THE COMPARATIVE ANALYSIS OF ECONOMIC POTENTIAL FOR WAR

2 March 1955

1839

CONTENTS

Page

INTRODUCTION--Colonel C. P. Conner, USAF, Chief of the Economic Potential Branch, ICAF..... 1

SPEAKER--Mr. Thomas Juster, Instructor of Economics, Amherst College..... 1

GENERAL DISCUSSION..... 16

NOTICE: This is a copy of material presented to the resident students at the Industrial College of the Armed Forces. It is furnished for official use only in connection with studies now being performed by the user. It is not for general publication. It may not be released to other persons, quoted or extracted for publication or otherwise copied or distributed without specific permission from the author and the Commandant, ICAF, in each case.

Publication No. L55-107

INDUSTRIAL COLLEGE OF THE ARMED FORCES

Washington, D. C.

Mr. F. Thomas Juster, Instructor of Economics, Amherst College, was born on 17 August 1926 in Hollis, New York. He received his B.S. degree in 1949 from Rutgers University and is currently writing a Ph.D. thesis at Columbia University. His Government service includes: Central Intelligence Agency, 1951 to 1953; consultant with the Weapons Systems Evaluation Group, 1953; consultant with the Central Intelligence Agency, 1953 to present. Mr. Juster appeared at the Industrial College as a seminarist in 1954.

THE COMPARATIVE ANALYSIS OF ECONOMIC POTENTIAL FOR WAR

2 March 1955

COLONEL CONNER: General Niblo, members of the class: Tomorrow you leave your committees and join your sections to start your research on the economies of specific geographic areas of the world.

To assist you in channeling your research along the most productive lines, our lecture this morning will examine some factors that serve as indicators of a nation's economic potential for war, and will also go into some of the problems involved in trying to estimate the economic potential for war of a nation or bloc of nations.

Our speaker, as you know, has had considerable experience with the Central Intelligence Agency, and is presently a consultant to that agency on matters such as we are studying in this unit. As a seminarist last year in the Economic Potential Unit, he was most helpful to us. The students who attended his seminars were highly complimentary, and recommended that in the future he return to the college as a lecturer, to share his knowledge and ideas with the class as a whole, rather than to limit it to just a few in a seminar.

We of the faculty agree that he has information to which all of us should have access.

So, Mr. Juster, it looks like you have literally talked yourself into a job. The college is pleased to have you back again, and it is my pleasure to welcome you to this year's class.

Mr. Thomas Juster.

MR. JUSTER: Thank you very much, Colonel Conner. General Niblo and members of the class: The Colonel suggested I talked myself into a job. I think that perhaps in view of that circumstance the first thing for me to do is to walk out, quit while I am winning. If I talked myself in, I am quite likely to talk myself out in the next 45 minutes.

The topic that we are looking at this morning is labeled "The Comparative Analysis of Economic Potential for War." I suppose the logical place for me to start would be to define what we mean by "economic potential." I propose to define it by saying simply that economic potential for war is a measure of the ability of an economic system to furnish (produce) munitions, including such things as military manpower, during the period of a prospective war. In effect, the notion that we have in mind here is that economic potential measures the ability of an economy to produce the things that are needed to fight wars with.

I think it would be useful in this discussion to make a distinction between what I would call economic potential and what I might label military potential. The two are in a way quite closely related. One is included in the other. We look on military potential as being the total amount of munitions and manpower that a nation has available to it during the period of a prospective war. The distinction between having available and being produced is the distinction between economic potential and military potential. And if you want to break down military potential to get a better idea of the nature of this distinction, one could say that military potential contains three components: (1) stockpiles in existence at the start of the war, (2) total production of munitions during the war, and (3) accretions of munitions and trained manpower obtained by conquest during the course of the war. We think of it as a measure of the total amount of "stuff," munitions and manpower, that a nation has. The only part of military potential of concern today, economic potential, is the second of the military potential categories discussed above.

It is worth while to note just in passing that, taking a particular period of time and considering circumstances in which the kind of war you are talking about is a very long war, military potential and economic potential become pretty close to being indistinguishable. The reason for this is that the longer the war goes on, the more of a nation's total military potential consists of that part which was produced during the war and the less consists of that part which was stockpiled before the war started. Thus under circumstances where the war lasts for quite a considerable period of time, it is by and large true that military potential and economic potential come to pretty much the same thing. Economic potential is the major part of military potential.

Now, in terms of getting somewhat more concrete about what we mean by economic potential, we have to talk a little bit in terms of the kind of units that would be used to measure economic potential. Do you want to think of it in terms of quantities of dollars? Over what time periods? Things of this sort. Ideally, what we want for purposes of measuring a country's economic potential is to get some notion of the total quantity of the particular kinds of munitions that a country could produce or is capable of producing during the period of a prospective war.

You will note that the term "could" is used here rather than "will" or rather than "is." "Could" implies futurity, which suggests that the kind of measure we want is one which is in a sense hypothetical, in that you measure the ability of a country to do something in a future period. Economic potential by its very nature implies futurity.

We can try to get some measure of economic potential by adding up all of these total quantities, if we can find out what they are, that a nation could produce during a wartime period. Presumably it would be helpful if we could aggregate these things, so we could talk about them as being a single number or a single value or a single concept, rather than as a very heterogeneous mass of different kinds of munitions--X, Y, and Z--which might get produced during the period of a prospective war.

In order to go about this it becomes necessary to find some unit which can be used to aggregate these heterogeneous units. One way of doing this is to say that we are going to measure economic potential in terms of the cost of the resources needed to produce that particular quantity of stuff which is capable of being produced rather than in terms of quantities of stuff which actually get produced. We don't necessarily have to specify which sorts of munitions will be in fact produced. We can talk simply about the aggregate of resources which a country could utilize for this kind of purpose. You will also realize that when we talk about aggregating or adding up the cost of the resources that actually could be used, we wind up with a measure which consists of the total monetary value, at some price level, of the total amount of resources that could be utilized for the purpose of making munitions during the period of a prospective war. I think the nature of this measure will become more clear as we move ahead.

The other problem here which is also concerned with units of measure is the problem of what kind of time period we should have in mind. Ideally, I think the thing that you want to know is the total amount of resources, or the total quantity of stuff, which a country could produce over the period when the prospective war is actually going on. This means that you aggregate over some time period, which is finite--that you add the total amounts of munitions produced over that 2-year period.

This is one notion of the way that time enters into the measurement of economic potential. However, we frequently think of this not in terms of the sum total of the munitions that could be produced over the period of the war, but rather in terms of the maximum amount of munitions per year that a country is hypothetically capable of producing at full mobilization.

This kind of measure of economic potential does have some uses, and is somewhat easier to measure than the other. But I think that ideally the thing we want is the sum total of all munitions that get produced over the period during which the prospective war goes on, not the annual rate of munitions production at full mobilization. In some cases these two will turn out to show more or less the same thing under certain kinds of circumstances. But they obviously don't have to do it.

I should note here also that we have been talking about economic potential so far in terms of absolute amounts, in terms of quantities of X, Y, Z weapons, or in terms of total resources. But very frequently we find that the measure of economic potential that has most significance is not absolute but relative. What you are interested in measuring is likely to be a relationship between economic potentials in one country at different periods of time, or the economic potential between two different countries at the same period of time. In effect you might choose to use an index rather than an absolute amount, and get some notion of the relative magnitude of the economic potential.

So much for the units. In terms of getting a little more concrete about the kind of things that you have to look at when you consider economic potential, or the kinds of factors that are important in determining how big economic potential is, what you are really asking is the sort of question that says: "Let us look at an economic system during particular periods of time. Let us try to determine which

factors we can locate and which serve to limit munitions production during some particular period of time." You want to know something about the factors that determine economic potential. Presumably what you mean by "determining" economic potential is that there are some factors which set a maximum limit to the quantity of munitions production, or to the amounts of economic resources that can be used for munitions production, at some particular period of time.

Now, to get a notion of what factors should be looked at, and what factors cause the quantity of munitions production in a particular period to be limited, we have to take a quick look at the sort of process that is involved when a country sets out to develop its economic potential, or in effect when a country sets out to mobilize.

Basically, a mobilization period starts off with a pattern of output set by the structure of cold war demand. There is a certain quantity of military goods, munitions, that are being produced, and it is set by the level of the military budget. There is a certain quantity of consumer goods being produced, set by the structure of consumer demand--similarly with capital goods, or investment goods. When you start mobilizing, essentially what happens is that a country uses exactly the same resources that it has in peacetime, but produces a different pattern of output. The actual resources you have available don't change when you mobilize. All that happens is that you use the same resources and produce more munitions and less of everything else.

At the same time you may find, and as a matter of fact you always will find, that during a period of mobilization some increase is possible in the total amount of resources that a country can make use of. This occurs because you substitute work for leisure during mobilization, and some resources which were not utilized during peacetime do get utilized during mobilization. So the total amount of resources will increase. The total amount of stuff that can be produced with these resources will also increase.

In line with shifting resources from peacetime industry, if you like, into military industry, what also takes place during the period of the mobilization is what I think can best be described as the successive breaking of bottlenecks. The problem in all mobilizations is to try to shift the pattern of output. When this is attempted on a large scale, some kinds of resources show up as bottlenecks, preventing

(temporarily) the achievement of a full mobilization pattern of output. You don't have enough steel. You don't have enough coal. You don't have enough capacity in certain kinds of industry. You can't get enough aluminum. So during the period of mobilization you concentrate on investing more resources in certain areas in order to break bottlenecks which prevent the maximum mobilization potential from being realized.

The process of mobilizing is essentially one of breaking successively a number of bottlenecks. One way of looking at the process is to observe that a mobilizing economy must have a disproportionate structure of output. Output of some commodities (copper, aluminum, uniform cloth) is too low relative to full mobilization requirements; output of others (refrigerators, automobiles, advertising services) is too high. As soon as the worst bottleneck sector is expanded sufficiently, the next worse comes up for expansion. The structure of output will continue to retard the maximum achievable level of munitions output until all these disproportions are eliminated.

The final result of this process presumably consists of a total output which is much greater than what you had before. It consists of a quite different distribution of the output. When you attempt to produce the greatest amount of munitions that can possibly be produced, the things that ultimately serve to limit the amount of munitions that can be obtained are presumably the other demands on resources that must be met. That is, what is required to maintain the civilian population and to maintain productive equipment.

This, then, is what the mobilization process consists of. Presumably we can look at this process and isolate those factors which serve to limit the total amount of munitions that a country can produce during any point in the whole period. If we can isolate those factors that serve to limit munitions production, then we in effect have succeeded in getting indicators of munitions production.

At the start the only limitation is cold war demand, which is rather uninteresting. But during a period of mobilization what limits munitions production is essentially bottlenecks of one sort or another which are overcome as the process of mobilization develops. These may be raw materials, such as steel or other kinds of metals. It may be plant capacity in certain kinds of durable goods industries, or skilled labor, or commodities that formerly were imported, which prevent you from utilizing the full potential. The likelihood is that all these will take turns at being bottlenecks, so that there is no one thing which you can say limits the amount of production during this period.

At the close of this thing, when you finally get yourself fully mobilized, you can measure somewhat more successfully the factors that serve to limit production. Here we find that what limits munitions production during full mobilization is, (1) total output, and (2) competing demands on this output which have to be met. These competing demands are consumer demands, since it is necessary to provide some minimum amount of goods to maintain labor productivity, and investment demands, since it is necessary to maintain the efficiency of the existing productive equipment. So you can specify quite clearly what the factors are which limit munitions production in the full mobilization period. During the transition period, before you get to full mobilization, it will be a messy problem.

Perhaps at this point it might be useful to take a look very briefly, if you like, at a procedure for constructing something that we might call an aggregate measure of economic potential for a particular country at some particular time. The unit we will use for this measurement will be total dollars' worth, or any particular monetary unit's worth, of resources that could be utilized for military purposes during the period of a prospective war.

We start from the end of the mobilization period, since the aggregate munitions production that can be achieved at full mobilization is the easiest part to measure. In principle all you need do is the following: We obtain some measurement of the degree to which the total output during peacetime can be increased during the process of mobilization. This is by and large something which can be done on historical grounds. We can look at what happened in various countries during World War II, when the combatant nations had plenty of time to get themselves mobilized. For example, during World War II the United States increased its total output by something like 37 percent between 1941 and 1944, Japan increased its total output by some 24 percent between 1940 and 1944, and Germany increased its output something like 20 percent between 1940 and 1944. The historical fact that these countries did this can be used as a basis for estimating how much could be achieved under present circumstances.

Once this measure has been achieved, we can calculate what kind of minimum consumer requirements have to be satisfied in terms of the share of total output that will have to be used to maintain the civilian population. This estimate is not as neat as it would seem, since what is needed to maintain the civilian population depends in part on what the population is used to, and in part on how long a period the war might last. But again in principle it is something that can be done.

The next thing we need do is try to make some decisions on how much of this total output you have to use to maintain the existing structure of industrial equipment at its normal efficiency. It is necessary to maintain your capacity by replacing worn-out capital equipment. Again, the degree to which this must be done depends on such factors as the expected duration of war.

By subtracting consumer and investment requirements from total output, we are left with a measure of the total amount of output that would be available for military purposes--a combination of munitions output consisting of weapons, manpower in the Armed Forces, and things of that sort. This will be an aggregate measurement in dollars.

The other parts of this measurement are somewhat more difficult to make. We have--in principle--measured the level of munitions production which can be reached at full mobilization. What we want to measure is the total production over the period of the prospective war. We have to get a measure of the total munitions production from the start of the war over as long a period as it is expected to continue. To do this, it becomes necessary to estimate munitions output at each point along the mobilization path. In general we can say that the starting and finishing points are moderately well known or at least can be handled with relatively simple techniques. The problem of where we finish--the full mobilization level of munitions output--has already been discussed. The problem of where we start--the cold war level of munitions output--is a question of forecasting cold war policy and has very little to do with economics. For the "in between" period, things get awfully messy. About all the economists and most other people who have been playing around with this can say is that this process takes a lot of time. It apparently takes between two and four years; at least, that is what it has taken historically. It probably is true that you have some sort of forecastable growth pattern from the cold war level of output to the full mobilization output. Output rises slowly at the start and accelerates more rapidly as full mobilization is approached. That is really about all one can say about this problem in general terms.

We can say a little more, I think, about how long a time period is going to be involved. For example, it is perfectly clear that how long this proposition takes will depend upon the difference between the level of cold war munitions output and the level of full mobilization munitions output. If a country is already close to full mobilization when the war starts, obviously it is not going to take very much time to get fully mobilized. If there is a very great magnitude of difference between the

peacetime production and the maximum war production, obviously it is going to take somewhat longer.

We can observe the fact that certain kinds of industries, say the munitions industries, will be able to make a rapid changeover, because they have made preparation during peacetime to be able to mobilize more rapidly. We can point to the fact that economies which are rather flexible, in terms of having, for example, a structure of productive equipment that makes use of unspecialized kinds of machine tools rather than highly specialized ones will be able to convert more rapidly than an economy which has a lot of very highly specialized kinds of productive equipment. This results from the fact that specialized equipment may be of almost no use except for making the products they habitually are used to making. However, once we have looked at some of the factors that make the time period between start and finish either very long or very short, there is not an awful lot more that can be done.

Once these kinds of factors have been examined, then what we have to do is simply take these estimates of munitions output at the start, munitions output at the full mobilization period, the length of time required for achieving mobilization, and sum up the total quantity of munitions that can be produced over the period of prospective war.

There are a few additional problems that ought to be discussed. One is the problem of whether you simply take the sum of these quantities to get a measure of a country's economic potential. What I have in mind is something like this: Suppose you are interested in the magnitude of the United States economic potential to fight a war, say, starting in two years, which is expected to last for one year. We will try to estimate the total amount of munitions that could be produced during the period of the war, which is a one-year period by hypothesis.

Presumably the United States would be able to produce munitions after the war is expected to be finished. In other words the mere fact that the war is expected to last one year doesn't mean that the United States can't produce munitions after the war is over. But the fact is that in terms of meaningfulness of measuring potential, all we are really interested in is what a country can produce during the period when the war is going on. After the war is over, it doesn't matter what quantity you produce, because it has no value. This problem can be handled by saying that all munitions outputs which can be produced but which will only be available after the war is finished are discounted at the rate of 100 percent.

It follows, therefore, that it does make a difference as to the magnitude of a country's economic potential whether or not the particular munitions in question--this aggregate sum of munitions produced over the entire period--are produced at the beginning of the war or are produced very much toward the end of the war. It is equally clear that, if you are going to say that munitions produced the day after the war ends are of no value to a country's economic potential, those produced the day before the war closes are of almost no value; and those produced two days before the war closes are also of almost no value. In effect, we must take account of the fact that this is not a simple summation. A discount rate must be applied because munitions produced very close to the time when the war is nearing its finish are of relatively little value as compared to the same munitions produced at the beginning of the war.

What must be kept in mind is that when munitions are produced it makes quite a difference in the magnitude of a country's economic potential. The closer to the beginning of the war they are produced, the greater is the economic potential; the closer to the end of the war they are produced, the lower is the economic potential.

Now, thus far the discussion has consisted of looking at a particular country at a particular period of time, and saying that a country's economic potential is simply the sum of the total amounts, the quantities, of resources that the country would be able to devote to military purposes during the period of the war. We have some notion as to what determines the maximum mobilization economic potential, or the approximate annual rate that is possible. We have some notion, but not a very satisfactory one, about what limits munitions production in other periods prior to full mobilization.

The question that all of this bears on, and the only reason why we bother inquiring about economic potential is so that we can get some idea of our ability to conduct wars against potential enemy countries. What we really want to know is a measure that will show the magnitude of one country's economic potential relative to that of some other country.

By using the kind of measure described above, we can make a comparison between, we will say, countries A and B. Again we simply say: "Let us take the aggregate of all the resources which country A can use for military purposes during the period of time and compare it directly with a similar aggregate of munitions, expressed in quantity of resources, which country B can produce during the same period."

If you measure potential munitions production in terms of the aggregate of resources used, what we get is a measure which says that the United States has X billion dollars' worth of economic potential, meaning that it can use this amount of resources for munitions production during the period of the war; that some other country, say, Great Britain, has Y pounds' worth of economic potential, meaning it could utilize Y pounds' worth of resources for military purposes during the period of the war. In order to compare A and B, obviously we have to know something about how much the dollar is worth relative to the pound. In effect, we have to know something about exchange rates.

But the exchange rate which is relevant to this kind of purpose, for this kind of comparison, has some peculiarities attached to it. It is not the usual kind of exchange rate that most people think of. What you want here is something that measures the military usefulness of country A's chunk of resources, or chunk of output that can be produced with the resources, as compared to country B's chunk of output or chunk of resources.

What we want is a ratio of a nature such that we can say that the military value or the military usefulness of X dollars' worth of A's resources is the equivalent in military usefulness to Y pounds' worth of country B's resources. In effect, what we want is a ratio that will convert the aggregate resource availability of country A expressed in its own currency, into country B's currency, and have the resulting resource totals measure military effectiveness in an accurate fashion.

Now, unfortunately, when we ususally talk about exchange rates, we have in mind the general purchasing power of one currency in terms of some other currency measured by looking at identical products that are produced in both countries and observing how much one costs in one country and how much it costs in the other country. We get a whole range of identical products, including things that are traded back and forth internationally, and get a notion of the buying power of the dollar in terms of the pound, meaning the buying power in particular kinds of goods or services similar to both countries. The usual exchange rates apply to essentially civilian types of output, consumer types of output and compare the consumer purchasing power of the currencies in the two countries.

However, once we start talking about exchange rates in the context of comparing economic potential aggregates, by taking the resources that are intended to represent the total amount of resources that can be used to produce munitions, then we run up against the problem that by

and large the kinds of munitions produced are by no means identical in either physical characteristics or effectiveness. They are certainly not traded back and forth; and they are produced under conditions of as much secrecy as possible. No country gives out freely information regarding the kinds of things it does, the technology it employs, the characteristics of the particular weapons that it has. It attempts to keep these things as secret as possible, while gathering as much information about the other country's weapons as it can.

What this means, unfortunately, is that, once we start talking about exchange rates for resource totals that will be utilized for munitions production, we have no reason for taking an exchange rate based upon the general price level for similar commodities in the two countries. We have no assurance that the same kind of relationships that prevail between the relative prices of civilian goods will also prevail between the weapons that get produced by the two countries.

There is no very satisfactory way of making the kind of adjustment that seems to be required. There are some ways that we can approach the problem and some of these will be touched on in a moment. But the essential difficulty is simply that the exchange rate normally used requires that the kinds of things we are comparing be similar goods that can, in principle, be traded back and forth. Munitions cannot, by their nature, be in this category, and we have no assurance that the aggregate resources are capable of producing a particular amount of military effectiveness or fighting effectiveness merely because the purchasing power exchange rate happens to be at some particular level.

If we look at an alternative way that this comparison can be made, the nature of the problem will become a little more clear. What we want is to get a comparison which indicates how effective a given aggregate of resources is as compared to how effective another country's aggregate of resources is. If we can find out enough information about the cost of all the weapons that would be produced in the United States during mobilization; if we can find out about the cost of the weapons that would be produced in the Soviet Union or any other country during their mobilization period; if we know that the United States will have X billion dollars' worth of resources; and if we know that the Russians will have Y billion rubles' worth of resources to use, then we could in principle translate these aggregate resource totals into hypothetical sets or quantities of munitions in actual numbers that each of these countries could produce.

It would not be necessary to translate that into the same kinds of munitions, because we would not produce the same things that the Russians would, for obvious reasons. However, what you can do is make a comparison of the quantities of XYZ in the United States as against X' Y' Z' in the USSR. We could then turn these figures over to military analysts and let them tell us which set of munitions is more valuable or has more military effectivensss--the set of XYZ that can be produced by this country or the X' Y' Z' that can be produced by that country.

Note that this really doesn't get around the problem of devising an exchange rate. All it does is give you a different problem to solve. If the military analysts and the field commanders say that XYZ has more fighting effectiveness than the other combination, then what we really have done in the process is to devise an implicit military value exchange rate between these aggregate resource totals that have been broken out into specific kinds of weapons.

The other problem contained in this measure that I think we have to take a quick look at is the relationship between economic potential as an aggregate of resources and economic potential as a measure of actual fighting effectiveness or combat capability.

The measure of economic potential that I have developed is one which simply consists of the measure of the aggregate chunk of resources that could be used for military purposes. You will note that it doesn't tell you specifically in what manner you ought to use these resources or for what kind of military purpose you ought to use them. All this tells us is that there is a certain amount of resources that are available.

On the basis of this kind of measure, all we can say is that one country would be able to use more resources, would be able to produce more stuff in general terms, than some other country during the period while this prospective war goes on.

However, this statement doesn't necessarily say that the country having the higher potential is bound to win any military conflict between the two. The reason is that all we have been estimating is the total stuff which can be used. Suppose that the circumstances in which the war is fought happen to include certain circumstances where one country is forced to fight on some other country's soil, is forced to use a sizable chunk of its potential simply to transport people, or simply to supply and maintain them, rather than being able to put all its potential into actual combat effectiveness, actual weapons, and things of this kind.

Thus what we find, of course, is that, even after getting to the point where we can compare the aggregate resource total or aggregate resource availability, something has to be said about the kind of circumstances under which the war is fought before we can translate this into actual combat effectiveness. If one country, in terms of the circumstances in which a particular war is fought, is forced to utilize a much larger share of its resources for these kinds of purposes, then presumably a given amount of economic potential doesn't get translated into as large an amount of fighting effectiveness as in the other country, due to the nature and characteristics of the war.

At this point I think we have about examined enough of the specific kinds of problems that are involved here. I should like to now attempt to make some kind of summary which will consist primarily of a reexamination of the kinds of assumptions that must be made in order to get a meaningful measure, or to get any measure at all, of economic potential. Then I shall attempt to make some brief comments as to the relevance or usefulness of this kind of measure in currentday circumstances.

To begin with we are trying to estimate the total quantity of stuff that countries could use for military purposes. This implies that one must make some assumption as to when the military conflict starts, because, clearly, if the war starts in 15 years from now, a country will be able to produce a considerably larger amount of military items than if the war starts now. The economy in general will be somewhat bigger, somewhat stronger, and will have a larger developable potential. So we have to make some kind of assumption as to when the war is expected to start.

We have to make some assumption regarding the kinds of circumstances that will surround the outbreak of the conflict. The reason for it is that the measure of potential figure is only a measure of the total economic resources that a country can use during the period that the war goes on. So, obviously, it makes quite a bit of difference whether a country has already started to mobilize at the outbreak of war or has started from a peacetime or cold war base. If it has started to mobilize, then during any one period it will be able to produce a greater quantity of munitions than during a similar period if it hadn't mobilized, since it will be at a higher level to start with. We have to make some assumption of how long the war is going to last. It is perfectly clear that if the war lasts only two months, no country has any sizable economic potential, since there will be almost no munitions produced

during the short time that the war lasts. Clearly, if the war lasts a very long period of time, then economic potential is extremely important. But, regardless of whether it lasts for a long period or a short period, we must have some notion of how long it is going to last if we are going to attempt to measure the resources that a country will be able to use during the relevant period. We also, I think, ought to make some assumption or have some notion as to the location and the characteristics of the kind of conflict being waged. The reason for this is that it makes quite a bit of difference how much military effectiveness is contained in a given amount of resources whether or not the war is waged in our own back yard or somebody else's back yard. This point is the problem I just discussed before--that if you have to use resources for transporting things around, this detracts from the total military effectiveness of a given amount of resources which you might have available to you.

So much for the assumptions that we have to make. I think probably I ought to use here just about two minutes worth of words to indicate what difference it makes in these current circumstances whether or not we have any notion of what a country's economic potential consists of. This much can be said: By and large, economic potential is significant in analysis if circumstances in which the conflict that we can visualize happening are such that it could last for a sufficiently long period of time to enable the economy to make its contribution to the total amount of munitions that the country will have available to it to fight the war.

In view of the fact that at the present time there is a widespread notion that, thermonuclear war means that the war will be over in two days or two weeks--it doesn't matter much which--you might have a strong inclination to say: "Well, the only important thing in this kind of problem is how big our stockpile is, because we will fight the war with the stockpile; and it doesn't matter how strong the economy is, because the economy never gets a chance to do anything besides be there for the period while the war is going on." It may very well be true that we are faced with that war, where the economic potential is relatively uninteresting. But the fact is that we just don't know.

The fact also is that there has been a historical tendency to underestimate very badly the degree to which an economy is capable of recovery from devastating strains. It was thought by a good many people during the last war that the Americans, having dropped a few million tons of bombs on Germany, had really knocked out most of the German economy. Following the war, when we examined what actually happened

to the German economy during the period while the heaviest bombing was going on, we found out that the output of munitions rose steadily during the entire period. Very strange but true.

Now, I don't mean to suggest that economic potential is certain to be a significant factor regardless of the kind of war. All I am suggesting is that we really have no notion as to the degree to which an economy is capable of withstanding the kind of strains which would be imposed by a wide-scale either atomic or thermonuclear kind of warfare. There is, I think, some likelihood that in part what would happen would be a considerable attempt, following the bombing, to make do with what little is left. What little is left bears upon economic potential, because, obviously, what is left over after a thermonuclear war back and forth on both sides has some relation to what was there at the start.

COLONEL CONNER: Gentlemen, Mr. Juster is ready for your questions.

QUESTION: I gather from the general orientation of your lecture that a substantial effort is made to crank out some number in this analysis. Is it true that one makes certain efforts to reduce this problem to a number that you might give to somebody else?

MR. JUSTER: An effort is certainly made to crank out, I wouldn't say, some number; I would say, numbers, rather. In general I would say that the chief focus of the effort is directed toward that part of the problem that is most amenable to be solved by getting numbers for it, namely, what magnitude can be said to be the full mobilization potential of the Soviet Union.

In other words the empirical work on this problem, as far as I know, has been almost exclusively concentrated on attempting to get some notion as to how big the Russian military effort could get under conditions of full mobilization, again the reason being simply that it is easier to measure this component of the problem than the problem as a whole. Presumably, the notion of trying to get some idea as to the development of Russian munitions production during a mobilization period, or during a hypothetical mobilization, is so extraordinarily difficult to get any numbers on that this has not to my knowledge been empirically attempted.

There have been attempts made to find out the total quantity of resources, measured in terms of rubles, and there have also been attempts made to translate these into specific quantities of tanks, guns, and planes

of particular kinds which the Soviet Union could produce under conditions of full mobilization for a particular period of time. This has actually been done. There are numbers of this sort available.

The other part of the problem, in terms of attempting to aggregate these things over a period of time, requires that we do something with the mobilization period. To my knowledge no empirical work has been done on this. There are devices which, if we apply them to a future effort, we might be able to make some conclusions and get some sort of solution to this particular problem. At least, there is some hope that some kind of technique will be the answer. But, so far as I know, nothing more than that has been done with the mobilization period.

QUESTION: In your work have such things as research and development been dealt with in your index, or is that dealt with separately?

MR. JUSTER: I would say that a particular level of research and development has gone into any index that you may make. If you are constructing an index of this sort of thing for different periods of time for the same country, trying to find out how big this country is as compared to how big it will be 10 years from now, you presumably would grind into the estimate some kind of notion as to the likely curve of development of its various technologies. This wouldn't be outside the thing. It would be embodied in it. At least it should be embodied in the estimates that we develop.

QUESTION: You made a statement early in the lecture that mobilization is accomplished with the same resources that you have at the beginning. I presume you are speaking of the effort rather than all across the board, because surely that doesn't apply necessarily to raw materials and natural resources?

MR. JUSTER: When I said it is accomplished with the same resources, what I meant was in terms of the basic resources that a country has--its population, its natural resources, and its stock of capital equipment--plus the background of experience, technology, and things of that sort.

Now, obviously, you utilize your resources more intensively during a mobilization period. You work your labor force harder. You may use more resources to build additions to your stock of basic resources, to increase your stock of capital goods by investment during the period. But it is still fundamentally the same set of resources. It is the same

labor force, the same population. It is the same natural resources. You may get them out of the ground a little more intensively. You may allow a little less leisure to the labor force. But all you are doing is--instead of producing the peacetime output pattern with some kind of desired leisure and some kind of rate of withdrawal of natural resources in peacetime--taking the same resources and using them more intensively to produce a different output pattern.

I think the difficulty comes in this term "resources." I meant to use it as things which are basic in the sense of being population, natural resources which are in the ground, and the stock of capital equipment--the man-made end of the resources total.

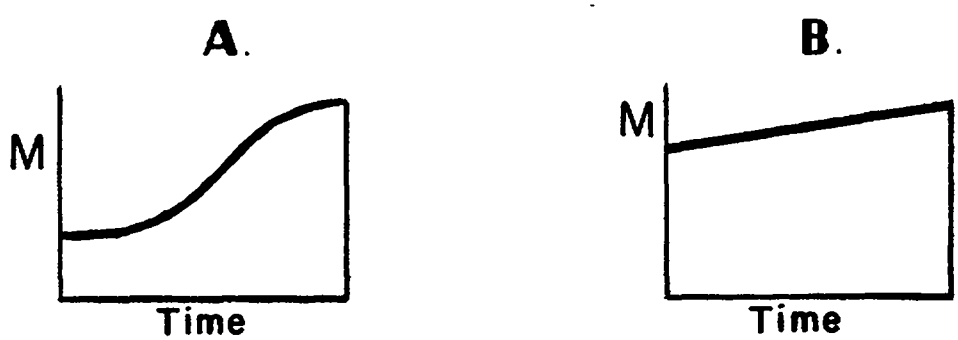
QUESTION: Mr. Juster, I don't quite follow or accept your tenet that it is necessary to apply a discount factor to your production potential toward the end of a projected war period. It seems to me that this would apply to all countries equally, and that therefore you would have to disregard it as a factor, since it applies in each case.

MR. JUSTER: You mean that it would be true that this same discounting procedure would apply to each country involved in the future, and therefore then tend to wash out?

QUESTION: Right.

MR. JUSTER: May I use the blackboard?

(Mr. Juster drew the following diagram on the blackboard:)



Suppose you have a situation where you have countries A and B and measure their output of munitions. It is quite conceivable that the total munitions produced over a time period will be the same in both cases, in both countries. In other words M would be the same, but the country with the most munitions coming in after the beginning would be

discounted more. The real value of their potential is less, despite the fact that you use the same discount rate on both. The time distribution for mobilization purposes itself varies between the two countries that you are talking about. You don't necessarily get the same total.

Obviously, the same rate of discount applies to munitions produced at any comparable time in the mobilization period; but in terms of the total impact of the necessity for discount, it doesn't follow that the discount factor is in fact washed out, because with this kind of pattern you see that those two curves are not the same. The undiscounted sum total of the munitions produced might be the same, but the fact that one country had more available at the start would mean that the effective value of their economic potential was greater.

COMMENT: I think it goes further than that. Assuming that the United States is fighting in Europe, and that Russia is fighting in its homeland. You would use a different discount rate, because of the time lapse from the time the item is produced until it is delivered to the using troops.

MR. JUSTER: I think again in principle you can handle this by definition, or by setting up classifications in such a way as to say that what you are going to call "produced munitions" are munitions which are produced in the sense of being able to be used.

Now, in the normal usage of the term, "production" means putting things together. You don't usually specify that they will be in a certain location before you call them produced. But in this context you would. You would say that the United States, for example, hasn't produced any munitions until the things are actually in the hands of the troops and available to be used. And in that case, as I point out, you would have an even greater time lag between the actual making of the thing and the time when you call it a militarily produced item. Obviously, this would be true if we were fighting over there and they were fighting on their home soil.

QUESTION: Following your comment as to the potentials being relative, how effective would you say our present ability is in determining the economic potential of Russia?

MR. JUSTER: You mean, to what degree can we make an accurate estimate at the present time of the economic potential of Russia?

QUESTION: Yes.

MR. JUSTER: Well, again I would say that we are able to make reasonably decent estimates of the full mobilization potential of the Soviet Union.

Whether you want to call this effective or not depends on whether you regard that as being an interesting question to ask. A good many people would say, when you start talking about full mobilization potential, "You may be able to measure it, but so what? It will never in fact be realized, because it is not conceivable that the war is going to last that long."

In terms of any other component of the economic potential of the Soviet Union other than the full mobilization component, I would say that we have not succeeded very accurately at all in making estimates of this sort of thing. We perhaps have some fairly good notion as to how long it would take for the Russian economy to get itself mobilized. We can do this, first, on the basis of historical evidence--on the basis of the kind of economy that they have, on the basis of the degree of flexibility that the economy has, and knowing the way in which they run things.

Presumably this implies that if we know the cold war level of munitions output and if we can make a guess as to their full mobilization level, then we would be able to make some kind of a decent guess as to the magnitude of the military effort which they could muster for any kind of war that is hypothesized.

But, unfortunately, the interesting part of this problem of economic potential is the rapidity and the rate of munitions production during the period of conversion from the time you start the effort until some months or some years afterward; and about this we just don't know very much. I think that the problem is inherently a time relationship problem, about which we are not able to say very much except the fact that, if we start way down here and go up to here, it takes a certain amount of time to arrive.

QUESTION: If you start off with a set of assumptions and arrive at a relative comparison of the economic potential between two countries, and you then vary your assumption and have the war start later or last

longer, do you interpolate in order to develop a new comparison, or do you have to go through the problem again and get new basic facts?

MR. JUSTER: I would say that, if you assume different basic facts, such as the war starting at a different point, it looks as if you would have to start the whole thing over again. If you start at a different point, presumably you can reach a higher level; in other words your mobilization potential is higher, because economies which are stronger can muster more capital, and so on.

I guess really the only difference in making an assumption that the war would start at a different time would be that your supposition as to the maximum potential would be changed. Each of these countries' maximum potential would be changed. There is no reason I can see why you would have to change the period of time that you assumed was necessary to get from start to finish. There is no reason why the potential mobilization basis itself would be any different in character.

But, if you start off with the same assumption, that the cold war output level will apply, which presumably it would, then the only difference would be that this country would have a higher peak, which can be reached in presumably the same time period approximately. In other words if you use the assumption that it will take two years to mobilize, the fact that you talk about starting in 1960 shouldn't make too much difference over starting in 1955. You might conceivably say that the time period between when the war starts and finishes is greater in the latter case and therefore you might have a longer time in which to mobilize.

However, the relationship isn't at all clear as to whether differences in degree of production from start to finish really make too much difference in how long it takes to mobilize. I suspect it is mostly a matter of what degree you gear your peacetime economy to the possibility that you may have to mobilize. The Russians presumably do this fairly well, I suppose, even much better in fact than we do, by and large.

QUESTION: I am wondering if you would say something about this resiliency that you talked about, or recuperability. Do you think that it is safe to use the British, German, and Russian experience data in estimating resiliency?

MR. JUSTER: That is a nasty question. That, obviously, is not safe data to use; and I think this is the reason: The impact of a million tons of bombs dropped during two years' time is not quite the same as

that of one bomb of equivalent power. I don't know. I would say that I would be inclined not to argue, but simply say that, by and large, we have a very strong tendency to underestimate this thing, simply based upon what happened the last time.

It is a little hard to say where you are if you really have thermonuclear devices which are going to be able to blow up New York City. Apparently, there isn't very much left when you get through. I gather from reading "The New York Times" that there isn't much left of what was there before. If this is the case, what difference does it make to talk about resiliency when there is nothing left to resile?

Any country, any economy, as big as either the US or the USSR--which is as varied, covers as big a land area, has so many centers of production, and which has as complex and interrelated and as tremendous an economic system--is not likely to be obliterated by dropping a number of devices on a number of strategic centers.

I think the notion of resiliency that I would find most useful to talk about would be one in which I would talk about the effects of this kind of activity in terms of actually obliterating a particular fraction of the total available economy, not in terms of being able by attacking particular locations so to disrupt individual parts of the economy as to make it inoperative. I think that if you do not make the economy inoperative by knocking out all its vital points, that by and large its resiliency is probably more than you would expect. In other words the ability of our economy to rebound after having vital portions knocked out is much stronger than is commonly supposed. It would take what would be called a complete saturation kind of attack, in which you didn't only knock out the key centers, but in which you knocked out everything, before you could really say that the economy would not be able to function.

This is just my judgment, which, as I say, is based upon what I have seen in terms of data from World War II. This is in terms of my own general hunches. You can't back up this kind of judgment. Presumably one man's guess is as good as another man's guess.

QUESTION: Have these techniques proved valid in the past? I understand, for example, that the Germans in World War II had a geopolitical institute, as they called it, where they studied the factors of this type throughout the world. Of course, presumably, as a result of their studies at this institute, the Germans concluded that they had the upper hand and they could win. Is there any experience like that on our

side? Is there any experience anywhere in the world which shows that after all these efforts are made to come up with comparative data, the final outcome has correlated with the studies or the information arrived at?

MR. JUSTER: First off, there is no reason why the fact that you attempt to find out these data should have any influence upon the impact that the existing facts have, even though you may or may not have acted on them. In other words the fact that you suppose the Germans studied this particular kind of problem and came to some decision--which is a totally not understandable conclusion--that they would win, would not vitiate the usefulness of this kind of analysis, because all you could say is that they made a very bad decision.

By and large I think that if a body of individuals had set out, in 1939 to make a study of the economic potential of Germany, Italy, Japan, and the United States to wage war, they would have arrived at the conclusion that it didn't matter what the levels of stockpiles of the various countries were, it didn't matter who got the upper hand initially, that if the war lasted long enough, the Allies would be bound to win because the overwhelming weight of the economic potential was with the Allied side. In the fundamental nature of things, the leading factor in the war was this overwhelming mound of military goods that kept pouring out of the United States factories during World War II. As far as winning the war is concerned, I can see no other factor that has as much influence.

QUESTION: There were no other such studies in advance of World War II?

MR. JUSTER: No. To my knowledge, the interest, at least in this country, in this kind of proposition has followed World War II rather than preceded it, which is almost always the case. The awareness of the fact that this kind of thing could be done, the awareness of the importance of economic potential, was indicated by the fact that we did win World War II. Our interest in such studies began then, in relation to our own effort. Unfortunately, we studied this sort of thing in relation to the World War II conditions and circumstances have changed so that now we have to study it all over again.

COMMENT: In 1938 I read an article which showed rather conclusively that Germany couldn't even afford to begin a war, let alone have any chance of winning one, because all indications were that it did

not have sufficient quantities of certain things to keep going. That indicates that some of these studies, at least in the past, have been entirely wide of the mark.

MR. JUSTER: I think I will have to comment on that, if I may. If you want to look at the development of economic potential in this fashion, what you do here is about what I tried to bring out during my lecture. You essentially talk about limiting factors. You say that the potential of the Germans depends on this metal, of which they don't have enough, and therefore they don't have the potential.

If anything has been demonstrated by experience, by history, the kinds of things we know about the way the economy operates, it is that you can't use this kind of analysis; that fundamentally the only thing which limits munitions production capability, or the economic potential of a country, when its people have enough time to mobilize, is the level of total output and the competing demands on it.

To say that they don't have enough steel, aluminum, copper and therefore they can't mount a munitions effort is not true, because every time you try to do it, you find out that it doesn't work. We tried to do that and the Germans demonstrated better than anybody else this sort of analysis couldn't be used. You have metallurgists, substitutes, synthetic rubber. You always manage to find substitutes, provided you are willing to spend enough time--that always historically has been the vital factor--provided you are willing to spend the necessary resources to get them.

So in talking about economic potential, in these terms, it has pretty much to be restricted to talking in terms of the aggregate size of the economy, not about the size of the steel industry and so forth.

COLONEL CONNER: Mr. Juster, I think it is quite evident from your discussion that anyone undertaking any very lengthy study of trying to compare economic potentials for war has his hands full, especially much more so in the short time that we have here--eight weeks. It has not been your purpose, to tell us how to solve these problems, but to point out to us some of the problems and difficulties in trying to estimate these potentials. You have done a marvelous and superior job, and in the name of the College I thank you.

(20 Apr 1955--450)S/gmh

A63764