LINKS ANALYTICS

Global Systemic Risks

2014

GLOBAL SYSTEMIC RISKS

2014

a LINKS Analytics annual review

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KEY FINDINGS

Global

2013 was marked by shifting systemic risks from Asia to the US.

US

Farmland and natural gas bubbles have spread into the related industries. Asset bubbles developing in the pipelines, rail and petrochemicals make the US the source of greatest systemic risk…

Japan

Japanese banks have restructured their balance sheets away from JGB's. They are no longer vulnerable to the domestic bond market meltdown.

China

Over $900 billion has been wiped out off the market capitalization in Chine since the beginning of the bubble. While things may deteriorate further, risks are now understood, while expectations are low.

Asia

Funded by market interventions of export finance agencies, Asian low-cost airlines continue to add more aircraft asset. Civil aerospace is one of the few true bubbles intact in Asia.

Shale gas revolution in the US was short-lived. The industrial revival triggered by shale has caused creation of excess and uneconomical capacity. The next big US bubble is in making…

INTRODUCTION

Global economy changes and morphs into something entirely different to such an extent that we are always astonished about just how much changes within a year. This year is no exception: seismic shifts have occurred, unnoticed on the surface, but potent in their reach and impact.

Within only a year, for instance, Japanese financial institutions that were a major source of global risk, have substantially reshuffled their balance sheets to the extent that they no longer pose significant risk to the global economy. In our opinion, we were very close to a Japan-induced meltdown during 2013, but the problem was averted, delayed and probably even neutralized.

Whereas two years ago, we observed accumulation of risks in the emerging markets, particularly China, which was experiencing an asset bubble induced by exuberant monetary policy and infrastructure spending, today we face multiple asset bubbles concentrated predominantly in the US – home of the last two major crises. This year's edition of Global Systemic Risks (GSR) focuses on the evolution and spread of natural gas bubble in the US. Its reach and impact are now felt elsewhere in the US and globally.

Readers who are new to the GSR research will find that unlike in conventional research, we hardly ever focus on stand-alone companies, industries or economies; instead, we direct all our attention to the relationships – links between them. Our core belief is that risks do not emerge inside a single entity, but rather develop as a result of conflicts and constraints in economic relationships between companies, industries and economies.

Subprime crisis, the dot com bubble, Asian and Russian crises in the late 1990s are all examples of how strained economic relationships between companies, industries and economies are spread in the economy like a virus to cause major crises. No amount of stand-alone analysis could help assess the risks associated with these events, and yet these are the events that had the largest impact on investors. Global Systemic Risks is our research of the system-as-a-whole – the network of economic agents based on their supplier relationships. Our aim in this research is to find the greatest vulnerabilities in the global economy and list the companies, banks, governments that are most exposed to these events.

Just like the global economy, our methodology, of course, does not stand still. The network-based analysis that is core to our approach is undergoing a seismic shift of its own. ***Driven by the advent of the social media, tools and technologies involved in network analysis are among the fastest developing fields in information technology.*** We believe that this year's report is in a transition phase between discrete annual research that we used to carry out in the past few years and a continuous, powerful and flexible network research framework that will take its place in the near future. It is exciting times!

In the meantime, we have to work with this report, which after covering key changes in the methodology, goes on to describe the world economy as a network and summarizes the key vulnerabilities. Individual risk sources are subsequently covered in the report.

THE METHODOLOGY

Our earlier editions were based on desk research of over 500 economic activities in three major regions aiming at spotting the hallmarks of a developing asset bubble:

1. Significant price or volume appreciation of products or assets in an industry over a short period of time
2. Sustainability constraints in the supply chain caused by this appreciation
3. New entrants with cheap borrowed money
4. Lack of transparency and poor corporate governance
5. Technological change and/or government intervention in markets [1]

This year, for the very first time, we were able to replace the manual screening with a network analysis of global input-output tables. Input-output tables are a part of national accounts and describe the sources and uses of products supplied by various industries. It is then a natural domain for our analysis.

Why did we use this only in 2014? Because global input-output tables became available for the first time in mid-2013 as a result of a project funded by the European Union. A large-scale integration of input-output tables of two dozen countries with international trade data took two years and Eur 4 million to accomplish. Based on this global table we are able to assess the major economies, industries and pathways between them in the global market.

We cross-reference the global network with Producer Price Index data at the national level and commodity prices to arrive at a short list of sources of global systemic risks.

THE GLOBAL NETWORK

The global input-output tables are dominated by the US and Chinese industries. Each country is represented in the table by 35 industries (Table 1).

Table 1: List of industries in the global input-output tables

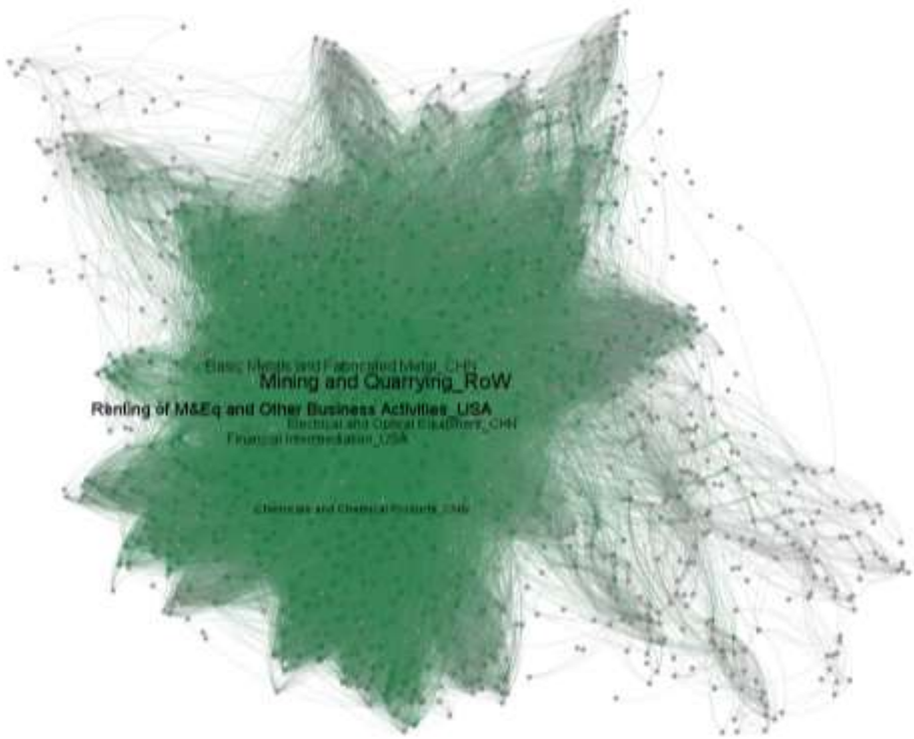
Agriculture, Hunting, Forestry and Fishing	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel
Mining and Quarrying	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles
Food, Beverages and Tobacco	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods
Textiles and Textile Products	Hotels and Restaurants
Leather, Leather and Footwear	Inland Transport
Wood and Products of Wood and Cork	Water Transport
Pulp, Paper, Paper , Printing and Publishing	Air Transport
Coke, Refined Petroleum and Nuclear Fuel	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies
Chemicals and Chemical Products	Post and Telecommunications
Rubber and Plastics	Financial Intermediation
Other Non-Metallic Mineral	Real Estate Activities
Basic Metals and Fabricated Metal	Renting of M&Eq and Other Business Activities

[1] For more on the rationale and academic research on this approach please consult Global Systemic Risks 2013.

Machinery, Nec	Public Admin and Defence; Compulsory Social Security
Electrical and Optical Equipment	Education
Transport Equipment	Health and Social Work
Manufacturing, Nec; Recycling	Other Community, Social and Personal Services
Electricity, Gas and Water Supply	Private Households with Employed Persons
Construction	

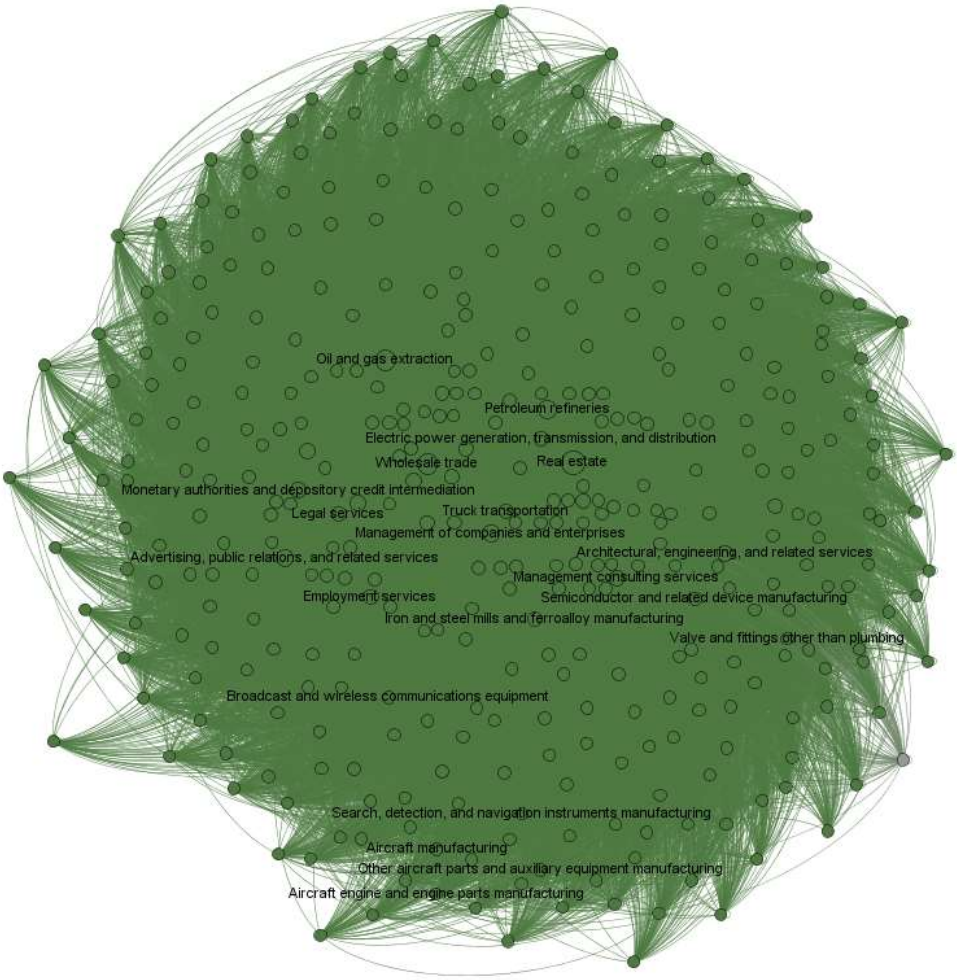
Supply and demand of each industry is linked with the supplying industries and countries. The resulting network diagram describes the global economy with larger “hub” industries closer to the centre of the diagram and smaller, less connected spoke industries in the periphery (Figure 1).

Figure 1: *A network diagram of the global input-output table.*



The United States is a dominant part of the network due to its size and the connectedness of the US financial institutions. The mining industry in the rest of the world and the manufacturing industry in China are also at the centre of the global industrial network. Due to the risk concentration in the US we run our screening on the basis of the world and the US input-output tables (Figure 2). Country-specific input-output tables allow us to carry out analysis on the basis of more specifically defined industries.

Figure 2: A network diagram of the US input-output table



Output price dynamics in each industry derived from the Producer Price Index (PPI) statistics and commodity prices are used to assess the degree of "stress" in each industry. We then simulate a crisis in each industry by assuming that the output prices fall dramatically in one year (similar to the price falls in the US property market). We estimate the impact of this change in each individual industry and how quickly the system becomes "infected" based on business rules. An industry that faces lower demand would cut its production volumes, fixed costs and capital expenditure. The ability of the industry to cause a system-wide slowdown defines its degree of systemic risk.

SUBSIDING RISKS

Two sources of risk that we covered in the 2013 edition have become less prominent in our assessment. The risk of a collapse of the Japanese financial system and the likely spillover into the world economy is far less acute than it was last year. Asset price deflation in China has wiped out large part of the bubble, leaving only operational risks.

JAPANESE FINANCIAL INSTITUTIONS

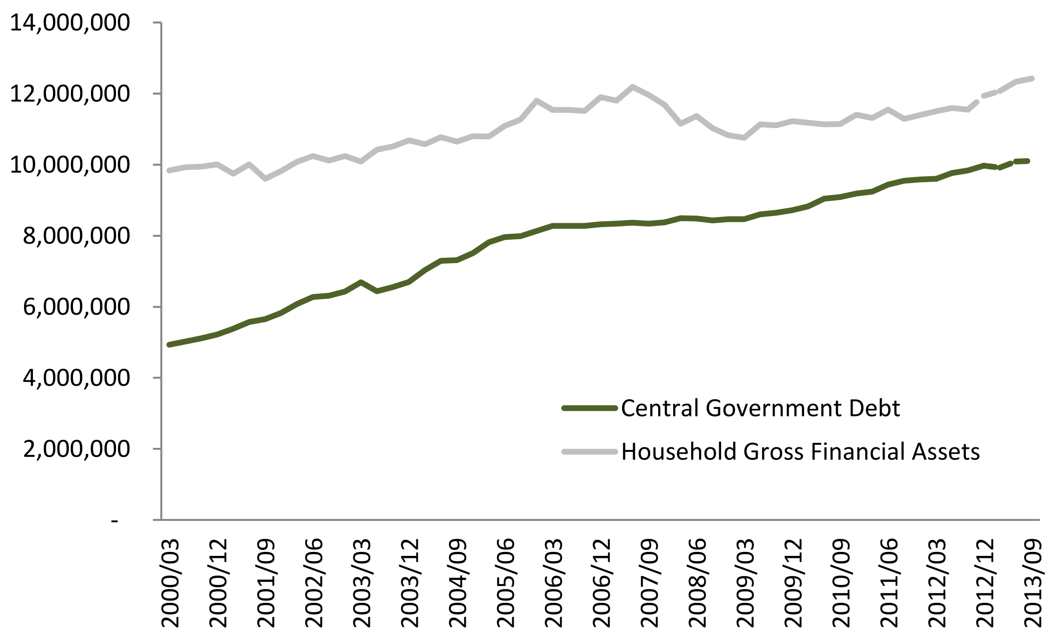
Early last year we included Japanese government debt as a source of global risks. Although Japanese government debt was on the radar of most macroeconomists, the country had managed to retain its stable status for over two decades. In this context, our "sudden" inclusion in the risk sources in 2013 raised a valid question: why now?

We had two reasons: debt funding and transmission mechanisms.

Debt funding

Bulk of the Japanese government debt is internally funded, that is, Japanese households hold the debt despite the low yields. So long as they are willing to hold the debt and they have the funds to do so, there should be no sustainability issue. Back in 2012 it appeared as though gross household assets were being quickly depleted, while the pace of debt growth was accellerating (Figure 3).

Figure 3: *Central government debt and household gross financial assets in Japan, Source: Statistics Bureau of Japan*



In the course of 2013 new data (in dotted lines) pointed at a strong rebound in gross household assets and a slight slowdown in debt accumulation levels, which means that the likelihood of immediate (read: 1-3 years) disaster is averted.

Transmission

But the overarching concern for this risk source was the transmission mechanism: Japanese banks had accumulated vast holdings of JGBs. At the same time they abruptly increased their presence in the global project finance market, with top three Japanese banks taking the top spots in the league tables. A sudden 150-200 basis point jump in JGB yields could wipe out the capital of Japanese banks and put global project finance market at risk and with it, most large industrial conglomerates and financial institutions globally.

Luckily, we were not alone in recognizing this risk. At their peak in March 2012 – the base year for our last year's report, holdings of JGB's by Japanese banks were at JPY 171 trillion. During 2013 Japanese banks drastically reduced their exposure to JGB's partly by selling them and partly by hedging. By November 2013 the exposure was at JPY 138.9 trillion, a decline of 19%. In nine months of 2013, Sumitomo Mitsui, the largest bank, cut its exposure by 56%!

Although Japanese banks continue to be a risk transfer pathway between the Japanese bond market and the rest of the world, the pace of de-risking is staggering, particularly for a consensus-driven country like Japan.

In view of these significant changes in the risk profile, we now consider this risk source as not acute enough to be of concern. This, of course, does not mean that Japanese debt is sustainable or long-term economic challenges that Japan faces are no longer there. If anything, the macroeconomic risks of Abenomics are greater than any time in the past and can be compared to "double-or-nothing" strategy in a casino. However, our coverage of Japanese government debt has never been about macroeconomics.

What we conclude is that a near term crisis in the Japanese government debt is significantly less likely to happen now compared to last year and even if it happens, the impact on global economy will be far less pronounced than a year ago.

INFRASTRUCTURE IN CHINA

While we ceased coverage of the Japanese financial system due to the risk of turmoil diminishing, we will no longer cover the Chinese financial system for the opposite reason: the Chinese excess infrastructure price deflation has been going on and is turning into a full-blown crisis as we speak. What is more important, it is now fully recognized and scrutinized, with clear understanding of the sources, reasons and the likely development of the crisis.

We launched the coverage of the Chinese financial system as a key source of risk in early 2012. At the time we estimated that up to 25% of assets held by the major banks are troubled. This was an extraordinary view bordering with unbelievable at the time. Since then we have had this view corroborated not only by major rating agencies, but also most astonishingly by the PBOC itself.

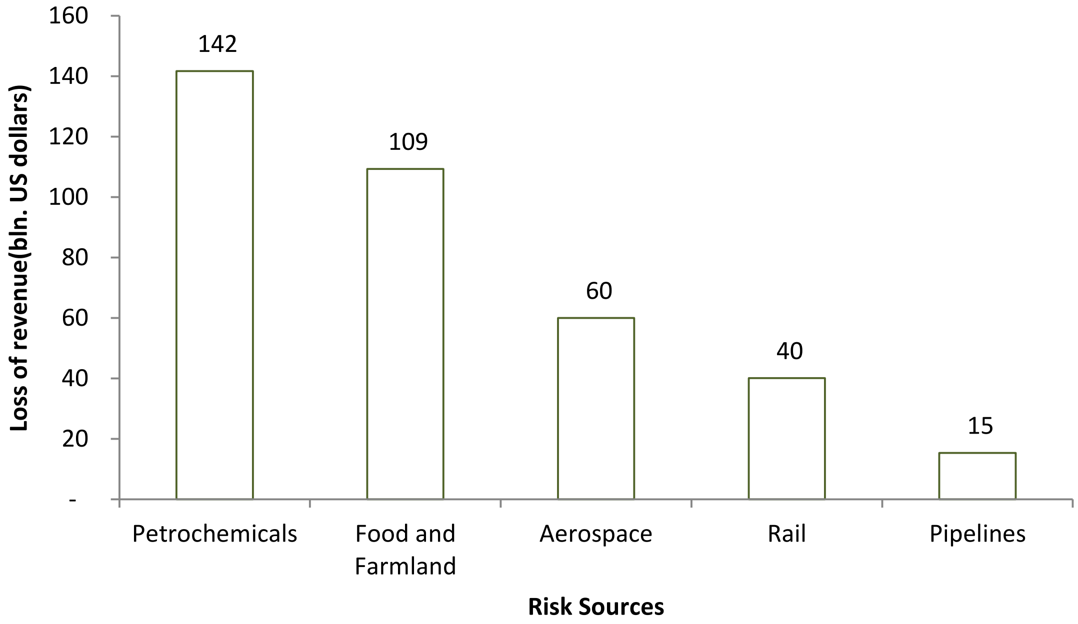
Since our first report, Shanghai Stock Exchange has lost ~$ 900 billion of its value. Considering large parts of assets are not listed, this number should be multiplied by 2-3 to have an idea about the scale of asset price deflation that has occurred in China.

Given that i) asset price deflation has already occurred, ii) the crisis in China is widely understood and acknowledged, there remains little of value that we can add to the debate. This issue of Global Systemic Risks therefore no longer concerns itself with China.

RISK SOURCES IN 2014

Risks have shifted in 2014 both in terms of industrial and geographic reach. We have now a US-centric risk world. Whereas the China-induced bubble in the commodity-based emerging markets has been slowly deflating, the US-based asset bubbles have been spreading into the adjacent industries. Price dynamic in the petrochemical, railway and pipeline industries has been impacted by the asset bubble in the natural gas industry. We estimate the revenue loss alone in these industries in case of a sharp appreciation of natural gas prices to be close to $200 billion (Figure 4).

Figure 4: *Revenue impact of risk sources*



Appreciation of food prices across the world continues as a direct consequence of the farmland bubble. Revenue loss from the global food and farmland asset bubble is estimated at $110 billion.

We should note that, in contrast with the earlier editions of GSR, the estimates of asset bubble size in this issue refer to the revenue loss in the economy. As such, these are estimates of flow and do not include the wealth loss due to revaluation of fixed assets, i.e. stock measures. If crop prices fall, for instance, the revenue loss will be price difference multiplied by the volume sold. The value loss of farmland owned by the farms, i.e. the balance sheet, is not included in these estimates.

NATURAL GAS-INDUCED ASSET BUBBLES

The advent of shale gas caused overestimation of natural gas supply volumes

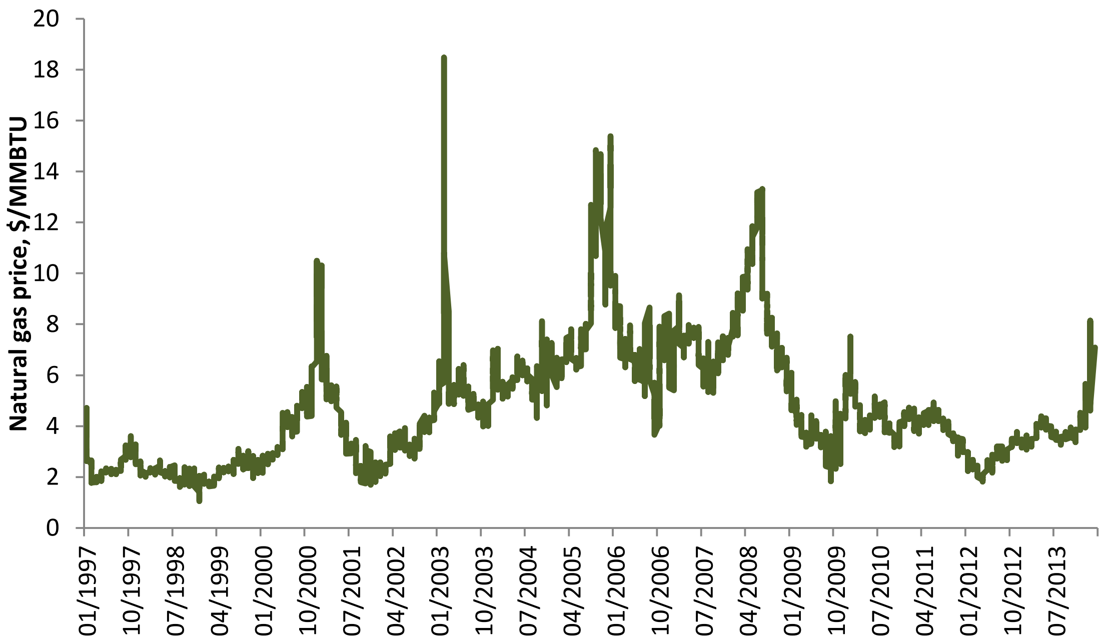
The advent of shale gas technology and the first commercial success of shale gas production five years ago raised expectations of cheap and abundant natural gas available in the United States and potentially – globally. Electricity generation utility companies that previously used natural gas only to balance the peak demand due to its high cost, now planned to benefit from the low price of natural gas by switching to gas-powered power plants for main production ('baseload') of electricity. New capacity to be introduced in the next few years assumed natural gas price below $5 per MMBTU – a level which is uneconomical for shale gas producers. The resulting capacity overhang threatens to destabilize the project management and industrial markets.

In the 2013 edition of the report we elaborated on the reasons we believed natural gas prices in the United States were unlikely to remain below 3-4 $/MMBTU. Chiefly among the reasons was the mismatch between the natural gas price required for the electric utilities to be profitable and the price at which return on shale gas production matches its cost of capital.

Natural gas prices climb higher in the US

As with other commodities, the long-term analysis of natural gas price is convoluted by weather patterns. This winter season in the United States was coldest in recorded history. Unsurprisingly, this translated into higher natural gas demand for heating and higher prices (Figure 5).

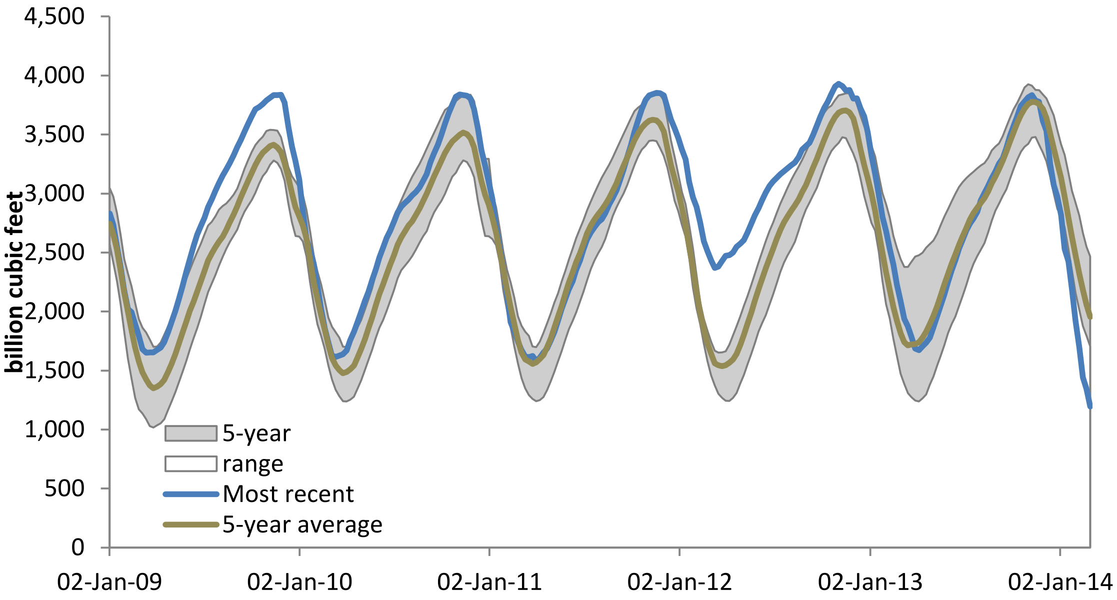
Figure 5: *Natural Gas Price, Henry Hub, Source: US Energy Information Agency (EIA)*



Extreme weather conditions, although lately happening with higher frequency, do revert to the norm, which means that we would expect natural gas prices to go back to the pre-freeze levels.

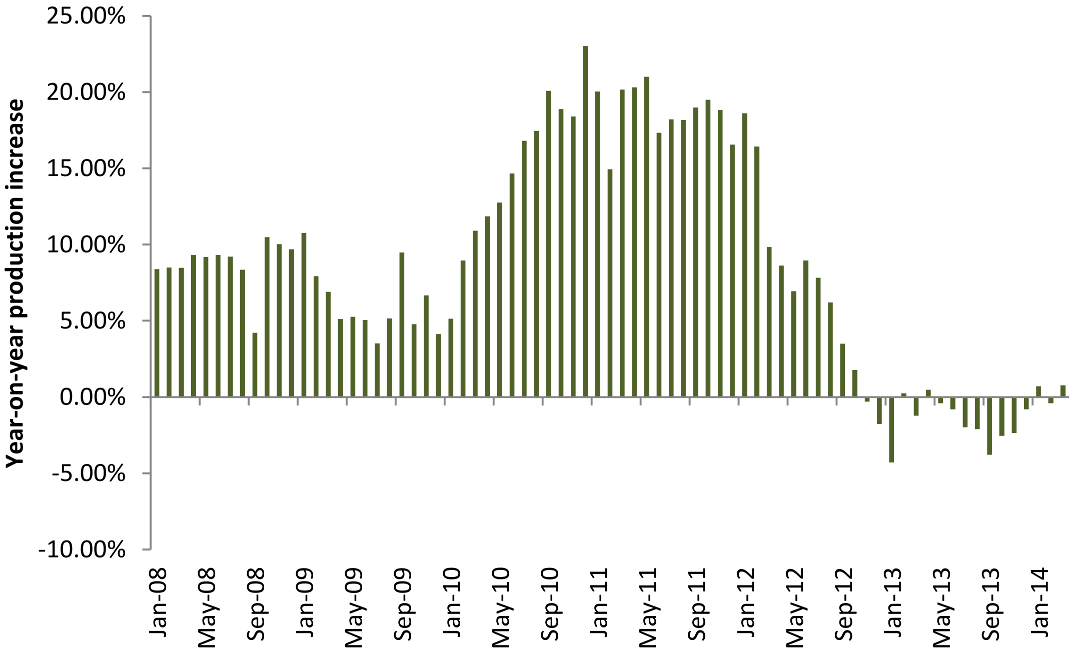
Nevertheless, there are reasons to believe that the extreme weather only accelerated the likely price hike in the natural gas market. First, the availability of "reserve" natural gas in the storage in the US began to shrink well before the winter season started in the US. The massive excess availability in 2012 was worked out of the system by January-February 2013 and by May natural gas in storage was already below 5-year average (Figure 6). The weather pattern created the additional excess demand after January 2014.

Figure 6: *Working gas in underground storage and its five-year average, Source: US EIA*



Secondly, shale gas "revolution" in the United States has quietly turned into a one-field revolution. Production in all shale gas fields except the giant Marcellus field is actually shrinking (Figure 7). Marcellus, on the other hand, provides the balance of increase and more. In February, however, the Energy Information Agency report points at a very large increase in legacy production decline of 49 MMCF/d month-on-month at the Marcellus field. What this means is that the production decline is much quicker than earlier anticipated – something we suggested that was likely to be the case in our last year's edition.

Figure 7: Production change, US shale gas excluding Marcellus, Source: US EIA, LINKS

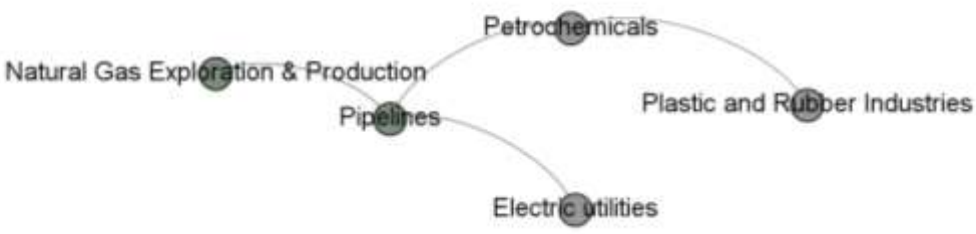


Marcellus field, of course, makes the difference. The giant field shows only muted signs of change in the pace of production and depletion. However, given the nature of the technology, such a change is inevitable in the near future.

Knock-on effects for multiple industries

Unusually low natural gas prices and a promise of abundance of gas in the future induced many energy-intensive industries in the US to expand or convert into using natural gas. In the 2013 edition we covered the extreme capacity build up in the natural gas fuelled power plants. During the year, however, the gas risk has also spread into a number of other related industries and supply chains that we cover in this edition (Figure 8).

Figure 8: A network diagram of risk transmission



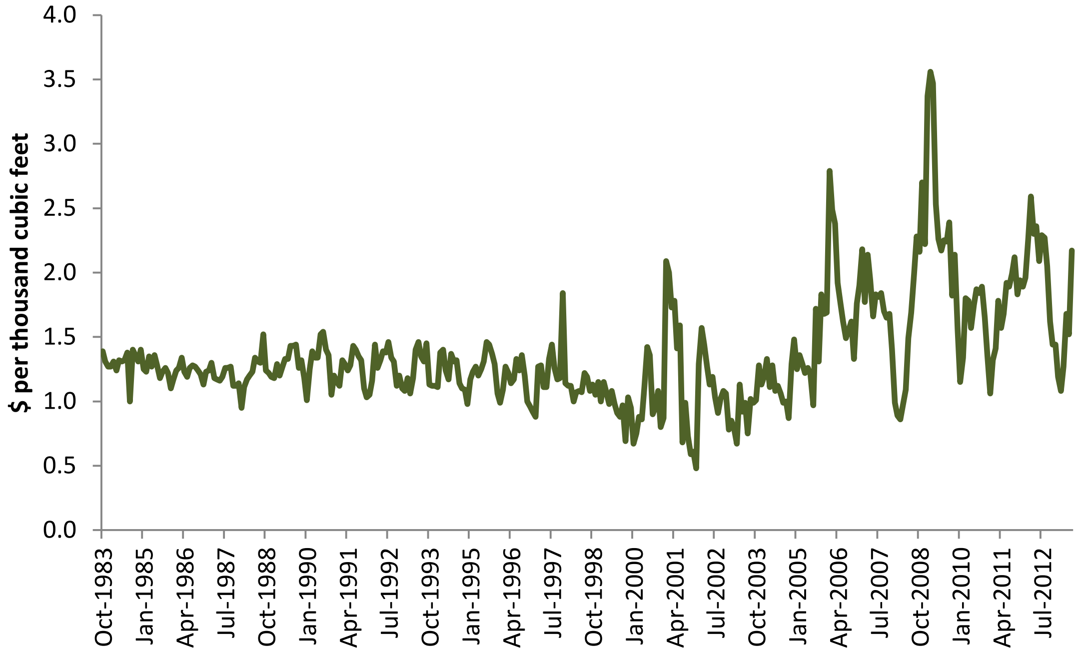
PIPELINES: THE FIVE TESTS

It took only a few months following the first signs of shale gas revolution for the industry to realize that natural gas pipelines were the bottleneck: abundance of gas did not mean ability to sell unless the infrastructure to deliver the new volumes was in place. The consequence was significantly higher prices for gas transportation and higher capital expenditure in the new pipeline infrastructure. The price pressure was also transmitted along the supply chain, with prices for pipeline construction almost doubling in two years.

Higher prices

Almost all price components in the industry have experienced a significant appreciation. Pipeline transportation price, as estimated by LINKS based on EIA data were at $ 2.5-3 per thousand cubic feet, double the normal range of between $1 and $1.5 for the past 25 years (Figure 9).

Figure 9: *Gas transportation pipeline prices, Source: US EIA, LINKS*



More importantly, the volatility of transport price has increased significantly, driven by uncertainty over long-term availability and supply of natural gas.

According to Oil & Gas Journal[2] construction costs too have risen by more than 32% in just two years since 2011, while material costs doubled in the same period.

[2] "US pipeline operators sink revenue growth into expansion", http://www.ogj.com/articles/print/volume-111/issue-9/special-report-pipeline-economics/us-pipeline-operators-sink-revenue-growth-into-expansion.html

Sustainability constraints

The planned, committed and already added pipeline capacity assumes large volumes and demand for natural gas that are a function of lower prices. Higher natural gas prices will result in lower volume demanded, which will affect both the pipeline utilization rate and the pricing. Current natural gas price (at the time of publishing this report) is double the average natural gas price in 2013. While residential demand is inelastic, industrial and utility demand, at least so far, are elastic to price changes. In our estimates (Table 2) if the natural gas price remains at the present level for much of 2014, the pipeline industry will turn double-digit negative operating margins.

Table 2: *Return on fixed asset simulation, Source: LINKS*

	Average 2013	Current (2014)
Natural gas price	3.74	7
Volume impact		-52.41%
Pipeline transport price	2	1.50
Operating income	20,969,959,000	7,485,266,114
Variable cost	9,587,263,000	4,562,921,963
Fixed costs	6,617,900,000	6,617,900,000
Net Income	4,764,796,000	- 3,695,555,849
Profit margin	22.7%	-49.4%
Return on fixed assets	3.35%	-2.60%

New entrants

Capital investments in pipelines in the US are predominantly channelled through Master Limited Partnerships (MLPs). Although there is no concrete evidence, there are anecdotes to suggest that MLP demand is growing both in the institutional and retail markets (Figure 10)

Figure 10: *MLP's become more popular for the first-time investors*

Poor corporate governance and lack of transparency

Arguably, the poor governance test is the only one that Pipelines fail: disclosure standards for the U.S. based MLPs are at par with the rest of the U.S. capital market. However, there are plenty of voices demanding a better disclosure of what standards apply to the definition of maintenance capital expenditure and cash available for distribution. Since MLPs are partnerships with high dividend yield being the key attraction, the definition of these terms is critical.

According to CFRA Research – a forensic accounting research firm, lack of specificity on maintenance capital expenditure gives MLPs a great deal of flexibility, but does not give investors a lot of transparency. Lack of disclosure certainly does impact the ability to assess the appropriate level of yield in the industry, which in turn creates unusually high expectations.

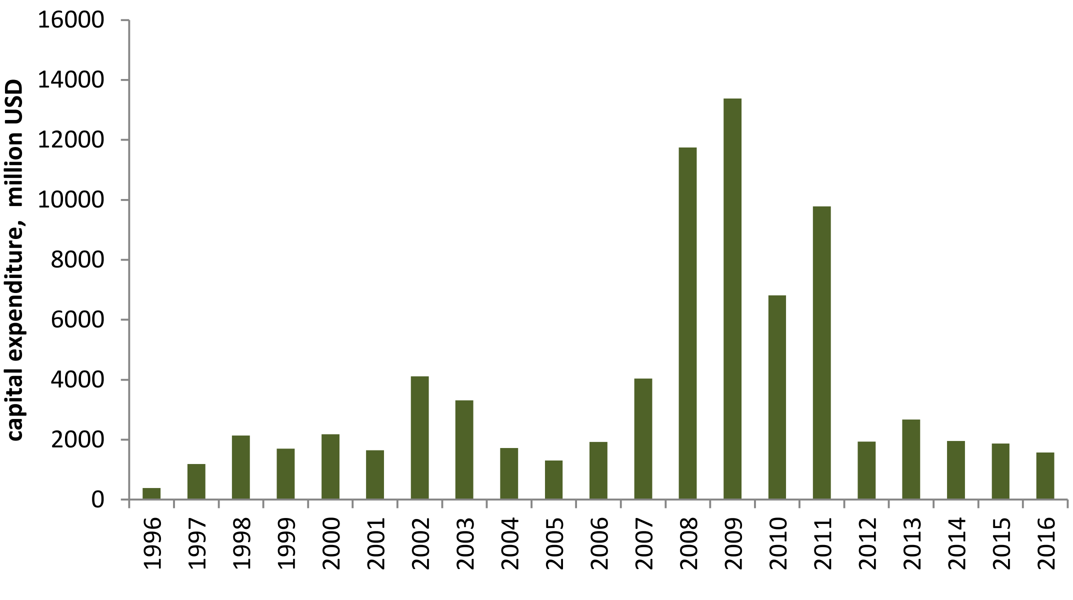
Government intervention and technological change

At the root of this asset bubble is still the shale gas boom, which was enabled by technological change and government regulation.

Transmission and impact

The total impact of higher natural gas prices on the pipeline industry comprises the impact of lower volumes, lower prices for transmission and the loss of capital expenditure (excess capacity). Pipeline construction capital expenditure in the period between 2011 and 2013 has been three times higher than average.

Figure 11: *Pipeline capital expenditure, Source: US EIA*



We estimate pipeline and gas plant excess capacity to cost over $ 45 billion in case of a crisis. In our assessment of impact we assume a one off $7 billion loss of revenue in the pipeline industry itself.

The supply chain impact across the board is strongest initially in the related industries: oil and gas extraction, petroleum refineries. However, very quickly the impact spreads to other industries (Figure 12), such as real estate, wholesale trade, legal services etc. The total impact is still modest, at 10 basis points of the U.S. GDP or $ 15 billion (Table 3).

Figure 12: A network diagram of pipeline risk transmission

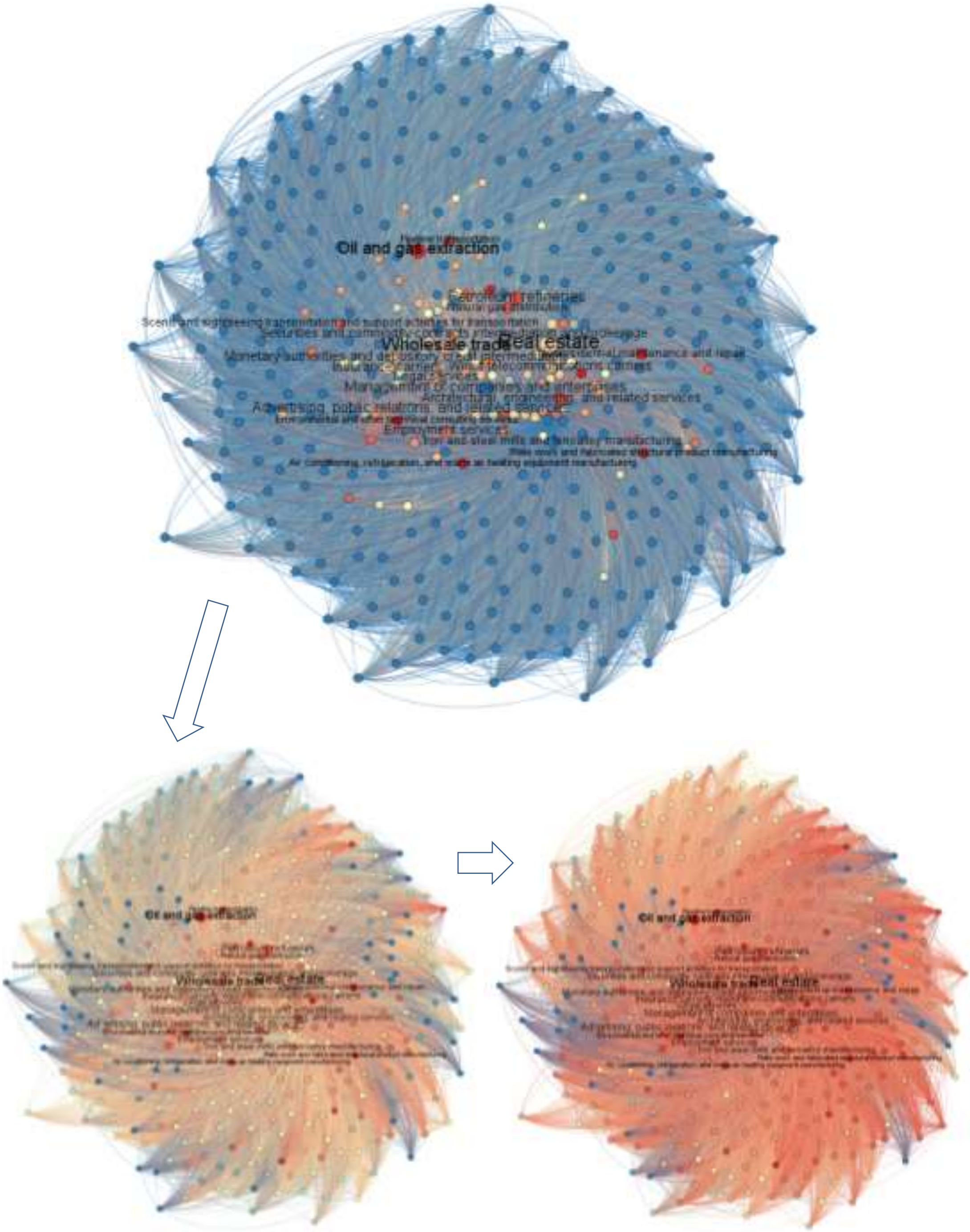


Table 3: Major industries affected by a slowdown in the pipeline industry

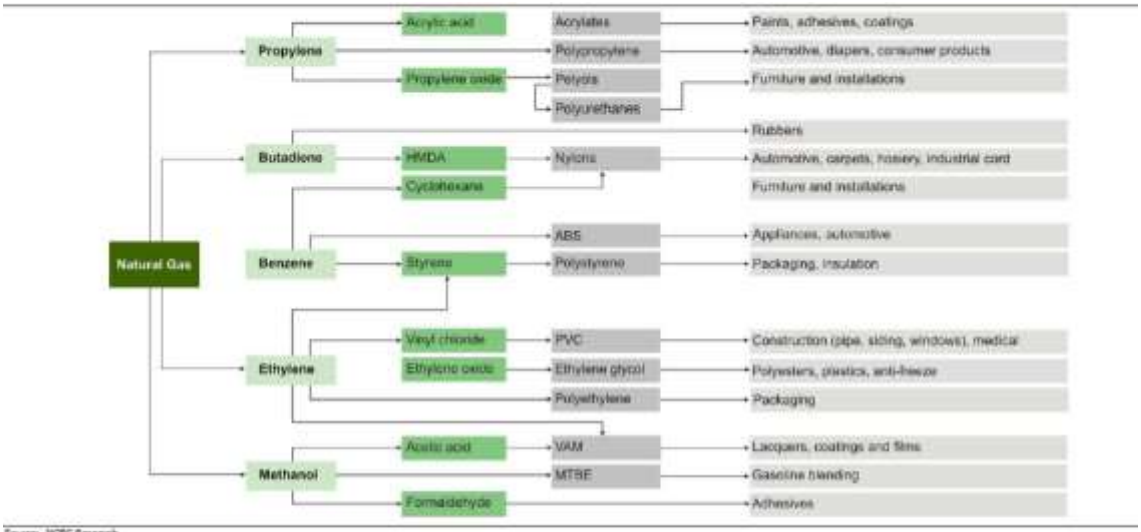
Industry	Simulation periods					Total Loss
	Period 1	Period 2	Period 3	Period 4	Period 5	$ mln
Pipeline transportation	-6,964	-26	-20	-7	-3	-7,019
Oil and gas extraction	-	-1,237	-434	-113	-74	-1,857
Petroleum refineries	-	-316	-69	-55	-48	-489
Nonresidential maintenance and repair	-	-319	-27	-23	-17	-387
Real estate	-	-81	-83	-86	-74	-325
Wholesale trade	-	-100	-75	-68	-59	-301
Architectural, engineering, and related services	-	-194	-47	-33	-27	-301
Plate work and fabricated structural product manufacturing	-	-254	-20	-7	-6	-287
Environmental and other technical consulting services	-	-201	-6	-4	-3	-215
Employment services	-	-76	-32	-21	-18	-146
Management of companies and enterprises	-	-	-55	-46	-38	-139
Iron and steel mills and ferroalloy manufacturing	-	-	-76	-36	-24	-136
Monetary authorities and depository credit intermediation	-	-43	-35	-30	-28	-135
Advertising, public relations, and related services	-	-0	-40	-43	-36	-119
Scenic and sightseeing transportation and support activities for transportation	-	-59	-24	-14	-11	-108
Insurance carriers	-	-25	-31	-26	-22	-104
Air conditioning, refrigeration, and warm air heating equipment manufacturing	-	-79	-16	-6	-3	-104
Securities and commodity contracts intermediation and brokerage	-	-33	-28	-21	-18	-100
Natural gas distribution	-	-66	-11	-12	-10	-99
Legal services	-	-32	-23	-20	-17	-92
Wired telecommunications carriers	-	-21	-22	-22	-20	-85
Other	-	-583	-765	-766	-703	-2,817
Total	-6,964	-3,745	-1,941	-1,457	-1,263	-15,369
As % of US GDP						-0.10%

PETROCHEMICALS: THE FIVE TESTS

Pricing

Similar to the pipelines, the petrochemical supply chain has become a hostage of heightened expectations of natural gas supply. Since petrochemicals are a process industry that is intimately linked with hundreds of other industries from tire manufacturing to pharmaceuticals, both the impact and the breadth of the supply chain are vast. The section of the supply chain that we will focus on is processing of natural gas liquids and naphtha into core petrochemical products: olefins (ethylene, propylene and butadiene) and aromatics (benzene, toluene, xylene) (Figure13).

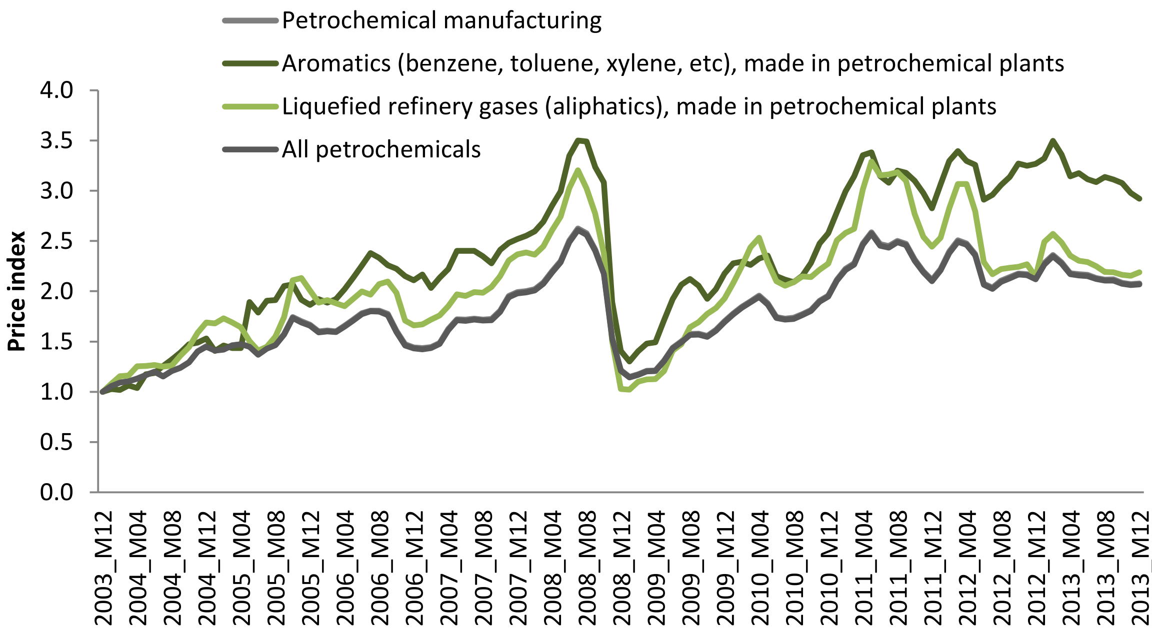
Figure 13: *Petrochemical supply chain*



Source: NCBC Research

The prices for most of the petrochemical products have doubled or trebled since early 2000s. Combined with expectations of low natural gas prices, this has given rise to estimates of abnormally high margins and large excess capital investment in the industry (Figure 14).

Figure 14: Price index of petrochemical products, Source: US Bureau of Labor Statistics (BLS)



Sustainability constraints

Ethylene is the largest component of the petrochemical supply chain. Despite the commodity nature of ethylene, its production is not uniform: it can be produced from natural gas liquids or naphtha, and depending on the production facility, feedstock, proximity to pipelines etc. production margins can vary drastically. We look at the sustainability constraints for an average ethylene production facility in the United States that uses predominantly ethanol as a feedstock.

Current ethylene margins for ethane-based US producers are ~$750 per ton. For comparison, European naphtha-based producers have faced negative margins of -$300-600 per ton throughout 2013. The difference is due to the shale-gas induced cheap ethane. A natural gas price of close to $ 10 or above would erode the margins to negative levels.

New entrants

There has been a wave of ambitious announcements by many global companies about ethylene/propylene projects in the U.S. Many of these companies have not done business in the U.S. before. Most recently, Brazilian conglomerate Odebrecht, which controls Braskem, has announced its intention to build a world-scale steam cracker and polyethylene unit.

To date, there are over 20 large-scale ethylene projects announced, with more companies announcing expansions and extensions of the existing facilities. Canadian Methanex, Saudi SABIC, Taiwan's Formosa Plastics are but a few of the companies rushing to the US.

Poor governance and transparency

Transparency in the context of petrochemicals can be replaced by visibility. The conviction about viability of shale gas and abundance of cheap feedstock depends on the optimistic assumptions of legacy field depletion. In essence, lack of transparency and poor governance are transmitted from shale gas industry into the petrochemicals.

Government Intervention and Technological Change

Once again, technological change that started the petrochemical asset bubble in the US can be traced to the advent of shale gas.

Transmission and Impact

The combined planned capacity introduction of ethylene and propylene production is close to $ 20 billion (Table 4). The total incremental investment in the US petrochemical industry due to the cheaper natural gas is close to $75 billion, with bulk of this capital scheduled for spending in 2014-2016 (Figure15).

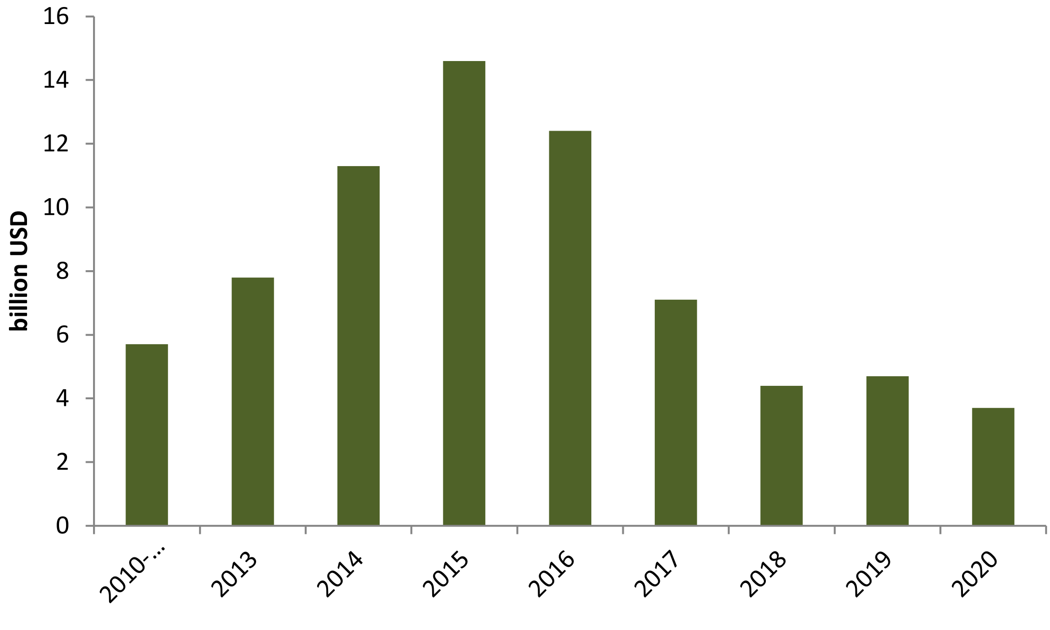


Figure 15: *Incremental US US Chemical Industry Capital Expenditures Arising from Shale gas-induced competitiveness*

Table 4: Planned capacity additions, Source: ICIS

Owner/Operator	Production capacity (mil mt/yr)	In-Service	Type
Westlake Chemical	0.08	2014	Ethylene
BASF-Total	0.1	2014	Ethylene
Dow Chemical	0.2	2014-16	Ethylene
Dow Chemical	0.2	2014-16	Ethylene
LyondellBasell	0.23	2014-16	Ethylene
LyondellBasell	0.39	2014-16	Ethylene
Westlake Chemical	0.11	2015	Ethylene
Aither Chemical	TBD	2016	Ethylene
Formosa Plastics	0.8	2016	Ethylene
ExxonMobil Chemical	1.5	2016	Ethylene
Chevron Phillips	1.5	2017	Ethylene
Dow Chemical	1.5	2017	Ethylene
OxyChem/Mexichem	0.55	2017	Ethylene
Shell Chemical	1	2017	Ethylene
Sasol	1	2017	Ethylene
C3 Petrochemicals	TBD	2015	Propylene
Enterprise Products	0.75	2015	Propylene
Dow Chemical	0.75	2015	Propylene
Formosa Plastics	0.6	2016	Propylene
Williams	0.5	2016	Propylene
Dow Chemical	TBD	2018	Propylene
PetroLogistics	TBD	NA	Propylene
Enterprise Products	TBD	NA	Propylene

Potentially higher feedstock prices will cause these investments to yield negative return on capital. Many will be cancelled, putting at risk revenues in respective industries. Due to the vast breadth of the relationships between the petrochemical industry and the rest of the economy, the total impact is significant, at 0.90% of the US GDP (Figure 16, Table 5).

Figure 16: *A network diagram of petrochemicals risk transmission*

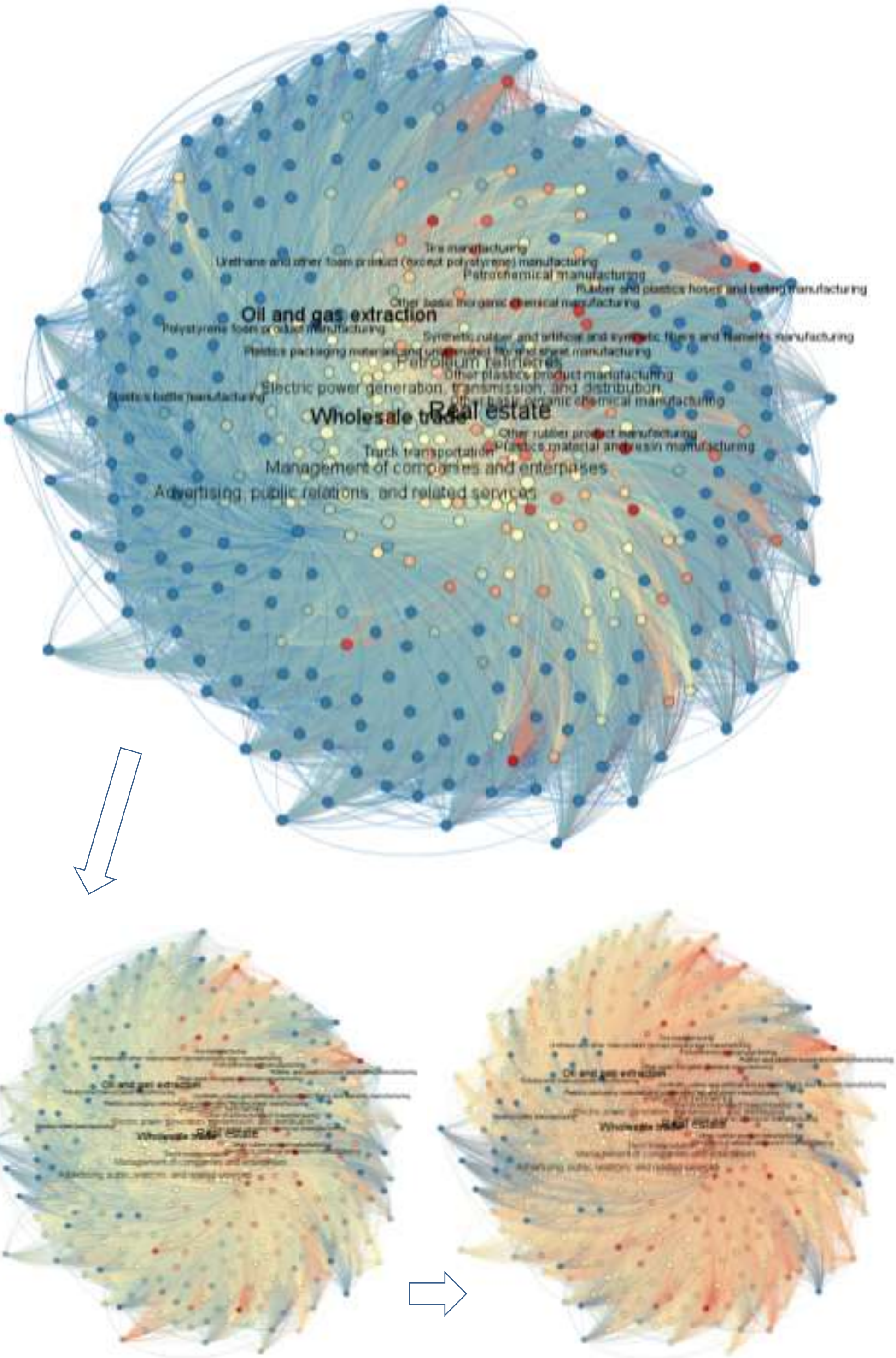


Table 5: *Impact of a slowdown in petrochemicals on other industries*

Industry	Simulation periods					Total Loss
	Period 1	Period 2	Period 3	Period 4	Period 5	$ mln
Other plastics product manufacturing	- 24,130	- 796	- 202	- 121	- 110	- 25,358
Plastics material and resin manufacturing	-	- 8,503	- 1,791	- 362	- 164	- 10,820
Petrochemical manufacturing	-	- 227	- 2,711	- 2,312	- 1,328	- 6,578
Other basic organic chemical manufacturing	-	- 857	- 2,797	- 1,291	- 624	- 5,569
Wholesale trade	-	- 2,066	- 1,352	- 1,127	- 916	- 5,462
Other rubber product manufacturing	- 4,557	- 650	- 70	- 23	- 19	- 5,320
Tire manufacturing	- 4,186	- 179	- 13	- 16	- 19	- 4,413
Oil and gas extraction	-	- 3	- 537	- 1,618	- 1,677	- 3,836
Plastics bottle manufacturing	- 3,541	- 1	- 5	- 15	- 14	- 3,575
Petroleum refineries	-	- 206	- 1,150	- 1,156	- 919	- 3,431
Management of companies and enterprises	-	- 1,096	- 1,128	- 647	- 526	- 3,397
Urethane and other foam product (except polystyrene) manufacturing	- 2,591	- 24	- 6	- 9	- 9	- 2,639
Real estate	-	- 91	- 621	- 858	- 971	- 2,541
Polystyrene foam product manufacturing	- 2,084	- 9	- 8	- 9	- 10	- 2,120
Electric power generation, transmission, and distribution	-	- 755	- 512	- 356	- 285	- 1,908
Plastics packaging materials and unlaminated film and sheet manufacturing	-	- 1,534	- 244	- 77	- 52	- 1,906
Advertising, public relations, and related services	-	- 240	- 532	- 499	- 480	- 1,751
Other basic inorganic chemical manufacturing	-	- 896	- 409	- 209	- 101	- 1,615
Synthetic rubber and artificial and synthetic fibers and filaments manufacturing	-	- 1,264	- 150	- 51	- 33	- 1,498
Truck transportation	-	- 567	- 342	- 290	- 242	- 1,441
Rubber and plastics hoses and belting manufacturing	- 1,408	- 11	- 7	- 6	- 7	- 1,439
Other	-	- 11,966	- 10,962	- 11,252	- 10,937	- 45,117
Total	- 42,497	- 31,943	- 25,549	- 22,305	- 19,442	- 141,736
As % of US GDP						-0.90%

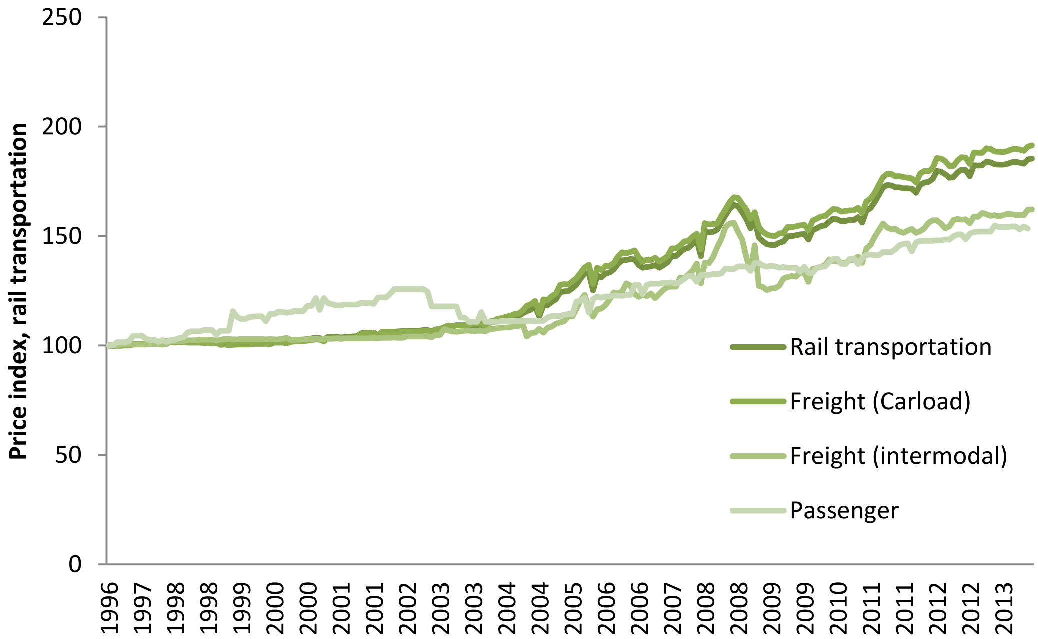
RAIL TRANSPORTATION: THE FIVE TESTS

Pricing

It is hard to imagine this "grandfather of industrial revolution" to be in any shape or form related to excess activity, however, as an article in the Wall Street Journal proclaimed: "Welcome to the revival of the Railroad Age". Yet, what we will show is that this revival of Railroad Age is a direct consequence of the spillover of natural gas and oil asset bubble into the related industries.

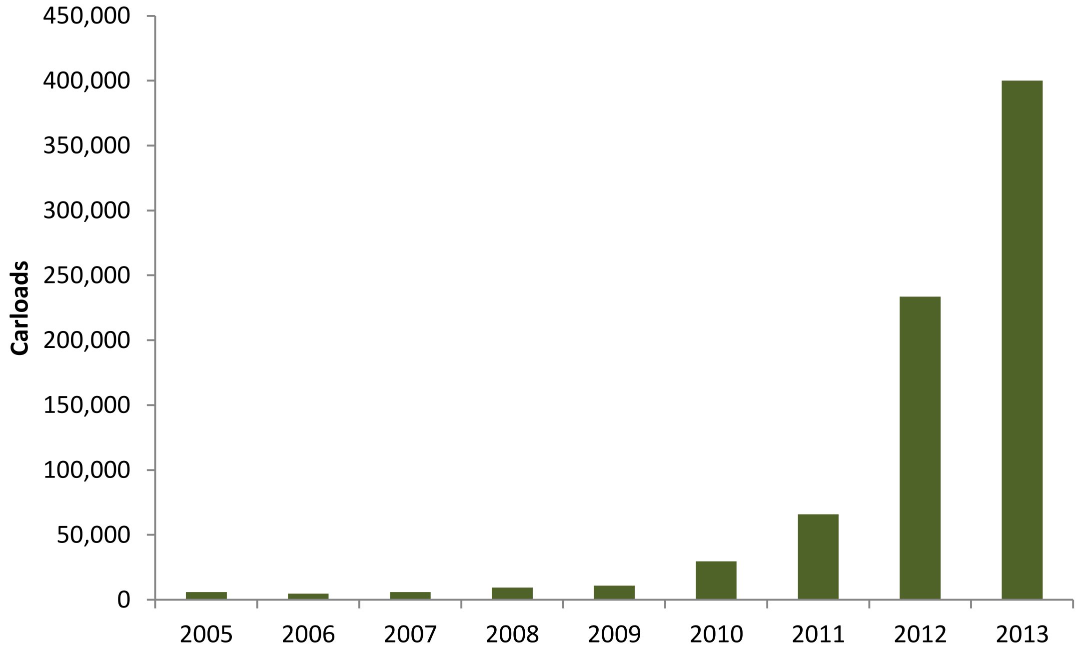
As far as prices are concerned, it is important to highlight that the US rail companies are in the midst of antitrust complaints and investigation. This, of course, means that references to prices by the industry bodies continuously understate the price level. Our source for rail transportation prices is producer price indices of the Bureau of Labor Statistics, which in contrast with the Association of American Railroads (AAR) point at a price appreciation ahead of inflation (Figure 17).

Figure 17: *Price indices of rail cargo, Source: US BLS*



The recent rail transport pricing trends supported by a particular significant shift in demand: production of shale oil and demand for oil transportation by rail. The pace of this source of demand qualifies for our definition of seismic (Figure 18).

Figure 18: Rail transport of crude oil, Source: ICIS



Although oil still accounts for a fraction of total commodities transported, the pace of growth means that it has a disproportionate impact on pricing.

The net result of such change is most noticeable at the capital expenditure level: capital expenditures in the industry have more than doubled since 2010 at $14 billion, compared to $ 6 billion. The added investment is partly to satisfy the new oil-related demand and partly in anticipation of the great recovery of the American petrochemical industry.

Sustainability constraints

In an industry that has not seen transportation volumes fully recover to pre-2008 levels, capital expenditure has more than doubled in a matter of two years. In many ways the business model of rail companies is very simple (Table 6): volume represented by tons of commodity transported for number of miles (ton-miles) multiplied by freight revenue per ton-mile make up the total revenues.

Table 6: Economics of rail transport

	2010	2011	2012	Scenario
Ton-miles (trillion)	1.691	1.729	1.713	1.65
Freight revenue per ton-mile (cents)	3.33	3.76	3.961	3.33
Revenue (million USD)	56,310.3	65,010.4	67,851.9	54,945.0
Operating expenses	42,700.0	49,300.0	50,600.0	47,462.51
Fixed costs	28,781.30	33,229.93	34,106.18	34,106.18
Variable costs	13,918.70	16,070.07	16,493.82	13,356.33
Margin	24.17%	24.17%	25.43%	13.62%
ROE	11.23%	11.13%	11.57%	4.12%

Assuming stable volumes and pricing back to 2010-11 levels, the newly added capital will translate into three times lower ROEs compared to the recent history. An ROE of 4% would mean economic loss of 6-7% annually.

New entrants

The railway industry is highly capital intensive and revenues related to coal are still vulnerable, which means there are no new pure rail entrants. However, related industries, such as warehousing and oil exploration and production have entered part of the railway business. As the Wall Street Journal reports[3], "other (oil) producers began leasing tank cars, buying land and putting up rail loading buildings. As a ***modern-day gold rush unfolded***, BNSF added track, replaced rail, upgraded signals…"

Transparency

Based on our estimates, cargo transportation prices have increased considerably faster than inflation in the last 10 years. And yet, according to the industry body –AAR, increases have been below the inflation rate. This can be explained by the accusations of monopolistic power and lack of competition in price setting, which AAR aims to dispel. Consequently, although there is plenty of high-level data, there is controversy with respect to details.

Most importantly, the true impact of increasing volumes of crude oil transport over rail is still not in any of the numbers.

Government regulation and technological change

The railway industry has always been under careful scrutiny due to its natural monopoly status. Over time there have been de-regulation waves that have caused greater capital discipline and efficiencies. The regulatory changes in the last few years have been in support of high-speed passenger rail network, which is not part of the major rail company business.

Any regulatory and technological changes that are causing shifts in this industry are driven by the adjacent industries of oil exploration and production (shale oil) and pricing in the pipeline industry.

Transmission and impact

Faced with economic losses of the magnitude described earlier, the industry is likely to attempt to shrink, which will trigger economy-wide implications. Since rail transportation has a very broad supplier relationship base with many other industries, the system-wide impact is large relative to the size of the industry (Figure 19).

Bulk of the impact comes from the truck transportation. Truck cargo is the most affected industry, since trucks not only substitute rail traffic but also complement. Other industries include other means of cargo traffic, warehousing, pipelines, passenger transit. The total impact on the economy is estimated at 0.26% of GDP (Table 7).

[3] http://online.wsj.com/news/articles/SB10001424127887324034804578348214242291132

Figure 19: A network diagram of rail transportation industry risk transmission

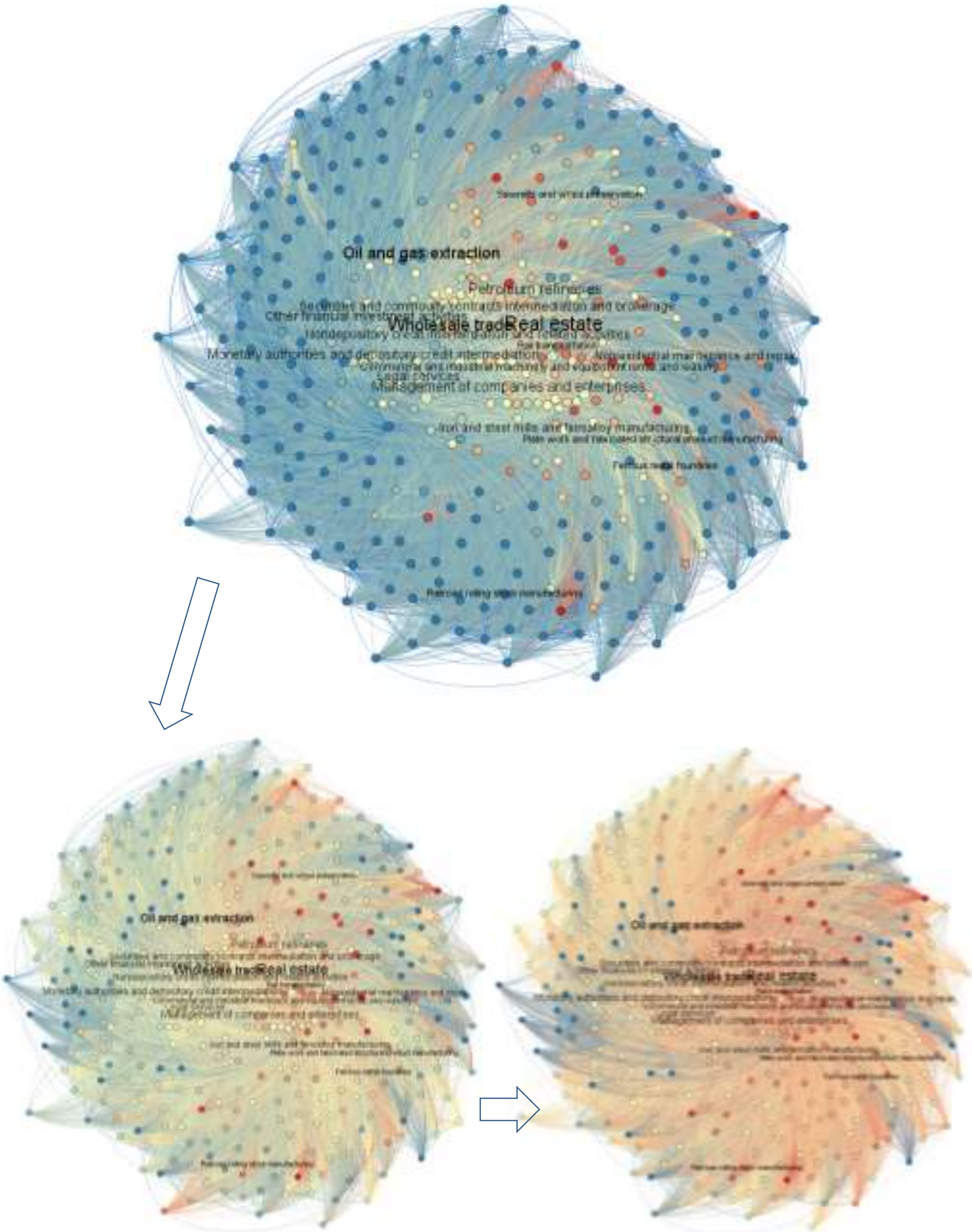


Table 7: *Impact of a slowdown in the railway transportation industry on other industries*

Industry	Simulation periods					Total Loss
	Period 1	Period 2	Period 3	Period 4	Period 5	$ mln
Rail transportation	-13,190	-37	-20	-22	-22	-13,290
Petroleum refineries	-	-2,721	-163	-176	-167	-3,227
Oil and gas extraction	-	-	-2,576	-397	-243	-3,216
Wholesale trade	-	-847	-351	-242	-223	-1,663
Nondepository credit intermediation and related activities	-	-982	-156	-86	-76	-1,300
Railroad rolling stock manufacturing	-	-432	-231	-117	-57	-837
Real estate	-	-47	-253	-267	-258	-825
Commercial and industrial machinery and equipment rental and leasing	-	-701	-22	-43	-32	-797
Other financial investment activities	-	-373	-93	-117	-89	-672
Management of companies and enterprises	-	-	-254	-181	-142	-577
Architectural engineering and related services	-	-238	-97	-117	-114	-567
Advertising public relations and related services	-	-79	-184	-148	-134	-546
Iron and steel mills and ferroalloy manufacturing	-	-28	-178	-171	-147	-523
Sawmills and wood preservation	-	-400	-59	-17	-12	-488
Monetary authorities and depository credit intermediation	-	-104	-152	-116	-105	-477
Ferrous metal foundries	-	-319	-85	-44	-27	-475
Nonresidential maintenance and repair	-	-209	-56	-88	-63	-416
Securities and commodity contracts intermediation and brokerage	-	-55	-129	-113	-91	-388
Legal services	-	-107	-68	-80	-66	-322
Plate work and fabricated structural product manufacturing	-	-1	-118	-113	-68	-299
Accounting tax preparation bookkeeping and payroll services	-	-128	-61	-55	-49	-292
Other	-	-1,000	-2,594	-2,733	-2,620	-8,946
Total	-13,190	-8,807	-7,901	-5,442	-4,806	-40,146
As % of US GDP						-0.26%

FARMLAND

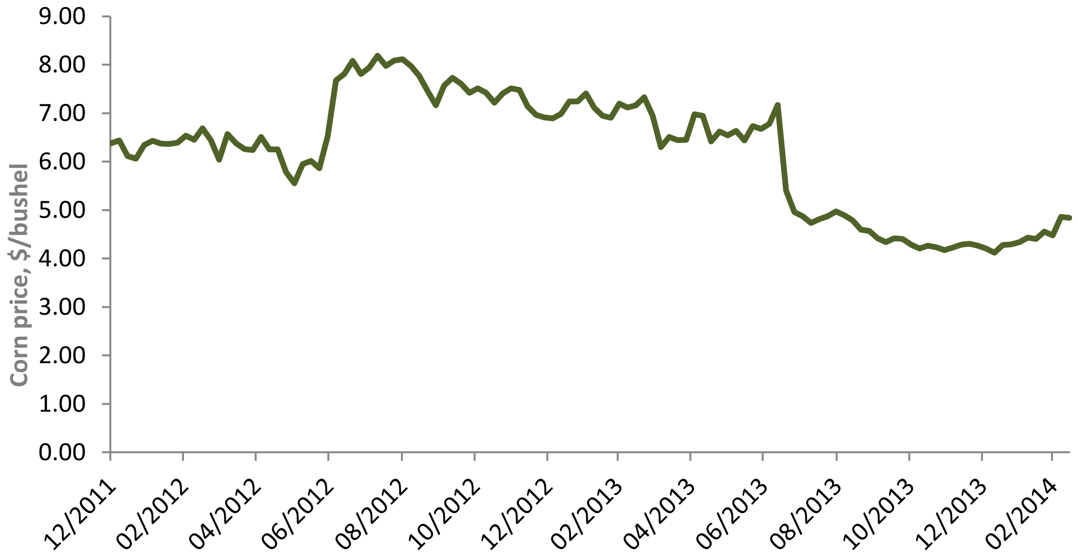
In late 2013 the pressure was building up in the US agricultural markets. As we had indicated in the 2013 edition of the Global Systemic Risks, we expected corn production volumes to recover, corn prices to plummet, with resulting impact on agricultural land prices and financial markets.

Corn production did recover and prices did fall reaching their lowest reading in January 2014. The combination of corn and ethanol prices brought the risk intensity level to its extreme (Figure 20).

Figure 20: *Risk intensity, US Farmland, Source: LINKS*

The intensity levels fell by March of this year, as ethanol prices and along with it corn demand showed some signs of recovery. There are some signs of corn prices recovering too (Figure 21).

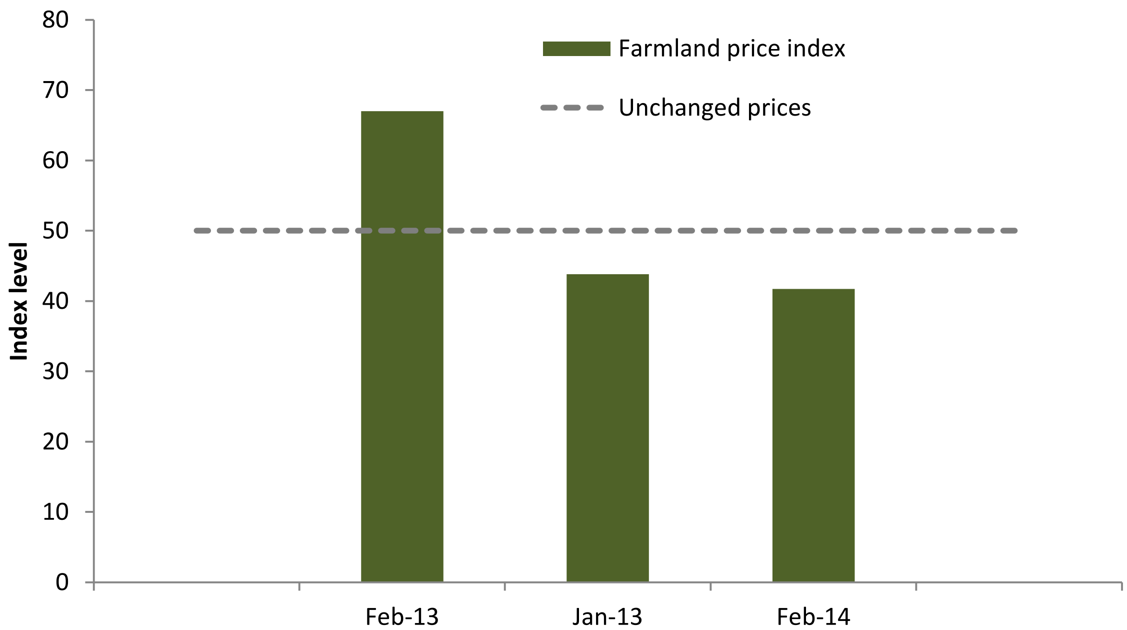
Figure 21: Nearby corn futures price, Source: CME



Food prices globally, however, are still on the rise, which is the key for continuing to include the farmland risk source in our list. The key question is whether there are any signs of farmland price deflation. Unfortunately farmland price data from the US Department of Agriculture is delayed and infrequent, which leaves us with alternative sources.

One such source is Creighton University in Nebraska, which carries out monthly surveys[4] (Figure 22).

Figure 22: Farmland price index, Source: Creighton University, Nebraska



[4] http://business.creighton.edu/centers-programs/economic-outlook/mainstreet-economy/survey-details

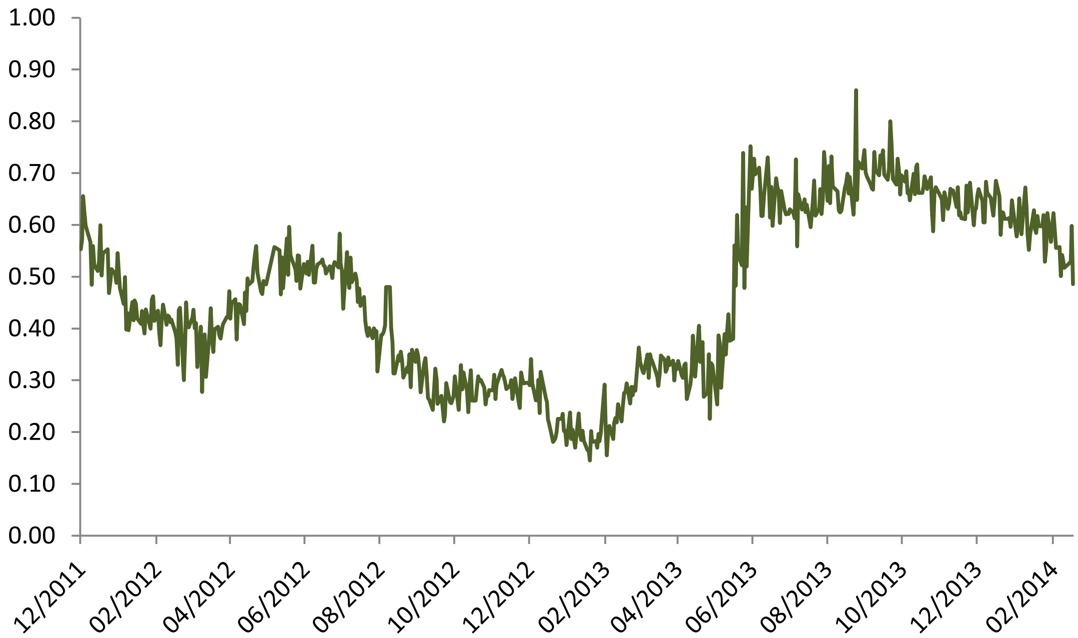
According to the February survey, farmland prices have started to fall first time since 2008. Compared to February 2013, the index level is 30 points lower. Expectations are not promising either. Majority of farm credit bankers, when asked about the likely direction of prices, pointed at a higher likelihood of prices falling (Table 8).

Table 8: Farm banker poll, Source: Creighton University

	Increase	Increase	No	Decrease	Decrease
	6% - 12%	1% - 5%	Change	1% - 5%	6% - 12%
Over the next year, what change in farmland prices do you expect in your area?	1.70%	11.70%	23.20%	35.00%	28.40%

It will take a few more months to receive a corroboration of these findings in the US Department of Agriculture data. In the meantime, agriculture-related financial markets are not perturbed. In fact, there is a slight compression of Federal Farm Credit Bond spreads (Figure 23).

Figure 233: FFCB Bond spread over treasuries, 10 year, Source: FFCA, LINKS



Judging by falling spreads it appears that the expectation is that the worst is over. We have not seen extended farmland price falls. Nor have we seen the resulting financial distress.

Transmission and impact

Although the ultimate epicenter of the risk is farmland, the impact on farmland and farms is rather limited. Only about USD 10 billion of the total estimated $ 100 billion impact can be attributed to farms. A wide range of industries, however, are affected due to the direct and indirect relationship with farms, among them: real estate, oil and gas extraction, fertilizer and pesticide manufacturing and others (Table 9). The total impact on the economy in our simulation is close to 0.70% of the US GDP.

Table 9: Impact of a slowdown in the farmland-related industries on other industries

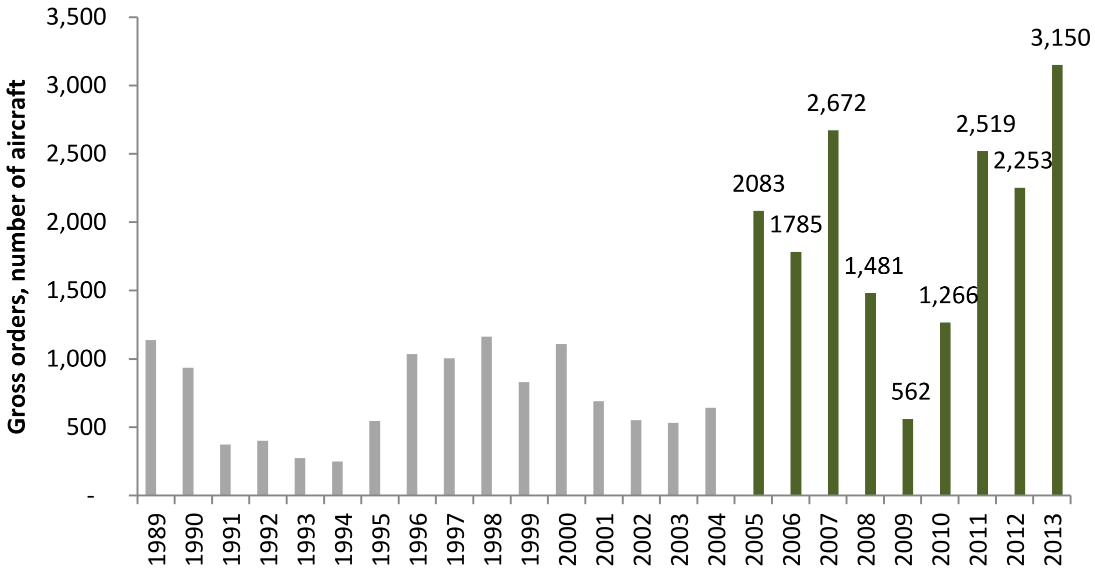
Industry	Simulation periods					Total Loss
	Period 1	Period 2	Period 3	Period 4	Period 5	$ mln
Grain farming	- 10,610	- 1,276	- 121	- 43	- 26	- 12,075
Oilseed farming	- 4,878	- 766	- 86	- 14	- 13	- 5,757
Real estate	-	- 2,651	- 1,146	- 896	- 836	- 5,530
Oil and gas extraction	-	-	- 2,720	- 1,568	- 1,122	- 5,410
Support activities for agriculture and forestry	-	- 4,701	- 481	- 75	- 30	- 5,288
Other crop farming	- 4,809	- 407	- 46	- 14	- 11	- 5,286
Petroleum refineries	-	- 2,594	- 1,096	- 825	- 612	- 5,126
Wholesale trade	-	- 2,267	- 1,187	- 762	- 633	- 4,850
Fertilizer manufacturing	-	- 2,679	- 1,041	- 286	- 83	- 4,090
Greenhouse, nursery, and floriculture production	- 2,124	- 813	- 312	- 125	- 50	- 3,424
Fruit and tree nut farming	- 3,236	- 39	- 0	- 3	- 6	- 3,284
Insurance carriers	-	- 1,287	- 650	- 365	- 271	- 2,573
Pesticide and other agricultural chemical manufacturing	-	- 1,631	- 339	- 43	- 11	- 2,024
Monetary authorities and depository credit intermediation	-	- 643	- 519	- 392	- 327	- 1,882
Vegetable and melon farming	- 1,441	- 157	- 12	- 2	- 2	- 1,614
Management of companies and enterprises	-	-	- 600	- 477	- 410	- 1,488
Insurance agencies, brokerages, and related activities	-	- 18	- 605	- 477	- 317	- 1,417
Nonresidential maintenance and repair	-	- 554	- 288	- 247	- 204	- 1,293
Natural gas distribution	-	- 401	- 423	- 252	- 150	- 1,226
Advertising, public relations, and related services	-	- 2	- 358	- 424	- 399	- 1,183
Truck transportation	-	- 518	- 262	- 197	- 169	- 1,146
Other	-	- 5,607	- 9,666	- 9,372	- 8,689	- 33,334
Total	- 27,097	- 29,010	- 21,958	- 16,862	- 14,373	- 109,300
As % of US GDP						-0.70%

The civil aerospace industry has been on our radar for two years now. Despite abundance of signs of overcapacity and developing asset bubble, the risk intensity has been low throughout the two years. As we have mentioned a number of times, the biggest unknown in global systemic risk assessment is timing: it often happens that the asset bubble continues to develop, redistributing wealth and making plenty of participants rich for many years after the imbalance is spotted. Civil aerospace is a case in point.

Pricing

In case of civil aircraft, order volumes have been the key metric that stood out (Figure 25). The average number of annual aircraft orders has doubled or trebled from the rates considered to be normal throughout the last 40 years. The culprit seems to be the competitive war between low cost carriers in Asia and to a lesser extent, state-sponsored airlines in the Middle East. Economics-based decision making has been redundant in the industry where new aircraft is a sign of prestige and a solution to life-or-death problem in equal measure.

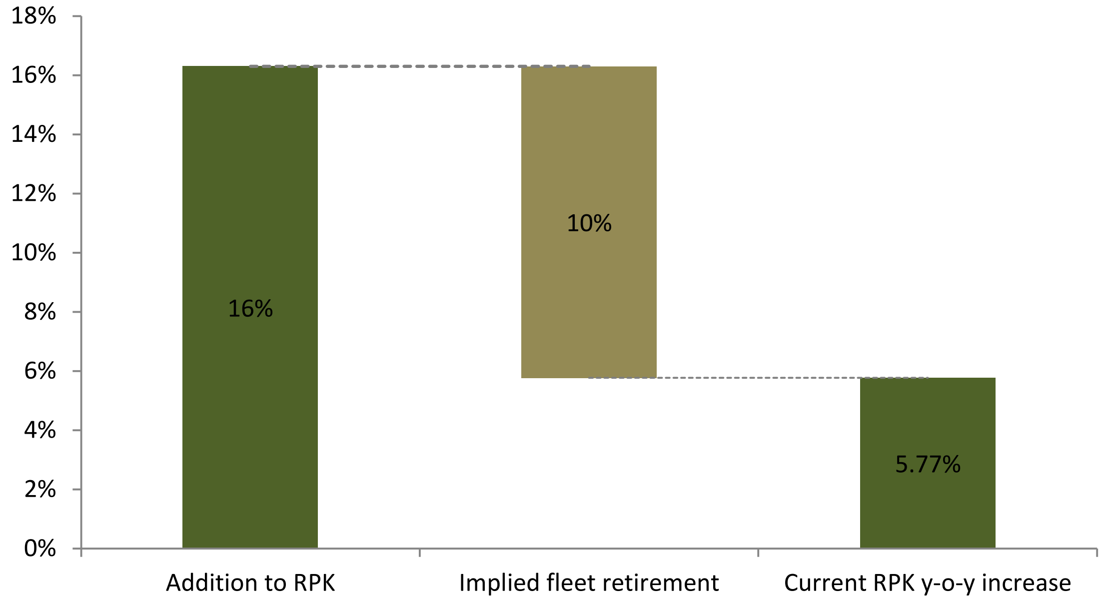
Figure 24: *Large civil aircraft order rate, Source: Boeing, Airbus*



Sustainability constraints

The biggest issue overlooked by the industry is the rapid deterioration of asset life for airlines and the implications for the economics of airline business. The current rate of production adds on average 16% to the global capacity per year, while demand globally grows only at 5.7% (average for 2013). If too much capacity is added, the load factors will fall and price competition will make current flights loss-making. Therefore, in order for load factors to remain stable, the difference – 10.5%, should be compensated by retiring the existing fleet (Figure 26). If, however, every year 1/10th of the fleet is retired (not sold off to a different airline, but permanently retired), the average life of the aircraft asset is then 9.5 years, down from 15-18 years formerly. This makes the airline business model even less sustainable than before.

Figure 25: *Rate of aircraft introduction and retirement, Source: LINKS research*



New entrants

Low-cost carriers in the Asia Pacific region are predominantly responsible for the upsurge in orders. Most of the existing low cost airlines have not been in existence for long, at least in present scale. More worryingly, the entry of new low-cost carriers in the region fuelled by low interest rates and European/US export credit agencies (cheap money) does not abate. In 2014 alone 10 new low-cost carriers are expected to start their operation in the region to compete with the existing 47 (Table 10).

Table 10: *New airlines to be launched in 2014 in Asia, Source: CAPA – Centre for Aviation*

Carrier	Country	Airline group owner(s)
AirAsia India	India	AirAsia
China United	China	China Eastern
Jetstar Hong Kong	Hong Kong	Jetstar (Qantas) and China Eastern
Jiu Yuan	China	Juneyao Airlines
NokScoot	Thailand	Nok (Thai Airways) and Scoot (Singapore Airlines)
Spring Japan	Japan	Spring Airlines
Thai AirAsia X	Thailand	AirAsia X
Thai VietJet	Thailand	VietJet and Kam Air
Tigerair Taiwan	Taiwan	Tigerair (Singapore Airlines) and China Airlines
V Air	Taiwan	TransAsia Airways

Governance and transparency

Reporting quality is poor to say the least. There is little indication of even current profits let alone airlines' assessment of long-term impact of capacity.

Transmission and impact

The impact on supplying industries is quite expected: aircraft engine and engine parts, other parts and auxiliary equipment industries are hurt most, with $3-7 billion impact each. Not far off, however, are broad industries such as semiconductors, wholesale, iron & steel etc. The total impact on the US economy alone is estimated at 0.38% of the US GDP.

Table 11: *Impact of a slowdown in the aircraft manufacturing industries on other industries*

Industry	Simulation periods					Total Loss
	Period 1	Period 2	Period 3	Period 4	Period 5	$ mln
Aircraft engine and engine parts manufacturing	-	- 3,047	- 2,076	- 1,242	- 731	- 7,096
Aircraft manufacturing	- 4,347	- 452	- 41	- 61	- 61	- 4,963
Other aircraft parts and auxiliary equipment manufacturing	-	- 2,979	- 1,021	- 338	- 169	- 4,507
Management of companies and enterprises	-	- 1,212	- 907	- 524	- 436	- 3,079
Wholesale trade	-	- 760	- 733	- 604	- 561	- 2,658
Real estate	-	- 166	- 416	- 525	- 561	- 1,669
Iron and steel mills and ferroalloy manufacturing	-	- 701	- 386	- 333	- 243	- 1,664
Semiconductor and related device manufacturing	-	- 974	- 227	- 110	- 103	- 1,414
Search, detection, and navigation instruments manufacturing	-	- 310	- 170	- 389	- 265	- 1,134
Advertising, public relations, and related services	-	- 121	- 295	- 311	- 306	- 1,033
Legal services	-	- 253	- 269	- 205	- 182	- 908
Architectural, engineering, and related services	-	- 167	- 208	- 258	- 257	- 890
Petroleum refineries	-	- 11	- 158	- 341	- 370	- 880
Management consulting services	-	- 198	- 246	- 189	- 162	- 794
Employment services	-	- 111	- 240	- 215	- 186	- 753
Oil and gas extraction	-	- 0	- 52	- 239	- 436	- 727
Truck transportation	-	- 176	- 161	- 145	- 136	- 618
Electric power generation, transmission, and distribution	-	- 81	- 178	- 180	- 168	- 606
Monetary authorities and depository credit intermediation	-	- 42	- 138	- 195	- 208	- 583
Valve and fittings other than plumbing	-	- 343	- 138	- 57	- 38	- 575
Broadcast and wireless communications equipment	-	- 241	- 146	- 91	- 76	- 554
Other	-	- 3,815	- 6,449	- 6,375	- 6,313	- 22,952
Total	- 4,347	- 16,163	- 14,654	- 12,926	- 11,967	- 60,057
As % of US GDP						-0.38%

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