# The USSR and Total War: Why didn't the Soviet economy collapse in 1942?

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## Introduction

Germany's campaign in Russia was intended to be the decisive factor in creating a new German empire in central and eastern Europe, a living space that could be restructured racially and economically in German interests as Hitler had defined them in *Mein Kampf*. When he launched his armies against the Soviet Union in 1941 the world had two good reasons to expect him to achieve a quick victory. One, for those with long memories, was the Russian economic performance in 1914–17: when faced with a small proportion of Germany's military might, Russia had struggled to mobilise itself and eventually disintegrated. The disintegration was just as much economic as military and political; indeed, it could be argued that Russia's economic disintegration had been the primary factor in both Russia's military defeat and the Russian revolution. Another much fresher reason was that the Germans had just proved in battlefields from Scandinavia to the Mediterranean that they were the best soldiers in Europe.

In the outcome these expectations were overturned. The Soviet economy did not disintegrate. The German army was overwhelmed by the scale and scope of Soviet resistance. The Soviet Union turned out to be the killing ground of Nazi ambitions.

How did this come about? Production was decisive: the Allies outgunned the Axis because they outproduced them. Economic factors carried more weight in the Allied victory than military or political factors. For example, the Allies were not better soldiers. It is true that some of the Allies were more democratic, but being a democracy did not save the Czechs or the French and being a dictatorship did not defeat the Soviets. The Allies won the war because their economies supported a greater volume of war production and military personnel in larger numbers. This was true of the war as a whole, and it was also true on the eastern front where the Soviet economy, of a similar size to Germany's but less developed and also seriously weakened by invasion, supplied more soldiers and weapons.

In a recent essay on World War II, I asserted that "Ultimately, economics determined the outcome".[1] A friendly critic objected that this left no room for "a whole series of contingent factors — moral, political, technical, and organizational — [that] worked to a greater or lesser degree on national war efforts".[2] I accept this criticism in the following sense: determinism must make bad economics, for economics is about nothing if not choices. To take it into account I will proceed as follows. My paper begins by reviewing what is known about the outcomes of the choices that people made. Part 1 surveys the scale of Soviet war preparations and their possible motivations. Part 2 analyses the changing wartime availability and uses of Soviet resources. Then I will consider the context within which these choices were made and the outcomes were obtained, so part 3 offers a re–examination of the Soviet economy in comparison with the German economy. In part 4 I propose a framework for understanding the incentives that people faced in choosing to work with or against the national war effort. Part 5 applies this analysis to the risks facing the Soviet economy in 1942, and part 6 concludes.

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[1] Harrison (1998), 2. This view is directly descended from Goldsmith (1946).

[2] Overy (1998).

## 1. War preparations

When war broke out the Soviet Union had already engaged in substantial rearmament. In 1940, the last year of less than total war (the Soviet Union had used military force only in Finland and the Baltic region), the Red Army comprised between four and five million soldiers; the military budget consumed one third of government outlays and 15 per cent of the net material product at prevailing prices. One third of the military budget was allocated to procurement of weapons, and Soviet industry produced thousands of tanks and combat aircraft, tens of thousands of guns and mortars, and millions of infantry weapons.[3]

The strategic purposes of prewar rearmament have been much debated. According to Lennart Samuelson's archival study of chief of Red Army armament Marshal M.N. Tukhachevskii, Soviet plans to build a military–industrial complex were laid down before the so–called war scare of 1927.[4] These plans were not aimed at immediate armament to counter any particular military threat, since at the time none existed. They involved huge investments in heavy and defence industry; an economist might call them "forward–looking". Samuelson does not rule on their underlying motivation. Nikolai Simonov, on the other hand, has located these plans in the context of the Stalinist regime's basic insecurity: the Soviet leadership feared a repetition of World War I when the industrial mobilization of a poorly integrated agrarian economy in the face of an external threat resulted in economic collapse and civil war. Simonov concludes that, although the 1927 war scare was just a scare, with no real threat of immediate war, it was also a trigger for change. It reminded Soviet leaders that the government of a poor country could be undermined by events at any moment; external difficulties would immediately give rise to internal tensions between the government and the peasantry which supplied both food and conscripts. The possibility of such an outcome could only be eliminated by countering internal and external threats simultaneously, in other words by executing the Stalin package of industrialization and farm collectivization as preconditions for sustained rearmament.[5]

Both Samuelson and Simonov confirm that in the mid–1930s Soviet military–economic planning was reoriented away from abstract threats to real ones emanating from Germany and Japan. As a result the pace of war production was accelerated far beyond that envisaged earlier in the decade while contingency plans for a war of the future became increasingly ambitious. In Samuelson's view the military archives leave open the question of whether these plans were designed to support an aggressive war against Germany, rather than to counter a German attack. However, the documentation assembled by Gabriel Gorodetsky in the central political, diplomatic, and military archives has surely settled this issue: Stalin was trying to head off Hitler's colonial ambitions and had no plans to conquer Europe, although it is true that his generals sometimes entertained the idea of a preemptive strike, and attack as the best means of defence was the official military doctrine of the time.[6]

Finally, it should not be forgotten that the Soviet Union remained relatively poor. The costs of prewar rearmament were much greater relative to Soviet resources and incomes than equivalent efforts in Germany, Britain, or the United States. Moreover, what was achieved by 1940 was only a tiny fraction of the effort required when war broke out.

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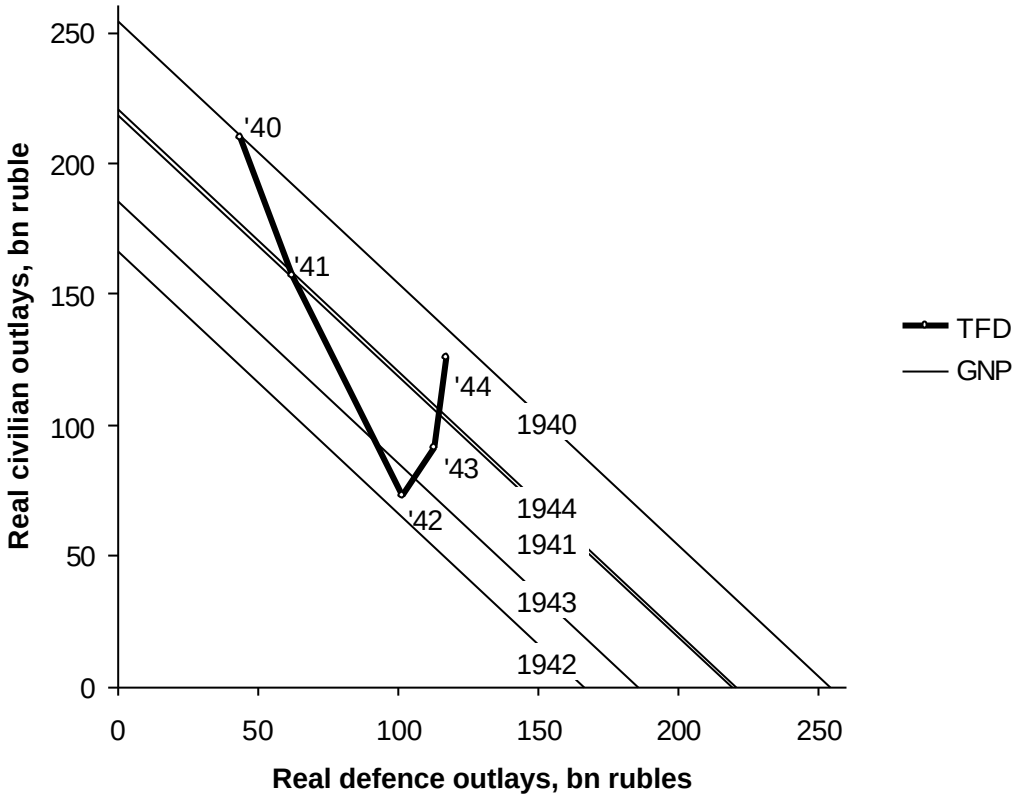
[3] Harrison (1996), 68, 284; Davies and Harrison (1997), 372, 394.

[4] Samuelson (1996, 2000a, and 2000b).

[5] Simonov (1996a, 1996b, and 2000).

[6] Gorodetsky (1999).

*Figure 1. Soviet production possibilities and uses of resources, 1940 to 1944 (billion rubles at 1937 factor costs)*




Source: see table 1. Total final demand (TFD) is the sum of civilian and defence outlays and equals the gross national product (GNP) plus net imports.

## 2. Wartime resources

The outlines of the Soviet wartime mobilisation of resources can be depicted in a few tables and figures. Under the pressure of a deep invasion, Soviet GNP fell by one third (table 1), while the resources allocated to defence increased not only relatively but absolutely too. The pressure on resources was somewhat alleviated by foreign aid, which was adding approximately 10 per cent in real terms to Soviet resources in 1943 and 1944. This is illustrated in figure 1, which compares Soviet production possibilities and military versus civilian resource uses through the war years. The bold line that wanders to the southeast before turning north marks the actual combinations of military and civilian uses of resources, or total final demand, in each year. The net import of Allied resources allowed the Soviet Union to use more resources than its gross national product in 1942, 1943, and 1944. In each year the Soviet Union's real GNP is used to mark a budget line showing the alternative possible uses of its own resources. The distance from the GNP line to the point representing total final demand in each year shows the difference that Allied resources made.

When the war was at its most intense, the resources available to the civilian economy were reduced below the minimum required to replace stocks of physical and

human capital. Household consumption was already being squeezed a little by rearmament in 1940; it was squeezed ferociously in 1941–2 by the cut in overall resources and the ballooning defence budget, and squeezed still further in 1943 by the recovery of capital formation. At the low point living standards were roughly 40 per cent below the prewar level. Millions were overworked and malnourished, and there was substantial excess mortality amongst the civilian population.

The changes in the structure of Soviet production are illustrated in table 2. An outstanding feature is the huge increase in value added in defence industry and military services, against a backdrop of decline and collapse in other sectors. Just between 1940 and 1942 the real output of most civilian branches fell by one half or two thirds, while that of military services more than doubled, and that of defence industry more than trebled. These trends are further illustrated in table 3; the latter confirms that by 1942 there was an immense disproportion between the rise in war production and the collapse of key materials such as steel, coal, and electricity, which declined by just as much as the output of consumer goods.

The pattern of wartime employment is reconstructed in table 4. The structure of employment changed much less than the structure of output; for example, employment in defence industry grew by less than half between 1940 and 1944. To some extent this gives a misleading impression. Millions of workers changed over from producing for civilian needs to supplying the war effort without changing their place of work or branch of industry. Although specialised defence industry was very important, it was only the tip of an iceberg of war–related production. In addition to weapons soldiers also needed food, fuel, transport services, and construction materials. The defence industry itself relied on inputs from the machinery, metallurgical, chemical, fuel, and energy sectors and transport services. All these had further indirect requirements. When the indirect and direct requirements are combined, the change in the composition of employment between 1940 and 1942 is remarkable. Table 5 shows that between 1940 and 1942 the number of soldiers and war workers supplying the war effort rose by nearly 14 millions. But since at the same time the total size of the workforce fell by 32 millions, the result was to cut the number of workers supplying the needs of the civilian economy by a staggering 46 millions. As a result, when more resources became available in 1943 and 1944 they were probably used more to relieve the strain on the civilian economy than to increase the war effort.

Two other aspects of employment change are represented poorly or not at all in table 4. One is the role of forced labour. The table shows nearly two million labourers employed in NKVD establishments at the outbreak of war. Labourers held by the NKVD in camps, colonies, and labour settlements either worked in NKVD establishments for construction or mineral extraction, or were leased to other ministries. Those leased to other ministries are hidden in the official public sector workforce total; they numbered roughly three quarters of a million in 1940–1, falling to half a million in 1943–5. In general, therefore, the trend in the number of forced labourers followed that of the workforce as a whole. On the other hand the gender composition of the workforce changed profoundly: with men called up into military service, women's share in public sector employment rose from nearly two fifths before the war to nearly three fifths in 1944. There was even more dramatic change in the countryside, which was stripped of men and also of horses and machinery; by the end of the war, four out of five collective farmers were women, who carried out basic agricultural tasks predominantly by hand.[7]

Wartime change in the structure of output therefore considerably affected the structure of employment. Its other main reflection was in productivity. Present estimates imply a very sharp divergence between productivity trends in defence and

[7] Barber and Harrison (1991), 216.

civilian industry. Table 6 suggests that between 1940 and 1944 value added per defence industry worker trebled, while value added per worker in civilian sectors fell, in some cases substantially. Essentially, much of the gain in defence industry output which followed the German invasion was achieved through more efficient use of existing materials, labour, and fixed capacity. A similar process was noted in Germany and accounts for much of the belated surge of German war production between 1941 and 1944.[8] There was no efficiency gain in other sectors, and labour productivity in the rest of the Soviet economy declined, increasing the resource requirements of civilian output and making it more difficult to divert resources to military use.

## 3. German comparisons

Comparisons with the German economy confirm how critical the situation was for the Soviet Union in 1942. Table 7 shows that, although Soviet exceeded German GDP in 1940, the result of German wartime mobilisation and the deep invasion of Soviet territory was to shift the balance strongly in Germany's favour. In the most critical years of the war overall Soviet resources were only 70 per cent of Germany's, and the increment arising from Allied aid compensated only to a small extent. It is true that Germany was engaged on two fronts. Tables 8 and 9 show, however, that despite the overall disadvantage the Soviet Union maintained a bigger army in the field than Germany, and outproduced German industry systematically in weapons other than warships.

Richard Overy and I agree that the technological key to Soviet superiority in the output of weapons was mass production.[9] At the outbreak of war Soviet industry as a whole was not larger and not more productive than German industry. The non–industrial resources on which Soviet industry could draw were larger than Germany's in the sense of territory and population, but of considerably lower quality, more far–flung, and less well integrated. Both countries had given considerable thought to industrial mobilisation preparations, but the results were of questionable efficacy. In both countries war production was poorly organised at first and productivity in the military–industrial sector had been falling for several years. The most important difference was that Soviet industry had made real strides towards mass production, while German industry was still locked into an artisan mode of production that placed a premium on quality and assortment rather than quantity. Soviet industry produced fewer models of each type of weapon, and subjected them to less modification, but produced them in far larger quantities. Thus the Soviet Union was able to make considerably more effective use of its limited industrial resources than Germany.

The foundations of Soviet wartime mass production were laid in the prewar period. However, the wartime period presents a sharp contrast in terms of the rate of military product innovation which came to a virtual standstill. Before the war Soviet defence industry was in a state of permanent technological reorganisation as new models of aircraft, tanks, and other weapons were introduced and old ones phased out at dizzying rate.[10] In wartime Soviet industry introduced just three new aircraft, all in 1942, and two new tanks, one in 1942 and the other in 1943. Also in 1943 several models of self–propelled artillery were also introduced, but these were scarcely radical departures, being based on recombining existing guns and tank bodies. The wartime budget for military research and development was strictly limited and no significant wartime developments entered production before 1945; indeed one of the charges against a number of senior air force and aviation industry leaders purged after

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[8] Overy (1994), 346; Abelshauser (1998), 155.

[9] Overy (1995), 207; Harrison (2000).

[10] Davies and Harrison (1997 and 2000).

the war was that in wartime they had pursued mass production of existing weapons at the expense of R&D, and so contributed to a postwar technological lag. In short, while Germany brought in many new tanks and aircraft (including completely new propulsion systems based on rockets and jets) the Red Army fought the war almost exclusively on the basis of weapons designed beforehand. But the resulting huge economies enabled the Soviet Union to make extremely effective use of its limited industrial base.

For illustration consider tables 10 and 11; table 10 deals with the aircraft industry and reproduces data already in the public domain, but recently released data for the tank industry are now available and it is useful to compare them in table 11. These tables show how Soviet industry concentrated on a small handful of models and factories. Eight plants produced three quarters of all Soviet military aircraft during the war, and half a dozen models accounted for three fifths of all the aircraft produced. The picture in the tank industry was still more extreme. Six sites produced 90 per cent of all tanks, and just two of them produced one half of the total. Five sites produced the entire run of self–propelled artillery. The distinction betweeen a factory and a site arises in table 11 because factories subject to wartime evacuation produced at more than one site, which created an additional obstacle to mass production. This distinction is not made in table 10. Four tank models accounted for 90 per cent of all units produced, and one of them, the T–34, accounted for nearly three quarters. The T–34 underwent just one major wartime modification: the gun was upgraded in 1944, resulting in the T–34–85. Similarly just six models of self–propelled artillery were introduced and one of them, the SU–76, accounted for more than half of all output.

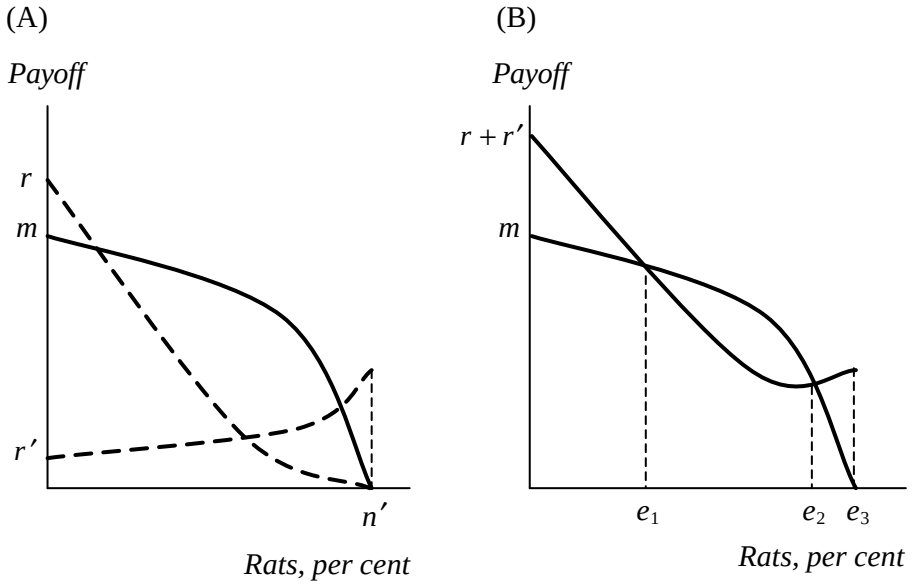
## 4. The point of collapse

War production was a decisive element of the Soviet war effort. But in 1941 and 1942 its foundations were crumbling. Soviet factories could not operate without metals, machinery, power, and transportation. Their workers needed to be fed and clothed, and competed for the same means of subsistence as the soldiers on the front line and the farmers in the rear. As war production climbed, this civilian infrastructure fell away. While Soviet factories turned out columns of combat–ready vehicles and aircraft, guns and shells, civilians were starving and freezing to death. The tribulations of the other Allied economies, even Britain under submarine blockade and aerial bombardment, seem almost frivolous in comparison. Why the Soviet economy stopped short of outright collapse is therefore a proper and serious question.

How do such economies collapse? A country's war effort will collapse when citizens choose to invest effort elsewhere. In wartime the citizen may choose to allocate effort to patriotic service of the country's interest and to service of self–interest. I define self–interest broadly: it includes service of anything to the exclusion of the interest of the country. Between the country and the self are many layers of association, for example the family, the village, or ethnic group. If the latter are served in ways that conduce to the country's interest I define it as patriotic service. Otherwise self–interest is being served.

A patriotic citizen serves in whatever capacity the state directs, does his or her duty, obeys orders, accepts rations, and respects state property; call this person a mouse. Specifically, mice serve their country to prevent it from being defeated and in the hope of victory. A self–serving citizen behaves opportunistically and ignores orders or gets around regulations, goes absent without leave, jumps queues, and steals government property and the property of others; call this person a rat. Specifically, rats allocate effort between two kinds of theft. They steal nondurable goods, for example food or civilian or military materials, in the hope of surviving until victory. They also steal capital assets, for example durable goods, productive equipment, and even land titles, in anticipation of defeat and in the hope of being permitted by the enemy to establish postwar ownership rights.

*Figure 2. The wartime payoffs to serving one's country and serving oneself*




Citizens may choose to be rats or mice, their choice depending on the relative payoffs. In other words mice are not better people than rats; it is not a moral choice, just a choice between payoffs. This choice is forward–looking, being based on the probability of defeat. Within the framework that I propose, the probability of defeat depends exclusively on the balance of production available to the war effort on each side. But the probability of defeat is endogenous since the level of production available to the war effort depends on people's choices.

Some possible implications are illustrated in figure 2 (for formal structure see the appendix). Being a mouse brings a payoff. The expected return to patriotic behaviour is the citizen's share in the utility that results from defending one's country (including one's community, one's family, and oneself). This return, labelled $m$, will fall as the number choosing to be mice falls. At the vertical axis there are only mice, and the payoff to mice has the value $m$. To the right, the proportion of rats to mice increases and with the community's impoverishment the payoff to mice falls away. First, with fewer mice less output is produced. Second, the growing population of rats diverts a rising share of output away from the war effort. Both raise the probability of defeat and cut the payoff to patriotism. Third, as the probability of defeat increases rats steal a rising share of productive assets, which additionally cuts output. Eventually the payoff to mice falls to zero at a point labelled $n'$ where defeat is certain because everyone has become a rat and output is zero.

Being a rat also brings returns. Consider panel (A). The return from stealing output is labelled $r$. When everyone else is being patriotic the payoff to the first rat will be substantial. The first to steal supplies will always be able to pick something of a value higher than the payoff to patriotic activity: why else do governments find it necessary to enforce wartime controls? So at the vertical axis $r > m$. But this return will fall as the number choosing to be rats increases. First, there are fewer mice producing less output for the rising population of rats to share. Second, as rats crowd in the risk of confiscation rises at first. Wartime controls are enforced by threats: crime incurs a certain probability of punishment, which confiscates the rat's payoff and reduces it to zero. Let the probability of punishment depend on the proportion of rats to mice, so that it is low when rats are few and there is little threat for mice to guard against; it rises as rats multiply, then peaks and falls again as mice become few

and are overwhelmed by rats.[11] These considerations make the rats' payoff decline more rapidly at first than the returns to mice. As rats begins to outnumber mice the rats' risk of confiscation falls again, but the few remaining mice provide little output for rats to steal, so the two payoffs converge on zero at $n'$, the point of certain defeat.

In addition to output rats also steal durable assets. The return from stealing assets is labelled $r'$ in panel (A). Under home rule illegally held assets are always at risk of confiscation. However, rats may calculate that under enemy rule, the previous legal owner being unrepresented, possession of stolen assets will be nine points of the law.[12] As an extension, the enemy may encourage rats by offering to protect their stolen assets after victory. Then the probability that property rights over grabbed assets will become enforceable, and the incentive to grab, will rise with the probability of defeat. And the probability of defeat will rise, the more output and assets are grabbed. Of course while the country is undefeated rats still face the threat of confiscation, and this rises at first when mice are still many, but eventually the danger of confiscation will fade as rats multiply and defeat becomes more likely.

Combine the rats' expected payoff under home rule with their payoff from the enemy. In figure 2 these give panel (B). The rats' combined payoff $r + r'$ is U–shaped; it has one maximum when rats are few and pickings are rich, and another when rats are so many that the country's defeat is ensured. In between there is a zone of disputed territory and unresolved conflict where the incentive to grab is weakened by impoverishment and the risks of punishment: there is less to grab, and what is grabbed cannot be held securely. But as defeat becomes more predictable the incentive to grab what's left rises again while the rats anticipate the enemy's arrival.

A result is a stable equilibrium at $e_1$. A few rats have invaded the community but, with the return to self–serving activity dropping away, grabbing stops at the point where the payoffs to rats and mice are equalised. Thus in any society at war a degree of rule–breaking and self–serving activity might be normal without necessarily threatening the state's survival. Further to the right, there is an unstable equilibrium at $e_2$ which is the "point of collapse". At the point of collapse the payoffs to rats and mice are equal again. To the right of this point the higher reward goes to rats and the war effort collapses unstoppably, taking the country straight to the other stable equilibrium at $e_3$ where the war is lost. But the existence of the "bad" equilibrium at $e_3$ is not a problem as long as the "good" equilibrium at $e_1$ is self–sustaining.

The problem presented by the point of collapse can be translated into the terms of a dictatorship of the stationary–bandit type.[13] The dictator administers his assets through agents. Each agent will remain loyal to the dictator's interests as long as his share in the dictator's expected rents from the assets he administers exceeds the expected value of the asset if it were stolen by the agent. If the agent were allowed to gain by stealing from the dictator he would become a roving bandit. This would reduce the expected value to all agents of serving the dictator loyally and increase the others' incentives to rove too. However, unregulated or roving banditry would also reduce the value of assets to all agents, so a rational dictator will enforce cooperation

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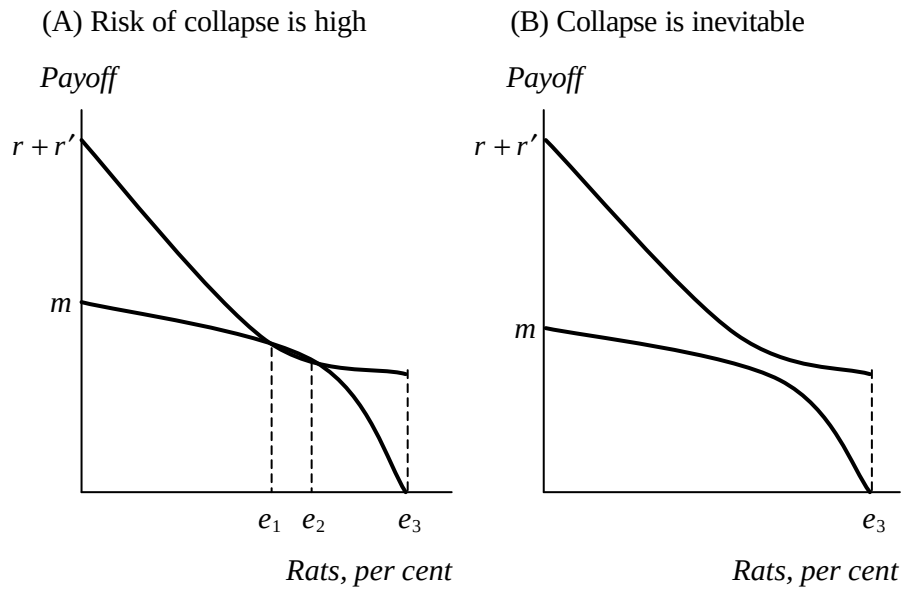
[11] In this respect the position of rats is different from that usually attributed to rent–seekers: up to a point at least, for rats there is no safety in numbers. On rent–seeking see Murphy, Shleifer, and Vishny (1993).

[12] In English law possession implies ownership unless someone with a better claim comes forward. Recently the appeal court ruled that someone who had bought a car knowing it to be stolen was entitled to keep it since the previous owner was no longer identifiable: there could be no one with a better claim. In short, "even a thief is entitled to the protection of the criminal law against the theft from him of that which he has stolen" (*The Guardian*, 23 March 2001).

[13] Olson (1993).

*Figure 3. Two more cases*




and rational agents will comply. However, their incentives would change if a neighbouring bandit were to offer to settle on the territory, expropriate the dictator, and share the rents on his new assets with the first few agents to defect, threatening the rest with wholesale destruction.

## 5. The risk of collapse

When citizens chose between serving their country and serving themselves, their calculations were driven by the probability of defeat. In the framework that I propose, the probability of defeat depended exclusively on production. Thus, controlling for rats, greater initial wealth always raised the payoff per mouse relative to the payoff per rat and reduced the likelihood of a wartime collapse. A wealthier community would offer a greater private return to its defence. A poorer enemy was less likely to win and less likely in the event of victory to honour postwar claims to assets laid by rats. When Japan attacked the United States, the rewards to American mice from defending American prosperity were obviously substantial, and the Japanese ability to offer significant rewards to American rats was self–evidently limited. The size disparity of the US and Japanese GDPs ensured that the zone of stability for the US war effort was very large: even if the good equilibrium allowed for significant numbers of cheats and thieves, it remained far to the left of the point of collapse.[14] There was not the slightest chance that the US war effort would collapse into a bad equilibrium, even if a more faint–hearted or more isolationist administration might have willfully chosen a less belligerent response to attack in the first place. This suggests that initial resource disparities can be decisive

Think of two economies closer to each other in size, for example Germany and the USSR, engaged in a military struggle that had become too close to call. Consider the Soviet war effort in the winter of 1942. Huge Soviet wealth had already been destroyed or lost to the invader. In figure 3 panel (A) illustrates this case. Controlling for rats, the payoff per mouse had been depressed by capital losses. Controlling for

[14] On food rationing violations in the United States in World War II see Mills and Rockoff (1987).

mice, the anarchy in the civilian economy and the dangers of outright defeat had raised the payoff per rat. The net effect was to shift the good equilibrium dangerously close to the point of collapse. Stalin could rationally fear that with only a small additional capital loss the good equilibrium and the point of collapse would converge and then disappear, making a disintegration of the Soviet war effort inevitable. This case is illustrated in panel (B): there is only one equilibrium where collapse has already occurred.

Under the circumstances shown in panel (A) of figure 3, the exact positions and slopes of the various schedules became critically important, and the contingent "moral, political, technical, and organizational" factors came fully into play. Fearing destabilisation, and with few means available to raise the payoff to mice, the Soviet regime did everything it could to depress the payoff to rats. It is true that the latter was fixed in part by the expected policies of a victorious enemy, and Stalin was helped by the fact that Hitler promised little or nothing to ethnic Russians. The Soviet authorities also downshifted the expected payoff from German occupation by threatening potential collaboration with death: even if the enemy prevailed, collaborators would not live to receive any benefit.

Various experiences of 1941–2 testify both to the risks of destabilisation and the measures taken to limit the expected payoff to self–serving activity, increasing patriotic activity and strengthening the stable equilibrium.[15]

*The probability of defeat*

There were widespread initial expectations that Soviet resistance to German invasion would follow the same course of unravelling and collapse as that already followed by Poland, Netherlands, Belgium, France, Norway, Greece, and Yugoslavia. These were accentuated by the ease with which the Wehrmacht moved into the Baltic and the western Ukraine and the warmth of Germany's reception there. The Soviet authorities made determined efforts to manipulate perceptions of the probability of defeat. Stalin suppressed information about Soviet defeats and casualties. Many were executed for spreading defeatist rumours, which might simply have been the truth. Moscow and Leningrad were closed to refugees from the occupied areas in the autumn of 1941 to prevent the spread of information about Soviet defeats. The evacuation of civilians from both Leningrad and Stalingrad was delayed by the authorities' desire to conceal the real military situation.

*"Theft" of human capital*

Against orders, millions of encircled Red Army soldiers surrendered to the invader in the autumn and winter of 1941 and the spring of 1942. Some of those taken prisoner went over to the German side and fought alongside the Wehrmacht, for example General A.A. Vlasov's "Russian Liberation Army", and the Germans also recruited national "legions" from ethnic groups in the occupied areas. At the end of July 1942 when the Germans' summer offensive reached Rostov on Don, significant numbers of Red Army troops ran away from the front line. In the economy, although labour discipline became highly militarised, lateness, absenteeism, and illegal quitting remained widespread.

*Theft of durable goods and land titles*

In the summer of 1941 defeatism stimulated speculative talk about sharing out state grain stocks and collective livestock. In 1941–2 there were widespread reports of collective farmers secretly agreeing the redivision of the kolkhoz fields into private property in anticipation of the arrival of German troops. They did not know that Hitler was determined to offer no concessions to Russian peasants, but the Germans

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[15] Unless otherwise specified all cases are taken from Barber and Harrison (1991).

permitted some decollectivisation in the north Caucasus and this stimulated local collaborationism. In mid–October 1941 at a critical moment in the battle for Moscow there was panic in the streets of the capital and crowds looted public property. Some of the trains evacuating the plant and equipment of the Soviet defence industries from the southern and western regions to the remote interior in the autumn and winter of 1941 were looted as they moved eastward.

*Theft of nondurable goods*

Food crimes became widespread. People stole food from the state and stole from each other. Military and civilian food administrators stole rations for own consumption and for sideline trade. Civilians forged and traded ration cards. Food crimes reached the extreme of cannibalism in Leningrad in the winter of 1941.[16] In the winter of 1942 Red Army units in the Caucasus began helping themselves to local food supplies.[17]

*Crimes and punishments*

Stalin's Order no. 270 of 16 August 1941 stigmatised the behaviour of soldiers who allowed themselves to fall into captivity as "betrayal of the Motherland" and inflicted both social and financial penalties on the families of Soviet prisoners of war. His Order no. 227 of 28 July 1942 ("Not a step back") combatted defeatism in the retreating Red Army by deploying military police behind the lines to round up stragglers and shoot men retreating without orders and officers who allowed their units to disintegrate. While the war was still going on Stalin singled out several national minorities suspected of collaboration, for example the Chechens, for mass deportation to Siberia. After the war the *Vlasovtsy* were mercilessly pursued, and Vlasov himself was horribly executed. Wartime "deserters" from the industrial front were doggedly pursued and hundreds of thousands were sentenced to terms of confinement in prisons and labour camps while the war continued.[18] Finally, food crimes were harshly punished, not infrequently by shooting.

*The role of Lend–Lease*

The first instalment of wartime Allied aid that reached the Soviet Union in 1942 was small, amounting to some 5 per cent of Soviet GNP in that year (table 1). Although Allied aid was used directly to supply the armed forces with both durable goods and consumables, indirectly it probably released resources to households. By improving the balance of overall resources it brought about a *ceteris paribus* improvement in the payoff to patriotic citizens. In other words, Lend–Lease was stabilising. We cannot measure the distance of the Soviet economy from the point of collapse in 1942, but it can hardly be doubted that collapse was near. Without Lend–Lease it would have been nearer.

## 6. Conclusion

The outcome of the war was decided by production, and production rested on the mobilisation of overall resources into the war effort. But in 1942 the Soviet war effort itself rested on a knife–edge. The war in that year saw a battle of motivations in which a hundred million people made individual choices based on the information and incentives available. Their preferences were shaped by moral, political, and national feeling. But their context was determined by overall resources. Only where the balance of overall resources was indecisive did moral, political, technical, and organisational factors play a significant role.

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[16] In addition to Barber and Harrison (1991) see Moskoff (1990) and, on Leningrad, Dzeniskevich (2001) and Barber (forthcoming).

[17] Zolotarev (1998), 304–5.

[18] Filtzer (2000).

## Tables

*Table 1. Soviet GNP by final use, 1940 and 1942 to 1944 (billion rubles at 1937 factor cost and percent)*

| | 1940 | 1942 | 1943 | 1944 |
|---|---|---|---|---|
| Gross national product | 253.9 | 166.8 | 185.4 | 220.3 |
| Net imports | 0.0 | 7.8 | 19.0 | 22.9 |
| Total final demand | 253.9 | 174.5 | 204.4 | 243.2 |
| Fixed capital formation | 39.9 | 10.1 | 9.4 | 18.4 |
| Inventories | 10.2 | –10.7 | 8.1 | 1.9 |
| Defence | 43.9 | 101.4 | 113.2 | 117.2 |
| Government & security | 10.1 | 5.4 | 6.0 | 7.9 |
| Communal services | 27.0 | 15.6 | 17.2 | 20.7 |
| Household consumption | 122.8 | 52.6 | 50.5 | 77.1 |
| — per worker | 100% | 68% | 63% | 81% |
| — per head | 100% | .. | 58% | .. |

Source: Harrison (1996), 104. Total final demand is the value of domestically produced and imported goods and services available for household and government consumption and investment, and equals GNP plus net imports.

*Table 2. Soviet GNP by sector of origin, 1940 to 1945 (billion rubles at 1937 factor cost)*

| | 1940 | 1941 | 1942 | 1943 | 1944 | 1945 |
|---|---|---|---|---|---|---|
| Agriculture | 69.9 | 44.1 | 27.4 | 30.5 | 45.1 | 47.3 |
| Industry | 75.1 | 73.3 | 64.8 | 75.7 | 84.9 | 71.9 |
| — defence | 10.5 | 16.8 | 38.7 | 47.8 | 52.3 | 36.7 |
| — civilian | 64.5 | 56.5 | 26.1 | 27.8 | 32.6 | 35.2 |
| Construction | 10.6 | 6.9 | 3.2 | 3.4 | 4.4 | 4.5 |
| Transport & communications | 19.3 | 17.8 | 10.2 | 11.8 | 13.7 | 14.9 |
| Trade & catering | 11.1 | 9.3 | 3.8 | 3.5 | 4.1 | 5.0 |
| Civilian services | 46.4 | 42.3 | 28.2 | 30.6 | 37.7 | 35.3 |
| Military services | 7.9 | 11.1 | 17.4 | 18.2 | 18.7 | 18.6 |
| — Army & Navy | 6.8 | 9.9 | 16.2 | 17.0 | 17.5 | 17.3 |
| — NKVD troops | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| Net national product | 240.3 | 204.7 | 155.1 | 173.6 | 208.6 | 197.4 |
| Depreciation | 13.6 | 14.0 | 11.7 | 11.8 | 11.7 | 11.7 |
| Gross national product | 253.9 | 218.7 | 166.8 | 185.4 | 220.3 | 209.1 |

Source: Harrison (1996), 92.

*Table 3. Soviet production, selected items, 1940 to 1944 (units)*

| | 1940 | 1941 | 1942 | 1943 | 1944 |
|---|---|---|---|---|---|
| (A) Defence products | | | | | |
| Combat aircraft | 8 331 | 12 377 | 21 681 | 29 877 | 33 205 |
| Armoured vehicles | 2 794 | 6 590 | 24 719 | 24 006 | 28 983 |
| Guns | 15 343 | 40 547 | 128 092 | 130 295 | 122 385 |
| Shells, million | 43 | 83 | 133 | 175 | 184 |
| Small arms, thou. | 1 916 | 2 956 | 5 358 | 5 081 | 4 045 |
| Cartridges, million | 3 006 | 4 335 | 4 117 | 5 956 | 7 406 |
| (B) Civilian products | | | | | |
| Crude steel, thou. tons | 18 317 | 17 893 | 8 070 | 8 475 | 10 887 |
| Coal, thou. tons | 165 923 | 151 428 | 75 536 | 93 141 | 121 470 |
| Electric power, mn kWh | 48 309 | 46 698 | 29 068 | 32 288 | 39 214 |
| Cement, thou. tons | 5 675 | 5 514 | 1 133 | 980 | 1 490 |
| Cotton textiles, million m. | 3 954 | 3 824 | 1 644 | 1 635 | 1 779 |
| Grains, million tons | 95.5 | 55.9 | 29.7 | 29.4 | 49.1 |

Source: Harrison (1996), 68–9.

*Table 4. The Soviet working population, 1940 to 1945 (millions)*

| | 1940 | 1941 | 1942 | 1943 | 1944 | 1945 |
|---|---|---|---|---|---|---|
| Working population | 86.8 | 72.9 | 54.7 | 57.1 | 67.1 | 75.7 |
| (A) By branch of employment | | | | | | |
| Agriculture | 49.3 | 36.9 | 24.3 | 25.5 | 31.3 | 36.1 |
| Industry | 13.8 | 12.6 | 8.7 | 9.0 | 10.2 | 11.6 |
| — defence | 1.8 | 1.9 | 2.7 | 2.9 | 2.9 | 2.1 |
| — civilian | 12.0 | 10.7 | 5.9 | 6.1 | 7.3 | 9.5 |
| Construction | 2.4 | 2.3 | 1.5 | 1.5 | 1.9 | 2.2 |
| Transport & communications | 4.0 | 3.5 | 2.4 | 2.4 | 3.0 | 3.6 |
| Trade & catering | 3.3 | 2.8 | 1.7 | 1.7 | 2.1 | 2.5 |
| Civilian services | 9.1 | 7.7 | 4.8 | 5.1 | 6.5 | 7.7 |
| Military services | 5.0 | 7.1 | 11.3 | 11.9 | 12.2 | 12.1 |
| (B) By type of establishment | | | | | | |
| Public sector | 31.2 | 27.3 | 18.4 | 19.4 | 23.6 | 27.3 |
| Artisan industry | 2.1 | 1.8 | 0.9 | 1.0 | 1.2 | 1.5 |
| Collective farms | 47.0 | 34.9 | 22.7 | 23.8 | 28.9 | 33.5 |
| NKVD establishments | 1.6 | 1.8 | 1.4 | 1.1 | 1.1 | 1.3 |
| Armed forces | 5.0 | 7.1 | 11.3 | 11.9 | 12.2 | 12.1 |

Source: Harrison (1996), 98, 100.

*Table 5. The balance of direct–plus–indirect labour requirements of Soviet civilian and military outlays, 1940 to 1944 (million)*

| | 1940–2 | 1942–4 |
|---|---|---|
| Initial numbers | | |
| — Working population | 86.8 | 54.7 |
| — Soldiers | 4.6 | 10.8 |
| — War workers | 9.8 | 17.3 |
| — Civilian workers | 72.5 | 26.5 |
| Change over period | | |
| — Working population | –32.1 | +12.4 |
| — Soldiers | +6.2 | +0.9 |
| — War workers | +7.5 | –6.4 |
| — Civilian workers | –46.0 | +17.9 |

Source: calculated from Harrison (1996), 100, 121. Civilian workers equal the working population, less soldiers, less war workers. "Soldiers" do not include NKVD troops. The table assumes that the effect of imports was to release domestic resources to the civilian economy.

*Table 6. Net value added per worker in Soviet material production, 1940 to 1945 (rubles and 1937 factor cost)*

| | 1940 | 1941 | 1942 | 1943 | 1944 | 1945 |
|---|---|---|---|---|---|---|
| Agriculture | 1 417 | 1 194 | 1 129 | 1 193 | 1 441 | 1 311 |
| Industry | 5 458 | 5 820 | 7 484 | 8 428 | 8 361 | 6 215 |
| — defence | 6 019 | 8 939 | 14 108 | 16 616 | 18 135 | 17 788 |
| — civilian | 5 376 | 5 273 | 4 412 | 4 562 | 4 483 | 3 706 |
| Construction | 4 503 | 3 040 | 2 085 | 2 256 | 2 286 | 2 069 |
| Transport & communications | 4 891 | 5 077 | 4 361 | 4 849 | 4 585 | 4 160 |
| Trade & catering | 3 336 | 3 286 | 2 248 | 2 065 | 1 976 | 2 026 |

Source: Harrison (1996), 103.

*Table 7. Soviet and German GDPs, 1940 to 1945, in international dollars and 1990 prices (billions)*

| | 1940 | 1941 | 1942 | 1943 | 1944 | 1945 |
|---|---|---|---|---|---|---|
| USSR | 417 | 359 | 274 | 305 | 362 | 343 |
| Germany | 387 | 412 | 417 | 426 | 437 | 310 |
| USSR/Germany | 1.1 | 0.9 | 0.7 | 0.7 | 0.8 | 1.1 |

Source: Harrison (1998), 10. This table corrects a spreadsheet error in the source.

*Table 8. Soviet and German armed forces, 1940 to 1945 (millions)*

| | 1940 | 1941 | 1942 | 1943 | 1944 | 1945 |
|---|---|---|---|---|---|---|
| USSR | 5.0 | 7.1 | 11.3 | 11.9 | 12.2 | 12.1 |
| Germany | 5.8 | 7.3 | 8.4 | 9.5 | 9.4 | 7.8 |
| USSR/Germany | 0.9 | 1.0 | 1.3 | 1.3 | 1.3 | 1.5 |

Source: Harrison (1998), 14.

*Table 9. Soviet and German war production, 1942 to 1944 (units)*

| | USSR | Germany | USSR/Germany |
|---|---|---|---|
| Machine pistols (thou.) | 5 501 | 695 | 7.9 |
| Mortars (thou.) | 306.5 | 66 | 4.6 |
| Tanks (thou.) | 77.5 | 35.2 | 2.2 |
| Guns (thou.) | 380 | 262 | 1.5 |
| Rifles, carbines (thou.) | 9 935 | 6 501 | 1.5 |
| Machine guns (thou.) | 1 254 | 889 | 1.4 |
| Combat aircraft (thou.) | 84.8 | 65 | 1.3 |
| Major naval vessels | 55 | 703 | 0.1 |

Source: Harrison (1998), 17.

*Table 10. Production runs of Soviet aircraft, 1941 to 1945*

10.1 Totals and averages

| | |
|---|---|
| Models | 23 |
| Factories | 34 |
| Runs | 70 |
| Aircraft | 142 756 |
| — per model | 6 207 |
| — per factory | 4 199 |
| — per run | 2 039 |

10.2 By factory

| Factory no. | Units | Per cent |
|---|---|---|
| 21 | 17 511 | 12 |
| 18 | 16 933 | 12 |
| 153 | 16 878 | 12 |
| 1 | 16 236 | 11 |
| 292 | 12 134 | 8 |
| 387 | 11 403 | 8 |
| 22 | 10 202 | 7 |
| 30 | 8 865 | 6 |
| Subtotal | 110 162 | 77 |
| Other factories | 32 594 | 23 |
| Total | 142 756 | 100 |

*Table 10 (continued).*

10.3 By model

| Model | Factory | Period | Units | Per cent |
|---|---|---|---|---|
| Il–2 | 18 | 1941–5 | 15 099 | 11 |
| Il–2 | 1 | 1941–5 | 11 929 | 8 |
| Il–2 | 30 | 1941–5 | 8 865 | 6 |
| U–2 | 387 | 1942–5 | 11 403 | 8 |
| Iak–9 | 153 | 1941–5 | 11 237 | 8 |
| Pe–2 | 22 | 1942–4 | 10 058 | 7 |
| La–5, La–5fn | 21 | 1942–5 | 9 229 | 6 |
| Iak–1 | 292 | 1941–4 | 8 534 | 6 |
| Subtotal | .. | .. | 86 354 | 60 |
| Other aircraft | .. | .. | 56 402 | 40 |
| Total | .. | .. | 142 756 | 100 |

Source: Harrison (2000), 114.

*Table 11. Production runs of Soviet tanks and self–propelled artillery, 1941 to 1945*

11.1 Totals and averages

| | Tanks | SPA |
|---|---|---|
| Models | 6 | 6 |
| Factories | 11 | 5 |
| Sites | 14 | 5 |
| Runs | 20 | 8 |
| Units of output | 78 859 | 23 587 |
| — per model | 13 143 | 3 931 |
| — per factory | 7 169 | 4 717 |
| — per site | 5 633 | 4 717 |
| — per run | 3 943 | 2 948 |

11.2 By site

| Factory | Site | Tanks | | SPA | |
|---|---|---|---|---|---|
| | | Units | Per cent | Units | Per cent |
| 183 | N. Tagil | 27 960 | 35 | .. | .. |
| 112 | Kr. Sormovo | 11 999 | 15 | .. | .. |
| Kirov | Cheliabinsk | 11 970 | 15 | 5 306 | 22 |
| GAZ | Gor'kii | 10 010 | 13 | 7 963 | 34 |
| UZTM | Sverdlovsk | .. | .. | 5 630 | 24 |
| 174 | Omsk | 5 467 | 7 | .. | .. |
| STZ | Stalingrad | 3 776 | 5 | .. | .. |
| 40 | Mytishchi | .. | .. | 2 462 | 10 |
| 38 | Kirov | .. | .. | 2 226 | 9 |
| Subtotal | | 71 182 | 90 | .. | .. |
| Other sites | | 7 677 | 10 | .. | .. |
| Total | | 78 859 | 100 | 23 587 | 100 |

*Table 11 (continued).*

11.3 By model: tanks

| Model | Factory | Site | Period | Units | Per cent |
|---|---|---|---|---|---|
| T–34, T–34–85 | 183 | N. Tagil | 1941–5 | 27 960 | 19 |
| | 112 | Kr. Sormovo | 1941–5 | 11 999 | 15 |
| | 174 | Omsk | 1942–5 | 8 644 | 11 |
| | Kirov | Cheliabinsk | 1942–4 | 5 094 | 6 |
| | STZ | Stalingrad | 1941–2 | 3 776 | 5 |
| | 183 | Khar'kov | 1941 | 1 560 | 2 |
| | UZTM | Sverdlovsk | 1942–3 | 719 | 1 |
| T–70 | GAZ | Gor'kii | 1942–3 | 6 927 | 9 |
| KV | Kirov | Cheliabinsk | 1941–3 | 3 684 | 5 |
| | Kirov | Leningrad | 1941 | 844 | 1 |
| IS–2 | Kirov | Cheliabinsk | 1943–5 | 3 192 | 4 |
| | Kirov | Leningrad | 1945 | 60 | 0 |
| Subtotal | | | | 71 282 | 90 |
| Other models | | | | 7 577 | 10 |
| Total | | | | 78 859 | 100 |

11.4 By model: self–propelled artillery

| Model | Factory | Site | Period | Units | Per cent |
|---|---|---|---|---|---|
| SU–76 | GAZ | Gor'kii | 1943–5 | 7 963 | 34 |
| | 40 | Mytishchi | 1943–5 | 2 462 | 10 |
| | 38 | Kirov | 1942–4 | 2 226 | 9 |
| ISU–122/152 | Kirov | Cheliabinsk | 1943–5 | 4 635 | 20 |
| SU–85 | UZTM | Sverdlovsk | 1943–5 | 2 659 | 11 |
| SU–100 | UZTM | Sverdlovsk | 1944–5 | 2 335 | 10 |
| SU–152 | Kirov | Cheliabinsk | 1943–4 | 671 | 3 |
| SU–122 | UZTM | Sverdlovsk | 1942–3 | 636 | 3 |
| Total | | | | 23 587 | 100 |

Source: calculated from Polikarpov (1998), 38–40.

# Appendix

In this appendix I provide a computable model of the payoffs to rats and mice, underpinning figures 2 and 3 in the text.

## Symbols

| | |
|---|---|
| $a$ | production technology |
| $a$ | labour–elasticity of output |
| $b$ | labour–elasticity of theft |
| $K$ | capital assets |
| $L$ | working population |
| $M$ | mouse population |
| $m$ | payoff per mouse |
| $n$ | rats' share in the working population |
| $p_C$ | probability that the payoff will be confiscated by the government |
| $p_D$ | probability that the country will be defeated by the enemy |
| $p_E$ | probability that the enemy will honour claims to stolen goods |
| $Q$ | output |
| $R$ | rat population |
| $r$ | payoff per rat from theft of output |
| $r'$ | payoff per rat from theft of assets |
| $T$ | theft of output |
| $t$ | theft technology |
| $T'$ | theft of assets |
| $X$ | output of the enemy |

## The payoff to mice

The payoff per mouse is the output not stolen, adjusted by the probability that it will avert defeat, divided among the population of mice:

1. $$m = (1 - p_D) \cdot \left( \frac{Q - T}{M} \right)$$

The probability of defeat is defined exclusively by economics: the square of the enemy's share in the total of resources available being invested in the conflict. Think of three possible outcomes: outright victory, outright defeat, and stalemate. *Ex ante*, a country faced by an adversary of identical resources will have one chance in four of victory, one in four of defeat, and one in two of an inconclusive outcome:

2. $$p_D = \left( \frac{X}{X - Q - T} \right)^2$$

Output is produced by means of a conventional technology with constant returns to scale and diminishing returns to each factor, the labour contributed by mice, and the capital assets not stolen by rats and available for production:

3. $$Q = a \cdot M^a \cdot (K - T')^{1-a}$$

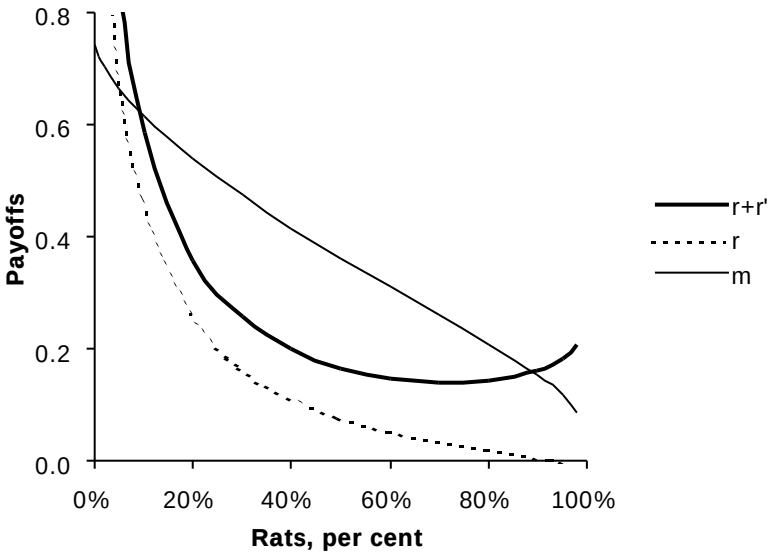
Rats use a theft technology with constant returns from what is to be stolen, and diminishing returns to their labour:

4. $$T = t \cdot Q \cdot R^b \text{ and } T' = t \cdot K \cdot R^b$$

The number of rats and mice is constrained by the working population:

5. $$R = n \cdot L \text{ and } M = (1 - n) \cdot L$$

*Figure A–1. The payoffs to rats and mice*




## The payoff to rats

The payoff per rat comprises two elements, the output they steal in order to survive until victory weighted by the probability of not–defeat, and the assets they steal against the likelihood of defeat weighted by the probabilities of defeat and that the enemy will honour rights of possession, in each case adjusted for the probability of avoiding confiscation by the government, and divided among the rats:

6. $$r = \frac{(1-p_C)\cdot(1-p_D)\cdot T}{R} \text{ and } r' = \frac{(1-p_C)\cdot p_D \cdot p_E \cdot T'}{R}$$

The probability of confiscation of stolen goods follows the geometric mean of the shares of rats and mice in the population, low when the share of rats is low and there is little threat for mice to guard against, rising with the level of self–serving activity, then falling again as the share of mice falls and mice are overwhelmed by rats:

7. $$p_C = \sqrt{n\cdot(1-n)}$$

Index $K$, $L$, and $a$ to one. Set $X$ equal to one (giving the adversary an economy of identical capacity to the home country and a one–in–four *ex ante* probability of outright victory), $p_E$ and $t$ equal to one half, and $a$ and $b$ equal to two thirds. Subject to these the payoffs can be computed and are charted in figure A–1.

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