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Globalization, Security, and Economic Wellbeing

Globalization and interconnected economies is a topic of keen interest to me both from my academic background and also from my position in international shipping. The container, along with advances in information technology co-evolving with advances in business organization are perhaps more than any other combination of factors responsible for trade as we know it today – disaggregated supply chains and trade focused on tasks, not goods – a topic explored in detail later. Before going in depth about globalization, security and economic wellbeing, a quote from one of my favorite authors will set the stage of this unique topic - “Economies have become so interdependent due to advances in transportation and communication technology that actions in one country produce nearly instantaneous effects in many others. Consequently conflict between states is futile since damage to one economy necessarily translates into damage to others, including that of the aggressor.” You might be tempted to ascribe this argument to Thomas Friedman in “The World is Flat” or some other multitude of gospels of globalization popular today, but in fact it is the argument advanced by the British Nobel Prize winning Economist Norman Angell in his famous book “The Great Illusion” published in 1910. At the time Angell published his book, the world was hurtling towards the catastrophe of World War I, which brought the first great age of globalization to a close. I study Angell’s work because he was a perpetual optimist, brilliant thinker and skilled economist, and his story reminds us that even the best and brightest can get something as complex as the global economy drastically wrong. Today when people contemplate globalization and interconnected, interdependent economies, outsourcing of jobs, trade displacing locally produced goods, access to vital commercial pathways, and the other hallmarks we consider unique to our age, it is important to remember we have been through this before and that leaders of the day badly misunderstood the dynamics at play.

The first great age of globalization is generally considered to have begun with the repeal of the Corn Laws in England in 1846. This was also the height of the Industrial Revolution with discontinuous advances in methods of production. The huge leaps in transport and communications technology Angell spoke about were the steam ship, railroads, and the telegraph. All every bit as disruptive then as disaggregated supply chains, containerization, and the internet are today. While today we worry about access to the Straits of Hormuz and Suez, back then it was the Bosphorus and Straits of Gibraltar. Then, as now, tensions arose as developing economies were accused of using cheap local resources to invade the distant markets of more advanced countries. At that time, the roles were somewhat reversed and it was the flood of cheap agricultural products from a comparatively backward but rapidly developing U.S. into the more mature and sophisticated markets of England and Europe that was the issue. Among other effects, this trade released local newly surplus labor from agricultural work and triggered rural to urban internal labor migrations in those countries, England in particular, that fed the insatiable demand for cheap labor to keep the cogs in the machinery of the industrial revolution turning. Social dynamics in those countries were permanently altered, as was the global distribution of power, launching the Golden Age of the British Empire. Much as is the case today, advances in one facet of economic activity

produced unanticipated consequences both within and across borders. Alexander Gerschenkron, in his seminal work "Bread and Democracy in Germany" lays out how the way countries dealt with those consequences set in motion the train of events that culminated in World War I even while the most learned men of the day, such as Angell, failed to comprehend the nature of globalization, what it meant, and the effect it was having on society. Consequently they were incapable of correctly responding to the policy and security challenges they faced. There are those that counter that this time is different than the last in one fundamental way. The last age of globalization was built entirely on advances in technology. This time the advances in technology are buttressed by a stabilizing institutional structure – the World Trade Organization (WTO), a structure meant to institutionalize free trade. Anyone giving stock to that should be greatly concerned over the spectacular failure that is the Doha round, and the proliferation of bi-lateral and regional trade agreements in place of broad multilateral advances. Our trading system has become what Jagdish Bhagwati, one of the preeminent trade economists of our time, calls a spaghetti bowl in his book "Termites in the Trading System." A complex, increasingly opaque mass of overlapping, sometimes contradictory, trade relationships that produce consequence pathways difficult to anticipate. In addition such agreements are called "preferential trade agreements" for the positive spin, but another view at them is discriminatory trade agreements as they are meant to exclude all but the privileged few who are members which are contrary to the intent of the WTO and the multilateral trade process. So if the institutional structure of the WTO is what makes some think this time is different, the foundation of that institution is in an advanced state of decay and every bilateral trade agreement knocks another large chunk out of it.

The first great age of globalization lasted about 2/3 of a century. The second great age of globalization, where we are now, began with the end of World War II. It took a quarter century to get back to where we left off at the close of the first in terms of overall economic integration but in some areas the loss was permanent. The UK, for example, is still not at the same level of export intensity that they previously were. Since the beginning of this age of globalization, we have witnessed discontinuous changes in global political economy driven again by dramatic advances in communications and transport technologies coevolving with advances in methods of production and business organization. We are nearly at the point of this age of globalization, about 2/3 of a century, where on the timeline of the last age it imploded, plunging the world into three decades of darkness. Given that we are approaching that point at which the last age of globalization failed, it is a useful exercise to examine the characteristics of the current age of globalization. With the events we are witnessing around the world, one wonders if there is some natural age limit for a globalization process after which the strain on society gets to be too much and our ability to manage complexity is overtaken by the complexity we are faced with. The system then demands some sort of reset and perhaps we are at that point now. Such resets are never graceful.

The U.S. Navy's "Cooperative Strategy for 21st Century Seapower" notes that today's global economies are tightly interconnected but does not explain its meaning, something Angell and his contemporaries clearly got wrong in their age. Many understand globalization as cheap sneakers on Walmart shelves made by exploited labor in a far off place. This is a reflection of the general understanding of interdependence, once promoted heavily by some segments in society and one all too readily accepted by the common public in times of economic turmoil as we see now. This view focuses on division of labor, some level of exploiting comparative advantage, with each making what they make best and trading what

they have for what they need, and in the process becoming mutually and voluntarily dependent on each other with intertwined well being – the Ricardian wine and cheese trade relationship from economics 101. Or, as a just released report from the Council on Foreign¹ relations describes it, “Globalization also allows each country to concentrate its scarce resources of people and ideas in those activities with which it is well suited compared with the rest of the world. It can then export these goods and services for imports of other products that can be enjoyed in greater variety and at lower prices.” This is however a strikingly narrow view of globalization and in truth it is a definition more fitting of the last age of globalization than the current one. This age is vastly more complicated than that. We no longer simply trade what we make for what we don’t make, but need. We now trade in order to get what we need **to make what we make**. Before, we were self sufficient in some but not all of what we needed and we could trade the excess of what we made to fill the gaps. Now, we are self sufficient in nothing but make everything – trade in tasks mentioned earlier. I belabor this point a little because this is a major leap in complexity as compared to the last age of globalization, apparently not as well appreciated as it should be as evidenced by the definition the Council on Foreign Relations uses, and has profound implications across a number of policy areas. It might be feasible to take a pen and ink change to your copy of the New Maritime Strategy and strike out words like “interdependent economies” and replace them with interdependent production process across economies.

If the last age was too complex for policy makers to manage competently, imagine how this one is – the tremendous advances in global economic complexity have not been matched, be corresponding advances in political or policy skill, evidence of which you can see by simply picking up a newspaper virtually anywhere in the world these days. The current age of globalization is certainly showing signs of stress, buffeted by the same but magnified forces of demographics, politics, changes in the global political order, and international instability that disrupted the last. And as the last great age showed us, the forward march of globalization is not inevitable, but also not reversible. We cannot slide easily backwards into a better previous time when the pressure gets to be too much. When globalization breaks, it does so violently, permanently altering the trajectory of history. The balance of my remarks will therefore be spent exploring a few pertinent high level economic aspects of globalization in an attempt to understand them (and it is important to note that while I view globalization as an economic process due to my academic and professional background, many in other disciplines view it as a different set of forces than economic ones). Along the way we will dispel some of the common myths surrounding globalization that persist, and sadly influence both public opinion and policy. To paraphrase Norman Angell, policy is not driven by facts, but the public’s opinion of facts.

The first myth we should address, and perhaps one of the most relevant to those in the room, is that 90 percent of world trade moves by water. That is simply not true. A more correct rendering of that phrase would be that 90 percent of world trade in physical goods (merchandise trade) as measured by volume moves by water. When measured by value, the number is closer to 65 percent. The first key issue is the trade in physical goods vs. total trade. In 2010, there was 18.8 trillion dollars in total world trade, of which 3.7 trillion, or about 19.5 percent, was in services. These services are considered very high value and critical (i.e. transportation services, financial services and communications). Much of this moves on fiber optic backbones, not ships, although as you will see further on, goods can

¹ US trade and investment policy, Independent task force report no 67

no longer move on ships without a robust and parallel flow in information. This means cyber warriors are doing every bit as much to ensure the smooth flow of trade as are those standing a watch on the bridge of a ship in the Straits of Hormuz. The second key issue is that given the difference in trade as measured by value vs. volume, it is clear that a lot of high value goods move by means other than water. That is, principally air and the importance to the global economy of aviation supply chain networks cannot be overemphasized. Such supply chains are responsible for the global movement of critical items such as pharmaceuticals and medical equipment, electronics, automotive parts, and computers. It also means we must pay attention to global supply chain critical nodes that are different than the more commonly discussed port system in marine supply chains. The largest air cargo terminal in the world is Nashville, Tennessee and the third is Anchorage, Alaska. These places do not register on the list of critical nodes in the marine supply chain. Air supply chains are faster in cycle times, meaning they will fail faster in the event of a disruption. They also carry goods with more time sensitivity and lower tolerance for supply chain disruption. One example that certainly made the news is the Iceland volcano eruptions of spring 2010. The air space closure resulting from the ash cloud was hugely disruptive for travel in Europe, but was also devastating to farmers in Kenya. Europe is the major market for fresh fruits, vegetables, and fresh flowers for Kenyan farmers, and such products are delivered via an aviation supply chain that was shut down, meaning rotting product on runways. It is not hard to extrapolate failed farms to social unrest and to the outbreak of conflict in the Horn of Africa due to a volcano in Iceland. I would guess Kenyan farmers and peace in the Horn of Africa were not high on the list of endangered stakeholders when the potential for an eruption was first contemplated in Iceland, but that is the way causality pathways work now. In the U.S. 40 percent of all finished pharmaceuticals, 80 percent of all ingredients for drugs mixed here, and 100 percent of the most common isotopes for nuclear medicine procedures are imported and delivered via an aviation supply chain, and are dispensed on within hours of landing. This means grounding all flights in response to an aviation security threat would rapidly translate into a healthcare crisis. The aviation supply chain business continues to innovate, as the pharmaceuticals industry shows. In response to soaring demand, drugs are currently the biggest growth segment for air cargo and service offerings are being refined and specialized (specialized being a code word for an increasingly efficient but rigid and unforgiving supply chain) including the recent innovation of highly specialized containers with active temperature control features, allowing the transport of pharmaceuticals at the +2 to +8 degree C range. Clearly this type of cargo is highly perishable, hence time sensitive, and completely intolerant of delays in the supply chain, however induced.

At this point you may be asking yourself – “why is this guy writing about aviation supply chains- that’s not what we do?” First, because we keep seeing that 90 percent by water statistic, but also because you can no longer meaningfully separate various supply chain vectors – in practice these are not stove piped. These are all interdependent processes. You cannot have international trade in physical goods without a robust international trade in services. Aviation supply chains depend on marine supply chains to function properly and marine supply chains are likewise dependent on aviation supply chains. Both depend on robust truck and train connectors. A friend of mine in the cruise ship industry told me of a case where a cruise ship was coming into Miami and as usual, a Coast Guard boarding party met the ship outside. They decided to further review paperwork resulting in the ship being held up. Airlines in Miami orient schedules around cruise ship times which consequently held planes and soon enough the disruption rippled across the entire U.S. air passenger network.

This is just one example of how different transport vectors interact in ways you might not expect.

A critical mistake made in supply chain security thinking is that sometimes you can break it apart and study individual components, to understand the behavior of the overall system. You cannot make that assumption and decisions made that way will be flawed. Likewise vulnerability is not about the physical ease or difficulty of attack on any particular node or vector in the supply chain. It is not. Vulnerability is about how the system behaves, how it fails and how quickly it can be made to recover once a particular node or vector has been disrupted, which is a very different view. So I mention some of the things we may view as tangential only to remind us that they are there and must be accommodated because the system will fail if we do not.

Of the goods that move by water, it is no longer simply boxes of manufactured goods made in competition with local labor, which leads to our next myth and by far the most important; the idea that the "made in" label has any relevance at all in today's version of trade. Unfortunately, much policy is driven by that meaningless anachronism of the first age of globalization. During that age we actually traded goods and the "made in label" had meaning. Now, as I mentioned before, we trade in tasks and a specific widget is actually manufactured in a variety of places with the made in label denoting where it received final assembly, the most dramatic effect of the combination of containerization and the internet. More than 50 percent of containerized trade is now in component level goods, meaning parts or inputs into factories rather than ready for retail goods heading for store shelves. In a Boeing 767 airplane with a made in America label plate, roughly 45 percent of the aircraft is actually composed of imported parts and in the 787 Dreamliner that figure is likely to be more like 70 percent, including such crucial parts as wings and engines. Boeing's role in that airplane has been described as being reduced to little more than project management, design, assembly and test operation. In the recent U.S. air tanker program that was in the news for example, the Boeing plane, billed as made in the U.S., is actually made in eight countries. The U.S. Congressional Research Service did a study on the key issues for congress on that airplane program and provided a list of countries where various components are made. The Czech Republic is listed as the source of airframe parts and while not being an airplane expert, my understanding is the airplane will not work well without an airframe. Likewise the flaps, also critical parts, are made in Indonesia. The avionics are not specifically listed, but of course, we know that whatever is on the made in label is not completely true since they contain components made from rare earths (as all avionics do) which are virtually sole sourced in China, which is not on the list of contributing countries. My guess is that for each of those eight countries listed, if you followed the trail on the components with their respective made in label there would be a multitude of other countries there. Clearly the notion that the production of the air tanker is not subject to events in faraway places, is false. The made in America label does nothing other than manage a perception. The fact is, we frequently have no idea where something "made in America" – or anywhere else, is really made. A loaf of bread sold in a local market can have ingredients from up to 14 different countries. Perhaps, the only thing from the U.S. is the baker, meaning the one who puts the made in America label on it, perhaps, the only thing that the business provides is the heat necessary to bake it, but we have a good chance those BTU's came from oil we got from Canada, so even that's imported. All we can say for sure is that the last stop on its production path is in the U.S. before being turned over to the customer. And there is nothing wrong with that. Another facet of trade in tasks is that in

many areas a positive economies of scale exists meaning there may be only one or a few plants globally that produce low value but critical components. The disruption of a single plant in one part of the world that produces some innocuous but critical component like an electronic power switch can cascade out to disrupt production processes all over the world. It is important to note that the system does not distinguish between disruptions from natural disasters, criminals, or bad policy. The system reacts to it all the same way, and that reaction is not good. While criminals get the press, a far greater danger to our collective freedom to leverage global pathways of commerce are the twin "ism's" of nationalism and protectionism with unwarranted fear a close second.

Disruptions to supply chains no longer just mean not having your favorite brand on the shelf, they now mean closing factories, unemployment, and social stress in areas far removed from the initial disruption. The value added of goods with a "Made in China" label can be as low as 6 percent and usually does not exceed 20 percent, meaning most of what is in such products comes from someplace other than China. Increasingly that is the U.S., where China is our largest customer by a very wide margin in terms of containerized exports and a major customer of our agricultural products. The now ubiquitous i-phone has a made in China label on it, but China is actually responsible for a relatively small amount of the production effort for an i-phone – something on the order of 5 percent. Japan is actually responsible for the majority of it, with Germany and Korea as close runners up. The U.S. itself is also a major contributor to that production process. A Federal Reserve Bank of Chicago study at the height of the "Great Recession" showed that the average value a typical car sporting a made in America label that is actually generated in the U.S. is only about 75 percent. But that is highly contentious with U.S. domestic content ranging widely. A Toyota Sequoia, a "Japanese" car was noted to be 80 percent U.S. content (the highest of any car), while the Jeep Patriot, an "American" car was only 66 percent. The irony of its name is amusing. So if you want to buy an American car, you need to buy it from a Japanese company. In addition, in terms of the actual assembly process those cars made in Detroit, they probably cross the U.S. – Canadian border five times, meaning not only are the parts sources globally, but the actual assembly is also something of an international activity. As an indicator of how policy can affect trade, approximately one million dollars of trade crosses the U.S. / Canadian border every minute, 24 hours a day, 365 days a year. The thickening of that border as a result of post 9-11 security procedures has erased all cost advantages achieved through NAFTA, meaning a huge deadweight loss to both the U.S. and Canadian economies. Overall the WTO estimates that about 80 percent of the value of goods exported by the U.S. represents U.S. domestic content, a statistic which excludes such indirect value components such as energy. Comparing that with the roughly 20 percent of a typical Chinese export highlights the complexity of today's trade relationships and complicates finger-pointing over who is the offender in what is perceived as unfair trade relationships.

One implication of all this, is that economic sanctions do not just effect the targeted country but every country along that particular good's supply chain often including the country invoking the sanctions to begin with. The fact is that the targeted country is likely to directly feel relatively little of the actual overall effect of the sanction. It also causes some level of discomfort when I read articles and news such as a RAND report released last week² which offers as a potential cyber warfare tactic; the disruption of a target countries shipping

² Conflict with China – Prospects, Consequences, and Strategies for Deterrence.

system in order to inflict economic pain, the implication being that such pain would be contained to the target country. As the forgoing demonstrates, it could not and would in fact result in an attack on a multitude of countries with the large divergence in economic vs. security relationships. It is difficult to determine who will be on what side in such circumstances.

The root of the issue in the forgoing is the way we measure things – our methods of accounting have not kept up with global business practices. Since we now trade in tasks – very fine level of supply chain disaggregation to the activity level where the distinction between goods and services gets blurry, the old measure of production, GDP in real or nominal currency, presents an inaccurate picture of actual economic activity, and more importantly from both a policy and public perception stand point – a distorted picture of actual trade imbalances. This is critically important because as Alejandro Jara, deputy general of the WTO puts it, “We know in times of crisis the pressure from public opinion can push in the wrong direction. In the absence of objective statistics demonstrating the interconnectivity of the modern production system, it is to be feared that false and obsolete will remain the panoply of the most popular remedies.” Every complex problem has a simple solution, one that is easy to understand, easy to explain and fits well in a sound bite, but that is totally wrong. That is where we are today.

The problem in a nutshell is that the old measure of GDP was based on gross flows, hence double or triple counting some aspects of economic activity and failing to take into account trade in intermediate goods. A more informative statistic is the value added content of trade where the flow of goods is recorded by assigning to each country of origin the value imbedded in final goods, rather than just value it all in the last place that touched it. The WTO is working on such a system of measurement, but trade tensions and poorly designed policy will be the order of the day until policy makers understand, adopt, and communicate it to their respective constituencies. Adoption of such a measure of trade flows would also highlights something that few seem to appreciate fully because of the distortions induced by current accounting that I previously mentioned. There is a stark difference now between many country's security alliances and their economic alliances. Who a country is allied with from a military perspective and who their economy depends on to function, are now frequently completely at odds. Security alliances and high politics are the province of the government elite, but economic alliances are the province of the general population and are where cultural and social as well as economic bonds are built. Thus, while virtually all countries say that in a serious crisis the security alliance would prevail, in the end we simply will not know which side a given country will take until that time comes and the internal battle between the elites and the population is waged.

A related myth is the notion that the “owned by” label has any meaning when applied to the owners of the means of production these days. Frequently now the owners of both the means of production and the means of distribution are international, with the location of “headquarters” being more an accident of history than some current overt business decision. The roots of ownership, and economic beneficiaries of productive activity are no longer easily identifiable. A fascinating recent example of this sort of “globalized ownership” is what has been described as “the battle for the future of copper” that played out earlier this year when Minmetals, a Chinese state owned mining company launched a hostile takeover for Equinox mining. In itself this was cause for great interest as hostile take-overs are not the typical strategy for Chinese firms. Equinox is an Australian company that has a nominal office in Toronto and is listed on the Toronto Stock Exchange. Equinox, one of the

world's top 20- copper producers, has as its main asset, a massive copper mine in Zambia and is building a copper-gold mine in Saudi Arabia. At the time MinMetals launched their hostile takeover bid, Equinox itself was in the middle of a hostile takeover attempt of Lundin mining, a Toronto listed firm whose primary mining activity is in Sweden and Portugal with smaller interests in Ireland and Spain. It is clear how very complicated international ownership structures can get these days, and consequently the unpredictability of policies like sanctions. In the Equinox example, nine countries were involved. From a security perspective there were some in Canada who advocated the government blocking the Minmetal bid as contrary to national security, even though none of Equinox's assets were actually in Canada and beneficial ownership was in Australia, making the national security angle hard to comprehend. In reality the only thing Canadian about Equinox was a file at the Toronto Stock Exchange. This is reminiscent of the Chinese National Offshore Oil Company (CNOOC) attempt to buy U.S. oil producer Unocal, a company headquartered in San Francisco, California but whose assets were primarily in the Gulf of Thailand. That proposed transaction generated huge amounts of anxiety in the U.S. and eventually action in congress to block it; not wanting to surrender U.S. oil assets to a foreign company, even though none of their oil assets were actually in the U.S. CNOOC went on instead to buy Calgary based PetroKazakhstan Inc, a Canadian company whose assets are, as the name suggests, in Kazakhstan, and in fact being the largest private integrated oil firm in that country, although they also owned a stake in Canada's oil sands. So the oil from Canada used to bake that bread mentioned earlier was probably bought from a Chinese oil company. The Dubai Ports World (DPW) fiasco is also an instructive example where a failure to appreciate international linkages in the shipping industry and the political reaction to the proposed takeover of a third tier terminal in New York by Dubai Ports World as part of a large acquisition of P and O assets actually turned what should have been a non-event into a potentially serious disruption to U.S. supply chains into the Horn of Africa, Iraq, and Afghanistan. In this case what everyone failed to realize was that Dubai Ports World controlled Shalala, a critical transshipment mode in material flowing to Iraq, Port Qasim, a critical supply chain node for goods flowing to Afghanistan, and Djibouti – the port of entry for goods supporting U.S. activity in the Horn of Africa. So if DPW wanted to disrupt U.S. supply chains, they did not need to buy a third rate port in the U.S. (already owned by a foreign company by the way) to do it– they could, and can, do it at will in the many foreign ports they control that the U.S. military is dependent on. By focusing on the local rather than global picture, a serious potential disruption to military supply chains was manufactured where none should have been. Fortunately, the DPW folks reacted with admirable restraint and defused the situation, but that may not happen the next time when circumstances and actors may be different. And as we think through the complex ownership structures like MinMetals/Equinox, it is important to remember these are firms engaged in the normal course of business in full compliance with international and relevant domestic laws. If this is what it looks like for legitimate firms trying to be transparent, imagine what illegitimate actors deliberately trying to conceal and deceive can make things look like. One industry notorious for this, is of course my own, where ownership is frequently nested in multiple shell companies spanning several countries. The registry or flag of the ship is unrelated to wherever ownership really sits, and the ship is operated by a management firm headquartered in yet another country employing crew from none of the above. And that is what a legitimate operation might look like. The number of seams to be exploited for unsavory purposes is obvious, but so is the potential to disrupt legitimate shipping acting in conformance with international law in an effort to seal off those seams.

The relevance of the foregoing discussion was to point out that we no longer know with any certainty where anything is truly made hence where supply chain disruptions might occur or how disruptions might propagate through the global production system. Further there is no way to know where the effect of deliberate action, sanctions, cyber-attacks, or physical attacks will ultimately be felt, nor who will be on what side in the event of conflict. The world is a far more complicated place than you would expect from looking at a “made in” label.

Another topic we need to explore is that nature of physical supply chains. It is a fact that in global trade the most efficient method of moving goods from A to B is rarely a straight line. Trade is moved in networks of networks that are themselves interconnected and completely dependent on the smooth flow of information across yet other networks. Disruptions in a rail network ripple out and manifest themselves as disruptions to ship networks. Disruptions in one port propagate out into disruptions into other ports. Ports themselves are not perfect substitutes for each other due to advances in ship technology with attending implications for resiliency. Containers often move through relay ports where a container enters the port on one ship and leaves on another, never leaving the port, meaning not going through the typical security apparatus found at the gates. The large Asian ports process in excess of 80,000 containers every day. Individual ships carry 15,000 to 18,000 containers and could fill a train 110 kilometers long if offloaded at once carrying cargo for thousands of customers whose identity is tied to just a number or bar code on the box. In Prince Rupert on the west coast of Canada, a new container port with enhanced rail infrastructure supported by upgraded roads and highways plus an advanced multimodal inland port near Manitoba is designed to offload a container directly from the ship to a train and have it in Chicago within 100 hours.

In container shipping, we are a step in the manufacturing process; an extension of the factory itself and a conveyor belt between factories linking assembly lines. While speed is important, the critical issues are consistency, reliability and predictability. Uncertainty is to be avoided at all costs as uncertainty requires buffer stocks to compensate for, which are expensive and something to be held to the absolute minimum. That means when we say we will have your box to you Tuesday, we mean Tuesday, because we know if we are late, you are at risk of having to shut a manufacturing line down. As in any conveyor belt linking assembly lines, a disruption to any part of the system becomes a disruption to the whole system. The sheer volume of activity can overwhelm even the most robust physical detection system without slowing the system down to a crawl and presenting significant disruptions to trade.

Another important issue to consider is that a significant component of the total value imbedded in transportation is information. Today’s modern system of trade is completely dependent on the uninterrupted flow of accurate information. Without it, trade simply will not happen. So while we have spent billions hardening ports and thickening borders, the most vulnerable portion of the global system of trade is the information component. Container yards are now fully automated – largely run by robots. In the container yard I see out of my office window, if a human is detected inside the yard (via automatic sensors of course) everything is automatically shut down. This intricate dance is controlled by incredible levels of information and computer technology. A container itself has nothing on it other than a box number and a bar code and without access to computerized information systems, you will have no idea where it came from or where it is going. Consider those 80,000 containers flowing through a large Asian port every day or the 18,000 on a ship you

may be boarding identified only by a number and the critical importance of information should be clear. The other aspect of information that is increasingly important is our role as an extension of the manufacturing process. Like every part of the process, manufacturers need information about what is happening at that particular step in order to properly control it, and that information is an important component of the total value of our service. You do not need a complex plot with a bomb on a pier to disrupt trade – you need a \$300 dollar computer and a connection to the internet. One no longer needs to achieve physical proximity to cause physical damage.

Ship, port, and connecting transportation technology continue to co-evolve with production methods and business management practices. The container completely revolutionized world trade and altered balances of power in ways that have not yet completely played out, but draw worrying parallels to the ways the steamship altered balances of power in the last age. One area I think about often is the technology that will make containers obsolete. I do not know what that technology is, I doubt it will come from my industry, and it is the technology the ships you are building today will have to contend with.

To say that the world's economies are interdependent does not adequately, or even remotely, express the true nature of today's global economic activity. Vulnerabilities exist everywhere, the most serious being those obscured by the very complexity of the system. But it is imperative that those charged with regulating and protecting the system of global trade have a good appreciation of what it is they are regulating and protecting. The system will propagate disruptions and there will be failures as a result of actions taken by those that mean to do us or the system harm such as transnational actors or terrorist groups. But like any complex adaptive self organizing system, given time and latitude for action the system will rewire itself and recover. The global system is far too large and complex for such groups on their own to do lasting harm. There is of course one set of international actors that do have the capacity and were-with-all to really do permanent damage or even destroy the trading system. That group is the States themselves, and they are the only ones. I reject out of hand the notion that conflict among major powers is no longer possible – I do not make the same mistake Angell did. States will always do what is in their best interest to do, and when they calculate it is in their best interest to fight, they will do so. This means they will first calculate the probability that in fighting they will be better off if they win, and second, the probability that they will in fact win if they fight. Thirty years ago the information needed to make those calculations was relatively clean. That is no longer the case today. As we noted in the GDP discussion, a significant measure of both economic prowess and trade imbalances used today is badly distorted, and does not provide accurate information on which to base policies that in the past have led to conflict, and in fact directly contributed to the demise of the last age of globalization. The wide and growing gap between security and economic alliances for individual states no longer allows states to accurately gauge which side their bread is truly buttered on, or estimate accurately which side a potential ally or adversary will judge his to be buttered on. The demise of the meaning of the made in label means we cannot longer gauge with any accuracy where the incidence of a specific trade sanction will fall, nor where failures in the global supply chain may manifest themselves. The continued use of a made in label that does not convey accurate information may actually make things worse by giving the false sense of security that we know where critical things we need are made, hence where we can afford to take risk in foreign policy. Trade in tasks means we can no longer accurately predict where and what will be the effects of a particular course of action, which can, among other things,

influence the final calculation between a security or economic relationship. The spaghetti bowl of bilateral and regional trade agreements that have replaced multilateral advances have resulted in pathways for trade disruptions that cannot be anticipated with any certainty. When we measure the wrong things, and measure them incorrectly, the potential for miscalculation is high. As the last age of globalization showed us, globalization is not inevitable, it is not reversible, but it is breakable. But, and it is the one thing Angell got right - when it breaks the consequences are catastrophic.