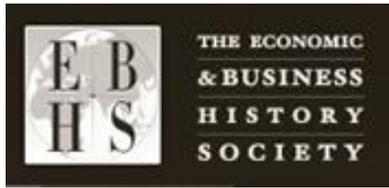


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DID RAW MATERIAL SHORTAGES DECIDE WORLD WAR TWO? NEW DATA FOR THE EXAMPLE OF NAZI RUBBER SUPPLIES

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Despite a well-established literature on the economics of World War Two, to this day reliable statistics on overall raw material supplies for Nazi Germany are lacking. The operations of shell companies, the special de jure status of occupied areas, and the Wehrmacht practice to “live off the land” have led to a significant underestimation of de facto resource endowments of the Third Reich. For the example of rubber—one of the prime “scarce war commodities”—this article demonstrates the extent and sources of deficiencies, and offers new data. On this basis, and in contrast to recent arguments that view raw materials as a “basic constraint” of the German economy, it is shown that surprisingly comfortable supplies existed between December 1941 and May 1944, during which Nazi-controlled Europe seemed ready to allow a realization of Hitler’s ‘Lebensraum’ designs. The failure to realize those designs originated in military setbacks—which subsequently impacted economic performance as a secondary effect.

Introduction

The story of Nazi Germany’s strategic efforts to create a self-sufficient economic “living space” across the European continent—beginning with Hermann Goering’s “Four Year Plan” in 1936 that sought to free the domestic industry from decisive foreign imports—has been told for six decades. For more than six decades, the idea that the German resource mobilization represents one of the key explanatory variables to rationalize the course of World War Two, and the eventual defeat of the Nazis in 1945, has not been contested (Adam Tooze 2006; Richard Overy 1982; Alan Milward 1965; Paul Wendt 1947). While qualitative evaluations about the German economy’s relative success or failure during the war years have oscillated back and forth, virtually all authors continue to rely on highly limited data to underpin their claims statistically. For apparent reasons, therefore, presenting fundamental revisions to the statistical basis

of the economic literature on World War Two also allows for the drawing of broader implications for the respective Allied and Nazi war strategies, and the underlying “inflection points” during 1939-45.

Against this background, I argue that the example of the statistical treatment of raw materials—specifically rubber—sheds crucial light on the misrepresentation in the existing literature. The latter has recently identified raw materials as a “basic constraint” of the overall German war effort (Tooze 2006, 455), a conclusion with key implications for the assessment of nominal economic strengths, and the turning points in relative power for the participating agents in World War Two.

The central problem shared by available contributions is that the utilized data takes insufficient account of the extensive territorial and organizational shifts occurring in the German war economy from 1939, and by the fact that, on a fundamental level, both the existing fine print in the sources, as well as the implications of the *de facto* logistical organization of the Nazi economic units have been either fully ignored or naively treated. Existing distortions can be traced back not least to Adolf Hitler’s personal orders to underreport material endowment figures following the initiation of Allied air campaigns (USSBS 1945a, 11). A comparison of the accepted data with actual daily reports from economic units suggests a gross underestimation of the supply figures – particularly as they only take negligible account of both plundering and production activities in occupied, but not fully administratively integrated, territory such as today’s Ukraine or the Baltics. As a consequence of those omissions, the literature on the Nazi war economy to this date lacks *de facto supply* statistics, which would illuminate the actual full availability of key strategic resources.

Against this background, recent contributions on the performance of the German war economy in the Nazi period are beset by the same deficiencies that earlier generations—at times consciously, at other times unconsciously—faced. Among the most prominent additions to the literature in recent years has been Tooze’s (2006) “Wages of Destruction”, who set out to revise the standard interpretations of both Milward’s (1965) “Blitzkrieg economy”, as well as Overy’s (1982), and Rolf-Dieter Mueller’s (1999) claims on the bureaucratic inefficiencies undermining the mobilization efforts. Tooze’s pessimistic assertion that the Nazi

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economy faced insurmountable economic constraints from the outset that it could hardly hope to free itself of once the United States entered the conflict, has influenced newer additions ever since (Anand Toprani 2014; Hein Klemann and Sergei Kudryashov 2012; Jonas Scherner 2012; Mark Mazower 2008).

The purpose of this article is to offer an exemplary investigation into the organization and statistical inclusion of rubber supplies during the war years. Why rubber? Our focus is not least justified by the fact that for the commodity, a comprehensive archival documentation relating to the geographical and organizational management the areas thus far omitted in the literature exists. It represents also one of the most crucial material inputs in itself for World War Two: over the course of the last 60 years, the literature on the German war economy has consistently stressed the central importance of the rubber industry, being highlighted as a “basic constraint” of the overall economic Nazi strategy (Tooze 2006, 455), with “oil and rubber, next to steel and coal as the globally most important strategic raw materials” (Treue 1955a, 169). Frequently, German generals referred to the country’s chemical industry as the Wehrmacht’s “fourth part,” next to the army, navy, and airforce themselves (Mueller 1988, 421). The German rubber industry became one of the priority targets of the US Combined Bomber Offensive in 1943-1944 (USSBS 1945a, 24-5), having been identified as one of the critical economic areas “able to affect front-line strength fairly quickly and thus render maximum assistance for the invasion of Western Europe” (USSBS 1945b, 3).

But rubber also lends itself exceptionally well as a proxy to draw implications for the aggregate “relative superiority” of the German war economy, and other typical “bottleneck” industries: with rubber supplies featuring as the core area of attention in Adolf Hitler’s original “Four Year Plan” directive, together with fuel and iron (Treue 1955b, 208), new insights into their actual availability provide a gauge to judge the success of autarky efforts *per se*. Previous studies have used the rubber industry as a proxy to draw implications regarding the wider import-substitution efforts (Todd 1981; Streb 2002). The economic-military commandos deployed to both the occupied East and West operated according to “priority lists” that in addition to rubber featured a range of other bottleneck commodities in the same “urgency category” for which

comparable means and efforts were to be invested, and which upon inspection are equally misrepresented in existing statistical accounts. Rubber was frequently treated as a “scare priority resource” along inputs such as zinc, chrome, or copper.¹ Comparing such lists with transport data—from the blockade-breaker channels to land-based movements—indeed confirms that the rubber statistics presented below are falling well within the averages of related commodities presented in such priority tables, if not even erring on the conservative side considering key cases such as fuel (Michaux 1955).² In consequence, it is argued that our results allow broader inferences about the success of overcoming critical perceived scarcities in key war industries.

Our new data shows that raw material endowments did not seem to represent a “basic constraint” (Tooze 2006, 455) on the Nazi war economy until well into 1944. Rather, the military turning points in World War Two preceded the economic deterioration for the Third Reich: as Hitler decided on the last meaningful Wehrmacht offensive in the summer of 1942 into the Caucasus (“Case Blue”), the *de facto* German raw material situation was at its peak. Despite the reservations of senior generals, and officials such as General Georg Thomas, military operations well into 1944 were not set against a “German economy... simply not strong enough to create the force necessary” although “everything else was sacrificed to rearmament” (Tooze 2006, XXV, 659). Our account suggests that the economic “zenith” of World War Two for the Axis side in fact was reached 12-17 months after the political one (Cf. Hillgruber 1977, who identifies July 1941 as the peak of Hitler’s political power), and that *relative* superiority—even when controlling for the demand side—against the Allies was in fact maintained well into 1944, given severe problems in the US rubber programs and Japanese control of East Asia. Such results put doubt on the oft-proposed assertion that “[from January 1942] Germany tried to avoid the logical consequences of a war against powers economically stronger than herself by pinning her faith in qualitative superiority”

¹ IfZ ED 99, Volume 12, “The Speer Chronicles,” 23ff.

² Also see for instance, Institut fuer Zeitgeschichte Archive (henceforth IfZ), MA 218: “OKW/Fwi Amt/Inl1: Besetzte Westgebiete, Abtransporte der Fwi-K. 30.6.1944,” June 30, 1944.

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(Milward 1965, 190), and also stand in contrast to the claim that Nazi-controlled European economy suffered from a “low level of mobilization” (Overy 1982, 291).

However, some authors have recently suggested that logistical problems resulting from the large-scale Allied bombing campaigns featured more prominently in the material deployment and (alleged) under-endowment of the Wehrmacht in the final war years than pure supply issues (O’Brien 2015). Two major rebuttals should be advanced here: first, the statistics of the USSBS confirm that during 1940-1943, no meaningful focus on “transportation” or logistical targets by Allied air forces actually existed. On a quarterly basis, the tonnage devoted to logistical targets in fact never exceeded 10.6 percent during this period³; during the year 1943, it dropped as low as 5.6 percent. Only from November 1944 were attacks on transportation hubs and railway lines assigned “strategic priority” status by the “*Supreme Headquarters Allied Expeditionary Forces Europe*” (SHAEF), but they were interrupted again by the Rundstedt-Offensive in December (USSBS 1945b, 5-6). Internally, SHAEF members opined that attacks on logistical targets would not hamper Wehrmacht strength sufficiently, claiming that even if such attacks “succeeded in reducing the railway system’s carrying capacity by two-thirds or three-quarters, this would cut only into non-military traffic and leave essential military communications unhindered.” (Ibid., 6). Secondly, transport statistics from the Nazi economic groups in both the East and West do not suggest that, even in mid-1944, logistical efforts were severely strained. In the “occupied West”, for instance, monthly raw material transports in May and June 1944 outpaced averages since 1941 across all industrial sectors. For the Russian territory, 61 percent of all identified iron and steel volumes—or 3.1m tons—were transferred to the Reich territory by February 1944, with another 435,000 tons consumed on site; 99.5 percent of identified fuels had been consumed or transferred to the Reich in the same period; and 48 percent of all chemical material.⁴

³ Statistics in USSBS (1945b), 2-5.

⁴ IfZ MA 218, “OKW/Fwi Amt/In1: Besetzte Westgebiete, Abtransporte der Fwi-K. 30.6.1944,” June 30, 1944; Ibid., “OKW/Fwi Amt/In1: Raeumungsbilanz Russland: Vergleichende Gegenueberstellung der Erkundungen, Abtransporte, 30

Clearly, therefore, until the Nazi-occupied territories were lost to the Red Army via military pushbacks, the logistical flow of material back to and from the Reich functioned smoothly, in contrast to accounts that suggest otherwise (O'Brien 2015, 76). Meanwhile, as will be shown below, the new data advanced here equally refutes suggestions that “[land battles] were fought over territory of little or no economic value, the loss or gain of which made relatively little difference to equipment development or production” (O'Brien 2015, 5). The Eastern Front—scene of the costliest battles in lives and material fought during World War Two—contributed more than 107,000 tons in additional rubber supplies to the German war economy, representing more than a quarter of existing documented domestic supplies during the entire war period.⁵

The following discussion is organized as follows. The first part will discuss the existing literature and statistical accounts and then proceed to explain the actual process of documenting and using seized raw material supplies. The second part will provide the first estimate of total volumes that plundering and local production operations assumed in the critical war years. The third part will provide a comparative discussion, setting full German supplies against domestic demands and US rubber coverage. The fourth part concludes.

Literature Review

Hans Umbreit (1988, 136-264) has early on already pointed out the divergences between *de jure* occupation practices, and *de facto* “muddling”, which provided the pretext of evading international legal conventions especially in the East. Mark Mazower (1996, 33) more recently noted the “bureaucratic chaos” of the New Europe sparked by the “patchwork of more or less provisional occupation regimes.” Against this background, it seems surprising such findings have not led to a deeper questioning of statistical material dependent on such a bureaucracy. In fact, as will be shown, the “chaos” extended to the economic, military, and

verbrauchte und zurueckgelassene Rohstoffe fuer die Zeit von Juni 1941 bis 29.2. 1944.”

⁵ Cf. Table 2.

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statistical agencies involved in the organization and logistics of occupied industrial areas, plundering goods, and re-constitution of factories.

Jonas Scherner (2012) has recently documented the extent of the distortion in the official Reich trade statistics between 1939-45: rather than the almost even trade balance with most occupied territories, he found evidence of a “spectacular import boom” during the war years, in particular concerning armament products. The underreporting—based not on conscious data manipulation, but upon changes in statistical regulations—served the purpose of deflecting accusations that Nazi Germany was exploiting Europe. The author also takes the re-calculated figures as evidence against the economic “Blitzkrieg hypothesis”, which emphasized the role of Albert Speer in the late mobilization of the war economy after 1941.

But, as Scherner admits, the statistical evidence remains unsatisfactory in several aspects: most importantly, the revised figures still exclude the “substantial plundering” activity by the Wehrmacht across the Continent, and that of the High Command of the Wehrmacht (OKW) economic staff. They also exclude production for Wehrmacht purposes that directly served the fighting forces at the front, and did not cross the border to the Reich. Christoph Buchheim (1986, 124-5) equally notes that such activities are left out of his estimates on the contribution of occupied territories to the German economy. A range of authors before Scherner have realized the importance of this question, but none so far has made an attempt to quantify the extent of the problem. Umbreit, who stresses the relevance of such activities for the wider assessment of the war economy in the West, states that “the precise numbers of the captured or purchased goods were not known even to the German occupational offices. Value- or volume-figures are partly estimated, partly incomplete.” (Umbreit 1988, 223). Overy (1996, 18) equally insists that “for the German Armed Forces [in the occupied territories], local production was initiated as a kind of import-substitution, to avoid the need to send supplies and components all the way from Germany over a congested rail network, and through potentially hostile populations. It is important to ask how effective German exploitation was, although the measurement of effectiveness is subject to obvious limitations, both conceptually and in quantitative terms.” Overy

apparently considers such limitations prohibitive enough not to undertake estimates himself.

Additional rubber-specific discussions that, while highlighting the importance of the commodity for the war effort, do not recognize the contributions in the occupied territories and rely on fully domestic production include Dietrich Eichholtz's (1985, 356-7) data, as well as an early account in a German military journal which only provides supply figures until March 1941—explained by the author by the fact that “at this stage, no reliable sources and statistics have been made available for the time afterwards” (Treue 1955, 183). While Milward (1965, 171-2) states that “Speer and [the head of the planning staff in the economics ministry] Kehrl both believed that rubber scarcity had no effect on the mobility of the Wehrmacht or on the conduct of Wehrmacht operations, and their conclusions are supported by the evidence”, he equally does not offer quantitative data underpinning such conclusions. A subsequent study by Susanne Heim (2004) focused on research activities in Dandelion-based rubber, but did not offer any new data or statistical discussion, while another recent addition by William Clarence-Smith (2013) discusses colonial and social aspects of the wartime rubber industry, and highlights useful details about American problems in the Brazilian rubber plantations, but contributes little to the statistics or the principal economic and historical literature.

The Statistics

The “classic” statistical reference in the literature remains the *Statistisches Handbuch fuer Deutschland* (henceforth *Handbook*) a compendium created by the American occupation forces in 1949. It provides data on the production and imports of rubber for the Reich territory of 1938, including Austria and the Sudetenland (Länderrat 1949, 312). A source of confusion might be the qualification given that from 1942 onwards the statistics include “the integrated Eastern and Western territories” (*eingegliederte Ost- und Westgebiete*). This status was given to areas, where the administrative command had been passed from military to civilian authorities, and which were considered areas subject to “Germanization” under the Generalplan Ost—essentially the so-called

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“CdZ territories.”⁶ In the East, only the districts of Ostmark, Wartheland, Bialystock, Ostoberschlesien and Danzig-Westprussia had this status, and in the West Luxemburg and Alsace-Lorraine. But as internal files from Speer’s office confirm, explicitly excluded from “*Grossdeutschland*” in the statistical collection were 12 territorial areas which were classified as “occupied”, a semi-autonomous status which was also explicitly distinguished from those countries with which trade contracts for imports had been signed, such as Finland, Slovakia, Croatia, Romania and Hungary.⁷

Speer’s method is fully in line with the statistical conventions that economic institutes at the time employed. The leading “Institute of the German Economy” (“*Institut der Deutschen Wirtschaft*”)—which reports identical overall output figures for the Reich in all sectors—even more restrictively just adds the Ostmark and the Wartheland from January 1939, from August 1940 Eastern Upper Silesia, and from August 1941 Lorraine to the 1938 Reich territory to arrive at overall output figures.⁸ Explicitly excluded are even the “Generalgouvernement” and Bohemia.

Further primary figures are provided via the *United States Strategic Bombing Service* (USSBS) compilation. But a comparison with the *Handbook* figures reveals an almost exact overlap for the years 1938-43; only for 1944 do the USSBS figures suggest a slightly higher synthetic rubber production than the *Handbook* (USSBS 1945b, 83).⁹ The USSBS figures thus obviously worked with the identical territorial basis.

⁶ On the occupation narrative, see: Mazower (1996), Umbreit (1988); “CdZ territories” denominated the areas formally under control of the “Chefs der Zivilverwaltung,” heads of civilian administration, which were however not de jure added to Reich territory.

⁷ The 12 countries under occupied status are France, Belgium, Holland, Denmark, Norway, Northern Italy, Serbia and Montenegro, Albania, Greece, Ostland, Ukraine and the “Wi-In Areas“. BArch R3/1975, “Allgemeine Korrespondenz betr. Soll- und Ist-Statistik fuer RM Speer,” undated.

⁸ BArch, R3/1959, “Die deutsche Industrieproduktion im Kriege und ihre Messung,” June 1942, 168-9.

⁹ The differences are less than 3percent for any year until 1944, i.e. we record a Buna production of 70,500 tons for 1941 in the *Handbook* accounts, compared to a production of 69,000 tons in the USSBS; for 1944, USSBS records a total synthetic production of 104,000 tons, versus a *Handbook* figure of 93,400 tons. Cf. (Länderrat 1947, 312).

Substantial difficulties for both economic planners and statisticians dealing with the occupied territories was caused by the sheer number of competing authorities vying for access to the captured raw material supplies, and those factories left largely intact. While the *de jure* organization in the East appears relatively straightforward, following the “Green Map”, and has been documented by the official diaries of the Wehrmacht High Command’s (OKW) “Economic Staff East” (Cf. Mueller 1991; Schustereit 1983), evidence of the *de facto* correspondence between the various involved groups indeed reveals a far more chaotic, ad hoc organization of the economic exploitation compared to the pre-campaign plans. As it shall become apparent, it is therefore insufficient to focus on the activities of the OKW staff when evaluating the economic exploitation and rebuilding efforts in both East and West (Ibid.).

Beyond the “Economic Staff”, in both war theaters at least three independent agencies were involved in material registration, logistics, and industrial planning: rubber transfers to the Reich were partly organized by the *Wirtschaftsforschungsgruppe* (Economic Research Unit, “*WiFo*”), a shell company created by the economics ministry, which directly supplied German industrial companies from the external territory. Problematically for the military administration, the “*Wi-Fo*” did not fully fall under its supervision, although it was temporarily allowed to pass orders to it. Against this background, the military created its own agency in July 1940, the *Allgemeine Warenverkehrsgesellschaft m.b.H.* (General Goods Distribution Society, “*AWG*”), directly run by military personnel. According to its internal documents, its principal tasks included the “execution of the business part of the sovereign tasks, such as the registration, administration, and further use of removal goods, plunder, enemy assets” as well as to “participate in the intermediation and control of securing goods for firms or offices in the Reich.”¹⁰

Finally, a second creation by the economics ministry represented the *Rohstoff-Handelsgesellschaft* (“Raw Material Trading Company,” ROGES). Similar to its institutional rivals, ROGES operated under orders to carry out the “identification and use of plunder in all occupied areas, as

¹⁰ IfZ, MA 190/2.

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well as purchasing, storing, and re-sale of war-relevant products” (Götz Aly 2005, 174).

Archival evidence reveals the full extent of the chaotic organizational consequences of such overlapping competencies. What did such practices imply for the statistical registration and rubber supplies? Müller (1983) previously hinted at evidence that the Wehrmacht units often simply bypassed the quartermasters, and organized supplies independently from the Reich—doubtless in realization of the confusing organizational structure, and notorious overlapping of competencies in the rear Army territory (Müller 1983, 976). From archival sources, it can be shown that, equally, many units transferred captured supplies back to the Reich independently: a fact that the economic organizations in the rear Army territory often bitterly complained about. In a letter to the Reich Finance Ministry in July 1941, ROGES, in reference to its operations in the East, lamented that: “it has been a particularly unpleasant burden on the registration of ‘West goods’ that the military instances are undertaking transfers to the German industry directly, bypassing our own allocation railway stations. By doing this, the calculation of tariffs is circumvented.”¹¹

The Finance Ministry reacted with new legislation on the registration of plundering goods with an order dated January 6, 1942, abolishing the requirement for the issuance of transfer and tariff authorization papers. Some stations were slow to react to the new procedures, so that ROGES stressed again to the Ministry that “we ask to be excluded from the demands [from the Terespol railway offices] ... since we cannot give the details required for transfer papers since we are dealing with irregular, non-purchased goods.”¹²

The Finance Ministry replied approvingly, since ROGES could report shortly afterwards that: “in our capacity as the distributor of the captured goods from the occupied territories ... we are facing difficulties far larger in the East than in the West, for which we ask for leniency: at the border stations in the East, where our distribution centers are located, there are no possibilities to inspect the incoming goods ... to save unnecessary stays,

¹¹ R121/32, “ROGES an Reichsfinanzministerium,” July 4, 1941.

¹² BArch, R121/32 “ROGES an GG Reg. Abt Finanzen,” August 4, 1941.

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we have obtained pre-approvals from all Reich-offices, which enable the distribution stations to immediately send items to the Reich without further communication with the Reich—which would take several days.”¹³

But the practice was not limited to the Eastern territories. ROGES in June 1941 complained that some administrative counterparts in the Reich—including the *Reichsstelle fuer Kautschuk und Asbest*—were assuming that its plundering transfers from France represented regular “purchasable goods” and were demanding a more transparent treatment.¹⁴ With a referral to its status as a special trustee of the Wehrmacht, it rejected such interference. With the same confidence, *WiFo* conducted its own trading and transferring operations in France with its German corporate counterparts, with 12,373 tons in transactions documented in a single month in February 1941 alone—no less than 46 percent of officially recorded imports for the Reich in 1941.¹⁵

Given the size of the extraterritorial economic output and investments, the potential size of omissions can be substantial: a report from the “Chefgruppe Wirtschaft” in Alfred Rosenberg’s ministry for the occupied eastern territories from the end of 1943 estimates that the total produced raw materials and final goods in the east in the 30 months after June 1941, valued in German domestic prices, reached between 4-5bn Reichsmark, or 6 percent of 1939 German GDP.¹⁶ Such efforts were underpinned by more than 1bn Reichsmark worth of industrial supplies being moved from the Reich into the occupied territories in the same period.¹⁷

New Supply Estimates

We divide overall rubber endowments into two general categories—the domestic, synthetic Buna output, and the non-domestic additions (on which our revisions will focus). Regarding the first category, we can note that estimates on underlying domestic Buna production are closely aligned

¹³ BArch, R121/225, “ROGES an Reichsbahn,” June 19, 1942.

¹⁴ BArch, R121/32, “Aktenvermerk vom 22.5. 1941.”

¹⁵ BArch, R121/32, “Schreiben vom 8.2. 1941, Schreiben vom 28.2.1941.”

¹⁶ IfZ, MA 246, “Bericht ueber die Taetigkeit der Chefgruppe Wirtschaft im Reichsministerium fuer die besetzten Ostgebiete,” 804. The figures excluded food and handicraft works. GDP figures from (USSBS 1945a, 12).

¹⁷ *Ibid.*

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(Table 1). A meaningful divergence only exists for synthetic production in 1944, with the Handbook implying a 10 percent lower production than both USSBS and the IG Farben data. All three accounts concur on peak annual volumes being reached in 1943—with the more granular IG Farben data noting quarterly peaks in Q1-1944 (at a monthly 11,830 tons), a finding supported by archival data on domestic Buna production.¹⁸

The non-domestic additions presented below not only change the timing of peak endowments, but—to a considerable extent—overall material supply volumes. We can summarize our results by noting that a combined 338,000 tons of synthetic and natural rubber, or 68 percent of all supplies recorded in the *Handbook*, are in total falling into this category. Our data shows that overall supplies in fact peaked in 1942—before the crucial phase of Allied air campaigns—rather than early in 1944.¹⁹ It were therefore not bombing raids, or logistical strains, that led to the reversal of endowment fortunes, but the loss of territorial control in the East as a result from military setbacks, especially after the failure of “Case Blue” in the Caucasus in November 1942 (cf. Wegner 1990).

Table 1
Existing Statistical Records, Total Available Rubber
(Synthetic and Natural Imports, in Tons)

	Statistical Handbook			USSBS			IG Farben Nuremberg		
	Synthetic	Imports	Total available	Synthetic	Imports	Total available	Synthetic	Imports	Total available
1939	22,000	77,000	99,000	22,000	77,000	99,000	22,200	n/a	22,200
1940	38,500	19,000	57,500	40,000	17,000	57,000	39,060	n/a	39,060
1941	71,000	27,000	98,000	69,000	27,000	96,000	67,560	n/a	67,560
1942	101,000	24,000	125,000	98,000	25,000	123,000	95,820	n/a	95,820
1943	120,000	8,000	128,000	117,000	7,000	124,000	116,640	n/a	116,640
1944	93,400		93,400	104,000		104,000	102,630	n/a	102,630

Source: Länderrat (1949, 312); USSBS (1945b, 83); United States of America v. Carl Krauch et al., Reel 61, “Entwicklung der Deutschen Bunaproduktion, Stand 1. November 1944.”

¹⁸ BArch, R3/1957, “4. Wochenbericht des Planungsamtes,” January 25, 1944.

¹⁹ We here regard 1944 as the year when the “crucial phase” of Allied air campaigns started. USSBS data shows that just 15 percent of overall bombing tonnage, or 300,000 tons, was dropped on Germany until 1943. Despite earlier initiatives such as the Casablanca conference in 1943, such numbers pale in comparison to the 1.68 million tons dropped in 1944-1945. See (USSBS 1945b, 2-5).

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In the following, we subdivide non-reported additions into three categories: imports, captured stocks, and production in occupied (but not formally integrated) territories. The additions following from these three areas will be presented chronologically. Table 2 provides an aggregation of additions from each of the areas, by year. Note that our new total supply disregards the Handbook import figures, and arrives at new total supply by combining the Handbook domestic supply (Table 1), and the full new “non-domestic” sum.

Table 2

Overview of Unofficial Rubber Supplies 1940-1944, in Tons

<i>NON-DOMESTIC RUBBER ADDITIONS, IN TONS</i>		1940	1941	1942	1943	1944	
<i>Agency/Location</i>							
WEST	Captured	Occupied France I (WiFo)		5,373			
		Occupied France II (WiFo)	3,064				
		Occupied France III (WiFo)			7,000		
		Ruestungsinspektion C	2,400				
					337		
		Unoccupied France		5,000			
		Netherlands		3,000			
		Belgium		500			
		Italy rubber				1,034	
		Denmark					12
	<i>Producing</i>	Producing factories	12,000	27,500	25,500	37,500	16,750
	<i>Imports</i>	France port entry		13,087	42,228	21,289	6,617
	(A) SUM WEST	26,301	52,960	67,728	59,823	23,379	
EAST	Captured	ROGES in Lida		1,500			
		OKW in Wilna		1,500			
		OKW in Shitomir/ Shepetovka			879		
		Kiev region, OKW				12,000	
		Stocks Kiev, May				2,000	
	<i>Producing</i>	Producing factories	12,000	15,113	24,296	10,025	5,133
	<i>Imports</i>	Regular imports	11,750	11,750			
		(B) SUM EAST	23,750	30,742	38,296	10,025	5,133
(C) TOTAL ADDITIONS (A+B)		50,051	83,702	106,024	69,848	28,512	
(D) STATISTISCHES HANDBUCH (DOMESTIC)		38,500	70,500	100,500	118,600	93,400	
(F) STATISTISCHES HANDBUCH (IMPORTS)		18,696	26,592	24,072	7,536		
NEW TOTAL SUPPLY (C+D)		88,551	154,202	206,524	188,448	121,912	

Sources: BArch R121/32; BArch R121/815; BArch R3/1957; BArch R 3102/10020; BArch R 3102/10024; IfZ MA 190/2 (various); IfZ MA 217 (various); IfZ MA 434 (various); IfZ ED 2; Lottman (2004); Medicott (1952, p.617); Michaux (1955); Mueller (1991); Schwendemann (1995); Treue (1955). Compare with references in text.

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For 1940, revisions are concentrated on captured supplies in occupied France following the invasion in May 1940, as well as regular imports from Russia stemming from the 1940 German-Russian Commercial Agreement. Specifically, imports from the East reached 11,750 tons for the year according to our records. We reach this volume as follows: it is known that up until June 21, 1941, the eve of Operation Barbarossa, natural rubber imports from Russia ran at 300 tons per day (Treue 1955, 182). In fact, it has been suggested that a single train hours before the launch of Operation Barbarossa delivered a final 21,000 tons of natural rubber across the Russo-German border (Goralski and Freeberg 1987, 66). Lower estimates that have been provided are merely covering *transit* volumes for supplies sourced in Japan, China, and Manchuria (Cf: Ericson 1995, 401, 405; Medlicott 1952, Vol. 1, 669) and should thus be treated merely as minimum bounds for overall imports. After the successful negotiation of the two German-Russian trade agreements from February 1940 and January 1941, from April 1940 substantial Russian rubber supplies originating from East Asia and India and elsewhere entered the Reich from the East (Ericson 1995; Schwendemann 1995). One account focusing on Indian-sourced rubber imports from Russia between April 1940 and June 1941 puts the overall figure at 15,000 tons (Schwendemann 1995, 162). Other reports speak of overall daily volumes of no less than 300 tons per day in 1941. A conservative estimate for imports by railway from Russia between January and June 1941—which assumes that the daily figures suggested by Treue (1955) for March 1941 represent peak figures that were only met by 50 percent in the preceding months – yields 23,500 tons—a number in line with fragmentary evidence presented in other accounts (Cf: Goralski and Freeberg 1987, 66; Treue 1955, 182). This figure also assumes that a further 6,000 tons of natural rubber already destined for the Reich in mid-March 1941 did not reach the German border in time before the outbreak of war and was consequently lost.²⁰ We smooth

²⁰ This represents a further conservative bias, since Treue suggests transportation times of 6-8 weeks from Manchuria to the border—thus making it quite possible that the supplies underway did reach Germany in time (Treue 1955, 182). Ericson (1972) even suggests 12-15 days for Trans-Siberian shipments (Ericson 1995, 358).

out the total of 23,500 tons from Russian origins symmetrically for 1940 and 1941.

We do not uncover non-recorded imports from the West in 1940, as port entries have yet to start. Turning to the second source for additions in 1940, a total of 14,301 tons of rubber are proven to have been mobilized from captured supplies in the West, according to *WiFo* and *Ruestungsinspektion* communications. These additions are supplemented by a total of 12,000 tons for West and East each stemming from producing factories—our third source of non-recorded additions. For the West, shortly after the conclusion of the French campaign in June 1940, the Wehrmacht and Berlin's ministerial offices integrated the French, Belgian, and Dutch economies into the German war efforts, shifting industrial orders to the occupied areas, and initiating transfers of identified supply stocks across the border. The seizure of the French rubber industry—which by 1940 was the fourth largest global consumer and home to the leading Michelin works—held particular appeal for Nazi economic officials (Wallace 1952, 334-5). By the third quarter of 1940, the German and Italian occupation forces controlled rubber factories with a pre-war turnover of 224,000 tons annually.²¹ From late 1940, residents of Germany's three Western neighbors were legally required to hand over all private tire stocks (Umbreit 1988, 224). With Vichy France, where a substantial share of the French rubber industry remained, the Reich negotiated favorable contracts securing an immediate transfer of 5,000 tons of existing stocks, plus half of all new subsequent rubber production for its own supplies (Umbreit 1988, 233). Importantly, it can be confirmed that “from the first days of the occupation,” the major Michelin works in Clermont-Ferrand, as well as the factories in Carmes and Cataroux (and later the Italian plant in Turin) produced consistently for the German war effort, and were supplied by synthetic Buna S rubber (Lottman 2003, 184). Only by March 1944 was production in France interrupted by RAF bomber raids (Lottman, 2003, 187-9).

In sum, we record just over 50,000 tons in non-regular rubber additions, compared to regular *Handbook* figures of 38,500 tons. In other words, 130

²¹ *The Economist*, “Rubber in War,” September 14, 1940, 343-344.

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percent more rubber endowments than thus far suggested were actually available to the German war economy.

In 1941, notable contributions from captured supplies are proven, though with only modest amounts resulting from the occupation of Eastern territories. There are confirmed 3,000 tons of captured supplies in the Lida and Wilna areas in July 1941, which ROGES sent directly to *Continental* factories in the Reich, as well as 879 tons near Shitomir, already representing 5 percent of total annual German supplies.²² The Western territories considerably outstrip such volumes, with a minimum of no less than 12,373 tons identified by *WiFo* staff for the year.²³

Finally, producing factories are reaching peak output in 1941 in the Western territories. The new figures for “Producing factories West” are based for the French contribution on calculating the output figures from data by the Speer office that record all completed orders for German use in the occupied French rubber industry—excluding the departments Pas-de-Calais and Nord—between May 1940 and June 1944 in value terms. The actual deliveries are reported at 71.8m RM.²⁴ Price data for French rubber is based on *WiFo* figures from February 1941.²⁵ A cross-check is provided by a comparison with pre-war annual consumption levels by French factories, which are recorded at 58,000 tons.²⁶ Since it is known that factories in Vichy France worked at full capacity—using Buna S, rather than natural rubber (John Sweets 1986, 195)—and contractually delivered up to 80 percent of output to the Germans, our peak figures of 24,000 tons for 1941-1943 represent conservative estimates—in particular since they do not take into account production by Benelux, Danish and Norwegian factories (Herbert Lottman 2003, 184-9). The single Michelin plant in Clermont-Ferrand consumed 10,075 tons of rubber per annum before the destruction (Sweets 1986, 195).²⁷ Representing the second part of Western

²² BAarch R121/32, “ROGES an OKW,” July 4, 1941.

²³ BAarch R121/32, *WiFo* communication February 8 and 28, 1941.

²⁴ BArch, R 3102/10020, “Die Auftragsverlagerung nach Frankreich in Mill RM”, Planungsamt, December 5, 1944.

²⁵ BArch, R121/32, “*WiFo* an Klentze,” February 28, 1941.

²⁶ BArch, R 3102/10024, Statistisches Reichsamt, “Weltweite Kautschuk Produktion/Verbrauch,” July 1940. Figures for 1938.

²⁷ A 69kg rubber input per regular 60kg truck tire is used here, in line with the relations found for instance in IfZ ED 14/1, “Monatszahlen ueber die industrielle

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producing supplies, Italian contributions are limited to the Michelin plant in Turin, and accounted for net of German Buna deliveries (Angela Raspin 1986).

From 1941, producing factories also began to make contributions in the former Soviet territories, which represented the earliest adopter of synthetic production. Soviet Russia pioneered domestic synthetic rubber production – establishing first producing plants as early as 1930. By 1938, Soviet synthetic rubber production already reached 53,000 tons, outstripping German Buna production nine-fold (George Wallace 1952, 331; Länderrat 1949, 312). Ironically, the Wehrmacht through its advance re-captured many facilities originally supplied by the Reich under the 1940 Commercial Agreement, which explicitly catered for the delivery of Buna plants.

According to primary sources of the “V1 Staff East”, between June 1941 and February 1944, total intact annual rubber factory capacity in occupied Russia was 30,000 tons, or about 23 percent of the total German supply in 1938.²⁸ In December 1943, the Generalmajor Hans Nagel of the “Economic Staff East” published an internal two-volume report “War economy in the Eastern operational territory in the Years of 1941-3” detailing their operations in the occupied former Soviet Union.²⁹ According to his statistics, 15,000 tons of rubber were transferred to the Reich during 1941-1943, as well as 200,000 tires. His statistics also show that overall, only 30.3 percent of the discovered raw material was transferred to the Reich, with the rest being used on site or stockpiled.³⁰ Nagel’s conservative account—which, as will be shown, misses substantial proven rubber volumes—implies that another 34,000 tons of rubber were available on site during that period, an amount sufficient to cover the entire capacity of the captured intact rubber factories in Soviet Russia. His reports give evidence that those facilities have had a significant output and

Produktion 1938, 1942 und 1943”, Statistisches Reichsamt, undated; IfZ MA 217, “Stenographische Niederschrift der 31. Besprechung der Zentralen Planung betreffend: Arbeitseinsatz, Kautschuk,” January 29, 1943.

²⁸ IfZ, MA 434, “Meldungen V1 Stab Ost, 22.4.1944,” April 22, 1944.

²⁹ IfZ, ED 2 (2 vols.): Nagel, H., *Kriegswirtschaft im Operationsgebiet des Ostens in den Jahren 1941-43*, undated; reprinted as Mueller (ed.) (1991).

³⁰ Ibid., cf.: Mueller (1991, 484).

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were fully able to function after they were captured, with the factories in Kauen, Riga and Reval producing an annual output of 200,000 rubber tires each.³¹ Further Russian factories under German occupation include locations in Latvia, Belarus, and—upon capture—in Crimea.³²

Turning, thirdly, to imports, deliveries from Russia resume until the very start of Operation Barbarossa, accounting for the second leg of our symmetric Eastern imports of 11,750 tons (Cf above). In the West, we have confirmation of the first successful blockade breaker arrivals beginning in the middle of 1941. In fact, in contrast to previous accounts, it can be proven that throughout January 1944, the overseas exports of natural rubber to the Reich-controlled ports in France were continuing: Speer's office records 4,000 tons of supplies reaching the French economic authorities in mid-January alone (Cf.: Michaux 1955, 500, reports that the last blockade breaker was the MS OSORNO, reaching Bordeaux on December 26, 1943, which is wrong).³³ Total estimates for natural rubber imports via blockade-breakers from Japanese territory reaching Bordeaux alone between mid-1941 and year-end 1943 have been put at between 44,495-60,000 tons with reference to documents of Admiral Raeder (Treue 1955, 184; Michaux 1955, 507).³⁴ The standard figures in Medlicott (1952, Vol. 2, 670-1) which have often been interpreted as "total rubber supplies" in fact only cover rubber shipments *through* Marseille from North African origins (including Algeria, Tunisia, French West Africa, and for 1942 Spain and Corsica)—thus excluding the Japanese supplies that reached the economic authorities in the occupied part of France (Michaux 1955). Going forward, we will smooth out evenly the total of 60,000 tons in supplies transported by the 16 blockade-breakers across the 30 months between July 1941 and December 1943, yielding for 1941 an import figure of 12,000 tons entering the German economy. An additional five Italian blockade breakers with rubber reached Bordeaux from Brazil before the country cut off diplomatic relations in January 1942 (Treue 1955, 184). Based on the typical load, their contribution is put evenly across years, and set at 1,086 tons for 1941 (Cf. load shares in

³¹ Ibid, pp.295ff.

³² Ibid.

³³ BArch, R3/1957, "3. Wochenbericht des Planungsamtes," January 19, 1944.

³⁴ See Treue (1955, 184).

Michaux 1955, 507).³⁵ In sum, we thus record 13,086 tons of Western port entries.

Combined imports (including captured supplies) thus account for a total of 41,109 tons – against a figure of only 27,000 tons in the *Handbook* (Länderrat 1949, 312). Note that this revised figure still assumes zero imports from other occupied areas or areas part of Hitler’s “informal empire” such as Denmark, Romania, Greece, or Hungary—all of which were indeed in the service of the German economic machinery at this stage (Per Hansen 1997; Gabriella Etmektsoglou 1997; Peter Sipos 1997). In 1941, our three “non-domestic” areas together account for a total of 83,702 tons in non-recorded additions, the second highest nominal number during the war.

In 1942, our data for captured supplies once more proves that Nagel’s figures are substantially underreporting actual supplies, missing transfers and registrations by other economic agencies, who operated increasingly independently from the OKW. In early June 1942, ROGES identified “between 8,000 and 16,000 tons of rubber” in the city region of Kiev alone, which appears nowhere in Nagel’s or that of his colleague Edwin Gruetzner’s documentations.³⁶ This single discovery alone represented 33–66 percent of overall Reich rubber imports for the year 1942, and on its own exceeded the total reported transfers into the Reich reported by Nagel.

1942 represented the year of maximum Eastern territorial expansion, a fact reflected by the peak rubber production volumes, put at close to 25,000 tons. The Maikop, Kauen, and Woronesh facilities are in 1942 able to deliver output for the entire year.

We further have details for Italian rubber production—where I.G. Farben managed to set up a Buna joint-venture—the *Societa Anonima Gomma Sintetica*—with IRI and Pirelli. Two synthetic rubber plants were running by mid-1942 in Ferrara and Terni, the latter with 18,000 tons annual capacity (Raspin 1986, 266–9). Italian contributions will be included net of German deliveries, and include only output based on

³⁵ Details also in BArch R3/1901, “Geheime Kommandosache: Betr.: Kautschuk-Einfuhr aus Ostasien,” September 3, 1941.

³⁶ BArch, R121/815, “ROGES an OKW,” June 6, 1942; cf.: Mueller (1991, section B).

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Italian stocks and its own Buna production—until the German pushback in Italy in mid-1944. German data indicates the remaining unaccounted Western areas had capacities running to a further annual 21,050 tons if maintained at pre-war production levels—though those capacities will be excluded from the producing figures as well here in lack of cross-checks of firm-level output data.³⁷

For a number of plants, individual or aggregate numbers do not exist, so they have not been included in the discussion. One such example are the facilities of the Austrian *Semperit* company, which had rubber factories in Crakow and Kranj (Yugoslavia), which are very likely to have been under German military control.³⁸ All those omissions represent biases of underestimation of the figures.

We note here that the divergence between officially recorded and actual supplies widens progressively with time: while the *Handbook* notes a total of 24,000 tons of rubber imports in 1942, the year of Albert Speer's arrival in office (Länderrat 1949, 312), supplies sourced from the Japanese territories to Bordeaux on their own reached an actual volume of 20,000 tons that year. In addition, the single Kiev discovery already brings total imports to 32,000 tons (assuming the mid-point of the estimate range). Altogether, in 1942—the peak for non-domestically sourced supplies—the three areas together thus account for a total of 106,024 tons in non-recorded additions, against regular domestic *Handbook* figures of 100,500 tons. Every second ton of rubber by 1942 was mobilized via non-domestic or “irregular” channels.

In 1943, under the impression of the territorial gains by the Red Army in the East, additions are once more concentrated on Western sources. The rubber factories in Maikop, Kauen, Woronesh, and Krasny are now assumed to be fully out of service. Only three factories—Riga, Uman, and Liwny—remain intact in the East, yielding a supply of 10,025 tons for the year. We find no evidence of notable captured supply additions in the East. On the producing side, however, the Italian rubber industry

³⁷ Ibid.

³⁸ The Crakow plant was probably included in the aggregate statistics from 1942 onwards, since Crakow was integrated into the Reich then. But the prior output most likely did not show up in the production statistics (as with the Polish plants in Reval and Dankowo). For the *Semperit* plants, see: Treue (1966, 282).

represents a more substantial addition to Germany's domestic supplies from this year onwards—now also including the Buna plants in Ferrara and Terni—with approximately three-quarters of all output being transferred for German war purposes (Treue 1955, 185; Raspin 1986, 266-9). In addition, some remaining rubber stocks were transferred to the Reich according to archival sources.³⁹ Together with the imports through France, we reach total additions of 68,559 tons for the year, against total imports in the *Handbook* of just 8,000 tons (Länderrat 1949, 312). It is worth noting, therefore, that the year 1943 turned the Nazi rubber supply trend almost entirely because of sharply declining inputs from the East, where the land war diminished additional production; in the West, where one recent author has questioned the consensus on the insignificant contribution of the air warfare to the German war economy (O'Brien 2015, 8-9), overall additions stayed close to record levels, and declined by a mere 7,905 tons year-on-year (or by 3.8 percent of total 1942 German rubber supplies). It is hard, therefore, to disagree with previous authors who have characterized the 1943 Allied air campaign as a general failure (Ibid., Beevor 2012).

In 1944, captured stocks are negligible, with a small Danish transfer recorded. On the ground, RAF bomber raids now put the Michelin works in France out of service by March (Lottman, 2003, 187-9). Combined with the territorial losses in the East, producing factories – at just over 21,000 tons – fail to reach even half their 1943 output. New captured supplies are unsurprisingly scarce at such an advanced stage of the conflict, though records such as the smaller ROGES capture in Denmark indicate ongoing regional efforts in long-held territories to seize stocks. Sharp contractions are also recorded for imports: after a final arrival in January, the intensifying naval warfare of the Allies virtually ended the maritime supplies from Japan.⁴⁰ Although Japanese submarines continued to successfully deliver rubber until April 1945, it would be inappropriate to annualize such sporadic evidence.⁴¹

³⁹ BArch, R121/815, ROGES note, October 5, 1943.

⁴⁰ BArch, R3/1957, “3. Wochenbericht des Planungsamtes,” January 19, 1944.

⁴¹ Ibid.

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Nevertheless, Nazi economic officials remained hopeful even at this time. In January 1944, for instance, the Reich planners in Speer's ministry internally opined that the imported natural rubber volumes would be sufficient to "make away for the next 1.5 years with all the technical difficulties that concern the production of aircraft tires when Buna is used."⁴²

Indeed, some optimism as late as 1944 was not unjustified. Even a number of authors advancing critical views on the supply situation have noted the "surprising" intactness of the German-controlled rubber industry in the face of large-scale Allied aerial bombardment in 1944 (Treue 1955, 185). Such a level of intactness was not confined to the old Reich: data for February 1944 indicates that the tire production in Italy and France combined added 43 percent to the current domestic Reich volumes.⁴³ And even under the impression of large-scale bomber raids, overall rubber supplies still exceeded the levels of 1940, by more than 15 percent. It should also be kept in mind that technological improvements implied a far better leverage of raw material supplies onto final outputs: for most tire types, for instance, the share of natural rubber additions required had been reduced between 1938-1943 from 40 percent to below 5 percent.⁴⁴

Overall, we thus note that 338,000 tons of rubber are sourced from non-domestic sources between 1941-1944, against total non-domestic volumes (recorded imports) of just 78,000 tons in the *Handbook*, used by authors such as Tooze (2006, 228) in their recent work.

The available rubber sources, however, also allow contributions to the debate about the relative importance of air warfare touched upon above. Here we should note that according to documents by the "Representative-General for Rubber" (*GBK*), in August 1941, for instance, 900 tons of rubber were allocated for Luftwaffe purposes—against a total monthly distribution of 7,000 tons. This implied share of 12.9 percent contrasts with suggestions that as much as 50-55 percent of German war production

⁴² Ibid.

⁴³ BArch, R3/1957, "8. Wochenbericht des Planungsamtes," February 23, 1944.

⁴⁴ IfZ, MA 217: Reichsministerium für Bewaffnung und Munition: "Stenographische Niederschrift der 31. Besprechung der Zentralen Planung betreffend: Arbeitseinsatz, Kautschuk," January 29, 1943.

was directed at the airforce (O'Brien 2015, 23). Later internal allocation figures confirm the broad order of importance: for the fourth quarter of 1943, direct and indirect monthly rubber allocations for the airforce are put at 1,195 tons, or 8.6 percent of a total monthly distribution of 13,915 tons. The lion's share—more than 6,030 tons in direct monthly distributions alone—were earmarked for motorized land units and technical Army requirements.⁴⁵ As far as rubber is concerned, then, there is no evidence to suggest that a focus on the airforce would have “crowded out” or provided resource constraints for other parts of the Nazi economy. If anything, the reverse is true: the share of rubber allocated to the German airforce was declining from already low levels between 1941-1943. Such trends fully align with key policy decisions not taken into account by O'Brien (Ibid.): on January 3, 1942, Adolf Hitler signed an order regarding “Ruestung 42” (Armament 42)—in which Army production was decisively put at the top of all economic priority lists, at the expense of the navy and airforce (Kroener 1988, 938).

Comparative Coverage

How did the Allied rubber coverage perform in relation to Nazi-controlled Europe? Previous discussions have, alas, suffered from a continued lack of comparative evidence—particularly related to raw material supplies—that would support claims that “Hitler's declaration of war on the US sealed the fate of Germany. The economic forces arrayed against the Third Reich by early 1942 were overwhelming” (Tooze 2006, 668). Such assertions would only stand the test of our new evidence if the German relative endowment showed a quick erosion after 1941, independent of renewed territorial advances throughout 1942.

Yet upon inspection, it is evident that the military inflection points which enabled Stalin to seize the initiative in the Eastern theatre clearly preceded a turn for the better in the economic realm for the Allies. Characteristically, the British “New Statesman and Nation” published an article after the Japanese invasion of Java in March 1942, “Britain's

⁴⁵ For 1941 figures: BArch R3/1901, “Vortragsnotiz August 1941,” 7726-7728; for 1943 figures: BArch R3/1901, Reichstelle Kautschuk (Planung), 7910.

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Rubber Problem”, in which it gave a gloomy assessment on the Allied rubber situation:

One thing is certain, the Western Democracies will get no rubber ... all the rubber produced in Africa and Latin America would not keep the United States industry going for three weeks. The situation is grave ... Germany has a finely organized, self-sufficient industry, which has been widely publicized as much in this country as anywhere ... the 100,000,000 Pound scheme recently announced by Mr. Jesse Jones is not one that can be carried out with great rapidity. Lacks of machinery and highly skilled technicians are insuperable difficulties.⁴⁶

Indeed, such pessimism is affirmed by German intelligence reports and studies on technological policies in the synthetic rubber industry of the US and the Reich by Paul Erker (2005), Jochen Streb (2002) or Klaus Knorr (1944). Beginning with the Japanese attacks at Pearl Harbor and the Asia campaign in January 1942, the Allied camp was immediately cut off the Netherland East Indies, supplying an annual 1.2m tons of rubber. French Indochina, the third biggest global rubber producer in 1939, was cut off since the French campaign as well, although it contributed not more than marginal amounts to the Axis side either (Conrad Gehlsen 1940, 4).

It was only in late 1941 that the US woke up to its critical rubber shortage. Comparing the state efforts to promote synthetic rubber production in the 1930s, Streb (2002) observes that the US only managed to overcome its supply crisis in 1944: “At the eve of World War Two, no public plans existed in the United States to develop a domestic synthetic rubber industry, to reduce the—from a military perspective—dangerous dependency on natural rubber imports from South East Asia.” Key US practitioners recall that in the summer of 1942—at the time of the “Case Blue” offensive at the Eastern front—“the [US] synthetic rubber program was becoming synonymous in the public mind with confusion and futility ... the public and the press had long ago lost confidence; the Congress had lost confidence; and now apparently our Allies, the British, to whom the best official and unofficial information was available, had also lost

⁴⁶ “Britain’s Rubber Problem” in *New Statesman and Nation*, March 21, 1942, 189-190.

confidence” (Howard 1947, 207-9). The “Special Committee to Study the Rubber Situation” in September 1942 direly stated that

Having lost to Japan 90 percent of our pre-war source of natural rubber, chief reliance must be placed on the new synthetic rubber program. But to obtain this in time we must, within two years after Pearl Harbor, have created one of the largest industries in the country. Normally such a development would require a dozen years. To compress it into less than two years is almost a superhuman task (Howard 1947, 216).

Streb (2002, 372) also offers US “coverage ratios” for rubber relating available supplies to actual domestic demand. It is in this sense a measure of how well the respective war parties were able to meet underlying economic requirements. The data, until very late in the war, is unequivocally unfavourable to the Allied side. In the year following the American declaration of war against Japan, the data shows a mere 0.6 percent coverage ratio for rubber for the US. Though the catch-up accelerated significantly in 1943, by the end of the year the ratio still did not exceed 23.4 percent (compared to a 121.5 percent ratio for the Reich according to Streb). Peak US coverage was achieved in 1944, at 69.7 percent, falling back to 69.2 percent in 1945.

Even in *absolute* production numbers—entirely abstracting from the civilian demand constraints in the largest rubber consumption economy in the world, which required 1.04 million tons per annum by the time Franklin Roosevelt declared war on Japan (Streb 2003, 35)—it is entirely inaccurate to suggest that Allied forces arrayed against their Axis adversaries were in any way “overwhelming” by early 1942. Over the entire year 1942, the United States managed to produce a meagre 3,781 tons of synthetic rubber—against 110,569 tons (Streb domestic estimate), or 206,524 tons (our new level); even in fact in 1943, absolute production numbers in the US fell short of supplies obtained by Nazi Germany (185,175 tons versus 188,448 tons).

Our new data now enables the calculation of actual coverage ratios for the Third Reich, by adding those unofficial rubber supplies that were transferred to supplement the domestic industry (we thereby control for officially recorded imports and the demand side, Figure 1). In a second

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step, we can directly relate those new figures to the known US coverage data, to present a new measure of comparative raw material sufficiently—here represented by the gap in coverage ratios between the two powers (Figure 2). It becomes clear that when the occupied territories are taken into account, Germany maintained a lead in rubber coverage throughout the entire war, into the late months of 1944. In fact, even after the Wehrmacht advance had come to a halt in the Russian winter of 1941, the Reich economy managed to mobilize record relative amounts of strategic raw materials for 1942. Comparatively, Nazi Germany remained better endowed than the Allied economies with key resources equally in 1943 – and a small, though rapidly diminishing, lead was even maintained for 1944. Again, aerial bombardments did not cause a reversal in the relative supply situation: the German coverage lead – just like its aggregate endowments—peaked in 1942, around 18 months before Allied air strikes started in earnest.⁴⁷

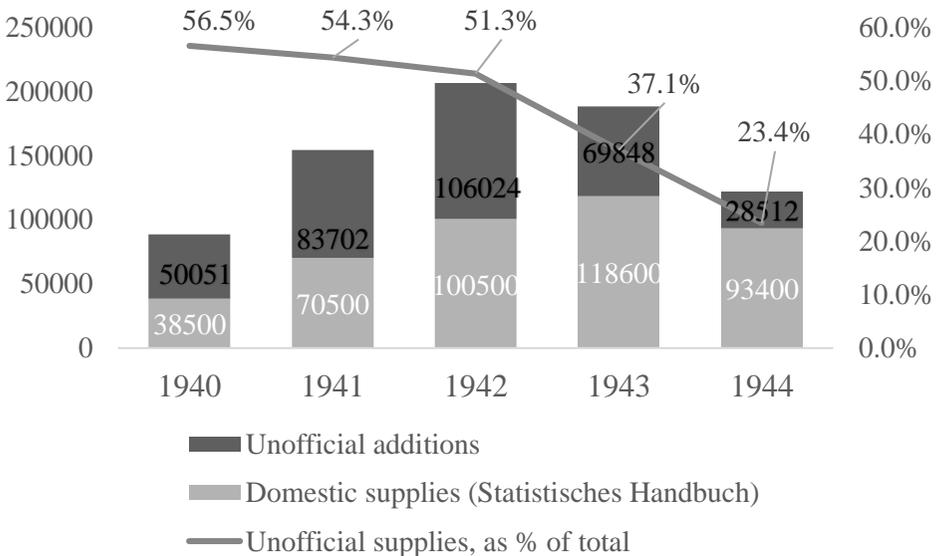


Figure 1

Official and de facto supplies of rubber for Nazi Germany, 1940-1944, in tons (LHS), unofficial as share of total supplies (RHS).

⁴⁷ Cf. Footnote 21, and (USSBS 1945b, 2-5).

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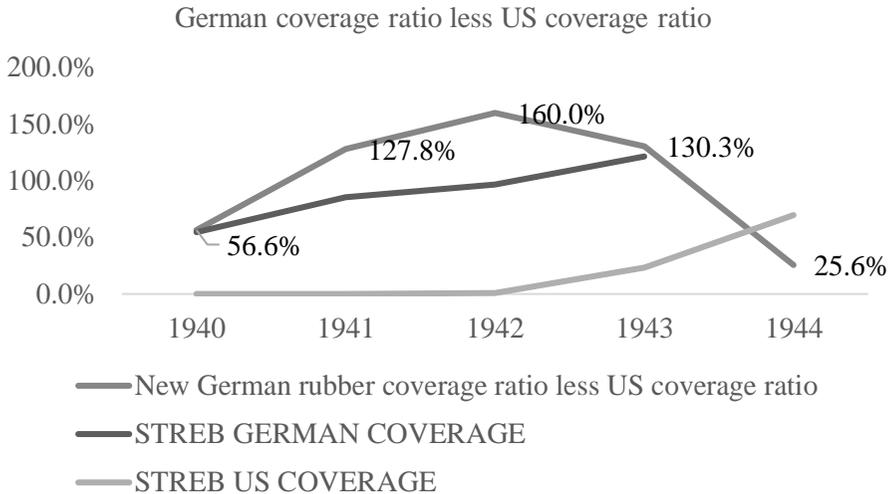


Figure 2

New German Rubber Coverage Ratio Less US Coverage Ratio.

Even when the US began to produce first notable amounts of Buna-S and Neoprene in the last quarter of 1943, the output suffered from serious quality deficiencies given persistent shortages of industrial alcohol; the country's existing Butyl production, meanwhile, was not suitable for actual tire usage (Howard 1947, 205, 299). On top, with 27 million registered vehicles in 1942, the country had to sustain the largest civilian automobile market in the world—as the Special Committee rejected large-scale cutbacks in general supplies, fearing a “breakdown” of an economy “geared to rubber-borne motor transport” (Ibid., 215). In desperation, the US side assembled a special rubber mission to Russia to obtain intelligence from the Soviet industrial organization—but “the mission was able to visit only one plant and even here failed to get the technical data most wanted” (Ibid., 228). Such failures reverberated internationally: the US and UK rubber transports to Russia, which had amounted to 81,000 tons up to this point, were reduced considerably in mid-1942.⁴⁸ Between August 1942

⁴⁸ The number is an estimate by the foreign military intelligence office “Foreign Armies East” of the Wehrmacht (*Fremde Heere Ost*), the so-called

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and March 1943, total exports of rubber into Russia amounted to a mere 13,000 tons.⁴⁹

On balance, then, whether measured in absolute or relative terms, we can conclude from the endowment data that only during the course of 1944, a meaningful closure of the resource gap was beginning to take place between the United States and Germany. In key war resources, the Axis advantage was carried on into the year 1944, when eventually rubber supplies fell by a dramatic 35 percent over 1943. Sixty-two percent of this German rubber supply decline can be attributed to losses in non-domestic sources—sources that hinged upon the political control of non-domestic territory. Particularly we can attribute endowment losses now to the loss of factories in Latvia and Belarus, where Nazi forces are pushed back amid Operation Bagration in July 1944 (Glantz and House 1995). Economic endowment levels, hence, depended upon military performance, rather than vice versa.

Implications

This article has for the first time provided an estimate of total available rubber resources to the Axis side during World War Two, and argued that basing conclusions on the mainstream statistical literature leads to significant downward biases. A wide range of “non-domestic” sources of raw material endowments are not recognized in the current economic and statistical literature, even though these provided a crucial input to the ongoing German war efforts. Given the prominent status of rubber supplies in the context of the Four-Year Plan, and the priority lists implying equal attention by the economic units for rubber, oil, and minerals such as manganese, for a range of other key war-economic inputs, the results presented here imply a similarly downward bias in existing supply records for other key war resources, and notably higher de facto endowments.

Crucially therefore, between the second half of 1941 and mid-1944, Germany records a fully self-sufficient rubber supply. The

“Weide-Reports,” but also used by Churchill in a speech to the House of Commons. See: IfZ, MA 190/1.

⁴⁹ Ibid.

supplementation of German Buna output by a combination of plunder, the activities of economic agencies, seized factories, and overseas imports were substantial: our data suggests total unofficial additions of 338,000 tons in the five years until 1945—representing 68 percent of all official supplies recorded in the *Handbook*. Therefore, in fact, the “import boom” detected by previous authors (Schnerer 2012) was accompanied by a “supply boom” in strategic raw materials levied from (and via) the occupied areas across the Eastern and Western territories. The new data suggests that 1942, rather than 1943, represented the peak year of overall rubber supplies for the Nazi industrial complex—when every second ton in the German war economy was sourced from non-domestic origins.

Since the peak of overall supplies—at a total of 206,524 tons in 1942—was reached before the Allied air campaign reached meaningful levels,⁵⁰ it is evident that the bomber attacks, and the associated logistical impediments were not actually the key to the reversal of Nazi Germany’s material endowments—a result more in line with suggestions advanced by Anthony Beevor (2012). However pronounced the attention given to the aerial strategy may have been from the Allied side (Cf. O’Brien 2015), what mattered more for material endowments were clearly the territorial changes on the ground.

With the 6th Army’s demise in Stalingrad, and the collapse of “Case Blue” at the Southern part of the front, the fortunes for the rear economic units, and their supplementation efforts crucially turned: 1943 marks the first year of absolute declines in supply figures—rather than 1944, which the *Handbook* suggested so far. It is the steep fall in captured supplies that previously accompanied the annexation of new territories by the economic units, and the fall in producing factory output in the East resulting from the loss of factories, which underlie the sharp reversal.

Our new data equally suggests that in comparative terms, we cannot speak of a “low level of mobilization” (Overy 1982, 291) in the critical war years either. Relative to the poor state of US industrial efforts to supplement natural rubber—triggering panic in industrial and military circles after Pearl Harbor—the Germans were well able to meet the surge in demand for critical goods from both the military and civilian sectors.

⁵⁰ Cf. Footnote 21, and (USSBS 1945b, 2-5).

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Adolf Hitler and senior staff including Albert Speer were aware that endowment volumes were in fact not primarily threatened by aerial attacks, but rather raw territorial losses (Helmut Heiber 1962, 946). During an interrogation in prison in August 1945, Speer referred to a key internal memorandum dated September 5, 1944 on raw material constraints. Explicitly, the memorandum not only proves that rubber was regarded as a representative “scarce resource” in the same priority category as zinc, copper, and chrome; but also that the eventual supply situation to keep domestic production running depended on the shifting of the strategic Tisza-line in Hungary. Absent shifts in this line—shifts of which depended on land battles alone—numerous scarce materials were projected to last well into 1948.⁵¹ In this context therefore, our contribution allows a refinement—and reiteration—of the two key messages of this (underused) contemporary insight: scarce raw materials were available in much greater quantities than the statistical literature has—given gross ignorance of alternative sources of supply—given credit. Secondly, if neither supply constraints, nor logistical constraints were the main reason for Germany’s defeat in World War Two, our implication is that explanations for Germany’s defeat should squarely focus on military and strategic areas, rather than economic ones.

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⁵¹ IfZ ED 99, Volume 12, “The Speer Chronicles”, 23ff.

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