Safeguards, China, and the Price of Steel

by

Benjamin H. Liebman*
(Saint Joseph's University)

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Abstract: The economic health of the US steel industry has fluctuated enormously over the last ten years. The implementation of steel safeguard tariffs in 2002 brought intense scrutiny by academics and industry observers, but little empirical work has focused on the factors that led to the industry's dramatic reversal of fortune in the period that followed. We use a panel data set of product-level monthly price observations between 1997 and March 2005 to test the importance of the safeguards compared to other possible determinants. We find little evidence that the safeguards affected steel prices in the US. Instead, results indicate that declining production capacity, improved macroeconomic conditions, and a falling dollar helped return prices to healthier levels. Finally, China's demand for imported steel, which has not been included in previous empirical studies on the US steel industry, also appears to impact prices, but only after a lag of more than six months.

JEL Codes: **F13 – Commercial Policy; Protection; Promotion;**

Key Words: Trade protection policies; Steel.

Liebman: Department of Economics, Saint Joseph's University, 5600 City Avenue, Philadelphia, PA 19131-1395; Ph: (610) 660-1553; Email bliebman@sju.edu

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I. Introduction

In March 2002, President Bush imposed tariffs on foreign steel, hoping to alleviate a crisis that had pushed almost one-third of the beleaguered sector into bankruptcy proceedings during the previous three years.[1,2] Soon after the imposition of safeguards, which slapped most non-NAFTA trade partners with duties of up to 30 percent, the industry showed obvious signs of improvement.[3] Opponents of the policy, however, including the WTO panel that declared the tariffs illegal, claimed that the industry's performance had actually rebounded prior the policy's implementation. Safeguard proponents countered that without the tariffs, steel prices could not have sustained their 30 month assent.[4] Even some critics of the policy saw protection as a key

[1] Steel prices had fallen to 20-year lows, while 35 firms comprising 30 percent of US steel capacity filed for bankruptcy between 1997 and 2001.

[2] The industry and its supporters, including members of the Congressional Steel Caucus, claimed that "unfair trade" practices such as "dumping" were partially to blame. However, the comprehensive "safeguard" tariffs technically avoided the issue of unfair trade, resting instead on a WTO law permitting temporary relief from "fair" international competition if domestic producers had been "severely damaged". As such, the tariffs were scheduled to last only three years, and would decrease over time. The Trade Act of 1974 and its extensions outline rules regarding the implementation of safeguards as well as antidumping and countervailing duties. Antidumping duties protect domestic firms from "less-than-fair-value" pricing, while countervailing duties target imports that have benefited from subsidization by foreign governments. Proponents of safeguards claimed that unfair trade contributed to the crisis, but the criterion for achieving antidumping or countervailing duties requires proof of dumping or subsidization, while safeguard protection does not. On the other hand, the injury criterion for safeguard protection is more stringent, since domestic firms must show proof of "serious injury" due to imports rather than "material injury."

[3] Carbon flat-rolled products, as well as tin mill, hot-rolled bar and cold-finished bar were all scheduled to face tariffs rates of 30 percent in year one, 24 percent in year two, and 18 percent in year three. Reinforcing bar, welded tubular products, stainless steel bar and stainless steel wire goods would all face rates of 15 percent in year one, 12 percent in year two, and 9 percent in year three. Finally, stainless steel wire rod was scheduled for rates of 8 percent in year one, 7 percent in year two, and 6 percent in year three Several products, including unfinished steel imports purchased by US steel companies (for additional processing), were granted exclusions from the tariffs. In fact, during the policy's first year, only about 45 percent of imports *within* the safeguard categories were actually covered by tariffs. Just under one quarter of *all* steel imports (measured by volume) were covered by tariffs. See http://hotdocs.usitc.gov/docs/pubs/332/pub3632/pub3632_vol3_all.pdf.

[4] The price of benchmark carbon hot rolled sheet peaked at 756 dollars per ton in September 2004. It reached a low point of 210 dollars in December 2001, but had risen to 260 dollars per ton by March 2002, when the safeguards were implemented.

factor in initiating a round of healthy consolidation during 2002-2003,[5] as expectations of higher prices and revenues granted acquiring firms deeper financing power.[6]

The return to profitability allowed President Bush to dismantle the tariffs in December 2003, 15 months prior to their scheduled termination date, without significant political opposition from the industry. Termination also meant that the US could avoid over two billion dollars worth of WTO-approved retaliatory tariffs from European trade partners, which were scheduled to go into effect in mid-December of 2003. Despite this fortuitous turn of events, little consensus has emerged regarding the role that the safeguards played in steel's dramatic reversal of fortune.[7] The elusive nature of this question, however, should come as no surprise. Rather, after more than three decades of various protectionist regimes, which include quotas, price floors, antidumping and countervailing duties, and finally safeguard tariffs, it remains difficult to determine just what impact protection has had on the US steel industry.[8]

In this paper, we attempt to assess the relative importance of the recent safeguards on steel prices in comparison to other frequently cited influences, such as fluctuations in the US business cycle, steel demand in China, declining production capacity, exchange rates, and input costs. In sum, we find little evidence that the safeguards caused steel

[5] International Steel Group purchased the assets of bankrupt firms Bethlehem Steel, LTV Steel and Acme Metals. US Steel purchased National Steel's assets, and Nucor acquired assets of Trico Steel, Auburn Steel, and Birmingham Steel.

[6] Hufbauer and Goodrich (2003: 12) argue that consolidation was instead the result of a new labor agreement between purchasing firms and the United Steelworkers of America (USWA), which permitted workforce reductions of up to 40 percent, as well as other measures increasing management flexibility.

[7] For example, Hufbauer and Goodrich (2003) find that the main source of higher steel prices following the start of safeguards was not the tariffs themselves but a reduction in US steelmaking capacity stemming from plant closures.

[8] From 1969-1974, voluntary restraint agreements (VRAs) with Japan and Europe established quotas on steel imports from those countries. From 1978-1982, price floors were used in the form of the "Trigger Price Mechanism", which required import prices to remain at par or above those offered by low-cost producer Japan. The penalty for undercutting Japanese import prices was to automatically face antidumping duties. From 1982-1984, a VRA against EC steel exporters was used. Comprehensive VRAs with all major foreign competitors except Canada were imposed between 1984 and 1992. Finally, antidumping and countervailing duties have regularly targeted steel imports since the mid-1970s.

prices to rise. Our estimates provide some support for the conventional wisdom that China's demand for foreign steel played a role in US steel price increases, although the link between the two variables seems to involve a lag of more than six months. There is stronger evidence that declining production capacity, stemming from a wave of bankruptcies and industry consolidation, led to higher prices. Finally, the business cycle, exchange rates, and antidumping duties, all appear to have influenced recent price fluctuation in the US market.

In section II, a brief history of trade protection in the steel industry is provided along with a summary of the literature analyzing such policies. The empirical model and data are discussed in section III. Econometric results are presented and analyzed in section IV, while conclusions and final comments appear in section V.

II. Background

Protection was first granted to the steel industry by President Johnson, who negotiated a voluntary restraint agreement (VRA) with Europe and Japan in 1969. The quotas, which lasted until 1974, appear to have provided steel producers with little aid. In fact, industry profits actually fell during this period, and job losses stemming from an overall structural decline continued (employment fell by 100,000 during 1965-1974). Canto (1984: 185) suggests that the VRA's ineffectiveness was in great part due to quality upgrading by targeted countries as well increasing imports from non-targeted countries.[9] Furthermore, econometric results from Canto's study reveal that the key determinant of import penetration in the steel market was the overall growth rate of the

[9] Trade diversion would continue to undermine the efficacy of trade barriers for the steel industry. Bown (2003) finds evidence of significant trade diversion during the recent safeguards.

US economy. Cima's (1986) analysis of Japanese steel exports during roughly the same period produced similar findings.[10] That is, Japanese exports to the US were highly (and positively) correlated with US industrial production, while overall Japanese exports seem to have been uninfluenced by the 1969-1974 VRA.[11]

Results from other studies also suggest that import penetration has been relatively immune to steel trade protection. Gallet (1997: 283) finds no evidence that VRAs during 1969-1974 and 1984-1988, or import price controls used during 1978-1982, had any impact on the quantity of US steel imports.[12] Econometric results from Blecker (1989: 84) also fail to show that the original VRA reduced imports, although price controls do appear to have suppressed the demand for foreign steel.

The dominating influence of business cycle fluctuations on both domestic and imported steel shipments is not surprising, given steel's primary role in pro-cyclical downstream industries such as automobiles and construction.[13] However, while the empirical literature suggests that protectionist policies have little impact on domestic and imported steel shipments, especially in comparison to macro variables, there is more evidence that prices are affected by trade barriers. Canto (1984: 184) finds that the original VRA helped reduce the domestic/imported steel price premium. Also, results from both Crandall (1981) and Blecker (1989: 74) show that the first VRA exerted

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[10] Data from Canto (1984) cover the period 1956-1979, while the time series used in Cima (1986) includes the period 1952-1975.

[11] In fact, econometric results from Cima (1986: 652) suggest that the VRA actually increased Japanese capacity utilization. The author believes that this counterintuitive finding possibly stemmed from omitted variable bias, and concludes that, "…it is possible that the restraints were mildly effective, yet not of sufficient magnitude to cause the net average impact of the (VRA) dummy to be negative."

[12] The Trigger Price Mechanism required that import prices not fall below import prices from Japan.

[13] Grossman (1986:201-223) estimates the elasticity of steel employment with respect to industrial production to be 1.40 (using 1973-1983 monthly data).

upward pressure on domestic prices. Scott and Blecker (1997: 409) estimate that the 1984-1989 VRA caused import prices to rise around 9.5 percent.

Two studies that analyze the impact of the recent safeguards (while they were currently in effect) are Hufbauer and Goodrich (2003) and Morici (2003). Empirical results from the former paper show that the safeguard tariffs caused steel prices to rise 3.3 percent, although this finding is statistically significant only at the 10 percent level. The majority of the price increase during the safeguard period, according to Hufbauer and Goodrich, was due to shrinking production capacity caused by bankruptcies and industry consolidation. Morici's (2003) analysis also suggests that the tariffs had only a minor impact on prices, which is partially inferred from the fact that steel prices grew much more slowly in the US during the safeguard period compared to other markets. For example, prices from carbon hot-rolled and cold-rolled sheet, both of which received 30 percent tariff rates under the safeguard program, experienced price increases of more than 50 percent in Europe and Japan but less than 10 percent in the US during the policy's first year (March 2002-March 2003).

In the following paper, we test the degree to which prices responded to the recent safeguards, controlling for other possible influences such as increasing steel demand in China, trends in the macroeconomy, and fluctuations in exchange rates and steel input cost. Our results suggest that prices were even less responsive to this most recent round of protection compared to other protectionist regimes. There is strong evidence, however, that declining production capacity, stemming from bankruptcies and mergers, contributed to the rise in steel prices. The business cycle, exchange rates, and antidumping duties have also helped bolster prices. Finally, China's large increase in steel demand, especially during 2003, seems to have helped push up US prices, but results indicate that this influence was delayed for at least half a year.

III. Empirical Framework and Data

We estimate a reduced-form model of US steel prices, using data that is more disaggregated and/or higher in frequency than other studies on the steel industry. This should allow us to better assess the impact of the safeguards, while controlling for domestic and global demand factors, input cost fluctuations, and exchange rates. Our data contain monthly US steel prices for seven different steel products that span from January 1997 to March 2005. Three of these products are dominated by integrated steel firms, which produce steel by combining iron ore and coking coal in blast furnaces: carbon hot-rolled sheet, cold-rolled sheet, and galvanized sheet. Another three are produced almost exclusively by minimills, which recycle steel scrap in electric arc furnaces: carbon structural shapes, cold finished bar, and reinforcing bar. Finally, we include carbon cut plate, which is divided almost evenly between integrated and minimill producers.

The rise of minimills, which are generally more efficient than integrated firms, has been a critical development in the industry, undermining the dominance of old-line producers such as Bethlehem Steel (now part of Mittal Steel) and US steel. Some critics contend that integrated producers have sought trade protection in order to remedy the loss of market share caused primarily by minimills.[14] Even in this recent round of protection, safeguard tariffs were granted primarily to products dominated by integrated firms, while

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[14] Treado (2003) finds that minimills played a more important role than import competition in the decline of capacity utilization rates in the traditional steel sector.

some minimill goods such as structural shapes and cold formed bar received no protection whatsoever. Our attempt to isolate the effects of the tariffs should be aided by the fact that our data contains variation in protection across these different steel products.

Our methodology will be similar to Grossman (1986), which estimates a reduced-form model of steel employment using aggregate, monthly data from 1973-1983. Grossman also generates counterfactual simulations using the model's parameters in order to assess the impact of imports on the industry's employment declines. His results indicate that imports were not, as the industry claimed in 1983, the biggest source of injury - a necessary condition for the lawful implementation of safeguards under GATT and WTO law.

Unlike Grossman, we use steel prices rather than employment as our dependent variable. One reason for this difference is that in previous studies such as Crandall (1981), Blecker (1989), and Scott and Blecker (1997), prices appear to be somewhat sensitive to trade barriers. Thus, we can compare the impact of the recent safeguards to other protectionist regimes of the past. Moreover, while employment losses might be an effective barometer of industry suffering, we're less certain that employment *gains* are an equally valid measure of the effectiveness of the safeguards. This is especially true if industry restructuring, a stated goal of the safeguards, leads to job shedding which results in improved efficiency and higher profits.

As will be explained below, our reduced-form equation for the price of steel is,

$$P_{it} = \beta_{0i} + \beta_{1t}\text{IndustrialProduction}_t + \beta_2\text{Ore}_t + \beta_3\text{Coal}_t + \beta_4\text{Electricity}_t + \beta_5\text{Scrap}_t + \beta_6\text{Wage}_t + \beta_7\text{Capacity}_t + \beta_8\text{Dollar}_t + \beta_9\text{Antidumping}_{it} + \beta_{10}\text{Safeguards}_{it} + \beta_{11}\text{China}_t + \beta_{12}\text{Time}, \qquad i=1\text{-}7. \qquad (1)$$

where P_{it} is the inflation-adjusted dollar price of steel in the US during period t, while β_{0i} represents product-specific dummies for the dataset's seven different steel goods. We include an inflation-adjusted index for US industrial production in order to capture downstream demand by industries that consume steel in the production process, such as automobiles, construction, appliances, and equipment.

Key input cost variables include inflation-adjusted price indexes for iron ore, coal, steel scrap, industrial electricity, as well as the dollar value of steel production worker wages. We also control for the overall capacity of steel output by including a steel production capacity index, since plant-closings stemming from bankruptcies and industry consolidation may have helped push up prices starting in 2002.

Unlike Grossman's model, I assume the price of imported steel to be endogenous, and instead include variables that would otherwise serve as instruments for import prices.[15] [16] This includes the value of the US dollar, which is captured by including a trade-weighted dollar index that incorporates a broad basket of currencies of US trade partners. Of course, the steel crisis in the late 1990s was believed by some to have been caused by currency crises (along with steep recessions) in steel exporting countries, such as South Korea and Russia, which in turn led to surges in low-priced exports to the US.

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[15] However, Grossman's simulations break down the impact of import competition into three determinants: exchange rate movements, tariff reductions, and exogenous shifts of the import supply curve. Results indicate that only the exchange rate variable has a consistent and substantial impact on steel employment (the model's dependent variable), with tariff reductions producing far more secondary effects.

[16] Regressions of import prices on the model's variables indicate that the dollar and antidumping indexes are highly significant with their expected signs and support their use as instruments of import prices. Interestingly, coefficients on the dollar variable are consistently greater than one, suggesting more-than-complete pass-through rates for imported steel. Separately, we also include import prices in our full econometric tests on the determinants of US steel prices, and find the variable to be insignificant. This may support the assumption of endogeneity, since imported and domestic US steel prices are very highly correlated. Finally, even with the inclusion of the import price variable, the antidumping and exchange rate variables continue to be statistically significant (although the latter variable is now significant only at the 10 percent level), carrying coefficient estimates that are similar to those produced when import prices are not included in the full model. This is consistent with Grossman's findings that exchange rate fluctuations and duties are the underlying factors behind import competition in the US steel market.

Conversely, the falling dollar after 2002 should have helped US producers by pushing up the price of imported steel. Thus, the expected coefficient on the dollar is negative.

We also include a variable measuring the quantity of China's steel imports from the rest of the world, since increased Chinese demand potentially diminishes the flow of global steel exports to the US. Conventional wisdom dictates that the dramatic rise in steel prices during 2004 stemmed from China's demand for raw materials needed to feed its enormous macroeconomic growth.[17] Our expectation is that as shipments to China increase, competitive pressures in the US market will moderate causing US import prices to rise. To our knowledge, this is the first econometric paper that actually investigates the impact of Chinese steel imports on the welfare of US steel companies.

The last variables in the model capture antidumping duty and safeguard tariff rates, which differ across products and over time.[18] If the safeguards functioned as intended, then we would expect the tariff variable to be positively correlated with steel prices. Finally, we add a time trend in order to capture any exogenous shifts in steel consumption, productivity, and import behavior in the US. All input cost variables, as well as industrial production and the exchange rate index, are divided by the aggregate

[17] In a previous version of the paper, we also included disaggregated steel shipments into the EU, since, following China and the US, the top three importers of steel are Germany, Italy, and France. This data was only available up to march 2004, while the rest of the dataset contains observations through March 2005. Since the EU variable was not statistically significant in early econometric test, it was excluded from subsequent models.

[18] Since antidumping orders have duty rates that vary by country and firm, the product-level antidumping variable was constructed in the following way: First, each country-specific dumping order was multiplied by its "all other manufacturers/exporters" duty rate. These figures were summed for each product to obtain the proxy for AD protection. Although this method fails to account for the size of the import source, we believe that incorporating both the number of cases and the size of the duties leads to an adequate measure of antidumping protection. See appendix 1 for a list of antidumping and countervailing order covering the products included in the dataset.

producer price index in order to adjust for inflation. Finally, all variables except the antidumping and safeguard variables, are estimated in log form.[19]

Data sources are as follows. The disaggregated, domestic, monthly steel price data, which include surcharges that are frequently added to listed prices, come from Purchasing Magazine. Monthly, Chinese steel import quantity data were very generously provided by Ecowin. Price indexes for aluminum, plastic, iron ore, coal, scrap, electricity, and steel wages are from the Bureau of Labor statistics. Aggregate steel capacity, the dollar exchange rate ("trade weighted index – Broad"), industrial production, and the producer price index are all from the Federal Reserve.

IV. Results

Reduced form estimates are found in Table 1. Various lag structures on the exogenous variables were tested in order to check the robustness of our results. It is generally appropriate to incorporate lags when using monthly data, since adjustment to a shock from an independent variable may take several periods. However, the literature provides little guidance regarding how long this period of adjustment should be in the steel industry. Grossman (1986: 209) provides some insight, but his dependent variable is steel employment, which is considerably less flexible than steel prices. In that paper, industrial production and wages are specified as five month free lags, while import and

[19] Augmented Dickey Fuller tests failed to find evidence that the inflation-adjusted price of steel contained a unit root. ADF test statistics incorporating an intercept with trend rejected the presence of a unit root at the one percent level. Correlograms were also analyzed prior to correcting the model for autocorrelation and also failed to reveal the presence of a unit root. Inverted AR (autoregressive) roots were also below 0.95, suggesting the absence of a unit root, although there is clearly need to correct for serial correlation. Generally, when the autoregressive coefficient is very close to unity, there is a strong likelihood of a unit root, i.e. that the autoregressive parameter in the data series is equal to one (random walk). Standard inference procedures can result in biased econometric results in the presence of data series that carry a unit root.

input prices (other than wages) carry an 18 month, fourth degree polynomial distributed lag structure. We test a variety a variety of specifications, and generally find that adjustment to fluctuations in the price of iron ore and steel scrap, as well as the dollar exchange rate, and Chinese steel imports occur more slowly compared with industrial production, coal and electricity prices, production capacity, and the antidumping and safeguard tariff variables. Therefore, in the two specifications presented, the former set of variables carry either six month free lags or nine month, second degree polynomial lags, while the latter set of variables carry either three month or six month free lags.

In all models, industrial production, coal, steel scrap, production capacity and antidumping duties are statistically significant with their expected signs at either the one percent or five percent levels. The importance of the industrial production variable is unsurprising, but the size of the estimated coefficients, which are to be interpreted as long-run elasticities, is worth noting. The average of the two coefficient estimates is around 2.5, suggesting that steel prices are extremely responsive to fluctuations in industrial production. One can see from figure 1, which plots the price of cold rolled steel alongside industrial production, that prices began falling even as industrial production (and the overall economy) was climbing. This was viewed by safeguard advocates as proof that the industry was being damaged by cheap imports, *not* an underperforming macroeconomy. It was not until the middle of 2000, however, when industrial production started to slide (see figure 1), that steel prices headed into their worst slump. The turning point for both steel prices and industrial production occurred during December of 2001, three months *before* the safeguards were implemented. Both variables then rose until mid-2002, fell for approximately another year, and then rose until the end of 2004.

This is not to suggest that the dramatic surge in steel prices during that second half of 2003 and 2004 was entirely due to the expanding economy. Our coefficient estimates indicate that, out of the total 110 percent increase in cold rolled sheet prices during July 2003 and December 2004, around 17 percent was due to rising industrial production, or around 60 dollars per ton.[20] Nevertheless, the generally high degree of correlation between prices and industrial production helps explain why the safeguard variable fails to produce statistically significant coefficient estimates in either of the model's specifications, despite the fact that prices did indeed rise during the policy's early months (See figure 2). The insignificance of the safeguard variable also probably stems from the fact that prices actually began to fall about six months *after* the safeguards were initiated, as figure 2 indicates, and continued to fall for approximately one year. However, it is reasonable to wonder if this slide was caused by the August 2002 announcement that certain products would be excluded from the safeguards. In other words, perhaps price declines stemmed from perceptions that that the safeguards no longer provided significant levels of protection following the product exclusions. Nevertheless, even after we include a dummy variable that controls for months in which product exclusions were announced, the safeguard variable remains insignificant. It's worth noting that the exclusions affected only 25 percent of the imports initially covered, half of which included products used solely by US steel companies. The other half, according to the Office of the US Trade Representative, covered products that either faced no objections from the industry or were not actually produced in the US.[21]

[20] Cold rolled steel prices rose from $360-$755 during July 2003-December 2004. The industrial production index rose 6.6 percent, and with our average calculated elasticity of 2.53, this would suggest that rising industrial production caused steel prices to increase about 16.7 percent. This translates into a price increase of around $60, from $360-$420).

[21] See http://www.citac.info/steeltaskforce/attach/exclusions.pdf

Finally, the possibility of generating a positive and significant safeguard coefficient was undermined by the fact that the most dramatic increase in steel prices occurred shortly after the safeguards were *removed* (see figure 2). Thus, we should not be surprised that our econometric results fail to show a link between the safeguards and higher steel prices.[22] What did cause prices to explode following the cancellation of the safeguards? The most frequently cited factor has been a rise in Chinese steel imports (i.e. world steel exports to China), which restricted the foreign supply of steel to US and Europe. Thus, as western steel companies faced less competition from imports (which China was absorbing), they were free to increase prices.

We test this theory by controlling for the quantity of Chinese steel imports. As table 1 indicates, the China coefficient in our first specifications is not statistically significant at the five percent level. It is highly significant, however, in the second specification which incorporates nine lags on the China variable. Our results, therefore, suggest that China's steel imports impact prices in the US, but only after more than half a year. This somewhat obscured relationship is apparent in figure 3, which graphs the price of cold rolled steel against China's steel imports. Note that steel prices basically stagnated in 2003, when China's steel imports grew to their highest levels.[23] Figure 3

[22] If the coefficient estimates for the safeguard variable *had been* statistically significant, then the calculated elasticities would imply that the implementation of safeguards caused steel prices to rise between 17 and 24 percent. In fact, steel prices for benchmark cold rolled sheet rose only 20 dollars per ton during the entire safeguard period, from $370-$390. On the other hand, prices did rise around 35 percent (from $370-500) during the first six months of the safeguards, lending support to the notion that the policy did boost prices. Of course, the lack of statistical significance on the safeguard variable undermines any assumptions we may make regarding the policy.

[23] For example, average monthly steel imports into China increased from around 2 to 3 million tons between 2002 and 2003, while average cold rolled steel prices fell from around 430 dollars to 380 dollars.

also reveals the fact that Chinese imports were falling in 2004 even as US steel prices surged.[24]

It appears, therefore, that if China is influencing steel prices in the US, it is with a considerable delay. Perhaps US steel executives wait to determine whether trends in China are firmly rooted before responding with price changes.[25] Moreover, if we use the model's estimated coefficients to gauge the magnitude of this effect, we find it to be perhaps smaller than expected. For example, while average cold rolled sheet prices rose 80 percent during degree 2004, it appears that only 12 percent of this increase (about 46 dollars per ton) was due to greater Chinese steel imports.[26] In other words, although steel firms were aided by China's greater absorption of world steel shipments, other contributing forces were clearly at work.

We find strong evidence that domestic production capacity, which is negative and significant in both specifications, played an important role in recent price fluctuations. Declining capacity followed from a wave of bankruptcies during 1998-2001, with some firms ceasing operations entirely.[27] The largest bankrupt firms, however, were acquired by other firms but continued to operate, as LTV and Bethlehem became part of International Steel Group (ISG), and National Steel was purchased by US Steel. LTV, National, and Bethlehem alone comprised about 25 percent of US steel making capacity.

[24] For example, between 2003 and 2004, average cold rolled steel prices increased from about 380 dollars to 690 dollars, while average monthly Chinese steel imports decreased from approximately 3 to 2.4 million tons.

[25] For example, perhaps steel firms in the US only started to lower prices in the fourth quarter of 2004 when it was clear that the decline in Chinese steel imports from early 2004 (due in part to increased Chinese domestic production and capacity) were permanent.

[26] This is calculated in the following way: the average price of cold rolled sheet during 2004 was about 690 dollars per ton, which was an 80 percent increase over the average 2003 price of 383 dollars. Moreover, China's steel imports increased by about 52 percent during 2003. If we multiply our estimated 'China' elasticity of 0.233 by this 52 percent increase, we calculate that about 12 percent of the total 80 price increase in cold rolled sheet was due to higher world shipments of steel to China, which translates into about 46 dollars per ton.

[27] These included Laclede Steel, Geneva Steel, Gulf States Steel and Northwestern Steel and Wire.

Consolidation has continued, with ISG and Ispat Steel merging in 2005 to become Mittal Steel, currently the largest steel company in the world. Thus, perhaps the negative and significant coefficient on the capacity variable serves as a proxy for the increased level of consolidation and market power in the steel industry.[28]

There is also evidence that exchange rates played a role in the collapse and recovery of the steel industry. The negative and significant coefficient on the dollar variable in the first specification indicates that as other currencies fell relative to the dollar, imported steel prices declined and brought down domestic prices with them. This was an expected finding, since our data encompass the period in which currencies from several steel-exporting countries collapsed during the Asian financial crisis. Figure 4, which plots the dollar exchange rate against cold rolled steel prices, reveals how the value of the dollar peaked during early 2002, just before the safeguards were imposed, and generally fell thereafter. As with industrial production, exchange rates conditions started to improve (i.e. the dollar weakened) just as the safeguards were being implemented, thereby facilitating the industry's return to health. More specifically, while the dollar fell about 4.7 percent in the twelve-month period following its February 2002 peak, cold rolled steel prices rose about 28 percent, or $90 per ton. Since the statistically significant exchange rate coefficient in the model is -0.988 (virtually complete pass-through), our results suggest that about 17 percent, or about $15 of the entire $90 per ton increase in cold rolled steel prices, was due to depreciation of the dollar.[29]

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[28] Declining prices in 2005 are testing this newfound market power, as one steel industry analyst stated to the Wall Street Journal, "It's all well and good if certain producers in the US decide to be more disciplined. But, ultimately, if our prices stay higher than the rest of the world because of that discipline, we will attract imports." (WSJ 7/7/05) Apparently, increased domestic market power can help keep prices high as long as there are other outlets for global exports besides than the US.

[29] The trade-weighted dollar index declined 4.7 percent in the 12 months following February 2002, while cold rolled sheet prices rose 28 percent (from $320-$410 per ton) during the same period. If we multiply the 4.7 percent dollar decline by the 'dollar' coefficient of 0.988, we calculate that exchange rate

There is mixed evidence regarding the impact of input costs. Coal and scrap are significant in all specifications, while iron ore, industrial electricity, and production worker wages appear to play almost no role in the formation of steel prices. In fact, iron ore and wages primarily generate negative coefficient estimates, opposite as expected. These counterintuitive results are not unusual in the steel literature. Grossman (1986) and others suggest that iron ore may be endogenous. Another explanation is that some of the integrated firms are insulated from ore price fluctuations because they have historically controlled some of the mines that supply this major input.[30] Concerning the insignificance of steel wages, the likely disconnect stems from long-term contracts frequently based on union negotiations.

Finally, the highly significant antidumping variable indicates that the steel industry, which is involved in between one-third and one-half of all dumping cases, is enjoying at least some benefit from its ongoing involvement with the unfair trade laws. Our coefficients estimates suggest that this benefit may rather modest. Turning to the case of hot rolled sheet, in which 16 antidumping and countervailing duty cases were added between September and December 2001 (to the four cases that were already in place), we find that duties caused prices to rise approximately 7.4 percent.[31] This

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depreciation caused cold rolled sheet prices to rise 4.6 percent, which is around 17 percent of the total 28 percent rise in prices, or about $15 of the entire $90 per ton price increase.

[30] This was pointed out to me by Carey Treado.

[31] See appendix 1 for a list of all antidumping and countervailing duty cases used in the dataset. Our methodology of calculating the increase in antidumping protection for hot rolled sheet in 2001 is as follows: We first multiply the average duty of the four existing antidumping cases prior to September 2001 (69.96 percent) by 4 (the number of cases) to give us a proxy measure of protection equaling 263.83. The addition of the 16 extra cases from September 2001 to December 2001 pushed the average duty on hot rolled sheet down to 50.85 percent, which we then multiply by 20 (the total number of cases covering hot rolled sheet after December 2001). This gives us a proxy measure of protection equaling 1016.98, which represents an increase in protection of 285.47 percent over the preceding level of protection of 263.83. If we multiply this 285.47 percent increase in protection by the average of the two calculated elasticities on our antidumping variable (0.026), we get 7.42. In other words, the 285.47 percent increase in protection covering hot rolled sheet during September 2001-December 2001 caused hot rolled steel prices to rise 7.42

represents a 17 dollar increase over the September 2001 price of 230 dollars for a ton of hot-rolled sheet. In fact, by the time all of the orders were in place at the end December 2001, prices had fallen even lower, to about 210 dollars per ton. Thus, our estimates indicate that additional dumping and countervailing duties prevented hot rolled sheet prices from declining even further.

IV. Conclusion

Despite the persistence of trade relief in the steel industry for over three decades, there is little consensus regarding the impact of such legislation on the welfare of US steel companies. Results from empirical studies produce conflicting results regarding the effectiveness of both quotas and duties. Proponents of the most recent round of protection by President Bush claim that the industry's strong rebound was in great part due to the safeguards. Critics of the tariffs, however, maintain that industry conditions had improved prior to the safeguards, and were primarily the result of other factors such as reductions in US steel-making capacity.

Our study uses an unusually disaggregated and high frequency data panel to investigate these competing claims in order to reveal the key determinants of US steel prices in recent years. As expected, we find overwhelming evidence that steel prices are influenced by business cycle conditions. Declining production capacity which followed a wave of bankruptcies, mergers, and overall industry rationalization, also allowed prices to rise.

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percent. A 7.42 percent increase over the $230 price of hot rolled sheet during September 2001 is equivalent to about $17.

Our results also suggest that demand conditions in China impact US steel prices, but only after a delay of more than six months. One explanation for this finding is that steel executives resist changing prices until shifts in foreign demand are determined to be non-transitory. In contrast, fluctuations in the exchange rate seem to influence steel prices in the US more quickly.

In sum, the steel industry's return to health was facilitated by both internal and external factors, including industry rationalization and consolidation, improved macroeconomic conditions, and a falling dollar. US policymakers could not have predicted that the alignment of these benign forces would occur just prior to the implementation of the safeguards, undermining both the necessity and impact of the tariffs.

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Appendix 1: US Antidumping and Countervailing Duty Orders Included in Dataset

Product	Country	Duties Implemented	Duties Revoked	ITC Case Number	Duty
Hot-rolled carbon steel flat products	Japan	6/30/1999		731-TA-807	29.3
Hot-rolled carbon steel flat products	Brazil*	7/7/1999		731-TA-806	42.12
Hot-rolled carbon steel flat products	Brazil*	7/7/1999		701-TA-384	7.850
Hot-rolled carbon steel flat products	Russia*	7/13/1999		731-TA-808	184.56
Hot-rolled carbon steel flat products	Argentina	9/12/2001		701-TA-404	40.60
Hot-rolled carbon steel flat products	Argentina	9/20/2001		731-TA-898	41.69
Hot-rolled carbon steel flat products	South Africa	9/20/2001		731-TA-905	9.28
Hot-rolled carbon steel flat products	Kazakhstan	11/22/2001		731-TA-902	243.46
Hot-rolled carbon steel flat products	Thailand	11/30/2001		731-TA-907	4.44
Hot-rolled carbon steel flat products	Ukraine	11/30/2001		731-TA-908	90.33
Hot-rolled carbon steel flat products	Romania	11/30/2001		731-TA-904	88.62
Hot-rolled carbon steel flat products	Taiwan	11/30/2001		731-TA-906	20.28
Hot-rolled carbon steel flat products	Netherlands	11/30/2001		731-TA-903	2.59
Hot-rolled carbon steel flat products	China	11/30/2001		731-TA-899	90.83
Hot-rolled carbon steel flat products	Indonesia	12/4/2001		701-TA-406	10.21
Hot-rolled carbon steel flat products	South Africa	12/4/2001		701-TA-407	5.76
Hot-rolled carbon steel flat products	Thailand	12/4/2001		701-TA-408	2.38
Hot-rolled carbon steel flat products	Indonesia	12/4/2001		731-TA-901	47.86
Hot-rolled carbon steel flat products	India	12/4/2001		701-TA-405	16.1
Hot-rolled carbon steel flat products	India	12/4/2001		731-TA-900	38.72
Cold-Rolled Carbon Steel Sheet	Germany	8/19/1993	12/10/2000	731-TA-604	21.66
Cold-Rolled Carbon Steel Sheet	South Korea	8/19/1993	12/10/2000	731-TA-607	14.44
Cold-Rolled Carbon Steel Sheet	Netherlands	8/19/1993	12/10/2000	731-TA-608	20.19
Cold-Rolled Carbon Steel Flat Products	Germany	8/19/1993	12/15/2000	701-TA-340	1.030
Cold-Rolled Carbon Steel Flat Products	Korea	8/19/1993	12/15/2000	701-TA-342	4.490
Corrosion-Resistant Carbon Steel Sheet	Australia	8/19/1993		731-TA-612	24.96
Corrosion-Resistant Carbon Steel Sheet	Canada	8/19/1993		731-TA-614	22.29
Corrosion-Resistant Carbon Steel Sheet	France	8/19/1993		731-TA-615	39.40
Corrosion-Resistant Carbon Steel Sheet	Germany	8/19/1993		731-TA-616	4.18
Corrosion-Resistant Carbon Steel Sheet	Japan	8/19/1993		731-TA-617	36.41
Corrosion-Resistant Carbon Steel Sheet	South Africa	8/19/1993		731-TA-618	17.70
Corrosion-Resistant Carbon Steel Flat Products	France	8/19/1993		701-TA-348	15.120
Corrosion-Resistant Carbon Steel Flat Products	Germany	8/19/1993	12/15/2000	701-TA-349	0.600
Corrosion-Resistant Carbon Steel Flat Products	South Africa	8/19/1993	12/15/2000	701-TA-350	2.690

Appendix 1: Continued

Product	Country	Duties Implemented	Duties Revoked	ITC Case Number	Duty
Structural steel beams	Japan	6/20/2000		731-TA-853	31.98
Structural steel beams	South Africa	8/15/2000		701-TA-401	3.87
Structural steel beams	South Africa	8/19/2000		731-TA-854	37.21
Steel concrete reinforcing bar	Turkey	4/18/1997		731-TA-745	16.06
Steel concrete reinforcing bar	Belarus	9/8/2001		731-TA-873	114.53
Steel concrete reinforcing bar	China	9/8/2001		731-TA-874	133
Steel concrete reinforcing bar	Indonesia	9/8/2001		731-TA-875	60.46
Steel concrete reinforcing bar	South Africa	9/8/2001		731-TA-877	22.89
Steel concrete reinforcing bar	Latvia	9/8/2001		731-TA-878	17.21
Steel concrete reinforcing bar	Moldova	9/8/2001		731-TA-879	232.86
Steel concrete reinforcing bar	Poland	9/8/2001		731-TA-880	47.13
Steel concrete reinforcing bar	Ukraine	9/8/2001		731-TA-882	41.69

Source: USITC, Bruce Blonigen's Antidumping Database (http://darkwing.uoregon.edu/%7Ebruceb/adpage.html), Chad Bown's Global Antidumping Database (http://people.brandeis.edu/~cbown/global_ad/)

*Note: suspension agreements were established for orders covering hot-rolled carbon steel flat products from Brazil (731-TA-806, 701-TA-384) and Russia (731-TA-808). The suspension agreement for the Brazilian antidumping case was terminated and duties were implemented on 9/17/04, with the 7.81 duty originally calculated by the USDOC. The suspension agreement for the Brazilian CVD case was terminated on 2/11/02. In calculating the antidumping variable used in the econometric tests, I incorporate the final duty calculated by the USDOC for these three cases, since the literature indicates that terminated and suspended cases still frequently result in higher prices (See Prusa, 1992).

Table 1: Reduced-Form Estimates of the Determinants of Monthly US Steel Prices [a, b]

Exogenous Variable	Pred Sign	6 month lags – China, dollar, ore, scrap 3 month lags - all other variables **Coefficient**	9 month lags – China, dollar, ore, scrap 6 month lags - all other variables **Coefficient**
Industrial production	+	2.250**	2.808**
		(0.569)	(0.859)
Ore price	+	0.352	1.098
		(0.472)	(0.775)
Coal price	+	0.688**	1.106**
		(0.268)	(0.355)
Scrap price	+	0.836**	0.814**
		(0.074)	(0.114)
Electricity price	+	0.356	-0.914*
		(0.193)	(0.384)
Wage	+	-1.171	-1.663
		(0.718)	(1.347)
Production capacity	-	-2.809**	-4.308**
		(1.200)	(1.655)
Dollar	-	-0.988*	-1.277
		(0.472)	(0.787)
China	+	0.079	0.233**
		(0.048)	(0.082)
Antidumping duty	+	0.023**	0.029**
		(0.007)	(0.008)
Safeguard tariff	+	0.254	0.172
		(0.197)	(0.201)
Time	?	-0.004	-0.007
		(0.003)	(0.004)
R-squared		0.98	0.98
Inverted AR Roots		0.93	0.92
Durbin-Watson stat		1.82	1.91

**, * indicate statistical significance at the one and five percent levels, respectively.
[a] Industry Specific intercepts are not displayed in order to save space.
[b] Errors are corrected for autocorrelation and heteroskedasticity.

Figure 1. Industrial Production and Cold Rolled Steel Prices

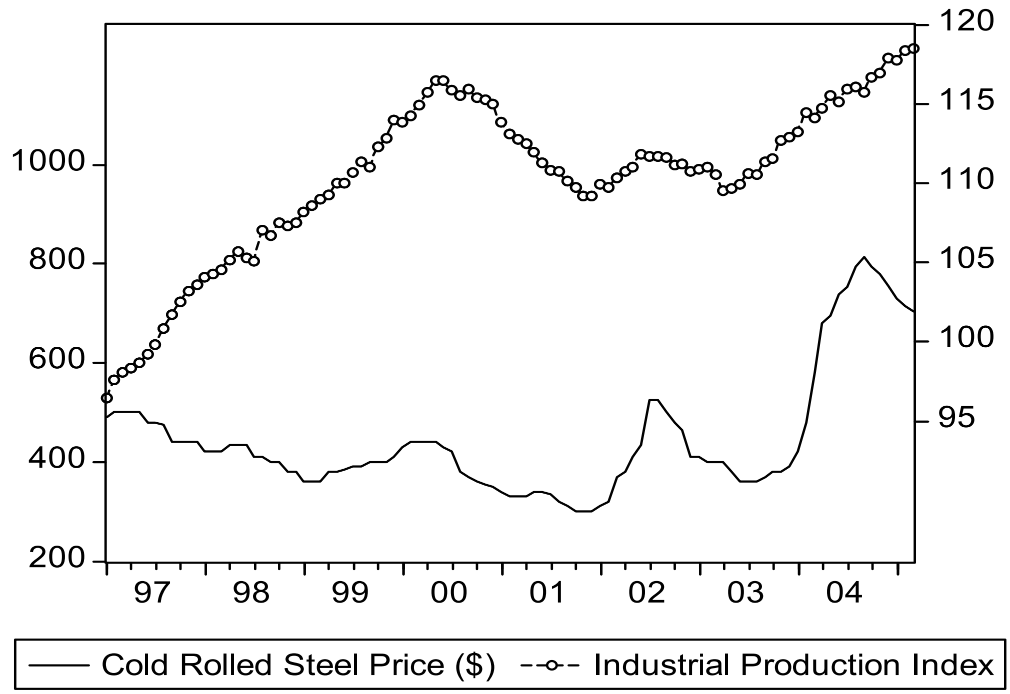

Figure 2. Safeguard Period and Cold Rolled Steel Prices

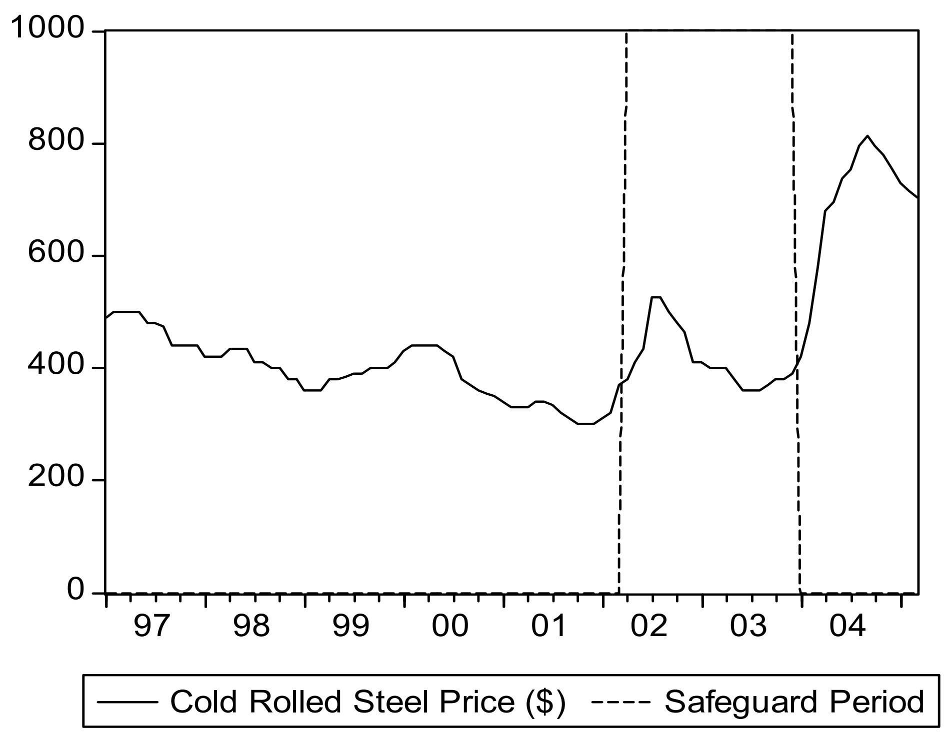

Figure 3. Chinese Steel Imports and Cold Rolled Steel Prices

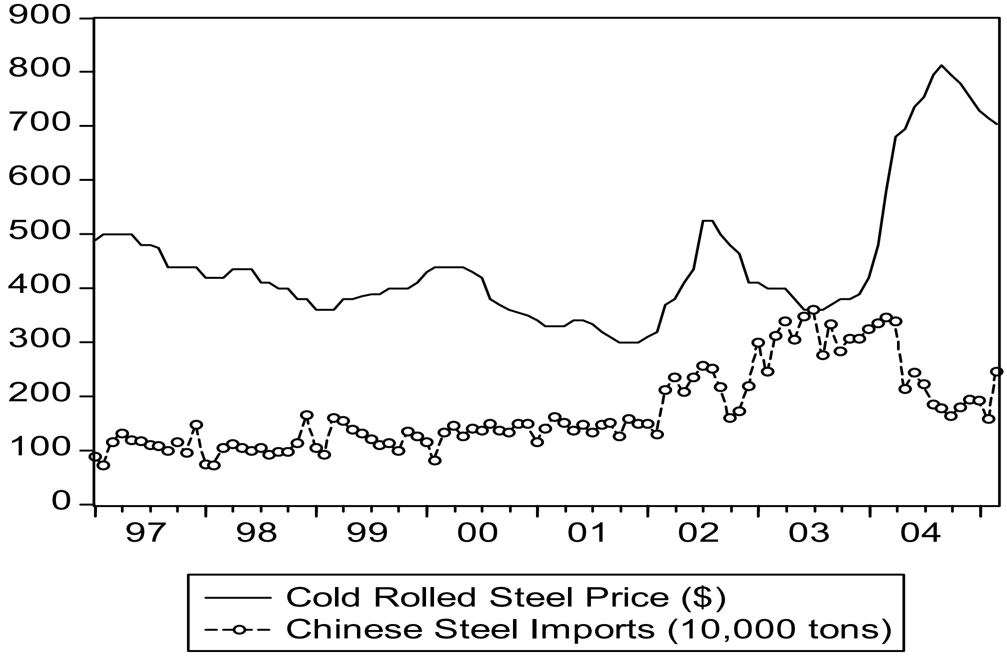

Figure 4. Dollar Exchange Rate Index and Cold Rolled Steel Prices