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KEEP ON SCRAPPING:
THE SALVAGE DRIVES OF WORLD WAR II

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ABSTRACT

During World War II Americans were called upon repeatedly to salvage raw materials for the war effort, often during brief, highly publicized "drives." Stories about the salvage drives are a staple in both popular and scholarly histories of the home front, and in film documentaries, because the drives appear to demonstrate the potential importance of non-economic motives such as patriotism and community spirit. Here I reexamine economic effects of five drives: aluminum, silk, cooking fat, and the two most important, iron and steel, and rubber. The drives, it turns out, had a more limited impact on the economy than might be imagined from some of the enthusiastic portrayals in the popular and historical literatures. At most, the drives increased scrap collections by relatively small margins above what would have been collected during a prosperous peacetime period. The impact of economic incentives on the supply of scrap materials, and the impact of the maneuvering of special interests for advantage, moreover, can be seen at every turn. If the drives were important it was through their impact on civilian morale.

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Keep on Scrapping: The Salvage Drives of World War II[1]

> Economics is a very unsatisfactory science. But it would have to be much more unsatisfactory than it is if such an event as a war, however extensive and destructive, sufficed to upset its teaching. (Joseph Schumpeter 1954, 1146)

I. The Conventional View of the Salvage Drives[2]

During World War II there were repeated calls on the public to salvage raw materials for the war effort: tin cans, old phonograph records, copper, aluminum, iron and steel, paper, rubber, even used silk and nylon stockings and waste cooking fat. In principle recycling scrap material would be an ongoing process, but in most cases attention focused on a short-term campaign to "get in the scrap." President Roosevelt and other important figures from government and the private sector provided leadership. Propaganda campaigns run by the Office of War Information, and by private companies and trade associations, stressed the importance scrap collection. In peacetime it was just the family kitchen; now it was a combination "frontline bunker and rear-echelon miniature war plant" (Lingeman 1970, 254). Explaining the conversion factors between salvaged materials and the munitions that could be produced from them drove the point home. As shown in Poster 1, Americans were told that 18 tons of scrap metal went into a medium tank; it was therefore imperative that Americans "get in the scrap." One pound of fat, the public was also told, contained enough glycerine to make a pound of black powder, enough for six 75-mm shells; Twenty three hundred used nylon stockings contained enough nylon to make one parachute; and thirty thousand razor blades contained enough steel to make

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1. An earlier version of this paper circulated with the title "Getting in the Scrap." But at that time I was unaware of the paper by Kirk (1995).

2. I use the terms salvage drive and scrap drive to refer to the same events. I lean toward the term salvage because it is, perhaps, a more dignified term suggesting the hard work that can go into the recycling of materials, especially by the professionals who brought in most of the scrap. But I use both terms to avoid biasing my case.

50 30-caliber machine guns (Lingeman 1970, 254-55).

Enthusiastic descriptions of the salvage drives occur frequently in popular histories of the war. Film documentaries about the home front and school textbooks often draw attention to them. Recently, pundits have contrasted World War II, when the public was asked to participate in the war effort through the scrap drives – and in other ways such as by purchasing bonds or paying higher taxes – with the War in Iraq, when no such demands have been made. The salvage drives also appear frequently in scholarly histories.[3] One of the best recent histories of the war is William L. O'Neill's *A Democracy at War*. Although, O'Neill notes some problems in the scrap drives, he lavishes praise on the Nebraska iron and steel scrap drive of July and August 1942. This drive made use of considerable incentives. Prizes worth up to $2,000 in war bonds were given to individuals and organizations who collected the most scrap, and competition was fostered among Nebraska counties to see which could bring in the most scrap. The Nebraska drive was widely hailed as a great success. The newspaper that organized the drive won a Pulitzer Prize and the Nebraska drive became the model for the national drive (Kimble 2000). What historians find so attractive about the scrap drives can be seen in O'Neill's (1993, 135) attempt to distill the underlying meaning of the Nebraska drive.

> The most successful state drive yet, the Nebraska model was widely copied, demonstrating that the will was there and could be mobilized with inventive planning. If the weakness of democracy was inefficient government, the strength was volunteerism, especially when it exploited the national love of competition.

The stories about the drives seem to show that something happened that could only have happened

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3. Taylor (1992, chapter 3, "The Great Scavenger Hunt," 71-100) is a superb collection of photographs of the scrap drives. The best overall social history of the drives that I am familiar with is Strasser (1999, 229-264).

through voluntary community action. Market incentives were not important and government played only an enabling role: community spirit was the key.

Such stories pose a familiar challenge to economic historians. Typically, the models we use explain behavior as a rational response to (mainly) financial incentives. Non-economists often challenge this approach, arguing that these models fail to take into account a wide variety of non-pecuniary motives. Wars provide a natural test. If non-pecuniary motives can override pecuniary motives at any time, then surely this must be true during wars – especially World War II, when the national consensus in favor of the war was overwhelming and people were constantly being asked to lay aside their personal interests in the interest of patriotism.

Patriotism may have influenced decisions at many points in the war economy. Mulligan (1998), for example, found evidence of the effects of patriotism on labor force participation. Here I look for the effects of patriotism on the supply of raw materials. If patriotism was a potent force that revoked ordinary economic constraints, then surely we should observe it in this case. The drives occurred in the darkest hours of the war, when victory appeared far from inevitable. The Office of War Information invoked patriotic feelings to encourage participation in the scrap drives. The posters it created have helped to shape the social memory of the war.[4] Government officials from the President on down and business leaders lent their authority to the drives. Even after the formal drives ended, government propaganda urged Americans to "keep on scrapping" (Poster 2).

Below I examine five drives in detail: for aluminum, used stockings, waste cooking fat, iron

4. The Office of War Information was created in June 1942, combining the functions of several predecessor agencies. It was the subject of bitter internal and external criticism. Indeed, in 1943 a number of prominent writers, including the historian Arthur Schlesinger Jr. resigned in protest. One complaint was that the Office's propaganda emphasized safe subjects, such as the campaign for scrap iron, rather than the need to achieve the fundamental goals of the war (Weinberg 1968).

and steel, and rubber. This is not a complete list of materials salvaged during the war. As I noted at the outset, the list was long and varied. But the drives discussed here include the two most important – iron and steel, and rubber – and what are probably the best known drives for other materials. The questions are straightforward. Why were patriotic salvage drives used? How were the drives influenced by the economic and technical constraints faced by the participants? Finally, how successful were the drives in increasing the supply of raw materials? The last question occurs naturally to an economic historian. We always want to know the answer to the question that starts with – by how much. By how much did the railroads increase real GDP? By how much did the stock market crash of 1929, or the Smoot-Hawley Tariff, or the banking crises lower real GDP? Typically, non-economic historians are enthusiastic about the salvage drives, and they often cite statistics about how much was collected (so many pounds or pounds per person), but they do not address the question of how much in terms that an economic historian would consider crucial. One might take the additional, speculative step and guess from the tone of the discussions that historians believe that the drives added significantly to the supply of raw materials. But this paper is the first that I am aware of that addresses the effect on the supply of raw materials in explicit quantitative terms. My conclusion is that the drives increased the supplies of raw material at most by small amounts. In making this point, my purpose is not to denigrate the spirit of self-sacrifice that motivated the drives, or to deny that they had any effect on the supply of raw materials. But I do challenge the idea that the scrap drives made vast amounts of additional materials available that would not have been available had normal sources of supply been relied upon, and that the drives prove that conventional economic analysis needs to be jettisoned "for the duration.

II. Aluminum

It was obvious to both the public and to policy makers from the start of American rearmament in the late 1930s that aluminum would be a key raw material, although even so policy makers and industry officials underestimated the increase in demand produced by the aircraft program.[5] The price of aluminum scrap rose rapidly, and it became one of the first prices formally fixed by the Office of Price Administration. It issued its schedule of prices for aluminum scrap in March 1941 (*Wall Street Journal*, March 24, 1941, p. 5). In July 1941, responding to concerns about the adequacy of the supply of aluminum for the aircraft program that had produced spontaneous local scrap drives, Mayor Fiorello H. LaGuardia of New York, who was serving as Roosevelt's Director of Civilian Defense, announced a two-week national drive to collect aluminum cookware and other items. There was an unforgettable response. Coffeepots, frying pans, skillets, stew pots, cocktail shakers, ice-cube forms, artificial legs, cigar tubes, watchcases, and radio parts were piled in great scrap heaps. "In Lubbock, Texas, a likeness of Adolph Hitler was placed in the middle of the courthouse square as a target for the pots and pans hurled by citizens" (Goodwin 1994, 260).

Why use a "drive" with a time limit to get in the scrap? Why not simply ask people to bring in the scrap as soon as possible? After all, sorting and distributing the scrap would be easier if it came in slowly and steadily. In most cases, as we noted above, people were encouraged to "keep on scrapping" after the official drive ended, but short drives had several advantages. First, the spirit of competition could be invoked. It became a football game with town pitted against town, and state against state, to see who could bring in the most scrap before the final whistle. A second reason for a short drive was that it permitted the monitoring necessary to bring social pressures to bear. With everyone going to the collection point at the same time people could see whether their neighbors were

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5. Smith (1988, 214-49) describes the evolution of the industry during the war. Smith does not mention

participating: rewarding participants with a hearty pat on the back, and punishing non-participants with a sharply arched eyebrow. A third reason for a short drive – one that was especially important, as we will see, for rubber – was that it yielded information. A drive would tell policy makers how much was out there and allow them to plan other measures – limitations on production for civilian markets, new production facilities, and so on – to deal with conditions in the market for the raw material.

In announcing the aluminum campaign LaGuardia had called for 20,000,000 pounds of aluminum scrap, enough to make 2,000 planes (*New York Times*, June 25, 1941, p.23). In truth, the scrap collected in the drive would be, for the most part, unsuitable for the production of the high-grade aluminum needed for warplanes. [6] Indeed, before the war it had been customary for dealers to sell aluminum scrap in unsegregated bundles that was used only to produce lower grade products. After Pearl Harbor an effort was made to force the dealers to separate aluminum scrap by quality to make more high quality scrap available. It seems unlikely, however, that even with improved sorting much of the scrap of sufficiently high quality for aircraft production would be found. And, as we will note below, the junk dealers who might have separated the high-grade aluminum scrap were cut out of the drive. The pots and pans collected in the drive, although few contributors were aware of it, were destined to be made into products other than aircraft (*New York Times*, June 26, 1941, p. 25). Conceivably, some of the families that participated enthusiastically in the aluminum drive by contributing some of their old pots and pans eventually were forced to buy new ones made from the those they had donated (O'Neill 1992, 131; Goodwin 1994, 260-61).

The aluminum drive and Mayor LaGuardia eventually came in for a great deal of criticism.

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the aluminum drive, which as we will see, was unimportant for the supply of aluminum during the war.

6. The British had undertaken an aluminum drive in 1940 – this may have been one of the inspirations for the American drive – with similar confusion about the actual value to the war effort of the material

There were long delays in moving the scrap to the refineries. People who were told that they had to sacrifice their pots and pans to save the country watched and waited while the great heaps of scrap created in the drives continued to stand. Richard Lingeman (1970, 16) put it this way: "it [the aluminum drive] turned into a fiasco, with great piles of pots and pans languishing in collection points because no one would cart the stuff away, and anyhow, its value in plane production was nonexistent." About a year after the drive the War Production Board issued a report explaining why less scrap aluminum was collected than expected and why there were long delays in getting the scrap to the refiners. Part of the problem was that Mayor LaGuardia had cut the junk dealers out of the process (*Wall Street Journal*, June 20, 1942, p. 5; *New York Times*, June 20, 1942, p. 7). LaGuardia did so for the usual reason: they were simply middlemen who contributed nothing to the production process, but profited from it by speculating on the price of scrap aluminum. Cutting out the middlemen, LaGuardia thought, would save money and do no harm. But the refineries preferred to buy scrap that had been sorted by the junkmen when they could get it, rather than the unsorted bundles provided by the drive. To be sure, many of the dollar-a-year men who served with the War Production Board were ideologically opposed to the New Deal mayor from New York, so a report blaming LaGuardia would be to their liking. Any projections of the amount of scrap to be collected, moreover, would have been highly problematic and would have been made, understandably, with an eye toward generating enthusiasm for the drive. Nevertheless, cutting out the skilled junk men surely was a mistake that reduced the efficiency of the sorting and distribution of the material collected.

The scrap drive brought it about 6,400,000 pounds of aluminum (*Wall Street Journal*, June 20, 1942, p. 5). As an isolated figure this sounds like a great deal, a mountain of aluminum. A comparison with production in 1941, however, is revealing. The amount salvaged, was 6.75 percent

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collected (*New York Times*, July 14, 1940, p. 29).

of total production from old scrap, 2.99 percent of total production from recycled aluminum (a larger sum that also includes waste recycled within aluminum plants), and only .77 percent of total production (*Historical Statistics* 2006, series Db88, Db89, and Db90). The amount collected was about 0.08 percent of total production during the war (1942-45). These figures would be lower still if adjusted for the low quality of the scrap-drive aluminum. The real solution to the aluminum problem was maximizing production in existing aluminum refineries and building of new ones. Overall, production of aluminum almost tripled from 377,000 metric tons in 1941 to 1,120,000 metric tons in 1943 (*Historical Statistics* 2006, series Db88).

The aluminum drive, although unimportant as a source of aluminum, may have been important in shaping public opinion and mobilizing support for U.S. involvement in the war. This was important before Pearl Harbor when many Americans were still strongly opposed to joining the war. According to Doris Kearns Goodwin, what Roosevelt had accomplished with the aluminum drive "was nothing less than an exhibition of the dormant energies of patriotic democracy" (Goodwin 1994, 261). Still, one can question whether historians in other circumstances would view the same policy with the same results so favorably. Suppose that in a later, less popular, war a president ordered a salvage drive that turned out to be a fiasco, at least as far as many observers were concerned, with great heaps of scrap left to weather in public squares. Would historians of this unpopular war view the decision to launch an aluminum drive favorably? Alternatively, would they view it as further confirmation of the incompetence of a government determined to manipulate public opinion and place ideology above sound management?

III. Used Silk and Nylon Stockings[7]

Before the war silk came to the United States largely from Japan, with smaller amounts from China and other countries. It had two military uses: parachutes and powder bags. Its lightweight, strength, and the ease with which it could be folded and unfolded without leaving a crease made it ideal for parachutes. When the War began experiments were just underway to make parachutes out of nylon. Nylon proved superior and, as it turned out, almost all parachutes produced during the war were made of nylon. Silk was also used for the bags that held powder behind artillery shells, especially in large naval guns. Silk burned completely whereas bags made of other fibers left glowing embers. Eventually, however, ways were found to make satisfactory bags from cotton, wool, and rayon.

Japan restricted shipments of silk to the United States in 1941, making it difficult to accumulate stocks, and embargoed all shipments shortly before Pearl Harbor. With Japanese silk embargoed, a drive to bring in used silk (and nylon) stockings seemed logical, and silk and nylon stocking drives arose spontaneously, that is without encouragement from the government. One such drive in Dallas, Texas yielded some 662 pounds of worn stockings. Unfortunately, when the war began there were no processes available for reclaiming used silk or nylon. Experts at the War Production Board felt that it was only a matter of time before such processes were developed. But until proof was available, the military would not accept delivery of used stockings. All that the War Production Board could do was write polite letters telling the collectors that they could not use the stockings (Walton 1945, 177).

Eventually, as the War Production Board predicted, methods were developed for recycling worn silk and nylon stockings. On November 15, 1942 the War Production Board launched an

7. This section is based largely on Walton (1945). Frank L. Walton was director of the Textile, Clothing, and Leather Division of the War Production Board.

official drive that continued until March 15, 1943, when the supply appeared to have dried up. The drive brought in an impressive amount of stockings, some 880,000 pounds, about one pair for every 2.7 women. This was about 3.26 percent of the peak annual rate of production of nylon (which occurred in May 1944) of 27,000,000 pounds, before allowing for the material lost in the recycling (Dewhurst and Associates 1947, 779). In other words, the amount collected, assuming a 100 percent recovery rate, yielded the equivalent of about 12 day's of production at the peak rate.

It appears that the War Production Board's Textile Division, perhaps because they were aware of these figures, did not consider used silk and nylon very important. One piece of evidence of the Textile Division's attitude toward used silk can be read from its approach to the opened bales of silk still in the hands of the mills when the war began. In the months leading up to the silk drive the Textile Division encouraged the mills to make stockings from opened bales. Had the Textile Division been convinced that silk was crucial to the war effort, and had it believed that ways would be found to recover silk from opened bales or from completed stockings, it would have commandeered all unopened bales at the mills, and all finished stockings.

On the first day of the national used stocking drive the Textile Division heard stories about women turning in used stockings and then buying new ones (Walton 1945, 178). Whether true or not, the Textile Division immediately issued a directive advising women to turn in only stockings that were completely worn out, so that there would be no increase in the demand for new stockings. Since at this time new stockings were made mainly from cotton and rayon, it is clear that the purpose of the directive was not to maximize the supply of used silk and nylon, but rather to reduce the risk that some consumers would face empty shelves for new non-silk-non-nylon stockings. If the textile division considered used silk and nylon crucial to the war effort, they would have asked consumers to turn in all stockings containing silk and nylon, whether usable or not.

The reason the Textile Division downplayed the significance of used silk and nylon was probably the availability of large supplies of nylon. Dupont had developed nylon in the early 1930s. The price of silk had been high in the late 1930s, and Dupont had gone full speed ahead toward large-scale production. This contrasts with synthetic rubber, where low prices of imported natural rubber discouraged mass production of synthetics. As early as January of 1940 an article in the *Far Eastern Survey* outlined the potential threat to Japan's silk industry posed by nylon, even though actual production at that time was limited (Farley 1940). The War delayed full-scale production of eagerly awaited nylon stockings for the home front – a sentiment captured in "Fats" Waller and George Marion Jr.'s "When the Nylons Bloom Again" – but it appears that the supply of nylon was adequate for military purposes. The stocking drives, to sum up, did not play an important role in the production of silk or nylon for the war effort.

IV. Cooking Fat

During the war women – in those days propaganda aimed at the home was aimed at women – were asked to save cooking fat. The fat was then exchanged at butcher shops for red ration points (for meat, fish, and dairy) and cash. Advertisements explained that the fat saved contributed to the war effort because fat was the source of glycerine, a key ingredient in explosives. Poster 3, a striking design by Henry Koerner, makes the point vividly. Another poster (not shown) spelled it out in simple, hard-hitting language: "...fat makes glycerine. And glycerine makes explosives for us and our allies – explosives to down Axis planes, stop their tanks, sink their ships" (Cohen 1991, 111).

In fact, the demand for glycerine to make explosives had little to do with the fat salvage drive. Only a small proportion of the U.S. production of rendered animal fat was needed for this purpose, and munitions makers operating on cost-plus contracts with the government could easily outbid rivals

for what they needed. Rather, the fat salvage drive was undertaken for the soap makers who organized and financed the drive. Soap production was high during the war by prewar standards (Russell 1947, 248). And fat supplies were also relatively abundant, especially later in the war. By January of 1944, lard was so abundant that the government was having storage difficulties (Fantin 1947, 209). But price controls meant that there was excess demand for soap. Early in the war (organizational meetings for the fat salvage campaign began in April 1942) soap makers feared that if soap was rationed, then some of the consumers forced to cut their use of soap during the war would learn that they could do with less. Rationing, in other words, would spoil postwar markets.[8] As far as the soap producers were concerned, anything that would avoid the need to ration soap was worth doing. Hence the plan organized by the soap makers to offer consumers cash and red points in exchange for fat.

From the beginning there was opposition to the plan. The Office of Price Administration was concerned that the fat salvage plan would produce an excess supply of red ration points, undermining the rationing program (Russell 1947, 239). Indeed, not all of the fat renderers favored the plan. The Eastern Melter's Association opposed the plan perhaps because it was concerned about a decline in the price of rendered fat that renderers in other parts of the country could offset with a larger volume, but that its renderers could not. Despite these concerns, the Office of Price Administration agreed at a meeting on November 22, 1943 to pay two red points and 2 cents for each pound of fat. The program was announced in December 1943. Since the fat would be generated continuously in the nation's kitchens it was by nature an ongoing program rather than a short-term campaign.

The advertising created by the American Fat Salvage Committee was financed by the soap

8. The preservation of postwar markets was a major preoccupation of the War Advertising Council, a private organization that placed ads extolling the patriotism of firms that were producing munitions during

makers, although this was somewhat hidden from the public. Butcher shops could display a sign that read "Official Fact Collecting Station." These were prepared by the "Glycerine Producers and Associated Industries with the Approval of the War Production Board." War Production Board was in large capital letters. The campaign was so aggressive in linking fat salvage to military uses that Chester Bowles, the head of the Office of Price Administration, wrote to Lever Brothers complaining about the misleading nature of the campaign (Russell 1947, 252). The campaign played no positive role in the mobilization of resources for the war effort. It may have had a positive effect, however, on the morale of people who could not otherwise find a way in their daily lives of contributing to the war effort. It provided, moreover, a way of assuaging the anxieties of children about the war by giving them a way of participating in the war. Nevertheless, one wonders what would have happened if a similar plan had been adopted in other wars. Suppose that during an unpopular later war a president had launched a fat salvage campaign that, as in World War II, was ostensibly about providing the raw materials to make bombs, but in fact was about providing fat for soap makers so they could avoid rationing. Suppose that in that unpopular later war the administrator in charge of price controls – widely respected as an outstanding public servant – was troubled by the deception. The deception, most likely, would be revealed during the war by an aggressive press and add to the public's discontent with the war. Even if the deception went undetected during the war, a later generation of historians, if they shared the public's disapproval of the war, would be more likely to condemn the campaign as a cynical attempt to deceive the public and benefit private interests than to celebrate it as a brilliant tactic for mobilizing public opinion.

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the war but would be producing for the private sector after the war (Leff 1991).

V. Iron and Steel

In the late 1930s and early 1940s recovery from the 1937-38 recession, rearmament, and European munitions purchases increased the demand for iron and steel, and iron and steel scrap. Iron and steel scrap purchased from dealers rose 41.6 percent between 1939 and 1941 (Figure 1 and Table 1, column 2). Increases in demand in turn produced increases in the prices of iron and steel scrap. The price of No. 1 heavy steel melting scrap rose 17.4 percent between 1939 and 1941 (Figure 2 and Table 1, column 5). It was obvious at the time, moreover, that if the United States entered the war scrap prices would go much higher.

To Leon Henderson, who was in charge of price stabilization for the National Defense Advisory Commission, the forerunner of the Office of Price Administration, increases in scrap iron and steel prices were an intolerable threat to the economy. In January 1941 he warned scrap dealers repeatedly that if they did not voluntarily reduce prices of iron and steel scrap, "drastic steps" toward price control would be taken (*Wall Street Journal*, January 10, 1941, p.2). And this proved no idle threat. Iron and steel scrap prices were placed under control in April 1941, well before Pearl Harbor, and were not freed until November 1946 (Barringer 1954, 51). Indeed, as shown in Figure 2, the Office of Price Administration succeeded in keeping the nominal price of scrap flat during the war. As a result, the real price of scrap fell as the general price level rose. Reported scrap prices, it is true, may not be entirely accurate. There are convincing stories about "expediters" who could help find materials, for a price, about individual firms paying more than the official price, and about low-grade scrap being sold as high-grade scrap. But to judge from the frequency of such stories, the impression conveyed by Figure 2, a sharp upward movement in prices cut short by controls, is probably broadly correct, at least for the initial years of the war. The picture may be less reliable for the latter part of the war.

To a classically inclined economist the increase in scrap prices relative to the general price

level before controls were imposed was an important market response that would provide the incentive to find more scrap and to economize on the use of scrap. Such an economist would not be surprised to find steel companies complaining about a shortage of scrap during the first half of 1942. Fixing the price of scrap, to this way of thinking, reduced the productivity of the war economy. Inflation, to such an economist, would be a macro-economic problem that should be attacked with monetary policy, or more likely given the professional consensus of the day, fiscal policy, not by fixing the price of scrap iron and steel. Henderson and the Office of Price Administration, however, saw things differently. In their view, the important fact was that the price of scrap was a component of the price of steel, which in turn was a strategic price in the war economy. If scrap prices were allowed to rise it would "start an inflationary price spiral whose consequences would have been disastrous for the stabilization program" (Benes 1947, 8). This view, which some economists today might justify on the grounds that price fixing was shaping expectations, was widely held by policy makers in the 1940s. To put it somewhat differently, inflation to Henderson and the Office of Price Administration economists was a kind of economic cancer: it could be controlled only by detecting it early and cutting it from the body economic before it could spread.

The decision to fix the prices of iron and steel scrap, whatever its benefits in reducing inflationary expectations nevertheless appears to have had negative consequences for the efficiency of the industry. The small dealer who drove his wagon from house to house buying scrap was a familiar figure in the Depression and earlier years.[9] He was an important part of the mechanism for collecting scrap. During the war, however, the number of small dealers "diminished sharply" (Benes 1947, 5). Perhaps some loss in the number of small dealers was inevitable. Many were pulled into the war

9. They were often referred to as peddlers, but this was a term they rejected, especially when it had anti-Semitic overtones.

industries where wages rose substantially. Indeed, many probably viewed the war as an opportune moment to make a change they had long contemplated. But the falling real price for scrap, which created losses that could be offset only by evading the law, must have helped push small dealers from the field. The Office of Price Administration, moreover, had considerable difficulty formulating lists of official prices for an industry characterized by a multitude of dealers, products, and shipping costs. Early experiments with prices controlled at the point of delivery gave way over time to an elaborate basing point system. In October 1944 a shortage of scrap loomed, and was met by eliminating many restrictions on where, what, and to whom dealers could sell (Benes 1947, 19-30).

Given the steel industry's voracious appetite for scrap – scrap was a necessary ingredient for the production of open-hearth steel – given the freezing of scrap prices, and given the history of drives in earlier wars, it was nearly inevitable that there would be an iron and steel scrap drive. The first initiatives came from the steel companies and from International Harvester. Then in the summer of 1942 the War Production Board backed these private sector efforts with a call for a national drive. Lessing J. Rosenwald, the director of the Conservation Division of the War Production Board, was the government's chief spokesman. As with the other drives, the response was dramatic. In California Walt Disney donated two iron deer (Bambi?) from his front lawn. The deer, it was said, contained enough iron to make one 75-mm field piece or 10,000 incendiary bombs (*New York Times*, August 11, 1942, p. 22). In New York many towns donated the cannons on the town square, some dating to the Civil War and earlier conflicts. At Fort Ticonderoga, the Revolutionary War action in which General Henry Knox retrieved Ticonderoga's cannons was reenacted, and the cannon were donated to the scrap drive (Hoopes 1977, 146-47). Roosevelt chimed in, promising that any towns that donated old cannons would get new World War II guns after the war. He also suggested, demurely, that if statues of political figures were donated to the scrap drive, subjects could be found for new

ones after the war (*New York Times*, August 8, 1942, p. 9).

As shown in Poster 1 farm country was an especially inviting target for scrap collection because farmers often held on to used farm machinery. International Harvester encouraged the collection of farm scrap and its dealerships served as collection centers. Harvester's involvement was undoubtedly motivated mainly by patriotism. But it did say that improving the relationships between farmers and Harvester dealers would pay postwar dividends. There was also, I should note, a direct connection with postwar markets. Farmers normally cannibalized their junked farm machines for used parts to keep older machines running. If the junked machines were scrapped during the war, it would be harder to keep old machines running after the war, forcing farmers to buy new ones.

One might be tempted by stories about the dramatic response to the iron and steel scrap drive to conclude that unprecedented amounts of scrap were collected. Stories about melting down old cannons and about the great poundages collected, however, need to be viewed in relationship to the statistical data on the supply of scrap. Historians, unfortunately, repeat the stories and bypass the numbers. The numbers, however, are revealing. Figure 1 shows iron and steel scrap purchased from American dealers for domestic consumption (Table 1, column 2) and for export (Table 1, column 3), and the peak-to-peak (1937 –1948) trend. The plot of domestic consumption follows a strong upward trend punctuated by recessions. Surprisingly, however, the war years do not stand out as years of unprecedented consumption. Consumption does show a local peak in the 1942, but that peak is lower than might be inferred from enthusiastic tales about the wartime scrap drives. Purchases in 1942 were 7.0 percent above the level in the rearmament year 1941, but they were 18.2 percent below the first postwar peak in 1948.[10] Purchases in 1942, as shown in Figure 1, were close to, if

10. Postwar salvage, however, was made somewhat easier because large amounts of scrap were available in the form of surplus military equipment, ships, and industrial plant.

anything a bit below, the peak-to-peak trend.

Figure 1 also shows exports. In the late 1930s exports of scrap iron and steel to Japan became controversial because, critics claimed, they were sustaining Japanese military expansion. For this reason, and also because it was feared that the exports were driving up domestic prices of scrap, exports of scrap iron and steel were embargoed in 1940: an embargo covering heavy melting steel, which was thought to be important militarily, was put in place in August, followed by a total embargo in October. The decline in exports, however, was not produced solely by the embargoes. Exports to Japan had been falling before the embargoes, as a result of rising scrap prices and regulations imposed by the Japanese government (Odell 1940, Newcomb 1940). As can be seen in Figure 1, as important as the scrap exports may have been from a strategic or political point of view, eliminating them made relatively small amounts available for domestic consumption. Banning exports, like the salvage campaign, did not succeed in pushing domestic consumption above trend. Since banning exports worked in the same direction as the patriotic drives – to make more scrap available to domestic purchasers – the decision to ban exports leaves even less scrap to be explained by the patriotic drive.

An alternative to the peak-to-peak trend for estimating counterfactual consumption (consumption of scrap in the absence of the drive) is a regression of the amount of scrap iron and steel consumed on variables measuring the supply and demand for scrap iron and steel. The fitted values from such an equation would show what might have been expected in a peacetime economy experiencing a similar boom, and the differences between actual consumption and the fitted values would measure the effects of the patriotic drives in bringing out additional scrap.

I first estimated an equation in levels. The dependent variable was total consumption of iron

and steel scrap (Table 1, column 1 plus column 2).[11] The independent variables were consumption lagged one period, contemporaneous industrial production, industrial production lagged one period, and dummy variables for the war years. Industrial production was used as the demand measure because it might capture some of the shift toward heavy industry during the war. I did not include prices because they were distorted by controls during the war. Hence, the regression is a reduced form that implicitly assumes peacetime price responses. This is the right way to go, given the questions I am most concerned with, because it allows me to compare what did happen with what would have happened in a prosperous peacetime economy that relied on normal market processes to bring in the scrap. I examined equations with up to six of scrap consumption and industrial production. None of the coefficients on higher order lags were significant, and adding additional lags did not improve the overall fit of the equation, or alter the conclusions with respect to the war years. The results are shown in Part A of Table 2. Although the coefficients on the war dummies are significant in 1943 and 1944, they have the wrong sign. Patriotic scrap drives, if they were having a big effect, should have raised consumption in those years above what it otherwise would have been. Conceivably, the desire to hold on to iron and steel scrap because of an expectation of higher prices once price controls were lifted – news stories did suggest that some scrap dealers were reluctant to part with stocks accumulated over decades – more than offset the patriotic motive. But this may be reading too much into the results. I also estimated the equation after taking natural logarithms of the variables. Taking natural logarithms makes interpreting the coefficients easier (they are percentages) and experience shows that logarithmic models often work well with time series data. But the results were similar: the coefficients on the

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11. The results are similar if purchased scrap (Table 1 column 2) is made the dependent variable. Intuitively, this series would be more likely to show the effects of the drives since producers purchased scrap collected in the drives from dealers. Unfortunately, this series is available only after 1934.

wartime dummies had the “wrong” sign, but in this model they were not statistically significant.

Tests, such as an Augmented Dickey-Fuller, suggested that there could be a unit root in the scrap consumption and industrial production series, so I also estimated the equation in first differences. The results are reported in Part B of Table 2. In this model, again, all of the wartime coefficients are negative, suggesting smaller increments in the consumption of reclaim than would have been expected, rather than the larger increments. But the coefficients are not significant, and there remains evidence of serial correlation in the estimated model. The safest conclusion from the regressions is that there is no evidence of a large positive effect from patriotism. I also estimated the equation in first difference of natural logarithms of the variables (percentage changes), with similar results.

Regressions cannot capture all of the costs of collecting scrap that were unique to the war years. We should, therefore, also give some weight to estimates made at the time by experts with an intimate knowledge of the market. Perhaps the estimate with the greatest claim to authority was made by Edwin C. Barringer. Barringer (1954, 54) argued that the drives did bring in additional scrap, and estimated that in 1942 and 1943 the salvage drives yielded about 4,000,000 additional tons of scrap. This was about 8.33 percent of consumption of purchased scrap in 1942 and 1943 and 3.67 percent of total consumption of scrap (Table 1, columns 1 and 2). He adds, "During the entire war perhaps about 9,000,000 tons was brought out that would not have been available to dealers under normal conditions." This was about 9.61 percent of purchased scrap and 4.21 percent of total scrap from 1942 through 1945 (Table 1, columns 1 and 2). Salvage-drive scrap was lighter than normal scrap, and according to Barringer, the mills preferred normal scrap when they could get it (*Wall Street Journal*, November 28, 1942, p. 1). These percentages, therefore, undoubtedly overstate the yield of the scrap drive compared with a statistic in which the numerator and denominator were measured in tons of scrap of constant quality. Barringer was a long-time official with the Institute of Scrap Iron and

Steel, a trade group representing the scrap dealers, and they sponsored his book. As a trade group they had an interest in stressing the contribution of professional dealers. To my knowledge, however, Barringer's book is the best-informed account of the industry during this period, and has a strong claim to authority.

Altogether the evidence of the peak-to-peak trend, the regressions, and Barringer's estimates suggest that the drives added at most a few percentage points to the supply of scrap. How significant was a "small" percentage increase in the supply of scrap? Measured in months of consumption at the 1941 rate, Barringer's estimate of 9,000,000 additional tons, the highest estimate that we have discussed, was only about two months worth of consumption of scrap: without the drives it would have taken two additional months for the private sector to produce and consume the same amount of scrap.[12] Measured against total steel production, Barringer's estimate would appear smaller. It amounted to about 1.6 percent of total steel production during the war (*Historical Statistics* 2006, series Dd399, Dd405 -407). To put it in more familiar terms, this was about 24 days of production. Conceivably, the timing of scrap collection could be crucial. A great battle, one could imagine, could turn on the deployment of a small amount of arms, so any slowdown in the flow of scrap that slowed production and prevented these particular arms from reaching the crucial battlefield at the crucial moment could be important (Kimble 2007, 95-96). "But for want of a nail …" But absent an argument of this sort that magnifies the impact of the availability of scrap at a particular moment, it is clear that even in the absence of the patriotic salvage drives the United States would have produced

12. In principle a large part of previously produced steel could have been salvaged and recycled at a price because little steel is lost before an article made from it is scrapped. Potentially, the scrap heap was, to simplify somewhat, the sum of previous production. Therefore, the danger of running out of scrap was relatively small. When it comes to rubber, the situation was somewhat different, and I will have to pay more attention to the size of the scrap heap.

enough scrap iron and steel to supply its steel industry and to equip its fighting forces

VI. Rubber

The Rubber drive was the most important. There was no question that given time the United States could produce large quantities of aluminum, copper, steel, and most of the other materials needed for the war because the United States produced the raw materials or could import them from allies or neutrals. In most of the cases in which the United States had depended on sources that were cut off by the war, it could make do with substitutes. In the case of tin, for example, the U.S. developed sources in the New World. And in the case of silk, the United States made do with nylon. But rubber remained a problem. Japanese military expansion in Southeast Asia cut off the United States and her Allies from their major sources of natural rubber – sources that had supplied ninety percent of U.S. raw rubber before the war. The United States was producing only small amounts of synthetic rubber for specialty purposes Although the basic chemistry for producing general purpose synthetic rubbers was understood, many technical hurdles had to be overcome. No one, in other words, could be sure how long it would take to get a large-scale synthetic rubber industry going. The fear that the United States would not have sufficient rubber to maintain its domestic transport system and equip its fighting forces, to sum up, was based firmly in reality.[13]

Table 3, which shows the "rubber budget" of the United States during the war, demonstrates that reclaimed rubber played an important role in closing the "rubber gap" during the first two years of U.S. involvement. Nevertheless, it was only one of five ways in which the United States closed the

13. There was also the fear that the stock of rubber was vulnerable to sabotage. On October 11, 1941 a fire at a Firestone plant in Fall River Massachusetts destroyed a large amount of the U.S. stockpile (*New York Times*, October 13, 1941, p.1). Although the FBI investigated; the state fire marshal later attributed the fire to spontaneous combustion (*New York Times,* Jan 4, 1942, p. 40).

rubber gap:

(1) Running down the stock of raw rubber. Sizeable imports in 1940 and 1941, based on the fear that access to Asian sources would be disrupted, had built up America's stocks. The Rubber Reserve Company, a federal agency founded in June 1940, had purchased much of this rubber. Initially, according to Herbert Feis (1947), he and like-minded State Department officials had pushed for an aggressive buying program, but were thwarted by Jesse Jones of the Reconstruction Finance Corporation who set tight limits on the prices the Rubber Reserve would pay. Eventually, when the private rubber companies found themselves desperately bidding against each other for raw rubber, and outbidding the Rubber Reserve, the decision was reached to make the Rubber Reserve the sole buyer. By the end of 1941 the United States had a stock of 533,000 long tons of rubber equal to over eight months consumption at the 1941 rate; by 1945 the U.S. had a stock of about 45,000 long tons, equal to about 5 months consumption at the much lower wartime rate (Table 3, column 3).

(2) Increasing production of natural rubber in areas controlled by the Allies. Sri Lanka (Ceylon) was the major remaining producer after the Japanese thrust into Southeast Asia, and its output increased substantially. Attempts were also made to increase production in Liberia, to buy wild rubber in Latin America, and even to plant rubber producing crops such as guayule in the United States. Together, however, these efforts produced only small amounts. Imports of natural rubber during the war (Table 3, column 1) remained well below prewar levels. As late as 1945 the United States imported only 139 thousand long tons, about 30 percent of imports in the depression year 1935.

(3) Building synthetic rubber plants. The technology for producing synthetic rubber, as noted above, was available, but plants sufficient to supply the American markets did not exist. The government launched a crash program to build new plants, financed through the Reconstruction

Finance Corporation, but no one could be sure how long it would take to get the new plants up and running. The synthetic rubber program, however, proved a success, and was providing substantial supplies by the fourth quarter of 1943. In 1944, their first full year of operation, the United States consumed 567 thousand long tons (Table 4, column 3), matching or exceeding consumption of rubber of all types in most prewar years. In 1945 the United States consumed 694 thousand long tons, exceeding consumption in any prewar year.[14]

As it turned out, the United States finished the war with stocks of rubber that were adequate, if barely so. Nevertheless, the sense of urgency at the beginning of the war was justified. The last line of Table 3, *1943, is a counterfactual rate of consumption which assumes that the synthetic rubber program was able to deliver only 50 percent more rubber in 1943 than in 1942, rather than the 10-fold increase that actually occurred. On this plausible assumption, and given maintenance of the wartime rate of consumption of rubber, the stock of rubber on hand would have been exhausted.

(4) Conserving rubber. The military changed its specifications to minimize the use of rubber. Civilian production was limited and supplies were rationed. Civilian rationing began, John Kenneth Galbraith (1981, 152-56) tells us, with his order, issued immediately after Pearl Harbor, prohibiting the sale of new automobile tires. His fear was that a rush to buy the existing stock would leave dealer shelves empty. Shortly afterwards, a rationing system was introduced that allowed people in essential occupations – doctors, police officers, and after a political dustup, ministers – to buy tires. A series of orders from the War Production Board prohibited the production of new tires for the civilian market for the first nine months of 1942 (Wendt 1947, 216-17).

It is tempting to view the prohibition of tire production for the civilian market and related

14. See Herbert and Bisio (1985) for a detailed history of the synthetic rubber program.

orders as important in pushing the industry into production for the military, but there was a pull as well as a push. Official government orders prohibiting production for the civilian market may have been merely a useful excuse for producers who wanted to break relations with long-term customers and concentrate on highly profitable military contracts. One part of the pull story is easy to verify; profits of the tire companies rose substantially during the war. Net income of the tire companies rose from $54 million in 1940 (the best previous year was $51 million in 1927) to a wartime record of $312 million in 1943 (U.S. Department of Commerce 1950, 9). These figures are in nominal terms, but even if we allow for the increase in the measured price level – the GDP deflator increased about 20 percent between 1940 and 1943 (*Historical Statistics*, series Ca13) – and a substantial margin for hidden prices increases, it is clear that there was a strong incentive to convert to war production.

(5) Increasing production and consumption of reclaim. Consumption of reclaim, which was only about 0.3 percent of total consumption in 1939, when natural rubber prices were low, rose to nearly 40 percent of total consumption in the key years 1943 and 1944.[15] There was a precedent, however, for heavy reliance on reclaim: as we will see below, reclaim had played an important role in the rubber budget in the 1920s.

The flow of scrap rubber to the reclaimers fell precipitously after Pearl Harbor. Owners were hoarding scrap on the reasonable speculation that prices would soon rise either because the Office of Price Administration would be forced to raise legal maximum prices or because ways around controls would be found. In response, the reclaimers, various government agencies, and the petroleum industry, quickly reached an agreement to keep the reclaimers supplied by embarking on a high-profile scrap drive. The drive lasted from June 15 to July 10, 1942. It was conducted throughout with much fanfare.

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15. The percentages were derived by dividing consumption from reclaim (Table 3, column 4) by the sum of consumption from natural rubber, reclaim, and synthetic rubber (Table 3, columns 2, 4, and 5).

President Roosevelt announced the initial plan for a two-week drive in a radio address delivered on June 12, 1942 (*New York Times*, June 13, 1942, p. 16). His address stressed, as might be expected, that reclaim would help tide the country over until synthetic rubber became available. It also stressed, perhaps even more, the uncertainty about how much scrap was available. The only way to find out, Roosevelt said, was "to get the used rubber in where it can stand up and be counted." Once we know how much used rubber is available, Roosevelt told his listeners, "we will make our plans accordingly" (*New York Times*, June 13, 1942, p. 16). There was an implicit warning here, and an implicit incentive (from the point of view of business), to cooperate: if the scrap drive did not turn up much, other measures, in particular gasoline rationing, which was widely touted as a way of conserving rubber, would have to be more restrictive. Eric W. Johnston, the president of the U.S. Chambers of Commerce, made this point in a circular letter urging his members to cooperate with the scrap rubber drive: a successful drive would "weigh heavily against any compulsory conservation efforts on the part of the government" (*New York Times*, June 13, 1942, p. 1). To frame it in a slightly different way, the president's talk, although it explicitly assured the public that it was not about gasoline, was in fact paving the way for gasoline rationing (Goodwin 1994, 357).

As with the other drives, the response was striking: Americans sacrificed their worn out tires, hot water bottles, rubber bands, and rubber duckies. Government officials vied to show their enthusiasm. The prominent New Dealer Harold Ickes, the Petroleum Administrator for War, denounced "hoarders" and in a well-publicized contretemps ordered that the floor mats in the Interior Department be scrapped. Unfortunately, it turned out that not all of them were his to donate. In the end, the Public Buildings Administration, which did have custody, decided not to scrap some of the more valuable mats (*New York Times*, July 3, 1942). A second problem was that the floor mats probably contained a large percentage of reclaim, and if so, the material reclaimed from them would

be unsuitable except for making tires, the most important use of reclaim.[16] According to some experts, about the only thing you could make from rubber floor mats was more rubber floor mats (*Wall Street Journal*, June 25, 1942, p.1).

Rubber was bought at a penny a pound ($20 per short ton) by filling stations.[17] The Rubber Reserve, in turn, reimbursed the Oil companies at the rate of $25 per ton. Profits were donated to charity. At the same time, the major reclaimers entered into an agreement with the Rubber Reserve to process the scrap with all costs reimbursed by the Rubber Reserve, and again, with any profits to be donated to charity. Many people treated a penny a pound as a token price and refused to take it, a way of underlining their patriotism. By historical standards, however, it was a high *point-of-origin* price for scrap rubber, and this was important to people who made their living by collecting scrap. Although exact figures are not available, one authority put the range of scrap prices between 1915 and 1940 at $15 to $30 per short ton *delivered-at-Akron*, with the typical price around $20 per short ton (Ball 1947, 150). One reason for setting a high point-of-origin price for scrap may have been recognition that incentives matter even in wartime. The high-point of origin price for scrap rubber may have reflected the recognition that the aluminum drive had been spoiled in part by the decision to deny the junk dealers an adequate incentive. An editorial in *Time Magazine* for June 8, 1942 made precisely this point. But price incentives could have been used to a much greater extent. The same article argued that the price of scrap rubber ought to be allowed to rise as high as $50 or $100 dollar

16. High quality reclaim could be used in combination with natural rubber to make tires. It was not possible, however, to make satisfactory tires entirely from reclaim.

17. No one expected motorists to turn in new tires at a penny a pound; there was a limit to what could be expected from patriotism. New, unmounted tires in the hands of the public were treated separately: it was required that they be sold to the government. They were paid for through the "Idle Tire Purchase Program."

per ton.[18] The decision to control prices of scrap rubber, and to rely on scrap drives, backed up by subsidies paid by the Reconstruction Finance Corporation to the scrap brokers, rather than high prices to bring in the scrap, was partly the product of the theory of inflation discussed in the preceding section. Price increases in scrap rubber, policy makers believed, would produce increases in the prices of products made from rubber, and contribute to the increase in the price level. The amount of inflation passed through to a final product would be small if it was proportional to the share of scrap rubber in the final product. The Office of Price Administration, however, believed that inflation could grow in an irrational, cancerous fashion, hence the need to clamp down on inflation at its source.

The drive produced approximately 400,000 long tons of scrap. Although some criticisms were made of the quality of the scrap procured, the oil industry took pride in the role it dealers had played, and in the resulting donations to charity (Petroleum Industry War Council 1943). When the rubber drive ended it was thought likely that more rubber drives would be undertaken, but this did not happen. The Rubber Reserve maintained its buying price at $25 per short ton until May 1943 when it lowered the price to $15 per short ton. This decision reflected the easing of the rubber situation, especially in prospect, because of the success of the synthetic rubber program. On January 1, 1944 the industry supplying scrap rubber to the reclaimers was returned to private hands.

The interest of the users of reclaim in promoting a scrap drive was straightforward: since they bought at fixed prices, more scrap and hence more reclaim was better. The interest of the oil companies was indirect. Gasoline was abundant in most of the country, especially the Southwest, by prewar standards, and there was little reason on that account to ration. The exception was part of the Northeast where supplies brought by sea had been interrupted by German submarine activity. It was

18. Quoted in Wolf (1943, 56-7).

widely believed, however, that gasoline rationing and low driving speeds were crucial for conserving tires. The *U.S. Special Committee to Study the Rubber Situation* (1942) –popularly known as the Baruch Report – after its chair, Bernard Baruch, head of the War Industries Board in World War I – pushed for nationwide gasoline rationing and a 35 mile per hour speed limit to conserve tires.[19] Thus, by promoting scrap rubber collection the oil companies hoped to increase the supply of rubber for civilian tires and limit the extent of gasoline rationing. Not only would gasoline rationing reduce consumption and profits during the war, it might also accustom some drivers to get along with less gasoline and spoil postwar markets.

The most baffling positions, on the surface, were those of the reclaimers who agreed to donate their profits to charity, and especially the major scrap brokers – four did most of the business – the firms that bought scrap rubber from junk dealers, sorted it, and sold it to the reclaimers, who went even further. An agreement between the Rubber Reserve Company, which became the sole buyer of scrap, and the scrap brokers emphasized reimbursement only for costs (*New York Times*, Jul 14, 1942. p. 10). And a history of the industry financed by one of the major scrap rubber brokers and published in 1943 described the deal, as being on an "out-and-out no profit basis" (Wolf 1943, 58). But it is understandable that the brokers would want at least to be seen as working on a "no profit basis." In the Aluminum drive undertaken in 1941, as noted above, Mayor LaGuardia had cut the junk dealers out of the business while denouncing them as unpatriotic speculators. The scrap rubber brokers wanted to avoid being placed in the same category, even if the public had developed some grudging respect for junk men in the wake of the aluminum drive.

The scrap rubber brokers, however, did not succeed in avoiding the charge of profiteering. Elliott E. Simpson, the counsel for the House subcommittee expediting the scrap rubber drive, charged

19. The Report, although issued shortly after the Rubber drive reflected opinion at the time of the drive.

that the brokers had reaped "enormous profits" (*New York Times*, June 29, 1942. p. 8; July 13, 1942. p. 17). A case could be made that much of the scrap collected in the drive would turn out to be of low quality (some of the floor mats Ickes was keen on scrapping) and costly to sort, so costs may have been high. But it would be difficult now to determine whether there were "excessive" profits, even if it was possible to define the term.

The rubber drive and subsequent purchases of scrap by the Rubber Reserve brought in a great deal of scrap, and production and consumption of reclaim was high during the war. But as with the other drives, the wartime experience needs to be put in perspective. Numbers suggesting that thousands of people contributed scrap, a long and varied list of objects were contributed, and computations of the amount collected per person, do not tell us about the economic importance of what was contributed. The key question is whether the drive increased the supply of scrap and the production of reclaim to levels substantially above what would have been available in a comparable peacetime period.

A number of considerations suggest that by this standard the additional scrap made available by the drive was relatively small. One indication that wartime consumption of reclaim was close to what might have been expected in peacetime in response to a strong market demand is the capacity of the reclaimers. The *Baruch Report* placed the capacity of the reclaimers at the time of the rubber drive at 350 thousand long tons per year, assuming intense utilization. The *Report*, in line with its theme of pushing every source of rubber to the maximum, called for a 20 percent increase in the capacity of the industry, and production of 400 thousand long tons in 1943. These projections were not met. Peak production was 303,991 long tons in 1942 (Table 4, column 4) – an amount well within the existing capacity of the prewar industry.

Figure 3 shows consumption of reclaimed rubber from 1919 to 1954 and a trend drawn

through the peaks in 1928 (the last peak before the depression) and the peak in 1947 (the first postwar peak). Although the war period shows up as a period of high consumption the amounts do not appear out of line with peacetime trends. Wartime consumption exceeds the peak-to-peak trend in only one year during the war, 1943, and then only by 6.34 percent. The 1943 peak, moreover, was only 2 percent above the peak in 1947, was 4 percent below the level reached in 1950, and was fully 17 percent below the level reached in 1951.[20]

Consumption of reclaim, which is the only series available before 1940, differs from production because of imports, exports, and additions to and subtractions from stocks. The use of the consumption figures, however, does not pose a major problem. The practice in the reclaim industry was to maintain relatively low inventories of unprocessed and processed scrap. During 1942-1945 stocks of reclaim on hand at the end of the year averaged less than 2 months consumption, and imports and exports were negligible. The Rubber Reserve reported the results of its operations in 1945 (U.S. Rubber Reserve Company 1945, 57). All told it purchased 990,944 long tons of scrap and sold 828,288 to reclaimers. Thus, about 18 percent failed to go through the reclaiming mills, although some of this was of low quality and some was purchased after the rubber situation eased.

Production figures, as we noted, are available beginning in 1940. The wartime peak for production occurred in 1942, when it reached a level 10.3 percent above the level in 1940. By 1949, however, current production exceeded the wartime peak by 2.9 percent, and in 1950 production exceeded the wartime peak by 18.5 percent (Table 4, column 4). The production figures, like the consumption figures, suggest that the accomplishments of the reclaiming industry during the war years

20. The latter were war years – the Korean War began in June 1950 – but patriotic pressures to salvage scrap were probably much less important than in World War II because synthetic rubber was now a reality, and because natural rubber producing areas were not immediately in danger.

were not far above what might have occurred in prosperous peacetime years in which access to imported rubber was restricted.

As Figure 3 shows, there was also a surge in the consumption of reclaim during the 1920s. This episode deserves a closer look because it provides another way to get a sense of what would have happened during the World War II if the United States had relied more on the market and less on patriotism to get in the scrap. The troubles in the rubber industry in the 1920s are usually associated with the Stevenson Restriction Plan.[21] The goal of the Plan, which became British law on November 1, 1922, was to boost raw rubber prices by limiting exports from British plantations in Malaysia (Malaya) and Sri Lanka. It was a response to depressed rubber prices that growers had tried to counteract unsuccessfully with voluntary restriction plans. The Plan imposed a prohibitive export tax when planters exported more than 60 percent of the amount sold in the year ending October 31, 1920. The allowable percent could be raised or lowered by 5 percent based on a scale tied to the London price of crude rubber. Prices sagged during the first years under the Plan and the amount that could be exported before the prohibitive tax kicked in was lowered. However, in 1925 heavy demand for rubber produced by the introduction of the rubber-intensive balloon tire ran into a supply restricted (at least to some degree) by the Stevenson Plan and the result was a dramatic increase in raw rubber prices (Figure 4).

Politicians and business leaders did invoke patriotism during the period of high rubber prices in the 1920s, so we do not have a completely patriotism-free comparison with the war years. The Stevenson Plan outraged Harvey Firestone, and his company's advertisements declared that "America Should Produce its Own Rubber." Firestone lobbied his fellow Ohioan, President Warren G. Harding,

21. The Stevenson Plan is described in Knorr (1945), McFadyean (1944), and Whittlesey (1931).

for government support for American rubber plantations in the Western Hemisphere. Enthusiasm waned, however, when raw rubber prices retreated in 1922 and 1923. But the rapid increase of prices in 1925 led to new calls for a national response. In December 1925 Secretary of Commerce Herbert Hoover appealed to the public and to the manufacturers for cooperation in beating back high rubber prices through conservation and the creation of independent American supplies. Inevitably, Congress launched and investigation of "The Means and Methods of Control of Production and Export of Crude Rubber." When natural rubber prices broke in February 1926, Hoover took credit (*New York Times*, February 16, 1926, p. 21).[22] The patriotic appeals of Hoover and other leaders for conservation may have motivated some people to turn in their scrap. Nevertheless, it seems unlikely that in the 1920s patriotism could have functioned on the same scale as in World War II because there was no threat to the nation's safety in the 1920s. Indeed, many people viewed Hoover's actions as grandstanding designed to improve his prospects for the White House.

Figure 4, which shows the annual real prices of natural rubber and reclaim from 1919 to 1947, puts the price gyrations of the 1920s into a long-term perspective. The picture is dramatic – a sharp increase in the price of raw rubber in the 1920s produced a sharp increase in the demand for reclaimed rubber, but a much smaller increase in the price of reclaimed rubber. Evidently, the supply of reclaim proved highly elastic. During the early thirties the price of raw rubber tumbled and at its low point was about equal to the price of reclaim. During World War II, however, the price of raw rubber and the price of reclaim both fell in real terms. This was the result of the limits placed on the prices of raw rubber and reclaim by the Office of Price Administration. As with steel, there were some hidden

22. Most sources attribute the ultimate failure of the Stevenson Plan, which was terminated on November 1, 1928, to the effectiveness of the scrap drive, smuggling, and most important, the rapid growth of output in Indonesia (the Netherlands East Indies).

price increases: money paid to "expediters," for example, to get supplies of rubber, and there were substantial subsidies paid by the government to the collectors of scrap and the producers of reclaim. As with steel, the official wartime prices may be misleading, particularly in the latter part of the war.

The amount of reclaim consumed annually during the World War II was higher than during the 1920s, but the available stock of discarded rubber – the "scrap heap" – was also larger, simply because the rubber industry had grown substantially between the 1920s and the 1930s despite the depression (Table 4, column 2).[23] To judge whether wartime patriotism made a big difference, we need to measure the amount of rubber reclaimed relative to the scrap heap. Unfortunately, estimates of the scrap heap made at the beginning of the war differed widely: from 300,000 long tons to 2,000,000 long tons. In order to compare the two periods I have made my own estimate of the scrap heap based on the figures for consumption of natural rubber, which would seem to be the most reliable starting point. The assumptions were: (1) that products made from natural rubber, such as tires, were normally scrapped after three years,[24] (2) that 75 percent of the original rubber was available for reclaim in the first year after scrapping, (3) that any rubber not reclaimed deteriorated another 25 percent each year that it remained in the scrap heap, and (4) that scrapping at one half the normal rate took place in 1942 and 1943.[25] These assumptions were chosen to produce estimates of the annual amount scrapped that are close to estimates made by experts during the war, and estimates of the scrap heap

23. There was also some technological progress in the reclaiming industry – some of it stimulated by the high prices for reclaim in the 1920s – that made reclaiming a better substitute for importing raw rubber in World War II.

24. This might appear to be a high rate of scrapping. But tire mileage seems to have been much lower before World War II. Davis (1931) discusses the low mileage for tires built before the improvements in the highway system and the introduction of the balloon tire in the 1920s. Although not strictly accurate I also assumed that reclaimed rubber was not reclaimed.

25. The last assumption reflects the idea that motorists tried to keep the existing stock of tires running as long as possible during the dark days of the war.

that fall in the middle of the range of estimates made during the war (Ball 1947, 148).

Figure 5 shows consumption of reclaim in each year as a percentage of this estimate of the scrap heap. The Figure suggests that the rate of consumption of scrap during World War II was similar to what had occurred during the period of high consumption in the 1920s. Admittedly, any attempt to infer the size of the "scrap heap" is highly speculative. I tried a variety of measures, based on different assumptions about how fast products made from natural rubber were scrapped and how fast these products deteriorated once they entered the scrap heap, and the results were similar. The simple fact is that production from raw rubber in the late 1930s was higher than in the early 1920s and the use of reclaim was much lower. As a result, most measures of the scrap heap that depend on recent past production from natural rubber produce rates of consumption during the war, measured as percentages of the scrap heap, similar to rates of consumption during the 1920s.

The peak-to-peak trend line and the comparison with the 1920s are the simplest ways to get at what would have happened in a peacetime boom during the 1940s. To get an alternative that is somewhat less dependent on subjective judgments, I regressed consumption of reclaim on lagged values of reclaim and contemporaneous and lagged values of industrial production and then compared actual and predicted values during the war. Industrial production was included as a proxy for demand. As I noted in the case of steel, industrial production is not ideal because the structure of demand changed dramatically during the war, but it appears to be the best alternative available because it is likely to capture some of the tilt in production toward the industrial sector. I did not include prices because, as discussed above, controls distorted prices. In effect, the regression is a reduced form that assumes that price responses (of the own price of reclaim and the prices of close substitutes), to determinants of demand and supply were "normal" during the war years. This assumption biases the exercise in favor of finding an effect from patriotism because it makes no special allowance for the

increases in the prices of raw rubber and reclaim that would have occurred in a peacetime economy in which prices were left free, and the supply of natural rubber was drastically reduced.

I began simply with contemporaneous industrial production and then added lagged values of industrial production and lagged values of consumption of reclaim as long as they entered significantly. I also included dummy variables for 1942, 1943, and 1944, the years when a patriotic effect might have been operating. The results are shown in Table 5, part A. Only the 1943 dummy is positive. Although the coefficient is not statistically significant, it does show excess consumption of about 12,800 tons, an increase of 4.57 percent. I examined equations with up to six lags even though the coefficients on the additional lags were not significant, but additional lags did not improve the fit of the equation, or alter the conclusions with respect to the war years. I also estimated the equation in natural logarithms. Again, the only war year with a positive coefficient was 1943, and the coefficient, although again not significant, indicated an even smaller effect, 0.8 percent.

Since several tests, such as an Augmented Dickey-Fuller, showed that there could be unit roots in the reclaim and industrial production series when measured in levels, I also estimated the equation in first differences, following the same procedure for establishing the lag length. Table 5, Part B shows the results. The main findings of interest here are similar to those that emerge from Part A: the dummy variables for 1942, 1943, and 1944 do not show reveal a strong positive effect from patriotism. In fact, the coefficients were negative – the sign was always the opposite of what we would expect if patriotism made additional supplies available. Only the 1944 coefficient, however, was significant. [26] I also estimated the equation after taking first differences of the natural logarithms of the

26. In this regression the actual increase in consumption of reclaim did exceed the static forecast by about 10.5 percent in 1941. Although there was a good deal of concern about the rubber situation in 1941, the drive, and the appeals to patriotism, came in the summer of 1942, so it would be hard to attribute the surge in 1941 to patriotism.

variables. Again all the coefficients on the wartime dummies were negative, although in this case none were significant. The safest conclusion, from the regression estimates, because it is consistent with the other evidence, is that any additional amounts of scrap rubber produced by the patriotic drive over and above what would have been forthcoming in a prosperous peacetime period in which the supply of natural rubber was compromised, at best, must have been relatively small.

VII. What Can We Salvage from the Salvage Drives?

Enthusiastic stories about the scrap drives of World War II might lead one to believe that the drives had an important impact on the supply of raw materials. This was not the case. To be sure, the iron and steel drive and the rubber drive may have made some additional supplies available, but the additional amounts were of a much smaller order of magnitude than popular stories about the drives might suggest. Historians often describe the scrap drives as if the mobilization of large amounts of scrap was unique to the war. Scrap collection, on the contrary, was an ancient, honorable, and efficient business that functioned in peace as well as war. The amount of iron and steel salvaged in 1942 was only 9 percent above the amount salvaged in 1937, the prewar peak. By 1950 more iron and steel scrap was being processed than during any year in World War II. The amount processed during the war never rose above the peak-to-peak trend. The wartime rubber drive was similar to the drive that occurred in the 1920s as a result of a sharp run-up in natural rubber prices. By 1950 more rubber scrap was being processed than during any year in World War II. In only one year, 1943, did consumption of reclaim rise above the peak-to-peak trend, and then only by a small amount. This and other evidence discussed above shows that the scrap drives did not push collections to unprecedented

heights.[27]

The patriotism that surrounded the drives, moreover, did not erase the importance of conventional economic incentives. The aluminum drive suffered because the junk dealers were excluded. The rubber drive was more effective because this lesson was learned, and the traditional brokers were brought into the program. The fat salvage program was unnecessary, the product of special interests seeking a way around price controls and rationing. The lack of adequate price incentives complicated the iron and steel scrap drive and made it less effective than it otherwise would have been.

To be sure, the political and psychological effects of the drives, as many historians have argued, may have been important. The prewar aluminum drive may have solidified support for active U.S. involvement. And the wartime drives gave Americans on the home front a concrete way to display their support for the war. Parents, moreover, could allay the anxieties of their children (and themselves) by providing concrete ways that children (and adults) could participate in the war effort (Kirk 1995). We should note, however, that historians celebrate Roosevelt's use of the drives to influence public opinion partly because they approve of his end purposes. Suppose, to take one example, that during a later less popular war a president had launched a "fat salvage" campaign that, as in World War II, was ostensibly about providing a raw material to make bombs, but in fact was about providing a raw material to make soap so that makers of soap could avoid rationing. Would historians of this later less popular war be likely to praise the campaign as a brilliant way of mobilizing public opinion, or would they be more likely to condemn it as a cynical attempt to deceive the public and

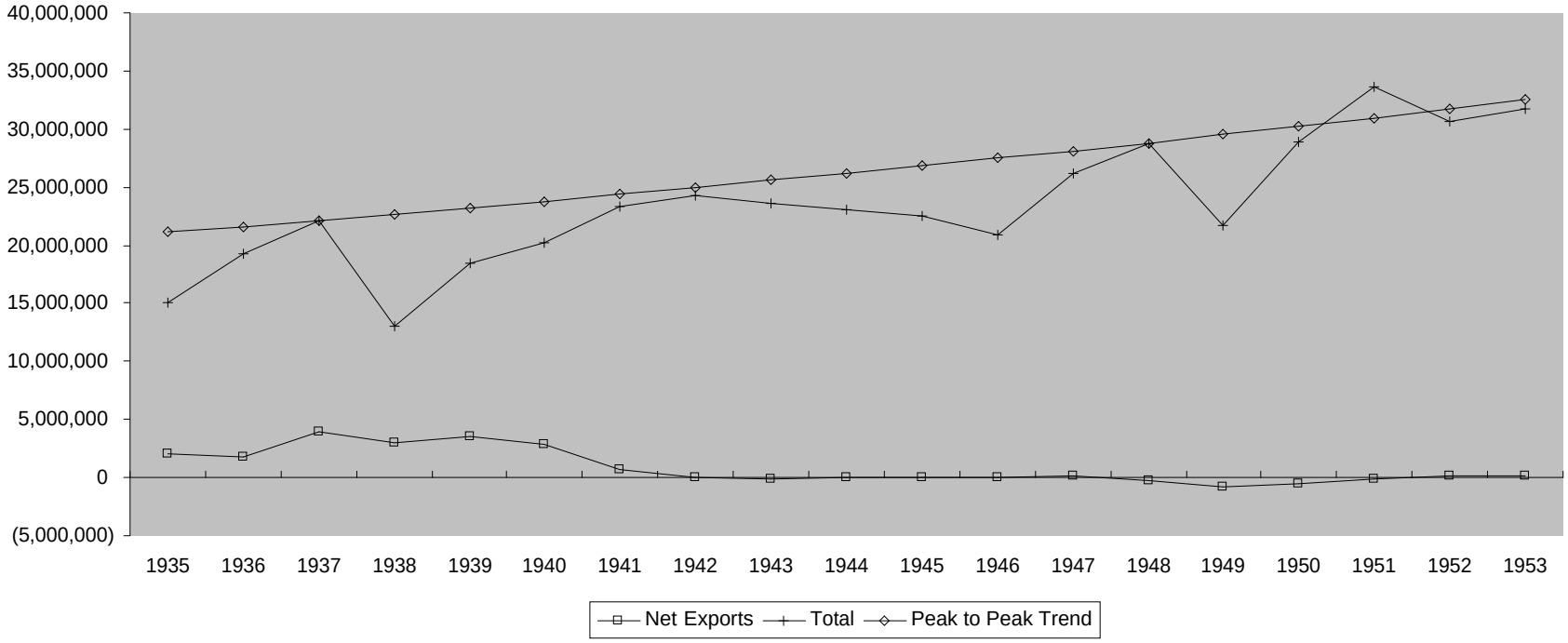
27. Strasser (1999, 262) focused on the social dimensions of the drives and did not offer any explicit data on the quantity of scrap collected. However, she also concluded that "industrial salvage was simply of much greater significance: more materials could be collected more efficiently."

benefit private interests?

Whatever the psychological effects of the drives, the economic effects were limited. Rather than demonstrating the importance of non-pecuniary motives and non-market means of production, the salvage drives demonstrate the limited ability of patriotism and community spirit to overcome technical constraints or the tendency of individuals and interest groups to respond to economic incentives.

Figure 1

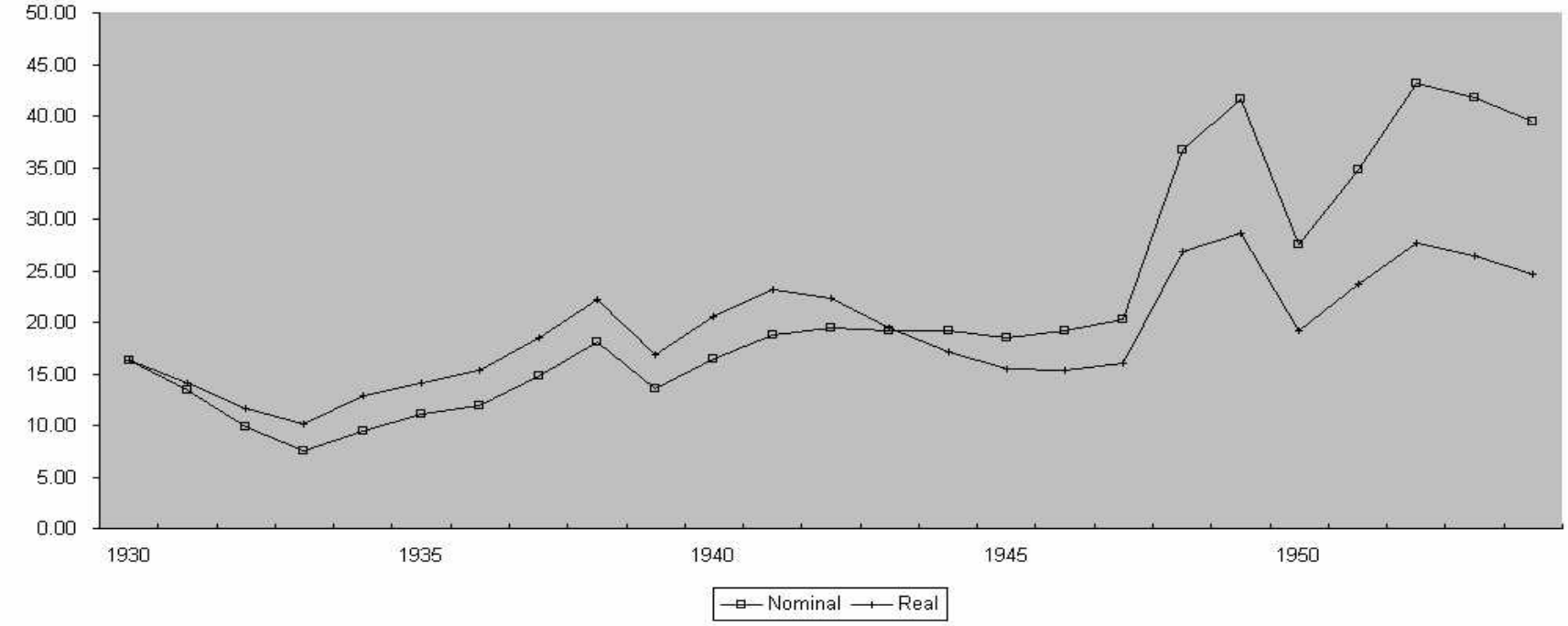
Purchases of Iron and Steel Scrap
Gross Tons, 1935-1953



Sources. Total: Table 1, column 2. Net exports: Table 1, column 3 – column 4.

Figure 2

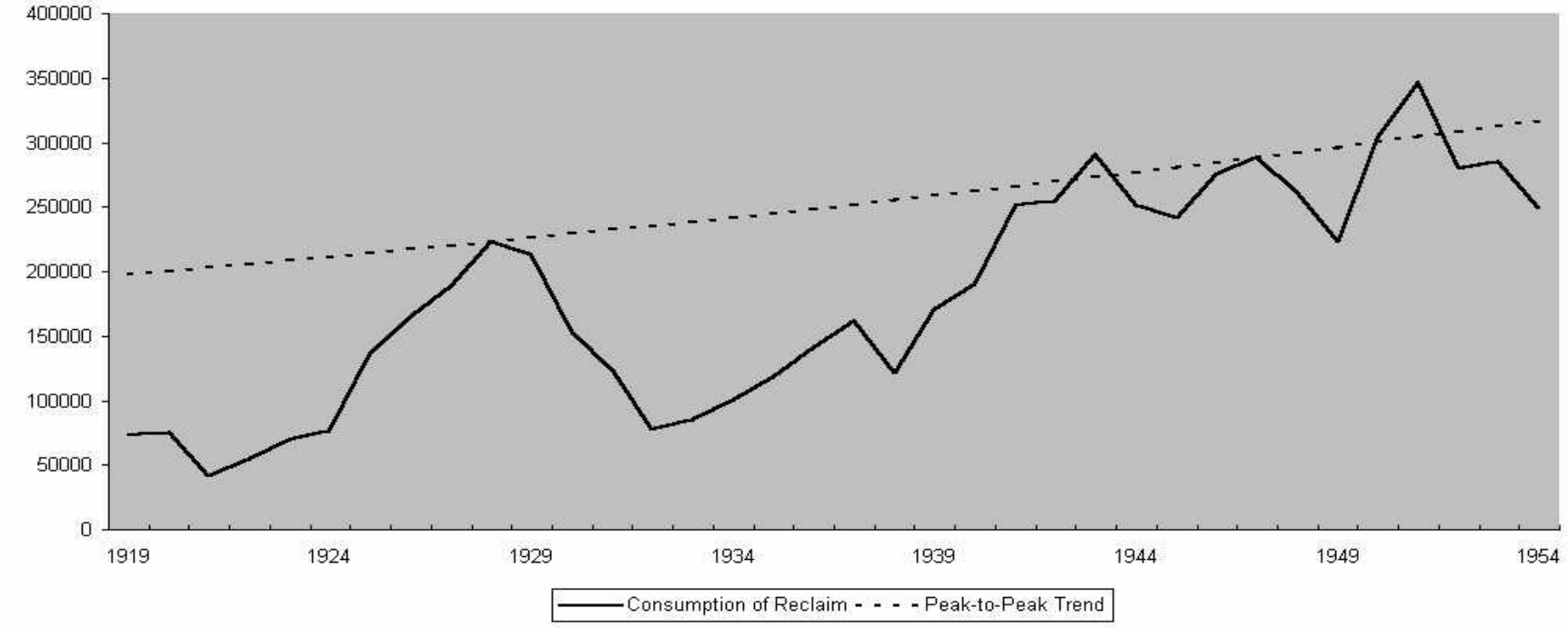
Steel Scrap Prices
1929-1953



Sources. Nominal: Table 1, column 5. Real: The nominal price in dollars per ton was deflated by the GDP deflator (*Historical Statistics* 2006, series CA13) and set equal to the nominal price in 1929.

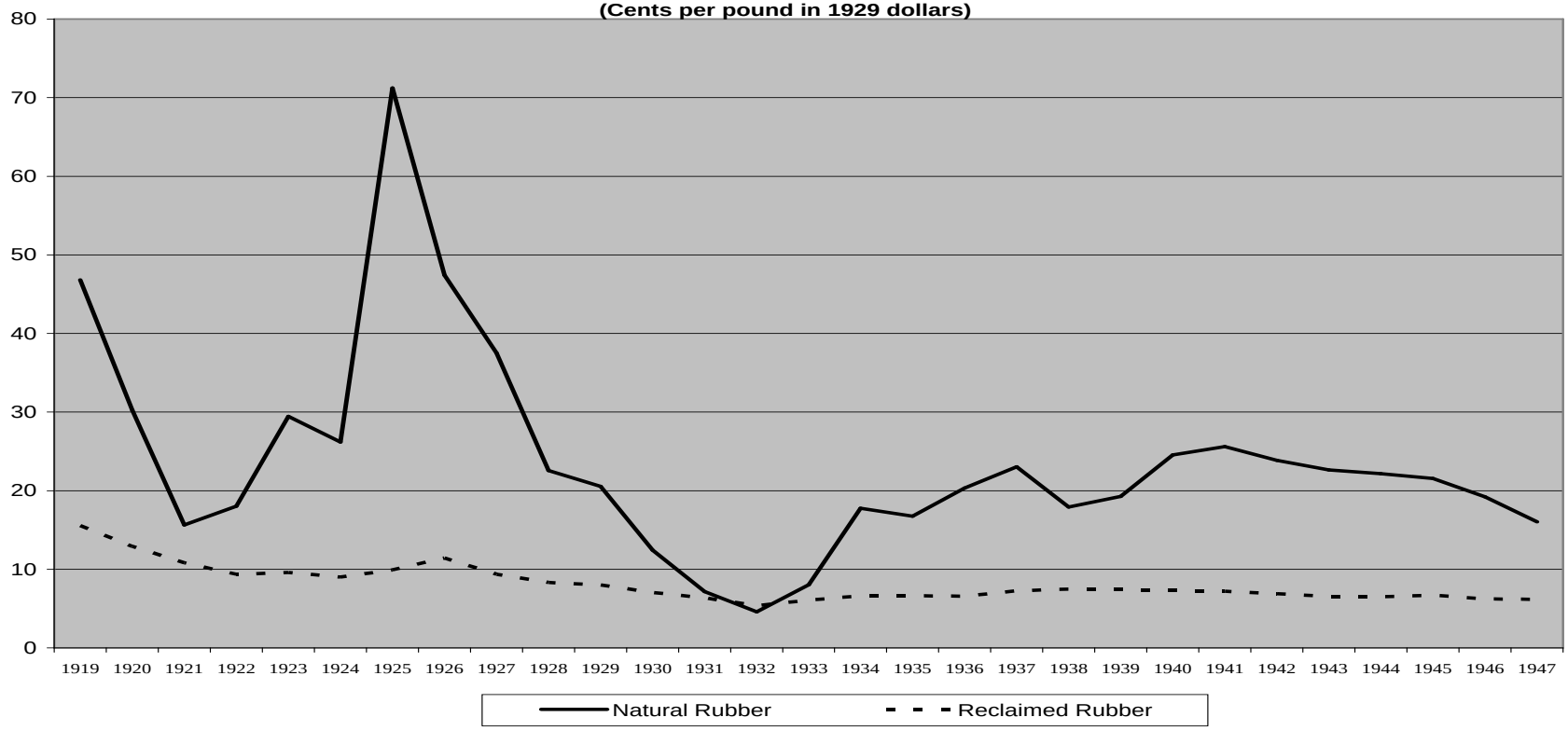
Figure 3

Consumption of Reclaimed Rubber
Long Tons, 1919-1954



Sources. Consumption of Reclaimed Rubber: Table 4, column 1.

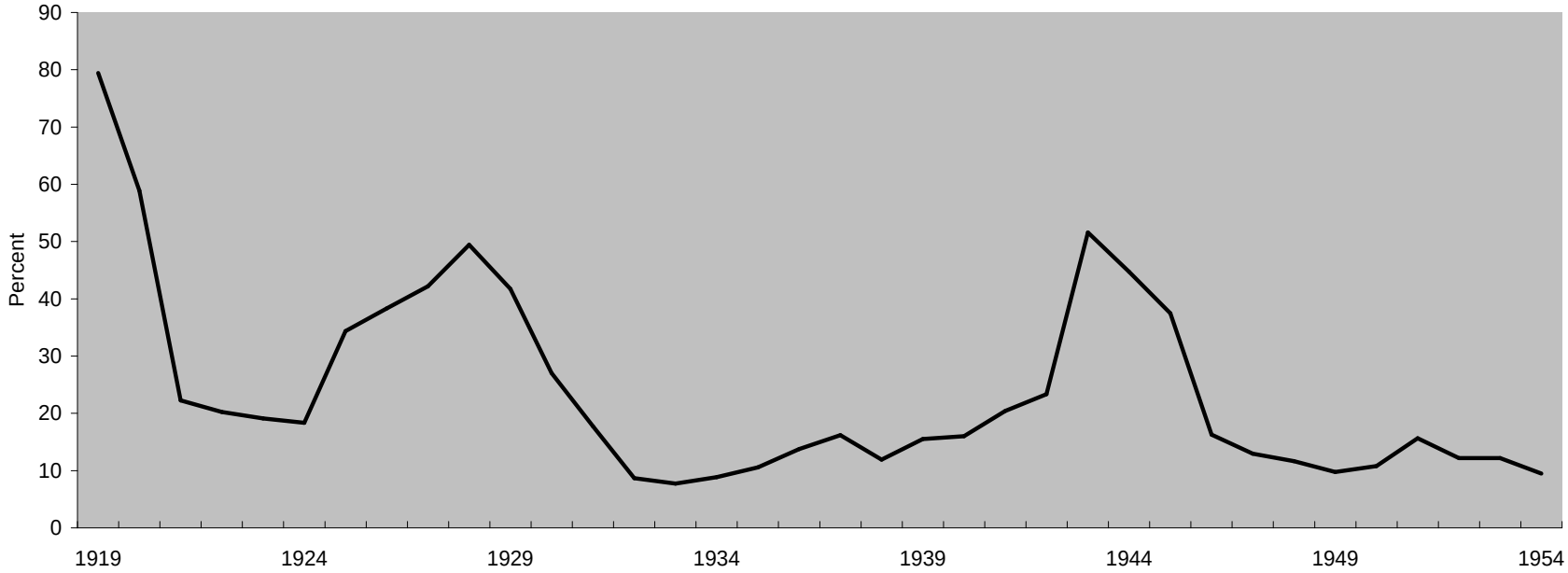
Figure 4
The Real Prices of Natural and Reclaimed Rubber, 1920-1947
(Cents per pound in 1929 dollars)



Sources. Prices of natural rubber and reclaimed rubber are from Table 4, columns (5) and (6). The nominal prices were deflated by the GDP deflator (*Historical Statistics* 2006, series CA13). The GDP deflator would seem to be the most relevant series, of those readily available, to the decisions being undertaken by the tire companies and other industrial users of rubber.

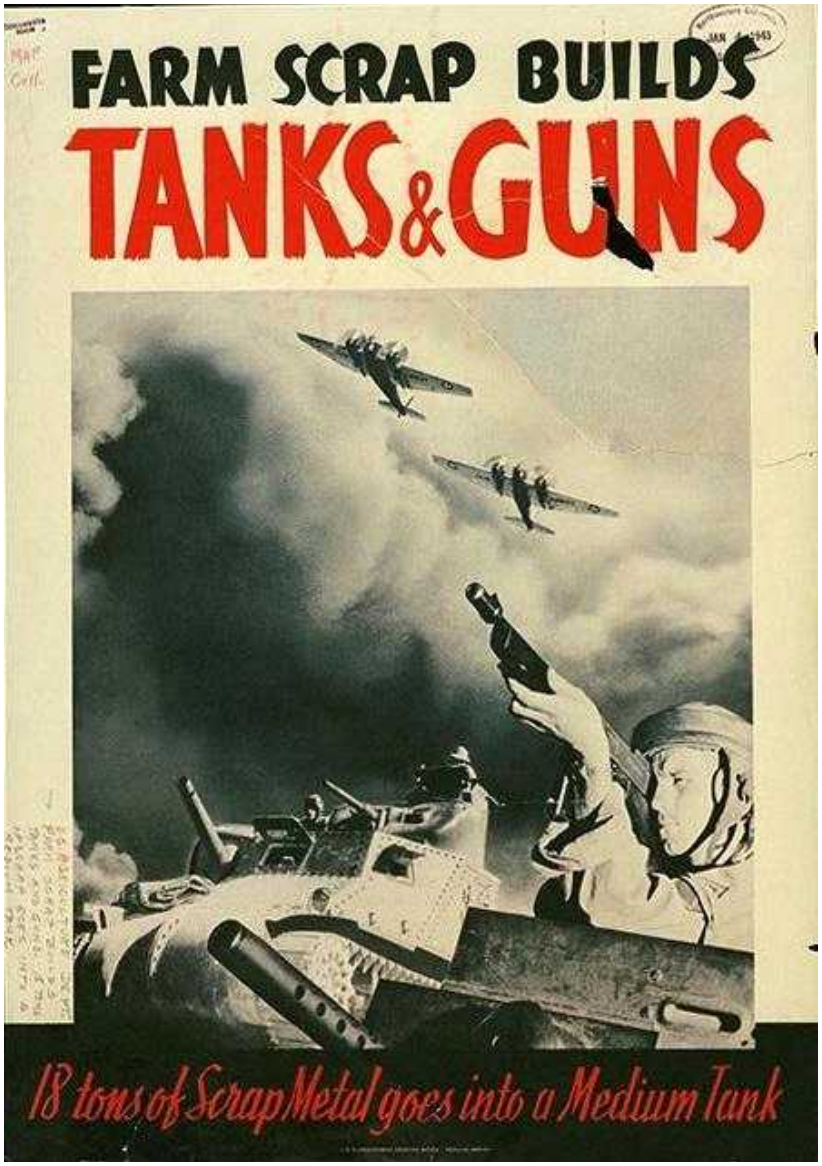
Figure 5

Consumption of Reclaim Relative to the "Scrap Heap," 1919-54

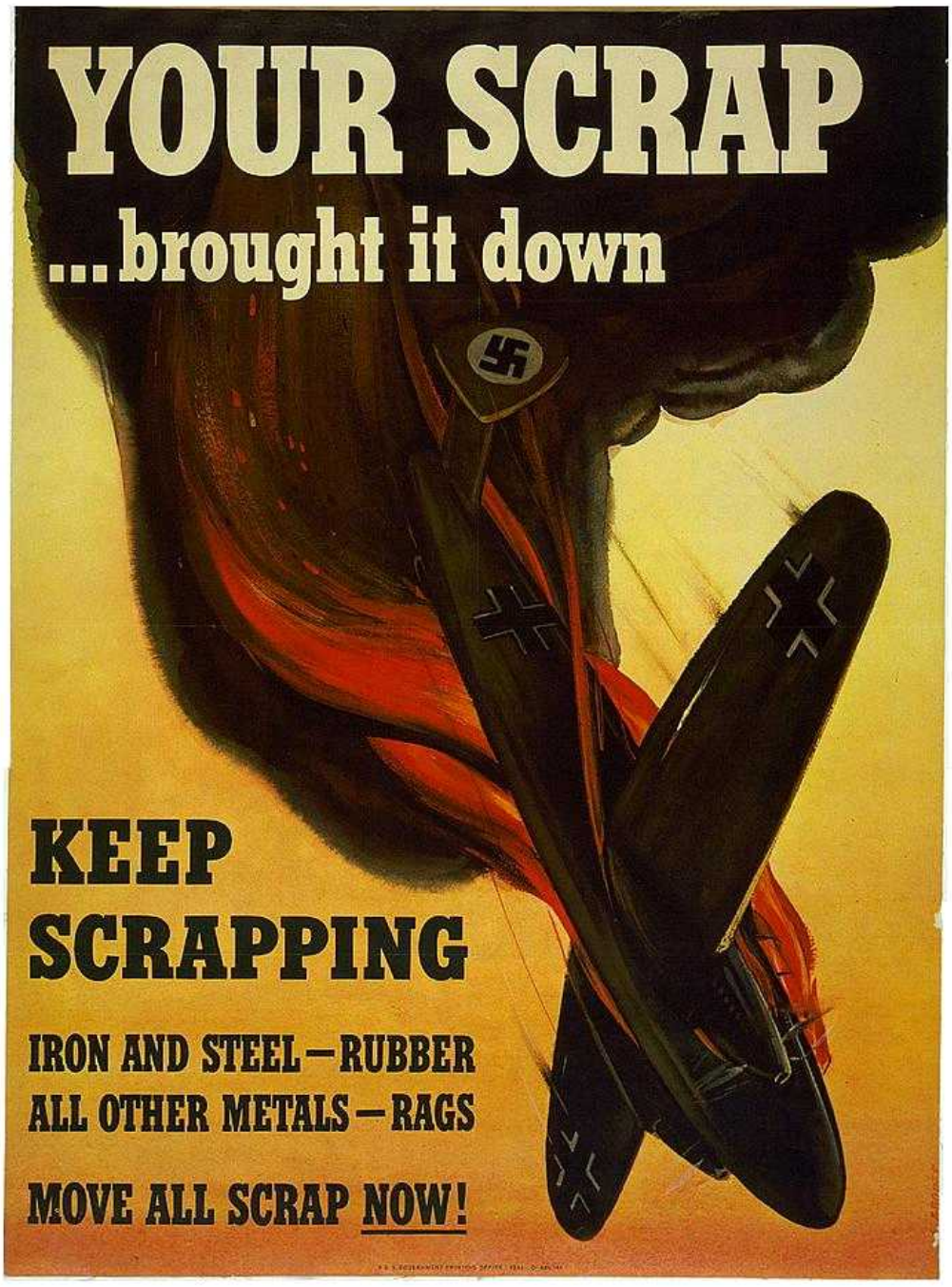


Sources. Consumption of Reclaimed Rubber: Table 4, column 1. See the text for the computation of the scrap heap.

Poster 1: "Farm Scrap Builds Tanks & Guns:"
http://www.library.northwestern.edu/govpub/collections/wwii-posters/img/ww1646-65, accessed June 28, 2007.



Poster 2. Library of Congress. http://hdl.loc.gov/loc.pnp/cph.3g01669, accessed June 8, 2007.



Poster 3. "Save Waste Fats" by Henry Koerner. New Hampshire State Library. http://www.nh.gov/ww2/ww14.html. Accessed July 29, 2008.

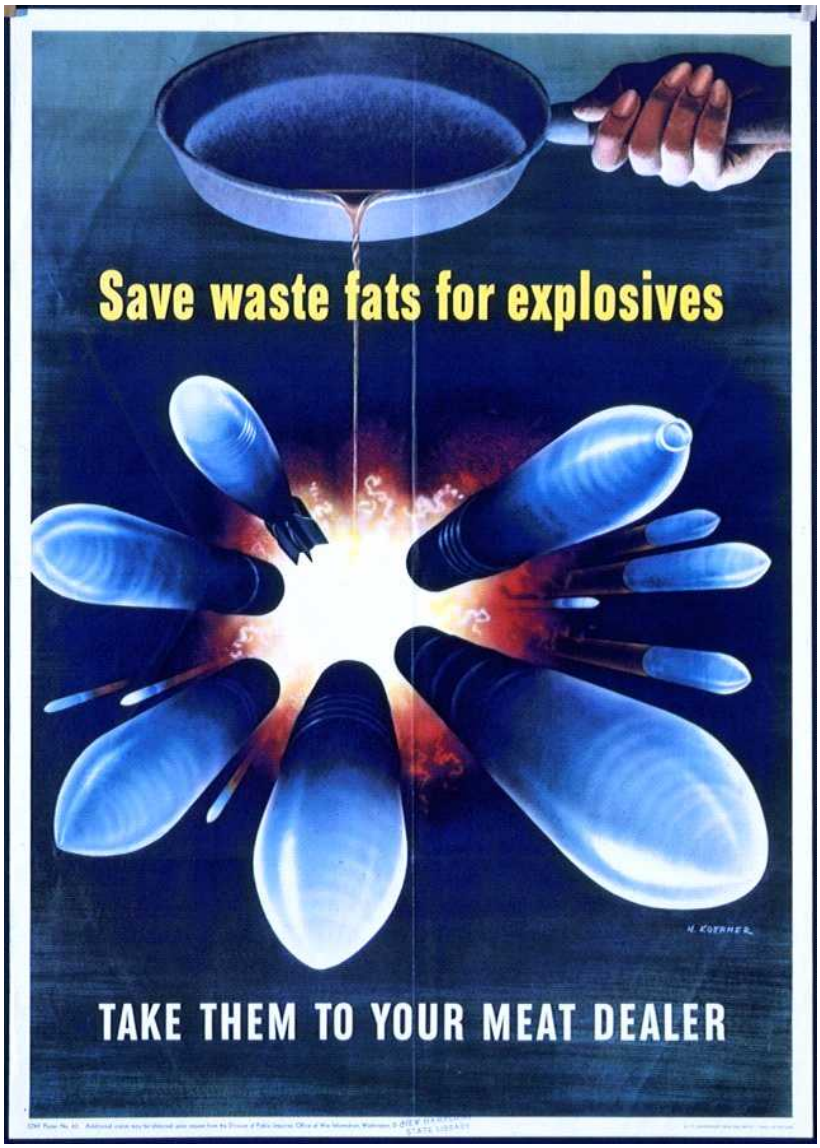


Table 1. Consumption of Iron and Steel Scrap, 1910-1953.					
	Consumption (In House)	Consumption (Purchased)	Exports	Imports	Price No. 1 Heavy Melting Steel Scrap
	Long Tons	Long Tons	Long Tons	Long Tons	Dollars per Long Ton
	(1) [a]	(2) [b]	(3)	(4)	(5) [c]
1910	13,100,000	NA	25,825	72,764	NA
1911	12,100,000	NA	77,918	17,272	NA
1912	16,100,000	NA	105,965	23,612	NA
1913	15,300,000	NA	94,429	44,154	NA
1914	12,200,000	NA	33,134	34,839	NA
1915	18,600,000	NA	79,361	79,982	NA
1916	23,400,000	NA	212,765	116,039	NA
1917	26,800,000	NA	145,574	180,034	NA
1918	25,400,000	NA	2,160	63,730	$28.76
1919	20,700,000	NA	27,275	177,293	17.89
1920	26,000,000	NA	219,250	140,645	23.71
1921	12,400,000	NA	37,592	41,469	12.61
1922	23,700,000	NA	67,784	142,969	15.83
1923	27,000,000	NA	65,980	162,066	19.05
1924	26,200,000	NA	97,748	66,841	17.15
1925	30,700,000	NA	82,573	99,815	17.12
1926	32,200,000	NA	104,838	86,725	15.48
1927	30,700,000	NA	239,209	60,207	14.00
1928	34,000,000	NA	516,148	63,314	14.29
1929	37,600,000	NA	557,044	90,479	16.30
1930	26,600,000	NA	358,649	27,482	13.48
1931	18,300,000	NA	136,125	16,279	9.8
1932	10,000,000	NA	227,522	9,775	7.54
1933	17,400,000	NA	773,406	56,133	9.47
1934	18,800,000	NA	1,835,170	44,421	11.07

Table 1. Consumption of Iron and Steel Scrap, 1910-1953.					
	Consumption (In House)	Consumption (Purchased)	Exports	Imports	Price No. 1 Heavy Melting Steel Scrap
1935	13,346,752	13,068,578	2,103,959	64,768	11.85
1936	18,901,389	17,456,744	1,936,132	142,245	14.83
1937	19,871,033	18,135,239	4,092,590	81,640	18.03
1938	11,321,341	10,023,593	3,003,523	24,451	13.54
1939	17,519,550	14,914,857	3,577,427	42,125	16.39
1940	22,364,030	17,394,597	2,820,789	18,578	18.76
1941	30,272,035	22,599,622	792,760	86,684	19.50
1942	29,579,797	24,228,374	126,473	112,365	19.17
1943	31,283,116	23,762,379	48,957	147,601	19.17
1944	31,631,437	23,145,723	82,329	114,504	18.55
1945	27,643,486	22,527,126	73,262	59,385	19.15
1946	23,334,073	20,848,167	126,426	51,519	20.28
1947	28,195,000	26,148,000	152,078	63,108	36.65
1948	28,946,000	29,057,000	189,459	429,218	41.66
1949	26,041,000	22,475,000	266,603	1,018,182	27.56
1950	32,095,000	29,402,000	194,114	660,260	34.75
1951	34,693,521	33,813,709	196,219	339,404	43.15
1952	31,104,280	30,523,508	300,440	128,841	41.79
1953	37,411,159	31,614,817	265,985	153,722	39.52

[a]Total through 1934, In House thereafter.

[b]The sum of column's (1) and (2) is the same as the United States Geological Survey's "Apparent Consumption" when both series are available (starting in 1935), except for differences resulting from rounding (U.S. Geological Survey 2005).

[c]Delivered at Pittsburgh, Philadelphia, and Chicago.

Source. Barringer (1954, 133, 135).

Table 2. Determinants of the Consumption of Iron and Steel Scrap, 1910-53.				
Part A – Levels				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	343,3408.0	1,315,697.	2.609574	0.0131
STEELSCRAP(-1)	0.434	0.126311	3.43826	0.0015
IP	149,149.8	13,333.3	11.18623	0.0000
IP(-1)	-98,716.20.0	18,289.8	-5.39734	0.0000
1942	-2,491,125.0	3,722,807.0	-0.66915	0.5077
1943	-10,816,733.0	3,750,454.0	-2.88411	0.0066
1944	-8,019,789.0	3,600,417.0	-2.22746	0.0323
R-squared	0.965	Mean dependent var		34,160,302
Adjusted R-squared	0.960	S.D. dependent var		16,793,702
Log likelihood	-703.6006	F-statistic		167.0401
Durbin-Watson stat	1.797131	Prob(F-statistic)		0.000000
Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	0.477783	Prob. F(4,20)		0.751740
Obs*R-squared	2.423356	Prob. Chi-Square(4)		0.658411
Part B – First Differences				
	Coefficient	Std. Error	t-Statistic	Prob.
C	-664850.8	757261.5	-0.877967	0.3872
ΔSTEELSCRAP(-1)	-0.274926	0.164948	-1.666744	0.1063
ΔSTEELSCRAP(-2)	-0.248061	0.164146	-1.511218	0.1416
ΔSTEELSCRAP(-3)	-0.343551	0.155284	-2.212397	0.0350
Δ(IP)	161178.6	17804.19	9.052846	0.0000
ΔIP(-1)	35179.88	31312.33	1.123515	0.2704
ΔIP(-2)	17559.96	29590.36	0.593435	0.5575
ΔIP(-3)	56285.77	27578.75	2.040911	0.0505
1942	-5724451.	4656669.	-1.229302	0.2288
1943	-14583863	4805698.	-3.034702	0.0050
1944	-10965298	5202546.	-2.107679	0.0438
R-squared	0.783816	Mean dependent var		1343149.
Adjusted R-squared	0.709270	S.D. dependent var		7381682.
Log likelihood	4.59E+14	F-statistic		10.51451
Durbin-Watson stat	1.816695	Prob(F-statistic)		0.000000
Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	1.346106	Prob. F(4,20)		0.280744
Obs*R-squared	7.088402	Prob. Chi-Square(4)		0.131290

Table 3. The U.S. Rubber Budget, 1935-1945

(1000s of long tons [2,240 pounds])

	Imports Natural Rubber	Consumption Natural Rubber	End of Year Stocks Natural Rubber[a]	Consumption Reclaim	Consumption Synthetic Rubber
	(1)	(2)	(3)	(4)	(5)
1935	467	492	312 (7.6)[b]	118 (19%)[c]	0.2
1936	487	575	223 (4.7)	142 (20)	0.3
1937	598	544	262 (5.8)	162 (23)	0.5
1938	409	438	231 (6.3)	121 (22)	1.0
1939	497	592	125 (2.5)	170 (22)	1.9
1940	815	649	289 (5.3)	190 (23)	2.9
1941	1024	775	533 (8.3)	251 (24)	6.3
1942	277	377	422 (13.4)	255 (39)	17.6
1943	52	318	139 (5.3)	291 (37)	170.9
1944	107	144	96 (8.0)	251 (26)	566.6
1945	139	105	45 (5.1)	241 (23)	693.5
*1943	52	462	-6	291	26.4

[a]The change in end of year stocks can differ from imports less consumption because of re-exports and for some other minor reasons.

[b]The term in parentheses is the stock in months of consumption at the current rate.

[c]The term in parentheses is consumption of reclaim as a percent of the total.

Source. Feis (1947, 311). The import figures are the same as in *Historical Statistics* (2006, series U302).

Table 4. Consumption, Production, and the Price of Reclaimed Rubber, and Related Data, 1919-1954.

	Consumption of Rubber (Long Tons)			Production (Long Tons)	Price of Rubber (Cents Per Pound)	
	Reclaimed	Natural	Synthetic	Reclaimed	Natural	Reclaimed[a]
	(1)	(2)	(3)	(4)	(5)	(6)
1919	73,500	215,000	0	NA	48.7	16.2
1920	75.300	206,000	0	NA	36.3	15.5
1921	41,400	177,800	0	NA	16.4	11.3
1922	54,500	301,500	0	NA	17.5	9.1
1923	69,500	319,400	0	NA	29.5	9.6
1924	76,100	328,800	0	NA	26.2	9.0
1925	137,100	388,500	0	NA	72.5	10.1
1926	164,500	366,200	0	NA	48.5	11.7
1927	189,500	373,000	0	NA	37.7	9.4
1928	223,000	437,000	0	NA	22.5	8.3
1929	212,700	467,400	0	NA	20.6	8.0
1930	153,500	376,000	0	NA	12.0	6.8
1931	123,000	355,200	0	NA	6.2	5.5
1932	77,500	336,700	0	NA	3.5	4.1
1933	85,000	412,400	0	NA	6.0	4.5
1934	100,900	462,500	0	NA	13.9	5.2
1935	117,500	491,500	200	NA	13.4	5.3
1936	141,500	575,000	300	NA	16.4	5.3
1937	162,000	543,600	500	NA	19.4	6.1
1938	120,800	438,000	1,000	NA	14.6	6.1
1939	170,000	592,000	1,900	NA	15.6	6.0
1940	190,200	648,500	2,900	274,202	20.1	6.0
1941	251,231	775,000	6,300	285,114	22.4	6.3

Table 4. Consumption, Production, and the Price of Reclaimed Rubber, and Related Data, 1919-1954.

	Consumption of Rubber (Long Tons)			Production (Long Tons)	Price of Rubber (Cents Per Pound)	
	Reclaimed	Natural	Synthetic	Reclaimed	Natural	Reclaimed[a]
	(1)	(2)	(3)	(4)	(5)	(6)
1942	254,820	376,800	17,600	303,991	22.5	6.5
1943	291,082	317,600	170,900	260,607	22.5	6.5
1944	251,083	144,100	566,600	243,309	22.5	6.6
1945	241,036	105,400	693,500	295,612	22.5	7.0
1946	275,400	277,600	761,700	291,395	22.5	7.3
1947	288,395	562,661	559,666	266,861	20.8	8.0[b]
1948	261,113	627,332	430,618	224,029	22.0	NA[b]
1949	222,679	574,522	397,139	313,006	17.6	NA[b]
1950	303,733	720,268	512,579	365,933	41.2	NA[b]
1951	346,121	454,015	748,650	273,386	57.7	NA[b]
1952	280,002	453,846	787,454	295,550	33.4	NA
1953	285,050	553,473	771,806	257,088	24.2	NA
1954	249,049	596,285	620,223	274,202	23.6	NA

[a]First Quality.

[b]According to the U.S. National Production Authority (1950, p. X-4), the price of first grade tire reclaim rose from 8 cents in 1947, "to 9 cents in June 1950, and to 10 1/2 cents in September 1950, where it remained during the first half of 1951."

Sources. Consumption. 1919-1946: (Ball 1947, 204-05); 1947-1954: (U.S. Department of Commerce 1954, 21, table 13). Prices 1919-1946: (Ball 1947, 206-07); 1947-54, natural only, (U.S. Department of Commerce, 1955, 11, table 4).

Table 5. Determinants of the Consumption of Reclaimed Rubber, 1922-54				
Part A – Levels				
Dependent Variable: Reclaim				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	16952.03	12346.44	1.373030	0.1824
RECLAIM(-1)	0.885906	0.174271	5.083500	0.0000
RECLAIM(-2)	-0.354995	0.178105	-1.993181	0.0577
IP	5,596.542	1407.204	3.977066	0.0006
IP(-1)	-7,011.596	2133.495	-3.286437	0.0031
IP(-2)	4,028.217	1647.816	2.444579	0.0222
1942	-61,74.551	30186.42	-0.204547	0.8397
1943	12,794.08	31486.13	0.406340	0.6881
1944	-42,857.58	30707.63	-1.395666	0.1756
R-squared	0.904632	Mean dependent var		193037.6
Adjusted R-squared	0.872843	S.D. dependent var		80486.25
Log likelihood	-380.3048	F-statistic		31.98094
Durbin-Watson stat	1.609342	Prob(F-statistic)		0.000000
Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	1.392266	Prob. F(4,20)		0.272466
Obs*R-squared	7.187558	Prob. Chi-Square(4)		0.126302
Part B – First Differences				
C	1197.910	5337.789	0.224421	0.8243
ΔRECLAIM(-1)	0.259137	0.170854	1.516718	0.1424
ΔRECLAIM(-2)	-0.375013	0.169725	-2.209528	0.0369
Δ IP	7406.538	1554.208	4.765473	0.0001
ΔIP(-1)	-3813.767	1676.282	-2.275134	0.0321
Δ IP(-2)	5126.820	1788.298	2.866872	0.0085
1942	-38953.31	31014.03	-1.255990	0.2212
1943	-21918.98	33242.77	-0.659361	0.5159
1944	-76199.10	32356.37	-2.354995	0.0270
R-squared	0.569587	Mean dependent var		6292.394
Adjusted R-squared	0.426116	S.D. dependent var		36471.62
S.E. of regression	27629.11	Akaike info criterion		23.56452
Durbin-Watson stat	1.751119	Prob(F-statistic)		0.003712
Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	5.066774	Prob. F(4,20)		0.005512
Obs*R-squared	16.60945	Prob. Chi-Square(4)		0.002301

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