	0.005	0.005
Kawasaki KZ550	553	0.011	0.011	0.014	0.015	-4.238	0.020	0.019	0.020	0.021	0.018
Honda CB650	655	0.026	0.026	0.034	0.035	0.047	-4.792	0.047	0.048	0.050	0.043
Honda VF750	748	0.044	0.045	0.054	0.056	0.072	0.073	-5.449	0.073	0.075	0.071
Honda VT750	749	0.017	0.018	0.023	0.025	0.033	0.033	0.033	-5.264	0.035	0.030
Honda VF1100	1100	0.015	0.016	0.023	0.025	0.033	0.034	0.033	0.034	-7.043	0.029
Honda GL1100	1100	0.060	0.060	0.060	0.058	0.069	0.071	0.075	0.070	0.069	-7.802

Notes:

This table lists the two best selling models in 1983 for each of the five categories by engine displacement shown in Table 1. Note that H-D did not have models in the category of 450-699cc. Thus, this table shows four H-D and six Japanese models. The (m, n) element in the matrix indicates elasticity of model n with respect to a change in the price of model m.

TABLE 4
Comparison between Actual and Simulated Prices
by Make and Engine Displacement

	Harley-Davidson		Japanese Makers		
	700-1099cc (Std. Error)	1100cc- (Std. Error)	450-699cc (Std. Error)	700-1099cc (Std. Error)	1100cc- (Std. Error)
1983	-0.09 (0.33)	-0.08 (0.20)	-2.80 (0.52)	17.94 (0.79)	18.19 (0.53)
1984	0.02 (0.09)	0.09 (0.41)	-1.93 (0.77)	23.83 (1.14)	24.88 (0.74)
1985	0.07 (0.28)	0.06 (0.25)	-1.71 (0.43)	17.31 (0.81)	17.77 (0.54)
1986	0.04 (0.27)	0.01 (0.14)	-0.73 (0.23)	12.63 (0.49)	13.03 (0.36)
1987	0.02 (0.07)	0.01 (0.05)	-0.65 (0.18)	11.57 (0.46)	11.84 (0.36)
Average	0.01 (0.33)	0.02 (0.21)	-1.76 (0.43)	16.66 (0.74)	17.14 (0.51)

Notes:
Stadard errors are shown inside parenthesis.
Japanese Makers include Honda, Yamaha, Suzuki, and Kawasaki. Each value in the table is calculated by:

$$100*(\text{Actual Prices} - \text{Simulated Prices}) / \text{Actual Price}$$

in which, simulated prices are obtained by the procedure described in Section 4.
Harley-Davidson manufactured no motorcycles with the range between 450 and 699 cc.
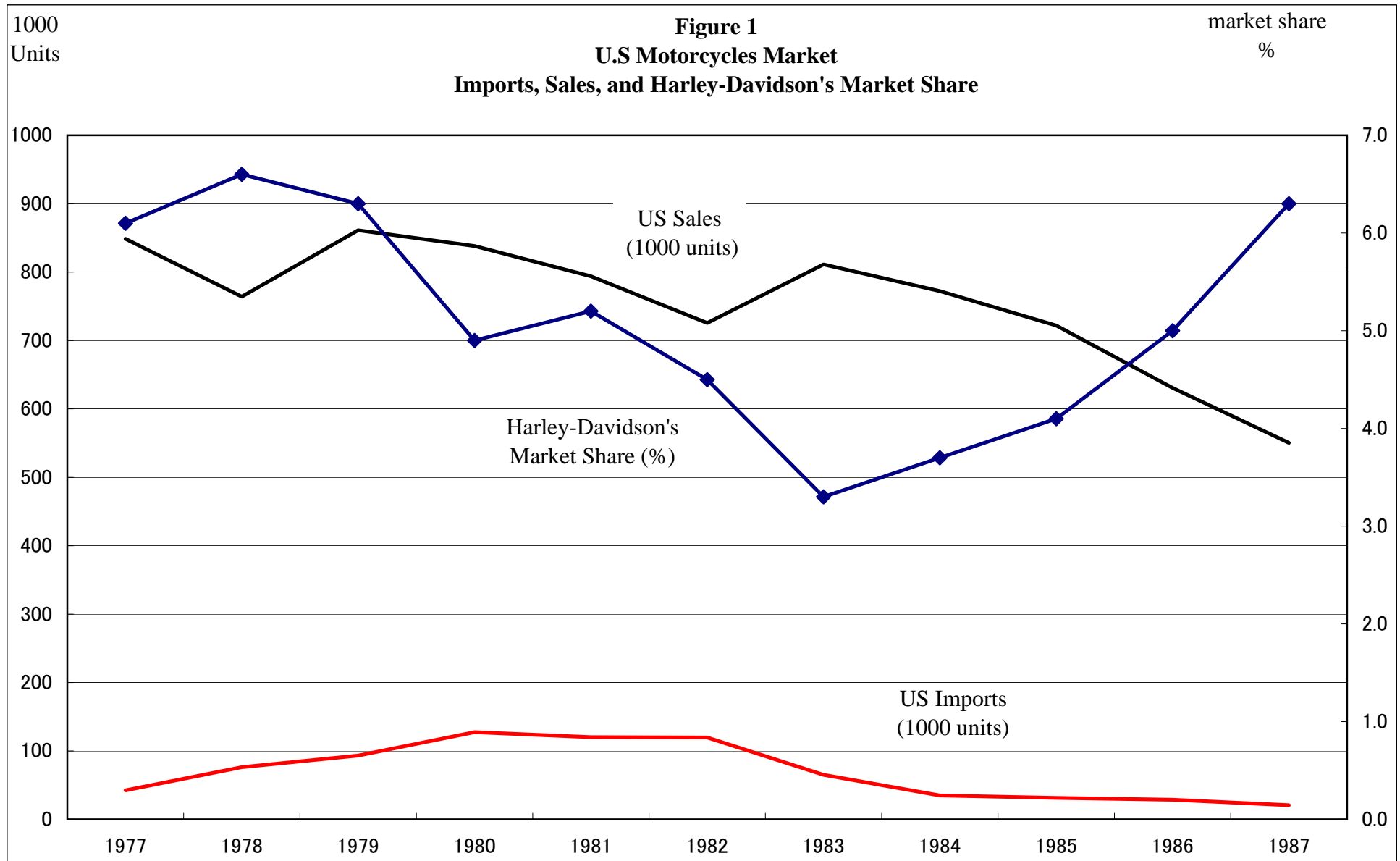
TABLE 5
Effects of Safeguard Tariffs on Sales and Profits

Harley-Davidson			Bertrand Competition		Collusion among the Japanese	
	Actual Sales (Units)	Actual Profits (Million USD)	Effect on Sales % (Std. Error)	Effect on Profit % (Std. Error)	Effect on Sales % (Std. Error)	Effect on Profit % (Std. Error)
1983	26675	18.10	8.92 (5.46)	7.96 (5.51)	7.74 (4.66)	6.94 (4.73)
1984	26636	18.55	11.50 (7.70)	12.40 (7.50)	10.37 (6.71)	11.28 (6.50)
1985	27564	18.86	3.92 (3.68)	4.65 (3.87)	3.67 (3.48)	4.38 (3.63)
1986	29940	21.47	2.39 (2.20)	2.42 (2.19)	2.28 (2.08)	2.31 (2.05)
1987	33426	25.71	1.09 (1.25)	1.10 (1.25)	1.05 (1.16)	1.06 (1.16)
Average	28848	20.54	5.57 (3.71)	5.71 (3.56)	5.02 (3.32)	5.20 (3.18)

Japanese Makers						
1983	324652	134.81	-61.56 (36.49)	-62.92 (33.58)	-57.96 (31.86)	-63.16 (29.63)
1984	305399	115.31	-62.86 (41.01)	-64.73 (39.16)	-60.37 (36.90)	-64.76 (35.17)
1985	231966	99.614	-50.92 (30.18)	-53.64 (29.01)	-49.06 (28.13)	-53.64 (26.96)
1986	186820	81.38	-36.73 (17.83)	-39.30 (17.46)	-35.47 (16.94)	-39.26 (16.53)
1987	191496	78.30	-28.70 (12.12)	-31.04 (12.00)	-27.76 (11.73)	-30.98 (11.53)
Average	248067	101.88	-48.15 (32.47)	-50.33 (30.27)	-46.12 (29.07)	-50.32 (27.37)

Note:

Simulated sales and profits are calculated under the assumption that all Japanese motorcycles sold in the U.S. were subject to the normal tariff of 4.4 percent in the period from 1983 to 1987.

Actual profits are calculated under the assumption of Bertrand competition described in Section 4.1.

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Figure 1
U.S Motorcycles Market
Imports, Sales, and Harley-Davidson's Market Share

1000 Units

market share %

US Sales (1000 units)

Harley-Davidson's Market Share (%)

US Imports (1000 units)

Note: The Harley-Davidson's market share increased as US sales, along with US imports of large-scale motorcycles, declined during the safeguard period.

FIGURE 2
Motorcycle Prices and Safeguard Tariffs
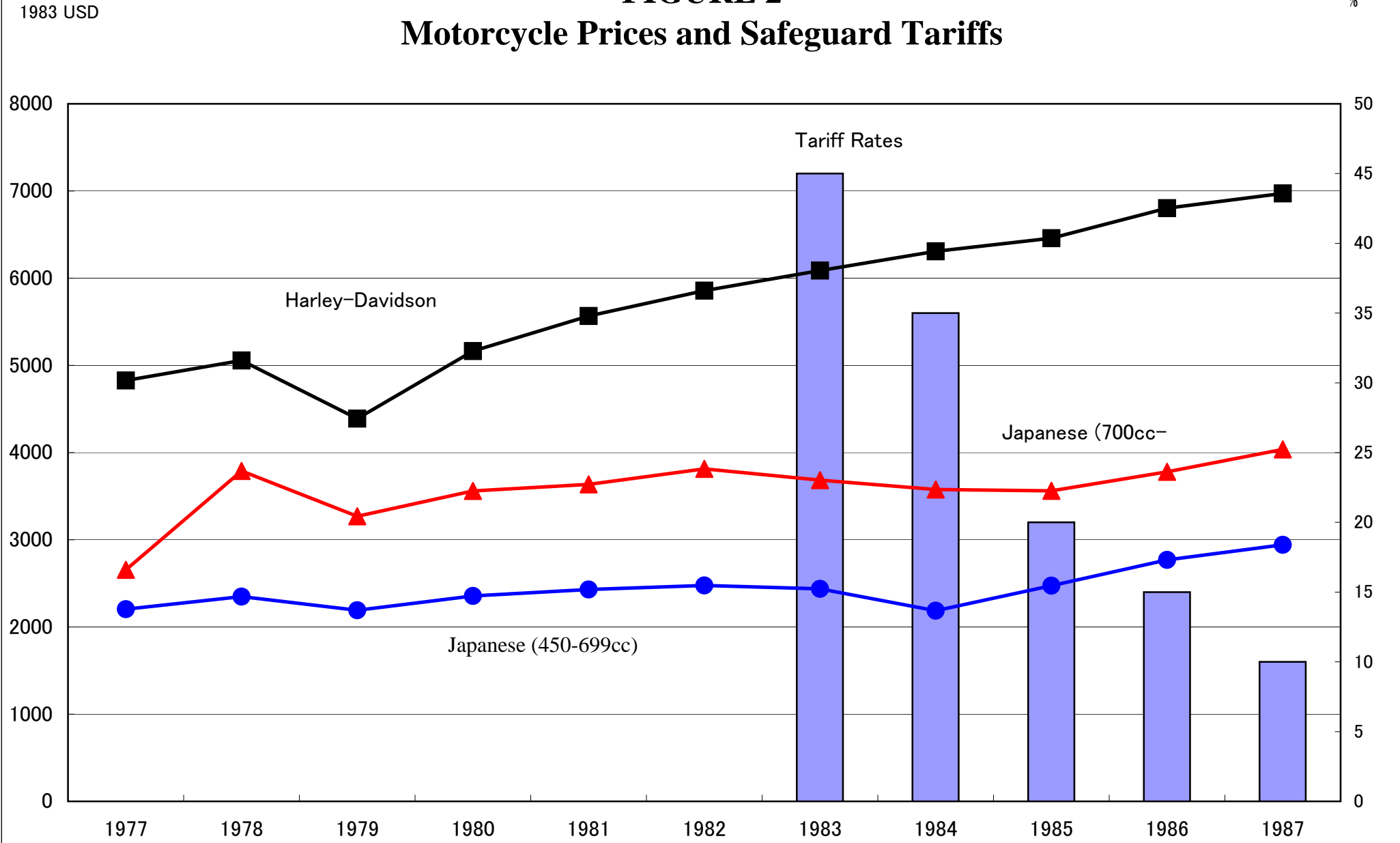
Note: Tariff rates were subject to safeguards. The annual average prime retail prices of Harley-Davidson increased much faster than those of Japanese models.

FIGURE 3
Number of New Motorcycle Models
Introduced by Year, 1976-1987

Number of New Models

Japanese with 700cc or larger

Harley-Davidson

Japanese with less than 700cc
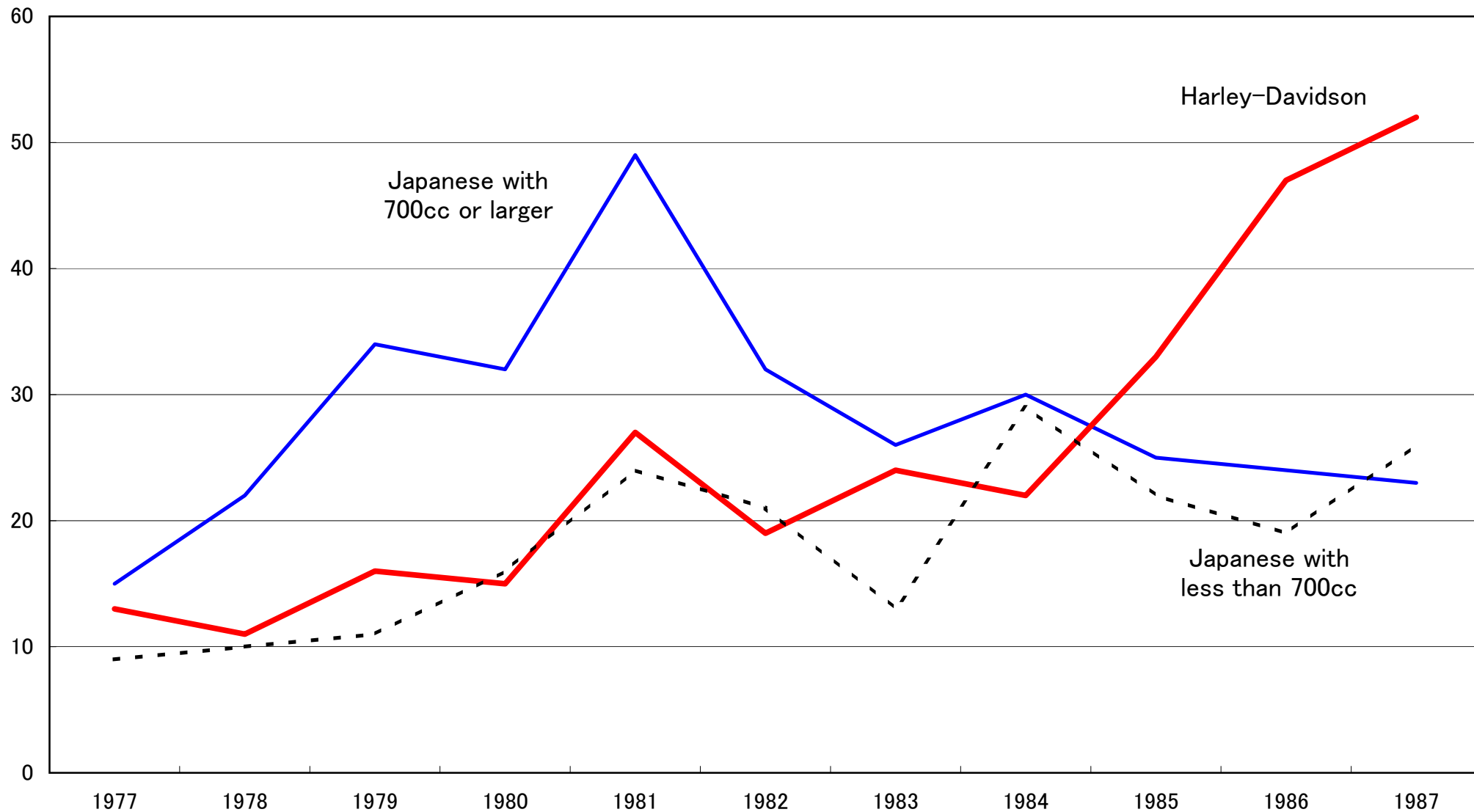
Note: The number of new Harley-Davidson models increased during the safeguard period, while that of Japanese models stagnated.