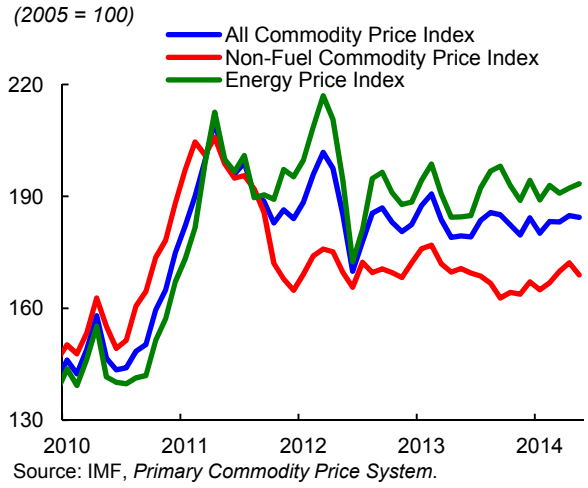
Quarterly Review of Commodity Markets

Research Department, Commodities Team*

This new report analyzes links between commodity market developments and global economic conditions. It complements the other reports produced by the IMF Research Department's Commodities Team: *Commodity Market Monthly* provides a detailed review of commodity price developments, and *Commodity Price Outlook & Risks* provides a monthly snapshot of futures-market-based commodity price forecasts. This publication will focus on describing the extent to which developments in commodity prices can be accounted for by changes in economic factors. It will also occasionally discuss special topics in commodity markets; this time the special topic is the impact of geopolitical tensions from the situation in Ukraine.

Global Economy & Commodity Markets

Figure 1: IMF Commodity Price Indices



Source: IMF, *Primary Commodity Price System.*

Commodity prices have been strengthening this year mostly because of non-fuel commodities. The IMF primary commodity price index rose by 1.2 percent in May from the first quarter of 2014. Geopolitical issues (see the special feature on this issue) supported global oil prices and a few metal prices. In addition, an unusually cold winter in the U.S. put upward pressure on U.S. natural gas prices Weather-related supply conditions for some agricultural products worsened, but growing conditions in the U.S. and Europe have recently turned favorable. Commodity prices have been lagging economic and market conditions of the global economy until recently. Currently, the global economy is growing at a steady pace mostly driven by the U.S. and Japan. In 2014, commodity price growth picked up pace and is now closer to the level predicted by economic conditions.

In this section, we look at commodity prices and global economic and market conditions using principal components analysis[1]. The first principal components of commodity prices have been lagging the first principal components of the global economic and market conditions, which are derived from industrial production indexes, purchasing managers index, and equity indexes of many advanced and emerging economies as in Figure 2.

[1] See Box on page 2.

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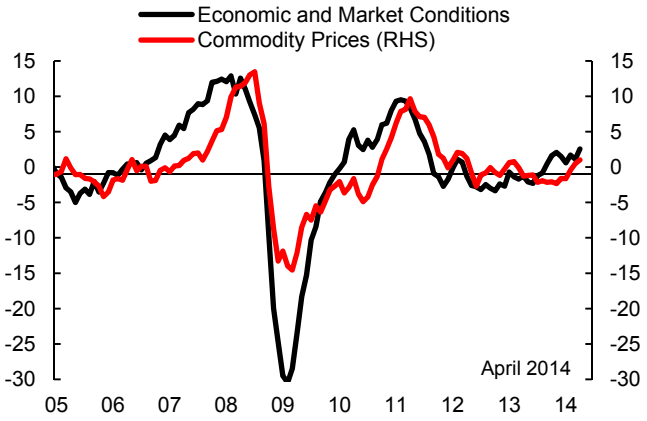
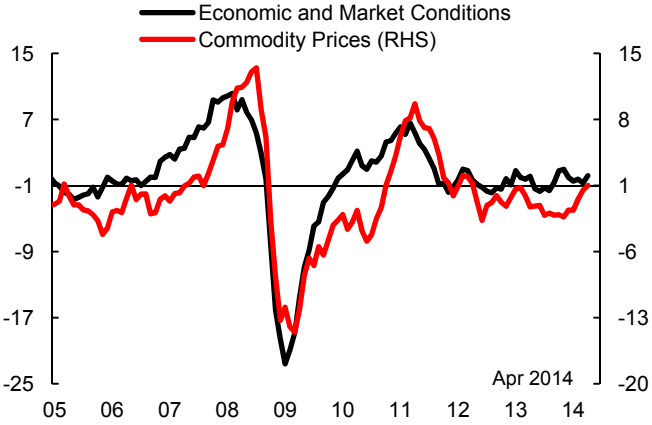
Figure 2: First Principal Components of HP-detrended Series



Sources: IMF, *Primary Commodity Price System*, and staff calculations.
Note: principal components are unit-free.

Commodity prices appear to be driven by economic and market conditions in the emerging market economies, since these economies play a more active role in global industrial production. Figure 3 depicts the first principal components of commodity prices and the economic and market conditions of emerging economies.

Figure 3: First Principal Components of HP detrended series (Emerging Economies)



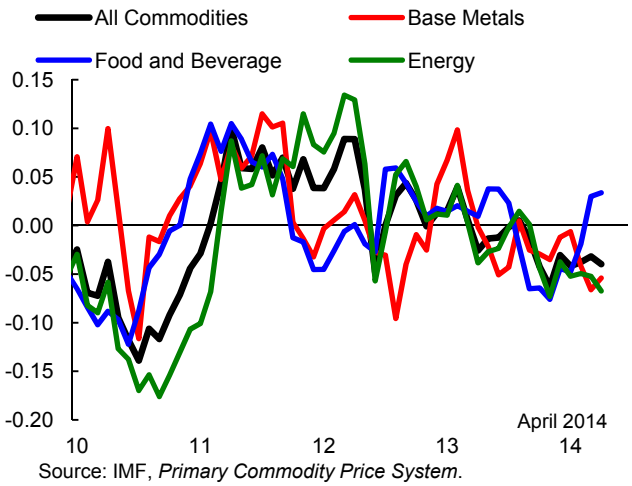
Sources: IMF, *Primary Commodity Price System*, and staff calculations.
Note: principal components are unit-free.

Regressing IMF commodity price indices on the first principal components of global economic and market conditions confirms the high degree of co-movement between the global economy and commodity prices with a correlation of 0.74. Food and beverage prices are higher than economic and market conditions imply, while metal and energy prices are weaker, as well as commodity prices overall.

> Principal component analysis (PCA) is a statistical procedure that uses an orthogonal transformation to convert a large set of observations of correlated variables into a set of values of linearly uncorrelated variables called principal components. We focus on the first principal component, which explains the largest part of the co-movement among the observable variables. The first principal component is often regarded as the common factor in these variables.

The residuals shown in Figure 4 indicate that commodity prices have been in line with economic conditions for the last few months as the absolute values of these residuals have been much smaller than the years after the global financial crisis. The negative residuals imply that commodity prices have been slightly lagging the economic and market conditions, but they started to shrink after November 2013.

Figure 4: Regression Residuals



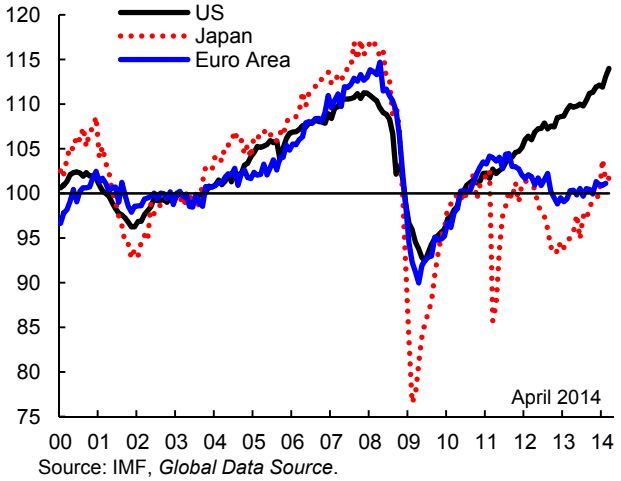
Source: IMF, *Primary Commodity Price System*.

Economic Situation Overview

The global economy shows signs of recovery albeit with regional differences. Among advanced economies, the euro area's slump persists while the U.S. maintains steady growth, and Japan's recovery gains acceleration with Abenomics. Emerging economies rebounded after the financial crisis but are experiencing a broad-based slowdown amid both slowing export and domestic demand and surplus capacity, particularly in China.

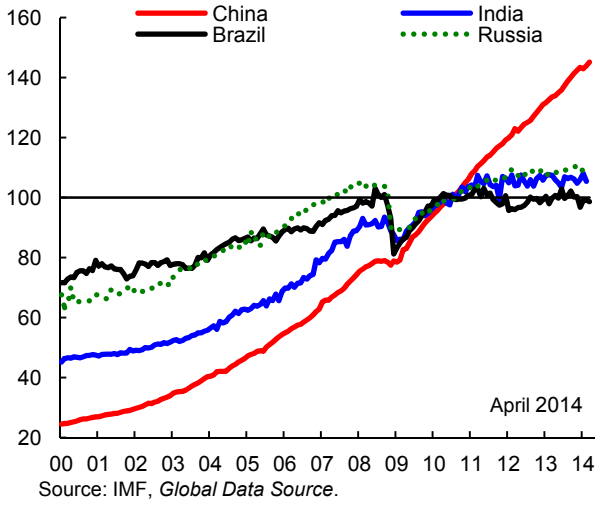
Despite a weak first quarter in the U.S., caused by abnormally severe weather, the strong recovery is expected to continue. Meanwhile, Japan's GDP grew by 6.7 percent (annualized) in the first quarter as Japanese consumers rushed to spend in advance of the consumption tax hike. So far, domestic demand after the consumption tax exceeded expectations. Euro area growth is lower than the IMF expected in the first quarter.

Figure 5: Industrial Production (Select Advanced Economies)



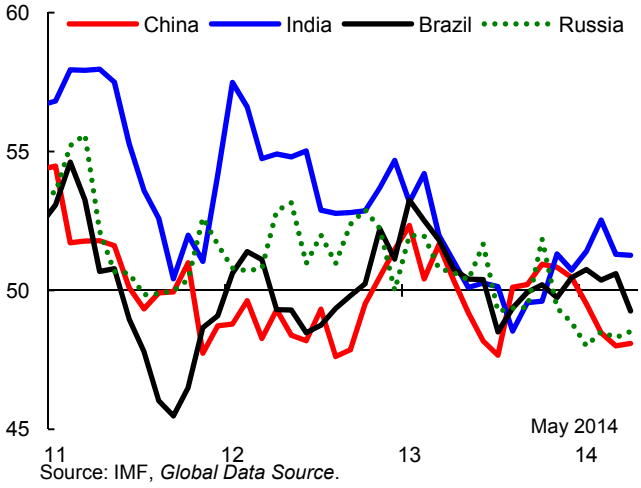
In the emerging economies, signs of weakening appeared in the last year in anticipation of the U.S. tapering off. China had been growing strongly but the pace of growth is easing. India has been suffering from a recent onset of inflation, while Russia is facing a recession amid capital outflows and sanctions imposed by western countries.

Figure 6: Industrial production (BRIC)



Coupled with the slowdown in other emerging economies, China's economic news received a lot of attention in the recent months as its shift in long-term growth prospects affects commodity demand in the long run. Recent weakness in China's Purchasing Managers Index (PMI) is said to be one of the key drivers of weak base metal prices.

Figure 7: PMI (BRIC Countries)



Commodity Markets

Commodity prices have been strengthening this year mostly for non-fuel commodities.

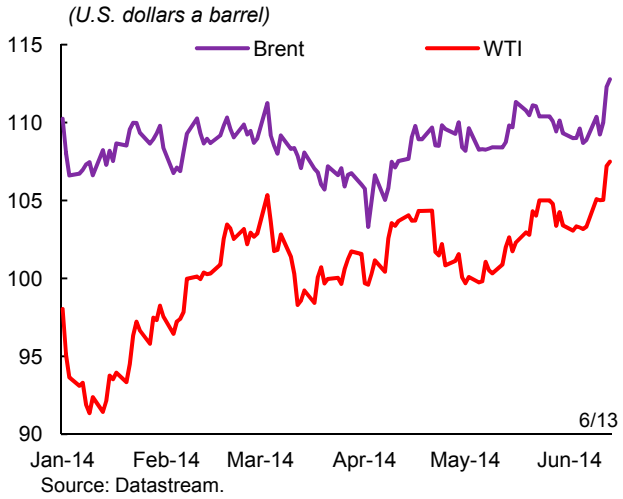
Energy

Crude oil prices have been remarkably stable despite the geopolitical tensions in Ukraine and

numerous supply outages in, especially Libya. Implied volatility has been at a historically low level, indicating that the market expected oil prices to remain within their current range in the near future. However, crude oil prices reached their 6-month high due to militant insurgence in Iraq in June. Iraq produced 3.37 million barrels per day (mb/d) of oil in May, while the effective spare capacity of OPEC is 3.27 mb/d. Thus, further escalation of violence in Iraq can have a huge impact on crude oil prices. The oil volatility index has also jumped though it remains at a relatively low level.

Henry Hub natural gas prices spiked due to severe winter weather but have since fallen from their peak as temperatures moderated. The storage level of natural gas in the U.S. is relatively low, while Europe benefited from a relatively warm winter leaving ample inventories at the end of the season. However, if Ukraine and Russia cannot reach a gas deal quickly, natural gas prices in Europe can rise especially since the crude oil price is already rising.

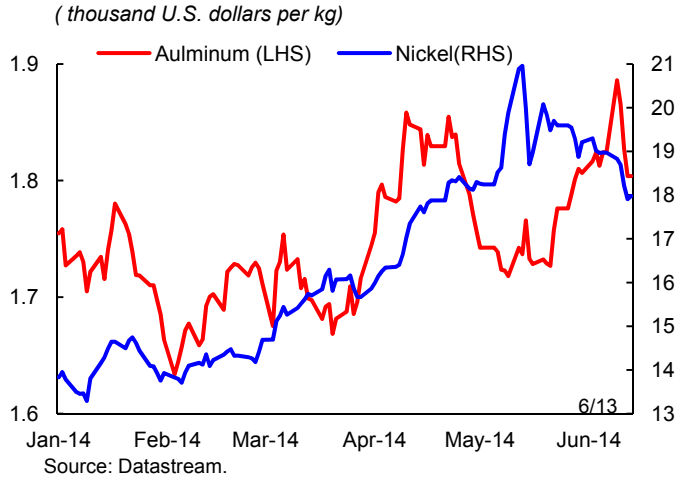
Figure 8: Daily Brent and WTI prices



Metals

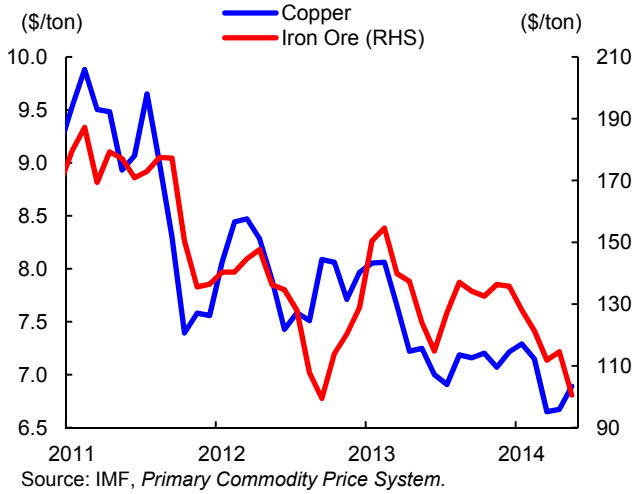
While fuel prices have been relatively stable, metals prices have generally declined. However, a few metal prices bounced back from their recent lows. In particular, nickel prices posted substantial gains due to Indonesia's recent export ban on unprocessed ores and fear of export disruptions from Russia, though prices have recently retreated from their recent highs. Aluminum prices rebounded in March after the UK court ruling against LME warehouse reform, and have recently increased on concerns that the Indonesian ban may affect aluminum, via bauxite—the primary resource used to manufacture the metal. However, the global market still suffers from excess supply capacity. Similarly, iron ore prices have been dampened by strong production in Australia and Brazil.

Figure 9: Daily Base Metal Prices



Base metal prices more broadly have been subdued due to concerns of weaker demand from China. Generally, base metal prices are most strongly influenced by economic conditions, according to our analysis, as the regression fit is the highest with a correlation of 0.88 among main commodity categories. This is because base metals are used as industrial inputs in manufacturing, construction and infrastructure projects, which are highly cyclical, and are relatively less influenced by geopolitical risks compared to fuels.

Figure 10: Monthly Base Metal Prices

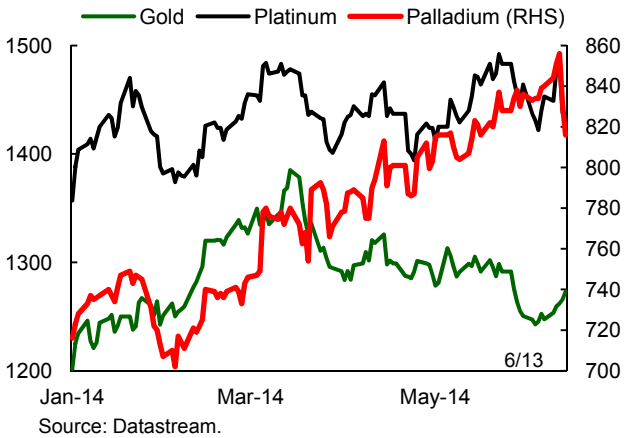


Source: IMF, *Primary Commodity Price System.*

Precious metal prices, which are not currently included in the IMF commodity price indexes, have been solid this year. Labor disputes at South African mines, which started in late January, have impacted platinum and palladium prices. Palladium prices have also been supported by fears of further sanctions on Russia, the world's biggest producer. However, on June 12 the hope to end the labor dispute emerged, and platinum and palladium prices have dropped from their recent highs. Gold prices rose until late March as the U.S. long-term interest rate fell and geopolitical risks emerged in Ukraine and Russia. However, prices receded from their peak as the long-term U.S. interest rate stabilized and concerns over U.S. economic slowdown abated.

Figure 11: Precious Metal Prices

(U.S. dollars per troy ounce)



Source: Datastream.

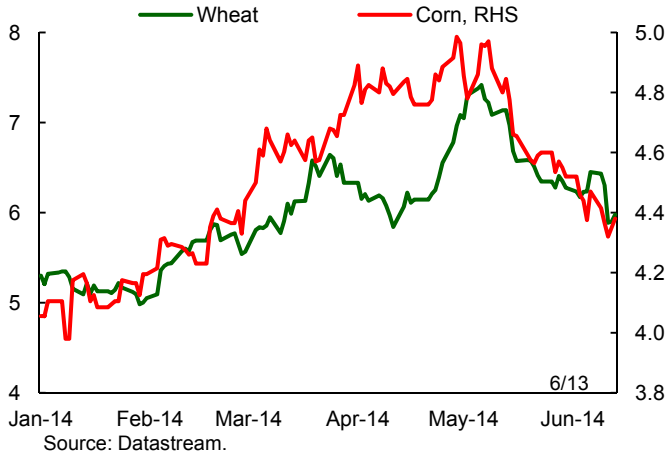
Food and Beverage

Food and beverage prices bounced back from last year's low levels, as supply concerns emerged for various food commodities due to adverse weather and disease.

Cereal prices, namely wheat and corn, benefited from weather-related supply concerns as well as tensions in the Black Sea region, as Ukraine accounts for 3 percent of global wheat exports and 16 percent of global corn exports. Soybean prices are also up due to strong demand from China and low U.S. stocks.

Figure 12: Wheat and Corn Daily Prices

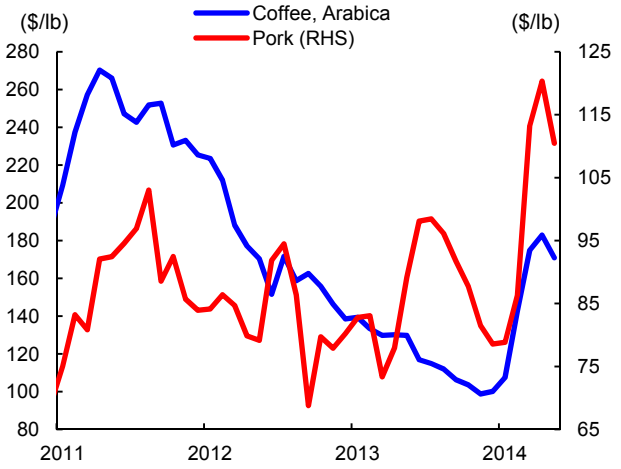
(U.S. dollars per bushel)



Source: Datastream.

Coffee prices of the Arabica grade recently gained 80 percent since their trough in December due to the drought in Brazil and disease in Central America. Pork prices rose by 50 percent from their trough due to the spread of a porcine virus, which in less than a year wiped out more than 10 percent of the U.S. swine population. Prices of both commodities eased in May as supply concerns slightly abated.

Figure 13: Coffee and Pork Monthly Prices



Source: IMF, *Primary Commodity Price System*.

Special Topic: Geopolitical Tensions

Geopolitical tensions around the world have been in the spotlight this year.

Commodity markets have been affected more than financial markets by the situation surrounding Ukraine and Russia because Ukraine is a big exporter of corn and wheat and Russia is an importantexporter of energy to the European Union as well as one of the largest global suppliers of palladium, platinum, nickel and other commodities.

Commodity exports are an important source of revenue for Russia, and the world in turn, especially Europe, relies on Russian commodities, particularly energy. It therefore may not be in the economic interest of the west to escalate sanctions or for Russia to stop exports. Nonetheless, a disruption to commodity flows can happen through disputes over payments or escalation of political tensions. In what follows, we analyze the impact from potential disruptions, which have already affected a few commodity markets to various degrees t because of the fears of disruption.

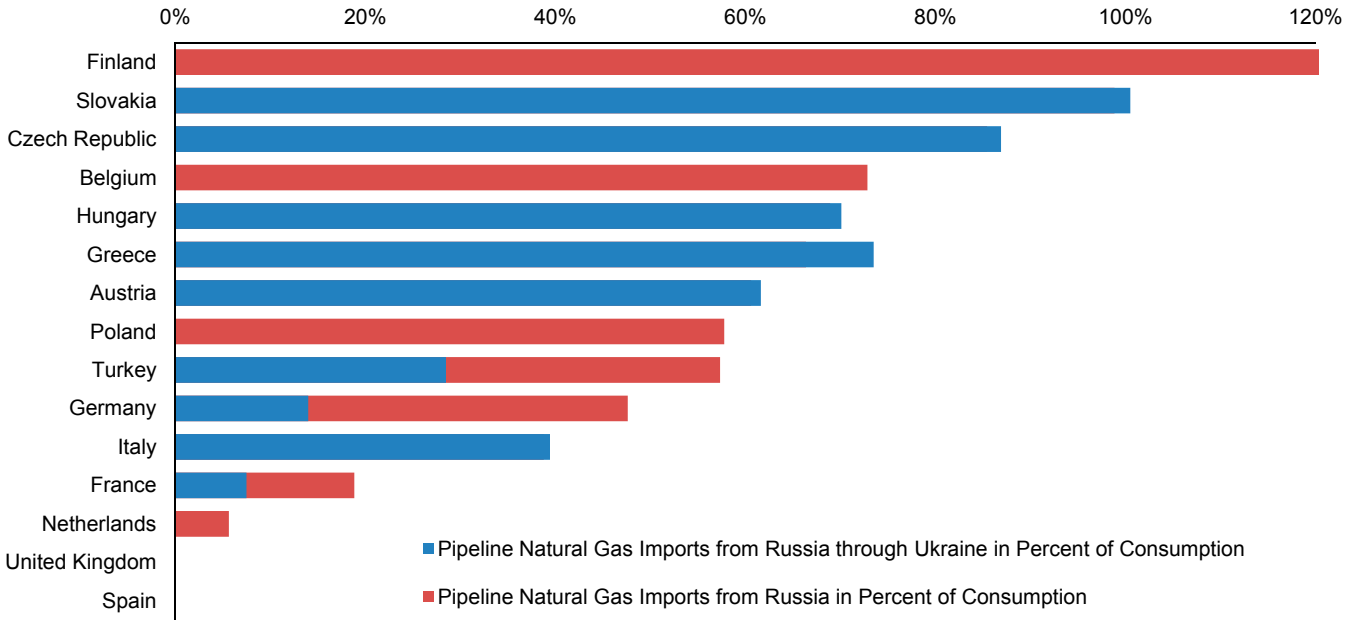
A disruption of natural gas supplies to Ukraine is more likely than other severe scenarios such as a total stoppage of natural gas supplies, crude oil, or metals. Natural gas markets are segmented and the effects of disruption will be felt by Europe and then Asia via competition for LNG supply. Other commodities are more fungible and the impact of disruption would be observed in price movements as already seen in nickel and palladium markets.

Disruption of Natural Gas Supply.
Russia supplies 25-30 percent of natural gas needs in Europe, roughly half of which are transported through pipeline via Ukraine (down from 80 percent before the Nord Stream pipeline was built). There is a potential risk of a supply disruption emanating from Ukraine's non-payment for its gas arrears, which could result in pipeline flows to cease to Ukraine, and possibly to Europe. Another risk, although a much less probable, is a broader embargo of Russian natural gas from either sanctions or counter-sanction measures.

Impact from the loss of Russian natural gas exports will be limited mainly to its trading partners and neighbors. This impact is mostly observed in quantities, as prices are fixed through long-term contracts indexed to oil prices Spot gas prices for both pipeline gas and LNG are likely to be affected. While market integration is limited, LNG trade is the main linkages between main global markets. If geopolitical tensions affect crude oil prices persistently, then the impact on gas prices will show up with some lags.

Disruption of Natural Gas Supply to Ukraine.
Natural gas supply flowing via Ukraine was disrupted in the past over payment disputes between Ukraine and Russia. These episodes happened in January 2005, March 2008, and January 2009, often preceded political tension, e.g., Ukraine becoming slightly pro-western during the Orange revolution at the end of 2004. The current situation resembles previous disputes. Even if geopolitical tensions lessen, the gas supply issue remains at risk until both sides agree on a natural gas deal for volumes, prices and debts.

Figure 14: Reliance on Natural Gas from Russia



Source: BP Statiscal Review 2014, Oxford Energy Comment
Note: The share exceeding 100% indicates that a country import from Russia more than consumption. A few countries import more than they consume. e.g. Belgium import twice as much as it consumes.

Table 1 : The Share of Gas in Primary Energy Consumption

Austria	22.0%	Italy	35.7%
Belgium	24.3%	Latvia	26.7%
Bulgaria	13.0%	Lithuania	36.5%
Croatia	30.0%	Luxembourg	24.4%
Cyprus	0.0%	Malta	0.0%
Czech Republic	16.1%	Netherlands	41.8%
Denmark	19.3%	Poland	13.9%
Estonia	9.1%	Portugal	17.7%
Finland	8.6%	Romania	34.3%
France	14.7%	Slovakia	26.3%
Germany	21.5%	Slovenia	10.0%
Greece	13.9%	Spain	22.0%
Hungary	30.1%	Sweden	1.9%
Ireland	29.6%	United Kingdom	32.7%

Source: Eurogas

If Gazprom cuts off gas supply to Ukraine, the impact would be felt beyond Ukraine like in the past, most notably in Southeastern Europe. (On June 16th, Ukraine said that Gazprom actually stopped gas supply to Ukraine though the supply to Europe through Ukraine was undisturbed.) Potentially, Ukraine could lose 2/3rds of its gas supplies, and Europe could lose 15 percent of its gas supplies transiting through Ukraine if Russian gas to and through Ukraine is completely stopped.

While some European countries have diversified natural gas suppliers as well as transportation routes and interconnections, a few countries depend heavily on Russian gas and transit via Ukraine, as shown in Figure 14.

So far, we have not observed a large increase of overall natural gas prices in Europe. Spot prices in Europe showed a few spikes since Russian troops entered Crimea but the trend of natural gas prices has been downward rather than upward. While this reflects that the current market supply/demand situation is rather loose, it does not imply that the risk of disruption is low.

If the gas supply to Ukraine is disrupted, the impact on Ukraine and Europe would be initially limited because of large stocks and weak demand resulting from a mild winter. Ukraine claims it has stocks of almost 14bn cubic meters of natural gas, enough to meet domestic demand until December. Summer demand for gas in Ukraine is expected to be filled with domestic supply, partly because the unrest in eastern Ukraine reduces industrial demand. Gas demand in Europe in general has been weak because of recession, increased use of renewables, and the relatively high expense of burning gas in power generation relative to coal. Many European countries also have a few months' worth of supply in stocks. The first response to a disruption will be to use existing stocks.

Europe could also source other supplies in the form of pipeline gas from Norway and Algeria, LNG imports, and other Russian gas via underutilized pipelines but the spare capacity of pipelines in winter may be limited. Gas could also be substituted by other fuels, notably coal and oil products.

Spot gas prices in Europe could spike sharply initially—as in past episodes—with average prices rising 20 percent until other supplies are secured. Global LNG prices could rise 10 percent as European buyers compete with Asian buyers. However, European customers would have to pay more for additional LNG. Currently LNG is entering Europe at around $11.50/mmbtu, and spot LNG prices to Europe are around $11/mmbtu (and $12 delivered into Asia). Europe could face incremental LNG costs of 40 percent and possibly higher depending on the tightness of LNG markets. The impact on oil prices would be smaller, given it is a much more liquid market. Still, geopolitical tensions and fears of further disruptions could see a 10 percent increase in oil prices in addition to the impact of the unrest in Iraq.

If the cut-offs last longer than in the past, the greatest impact will be on Ukraine and countries in southeast Europe that receive Russian gas transiting Ukraine—in particular Bulgaria and the former Yugoslavian countries, which rely on Russian gas for virtually all of their import requirements and have only limited access to gas from alternative routes. Romania relies on the Ukrainian pipeline for its natural gas imports from Russia, but is producing 80 percent of its consumption needs domestically. Austria, Hungary, Slovakia and the Czech Republic would also be affected, but these countries have access to Nord Stream. Italy, which depends on Russia for 20 percent of its gas needs, has additional options for supply from pipelines in Europe and from North Africa, and also from LNG. LNG ports are operational in Belgium, France, Greece, Italy, Netherland Portugal, Spain, Turkey, and the United Kingdom. A Lithuanian LNG port is expected to be operational this fall and a Polish LNG port is expected to be open this winter.

If Russia cuts off its supply to Ukraine for an extended period, it would likely affect energy markets incrementally assuming no further disruptions. Not only would oil prices be affected, but coal prices as well, and not just limited to European markets. Russia would lose revenue from natural gas sales to Ukraine and other countries. Sales revenue from Ukraine amounted to 12 billion U.S. dollars last year.

Disruption of Natural Gas Supply to all of Europe. While it seems unlikely that Russia would stop supplying natural gas to Europe entirely, it is not an impossible scenario. Russia produces 18 percent of global natural gas—the second largest producer next to the U.S.—and is the world's largest gas exporter. In 2012, roughly 130 billion cubic meters

(bcm) of natural gas was exported to Europe, 30 bcm to Ukraine and 25 bcm to other former Soviet Union countries, which is roughly 25 percent of gas consumption of Europe in 2012. Given the cold weather in early 2013, last year Europe relied on Russian gas for roughly 30 percent of its needs. The reliance on Russia, as well as current stock levels, varies among countries.

Russia's revenue loss from gas sales to Europe and Ukraine (160 bcm/year) at a price of $400/kcm is $64 billon, or roughly 3 percent of GDP. Thus, a full cut-off would hurt both Russia and European countries significantly, which makes it an unlikely scenario. Although Russia and China recently struck a gas trade deal, the actual export of gas will not begin for a few years until pipelines are built.

Disruption of Russian Crude Oil Export

Russia's crude oil exports could also be disrupted. While the dependence on Russian oil is not as significant as for natural gas, Russia produces about 11 million barrels a day (mb/d) of crude oil, out of global production of 92.1 mb/d. Russia exports roughly 7.5 mb/d. Spare capacity of OPEC countries is estimated at under 5 mb/d with effective spare capacity at 3.27 mb/d in May, as mentioned earlier. OECD stocks (including government) are estimated at roughly 4 billion barrels, which covers 92 days of demand at the end of March.

Crude oil markets are more flexible than natural gas markets, as it is much easier to access and transport alternative supplies. If Russia restrains its exports, the negative impact of a supply shock will be felt more in oil-importing countries, as the price will need to rise to clear the market.

However, if the supply disruption is on the scale of 4 mb/d, it is close to the first Gulf war disruption in 1990-1991 with the 5 mb/d loss of Kuwait and Iraq oil exports. The crude oil price more than doubled from $15/bbl in June 1990 to $35/bbl in October 1990. This scenario is also more than twice as big as the loss of Libyan exports (Libya produced 1.6 mb/d in the fourth quarter of 2010.) Then the crude oil price jumped from $75/bbl in September 2010, to $98 in February 2011 to $116 in April 2011.

In this scenario, Russia would lose $400 million a day if prices are assumed at $100/barrel. If crude prices jump to $155/bbl, then the loss of revenue is much smaller as Russia would benefit from higher prices on its remaining exports of 3.5 mb/d. In terms of revenue, Russia relies more on oil than natural gas. If Russia diverts its crude oil to non-western countries, such as China, to compensate its export loss to Europe, the revenue loss is limited but the price effect may be limited as well. Thus, a disruption may not hurt the global economy on a large scale as long as Russian crude oil is made available to international markets.

Price reactions would hinge on Russia's ability and willingness to adjust its sales destination. Russia already has been shifting its export destination to China, and China's import from Russia is at the highest level in seven years. In March, China and Russia agreed that China may import more than 620 kb/d, which makes it Russia's biggest customer next to Germany.

As the energy sector is key for the Russian economy, it could be the target of sanctions if the situation deteriorated substantially. Russia could also strike back by putting pressure on joint ventures. Russia has already retaliated with an export ban on Russian rocket engines and a limit on access to the international space station after 2020.

Russian Metals

Russia is a leading producer of several metals. Metals are generally fungible and disruptions usually affect consumers through price increases as markets rebalance. Norilsk Nickel is the top producer of palladium (accounting for roughly 40 percent of world production) and nickel (10-14 percent). It is also one of the top producers of platinum (12 percent). RusAl is the world's largest producer of aluminum accounting for roughly 7 percent of world production. So far palladium and

nickel markets gained roughly 10 percent each since Russia entered Crimea as shown in Figure 9 and 11, though events in South Africa and Indonesia have played significant roles in each market.

Platinum and palladium are used in catalytic converters by the automobile industry. While palladium is also available from South Africa (40 percent of world production as well), given Russia's share of palladium production, any disturbance in palladium trade would affect most automobile industries as the price of palladium increases, even though they do not trade directly with Russia. Palladium and platinum producers in South Africa have been facing labor disputes in their mines, putting upward pressure on prices until recently

The role of Russia in the nickel market is not as large as in the palladium market. However, with the current export ban on nickel in Indonesia, which produced 30 percent of global supplies, trade disruptions in Russia would push nickel prices even higher, although the impact from Russia alone is smaller than on palladium. Nickel is used for various purposes, such as alloys, mainly stainless steel, and rechargeable batteries.

A Russian company, VSMPO-AVISMA , is the world's largest titanium producer. While titanium is available widely, the low cost of processing makes VSMPO-AVISMA an important supplier of titanium alloy. It supplies Airbus and Boeing among other aerospace companies. Boeing created a joint venture with VSMPO-AVISMA in Russia. Given the oligopolistic nature of the industry, export restrictions by Russia on titanium-related products could be a potential reaction to further sanctions. Thus, the trade disruption relating to VSMPO-AVISMA could impact the aerospace companies.

Conclusion on Geopolitical Tensions' Impact on the Economy via Commodities

While the risk of actual commodity supply disruptions may be low, some commodity prices have already been affected by disruption worries nonetheless. In general, the consensus view is that commodity prices alone cannot impact economic activity. However, through their effect on broader economic confidence, the impact of commodity prices tends to be much larger. At this point, stability of oil prices and financial markets provides support to the global economy, although the regional economy associated with Russia and Ukraine is expected to suffer as a result of sanctions and capital outflows. It is important for policy makers to monitor commodity market developments as well as support natural gas negotiation between Ukraine and Russia to avoid supply disruptions.