

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

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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. Although Harley-Davidson must have earned extra profits from innovation by receiving safeguard protection, it is unclear whether protection was necessary for Harley-Davidson to innovate. 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

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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 firm cost functions. 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 motorcycle safeguard from both the short- and long-term perspectives. In the short-term analysis, we examine the extent to which safeguard tariffs affected H-D prices and sales, leaving long-term strategies, such as changes in motorcycle characteristics, constant. In the long-term study, we attempt to investigate the effect of incentives for H-D to upgrade new motorcycle models.

Our simulation results demonstrate that safeguard tariffs explain at most eight percent of H-D's sales and profit recovery in the short term. 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

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

²Unlike 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).

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. Our long-term simulation exercise thus asks whether the safeguard remedy induced H-D to upgrade its new models. We find that, thanks to safeguard protection, H-D earned only 10 percent more profits, representing mere USD 700,000 (in 1983 prices) per year.

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.

A major aim of the safeguard remedy is to allow domestic industries adversely affected by increased imports to improve their competitiveness in international markets. Even though H-D would not have been entitled to the escape clause, it remains plausible that safeguard protection did give H-D breathing room in which to innovate, or upgrade its new motorcycles. The long-term simulation results indicate that, with the safeguard remedy, H-D likely derived 10 percent more profits from its innovation activities than if no safeguards had been available. Though we had to impose restrictive modeling assumptions to obtain this estimate, the finding of such a small amount of extra benefit leads us to suspect that H-D would have 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

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

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, especially from the short-term perspective. To quantitatively assess the extent to which US safeguard protection promoted H-D's recovery, subsequent sections present structural supply and demand estimates that describe 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 estimates of 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. We evaluate the effects of safeguard protection from the short-run and long-term perspectives already presented above. 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 and technical appendices.

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 primarily belonged 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

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

did not apply to domestic production, foreign producers, namely Honda and Kawasaki, gradually shifted production to the United States.⁵ While no data are publicly available on US domestic production by Japanese motorcycle companies, in Section 3 we discuss the implications 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 in the first two years of the safeguard period. In fact, H-D’s prices remained 70% higher and increased at a rate three times faster than did those of its Japanese counterparts. This observation might have been accounted for by 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-

⁵Daily Automobile Newspaper, July 1985.

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 1380 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 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 . This is by no means an accurate description of the potential buyers; for example, the second-hand motorcycle market was known to be a not-negligible size in our study period. We thus tested different definitions of the market size, and found that our estimation results reported in Section 4 are robust to them. ⁶

⁶Different definitions of the market size include 1) the set of all motorcycle owners, including with units under 450 cc in size, as the potential buyers and 2) the set of all US households.

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 motorcycle:

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

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 the variables of engine displacement and dry weight (that is, motorcycle weight with an empty gasoline tank). 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 also 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. The utility function contains ξ_{jt} , an unobserved (to an econometrician) product quality of motorcycle model j with the property that $E(\xi_{jt}) = 0$. In this section, we discuss the econometric endogeneity problem generated by ξ_{jt} . Note that $x_{jt}\bar{\beta} + \xi_{jt}$, where $\bar{\beta}$ 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. 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, $dG(y)$, with the mean and variance of the distribution being estimated based on data available a 1985 publication of the Motorcycle Industry Council (MIC).⁷ Consumers with similar demographic attributes tend to have similar rankings of products and thus similar substitution patterns.

⁷The mean and variance of the log-normal distribution of motorcycle owner income is estimated as 24,487 and 15,434 (in terms of 1983 constant USD), respectively.

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 ;

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

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

$$s_{jt} = \int_y \int_{\nu} s_{ijt} dF(\nu) dG(y), \quad (2)$$

where $dF(\nu)$ 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 $dF(\nu)$ and $dG(y)$, 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.⁸

Traditionally, cost variables excluded from x_j are used as instruments in homogeneous-goods models, and this practice is still appropriate here. For such instruments, we employ JPY-USD exchange rates from *International Financial Statistics Yearbook* (1988), and the tariff rates on imports of motorcycles with 700 cc and larger engines. Since many motorcycles sold in the USA were imports, the US motorcycle price should have been affected by the JPY-USD exchange rate and tariff rate. Note, however, that these instruments are an industry aggregate, and do not vary by motorcycle model: the use of the instruments thus only help identify the motorcycle demand through the variations of the instruments 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 Appendix A. 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 neither economically nor statistically significant. Although many coefficients are estimated to be significantly different from zero, we are concerned that endogeneity in

⁸The same set of instruments are used by Berry, Levinsohn and Pakes (1999) and Ohashi (2002, 2003), among others.

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-statistics reported in models 2-2 and 2-3 do not allow us to reject the orthogonality condition between some of the instruments and the error. The price estimate reported under model 2-2 indicates the successful elimination of endogeneity in the positive correlation with the unobserved quality.

The estimated coefficient of engine displacement is estimated to differ from zero at the margin, indicating that consumers appear to care for engine size when choosing a motorcycle model. 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 worth 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 coefficient of the H-D dummy reflects 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, dryweight, 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.

Dryweight is a major characteristic of a motorcycle, as it represents the degree of stability in riding. The high significance in the estimated mean coefficient appears to reflect the consumer perception of dryweight. The variable can also serve as a proxy for motorcycle luxuriousness, including the seat comfort. It is reasonable that the random coefficient of dryweight is estimated to be significant, as consumer perceptions of ride quality may differ.

Notably, the coefficient of engine displacement is estimated to be statistically insignificant in the mean, but significant in the standard deviation. The estimates might indicate that the average consumer did not value motorcycles with larger engine sizes, but that individual consumers had different tastes regarding different engine displacements. The latter 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 may imply that consumers' heterogeneous responses to the outside good may play a role in the demand for new motorcycles.

Using the obtained price estimate, we present average values of estimated own- and cross-price semi-elasticities. Semi-elasticity is defined as the percentage change in the market share of a motorcycle in the row associated with a USD100 increase of the price in the motorcycle column. We calculated the value of semi-elasticity between pairs of all motorcycle models included in our dataset, and for each entry in the table calculate the average of the values using the model-sales share as a weight. Table 3 indicates that the average own semi-elasticity of Japanese motorcycle models is 40 percent higher in absolute value than that of H-D models. Cross-price semi-elasticities are small, in particular, between H-D and Japanese motorcycles. The sales share of H-D increases by a fraction of one percent with a USD 100 increase in the average price of large-sized Japanese motorcycles. The finding of small cross-price elasticities between American and Japanese motorcycles is consistent with our findings 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. 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 evaluate the effects of the safeguards from two perspectives, the short and long-term. In the former case, we examine the price effect of tariffs, leaving long-term strategies, such as changes in motorcycle characteristics, constant. In the long-term perspective, we investigate the effect of the safeguards on H-D's upgrading of motorcycle quality. These exercises require 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 strategies.

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.⁹

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, as we ignore the existence of quota, local production, and inventory accumulated by the Japanese. This alternative approach, however, substantially reduces the complexity of our estimation model given the limited data availability.

Consider the situation where firm f ($= 1, \dots, F$) 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.

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

⁹As discussed in the previous section, the accumulation of inventory prior to safeguard imposition was not likely prompted by anticipation of the policy introduction.

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 ($= 1, \dots, J$) is given by:

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

or

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

where $p \equiv (p_1, \dots, p_J)'$, $s \equiv (s_1, \dots, s_J)'$, and $mc \equiv (mc_1, \dots, mc_J)'$. The tariff-rate vector, $(1 + \tau)^{-1}$, is defined as $diag(\frac{1}{1+\tau_1}, \dots, \frac{1}{1+\tau_J})$. 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 consists only of market shares, demand parameters, and simulated draws. Thus, using the data and the obtained demand estimates presented in Table 2, we estimate marginal costs of motorcycle models as explained in Appendix B.¹⁰

In the following counterfactual analysis sections, we use the demand equation (2) and supply equation (3) along with the estimated 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 Analysis of Short-term Price Effect

In this section, we examine the short-term impact of the motorcycle safeguard policy, ignoring the effect on long-term strategies, including the upgrading of quality. Such long-term effects of the policy are analyzed in the subsequent section. We assume that all Japanese motorcycles with 699 cc or larger engines were

¹⁰Another method for estimating marginal costs would be simply to solve (3). This method, however, is not attractive, because we want the marginal costs (especially H-D's) to fall in response to the output increases.

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 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 1987.¹¹ Note that the prices would not have increased by the magnitude of the safeguard tariff rates shown in Figure 2, as the own-price semi-elasticities presented in Table 3 are found to be as elastic as -8.4 . 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 semi 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, between H-D and Japanese motorcycles with engine displacements exceeding 699 cc.

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 marginal cost estimates obtained in Section 4.1 and Appendix B. The fourth and fifth columns of Table 5 present the short-term 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. The table indicates that the safeguard tariffs would have reduced Japanese sales and profit by 18 and 21 percent, respectively. Notably, H-D does not appear to have benefitted

¹¹The 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.

much from safeguard protection, even though its sales recovered dramatically in 1983. Indeed, our simulation results reveal that safeguard tariffs accounted for merely eight percent of H-D’s sales and profits.

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 estimated based on this alternative supply-side assumption, and reported in Appendix B. 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.

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.¹² 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.

¹²Grossman (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.

4.3 Analysis of Long-term Effect of Incentives to Innovate

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). While we found the short-term benefit of safeguard protection to be small, four-year temporary protection would have presumably stimulated H-D to innovate, or upgrade its motorcycle models. In this section, we assess the long-term impact of safeguard protection, and examine whether or not safeguard protection prompted H-D to upgrade its motorcycle quality.¹³

The estimation and simulation results, combined with the data analysis done in Section 2, indicate that price alone is insufficient to explain H-D's turnaround in 1983: motorcycle characteristics must have also played an important role in its recovery. We begin this section by analyzing to what extent motorcycle characteristics accounted for H-D's increase in sales in the safeguard period: we then investigate H-D's incentives to innovate under safeguard protection.

To start the analysis, we need to know what would have happened to motorcycle characteristics had H-D not innovated. Decisions with regard to upgrading models are inherently dynamic: each company presumably chooses when to innovate and what quality level it wishes to attain in its new models. There are at least two ways we might approach this question. First, we could develop a structural representation of quality upgrading by making specific assumptions as to the form of the profit function and the processes that generate uncertainties regarding innovation. Alternatively, we could forgo identifying the dynamic decision-making process, and assume some exogenous quality-upgrading processes that firms follow in the absence of innovation. In principle, the first approach completely describes the quality-choice process, and allows identification of the parameters regarding the determination of quality improvements. It also allows us to treat the timing of either innovation or the introduction of new models as endogenous, and thus in theory enables us to analyze the time inconsistency problems of protection policy examined in the theoretical literature (for example, Matsuyama, 1990). However, the main disadvantage of the approach is that restrictive parameterizations are required in order to describe the pattern of supplier quality choices. This problem is particularly serious in our case, because we lack detailed knowledge of what motorcycle models received safeguard tariffs. The nature of the oligopolistic market with multi-product suppliers would add additional complications to the first approach. Thus, we will pursue the second approach, and assume that had H-D not innovated, consumers would have perceived no difference between H-D and the average Japanese motorcycle models. From a modeling perspective, this essentially assumes that in the absence of innovation on the part

¹³We use the term "innovate" to refer to upgrading the quality or characteristics of new motorcycle models: the terms "quality" and "characteristics" do not include price, unless otherwise specified.

of H-D, the mean utility, δ_{jt} , for H-D would have been at the same level as the average of the mean utilities for Japanese models. On the other hand, the mean utility for H-D is set at the actual level when it does innovate. The assumption made in this paragraph may place H-D in an unduly disadvantaged counterfactual situation, because we ignore the existence of a large number of buyers loyal to the brand, which indicates high ξ_{jt} for H-D. This section's analysis may thus overstate the impact, if any, of H-D's innovation activities.

Figure 4 identifies two factors contributing to H-D's sales. The actual sales, denoted by the thin line, are taken from Figure 1. The remaining two lines are obtained by using a simulation method similar to that used in Section 4.2. The dotted line indicates the simulated sales reported in Table 5 under the assumption of Bertrand-type competition. The thick line represents the simulated sales under the assumption described in the previous paragraph. It is evident that motorcycle characteristics played an important role in the turnaround of H-D. Had H-D not updated its motorcycles, no recovery would have been observed in 1983 and thereafter: in fact, the company's sales would have dropped to a tenth of the actual level by the end of the study period. The figure confirmed that upgrading the quality of new models was a critical determining factor in H-D's recovery.

We now investigate to what extent safeguard protection provided incentives for H-D to innovate, or upgrade motorcycle characteristics. In this analysis, we consider H-D's pecuniary incentives for innovation. Similar to the assumption we made in Section 4.1, multi-product motorcycle firms are assumed to choose their prices simultaneously to maximize profits in every period t , given their current innovation level. Remember that we only experiment with H-D's motorcycle characteristics, leaving the Japanese motorcycle characteristics intact. Let $\bar{\pi}_t^S$ (or $\bar{\pi}_t^N$) denote the per-period equilibrium profits earned by H-D when the company innovated in the presence (or absence) of safeguard protection: note that the superscripts S or N indicate the presence or absence of safeguard protection. Similarly, let $\underline{\pi}_t^S$ (or $\underline{\pi}_t^N$) denote the per-period equilibrium profits earned by H-D when the company did not innovate in the presence (or absence) of the policy. Note that the sales that generate $\bar{\pi}_t^S$ and $\underline{\pi}_t^N$ correspond to the thin and thick lines, respectively, in Figure 4. The cost incurred by H-D in upgrading motorcycle characteristics in period t is denoted by C_t . This cost is expressed as a sunk cost, not influenced by the presence or absence of safeguards. We compute these per-period equilibrium counterfactual profits using the same simulation method described in Section 4.2.

In each period, H-D decides whether or not to innovate based on its per-period pecuniary net gain, represented by $\Delta\pi_t^S - C_t$ in the presence of safeguards, and $\Delta\pi_t^N - C_t$ in the absence of safeguards, where $\Delta\pi_t^P \equiv \bar{\pi}_t^P - \underline{\pi}_t^P$, and P takes either S or N .¹⁴ Therefore, safeguard protection provides extra incentives for H-D to innovate in period t if the following inequality holds:

¹⁴An alternative assumption would be that Harley-Davidson makes the decision at $t = 0$ based on its present discounted profits. As we discuss below, this alternative assumption does not change the results discussed in this section.

$$\Delta\pi_t^S > \Delta\pi_t^N. \quad (4)$$

Table 6 shows the long-term effect of safeguard protection on H-D's profits. The first column in the table presents the left-hand side of (4), while the second column presents the right-hand side. Each number in the table is annualized, aggregating the per-period equilibrium profits using simple averaging. The table implies that safeguard protection provides additional incentives to innovate (i.e., $\Delta\pi_t^S - \Delta\pi_t^N$) throughout the study period. The protection policy would have rewarded H-D for innovating by an average of 10 percent of its profits, or 3.6 million USD (in 1983 prices without discounting).

While the analysis reported above indicates that H-D received additional monetary incentives to upgrade its new motorcycle models, it does not necessarily imply that H-D would not have been able to innovate without the protection. Indeed, safeguard protection plays a decisive role in H-D's innovation in period t , if the cost of innovation, C_t , lies between $\Delta\pi_t^S$ and $\Delta\pi_t^N$. While an accurate analysis requires knowledge of C_t , such information is not publicly available. Table 6 reveals that the difference between $\Delta\pi_t^S$ and $\Delta\pi_t^N$ is not large, though it is probably fair to say that the condition that $\Delta\pi_t^S > C_t > \Delta\pi_t^N$ may be difficult to hold in practice.

As detailed in Section 2, in 1981, H-D changed its management and committed itself to research and development activities. 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. According to Reid (1990), the product development efforts H-D initiated in 1981 led to its successful launch of new motorcycles with 883-cc engines. Although the method used in this section awaits further refinement in future research, the results obtained so far in this section, along with anecdotal evidence, indicate that US motorcycle safeguard protection provided modest monetary benefits for H-D; however, it is not clear whether the protection was necessary for H-D to innovate at that time.

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,

¹⁵The 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.

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 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 short-term simulation results revealed that safeguard tariffs explained at most only eight 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. Our long-term simulation exercise asked whether the safeguard remedy had been necessary to provide incentives for H-D to innovate new models. We find that, with the safeguard remedy in place, H-D likely gained 10 percent more profits from its innovation activities than if no safeguard had been available. The finding of such small extra benefits leads us to suspect that H-D would have upgraded its new motorcycles even in the absence of safeguard protection. 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.

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 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.

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 1985 issue 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.

B Estimated Marginal Cost

Using the demand estimates in Table 2 and the data, we derive model marginal costs from (3). The reason we estimated marginal costs, instead of using the estimates directly calculated from (3), was explained in footnote 10. Since the prices were already deflated by CPI, the obtained marginal costs were expressed in terms of 1983 USD. We estimated the marginal costs at the level of motorcycle model, using the following independent variables: engine displacement, dryweight, and cumulative production volume for the company that manufactured the model j , along with make- and time-specific variables. All continuous variables are

expressed in logarithms. To account for possible nonlinearity in the cost determinants, we include quadratic terms for the engine-displacement and dryweight variables. The cumulative output variable is included as a proxy for the firm’s experience level. The Boston Consulting Group (1975) argued, in a report prepared for the Secretary of State for Industry in the United Kingdom, that production costs of motorcycles declined in response to a company’s accumulated experience. We follow the method of the Boston Consulting Group (1975), and assume that experience is fully appropriated within each firm, spilling equally over into producing the different motorcycle models of the same firm.¹⁶

OLS estimation results are shown in Table A1. We present two specifications in the table, depending on the assumption of the mode of competition. Specification A-1 is based on Bertrand-type competition, while A-2 assumes that the Japanese firms colluded in supplying their motorcycles. The latter assumption essentially changes the firm’s first-order conditions (3) such that all Japanese firms act like a single multi-product oligopolist. Both specifications fitted the data moderately well: most of the parameters are precisely estimated, and the estimates produced by the two specifications did not differ significantly. The estimated coefficients of experience indicate that a one percent increase in cumulative output decreases the marginal cost of motorcycle production by approximately five percent. Note that the experience variable may not be exogenous, if the error in the marginal cost equation is serially correlated. Such correlation occurs if the error in the current marginal cost influences the sequence of errors in the future marginal costs, as well as the sequence of future experience variables. This consideration raises endogeneity concerns regarding the estimated experience coefficient. We perform the Durbin-Watson test for the existence of serial correlation in the error. The AR(1) coefficient in Table A1 is constructed by first obtaining an autocorrelation coefficient of the lagged residual for each firm. Most coefficients are not significantly different from zero. The results in the table represent an average of the coefficients, and we cannot reject the hypothesis that the experience variable is exogenous. While in principle the presence of experience should make firm’s pricing dynamic, a firms’ cumulative output volume build up so large that the future benefit of cost reductions with respect to the increased current output is economically insignificant. We thus employ the static framework of oligopolistic competition as described in Section 4.

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¹⁶We construct the variable by summing over the number of motorcycles (with 250-cc or larger engines) produced starting from 1903 for Harley-Davidson, 1955 for Honda and Yamaha, 1965 for Kawasaki, and 1970 for Suzuki. The cumulative output data for the Japanese companies are obtained from Japan Automobile Dealers Association: those for Harley-Davidson are from Conner (1996).

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TABLE 1
U.S Motorcycle Sales by Engine Displacement

Harley-Davidson										
	1100cc-			700-1099cc						
	Sales (%)	Price (USD)	No. Models	Sales (%)	Price (USD)	No. Models				
1983	72.11	6831	15	27.89	4395	4				
1984	66.79	6636	19	33.21	4198	5				
1985	71.51	6771	18	28.49	3890	4				
1986	76.41	7128	31	23.59	3626	3				
1987	72.42	7115	44	27.58	3535	8				
Average	71.85	6896	25	28.15	3929	5				
Japanese firms										
	1100cc-			700-1099cc			450-699cc			Total Sales (Unit)
	Sales (%)	Price (USD)	No. Models	Sales (%)	Price (USD)	No. Models	Sales (%)	Price (USD)	No. Models	
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	-1.09	0.57	-4.63 ^a	0.97	-44.68 ^a	7.09
Mean Parameters (β)						
Engine Displacement	-1.49 ^a	0.24	-0.74 ^b	0.30	-0.08	0.69
Dryweight	2.26 ^a	0.76	4.76 ^a	0.96	6.57 ^a	0.97
Age	-0.05 ^a	0.00	-0.06 ^a	0.01	-0.08 ^a	0.01
Constant	-6.96 ^a	0.27	-7.59 ^a	0.30	-7.67 ^a	0.64
Harley-Davidson	0.08 ^b	0.04	0.27 ^a	0.06	0.43 ^a	0.05
Std. Deviations (σ)						
Engine Displacement	-	-	-	-	-1.17 ^b	0.50
Dryweight	-	-	-	-	-0.91 ^b	0.42
Constant	-	-	-	-	1.73 ^a	0.36
First-stage F-stats	-		105.94 ^a		105.94 ^a	
R-squared	0.35		-		-	
J-statistics (D.F)			39.04 (9)		14.64 (9)	
Number of observations	920		920		920	

Notes:

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. The dummy variable specific to Harley-Davidson is allowed to change over time, by multiplying a trend variable. Time-control variables, which are a seasonal dummy variable and yearly trend, are included in the model, but not reported in the table.

The superscripts, a, b, indicate significance at the 99-, and 95-confidence levels.

TABLE 3
Own and Cross Semi-Elasticities

	Harley-Davidson 700-1099cc	Harley-Davidson 1100cc-	Japanese with 450-699cc	Japanese with 700-1099cc	Japanese with 1100cc-
Harley-Davidson 700-1099cc	-8.668	0.079	0.046	0.068	0.085
Harley-Davidson 1100cc-	0.199	-6.983	0.091	0.171	0.259
Japanese with 450-699cc	0.796	0.650	-10.975	1.003	0.928
Japanese with 700-1099cc	0.742	0.819	0.578	-9.325	0.931
Japanese with 1100cc-	0.228	0.286	0.134	0.215	-8.407

Note: The (i, j) element in the matrix indicates the share weighted average percentage change in market share of motorcycle model j with a \$100 increase in the model i .

TABLE 4
Comparison between Actual and Simulated Prices
by Make and CC

	Harley-Davidson		Japanese Makers		
	700-1099cc (%)	1100cc- (%)	450-699cc (%)	700-1099cc (%)	1100cc- (%)
1983	-0.16	-0.19	-0.33	19.78	20.57
1984	0.08	-0.05	-0.45	25.20	28.75
1985	0.40	0.12	0.29	16.76	18.22
1986	0.27	0.10	0.19	11.78	12.53
1987	-0.13	0.03	-0.29	10.91	11.72
Average	0.12	0.02	-0.22	15.78	17.74

Notes:

Japanese Makers include Honda, Yamaha, Suzuki, and Kawasaki. Each value in the table is calculated by:

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

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	Actual Sales (Units)	Actual Profits (Million USD)	Bertrand Competition		Collusion among the Japanese	
			Effect on Sales % (Std. Error)	Effect on Profit % (Std. Error)	Effect on Sales % (Std. Error)	Effect on Profit % (Std. Error)
1983	26675	40.26	10.97 (2.05)	8.75 (1.76)	8.02 (1.79)	6.50 (1.70)
1984	26636	34.07	12.49 (2.51)	12.55 (2.42)	9.19 (1.61)	9.52 (1.59)
1985	27564	36.63	10.13 (1.81)	11.20 (1.82)	8.86 (1.54)	9.87 (1.54)
1986	29940	43.45	5.51 (1.10)	6.24 (1.16)	4.84 (0.92)	5.51 (0.95)
1987	33426	42.65	3.46 (0.75)	3.55 (0.74)	3.21 (0.65)	3.38 (0.65)
Average	28848	39.41	8.17 (2.20)	8.09 (0.70)	6.61 (1.75)	6.70 (0.58)
Japanese Makers						
1983	324652	305.93	-20.93 (2.18)	-23.95 (2.27)	-15.29 (2.10)	-21.80 (2.46)
1984	305399	236.03	-22.55 (1.52)	-28.79 (1.72)	-16.02 (1.48)	-26.76 (2.24)
1985	231966	203.44	-14.94 (1.07)	-19.20 (1.31)	-12.48 (0.86)	-18.85 (1.06)
1986	186820	177.11	-11.12 (0.60)	-13.37 (0.75)	-9.57 (0.55)	-13.30 (0.69)
1987	191496	142.12	-11.14 (0.52)	-12.26 (0.61)	-10.25 (0.44)	-12.02 (0.52)
Average	248067	212.93	-17.63 (2.90)	-21.25 (0.84)	-13.45 (2.57)	-20.17 (0.98)

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.

TABLE 6

**Long-run Effect of Safeguard Protection
Harley-Davidson's Incentives to Innovate**

	Profits from Innovation		Additional Incentives to Innovate (Million USD)
	With Safeguard (Million USD)	Without Safeguard (Million USD)	
1983	5.62	5.12	0.50
1984	7.68	6.37	1.31
1985	10.08	9.18	0.90
1986	12.23	11.53	0.70
1987	4.08	3.85	0.22
		Total	3.63

TABLE A1
Cost Estimates

	(A - 1) Bertrand Competition		(A - 2) Collusion among the Japanese	
	Est.	Std. Err.	Est.	Std. Err.
Engine displacement	-2.06 ^a	0.44	-2.40 ^a	0.48
(Engine displacement) ²	0.96 ^a	0.23	1.04 ^a	0.25
Dryweight	5.63 ^a	0.63	6.00 ^a	0.68
(Dryweight) ²	3.79 ^a	0.52	4.02 ^a	0.58
(Engine displacement)*(Dryweight)	-4.21 ^a	0.70	-4.69 ^a	0.75
Experience	-5.01 ^a	0.69	-4.16 ^a	0.79
Constant	80.94 ^a	9.75	69.16 ^a	11.22
Coefficient of AR(1)	0.01	0.05	-0.07	0.06
R ²		0.88		0.87
Number of Observations		920		920

Note:

The variables of Experience, Engine Displacement, Dryweight are expressed in logarithms.

The model includes the make dummy and time-specific variables.

The superscripts, a, b, indicate significance at the 99- and 90-confidence levels.

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

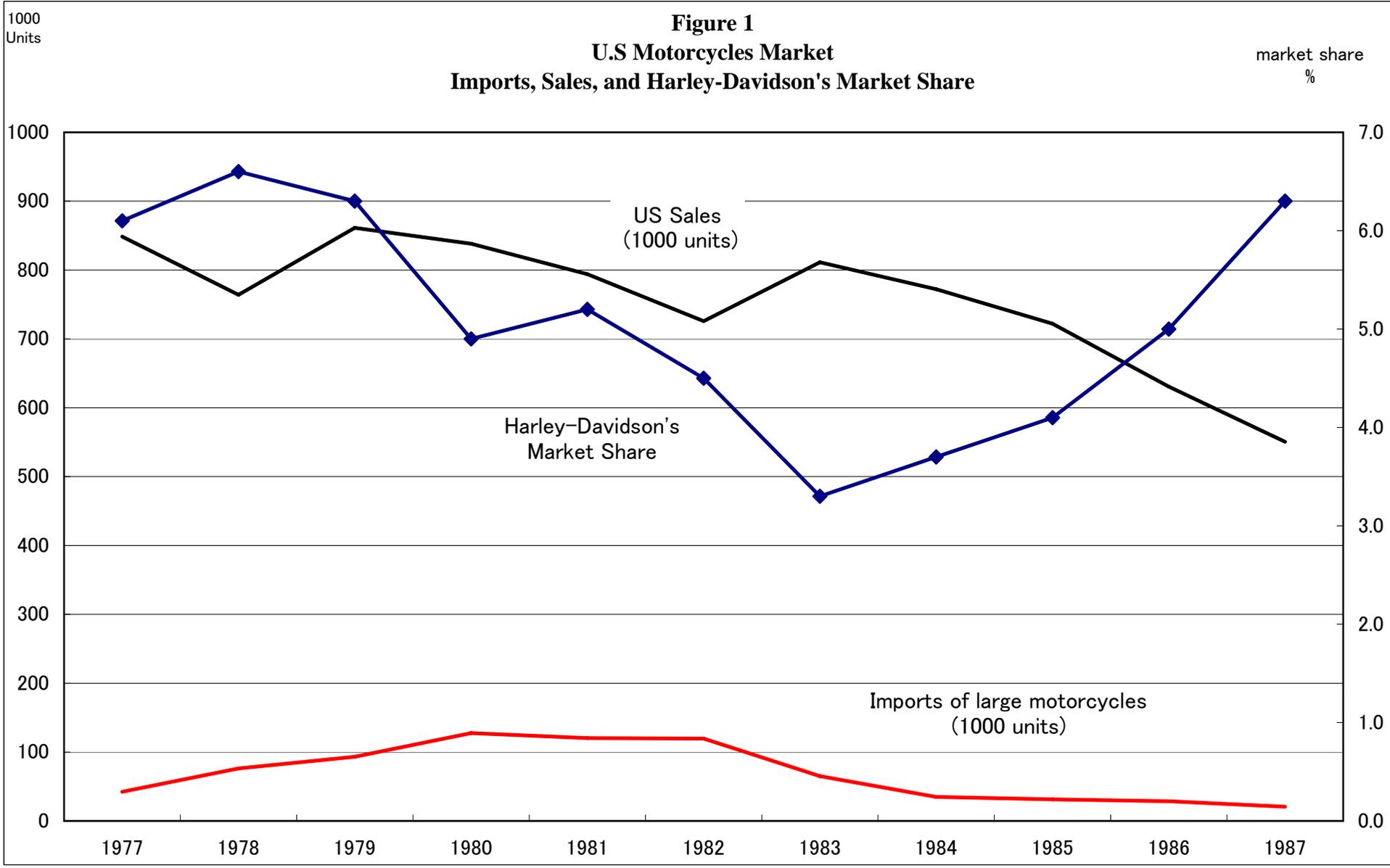
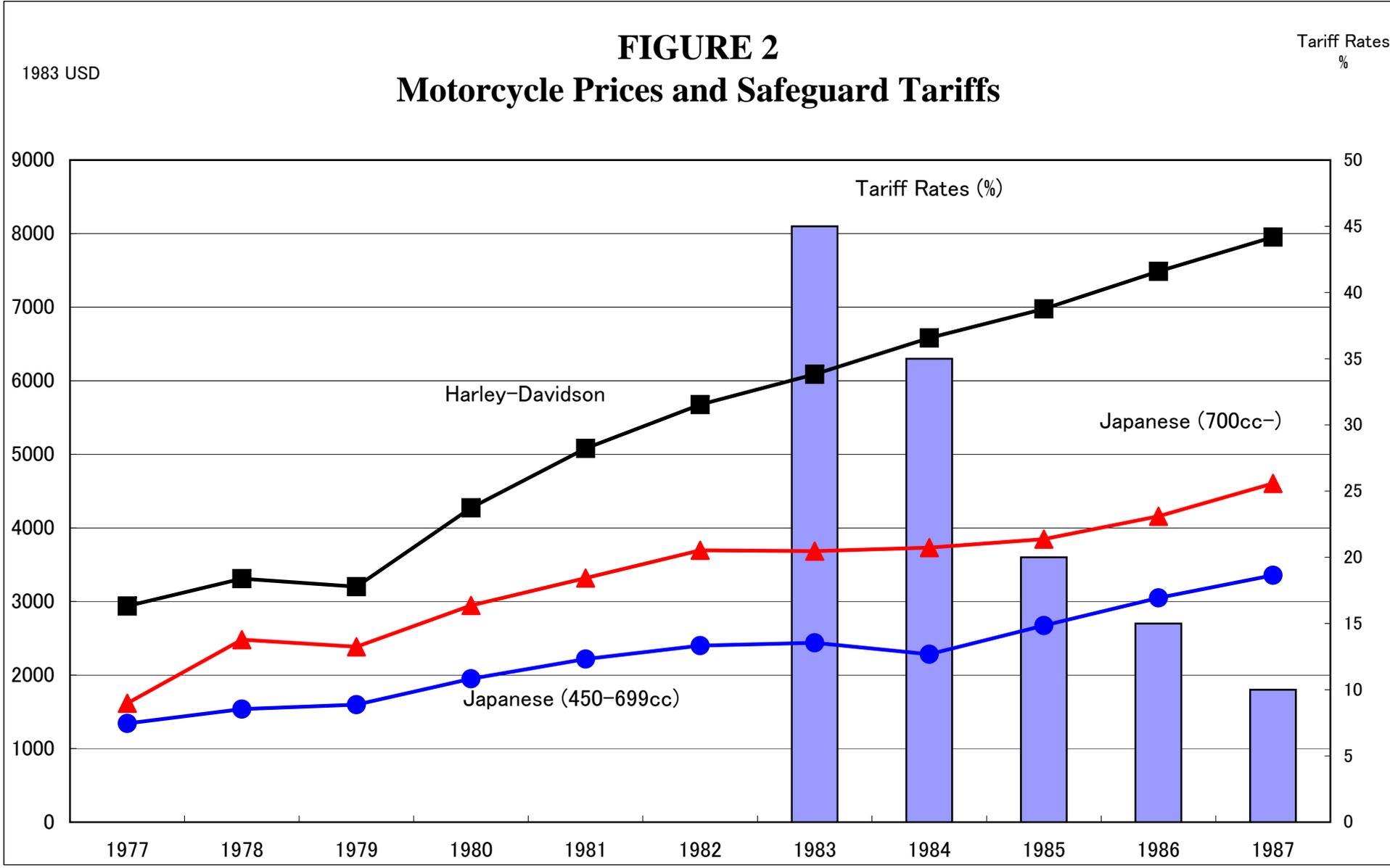


FIGURE 2
Motorcycle Prices and Safeguard Tariffs



Number of
New Models

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

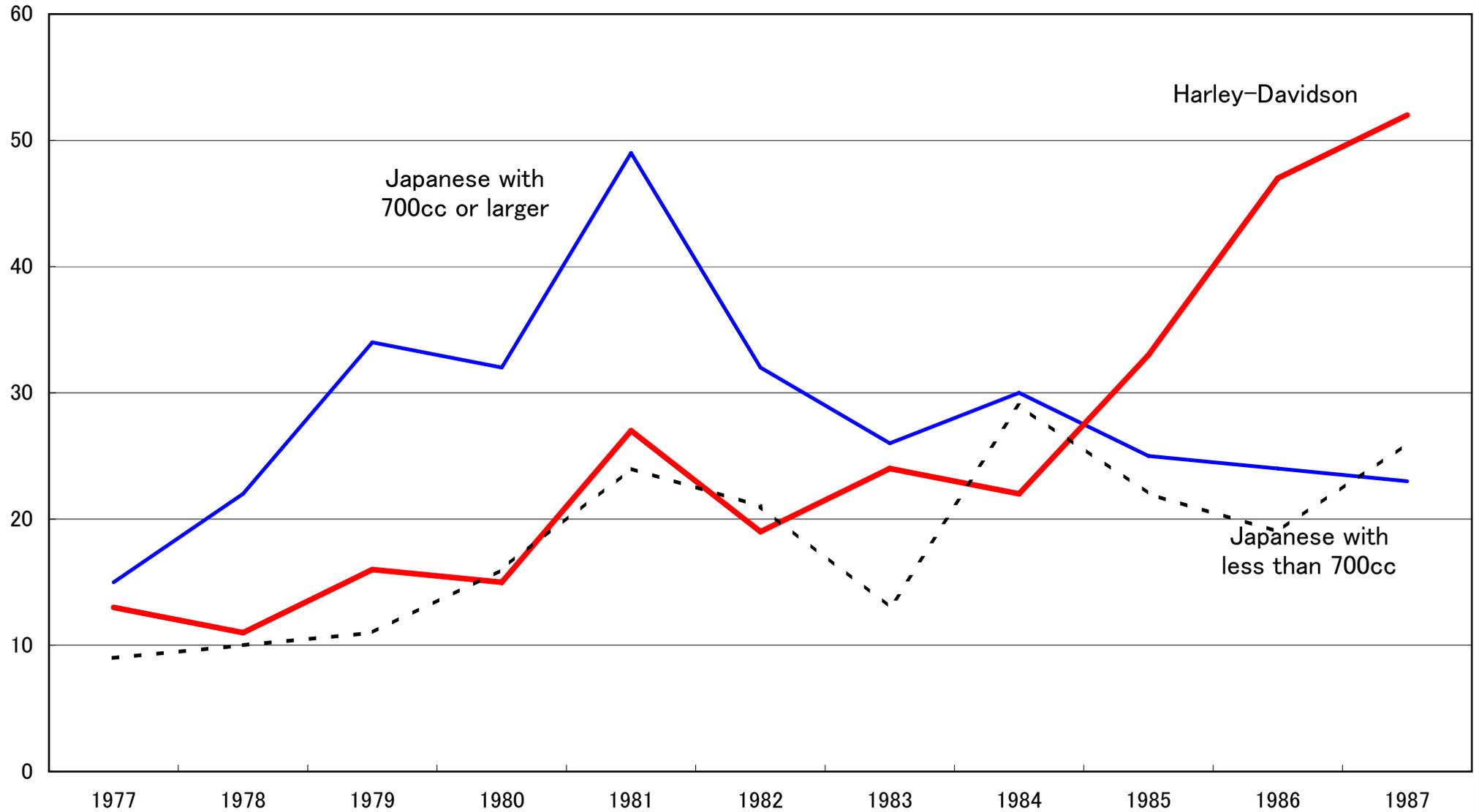


Figure 4
Actual and Counterfactual Sales of
Harley-Davidson

Sales (Units)

