Did Late-Nineteenth-Century U.S. Tariffs Promote Infant Industries? Evidence from the Tinplate Industry

DOUGLAS A. IRWIN

Did late-nineteenth-century U.S. tariffs promote infant industries? After earlier failures, the tinplate industry became established and flourished after receiving protection with the 1890 McKinley tariff. Treating producers’ entry and exit decisions as endogenous, a probability model is estimated to determine the conditions under which domestic tinplate production will occur. Counterfactual simulations indicate that, without the McKinley duties, domestic tinplate production would have arisen about a decade later as U.S. iron and steel input prices converged with those in Britain. Although the tariff accelerated the industry’s development, welfare calculations suggest that protection does not pass a cost-benefit test.

The United States rapidly industrialized in the late nineteenth century and, around the turn of the century, became not just a net exporter of manufactured goods for the first time, but the world’s leading producer of such goods. This industrial expansion occurred during a period of high import tariffs, raising the question of whether protection contributed to the U.S. success in manufacturing by fostering the growth of infant industries. Agreeing with those who later found it difficult to rule out a possible beneficial role of tariffs during this period, Frank Taussig stated that “there is a prima facie case for the protectionist,—again an apparent confirmation of the validity of the young industries argument,—from the nature and extent of the industrial development during the last two decades of the nineteenth century.”

Taussig remained agnostic, however, because he recognized that the impact of protection can be determined only by answering a counterfactual question about how an industry would have developed in the absence of the tariff. This counterfactual is particularly important in considering the iron and steel industry, in which the strongest candidates for examples of “successful” protection have tended to be. America’s abundance of natural re-

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1 Taussig, Some Aspects, p. 153. Although skeptical of antebellum infant-industry protection, Taussig was so impressed by the post–Civil War industrial expansion that, “notwithstanding early prepossessions to the contrary, I am disposed to admit that there is scope for protection to young industries even in such a later stage of development.” Ibid., p. 21. For a recent discussion of this issue, see De Long, “Trade Policy.”
sources, such as iron ore and coal in Pennsylvania and elsewhere, has led many to believe that the U.S. iron and steel industry would have developed at some point anyway, even without the benefit of protection. Taussig himself suggested that "the same sort of growth [in iron and steel] would doubtless have taken place eventually, tariff or no tariff; but not so soon or on so great a scale."2

Such assertions require substantiation, and if true the question then becomes one of whether it proved worthwhile to impose protective tariffs in order to establish domestic production of a product in advance of when it otherwise would have arisen. This article investigates such issues by focusing on a segment of the iron and steel industry that has been heralded as possibly the best example of infant-industry protection. The experience of the tinplate industry, which produces thin sheets of iron or steel that have been coated with tin, is unique on several dimensions. First, unlike most manufacturing industries, tinplate did not receive significant tariff protection after the Civil War, apparently due to a mistaken interpretation of the tariff code. Left without adequate protection, there was virtually no domestic production prior to 1890. Second, the McKinley tariff of 1890 substantially raised the duty on imported tinplate to encourage the entry and growth of domestic producers. The act also contained an unusual provision in which the tariff would have been completely eliminated in six years if, by that time, domestic production had not amounted to at least one-third of imports. Finally, the tariff succeeded in promoting domestic production, and output rapidly expanded, despite a tariff reduction during the period from 1894 to 1897. By about 1910 the price of U.S. tinplates fell below those produced in the United Kingdom, and the United States became a net exporter.

The tinplate example has all the elements of an apparently successful application of infant industry protection. The industry failed to receive protection initially, and it clearly did not develop until protection was applied. The industry improved rapidly and domestic prices fell to the world price level within two decades. But the counterfactual question remains: would the industry have developed anyway, and were the tariffs worthwhile?

To anticipate the article's main conclusions, the analysis here suggests that tinplate was not an "infant industry" that floundered due to the lack of previous production experience, but rather one in which domestic production was not profitable until the high domestic cost of iron and steel inputs fell to levels that roughly matched those of foreign rivals. In the absence of the

2 Taussig, Some Aspects, p. 151. Others have endorsed Taussig's judgment. Berglund and Wright maintain that "whatever had been our policy with respect to the tariff, the United States would have developed a great iron and steel industry," Berglund and Wright, Tariff, p. 134. Hogan argues that "it seems inevitable that with our resources of ore and coal that the United States would naturally have been an iron and steel producer," although "it also seems probable that British competition might have hindered the proper growth of the industry in the early years." Hogan, Economic History, Vol. 1, p. 357.
Tariffs and the Tinplate Industry

McKinley tariff, the U.S. tinplate industry would have established itself about a decade later as those material input costs converged with those abroad. Over this time horizon, the McKinley duty fails to pass a cost-benefit test.

SEARCHING FOR LATE-NINETEENTH-CENTURY INFANT INDUSTRIES: THE CASE OF TINPLATE

Import tariffs were frequently justified on infant-industry grounds in the nineteenth century United States. Noting that "there has been virtually no systematic examination of the empirical relevance of the infant industry argument," Anne Krueger and Baran Tuncer attempted to evaluate such protection by examining the relationship between various measures of trade protection and total factor productivity growth across industries. Yet interpreting cross-industry correlations of measures of trade policy (such as the nominal tariff or the effective rate of protection) and measures of sectoral economic performance (such as total factor productivity) is exceedingly problematic.

Such problems force us to take up Taussig's suggestion that the best approach to analyzing infant-industry protection is "by direct investigation of the particular cases." But despite the breadth of the late-nineteenth-century U.S. industrial expansion, surprisingly few candidates have been proposed as successful instances of such protection. Cotton and woolen manufactures were, by this time, old industries that had been protected for decades. Taussig and others favorably mention the silk industry as one that successfully matured under protection, but this industry apparently required substantial, ongoing protection. Protection surely succeeded in increasing domestic

3 For a discussion of the infant-industry argument for protection, see Irwin, Against the Tide, chap. 8.
4 Krueger and Tuncer, "Empirical Test," p. 1142. Paul David and Jeffrey Williamson, however, have debated the evidence on infant-industry protection for the ante-bellum U.S. cotton textile industry: David, "Learning"; and Williamson, "Embodiment."
5 The working-paper version of this article reported that the Spearman rank correlation of the effective rate of protection and total factor productivity (for 14 sectors over the period 1899 to 1909) is 0.27, but not statistically significant at standard confidence levels. Any interpretation of this broad correlation, however, is plagued by numerous difficulties. First, the measures of policy intervention are poor because input substitution can render calculations of the effective rates of protection meaningless in general equilibrium. Second, the specific timing of productivity changes in relation to protection can always be questioned, particularly in this period when the tariff is roughly constant over time. Third, the sectoral definitions are so broad as to possibly encompass both leading and lagging industries, masking the role of the tariff in particular cases. Finally, and perhaps most importantly, no attempt is made to control for other factors determining productivity at the same time. Furthermore, in the absence of a well-specified benchmark or alternative, any specific result is uninformative: how does one assess whether any particular correlation is high or low?
6 Taussig, p. 29.
7 James Swank, the "ultra-protectionist" secretary of the American Iron and Steel Association, "had largely jettisoned whatever systematic theory of protection he ever had" and "de-emphasized the basic 'infant industries' argument. Only in silk and tinplate was he ever able to claim vindication of protection for that purpose. Even then, he could not prove that these two manufactures would not have developed without protection." Tedesco, Patriotism, p. 190.
output in these cases, but advantageous infant-industry protection requires that the domestic industry’s prices soon fall to the world level so that the present discounted value of social benefits at least has a chance of exceeding that of the costs.

More suitable cases appear in accounts of the iron and steel industry, in which the tinplate industry is frequently mentioned. The tinplate industry differs from nearly every other manufacturing industry in that it did not receive significant protection initially, but only after decades had passed with virtually no domestic production. The industry initially failed to receive protection because of a mistaken interpretation of the tariff code in 1864 by the Secretary of the Treasury, who erroneously moved a comma in the tariff act by just two words. As a result, instead of receiving a more than 50 percent ad valorem tariff implied by the 1864 act, imported tinplates were construed as falling under a different section of the tariff code in which they received a 15 percent duty. This mistake provides us with the rare opportunity to observe what would happen to a manufacturing industry that did not receive protection during this period.

As a result of the Treasury decision, there was no domestic production in the late 1860s and virtually all of U.S. consumption was served by imports from the United Kingdom, where production was highly concentrated in South Wales. U.S. demand for tinplate grew steadily through the late nineteenth century as it proved useful in making cans to preserve food, drums to store and ship petroleum, sheets for roofing, and various household utensils. Despite the low level of tariff protection, high prices for tinplate prompted

8 Keith Head has examined protection and the steel rail industry, which grew rapidly under the protection, survived the phased reduction and eventual removal of import duties, and eventually began to export as its prices fell below those in the United Kingdom. He performs a counterfactual simulation of steel rail tariff policies in which country-specific learning by doing proves so important that, under free trade, the U.S. industry never begins production until almost 1913. Head, “Infant Industry Protection.” This paper is discussed further in note 27.

9 For general discussions of the tinplate industry, see Ayers, “Tinplate Industry”; Gray, “Development”; Dunbar, Tinplate Industry; and Minchinton, British Tinplate Industry.

10 The Tariff Act of 1864 provided for the following duty on imported tinplate: “On tinplates, and iron galvanized or coated with any metal by electric batteries or otherwise, two cents and a half per pound.” U.S. House of Representatives, Tariff Acts, p. 233. A month after Congress enacted this tariff, Secretary of the Treasury William Fessenden informed the customs collector in New York that there was an “error of punctuation” in the provision, “probably by the clerk who engrossed that part of the act,” he speculated. If the comma after the word “tinplates” was moved to after the word “iron,” Fessenden suggested, then “the true sense” of the provision would be clear, namely that “the tin plates as well as the iron must be galvanized or coated with any metal . . . in order to bring them within the provision.” Tariff Commission, Report, p. 2082. Fessenden apparently did not realize exactly what tinplates are: not plates of tin coated with another metal, but plates of iron or steel that have been dipped in molten tin. The interpretation is clearly erroneous because no one has ever sought to coat tin or tinplates with another metal.

11 Wales exported roughly three-quarters of its output to the United States. By contrast, Germany was a relatively small producer of tinplate; see Webb, “Tariffs,” p. 323, n. 47; and Minchinton, British Tinplate Industry, p. 61.
three U.S. firms, begun at the initiative or with the assistance of Welsh immigrants, to begin producing tinplate in western Pennsylvania and eastern Ohio during the 1872 to 1874 period.\textsuperscript{12}

Unfortunately for the U.S. producers, tinplate prices peaked in 1872 and then collapsed, as illustrated in Figure 1. The three fledgling firms claimed that Welsh exporters were deliberately "dumping" their products in order to drive them out of business. Indeed, the firms shut down production sequentially, one in 1874, another in 1875, and the last in 1877. The price collapse, however, probably did not reflect "dumping" but rather the "recurrent problem of overproduction."\textsuperscript{13} High margins for U.K. tinplate producers during the early 1870s had induced the entry of many other Welsh producers; there were roughly a third more mills operating in Wales in 1878 (a total of 229) than there had been a decade earlier. A Welsh producer association attempted to limit output and raise prices, but the

\textsuperscript{12} See Minchinton, ibid., p. 63; and Clark, History, p. 373.

\textsuperscript{13} Minchinton, ibid., p. 48.
result was "wholly ineffective."\textsuperscript{14} Prices stabilized by the late 1870s, but too late to help the U.S. firms. The timing of the price decline and subsequent modest rise, however, lent credibility to charges that Welsh producers deliberately raised their prices after having successfully eliminated their American rivals through dumping.

Tinplate interests agitated throughout the 1870s and 1880s for a higher tariff, but to no avail.\textsuperscript{15} Finally, in 1890, William McKinley, the chairman of the House Ways and Means Committee who represented the Ohio region where tinplate producers had originally sought to establish production, embraced the tinplate cause and proposed a higher tariff. Despite the fact that protectionist Republicans controlled Congress, serious political obstacles stood in the way of establishing high duties on tinplate. Although there was a domestic tinplate interest, there was no domestic tinplate production. Past efforts to establish production had demonstrably failed, and there was no assurance that new firms would enter the business or that they would be successful. Tinplate consumers—particularly the Standard Oil Company, the food canning industry, and the roofing industry, all of which used tinplate extensively—were well organized and actively opposed the tariff hike. In light of these considerations, even the Republicans found it difficult to muster political support for higher tinplate duties. At the Ways and Means Committee’s recommendation, the House passed by a single vote, 150 to 149, an amendment to raise the tinplate duty to 2.2 cents per pound.\textsuperscript{16}

Opponents of the duty fought aggressively in the Senate. To counter the fear that the duty would merely cost tinplate-consuming industries without ensuring domestic production, Senator William Spooner (R-WI) introduced an amendment in which the 2.2 cents per pound duty would be effective only from 1 July 1891 (not 1 October 1890, when the McKinley tariff went into effect) and included the following unusual provision: "after October 1, 1897, tin and terne plates . . . should be admitted free of duty, unless it shall be made to appear to the satisfaction of the President that the aggregate quantity

\textsuperscript{14} Ibid., pp. 49–50.

\textsuperscript{15} The defunct tinplate producers appeared before the House Ways and Means Committee in 1877 to complain about the lack of adequate tariff protection, but achieved no remedy. Domestic tinplate interests then appealed, unsuccessfully, to the Secretary of the Treasury for a reconsideration of the 1864 tariff interpretation. Tinplate interests then explained their plight to a sympathetic Tariff Commission, which recommended "that a moderate rate of duty will develop this important industry, and that wise public policy dictates that at least a part of the amount consumed in this country of so essential an article as tin plate should be produced here." Tariff Commission, Report, p. 20. Congress ignored this advice and even reduced the duty to one cent per pound in 1883.

\textsuperscript{16} Stanwood, American Tariff Controversies, pp. 272ff. The Ways and Means Committee report stated that "there is no reason except inadequate protection why we are not today manufacturing the more than $21,000,000 worth of tin[plate] now imported. . . . If the recommendation of the committee is adopted, it is believed that a new and important industry will be secured to the United States with large resultant benefits to the people." U.S. House of Representatives, To Reduce the Revenue, pp. 13–14.
of such plates... produced in the United States during any of the six years next preceding June 30, 1897, has equaled one third of the amount of such plates imported and entered for consumption during any fiscal year after the passage of this act and prior to said October 1, 1897." Thus, protection was to be conditional or probationary to see if domestic tinplate production was viable. (Of course, Congress could not commit itself to enforcing this particular provision.) Tinplate interests disliked this condition but accepted it, given their precarious political position, and the provision was enacted.

The McKinley duty sharply increased protection to the industry. Figure 2 depicts the ad valorem equivalent of the specific tinplate duties and indicates that the McKinley act pushed the tariff from about 30 percent to over 70 percent. Tinplate imports from Wales initially surged to beat the imposition.

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18 Democrats took a dim view of the tinplate tariff, saying that it "involved a new and distinct perversion of the Federal taxing power by making present, tangible, and profitable industries the sport and prey of prospective, conjectural, and speculative adventures." U.S. House of Representatives, "Revision of the Tariff," (1892), p. 2. In 1894 they cut the tinplate duty to 1.2 cents per pound. The Republicans raised the duty to 1.5 cents per pound in 1897, but by this time the industry was firmly established. Subsequent tariff changes appear to have had little effect on the industry.
of the duty, but shrank thereafter. Many firms entered the industry, and domestic production increased sharply. Figure 3 illustrates how domestic production soared after 1891, matching the quantity of imports by 1896 and capturing nearly 90 percent of the market by 1899. By 1899 there were 57 U.S. tinplate firms in operation, 35 of which rolled their own iron and steel plates while the others purchased those plates from U.S. and U.K. producers and just engaged in the tin dipping operation.  

The success of the tinplate industry was greeted with tremendous enthusiasm by its proponents. "The growth of this industry was heralded in the protectionist press as a dramatic illustration of the benefits of a high tariff," Victor Clark reports, "and consequently new entrepreneurs received an unusual amount of publicity. . . . though contemporary records of [the industry's] progress bear abundant evidence of

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19 Gray, "Tin and Terne Plate," pp. 99–100. There were apparently no cost savings from vertically integrating iron and steel production or rolling and tinplate manufacturing. As Lamoreaux notes, "none of the important [tinplate] firms had integrated backward into steel production to save on the cost of billets (most likely because their steel requirements were not great enough to justify an investment sufficient to capture scale economies). At the same time, those manufacturers who believed their connections with neighboring steel mills gave them a cost advantage quickly discovered that their competitors could obtain similar concessions." Lamoreaux, Great Merger Movement, pp. 39–40.
juvenile exaggeration and evidence.” Later commentators also singled out the tinplate industry for distinction. While generally skeptical of iron and steel tariffs, Abraham Berglund and Philip Wright state that the “efficacy of the tariff in fostering a new industry is especially manifest in the case of tin and terneplate,” an example “so striking that it calls for special mention.”

At the same time, the counterfactual question must be confronted. Taussig believed that “the unexpected growth of the tin plate industry after 1890 was due chiefly to the cheapening of the fundamental raw material,” namely, iron and steel bars. Howard Knox argues that “it is a misconception for anyone to attribute the beginning of the tin plate industry in this country to the McKinley Tariff Act” because “this protective tariff hastened its start, but it was inevitable that American ingenuity and steel-making resources would have eventually accomplished the same results at some later date.” Clark also notes that “the United States afforded the largest market in the world for tin cans for preserving food stuffs and shipping petroleum, and for other tin containers,” the implication being that some domestic tinplate production probably would have been established at some point anyway.

BARRIERS TO ESTABLISHING DOMESTIC TINPLATE PRODUCTION

What factors prevented the establishment of domestic tinplate production prior to the McKinley tariff? Two potentially important determinants of an entrant’s production costs were the prices of raw material inputs and the lack of previous production experience, in other words, dynamic scale economies resulting from learning by doing. This section seeks to ascertain the relative importance of these two factors.

Raw materials costs, particularly of the iron and steel sheets which were to be coated with tin, were critical for the tinplate industry. Iron and steel inputs accounted for nearly three-quarters of the cost of producing tinplate and about two-thirds of the value of tinplate. In 1899 the U.S. tin and terne plate industry used $20.7 million worth of iron and steel to make tinplate.

Clark, *History*, p. 374. In its annual report for 1892, for example, the American Iron and Steel Institute proudly proclaimed that “The McKinley tariff is entitled to the whole credit of establishing this new industry.” Quoted in Hogan, *Economic History*, p. 353.

Berglund and Wright, *Tariff*, p. 130. “The most spectacular event in American metallurgical history” during the last two decades of the nineteenth century, Clark declares, was “the final establishment of the tin plate industry under the stimulus of the McKinley tariff.” Clark, *History*, p. 372. Temin also suggests that tinplates provide an example of tariffs working out in the best possible way. Temin, *Iron*, p. 212.


Clark, *History*, p. 375. The number of domestic canning firms grew from 97 in 1871 to 411 in 1880 to 886 in 1890, all in a period in which there was no significant domestic tinplate production. See Minchinton, *British Tinplate Industry*, p. 63.
that cost $28.6 million (in materials and labor) to produce and which sold at a value of $31.9 million, according to Census of Manufactures data. On this score, Welsh producers had a significant cost advantage over potential American rivals: due in part to high import tariffs, U.S. prices of iron and steel greatly exceeded U.K. prices for most of the late nineteenth century. As a result, iron- and steel-using industries in the United States paid a significant premium for their inputs compared with their foreign counterparts.

Figure 4 plots the price premium on iron bar paid by U.S. tinplate producers vis-à-vis their Welsh rivals. In 1869 the price of basic bar iron in the United States was double that in the United Kingdom, but the price differential rapidly fell to about 20 percent above that in the United Kingdom in the early 1870s. Through most of the 1880s, however, U.S. iron bar prices stood roughly 70 percent above those in the United Kingdom, but the premium declined again in the early 1890s until the prices were virtually equivalent by the turn of the century. Variation in the relative price of iron bars appears closely related to the entry of U.S. tinplate producers: when the premium was high (1860s and 1880s), the effective protection given to domestic

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producers was significantly negative; when the premium was low (mid-1870s, mid-1890s), domestic tinplate production was profitable. This is the basis for the belief that the declining input price premium would have enabled domestic tinplate producers to enter the industry eventually even without the aid of the McKinley tariff.

Another potential barrier to the establishment of domestic tinplate production, and one particularly relevant to the infant-industry argument for protection, is the lack of previous production experience. If cumulative production experience significantly reduced production costs (that is, learning by doing), then late entrants in the industry could face a significant cost disadvantage compared to incumbents. The case for intervention, however, hinges crucially on the degree to which the knowledge generated by production experience spills over between firms and between countries. If there are international spillovers, then the obstacles to entrants who lack production experience are less severe because they can learn from the experience of other established producers.

The U.S. tinplate industry appears to have been characterized by both domestic and international technological and learning-based knowledge spillovers. Tinplate interests argued for tariff protection on the basis that domestic learning spillovers would enable the industry to reduce prices rapidly. As the president of the American Tin Plate Association maintained during the consideration of the McKinley tariff, “after we get 50 mills in this country and exchange our ideas we can reduce the price by the use of improved machinery and methods which they never thought of in the other countries.” The domestic spillovers received specific impetus from a gentleman’s agreement to facilitate the passage of the tinplate provision in the McKinley tariff. In order to obtain Senator Spooner’s vote, the U.S. Iron and Tinplate Company, the first domestic entrant at this time, gave “consent to

26 For example, using the basic formula for effective protection, if iron and steel account for two-thirds of the cost of producing tinplate and the tariff on iron and steel is 75 percent, then a nominal tariff on tinplate of 25 percent delivers an effective rate of protection of 72 percent!

27 In examining the steel rail industry, Head finds significant learning effects that are assumed to spill over perfectly between domestic firms, but his empirical analysis rules out international spillovers of learning-based knowledge. Head ("Infant Industry Protection,” p. 149) writes that “these assumptions, which appear frequently in the theoretical literature, seem appropriate if we think of accumulated knowledge as residing within entrepreneurs, engineers, and workers who either communicate with each other or move from one domestic firm to another but never move overseas.” The assumption of no international spillovers, implying that subsequent entrants cannot adapt or build upon the production experience of the British leaders, essentially ensures that initial producers have an entrenched and virtually insurmountable advantage over subsequent rivals. Yet this period was also one of tremendous international labor mobility and the United States was the principal destination for skilled European migrants. The assumption is hard to sustain in view of a 1901 report by a visiting party of British iron officials which noted that “a considerably number of the heads of the American iron industry of today acquired their training, their knowledge, and their experience in British works.” Quoted in Berthoff, British Immigrants, p. 67. See also Hyde, “Iron and Steel Technologies.”

keep its mills open for inspection by and demonstration to any prospective Tinplate manufacturers and their engineers,” according to the company’s president, William Cronemeyer.29

The international spillovers arose from the migration of skilled tinplate workers from Wales to the United States. The U.S. plants initiating production in the 1870s were partly owned or managed by Welshmen. These immigrants carried with them technical knowledge of tinplate production and essentially transplanted current Welsh production methods into the United States. After the imposition of the McKinley tariff, “Welsh manufacturers moved all or parts of their plants to America, though, since the tariff protected only the final dipping process, many still imported all the materials from Wales,” according to Rowland Berthoff. Berthoff also states that “whether owned by Welshmen or Americans, the early works relied on the skill of Welsh tinners using Welsh machinery and Welsh techniques. Within a few years, however, as equipment and methods were improved, Welsh workmen no longer were necessary nor, over-fond of time-honored ways, even desirable.”30 U.S. firms successfully recruited skilled Welsh labor and attracted them to the United States. That U.S. tinplate entrants could draw upon Welsh production techniques by hiring the skill and expertise of Welsh tinners suggests that they did not face insurmountable hurdles to entering the industry.

To provide some empirical evidence on the economic importance of raw materials costs and experience effects, the following cost markup equation is employed (using price data due to the unavailability of cost data) to explain the variation in tinplate prices observed in Figure 1. Suppressing time subscripts, the following log-linear specification is employed

\[
\log (p_{US}) = \alpha + \beta \log (pb_{US}) + \lambda \log (E_{US}) + \mu \log (time) + \epsilon, \quad (1)
\]

where \( p_{US} \) is the U.S. price of tinplate, \( pb_{US} \) is the U.S. price of iron bars, the experience variable \( E_{US} \) represents the lagged cumulative production of U.S. producers, time is a linear trend, and \( \epsilon \) is an error term. The estimated parameters can be interpreted as follows: \( \alpha \) is the fixed and \( \mu \) is the time-varying markup over marginal cost, \( \beta \) captures the role of iron bar costs, \( \lambda \) is the effect of production experience (learning by doing) on costs.31

29 Cronemeyer, “Development,” p. 45. Lamoreaux (Great Merger Movement, p. 40) notes that “because the basic technology of tinplate manufacture had been developed earlier in Wales, there were no crucial patents to provide one American firm with an advantage over the rest. Those improvements in technique that did occur in the United States . . . appear to have diffused rapidly throughout the industry in the early 1890s.”

30 Berthoff, British Immigrants, pp. 68–69. As Taussig (Some Aspects, p. 185) also notes, “When the McKinley Act was passed in 1890, the tin plate mills first established in the United States were copied from the Welsh. Sometimes the whole equipment,—rolls, shears, pots,—was imported, and then was operated by Welshmen also brought over.”

31 This specification embodies several assumptions. In lieu of firm-level data, the use of industry-level data to estimate this equation implies that cost reductions due to domestic production experience
TABLE 1
ESTIMATES OF TINPLATE PRODUCTION COSTS

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1) OLS</th>
<th>(2) AR Correction</th>
<th>(3) First Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha ) (constant)</td>
<td>1.73</td>
<td>1.84</td>
<td>—</td>
</tr>
<tr>
<td>( \beta ) (price of iron bars)</td>
<td>(0.15)</td>
<td>(0.31)</td>
<td>0.40</td>
</tr>
<tr>
<td>( \lambda ) (experience)</td>
<td>-0.015</td>
<td>-0.014</td>
<td>0.004</td>
</tr>
<tr>
<td>( \mu ) (time trend)</td>
<td>-0.014</td>
<td>-0.02</td>
<td>-0.018</td>
</tr>
<tr>
<td>AR (1) correction</td>
<td>—</td>
<td>0.54</td>
<td>—</td>
</tr>
<tr>
<td>Adjusted ( R^2 )</td>
<td>0.67</td>
<td>0.78</td>
<td>0.27</td>
</tr>
<tr>
<td>Durbin-Watson</td>
<td>0.83</td>
<td>1.26</td>
<td>1.68</td>
</tr>
</tbody>
</table>

Notes: The dependent variable is the U.S. price of tinplate. Standard errors, in parenthesis, have been corrected for heteroskedasticity. The sample time period is 1891 to 1913.

Table 1 applies several different estimation methods to equation 1 using annual data from 1891 through 1913, the period in which we observe continuous U.S. tinplate production. In the first column of Table 1, the coefficient on the price of iron bars indicates that a 1 percent increase in the price of iron bars increases the price (cost) of tinplate by about 0.4 percent, roughly consistent with the cost data discussed above. Cumulative production experience also appears to reduce costs, but the learning coefficient of –0.015 implies that a doubling of cumulative output would reduce costs by only 1 percent (calculated as \( 1 - 2^{-0.015} \)). The coefficient on time indicates that there were cost reductions on the order of 1.4 percent per year due to continuous technological progress. The next two columns correct for bias due to serial correlation. An AR(1) correction does not have a substantial impact on the estimates, and under a first-difference specification there does not appear to be any learning by doing during this period.
Thus, the effect of production experience on costs appears trivial when compared with the benefit of cheaper iron bars: a 2.5 percent decline in the price of iron bars would have the same effect on costs as a doubling of cumulative output.\textsuperscript{32} In view of the limited scope for cutting costs beyond the price of the necessary material inputs, as suggested by the flattening of U.K. margins after 1890, this finding is perhaps not too surprising.

These econometric results are consistent with other descriptive industry evidence. It is hard to describe the tinplate industry as one in which static or dynamic scale economies served as a barrier to new entrants. The large number of firms (and apparently easy entry of those firms) suggests that there were no great economies of scale. Learning by doing had only a modest impact on costs, and what effect there was appears to have been easily transferable internationally. Partly because they could adopt current Welsh production practices and technology and not start from scratch, U.S. producers were willing to enter the industry in 1891 at much lower tinplate prices than had prevailed in the past (as shown by Figure 1), despite their own lack of production experience. The price of iron inputs looms large in the cost structure of tinplate, however, and will be examined in greater detail in the next section.

MODELING THE DOMESTIC PRODUCTION DECISION

This section develops an empirical model of the decision to produce tinplate in the United States. In the apparent absence of important industry scale economies, this decision depends simply upon the configuration of output prices and input costs necessary to make domestic production profitable. The parameters of this decision are estimated using annual data from 1869 through 1913 and exploit the fact that we observe domestic production in the period 1872 to 1875, the subsequent exit of those producers from the market, and the reentry of domestic producers from 1891. Once the parameters of the production decision have been estimated, the decision to produce can be reexamined based on counterfactual paths of the tariff and other variables of interest.

The decision to produce tinplate in the United States is modeled as follows

\[
\text{prob}\ (q_{\text{US}}>0) = F(p_{\text{UK}}(1 + \tau) - \delta c_{\text{UK}})
\]

which states that the probability of domestic tinplate production ($q_{\text{US}}$ greater than zero) is some increasing function of the profitability of domestic production, the elements of which are the U.K. price of tinplate ($p_{\text{UK}}$), the \textit{ad}

\textsuperscript{32} These sparse specifications may overstate the importance of learning by doing by attributing cost reductions to experience that should be attributed to other omitted variables, such as capital. In a recent reevaluation of the Liberty ship example of learning by doing, Peter Thompson ("How Much") finds that including capital in a regression that previously only included cumulative output significantly reduces the coefficient on experience. Unfortunately, to the best of my knowledge, more detailed tinplate data, which would allow further exploration of this, do not exist.
Table 2
DETERMINANTS OF THE DECISION TO PRODUCE TINPLATE IN THE UNITED STATES: MARGINAL EFFECTS FROM PROBIT REGRESSION, 1869–1913.

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Import tariff</td>
<td>0.76</td>
<td>2.67</td>
<td>1.97</td>
</tr>
<tr>
<td>(ad valorem equivalent)</td>
<td>(0.61)</td>
<td>(1.70)</td>
<td>(0.94)</td>
</tr>
<tr>
<td>Iron bar price differential</td>
<td>-0.83</td>
<td>-1.30</td>
<td>-1.34</td>
</tr>
<tr>
<td>(0.40)</td>
<td>(0.37)</td>
<td></td>
<td>(0.37)</td>
</tr>
<tr>
<td>U.K. price - bar cost margin</td>
<td></td>
<td>0.48</td>
<td>1.15</td>
</tr>
<tr>
<td>(0.19)</td>
<td></td>
<td></td>
<td>(0.21)</td>
</tr>
<tr>
<td>Log of domestic market size</td>
<td></td>
<td></td>
<td>1.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.21)</td>
</tr>
<tr>
<td>Pseudo $R^2$</td>
<td>0.41</td>
<td>0.55</td>
<td>0.71</td>
</tr>
<tr>
<td>Percentage correctly predicted</td>
<td>84.4</td>
<td>91.1</td>
<td>95.6</td>
</tr>
</tbody>
</table>

Notes: The dependent variable takes the value of one for the years 1872 to 1875 and 1891 to 1913, and is zero otherwise. The number of observations is 45. Robust standard errors are in parenthesis. Pseudo-$R^2$ is defined as $(1 - L_1 / L_0)$, where $L_1$ is the value of the log-likelihood function including the independent variables and $L_0$ is its value including just a constant term.

valorem equivalent of the U.S. import tariff on tinplate ($\tau$), the U.K. price of rolled iron bars ($c_{UK}$), and the U.S. price premium on iron bars ($\delta$, usually greater than one). In essence, the probability of domestic production in a given year is a function of three components: $p_{UK} - c_{UK}$, the price minus iron-input cost margin in the United Kingdom; $\tau$, the ad valorem tariff on tinplate; and $\delta$, the U.S. price premium on iron bar inputs. The probability of domestic production is increasing with respect to the price-cost margin and the tariff, and decreasing with respect to the premium on iron inputs.

This model can be estimated as a probit in which the dependent variable indicates whether or not there is domestic production (that is, taking the value one for the years 1872 through 1875 and 1891 through 1913, and zero otherwise). Table 2 presents the marginal effects from the probit regression, which indicate the slope of the probability function (that is, the change in the probability that $q_{US}$ is greater than zero) for an infinitesimal change from the mean of the independent variables. If the errors from the regression are serially correlated, the probit estimates are still consistent and asymptotically normal, but inefficient. Probit regressions are sensitive to omitted variable bias and therefore several specifications will be examined.

The first column regression includes variables for the import tariff and the iron price premium, which alone explain much of the decision of domestic producers. The marginal effects are nearly equal in magnitude and of the opposite sign. The second column adds a variable for the profitability of U.K. tinplate producers (the price-materials cost margin), which is both economically and statistically significant, and does not detract from the importance of the other variables.

33 Poirier and Ruud, “Probit.”
The final column (3) adds the log of the value of U.S. tinplate consumption to see if entry is dependent upon market size effects, in other words, whether the domestic market must pass some critical threshold in order to induce the entry of domestic producers. This variable has a coefficient comparable in size to those on the other variables, is statistically significant, and does not detract from the economic or statistical significance of the other variables. The variable also adds to the overall explanatory power of the probit model, and therefore column 3 is the preferred specification.

In this specification, the marginal effect on the iron bar price variable is about two-thirds of that on the tariff variable. This is remarkably consistent with both the Census of Manufactures data, which indicated that iron inputs comprised about two-thirds of the value of tinplate output. The marginal effects here indicate that a 10 percent reduction in the iron price premium is economically as valuable to domestic producers as a 6 to 7 percent increase in the ad valorem tariff; in other words, a given percentage increase in the tariff is about 1.5 times more valuable to domestic producers than the same percentage decrease in the iron price premium.

The underlying coefficients from equation 3 can be used to solve for the implied probability of domestic production under various counterfactual scenarios. Such an exercise assumes, of course, that the actual paths of the iron price premium, the U.K. price-cost margin, and the domestic market size (in terms of total expenditures) are unchanged and are independent of the tariff. While the iron price premium can be safely assumed to be exogenous (the tinplate industry was an extremely small consumer of iron and steel; see note 35), the U.K. price-cost margin and domestic market size could depend upon the tariff. The effect of this bias will be discussed later, although the results do not appear to be significantly affected; virtually identical results were obtained by using the estimated probit coefficients from the Table 2, column 1 regression, which includes only exogenous variables.

Four possible counterfactual scenarios are considered.

No Erroneous Treasury Decision

Figure 5a depicts the implied probability of domestic production under the supposition that the Treasury Secretary did not move the comma by two words in the 1864 tinplate tariff and customs had imposed the 2.5-cent tariff on imported tinplate from that point onward. The results suggest that this high initial tariff would not have been sufficient to bring about domestic production until 1872, when we observe entry even in the absence of this tariff. The iron-bar price premium is apparently so great in the late 1860s that even the higher tariff would not have been sufficient to make domestic production profitable. The higher tariff also does not prevent the subsequent
exit of domestic producers when tinplate prices collapsed in the mid-1870s, but postpones this exit for three years until 1878. However, the high tariff enables domestic production to commence again in 1883, eight years prior to the McKinley tariff. In sum, the higher tariff would have accelerated the entry of the domestic producers in the 1880s, but it neither would have assured the entry of domestic producers in the late 1860s to early 1870s nor would it have prevented their exit in the mid- to late-1870s.

No McKinley Tariff

If the House had failed to pass the tinplate provision of the McKinley tariff, the one-cent-per-pound tariff could have persisted for some time. This scenario allows us to examine the hypothesis that domestic entry would have occurred anyway as a result of the convergence in the price of iron bars. Figure 5b shows the predicted probability of domestic production in this case. The probability repeatedly crosses the 50 percent line between 1898
and 1902. After 1903 the United States is virtually assured of having ongoing domestic production of tinplate. According to this result, if the McKinley tariff had not been enacted, a tinplate industry would have established itself in the United States about a decade later. The declining iron-bar price premium, which was about 40 percent around 1890 but fell to 0 to 20 percent around 1900, largely accounts for this finding. This convergence in the prices of basic iron inputs is apparently sufficient to ensure that domestic production would eventually have taken place.

As previously noted, a possible problem with this counterfactual calculation is that the U.K. markup might have been endogenously affected by the imposition of the McKinley duties. This possibility is not a certainty: with over 200 firms operating in Wales, declining sales could have been accommodated by the exit and consolidation of firms rather than falling markups, although the declining trend in the U.K. markup did not accelerate after 1891. To the extent that the markup actually did fall as a result of the McKinley duties, however, it biases the results against early entry by U.S. producers. In fact, performing this counterfactual with the Table 2, column 1 coefficients

Note: Shaded areas indicate periods of actual domestic production.
Source: See the text.
on the exogenous variables alone (the tariff and input price premium) suggests that U.S. firms would have entered the market around 1895 to 1897, slightly sooner than the above counterfactual predicted.

This simulation also might not capture the tariff's role in inducing the migration of labor and technology from Wales to the United States. As the early 1870s experience demonstrates, however, a steep tariff hike was not required to attract Welsh skilled labor to America. U.S. entrepreneurs could freely recruit such labor and purchase specialized Welsh capital at any time.

Zero Tinplate Tariff

If tinplate imports had been placed on the duty-free list from 1869 onward, a brief period of domestic production would still have been observed in the early 1870s, according to Figure 5c. However, the industry would not have established itself until about 1908, almost 20 years after the imposition of the McKinley duties.

![Figure 5c](image-url)

**FIGURE 5C**
PREDICTED PROBABILITY OF DOMESTIC TINPLATE PRODUCTION, 1869–1913: ZERO TINPLATE TARIFF

*Note:* Shaded areas indicate periods of actual domestic production.  
*Source:* See the text.
Figure 5d
Predicted Probability of Domestic Tinplate Production, 1869–1913:
No Iron Price Premium

Source: See the text.

No Iron Price Premium

Had the United States allowed the free importation of iron bars at the U.K. price, Figure 5d indicates that a domestic tinplate industry would have existed for most of the late nineteenth century. The possible lack of domestic iron production that this scenario might have entailed would not have posed a serious problem for tinplate producers. As previously noted, vertical integration or domestic iron production was not a necessary condition for tinplate production. After the imposition of the McKinley tariff, for example, many U.S. producers imported “blackplate”—iron and steel sheets ready for dipping in tin—from the United Kingdom and performed the final production stage in America.

To summarize, the McKinley tariff clearly accelerated the development of the tinplate industry, according to these results, but the industry would have been established shortly thereafter anyway as the price of iron in the United States converged to that in the United Kingdom. Had there been no price premium on such material inputs, the United States might well have had
a tinplate industry for most of the late nineteenth century. These findings suggest that the tinplate industry was not really an infant industry in the sense that new entrants faced particular hardships in overcoming a lack of production experience or in facing an imperfect capital market (Andrew Carnegie was not liquidity constrained and could easily vertically integrate). Rather, the tinplate industry was laboring under extreme conditions of negative effective protection due to the high price of basic iron and steel products in the United States.

WELFARE EFFECTS OF TINPLATE PROTECTION

Having found that the McKinley tariff enabled the United States to acquire a tinplate industry about a decade sooner that it otherwise would have arisen, the remaining question is whether this tariff policy was economically worthwhile.

The theory of optimal policy intervention provides a framework for assessing the welfare effects of the McKinley duties. The first-best policy toward the tinplate industry would have been to remove the tariffs and other trade barriers that accounted for the high U.S. price of basic iron and steel products. This policy would have enabled the tinplate industry to function profitably throughout the late nineteenth century, as indicated by Figure 5d, and would have contributed to economic welfare. If the duties on basic iron and steel were considered immutable, the second-best policy for the tinplate industry would have been to offset the distorted domestic price of iron and steel by subsidizing its use by tinplate producers (perhaps through a rebate). The third-best policy would have been a production subsidy to tinplate producers, which would have also offset the distorted price of iron and steel, but less directly and therefore less efficiently. The fourth-best policy toward the tinplate industry would have been a tariff on imported tinplate. A tariff would have been akin to a production subsidy but even less efficient due to the by-product distortion to consumption. Though fourth-best, an optimally-set tinplate tariff would still have been welfare improving vis-à-vis a policy of inaction.

For the McKinley tariff to have been near the optimal rate and therefore beneficial, the initial costs to tinplate consumers as a result of the tariff must have been more than compensated by the stream of profits received by domestic producers and tariff revenue received by the government (in a net present value sense). More formally, we can calculate the net welfare effects of infant industry protection as follows

$$\Delta W_t = \Delta \Pi_t + \Delta CS_t + \Delta \tau M_t$$

34 See, for example, Bhagwati, "Generalized Theory."
35 We can treat the tinplate industry in partial equilibrium since it had a negligible effect on the output of the iron and steel industry overall; in 1899, the tinplate industry consumed 36,855 tons of iron and steel when 29,507,860 tons were produced. Gray, "Tin and Terne Plate," pp. 101, 104.
where the change in welfare \( W \) is decomposed into the change in producer profits \( \Pi \), the change in consumers' surplus \( CS \), and the change in tariff revenue \( \tau M \). The stream of profits received by domestic producers, however, should be calculated using the world price of iron and steel (the true opportunity cost, and therefore the true shadow price), as suggested in the project evaluation literature.\(^{36}\) The tariff is economically beneficial if the present discounted value of the change in welfare is positive

\[
P V(r) = \sum \Delta W_t / (1 + r)^t > 0
\]

where \( r \) is the real interest rate.

In performing this calculation, the actual McKinley and subsequent tariffs imposed on imported tinplate will be evaluated against the counterfactual benchmark of maintaining the preexisting one-cent-per-pound tariff on imported tinplate. The path of output and prices under the McKinley and subsequent tariffs is observed, and therefore we are required to speculate as to what would have happened to each of the components of welfare had the existing duty continued in force up to a specified time horizon. That horizon will be taken as the year 1900: If the object of the tariff policy was merely to establish some domestic tinplate production, without specifying the precise amount, then the simulations in the previous section suggest that production would have commenced sometime around 1895 to 1902, in the absence of the McKinley tariff.

For \( \Delta \Pi \), the actual profits received by domestic producers can be compared with zero profits (presuming there was no domestic production) over this horizon. Census of Manufacturing data indicate that the ratio of average costs to price \( (AC/P_{US}) \) was 0.90 in 1899, but this measures profits using the domestic price of iron inputs rather than the (shadow) import price. This measure needs to be adjusted by a factor \( \phi \) that represents the degree to which average costs would have been lower had the import price been used. Rather than 0.90, the term \( \phi AC / P_{US} \) is about 0.7 in the early 1890s, about 0.8 in the mid-1890s, and about 0.9 by the turn of the century, tracking the declining iron price premium shown on Figure 4. Thus, \( \Delta \Pi = (1 - [\phi AC / P_{US}]P_{US}Q_{US})P_{US}Q_{US} - 0 \), where \( P_{US}Q_{US} \) is the actual value of domestic tinplate sold.

The consumers' surplus calculation is simply the price wedge over all purchases under the McKinley tariff regime (note that the second-order deadweight loss will not be included in this calculation). Thus, \( \Delta CS = (P_{US}Q_{US} + [P_{UK} + \tau]M) - ([P_{UK} + 1][Q_{US} + M]) \), where the first term in parenthesis is the cost to consumers of their actual observed purchases and the second term is the cost of that same quantity of tinplate had they been able to purchase it from the United Kingdom under the one-cent duty. The

latter cost depends upon \( P_{UK}' \), the (counterfactual) price of U.K. tinplate in the absence of the McKinley duties. Two counterfactual prices are considered: the actual price, which may have been lower due to the McKinley tariff, and the out-of-sample forecasted price based on estimating the equivalent of the markup equation from Table 2 using U.K. data. This forecasted U.K. tinplate price is, on average, slightly higher than the actual price: The average actual price is $2.65 per hundred pounds over the period from 1891 to 1900, whereas the forecasted price is $2.95 per hundred pounds. Because U.S. tinplate prices quickly fall to almost those prevailing in the United Kingdom, there is the possibility that the consumer surplus calculation will be positive, particularly in comparison with the higher forecasted U.K. price.

The final component is tariff revenue, calculated as \( \Delta \tau M = \tau M - 1^*(M') \). The amount of tariff revenue raised under a one-cent-per-pound tariff regime depends upon the counterfactual volume of imports, \( M' \). This counterfactual import volume was projected by a logarithmic autoregressive trend extrapolation estimated over the 1869 to 1890 period. This projection implies an average annual import growth of 6.6 percent and yields a trend very similar to that of total consumption after 1890 in Figure 3 but at a slightly higher level.

These welfare calculations should be viewed as a simple back-of-the-envelope calculation as to the possible impact of the tariff over the 1891 through 1900 period because they are not based on a fully specified counterfactual simulation. Table 3 presents the results for two real interest rates and for two calculations of the counterfactual U.K. price. The findings are uniformly negative for the McKinley tariff: the initial large loss of consumer surplus (and eventually tariff revenue) is not offset by the stream of profits received by domestic producers evaluated using the import price of iron bar. Tinplate production does not generate large profits because it is a relatively easy entry, low margin business, and the import price of iron bars does not remain significantly below the U.S. price for long (when the import price of iron is significantly below the U.S. price, domestic output and profits are small; by the end of the century when output and profits are higher, the shadow price is about equivalent to the U.S. price). The change in tariff revenue starts highly positive, as import volume does not decline much initially when the higher duty is imposed, but imports rapidly shrink with time and thereby generate large revenue losses for the government.

The change in consumer surplus actually becomes positive by the late 1890s when U.S. prices fall below the higher forecasted U.K. prices, which explains why the welfare losses diminish over the longer horizon. But this later gain does not compensate for the initial consumer losses. If actual prices are taken as the relevant counterfactual, then the McKinley tariff has a harder time paying off because these U.K. prices remain low through the 1890s.
TABLE 3
WELFARE EFFECTS OF THE MCKINLEY TINPLATE TARIFF

<table>
<thead>
<tr>
<th>Time Horizon</th>
<th>Discount Rate ( r = 0.06 )</th>
<th>Discount Rate ( r = 0.03 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1891–1895</td>
<td>-$12.4 m</td>
<td>-$13.2 m</td>
</tr>
<tr>
<td>1891–1897</td>
<td>-$14.5 m</td>
<td>-$15.5 m</td>
</tr>
<tr>
<td>1891–1900</td>
<td>-$11.3 m</td>
<td>-$9.9 m</td>
</tr>
</tbody>
</table>

A. Using Forecasted (Counterfactual) U.K. Prices

B. Using Actual U.K. Prices

<table>
<thead>
<tr>
<th>Time Horizon</th>
<th>Discount Rate ( r = 0.06 )</th>
<th>Discount Rate ( r = 0.03 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1891–1895</td>
<td>-$8.2 m</td>
<td>-$9.5 m</td>
</tr>
<tr>
<td>1891–1897</td>
<td>-$15.1 m</td>
<td>-$17.1 m</td>
</tr>
<tr>
<td>1891–1900</td>
<td>-$25.6 m</td>
<td>-$30.4 m</td>
</tr>
</tbody>
</table>

Notes: Basis of Comparison: Imposing the McKinley tariff vis-a-vis the existing one-cent-per-pound tariff. Figures are calculation of \( PV(r) = \sum_1^n \Delta W_i / (1 + r)^t \), where \( \Delta W_i = \Delta I_i + \Delta C_i + \Delta \pi M_i \) as described in the text. All figures are in millions of 1891 dollars, having been deflated by the consumer price index in David and Solar (1977), p. 16.

To conclude, U.S. economic welfare could have been enhanced by an optimally set fourth-best tariff that would offset the distorted price of iron bars faced by domestic tinplate producers. In a period when the domestic price of iron bars was rapidly converging to the import price, however, the McKinley and subsequent tariffs appear to have been set too high, thereby over-compensating for the input price distortion and reducing welfare. 37

CONCLUSION

This article posed two questions regarding infant industry protection for the tinplate industry: When (if ever) would the industry have developed in the absence of protection? Were tariffs economically worthwhile in establishing domestic production sooner than it otherwise would have occurred? At first glance, the tinplate industry appears to be a successful instance of infant industry protection. Upon further examination, the industry is revealed to be one in which material input costs are paramount, static and dynamic scale economies are not substantial, and production technology and experience is readily transferable internationally. The failure of the industry to develop appears to have been due to the high domestic price of iron and steel inputs. The analysis here suggests that, in the absence of the McKinley tariff, the tinplate industry would have developed in the United States about a decade later as the domestic price of those inputs converged to international

37 For example, using the simple formula for the effective rate of protection and data in footnote 14, a 50 percent tariff on tinplate would have yielded an effective rate of zero, completely offsetting the iron bar tariff. If the iron bar price premium fell to 10 percent, then only a 7 percent tinplate tariff would have been necessary to yield an effective rate of zero. A duty of the McKinley tariff's height may have been more suitable for the 1870s and 1880s when the domestic price premium on iron and steel was substantially higher than it was in the 1890s.
levels. While an optimally set tariff would have been a fourth-best but welfare-improving method of correcting the distorted domestic price of iron faced by tinplate producers, the McKinley tariff was set too high, more than offset that distortion, and thus failed to improve welfare.

REFERENCES


