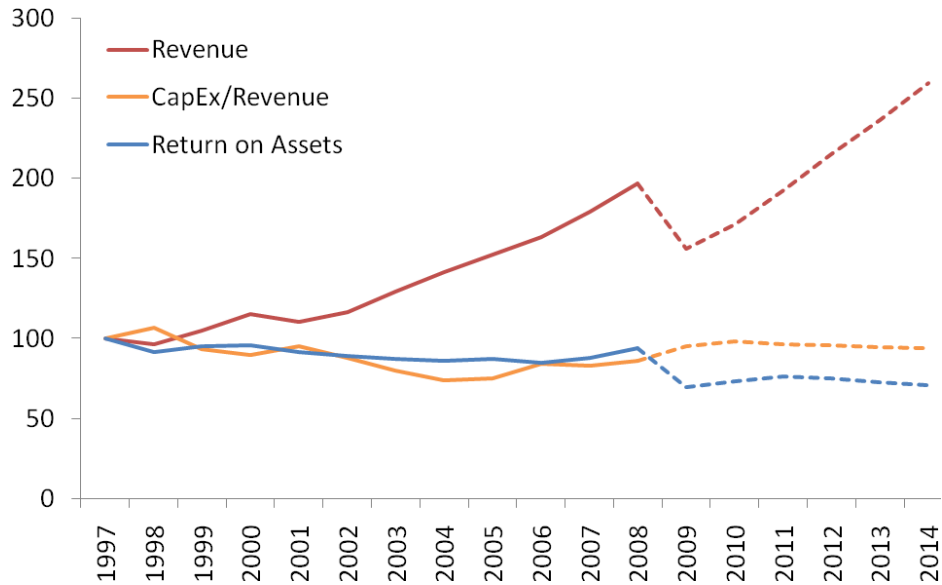


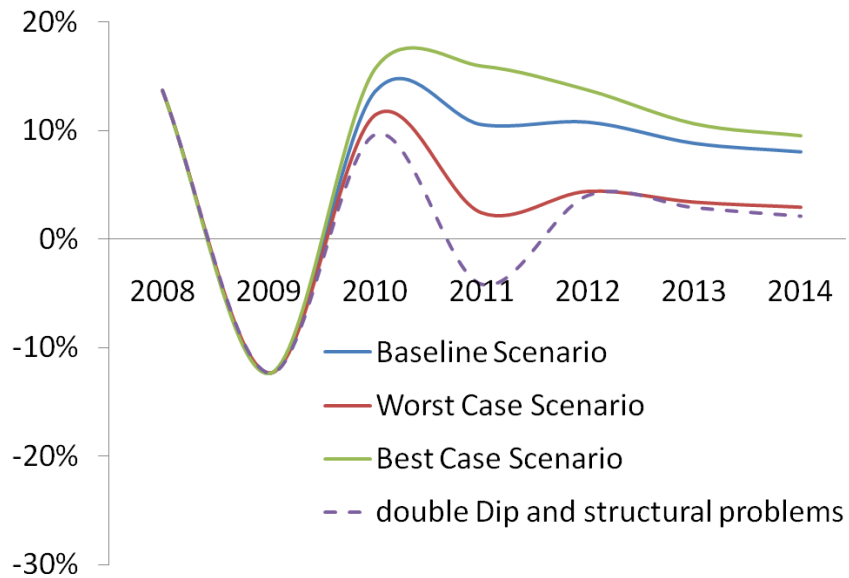
## Capital Expenditure Survey 2010

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**CapEx vs. Revenue, Revenue and Return on Assets  
All Industries with ARC Projection (Baseline Scenario) Scenarios for  
CapEx Development, 2008 to 2014**



**CapEx Scenarios**

## Executive Overview

In the year since ARC's last CapEx report, the world's economies, which had just nose-dived and bottomed out in the worst recession since the Great Depression, have begun to recover, but at different rates and for different reasons. Now that the dust has settled, the period of economic chaos and uncertainty has come to an end. However, there is still a lot of "broken porcelain" lying around in the aftermath of the economic crisis.

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China, India, and Brazil emerged from the crisis not only unscathed, but with newfound economic strength and a bright view to the future. The US still battles with sluggish growth and stubbornly high unemployment after the crisis exposed the country's structural problems, especially in the labor market. In Europe, most countries lie somewhere in the middle. Rattled by the near-collapse of the euro, most European countries are also burdened by sovereign debt, which only grew in the crisis. Most have initiated austerity programs to tackle the problems brought on by decades of irresponsible fiscal policy exacerbated by demographic developments. Led by Germany, the exporting economies are enjoying a sustainable boom, fed by demand from emerging markets. The days of the transatlantic virtuous circle are over.

According to ARC's most recent data, capital spending as a percentage of revenue across all ten target industries declined between 1997 and 2008 at a compounded annual rate of just -0.4 percent. Excluding the highly profitable oil & gas industries, this value falls to -1.9 percent, which more accurately reflects the long-time decline in capital spending due to efficiencies gained through technology. While absolute capital spending dropped by -12 percent in 2009, this value tends to fluctuate from year to year. This drop followed the previous year's increase of 14 percent and a three-year boom of above-average spending just prior to the crisis.

ARC's CapEx index tracks capital expenditures, total revenue, total assets, EBIT, and return on assets (ROA) for 52 companies in 10 major industries, representing over \$3 trillion in annual revenue. Companies in the index generate revenue from most global markets and many spread their manufacturing around the globe. Sixty-five percent have their headquarters in North America, 25 percent in Europe, and 10 percent in Asia.

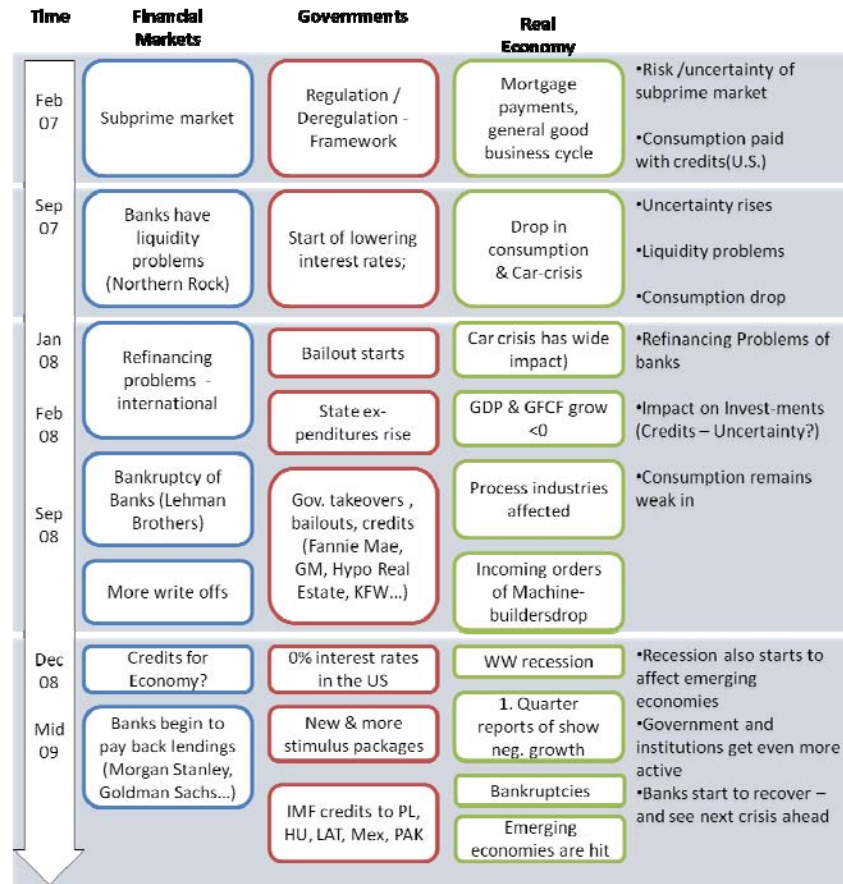
## **The Crisis and the Global Investment Climate**

The global economy began a steadily accelerating decline in about mid-2008, the end of a string of boom years. The bubble economy, with massive consumption in many developed and developing nations, simply could not be sustained. Emerging markets had been growing steadily at 7 to 10 percent for years and property and stock market booms translated into remarkable growth in North America and Europe. Huge investment fueled economic development further in Eastern Europe and the Middle East. Japan was recovering from its deflationary “Lost Decade.” For four years through the summer of 2007, the global economy boomed. Global GDP rose at an average of about 5 percent per year - its highest sustained rate since the early 1970s. Then things began to change.

As early as 2007, the global economy began to contract because of uncertainties in financial markets. This severely impacted the global automation market, with automotive and machinery markets caving in during the latter part of 2008 and first half of 2009. Certainly, the discrete industries took the brunt of the economic downturn, particularly industries that serve markets with high income elasticity like the automotive industry. But spillover effects have also affected process industries, such as bulk and specialty chemicals, reducing capacity utilization significantly.

### **The Economic Crisis – An Overview**

The first phase of the economic crisis was the financial crisis, which started in early 2007 with the first collapses on the subprime market in the US. At first, this was not seen as an economy-wide crisis. The situation then changed abruptly.

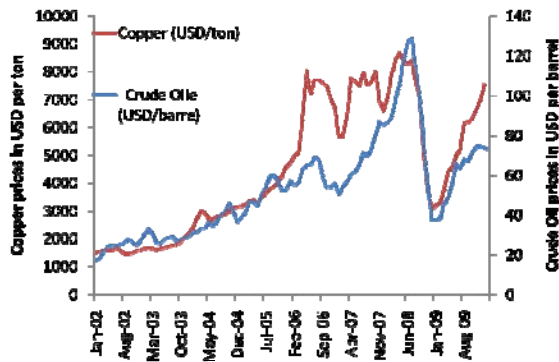


**Timeline of the Economic Crisis**

Currently, the credit crunch is a major topic for discussion industry-wide. While banks claim that loans are available, market players complain about the tightened criteria for applying for a loan. Bank loans for capital investments have to be available at reasonable interest rates to finance growth and recovery. However, low interest rates alone do not necessarily trigger expenditures in automation equipment. Future spending in automation equipment depends not only on the ability of companies to get loans to invest in new capital equipment, but also on their willingness to borrow money in the first place.

**Impact of Natural Resource Prices**

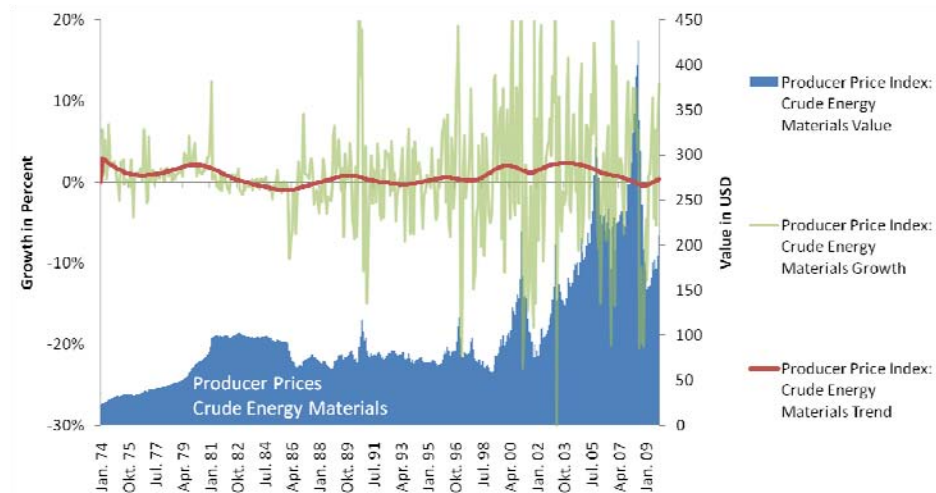
In the last eight years, it has become evident that energy prices will have a large impact on manufacturing in all industries. As prices rise, the energy required to generate heat, cooling, steam, compressed air, and electricity, and pump water is becoming an increasingly important cost factor that must be measured, monitored, and controlled as any other cost factor.



**Commodity Prices (Copper and Crude Oil)**  
 Source: Federal Reserve Bank and Westmetall

The figure to the left helps illustrate the long-term trend in which commodity and energy prices alike have become increasingly more volatile (with commodity prices rising significantly) since 2002. From 2006 until the start of the financial crisis, skyrocketing prices of natural resources concerned economists, investors, and automation suppliers alike, since they directly impact production costs. The price development will have a sustainable effect since, unlike during the oil crises of 1973 and 1980, the commodity price shock was not induced by a supply shortage, but rather by rising demand.

The sustainability movement in manufacturing, which is a direct result of rising input prices, is important for industrial markets. Not only does it require a more flexible approach to production, it also demands more measurement and control of processes, which ultimately enlarges the nodes needed within a system.



**Development of Energy Prices**  
 Source: Federal Reserve Bank of St. Louis

**Capital Investment and Its Dependency on the Business Cycle**  
 Manufacturers typically borrow money from banks to invest in automation capital equipment. As such, real long-term interest rates directly influence the total cost of ownership for automation equipment. The lower the interest rate, the less cash flow is needed to service the loan. The central banks (such as the US Federal Reserve, the European Central Bank, and the Bank

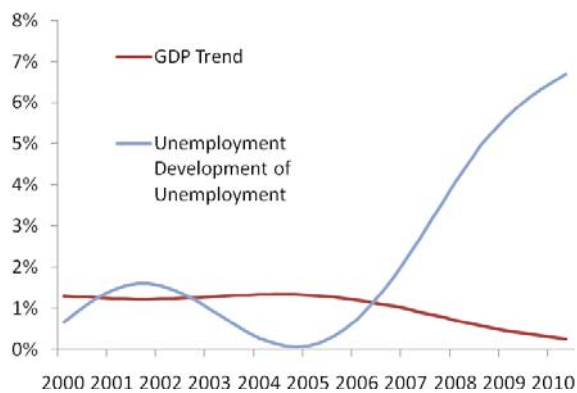
of England) establish the target interest rates. Individual commercial banks then incorporate economic risks when analyzing the rates they charge to manufacturers, so these interest rates are above the central banks' target rates. While low interest rates benefit investment, if combined with a positive economic development, they can create inflationary pressure.

## Scenarios for ARC's CapEx Forecast

In light of the effects of the economic crisis, ARC has applied its scenario methodology to the CapEx data and forecasted various scenarios. The scenario analysis is based on economic modeling and time series fundamentals and takes into account factors affecting the development and dynamics in the ten target industries. In addition, the factors look at the main drivers for growth in capital expenditures, revenue, and assets. Scenario analysis allows the analyst to weight certain factors or to turn them off or on, as well as consider the codependency of all factors.

### Last Year's Forecast

Comparing the situation today with expectations of a year ago, it's obvious that even our best-case scenario for capital expenditures was slightly too pessimistic compared to the actual development. Strong demand in the BRIC



Development of GDP Growth versus Unemployment in the US

countries and positive development in some European countries (especially Germany), were unprecedented. Old rules, such as "the US recovers first," or "German growth is predominantly export-driven," were no longer valid.

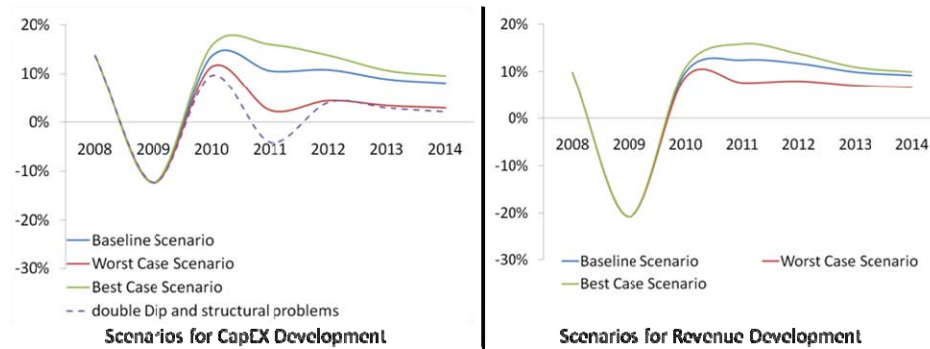
While companies benefited from the development in Europe and Asia, in the US economy, there is increasing concern that many of the current changes may be structural rather than cyclical. Unemployment remains stubbornly high and GDP growth is sluggish. The chart to the left depicts two curves: the US unemployment rate (calculated with a low pass filter) and US GDP growth. Since the trend eliminates short-term influences, it shows the structural development of an economy. In this case the trend shows a lower GDP growth and a higher unemployment rate.

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## Scenarios

As for last year, we used our scenario technique to model the future development of CapEx and revenue of the companies in our sample. Incorporating the latest data available, we see a strong rise in capital expenditures through 2010 and are confident that this development will continue through 2011. However, the speed of recovery in 2010 will not be reached in CapEx development in 2011 and long-term growth will gradually dampen out.

ARC expects stronger revenue development in 2011 versus 2010. Looking at the different development of CapEx and revenue, it is surprising that revenue was less stable than CapEx - usually it is the other way around. In this regard, market effects in 2009 caused the drastic drop in commodity prices. Due to market capitalization, the oil & gas and metals industries have a comparably high weight in our sample. Compared to worldwide GDP, the revenue development of these industries suffered from price drops caused not only by a drop in demand but also by the bursting price bubble at the markets. Without the commodity sectors (oil & gas, metals), CapEx dropped by -18 percent and revenue by -8 percent. The difference shows the impact of resource prices on our index.



### Scenarios for Capital Expenditures and Revenue Development

Another sector where revenues were affected more drastically than investments was the automotive industry. The main reason is that automotive has long planning and investment cycles. Because the crisis came fast, consumer stopped buying cars overnight. The industry could not cut expenditures quickly enough and the recovery, especially in Asia and Europe, came fast so that further investment stops were no longer necessary.

## Introducing the Factors

Compared to last year's scenario, we modified our scenario factors slightly, and adjusted the impact of the factors over time to match the latest developments.

Scenario Factor	Change from Last Year
Business cycle	Changed from crisis to overall economic development
Prices of natural resources	No change
Availability of natural resources	New
Interest rates	Identical but different emphasis
Asian markets still have positive growth	No change
Development of food & beverage, pharma - Demand and Urbanization	No change
Rising degree of automation in emerging economies (rising wages)	No change
Debt problems of governments	New
Investment in Infrastructure	No change
Projects are on hold - not canceled (backlash effect)	No change
Credit crunch	Eliminated
Stimulus packages	Eliminated
Struggling automotive industry	Eliminated

### Factors in ARC's CapEx Scenario Analysis

continued production is still economically reasonable. Opportunity costs (the costs of not investing in new machinery) also must be considered. New equipment increases operating performance, so the differences in performance and quality between old and new equipment are missed opportunities for revenue.

CapEx does not capture investments in services. Services in general are based on the installed base, not on assumed consumer demand. For example, the purchase of plant asset management (PAM) software is a capital investment, but maintenance services are booked simply as expenses.

The value-add associated with capital investment depends on factors such as the volume and the price of the product sold. The costs of these investments are represented by interest rates, since most investments are financed. We used the identical factors for revenue and investment modeling but changed their impact and the time lags.

Another factor is crucial for investment: depreciation. Economically, a machine becomes "cheaper" to own due to annual depreciation, losing value the longer it produces. However, if a machine still produces well and without increasing maintenance costs, then con-

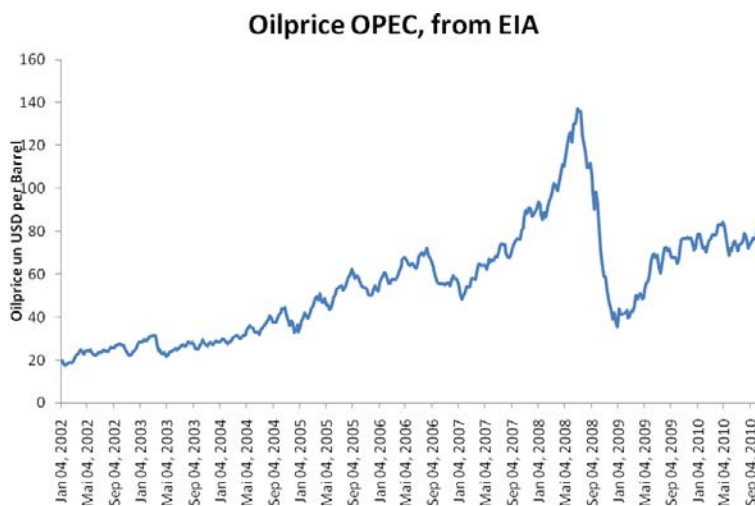
Each industry has its specific dynamics of producing and investing. For example the electric power, water & wastewater, pharmaceutical, and food & beverage industries invest steadily, while the electronics or the machinery sectors vary heavily in the amount of investments.

### Mechanisms

It is important to describe the mechanisms associated with each factor to understand the dynamics of overall CapEx, revenues, and assets, since not every factor has a clear one-way causality. Also, factors tend to be co-dependent.

### Prices and Availability of Natural Resources

The price development of some commodities has raised concerns among economists and many companies for which commodities represent a significant share of variable costs. The chart to the left shows the development of



**Development of Oil Prices**

Source: OPEC

oil prices before, during, and after the crisis. Currently, the prices have settled at a level higher than before the crisis.

While high commodity prices can boost inflation and influence production, their impact on capital expenditures and revenue is not as dramatic as the availability of resources. The availability of resources is closely linked to the price (reduced availability increases prices, but higher prices also increase exploration and

thus ultimate availability). Currently, the availability of rare earth metals has become a problem after China nearly stopped exports of rare earth metals, especially to Japan following a maritime dispute. In July, the quotas for these special commodities were limited and analysts expect that Chinese exports will drop from 60,000 tons in 2009 to 38,000 tons in 2010. This could pose a real danger for selected industries.

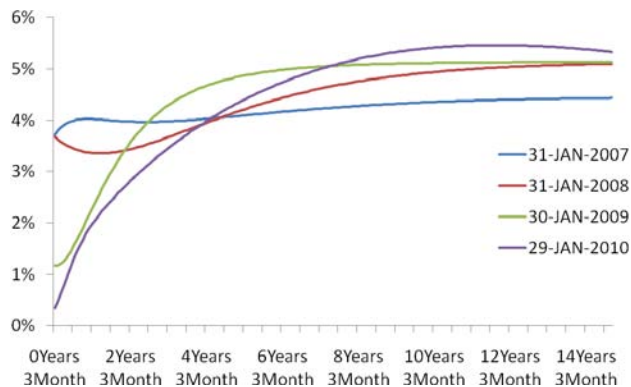
Our worst case scenario includes ongoing high prices and scarce resources of rare earth metals. Our baseline scenario includes only high prices of these metals and assumes that the supply will nevertheless be guaranteed.

One reason for this assumption is that China, which already faces troubles with the World Trade Organization (WTO), depends on its exports.

### Interest Rates

Interest rates heavily affect the development of capital expenditures as well as the overall economic situation. Most central banks lowered interest rates during the recession to boost investment, but with only partial success.

This race to the bottom ended at the bottom, at around 0 percent interest rates. Now, central banks must resort to monetary instruments. For example, to raise money for the Greek rescue, the European Central Bank (ECB) currently accepts Greek bonds as securities, even though they are rated as junk. This form of “printing money” blurs the critical separation of central bank and politics.



**European Yield Curve**  
Source: European Central Bank

Interest rates not only impact the economy, they are also a predictor. The yield curve is the relation between the interest rate and the time to maturity of debt at a given point in time. The yield curve in the euro area has developed from flat (January 2007) to its normal shape (January 2010). Flat yield curves are a sign that economy is in a recession, since the risks for a three-month investment, represented by the interest rate, are as high as for a 10-year investment. Usually, long-term interest rates are higher.

In the US, the Federal Reserve Bank (Fed) is pumping trillions of dollars into the market by buying government bonds and offering near-zero interest rates, as well as buying non-conventional assets, such as mortgage-backed securities.

In our scenarios, we included the lack of any consumption boosts from the US monetary policy and also included the fact that the yield curves in Europe now show positive development.

### Asian Markets

After the financial markets developed from an allocator of risk to a creator of risk, economists hope that the real economy will provide stability. China and other heavily populated countries are the bearers of hope. After capitalism saved China, China may now save capitalism. Urbanization and

	Imports	Exports	Balance
North America	98	350	252
Latin America	67	57	-11
Europe	145	371	227
Commonwealth of Independent States	34	65	31
Africa	56	50	-6
Middle East	80	58	-22
Asia	651	476	-175
<b>WORLD</b>	<b>1,132</b>	<b>1,428</b>	<b>296</b>

**China's Trade with the World**  
Source: WTO

WTO numbers in the table, current exports to China from the western economies (and thus their effect on GDP) is still small, but these will increase, as the Chinese middle class emerges.

### Consumption and Hybrid Industries

Demand for capital expenditures in production varies greatly by industry. While the ratio of capital expenditure to revenue tends to remain stable within an industry, some industries show specific characteristics. For example, customers only purchase new cars when they are certain about financing, whereas the same customers will purchase bread daily as a basic need. Since capital spending depends in part on the expected revenue generation of a machine, it is plausible that, in a crisis, investing in a bread-making machine will pay off more than investing in a machine that produces a cylinder head.

Certainly, more factors connect consumer demand with capital spending, but ultimately, consumption has the strongest influence on capital spending within most industries. Within the crisis, it has become obvious that the discrete industries are much more volatile, but also that many process industries (such as chemicals) heavily depend on discrete industries (such as automotive) as customers.

### Backlash

Many manufacturers postponed capital investments due to recent drops in demand and in anticipation of a long dry spell. However, these investments cannot be postponed forever. For example, automobile manufacturers plan new models and facelifts years in advance. Most au-

ngoing growth in the middle class raise demand for manufactured goods, including processed foods and pharmaceuticals. In addition, rising wages drive capital expenditures as manufacturers automate processes currently performed by manual labor.

Even though the latest five-year plan aims to take pressure from the large cities along China's coastal line, over the next 20 years more people will migrate to China's bursting cities. These workers will form tomorrow's middle class. Looking at the

tomakers will not likely put off these important milestone investments for more than a few months. Other investments are necessary simply to ensure the continuation and quality of production and cannot be delayed for too long. As soon as economies begin to stabilize, uncertainty will decrease, access to capital for companies will resume, and the virtuous circle of spending and consumption will be restored.

### **The Scenarios**

The following section looks at three scenarios based on different developments of each indicator. Each indicator is dependent on others, as described in examples, and the scenarios take these dependencies into account.

#### **Baseline: Most Plausible**

The overall positive economic climate leads us to the conclusion, that we can assume stable growth for the next years. The years 2010 and 2011 are characterized by a strong growth in capital expenditures, where many companies invest to catch up with investment, which was postponed during the crisis, to build up capacities in BRIC countries, and to modernize plants to reduce commodity consumption.

#### **Worst Case: And the Crisis Goes on....**

Our worst-case scenario includes many negative factors currently discussed. Here, the semiconductor industry will suffer from a lack of rare earth metals, debt crisis in Europe endangers growth, and the US economy is not able to fight its structural problems. However, both the emerging economies in Asia and new capital expenditures in energy-efficient technologies to reduce commodity and energy costs will work to boost investment in this scenario. While, in this case, we don't think it's likely we will face another negative growth year in 2011, several factors, including a potential structural crisis in the US, will dampen growth in the long run.

#### **Best Case: The Glass Is Half Full**

Our best-case scenario is, in our point of view, more likely than the last scenario below. In the best case, the debt crisis has hardly any impact on real economic growth and the worldwide economic growth eases the pressure on these economies as their income rises again.

Also backlash effects are very strong and lead to a very good year in 2011. For this it is important that the industries with long investment cycles gain confidence in the recovery.

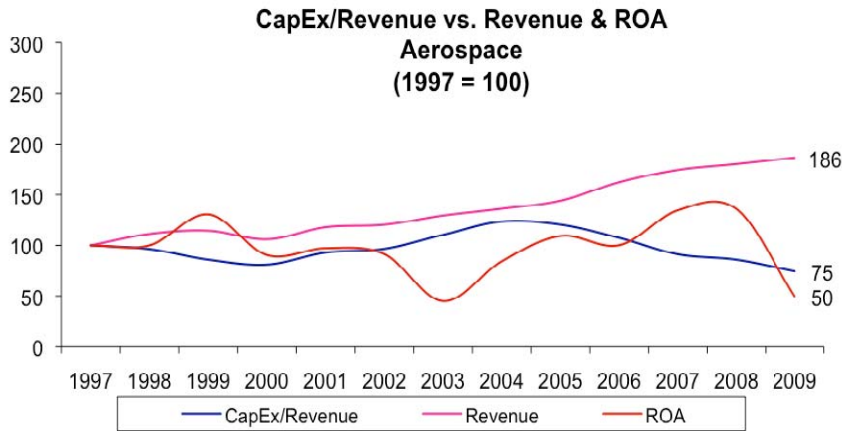
**Double Dip and Structural Problems**

This scenario is very unlikely. The double dip is in our point of view only possible if debt crisis and currency crisis lead to a global uncertainty and the US economy gets into a severe liquidity trap like Japan in 1999-2000.

**CapEx Trends by Industry**

**Aerospace**

The aerospace industry has grown at about twice the rate of world GDP for the last 30 years. Aerospace manufacturers employ advanced automation



software and hardware to maximize planning accuracy and minimize waste. In the long run, a possible carbon tax and higher flight prices could diminish demand for airplanes.

Aerospace is currently experiencing a shift in production towards a flattened supply chain and

more distributed production. Global aerospace players have become system integrators, enabling them to effectively leverage brand name, core competence, and domain knowledge. Driven by these factors, OEMs are becoming increasingly dependent on tier 1, 2, and 3 suppliers for sourcing parts, subassemblies, and services. Even though many emerging economies benefit from this development, the aerospace industry faces large problems in emerging economies where ecosystems or industry clusters often are not well-developed.

The aerospace industry is traditionally a leader in and early adopter of cutting edge manufacturing technologies. In the complex processes of building commercial and military aircraft, product lifecycle management (PLM) tools and simulation play an increasingly pivotal role in reducing costs. PLM will continue to be the primary design/build tool for A&D,

Utilities	16.5%
Semiconductor	8.6%
Chemicals	7.3%
Metals & Mining	7.0%
Automotive	6.3%
Oil & Gas	6.2%
Pharma	6.0%
Pulp & Paper	5.8%
Food & Beverage	4.4%
Aerospace	3.7%

**CapEx as a Percentage of Revenue by Industry, 12-Year Average**

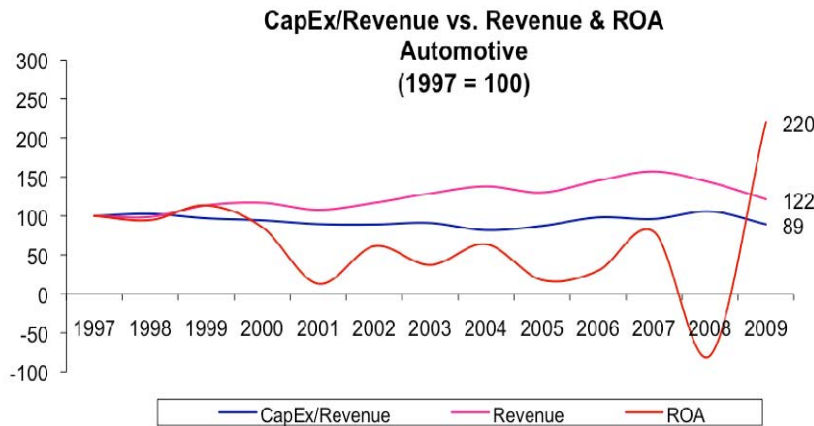
while digital manufacturing and virtual commissioning are being used more to validate automated assembly systems.

With just three large companies in this category (Boeing, EADS, and Lockheed Martin), capital spending as a percentage of revenue has remained mostly flat since 1997, declining somewhat since 2005 due to flat spending while revenue increased. At the same time, ROA recovered steadily until 2009, according to ARC's CapEx Index.

## Automotive

The economic crisis affected the automotive industry more than any other. In North America, two of Detroit's Big Three automakers filed for bankruptcy in 2009, but emerged surprisingly fast in 2010 thanks to liberal US bankruptcy law. Ongoing competition and cost pressures caused the tier 1 supplier market to consolidate considerably, forcing automation suppliers to deal with a shrinking number of customers.

During the crisis, in Europe, the most successful program to combat the economic crisis was Germany's *Abwrackprämie* (cash for clunkers) that



boosted demand for cars significantly in 2009, albeit for a short time. In combination with government loans, many European governments enlarged their influence on the industry and managed to sustain production in Europe. In North America, while the two of Detroit's Big Three automakers

that filed for bankruptcy in 2009 both emerged from Chapter 11 by mid-year, the North American car industry still has a long way to go if it is to survive in the long term. Generous investments in e-car technology just might save the industry.

All automakers recognize the potential and growing importance of emerging markets, especially the BRIC countries (Brazil, Russia, India, and

China). General Motors, Toyota, BMW and Ford all have increased output in China to satisfy the appetite of an increasing affluent and mobile society. However, with all this capacity build-up, there is a risk of quickly creating over-capacity in a drive to win market share, just as the electronics industry in China has experienced. The threat to North America and Europe is that over-capacity in China could lead to low-cost exports to these markets sooner than expected.

Now, the picture has changed completely. Only a few months after filing for bankruptcy, GM experienced fundamental restructuring and announced what many expect to be the biggest initial public offering in history. In Europe, many car manufacturers are not able to meet demand quickly enough. In some cases, customers have to wait up to five month to receive their cars.

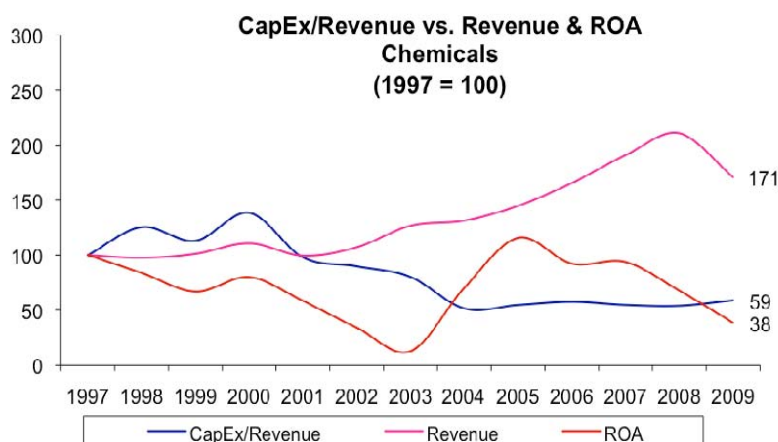
According to ARC's CapEx Index, capital spending in the automotive industry remains between 5 and 7 percent of revenue. GM offset its heavy losses in 2008 in 2009 after the company shed much of its financial yoke. The real winner is Ford Motor Company, which posted record profits in 2009 without a government bailout and, according to several sources, has been investing heavily in its future.

### Chemicals

Today, chemical manufacturers face a rapid pace of change in the marketplace. Some manufacturers experience rapid growth, while others find it difficult to keep their business going. Irrespective of size and strengths and weaknesses, most companies now face problems of increased global competition, higher costs of energy and raw materials, demand for high-quality products, more regulations regarding environmental and safety issues,

higher labor costs, and the problem of retaining trained manpower.

Despite the increase in worldwide demand for all types of chemicals, rising costs and more demanding customers put pressure on chemical manufacturers, which are forced to increase the breadth of product categories,



dedicating more resources to R&D to stay competitive. The development towards more R&D and more diverse product portfolio is partially driven by safety regulations that ban certain chemicals and demand less hazardous replacements. In the future, new environmental and safety regulations will help drive the market for investments in automation equipment, both new equipment and retrofits. In Europe, the REACH regulation covering the registration, evaluation, and authorization of chemicals has critical impact now and will continue to do so in the future.

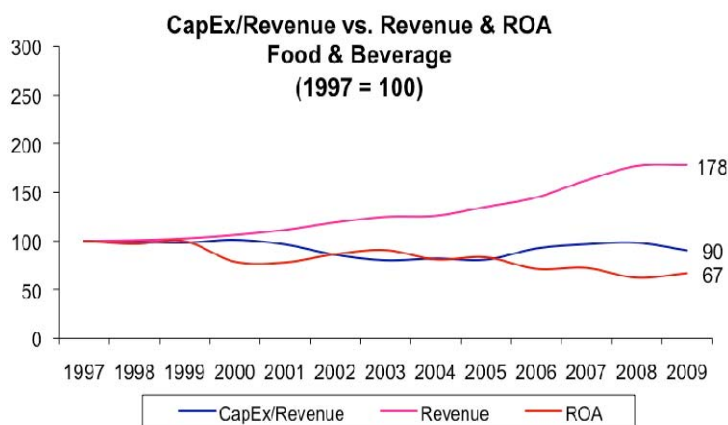
The levels of automation in the chemical industry vary enormously by manufacturing site and product type (specialty or commodity chemicals). Even though the chemical industry is a leader in research and innovation in automation, many chemical plants operate at below their potential efficiency.

Capital spending as a percentage of revenue in the chemical industry has fluctuated cyclically, declining to about 5 percent since 1997, according to ARC's CapEx Index.

## Food & Beverage

The food & beverage industries are mostly crisis-resistant and the demand for automation products continues to grow at a stable rate. The economic concept of income elasticity explains this. Consumers typically have low income elasticity for food, which means that demand for processed food products hardly changes – regardless whether incomes rise or decline. As a result, in difficult economic times when real incomes fall, demand for basic necessities remains constant. This behavior is also typical for the consumption of pharmaceuticals. Demographic changes in emerging economies help explain the steady growth. In Europe, packaged food is often cheaper

than fresh “market” food – a counter-cyclical effect.



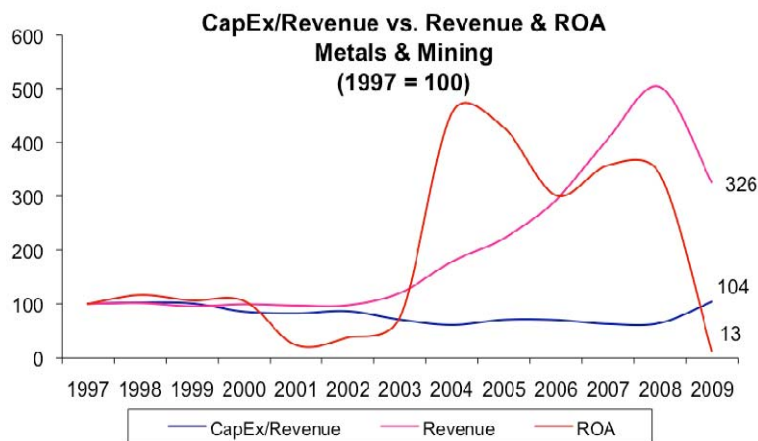
The food & beverage and CPG industries are leaders in adopting high-performance solutions and automation suppliers now lose opportunities to specialized suppliers as performance demands increase. In recent years, food & beverage producers invested heavily in their IT infrastructures, and most now have

reliable systems in place. These investments support the automated information flow necessary to meet the increasing regulatory requirements as well as the sophisticated product information tracking necessary to remain competitive and maintain regulatory compliance. Concerns over food safety have increased dramatically in recent years, driving “power” retailers to invest in supply chain visibility to increase safety and efficiency.

According to ARC’s CapEx Index, both capital spending as a percentage of revenue and ROA in the food & beverage industries have remained consistently within a constant, narrow band of 4 to 5 percent since 1997.

## Metals & Mining

Just before the economic crisis, demand for metals worldwide continued to grow and mergers dominated the industry, with Mittal Steel becoming the world’s largest steel company with over 300,000 employees and over \$100 billion in revenue. Demand in emerging markets grew fastest as manufacturers in Asia and Eastern Europe increased production. Automation suppliers serving the metals & mining industry benefited from higher metal demands. Prior to the end of 2008, high commodity prices helped automation suppliers that could address the ever increasing cost of energy in producing, transporting, and processing minerals.



In the past, volatile steel prices have been a major challenge for integrated and mini mills and have changed the landscape. In the future, commodity prices for coal or electricity will change the landscape as well. In Germany, for example, electricity prices for industrial users have risen by 30 percent since 2005, creating additional production costs of roughly \$500 million per year for producing

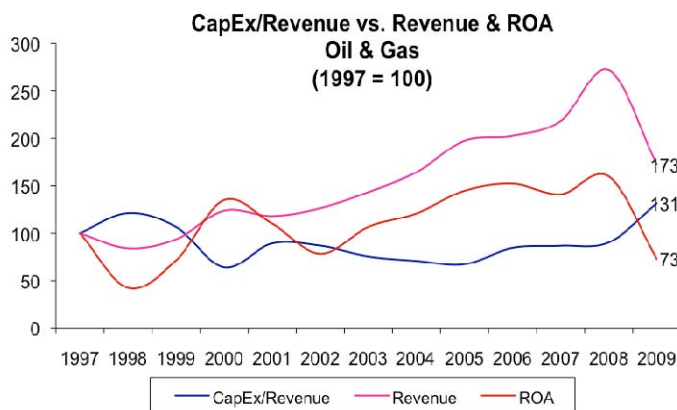
steel in Germany. The energy shortages experienced in certain regions of the world in 2007, such as South Africa and Chile, hampered production.

Demand for metals worldwide will continue to grow, thanks to fast growth in emerging markets as manufacturers in Asia increase production of industrial and consumer goods. China, now the world’s largest steel

producer, makes two and a half times as much steel as Japan and nearly three times as much as the US. Most of the industry's capacity expansion is in China, while the rest of the world focuses spending on improving and optimizing existing assets.

## Oil & Gas

Capital expenditures in the oil & gas industry did not slow down much in the first half of 2009, with energy companies and oil services companies still raking in a tremendous amount of cash. Here, the backlogs of EPCs and automation suppliers (up to 18 months) helped stabilize demand. Upstream oil & gas will provide opportunities for automation suppliers in the near future. Capital spending plans for oil & gas companies remain strong, since service activities drive the overall market.



Over the past year, the global oil & gas industry weathered a punishing boom-to-bust cycle. In 2007, the economics favored industry investments and project activity. Oil prices rose from roughly \$60 to \$100 per barrel that year, and by mid 2008, shot up to nearly \$150 per barrel. By the end of the year, however, the unraveling global economy squelched demand, and the price had fallen to \$45 per barrel, where it has

remained since, even falling below \$40 for a time.

Oil extraction is costly, with a great deal of expenditure going to maximizing production from older conventional fields that experience a greater decline in output with each passing year. The pressure to find and develop new sources of oil and gas eased somewhat with the economic crisis, but the urgency returns as the downturn eases and oil prices recover gradually.

Oil prices remained too low to drive exploration, which has reduced the demand for consumables in oil & gas (i.e., drill bits, piping, couplings, etc.), most which are produced in discrete manufacturing operations.

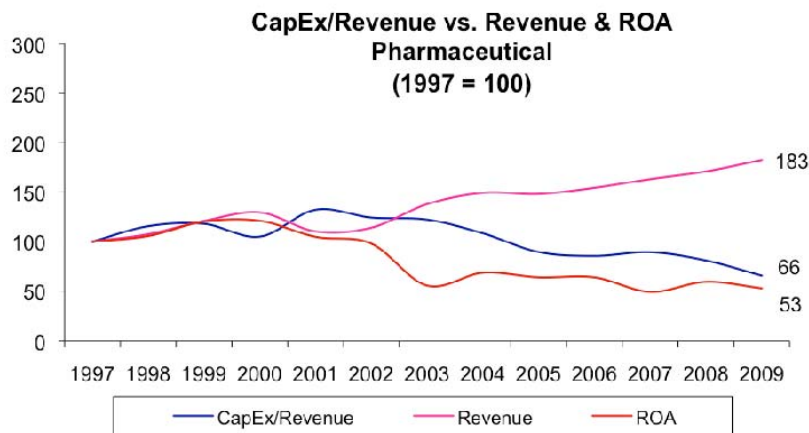
According to ARC's CapEx Index, capital spending as a percentage of revenue decreased marginally since 1997, but this effect is heavily distorted by high revenue growth in addition to real efficiencies gained due to mega

mergers. Absolute CapEx has nearly doubled in that same period. ROA grew steadily through 2008, but then dropped dramatically in 2009 due to the crisis-induced drop in demand and falling prices.

## Pharmaceutical

High capital investment, competitive markets, domination by large players, and strict regulatory controls are the pharma industry's main characteristics. Pharma operations now focus on efficiency and research capabilities. In addition, companies face various risks, including availability of funds for servicing debt repayment, long product development cycles, fluctuation in interest rates and foreign currency exchange rates, governmental regulatory controls, environmental and safety matters, and product liabilities.

Capital spending in the pharmaceutical industry is driven primarily by new drug development along with pressure to meet financial expectations, shorter time-to-market, and maintain consistent product quality. Drug makers also invest in the technologies and infrastructures necessary to achieve and demonstrate compliance with current and future regulatory requirements.



Changing consumption habits in packaged goods and food and beverages trigger business opportunities in pharmaceuticals. In China, consumption of consumer packaged goods and food increased by approximately 50 percent from 1998 to 2005. Chinese consumers now turn to packaged goods that offer convenience and

suggest a Western lifestyle. This change does not portend well for the health of the nation, but offers a huge market for pharmaceuticals: more than 20 million Chinese have diabetes, more than 160 million have high cholesterol levels, and as many have high blood pressure. In Chinese cities, around 30 percent of the population is overweight.

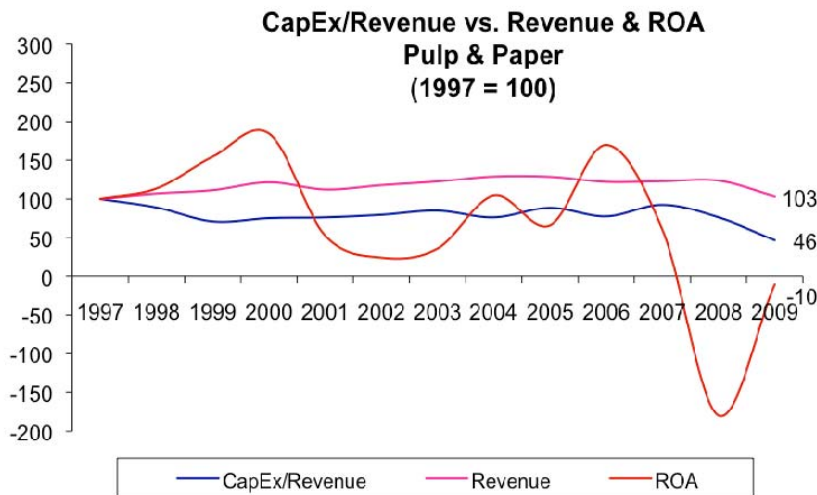
The Chinese healthcare plan aims to provide near-universal coverage to 90 percent of China's 1.3 billion citizens and make substantial improvement to the nation's healthcare infrastructure. Medical devices and equipment, di-

agnostic reagent manufacturers, equipment suppliers, and pharmaceutical companies should all benefit from this healthcare reform plan. China is investing in life science and biotechnology research and development – a trend that will continue over the next few years. China may become larger than the US in terms of pharmaceutical manufacturing capacity and prescription drug sales within the decade.

Pharmaceutical capital spending in ARC's CapEx Index remained consistent at 5 to 7 percent of revenue since 1997. ROA has declined steadily since 2002 for the five companies in the CapEx Index, consistent with general industry performance.

### Pulp & Paper

Pulp & paper is a low-margin industry with relatively little innovation and a low rate of capital spending. In recent years, the traditionally strong Nordic countries and Canada saw job cuts and mill closures, while new production centers emerged in China and Brazil. Since pulp and paper



products are an essential part of everyday life, the paper and paperboard industry is linked largely to an economy's GDP. In 2009, industry revenue declined by around 9 percent on a global scale. Especially in Europe, the industry will now have to restructure after the economic rally concealed many problems that are now apparent.

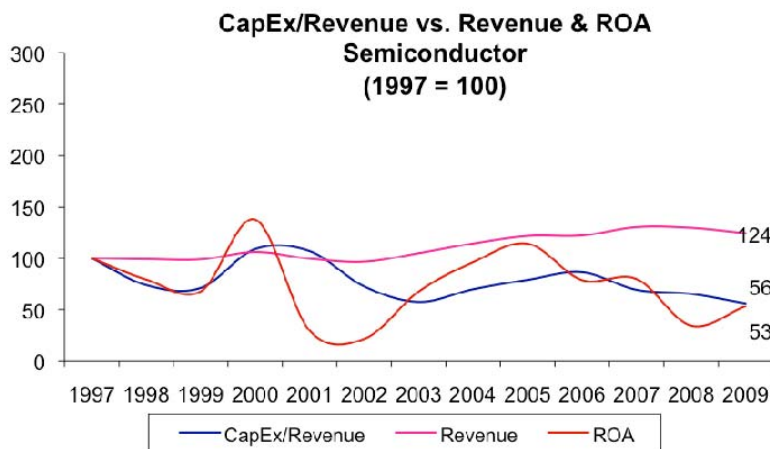
In the energy- and water-intensive pulp & paper manufacturing industry, it is crucial to control and monitor each part of the process to optimize energy and water consumption. While the control of emissions and water usage increased during the last 20 years, measurement requirements have also increased.

According to ARC's CapEx Index, capital spending as a percentage of revenue has declined gradually since 1997. The roller coaster-like swings in

ROA recovered somewhat last year as profits swung back from a disastrous 2008.

## Semiconductor

The semi-conductor industry is one of the most volatile and is characterized not only by fast-changing demand and the resulting price fluctuations, but also by rapid technological development. CapEx trends in semiconductor are typically more cyclical than other industries due to short product life-cycles and high market dynamics. As a function of revenue, capital spending has remained consistently cyclical over the past decade among the five companies in ARC's Index.



The highly cyclical semiconductor industry follows three markets: consumer electronics, telecommunications, and personal computers. Prior to the financial crisis many companies had built up capacities to gain market share. As a result, investment in automation equipment not only declined early in the crisis, but also did so

more heavily than in other industries. This decline preceded the collapse by more than eight months. Currently, there is light at the end of the tunnel. In mid-2009, capital equipment purchases rose slightly and the outlook even suggests a chip shortage, which will drive additional investment. The market for photovoltaic cells faces stable demand, but investment has been lacking due to capital restrictions. Since 2007, flat panel displays are driving the market and will continue to do so in 2010 and beyond. As capital markets open up, investments in solar equipment will continue.

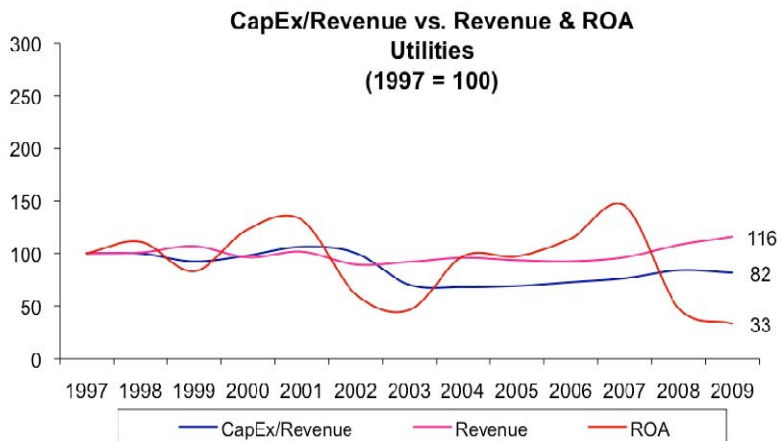
The semiconductor industry has strongly adopted PC technology in manufacturing, using the PC as a platform to integrate third-party IO, motion control, and networks. For automation suppliers, it is crucial to emphasize the issue of speed in this market. Production accuracy in the nanometer area at the highest possible speed is an important driver, which is why complete solutions – often in combination with mechatronics – have success in this market.

According to ARC's CapEx Index, capital spending has followed the industry's highly volatile business cycle. ROA peaked in 2005, but fluctuated during the recent boom-to-bust years.

## Utilities

The electric power industry continues to experience growth due to long-term project commitments based on increased demand for more power in all parts of the world. Power generation & transmission, water & wastewater, and other infrastructure industries will benefit from stimulus packages enacted in the US, China, and other countries around the world.

In contrast to commodities, which are mostly traded on global markets, electricity supply differs from country to country and depends on the regional regulation, carbon tax, and the structure of installed power plants. The supply curve of electricity results from the costs of producing one kWh and the installed base of different types of power plants.



Automation suppliers could also continue to grow their business in the fossil, nuclear, and renewable electric generation sectors, which offer tremendous opportunities. Due to the increasing share of volatile electricity generation from renewables, there will be a higher demand for flexibility in power generation. This in-

cludes new builds and retrofits of old power plants that have to be more flexible to ensure cost-efficient energy production.

Electricity supply in mature economies, especially in Eastern Europe, will change in the coming years as many power plants reach the end of their lifecycle. In general, Europe's installed base will shift towards renewable energy sources.

Capital spending as a percentage of revenue for utilities, which is by far the highest in the index, has fluctuated between 13 and 20 percent since 1997. Losses in 2008 and 2009 dragged down the overall ROA performance of the five utilities companies in ARC's CapEx index.

## Last Word

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There is no clear-cut, single approach or strategy to take advantage of the current economic recovery. The dynamics of the crisis caused a reset in many industries, hobbling growth in regions with structural problems, while opening new opportunities in others. For automation suppliers, there are immediate opportunities in less affected industries such as food & beverage, pharmaceuticals and infrastructure. Thanks to federal bailouts and surprisingly clear future visions, the automotive industry is recovering fast and investing in new or upgraded production assets.

Lower capital spending can signal opportunities for services and solution providers, especially when manufacturers can profit by shifting spending in non-core areas to an outside partner. Now is a good time for providers to help customers identify which services - including operational services - could be more efficiently outsourced.

As they emerge from the crisis, many end users are evaluating new automation architectures to carry them through the next decade. Most are open to new ideas after having spent too much time during the boom years focusing only on execution. For automation suppliers, the next two years may present more opportunities for new business than they have seen in the last decade.

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**Acronym Reference:** For a complete list of industry acronyms, refer to our web page at [www.arcweb.com/Research/IndustryTerms/](http://www.arcweb.com/Research/IndustryTerms/)

<b>BRIC</b> Brazil, Russia, India, China	<b>GDP</b> Gross Domestic Product
<b>CAGR</b> Compound Annual Growth Rate	<b>IOP</b> Interoperability
<b>CPG</b> Consumer Packaged Goods	<b>IT</b> Information Technology
<b>CPM</b> Collaborative Production Management	<b>OEM</b> Original Equipment Manufacturer
<b>CRM</b> Customer Relationship Management	<b>OpX</b> Operational Excellence
<b>EBIT</b> Earning Before Interest & Taxes	<b>OPEC</b> Organization of the Petroleum Exporting Countries
<b>ECB</b> European Central Bank	<b>PLM</b> Product Lifecycle Management
<b>EPC</b> Engineering, Procurement & Construction	<b>ROA</b> Return on Assets
	<b>SCM</b> Supply Chain Management
	<b>WTO</b> World Trade Organization

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