SPECIAL REPORT

TD Economics

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OFFSHORING, ONSHORING, AND THE REBIRTH OF AMERICAN MANUFACTURING

Highlights

- After a decade of employment losses, the manufacturing sector has become a key driver of the recovery adding nearly half-million jobs since the January 2010 trough.
- A slowdown in offshoring activity has been an important component of the manufacturing recovery, accounting for about one-quarter of the recent manufacturing job gains. For some industries – such as computers & electronics and plastics & rubber – offshoring activity has slowed to a trickle.
- Onshoring is still in its infancy and largely limited to anecdotes. However, the scales are beginning to rebalance for some industries as global conditions evolve. These changes include rising offshore labor costs, an appreciating renminbi, and several increasingly important domestic advantages. Additionally, an overarching theme of rising capital-intensity across the manufacturing sector continues to gradually erode the primary benefit of offshore-production.
- A group of relatively capital-intensive recently-offshored manufacturing industries – computers & electronics, machinery, fabricated metals, electrical equipment, and plastics & rubber – is likely to lead the onshoring trend, while the labor-intensive early-offshored industries – including apparel and textiles – will stay or move further offshore. Furniture, while not very capital-intensive, has nonetheless made some onshoring inroads recently.
- The remaining group, or not-substantially offshored manufacturing industries – consisting of petroleum, chemicals, primary metals, food & beverage etc. – has never really offshored in the first place. Nevertheless, it may contribute to the manufacturing revival through improved competitiveness resulting in organic domestic- and export-led growth.

Introduction

At the end of the last decade American manufacturing appeared to be a shadow of its former self. Ten years of consecutive employment declines reduced the number of jobs in the industry by nearly six million – one in three positions in existence prior to the turn of the century. Employment losses were especially dire during the decade's two recessions, but were not limited to contractionary periods. Manufacturing employment declined both prior to the 2001 recession as well as during the subsequent robust recovery. The Great Recession brought about even sharper declines. But then something unexpected happened. After a decade of bloodletting, the manufacturing sector began adding jobs in 2010 and has continued to do so consistently since.[1]

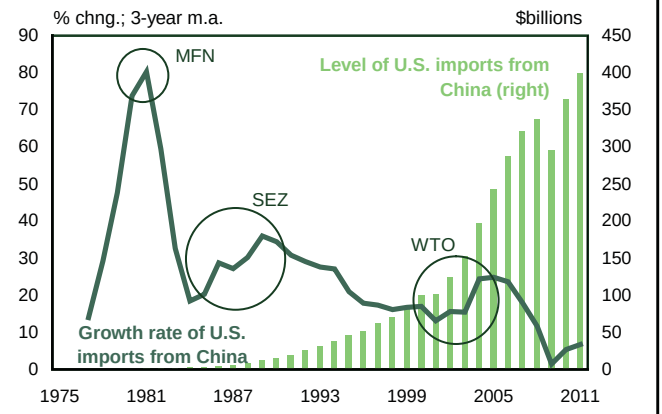
One of the reasons for manufacturing bucking its declining trend is the slowdown in offshoring activity. Offshoring is broadly defined as the process of substituting foreign factors of production for domestic ones in order to produce goods and services then imported. This notion follows from a two-hundred year old economic law of comparative advantage, suggesting things be produced where their opportunity cost is lower. While the concept should in effect benefit both trading partners, offshoring has become a dirty word, synonymous with the overall decline of American manufacturing, implying "shipping jobs overseas" or "migration of jobs, but not people."

Michael Dolega, Economist, 416-983-0500

In this report we argue that offshoring activity – having peaked in the middle of the last decade – decelerated recently as its appeal began to wane. Moreover, we estimate this slowdown accounts for 56,000, or about one-quarter of manufacturing jobs created in the past year. The appeal of offshoring has been gradually eroding due to a myriad of factors including rapidly rising wages abroad, an appreciating renminbi, and volatile transportation costs. Furthermore, offshoring advantages are being increasingly undermined by domestic benefits stemming from intellectual property protection, flexibility of tighter supply chains, trend toward mass-customization, and access to less expensive natural gas from shale formations across the United States.

For select industries – like computers & electronics and plastics & rubber – the offshoring tide appears to have ebbed altogether, with growth of domestic production matching net import growth. In fact, some U.S. firms have already decided to re-establish or expand production at home. This relatively recent phenomenon – coined by various terms such as onshoring, reshoring, inshoring, or backshoring – has come to embody a sense of rebirth, or renaissance, of American manufacturing. But while the pioneering announcements of reshoring have grabbed headlines, evidence remains largely anecdotal, with signs of en masse industry onshoring yet to emerge. Having said that, we believe that some industries may be primed for a comeback home[2] over the coming decade. However, these industries tend to be more capital-intensive with any future contribution to overall employment expected to be somewhat muted. In other words, jobs that will come back are not the same jobs that were lost. Moreover, the near six million positions eliminated during the last decade are unlikely to be fully made up – at least not in the foreseeable future.

TRIPLE BOOST FOR U.S. IMPORTS FROM CHINA



Source: Census Bureau, TD Economics

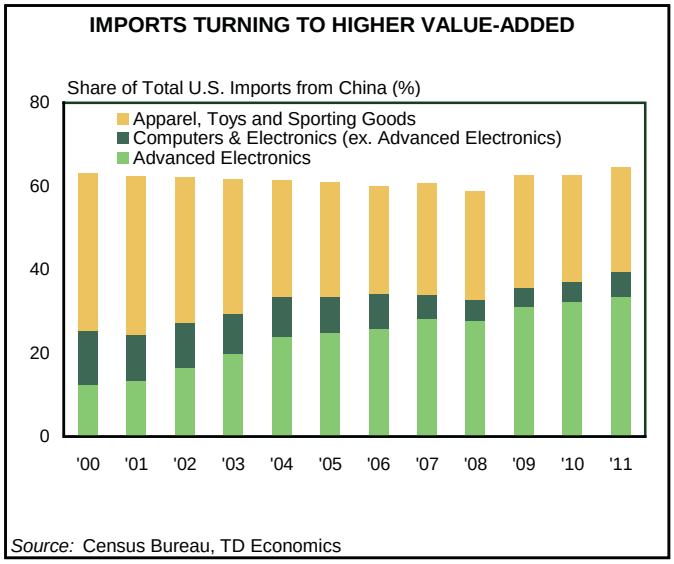
Box 1: Behind the Scenes

Below we clarify a number of concepts relevant to this report. Firstly, while the tradable category is no longer limited to "things you can put in a box and ship" with numerous services being offshored and onshored, the focus of this report will be on manufactured goods only, as it is the sector which appears to be benefitting most from the slowdown in offshoring activity. Secondly, while the arguments of the report can be extended to developing countries more broadly, the examples will largely concentrate on China, or more formally, the People's Republic of China, given its status as a de facto offshoring destination for more than a decade, and the sheer magnitude of its trade linkages with the United States. Thirdly, onshoring and offshoring are two sides of the same coin, with onshoring merely the opposite of offshoring. Having said that, increased offshoring activity may lead to actual job cuts in America, but could also manifest itself only through "the absence of domestic job gains" alongside increased domestic consumption. Lastly, on/offshoring is defined in net terms, with jobs lost to offshoring for import-substitution purposes subtracted from jobs related to producing goods destined for export to China. According to this definition, an industry would be considered more highly offshored the more negative its job on/offshoring level. In the same vein, an industry with a positive job on/offshoring level would be a net onshorer, with more jobs supporting exports to China than were lost to Chinese imports.

Made in China no longer just toys and clothing

In the early eighties, China developed a toehold in the American consumer market through low-valued, labor intensive goods – such as clothing and toys. This was facilitated through tariff reductions stemming from the U.S. reinstating China's Most Favorable Nation (MFN) trade status.[3] Trade accelerated further with the establishment of export-oriented Special Economic Zones (SEZ) and Coastal Development Areas by Chinese authorities. These regions were designed to encourage foreign direct investment through generous tax incentives, limited regulation, access to cheap industrial land and transport infrastructure, and an abundant and flexible low-wage labor force.

The subsequent era of rapid economic development, coupled with transfers of knowledge and technology, allowed developing world manufacturers to move up the



value-added chain and compete in a wider range of products with American-based producers. Still, by the mid-90's, 60% of all imports from China consisted of just clothing and toys, with just 25% in the higher value-added categories such as machinery, electrical equipment, and computers & electronics. By the turn of the century, these shares were nearly equalized at 42% and 38%, respectively, and continuing to shift toward higher value-added goods.

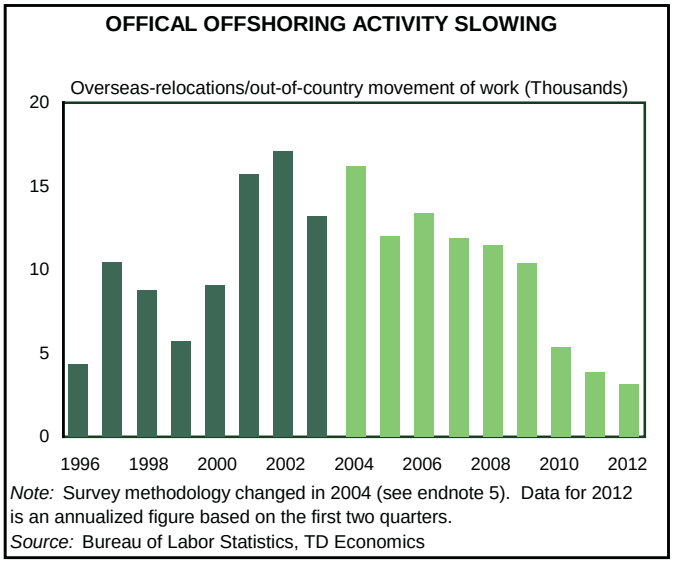
At this point, domestic economic conditions intersected with international developments making it increasingly difficult for U.S.-based manufacturers to compete in the absence of finding cheaper production methods. In 2001, tariffs were reduced with China's accession to the World Trade Organization (WTO).[4] This helped to feed into rapid Chinese growth in an expanding range of industries, alongside the ongoing transfer of more advanced technologies and improvements in transportation and telecommunication techniques. In the face of low-cost competition in an expanding range of products, America's manufacturers were left with few options. Unless they were able to boost productivity or move into niche markets, they often had to shift some or all of their production offshore. This was especially true in the wake of the recovery from the 2001 recession, with many operations downsized or shuttered during the recession expanded offshore instead. We estimate that this trend peaked around mid-decade, as recovering domestic demand was increasingly satiated through imports, resulting in a recovery completely devoid of a cyclical manufacturing employment rebound.

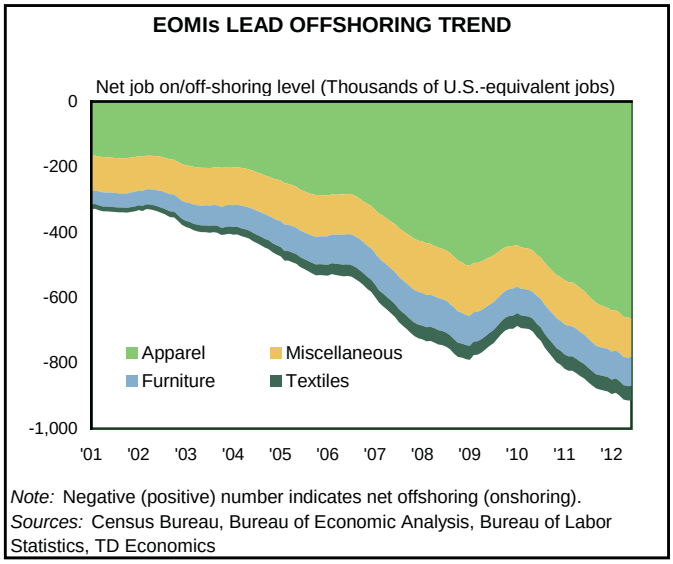
The remainder of the decade saw manufacturing imports from China surge threefold. Furthermore, computers & electronics, including advanced technology products, grew at an astounding pace and became China's top export to the U.S. by a wide margin. At the same time, domestic manufacturing employment continued to dwindle, before finding its footing at the onset of this decade.

Sizing up job offshoring

Of the 5.3 million manufacturing jobs lost since the turn of the century, we estimate that roughly 1 million were from the direct effects of offshoring to low-cost China. However, you won't find this estimate in any formal data sets. Official figures on jobs lost to offshoring are limited and consist of the Mass Layoff Statistics from the Bureau of Labor Statistics. These numbers suggest that between 2004 and 2010, about 75,000 manufacturing jobs were moved out-of-country. Additionally, in the 2000-03 period, offshoring amounted to about 55,000 lost manufacturing positions. While these two numbers are not strictly additive, due to methodology differences in the survey,[5] they suggest the consequence of offshoring was limited. However, these statistics grossly underestimate the full impact because they do not account for layoffs that eliminated less than 50 positions, businesses which downsized or closed outright due to offshore competition without offshoring operations themselves, or indirect impacts of suppliers downsizing or closing because their main client offshored.

In order to capture these dynamics we develop an in-house monthly-frequency measure of on/offshoring based on trade flows and domestic industrial production data. This measure, designed as a proxy for the number of jobs offshored (and onshored) is timely as it becomes available as





Note: Negative (positive) number indicates net offshoring (onshoring).
Sources: Census Bureau, Bureau of Economic Analysis, Bureau of Labor Statistics, TD Economics

trade data is released. The methodology behind developing the measure is described in greater detail in the appendix.

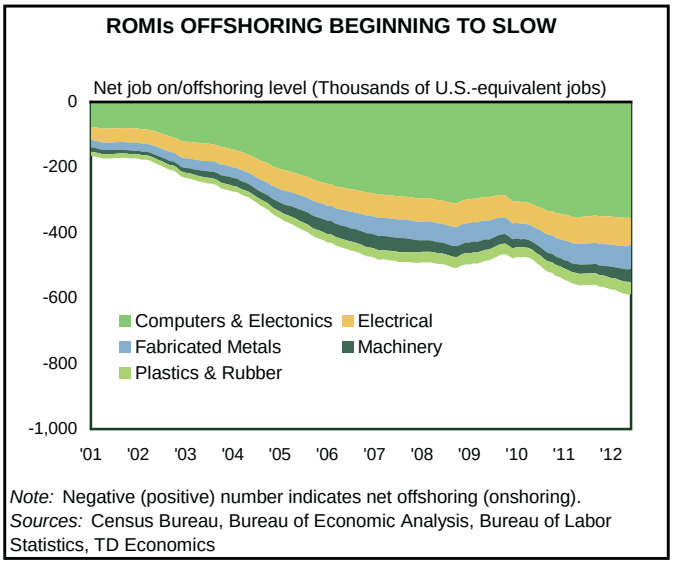
When discussing offshoring it is important to consider both sides of the coin. For instance, offshoring is typically viewed as the substitution of domestic production by imports. But, by the same token, a number of American jobs are directly involved in making products destined for abroad – U.S. exports to China can be thought of as offshoring of Chinese jobs to America, or U.S. onshoring. Therefore, to get the true picture of offshoring, we net off[6] this influence by subtracting jobs lost to import offshoring from jobs sustained by exports. This measure, referred to as the job net-on/offshoring level, or simply job net-onshoring level, will be negative for net-offshorers and positive for net-onshorers. Also, our estimates are intended to quantify direct manufacturing job losses only, and do not account for the spillover effects to other sectors of the economy. However, this shortfall may be offset by industry-based estimates not accounting for aggregate sector productivity gains, accruing from offshoring or trade, and manifested in the changing composition of domestic manufacturing.[7]

The numbers, presented in detail in the appendix table, suggest that by the end of 2000, the level of imports from China already accounted for about 560,000 lost manufacturing jobs. At the same time, about 52,000 domestic manufacturing jobs were needed to support the production of exports to China. Hence, the net job onshoring level as of December 2000 was -507,000 equivalent domestic positions, or nearly half-million net jobs offshored. This amounted to approximately 3% of U.S. manufacturing production. The net onshoring level remained largely unchanged during the 2001 recession, before tripling during the subsequent recovery. Net offshoring activity averaged about 156,000 jobs per year between 2004 and 2007 and peaked at just under 200,000 jobs per year. In total, the number of jobs offshored due to imports from China between 2001 and mid-2012 is estimated at 1.16 million, or less than a quarter of the manufacturing job losses sustained in that period. At the same time, about 123,000 new jobs were created to support the growing exports to China, reducing the offshoring job losses to a net of approximately one million.[8]

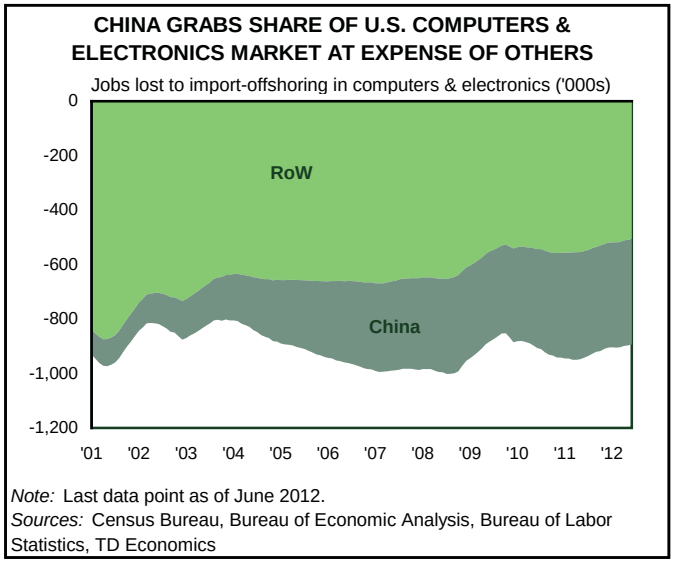
Clothes do offshoring make... and computers do too

Let us now consider the net-offshoring impact on individual industries. As of the end of 2000, approximately 324,000, or nearly two out of every three jobs already net-offshored to China were in four of the lowest value-added sectors. These were the first to be offshored in the eighties and nineties. This early-offshored manufacturing industry (EOMI) group consists of apparel, textiles, furniture and other miscellaneous products.[9] The loss of jobs to Chinese net-offshoring from this group of labor-intensive industries amounted to 592,000 (of the one million tally) in the subsequent twelve years. The brunt of the losses – roughly half-million – was incurred by the apparel industry, which is the least-productive of all manufacturing industries at less than half of average sector productivity.

The remaining 427,000 net-offshored jobs over the past twelve years were in a category we refer to as the recently-offshored manufacturing industries, or ROMIs. This group consists of computers & electronics, fabricated metals, electrical equipment, machinery, and plastics & rubber prod-



Note: Negative (positive) number indicates net offshoring (onshoring).
Sources: Census Bureau, Bureau of Economic Analysis, Bureau of Labor Statistics, TD Economics



ucts. The computer & electronics industry is of particular importance, as it alone net-offshored nearly 278,000 jobs, or about 40% of the job losses sustained in that industry since 2001. The remaining nine industries contributed negligible amounts to the net-offshore tally. We refer to this group as not-substantially offshored manufacturing industries (NSOMIs). Within this group, minor net-offshoring in non-metallic minerals, printing, and wood industries is largely balanced by net-onshoring in transportation equipment and primary metals.

Just to show that it's not all a one-way street, industries such as transport equipment and primary metals substantially reduced their net-offshoring vis-à-vis the rest of the world (RoW) during the same period, contributing an equivalent of over one-hundred thousand jobs.[10]

Others were not immune to China either

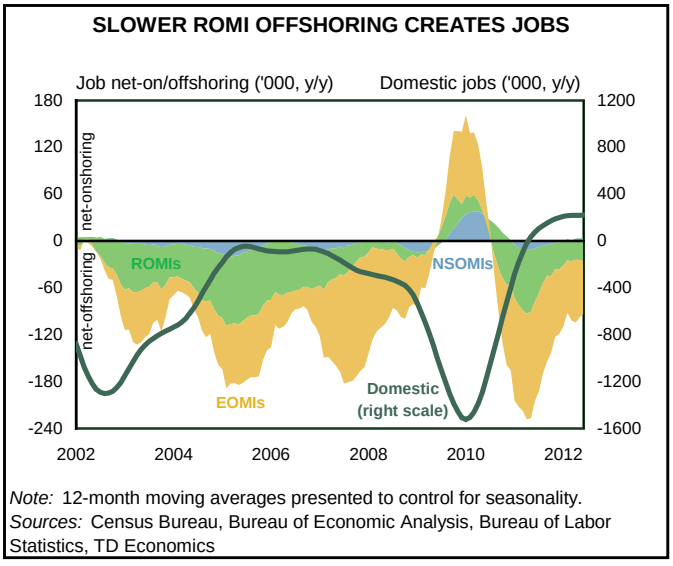
Although our discussion in this report is focused solely on American jobs lost to offshoring to China, we couldn't help but notice interesting trade patterns with RoW. It was not just America that shipped production (and hence jobs) to China. China's comparative advantages also drew jobs away from other countries, particularly within broader Asia. For instance, in the case of computers & electronics, furniture, and textile industries, increased U.S. imports from China merely substituted for imports from elsewhere. In fact, total U.S. *import-related worldwide offshoring* in the computers & electronics industry is nearly identical in number to what it was over a decade ago, with approximately 900,000 jobs offshored for computers & electronics imports. Thus, while U.S. electronics imports from China rose, the RoW imports declined, with China in effect pulling export-production from other countries such as Japan, Korea, Taiwan, etc. Moreover, China's competitive advantage in computers & electronics crowded-out U.S. electronics exports to RoW, rendering China a de facto global electronics manufacturing hub. Hence, job losses sustained over the past decade in the U.S. computers & electronics industry *were not due to increased U.S. imports, but rather decreased U.S. exports* of computers & electronics worldwide.

Slowing offshoring contributing to job growth

The good news is that net-offshoring activity to China appears to have decelerated in recent months to about 100,000 jobs lost per year, with the majority of the current activity in the apparel industry. This figure is approximately 56,000 job losses per year lower than during the 2004-07 period of substantial net-offshoring activity. The number is further confirmed by regression analysis over the last decade, controlling for business cycles. This leads us to conclude that about one-quarter of the 200,000 job gains in the past year can be attributed to the slowing net-offshoring trend to China. Furthermore, we believe this slowdown in net-offshoring is not a one-off impact that the industry 'lucked' into, but rather the beginning of a more persistent trend, as offshoring becomes less attractive.

Offshoring looses some appeal

In the past two decades, the world economy has undergone a significant transformation, as economies evolved and trade expanded. Recessions, oil shocks, technological advances and the rapid expansion in the emerging world

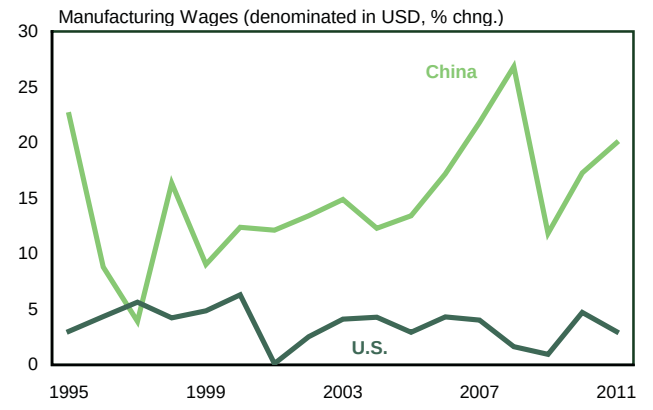


have changed the playing field for businesses. Cost-benefit analysis of domestic versus overseas production – once a 'no brainer' for many firms – has become more complex. The subsequent paragraphs outline some of the factors that are providing American manufacturing with a competitive edge, and may end up tipping the scales for some previously offshored industries.

i. I Robot

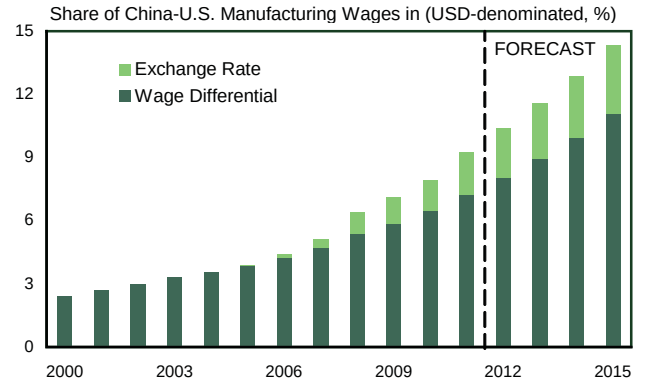
Wages in developing countries are rising at a considerable speed. At the turn of the century, average Chinese manufacturing wages were roughly one-fortieth of their American counterparts. Since then, wage inflation in China averaged 12.8%, or more than triple the pace in the United States, with Chinese manufacturing wages rising to about one-tenth of their U.S. equivalent this year. Wage gains have continued to accelerate in recent years in the coastal, and more-recently, interior labor markets. Moreover, rapid wage increases are likely to continue at a 15-20% clip in the coming years. At this pace, the share of Chinese to U.S. manufacturing wages will rise to a non-negligible 15% of American wages by 2015 and the gap is expected to narrow through the foreseeable future. Furthermore, this aggregate ratio likely understates the true figure, as it does not account for compositional differences between the Chinese and U.S. industries. Since China produces a far larger share of low-wage products than the U.S., industry-specific comparisons are more relevant. For instance, all-in wages in coastal areas of China specializing in computers & electronics and transportation equipment production may approach one-quarter of wages in southern U.S. by 2015.[11]

CHINA MFG WAGES OUTPACING U.S.



Sources: Bureau of Labor Statistics, China National Bureau of Statistics, TD Economics

CHINA MANUFACTURING WAGES CATCHING UP



Note: Chart disaggregates impact of wage growth differentials and exchange rate movements relative to USD-CNY rate, fixed between 1996 and mid-2005.
Sources: Bureau of Labor Statistics, China National Bureau of Statistics, State Administration of Foreign Exchange, TD Economics

More importantly, labor productivity growth in China has not kept pace with the rapidly increasing wages. This has led Chinese unit labor costs (ULC) to double between 2001 and 2011. In contrast, the U.S. economy experienced a rise in ULC of less than 10% in the same time period.

The shrinking wage gap will impact both highly labor-intensive industries as well as ones which are more technologically advanced, but the outcomes are likely to differ. Rising Chinese costs will motivate labor-intensive firms to further maximize productivity (leading sometimes to sweatshop-type activity given their low-technology processes) or seek ever cheaper labor markets elsewhere. Industries affected are likely in the EOMI group of apparel, other miscellaneous goods, textiles, and to lesser extent, furniture. Due to their labor-intensity, wages will continue to be a key determinant of location, with production likely continuing in low-cost countries. Rising labor costs in coastal China will not result in any significant shift towards onshoring, and are instead likely going to push them further inland, or further offshore to Vietnam, Indonesia, Cambodia, etc.

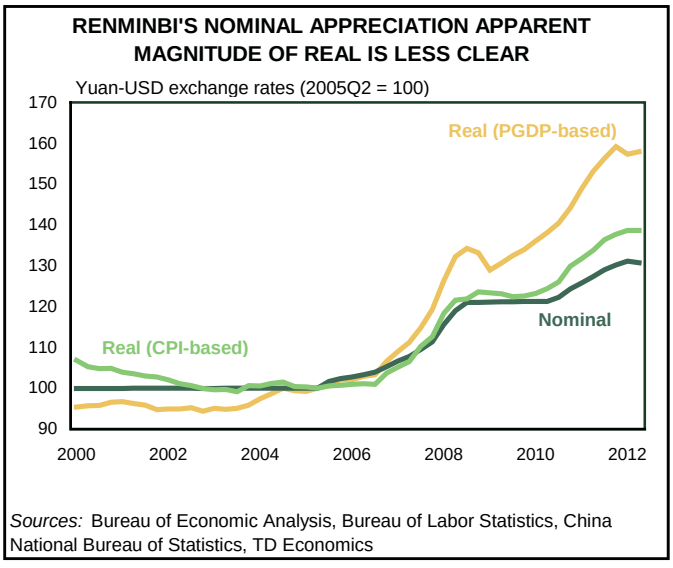
On the other hand, the more capital-intensive industries part of the ROMI group – like computers & electronics, machinery and electrical equipment – may attempt to add capital to increase productivity. Already, some firms have announced plans[12] to replace part of their Chinese workforce by robots over the next several years as wage hikes make automation increasingly affordable. But, this trend will only serve to make these industries less labor-intensive and thus diminish the benefits of producing offshore in the first place. With industrial land prices higher in parts of China than in southern U.S.[13] and accounting for other costs related to

offshoring these developments may be enough to start tipping the scales in favor of domestic production.

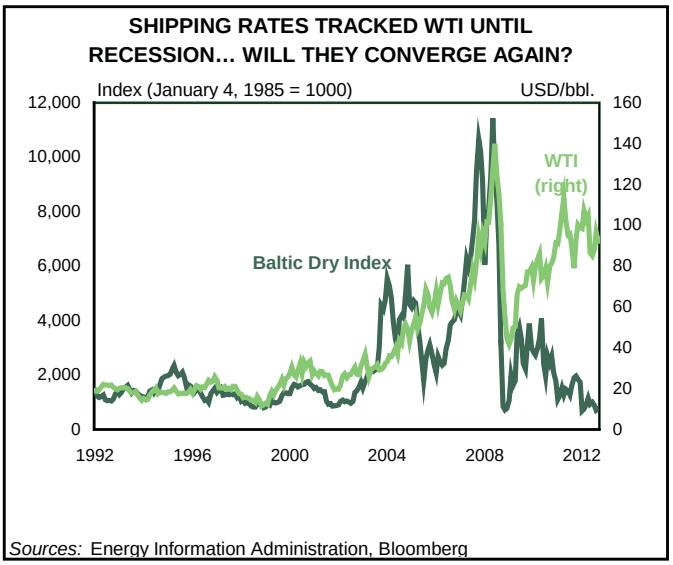
However, it's important to bear in mind that any tipping of scales is unlikely to bring jobs home of the magnitude in which they were reduced. Increasing capital-intensity has been at the core of manufacturing for decades as a way to boost productivity and competitiveness in the highly tradable sector. The broad trend continues across all manufacturing industries, regardless of the level of offshoring. In the last two decades, as U.S. labor-hours declined by one-third, real capital in the sector rose by 44% while real equipment stock increased by 80%. This staggering deepening of capital is not expected to reverse and should continue unabated as advances in automation are making robots cheaper and enabling them to handle more complex tasks. While this serves to diminish the importance of labor-cost differentials in offshoring decisions, it also means that operations moved back home would equate with fewer workers than those which were initially reduced due to offshoring.

ii. Yuan step at a time

Currency shifts are also escalating made-in-China costs. Following the effective devaluation of the renminbi in 1994, when the official and swap rates were unified, the yuan was pegged at a rate of 8.3 to the U.S. dollar through June 2005. In the following month, the dollar peg was replaced with a link to a basket consisting of four main currencies: U.S. dollar, euro, yen, and the Korean won; and the yuan allowed to appreciate against it at a measured pace. Since June 2005, the Chinese currency rose versus the greenback by 31% in nominal terms, and nearly 40% in real terms,



Sources: Bureau of Economic Analysis, Bureau of Labor Statistics, China National Bureau of Statistics, TD Economics



Sources: Energy Information Administration, Bloomberg

significantly augmenting the effective USD-denominated unit labor costs in China.

Still, most estimates based on purchasing power parity peg the renminbi as undervalued. This should put pressure on China to allow continued appreciation of its currency against the greenback, further narrowing future ULC differentials between China and America and weakening the case for offshoring from a labor cost perspective. It is important to note, however, that any impact of real renminbi appreciation should be taken in the context of value-added content, as U.S.-bound Chinese exports typically contain only 20-30% of Chinese content.[14] The remainder is raw materials and energy which are effectively shielded from the USD-CNY movements by being produced elsewhere, or denominated in USD. Still, the greenback has fallen vis-à-vis most of its trading partners over the last few years. This makes American producers across all manufacturing industries more competitive in world markets, providing additional incentive for producing at home, with benefits of employment gains especially across the ROMI and NSOMI groups.

iii. Short and lean looking good

Producing goods thousands of miles from their intended market also embodies costs. Some of these are easily quantifiable such as the cost of freight. For instance, shipping costs increased as much as tenfold between 2002 and 2008. They have since retreated to near record lows under the current global economic backdrop and the increased supply of ships commissioned during boom years. But, the inherent volatility can be costly to firms. Likewise, shipping rates are unlikely to remain at current levels and are expected to

rise when global economic growth accelerates.

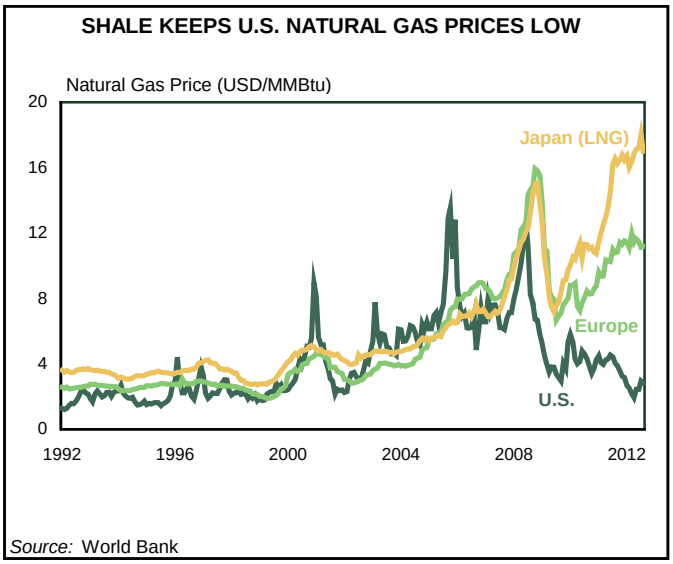
However, perhaps more important is that distant shipping routes increase the required size of a firm's inventories tying up valuable capital. This opportunity cost can be especially detrimental for firms that use credit to fund inventories. Credit conditions have eased somewhat since the recession but remain elevated – especially for small and medium-sized businesses. This, in effect, raises the cost of holding inventory, favoring shorter and leaner supply-chains.

Leaner inventories have also proved beneficial for firms which are facing increasing levels of volatility in demand. The oscillating demand picture has resulted from an uneven recovery that has made consumers increasingly cautious. Lean inventories increase flexibility in reacting to changing demand conditions and provide an additional edge to businesses with short lead-time supply chains. The reasons listed above will make production closer to home beneficial for most industries, with the furniture industry, in particular, expected to make some onshore or near-shore inroads given the high weight-to-value of its products and the resulting high relative transport costs.

Another transportation cost, somewhat challenging to calculate, relates to the risks associated with unforeseen events. These can range from delays or damage, through political or labor unrest, to tail-risk events such as natural disasters. While producing at home does not eliminate these risks, it tends to mitigate some of them. Transportation delays are typically shorter and the more direct the journey from factory to market, the less that can typically go wrong. The U.S. is also not immune to natural disasters, but any supply-disruption will likely be at least somewhat offset by some moderation in demand as well as existing inventories. This was highlighted in the Japanese automakers' loss of revenue and market share following the tragic earthquake and tsunami last March, while massive floods in Thailand brought to the forefront the inherent risk of concentrated supply chains.

iv. Mass-production vs. mass-customization

Firms choosing to offshore production often separate it from research and development and final quality control units. These often remained domestic due to the availability of skilled labor with knowledge of local needs and the overall economy. This business model may be suitable for production of relatively simple products which do not undergo substantial development. But, the trend towards mass customization requires more agile manufacturing, via flexibility in production and closer ties to research and development (R&D). China's ranks of skilled engineers and scientists are quickly swelling but America still has an advantage on this front, which should entice firms to consider onshoring. Producing at home has an additional advantage of intellectual property (IP) protection, which is severely lacking in China and many other developing nations. There are plenty of anecdotal stories of suppliers turning into competitors, or third parties emerging to produce virtually identical products. These are sometimes blatant copies made in a factory across the street (or the same factory even), often exported alongside the original product at a lower price. Industries that stand to benefit most from IP protection and closer ties with R&D are computers & electronics, as well as machinery, fabricated metals, and electrical equipment.



v. Energy costs falling

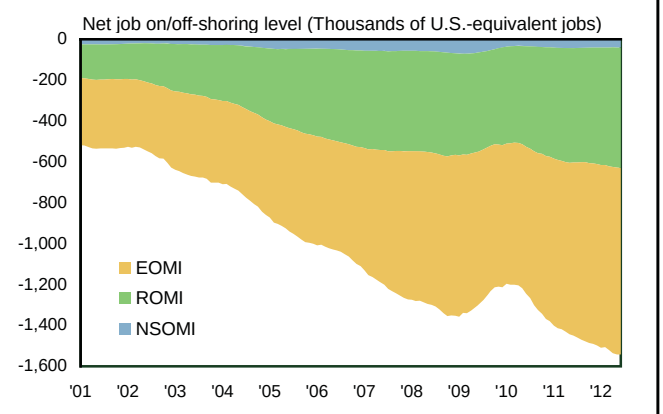
Recent years have yielded advances in hydraulic fracturing or 'fracking' technology resulting in a significant increase in proven natural gas reserves embedded in shale formations across North America. This has led to a sharp divergence of natural gas prices between the U.S. and the rest of the world. Recently, prices in the U.S. were roughly one-fourth of the European equivalent, and one-sixth of Japanese LNG imports. While price differentials many not remain so large due to planned LNG export terminals likely narrowing the gap somewhat, its abundance and proximity should continue to prove beneficial for American manufacturers. Cheaper natural gas will have an impact across all industries

by lowering production costs directly – approximately 28% of manufacturing sector energy is derived from natural gas[15] – and indirectly through electricity generation and lower refining costs. Across the entire manufacturing sector it should shave off $50 to $80 billion in energy input costs per year. While this amounts to about 2% of total intermediate input costs for U.S. manufacturing, the benefits are actually concentrated amongst several industries. These heavy-users include chemicals (which use it as an energy source but also as a feedstock), petroleum & coal, food & beverage, paper, and primary metals. These NSOMI sectors consume nearly 80% of all natural gas used in the manufacturing sector and stand to gain most in terms of competitive advantage vis-à-vis global counterparts.

Benefits will vary by region

The U.S. manufacturing revival will manifest itself differently across the country, with regional impacts dependent on the size of the manufacturing sector and concentration of individual industries. Growth will manifest itself through organic expansion for domestic- or export-markets, reduction of offshoring activity, or job creation related to onshoring. Whatever the source, choosing to produce domestically will require a globally competitive strategy based on efficient factors of production. Many of the industries flagged earlier for a potential comeback are in the ROMI group and include machinery, fabricated metals, plastics & rubber, and electrical equipment & appliances. They are most likely to position themselves in regions with competitive and flexible labor markets, affordable industrial land and existing transport infrastructure. Many may find themselves attracted to existing clusters around metro areas in the Mid-West (machinery), South (electrical), or the Rust-Belt (fabricated metals). Within the TD footprint, Pennsylvania and North Carolina stand to benefit most, with potential upside for South Carolina and Georgia. Already, NCR has moved production of ATMs to Georgia, while Coleman began producing its plastic coolers in Kansas.

EOMIs ACCOUNT FOR MOST NET-OFFSHORING



Note: Negative (positive) number indicates net-offshoring (net-onshoring).
Sources: Census Bureau, Bureau of Economic Analysis, Bureau of Labor Statistics, TD Economics

On the other hand, the most capital-intensive ROMI group industry – computers & electronics – may position itself in regions with close access to top research universities, a highly-skilled workforce, and access to venture capital. California is slated to benefit, while within the TD footprint, the most likely candidates appear to be Massachusetts and New York, with North Carolina also a possibility. Already, GlobalFoundries has opened a semiconductor plant in upstate New York, as part of a joint-venture with IBM.

Not-substantially offshored industries will also benefit, largely from increased export competitiveness resulting from productivity gains, a weaker dollar, and inexpensive natural gas. Regions expected to benefit from shale gas through their manufacturing base are ones which are home to gas intensive industries. These tend to use large quantities of it as energy or feedstocks and include petroleum & coal, chemicals, and primary metals. Their concentration is highest in the Rust-Belt (primary metals), South (petroleum & coal) and across East and Gulf Coasts (chemicals). Within the TD footprint Pennsylvania and West Virginia appear as top candidates. Already, an ethylene-cracker – shuttered as recently as 2009 – is being reopened by Dow Chemical while a new facility is planned by Shell Oil due to the benefit of shale gas access. These facilities will take advantage of gas from the Marcellus shale formation which contains relatively high ethane content. These chemical crackers will convert ethane into ethylene, later used by the plastics & rubber, petrochemical, and agriculture industries. In the interest of space the regional impacts will be explored in greater detail in a future report.

Conclusion

The resurgence of U.S. manufacturing employment since the trough of the Great Recession has been remarkable. The recent period of robust employment gains has been the longest since the early nineties, with the sector adding nearly half-million jobs since January 2010. Also, the recent pace of job gains in the sector has been highest in fifteen years. While much of the strength has been due to a cyclical rebound, especially in the automotive sector,

some can be attributed to the slowing trend of offshoring. In fact, approximately 56,000, or one-quarter of the jobs created over the last year is due to less firms moving production overseas. Changing global conditions are slowly beginning to erode China's advantages which have made it a manufacturing hub for many of the products consumed in America and elsewhere. The rapidly rising wages, which have been outpacing productivity gains, have steadily increased the unit labor costs of production. This is all the more apparent when accounting for the renminbi appreciation, both in nominal and real terms. Furthermore, risks associated with hauling goods across great distances together with volatile shipping costs and long lead-times have also contributed to the slowing trend. This is accentuated by a growing tendency towards customization and agile manufacturing. Moreover, the overarching trend of increased capital intensity has had a two-fold effect. Firstly, it has made labor-cost savings less important, weakening the case for offshoring. And secondly, it has accentuated the need for closer ties between production and R&D, benefits of IP protection, and potential security risks of producing offshore, thereby strengthening the case for onshoring.

Onshoring en masse is yet to emerge and unlikely to do so for the manufacturing sector as a whole, but the aforementioned factors are beginning to set the stage for a sustained deceleration in offshoring activity as well as improving the competitive position of industries that did not offshore, or NSOMIs. A gradual comeback may be possible in some industries over the coming decade. This is especially likely across the recently-offshored manufacturing industries, or ROMIs, which tend to be relatively more capital intensive, as well as furniture. Interestingly, future onshoring may not involve shuttering of factories in China's established industrial clusters, but rather diverting their output from North American to the rapidly growing Asian market. At the same time the U.S. market would begin to be served by factories at home employing American workers. But jobs onshored will not be of the magnitude or skill-level as the ones that were lost to offshoring in the first place. Also, the near six million jobs lost over the past decade is unlikely to be made up fully in the foreseeable future. New manufacturing jobs will require less labor-content and consist of high-skilled, highly-productive positions, in which America has a competitive advantage. Exploiting this advantage is the only way American manufacturing can attain meaningful and lasting progress thereby leading to the industry's rebirth.

Michael Dolega
Economist
416-983-0500

TABLES

TABLE: NET ON/OFFSHORING LEVEL AND ACTIVITY BY INDUSTRY

		Jobs gained to exports			Jobs lost to imports			Job net-on/offshoring level			Pace of on/offshoring activity		
		(Thousands)			(Thousands)			(Thousands)			(Thousands of jobs per year)		
	NAICS	Dec-00	Jun-12	Change	Dec-00	Jun-12	Change	Dec-00	Jun-12	Change	Mid-2000's	Current	Change
Apparel and Leather & Allied	315,316	0.8	4.6	3.8	161.9	665.8	503.9	-161.1	-661.2	-500.2	-60.7	-90.0	-29.3
Miscellaneous	339	1.0	7.4	6.4	106.9	129.0	22.1	-106.0	-121.6	-15.7	-8.2	10.8	19.0
Furniture & Related	337	0.2	0.7	0.4	40.2	87.4	47.2	-40.0	-86.7	-46.7	-10.6	5.2	15.9
Textile Mills and Textile Product Mills	313,314	0.7	2.3	1.6	15.5	46.6	31.2	-14.8	-44.3	-29.5	-4.8	0.2	5.0
EOMI		**2.7**	**14.9**	**12.2**	**324.5**	**928.8**	**604.3**	**-321.8**	**-913.9**	**-592.1**	**-84.3**	**-73.8**	**10.5**
Computers & Electronics	334	15.3	34.5	19.2	89.2	386.6	297.5	-73.9	-352.2	-278.3	-42.2	-3.2	39.0
Electrical Equipment	335	2.1	6.3	4.3	41.9	93.5	51.6	-39.8	-87.2	-47.3	-5.5	-5.7	-0.1
Fabricated Metals	332	1.9	7.9	6.0	23.3	79.3	56.1	-21.3	-71.4	-50.0	-6.2	-7.3	-1.1
Machinery	333	10.3	31.8	21.6	23.4	71.5	48.0	-13.2	-39.6	-26.4	-7.4	-9.5	-2.1
Plastics & Rubber	326	0.9	3.8	2.9	13.6	41.9	28.2	-12.7	-38.0	-25.3	-3.3	-2.2	1.1
ROMI		**30.5**	**84.4**	**53.9**	**191.4**	**672.7**	**481.3**	**-160.9**	**-588.3**	**-427.4**	**-64.6**	**-27.9**	**36.7**
Food and Beverage & Tobbaco	311,312	1.8	8.2	6.4	1.7	6.7	5.0	0.1	1.4	1.4	-0.2	0.1	0.3
Wood	321	0.5	3.8	3.3	5.3	14.1	8.7	-4.8	-10.3	-5.4	-1.5	1.0	2.5
Paper	322	2.1	6.4	4.3	2.3	7.3	5.0	-0.2	-0.8	-0.7	-0.6	0.4	1.1
Printing & Related	323	0.5	0.9	0.4	5.2	12.6	7.4	-4.7	-11.6	-6.9	-1.3	0.2	1.5
Petroleum & Coal	324	0.0	0.2	0.1	0.1	0.0	-0.1	-0.1	0.1	0.2	0.0	0.0	0.0
Chemicals	325	5.2	16.6	11.4	3.6	19.3	15.7	1.6	-2.8	-4.4	-0.2	-1.4	-1.3
Non-Metalic Minerals	327	1.0	2.1	1.1	13.7	23.4	9.7	-12.7	-21.3	-8.6	-1.1	-1.4	-0.3
Primary Metals	331	1.5	5.4	3.9	4.5	7.3	2.8	-3.0	-1.9	1.1	-1.0	-1.4	-0.4
Transportation Equipment	336	6.7	33.0	26.3	7.3	26.3	19.0	-0.6	6.7	7.3	-1.3	4.5	5.8
NSOMI		**19.4**	**76.6**	**57.2**	**43.8**	**117.0**	**73.2**	**-24.4**	**-40.4**	**-16.0**	**-7.3**	**2.0**	**9.3**
Total Manufacturing	**31-33**	**52.5**	**175.9**	**123.4**	**559.7**	**1,718.6**	**1,158.9**	**-507.2**	**-1,542.7**	**-1,035.5**	**-156.2**	**-99.7**	**56.5**

Sources: Census Bureau, Bureau of Economic Analysis, Bureau of Labor Statistics, TD Economics

TABLE: INDUSTRY EMPLOYMENT AND OUTPUT DETAILS

		Employment						Output (value-added)	Value-added per hour	Relative size (hours)	Relative size (output)
		(Thousands)						$billions	$/hr	%	
	NAICS	Level (Jan-90)	Level (Jan-00)	Level (Jun-12)	Chng. (1990-00)	Chng. (2000-Jun12)	Chng. (y/y,Jun-12)	(2010)		(2010)	
Food and Beverage & Tobbaco	311,312	1,726	1,767	1,661	41	-106	16	207.4	62.0	13.9	12.2
Textile Mills and Textile Product Mills	313,314	747	616	233	-131	-383	-6	15.6	32.6	2.0	0.9
Apparel and Leather & Allied	315,316	1,075	575	177	-500	-398	-4	11.8	33.5	1.5	0.7
Wood	321	557	625	329	68	-296	-4	22.3	32.2	2.9	1.3
Paper	322	647	609	392	-38	-217	1	56.6	66.9	3.5	3.3
Printing & Related	323	806	807	456	0	-351	-13	31.7	33.3	3.9	1.9
Petroleum & Coal	324	152	123	113	-29	-10	1	171.8	687.3	1.0	10.1
Chemicals	325	1,036	985	798	-51	-187	11	226.1	135.7	6.9	13.3
Plastics & Rubber	326	824	957	647	134	-311	15	66.5	49.4	5.6	3.9
Non-Metalic Minerals	327	540	552	362	12	-191	-6	35.1	45.9	3.2	2.1
Primary Metals	331	688	625	409	-63	-216	18	43.2	53.6	3.3	2.5
Fabricated Metals	332	1,620	1,730	1,407	110	-323	57	120.6	45.2	11.1	7.1
Machinery	333	1,423	1,453	1,106	30	-348	49	139.7	66.0	8.8	8.2
Computers & Electronics	334	1,940	1,782	1,109	-158	-672	2	264.9	116.1	9.5	15.6
Electrical Equipment	335	648	590	374	-57	-216	7	44.2	58.9	3.1	2.6
Transportation Equipment	336	2,066	2,092	1,461	26	-631	84	126.5	43.2	12.2	7.4
Furniture & Related	337	617	678	349	61	-329	-5	29.5	41.8	2.9	1.7
Miscellaneous	339	684	726	583	42	-143	6	88.6	78.3	4.7	5.2
Miscellaneous (Medical)	3391	284	306	317	23	10	5				
Miscellaneous (Other)	3399	405	425	266	20	-159	0				
Total Manufacturing	**31-33**	**17,796**	**17,292**	**11,962**	**-504**	**-5,330**	**224**	**1701.9**	**70.7**	**100.0**	**100.0**

Sources: Bureau of Economic Analysis, Bureau of Labor Statistics, TD Economics

APPENDIX

Construction of job net-on/offshoring level

In order to estimate the impact of offshoring (and onshoring) on manufacturing jobs we must convert the trade figures to equivalent jobs. Imports from country *c*, for instance, can be thought of in terms of jobs lost as a result of the manufacturing work required to produce imported goods no longer performed domestically, but instead in country *c*. For each industry *i*, the quantitity of jobs lost in due to import-substitution from country *c* will then be a function of: total U.S. industry *i* imports from country *c*, nominal gross-output of domestic industry *i*, and the number of employees in industry *i*, *or*:

$$jobs\_lost\_to\_imports_{c,i} = \frac{imports_{c,i}}{(gross\text{-}output_i/employment_i)}$$

The nominal gross-output per worker measure of productivity is admittedly not a perfect one. However, it is a necessary one for the sake of consistency, as trade data are expressed in current-dollar, gross-output terms. In the same vein, we calculate the jobs gained in industry *i* from (or supported by) exports to country *c* as:

$$jobs\_gained\_from\_exports_{c,i} = \frac{exports_{c,i}}{(gross\text{-}output_i/employment_i)}$$

Thus, the net job on/offshoring level to country *c* in industry *i* is defined as the difference of these two measures, or:

$$net\_jobs\_on\text{-}offshored_{c,i} = jobs\_gained\_from\_exports_{c,i} - jobs\_lost\_to\_imports_{c,i}$$

Thus, any industry with a positive net job on/offshoring level would be a net onshorer, such as transportation equipment. In this industry, exports to China support more jobs than have been lost due to imports from China. A negative net job on/offshoring level industry, like computers & electronics, on the other hand has sustained far more job losses due to imports from China than the exports there are supporting. The more negative the level, the more of an offshorer the industry is. The more positive, the more of an onshorer.

The industry on/offshoring level will change as trade patterns change. For example, the computers & electronics industry net-offshored 278,000 jobs since December 2000. This is manifested in its on/offshoring level falling from -89,000 jobs to -352,000 jobs. It has become even more offshored. On the other hand, transportation equipment has net-onshored 7,300 jobs since December 2000, with it's net on/offshoring level rising from -600 to 6,700 jobs.

Lastly, we can also look at the pace of activity which could be positive, negative, or zero at any given point in time. For instance, furniture & related industry is currently (over the last six months ending June 2012) bringing 5,200 jobs per year back home (a positive figure). But in the mid-2000's it was loosing 10,600 thousand to offshoring (the pace of on/offshoring was negative then).

Making it more timely

The concepts presented above, while helpful in analysing longer-term trends, fail to allow for analysis of more recent movements due to the fact that GDP by industry data – unlike trade which is monthly – is published at an annual frequency. In order to remedy that shortcoming – and to allow for analysis of very recent history – we develop a GDP by industry measure at a monthly frequency. While both value-added and gross-output measures are constructed, it is the gross-output measure that is used here for consistency with trade data.

Generating the gross-output GDP by industry is done by regressing each industry annual gross-output on annual averages of industrial production for each industry as well as industry-specific deflators, or:

$$gross\text{-}output_i = beta_{0,i} + beta_{1,i} * IP_i + beta_{2,i} * deflator_i$$

The estimated coefficients ($beta_{0,i}$,$beta_{1,i}$,$beta_{2,i}$) are then used to construct the monthly gross-output measure by substituting in monthly industrial production and monthly deflator data. The constructed measure was backtested by annualizing and comparing to actual annual data, with satisfactory accuracy. Constructing this measure and using together with the published trade data allows us for a more timely measure and enables ongoing analysis of on/offshoring trends.

Endnotes

1. Employment data for the most recent two months (August and September) indicated modest declines. We feel that this is a temporary cyclical setback, caused by the broadening global slowdown, which should reverse as the world economy continues on its path of recovery.
2. In addition to onshoring, near-shoring exists as a compromise for firms who choose to pull the plug on Asian-offshoring – due to transport or other costs – but still want the benefits of cheap labor. For instance, China's manufacturing wages in its coastal regions have recently exceeded all-in wages in Mexico's free trade maquiladora zones near the U.S. border, making these zones attractive alternatives for some businesses.
3. China's Most Favorable Nation (MFN) trade status had been suspended as per the Trade Agreements Extension Act of 1951, aimed at the then Sino-Soviet bloc. After it was reinstated in 1980, China's MFN status was conditional and had to be renewed annually until 2000. Renewal required the President to waive the Jackson-Vanik freedom-of-emigration amendment to the 1974 Trade Act. For more details see Pregelj, Vladimir N. "Most-Favored-Nation Status of the People's Republic of China," 2001 Congressional Research Service Report for Congress.
4. China's accession to the World Trade Organization was contingent on the U.S. making permanent China's temporary MFN status which by then had been renamed to Permanent Normal Trade Relations status.
5. Between 1995 and 2003 an "overseas-relocation" was a reason for layoffs/separations. Since 2004, the survey was modified with "out-of-country movement of work" instead considered an effect of another economic reason for layoffs/separations. Detailed description of the survey can be found in: Brown, Sharon. "Mass Layoff Statistics Data in the United States and Domestic and Overseas Relocation," presented at the EU-US Seminar on "Offshoring of Services in ICT and Related Services," Brussels, Belgium, December 13-14, 2004.
6. Analysis based on offshoring related to imports only (without netting jobs supporting exports) does not materially change the findings of the report.
7. Industry-based estimates neccesarily fail to account for across-sector labor productivity gain from trade or offshoring. This is a consequence of simple arithmetics, as lower-productivity sectors are offshored to a larger extent than higher-productivity sectors – as has been the case over the past decade – leading to higher productivity for the sector as a whole.
8. This value does not account from the productivity gains from trade. Accounting for these gains – by allowing industry shares to vary from their 2001 levels – the estimated number of jobs offshored to China is reduced from a net trade figure of one million to about 400 thousand, with the remaining 600 thousand due to the benefits of comparative advantage, by having trading partners produce what they can relatively cheaper. This adjusted impact of net Chinese offshoring is essentialy offset the reduction of net offshoring in the rest of the world during the same period. In summary, it appears that on a net trade basis and accounting for productivity, the worldwide number of jobs offshored by the U.S. economy remained largely unchanged over the past twelve years, with merely the sources of the imports changing with net manufacturing trade gains made by China roughly equal to the net manufacturing trade losses of the rest of the world. Lastly, while the inter-sectoral compositional changes have led to substantial benefits according to our crude nominal gross output per employee measure of producitivty, it is worth noting that this measure evolved in a similar manner to the real value added per employee, with the measures advancing by a combined 82.4 and 80.5 between 2000 and 2011, respectively.
9. The miscellaneous manufactured product industry is not homogenous, and can be sub-divided into medical equipment manufacturing and other miscellaneous products. While the latter includes the heavily offshored toys and sporting goods which will continue to be offshored, the former is highly-specialized and its strong domestic growth may lead to a reduction in net offshoring for the category as a whole. For the purpose of the report we cannot disaggregate this industry due to limitations of GDP by industry data, which is not available at higher than the 3-digit NAICS level.
10. Some of the net offshoring to China was more of a case of substituting Chinese imports for rest-of-world (RoW) imports rather than domestic production. Since 2001, declines in RoW net offshoring brought back 125k jobs, somewhat offsetting the impact of Chinese offshoring on U.S. manufacturing jobs.
11. The Boston Consulting Group. "Made in America, Again," August 25, 2011.
12. See Reuters "Foxconn to rely more on robots; could use 1 million in 3 years" http://www.reuters.com/article/2011/08/01/us-foxconn-robots-idUS-TRE77016B20110801 or The Economist "Robots Don't Complain" http://www.economist.com/node/21525432. Last retrieved on August 14, 2012.
13. *Ibid.* 11
14. Holtz-Eakin, Douglas. "The Chinese Exchange Rate and U.S. Manufacturing Employment," CBO testimony before the Committee on Ways and Means, U.S. House of Representatives, October 2003.
15. U.S. Energy Information Administration. 2010 Manufacturing Energy Consumption Survey. Released March 28, 2012.