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Remarks by

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Owing to the current turmoil in oil markets, a number of analysts have raised the specter of the world soon running out of oil. This concern emerges periodically in large measure because of the inherent uncertainty of estimates of worldwide reserves. Such episodes of heightened anxiety about pending depletion date back a century and more. But, unlike past concerns, the current situation reflects an increasing fear that existing reserves and productive crude oil capacity have become subject to potential geopolitical adversity. These anxieties patently are not frivolous given the stark realities evident in many areas of the world.

While there are concerns of seeming inadequate levels of investment to meet expected rising world demand for oil over coming decades, technology, given a more supportive environment, is likely to ensure the needed supplies, at least for a very long while.

Notwithstanding the recent paucity of discoveries of new major oil fields, innovation has proved adequate to meet ever-rising demands for oil. Increasingly sophisticated techniques have facilitated far deeper drilling of promising fields, especially offshore, and have significantly increased the average proportion of oil reserves eventually brought to the surface. During the past decade, despite more than 250 billion barrels of oil extracted worldwide, net proved reserves rose in excess of 100 billion barrels. That is, gross additions to reserves have significantly exceeded the extraction of oil the reserves replaced. Indeed, in fields where, two decades ago, roughly one-third of the oil in place ultimately could be extracted, almost half appears to be recoverable today. I exclude from these calculations the reported vast reserves of so-called unconventional oils such as Canadian tar sands and Venezuelan heavy oil.

Gains in proved reserves have been concentrated among OPEC members, though proved reserves in the United States, for the most part offshore, apparently have risen slightly during the past five years. The uptrend in world proved reserves is likely to continue at least for awhile. Oil service firms still report significant involvement in reservoir extension and enhancement. Nonetheless, growing uncertainties about the long-term security of world oil production, especially in the Middle East, have been pressing oil prices sharply higher.

These heightened worries about the reliability of supply have led to a pronounced increase in the demand to hold larger precautionary inventories of oil. In addition to the ongoing endeavors of the oil industry to build inventories, demand from investors who have accumulated large net long positions in distant oil futures and options is expanding once again. Such speculative positions are claims against future oil holdings of oil firms. Currently, strained capacity has limited the ability of oil producers to quickly satisfy this markedly increased demand for inventory.

Adding to the difficulties is the rising consumption of oil, especially in China and India, both of which are expanding economically in ways that are relatively energy intensive. Even the recent notable pickup in OPEC output, by exhausting most of its remaining excess capacity, has only modestly satisfied overall demand. Output from producers outside OPEC has also increased materially, but investment in new producing wells has lagged, limiting growth of production in the near term.

Crude oil prices are also being distorted by shortages of capacity to upgrade the higher sulphur content and heavier grades of crude oil. Over the years, increasing demand for the environmentally desirable lighter grades of oil products has pressed refiners to upgrade the heavier

crude oils, which compose more than two-thirds of total world output. But refiners have been only partly successful in that effort, judging from the recent extraordinarily large increase in price spreads between the lighter and heavier crudes. For example, the spread between the price of West Texas intermediate (WTI), a light, low-sulphur crude, and Dubai, a benchmark heavier grade, has risen about \$10 per barrel since late August, to an exceptionally high \$17 a barrel. While spot prices for WTI soared in recent weeks to meet the rising demand for light products, prices of heavier crudes lagged.

This temporary partial fragmentation of the crude oil market has clearly pushed gasoline prices higher than would have been the case were all crudes available to supply the demand for lighter grades of oil products. Moreover, gasoline prices are no longer buffered against increasing crude oil costs as they were during the summer surge in crude oil prices. Earlier refinery capacity shortages had augmented gasoline refinery-marketing margins by 20 to 30 cents per gallon. But those elevated margins were quickly eroded by competition, thus allowing gasoline prices to actually fall during the summer months even as crude oil prices remained firm. That cushion no longer exists. Refinery-marketing margins are back to normal and, hence, future gasoline and home heating oil prices will likely mirror changes in costs of light crude oil.

With increasing investment in upgrading capacity at refineries, the short-term refinery problem will be resolved. More worrisome are the longer-term uncertainties that in recent years have been boosting prices in distant futures markets for oil.

Between 1990 and 2000, although spot crude oil prices ranged between \$11 and \$40 per barrel for WTI crude, distant futures exhibited little variation around \$20 per barrel. The

presumption was that temporary increases in demand or shortfalls of supply would lead producers, with sufficient time to seek, discover, drill, and lift oil, or expand reservoir recovery from existing fields, to raise output by enough to eventually cause prices to fall back to the presumed long-term marginal cost of extracting oil. Even an increasingly inhospitable and costly exploratory environment--an environment that reflects more than a century of draining the more immediately accessible sources of crude oil--did not seem to weigh significantly on distant price prospects.

Such long-term price tranquility has faded dramatically over the past four years. Prices for delivery in 2010 of light, low-sulphur crude rose to more than \$35 per barrel when spot prices touched near \$49 per barrel in late August. Rising geopolitical concerns about insecure reserves and the lack of investment to exploit them appear to be the key sources of upward pressure on distant future prices. However, the most recent runup in spot prices to nearly \$55 per barrel, attributed largely to the destructive effects of Hurricane Ivan, left the price for delivery in 2010 barely above its August high. This suggests that part of the recent rise in spot prices is expected to wash out over the longer run.

Should future balances between supply and demand remain precarious, incentives for oil consumers in developed countries to decrease the oil intensity of their economies will doubtless continue. Presumably, similar developments will emerge in the large oil-consuming developing economies.

Elevated long-term oil futures prices, if sustained at current levels or higher, would no doubt alter the extent of, and manner in which, the world consumes oil. Much of the capital infrastructure of the United States and elsewhere was built in anticipation of lower real oil prices than currently

prevail or are anticipated for the future. Unless oil prices fall back, some of the more oil-intensive parts of our capital stock would lose part of their competitive edge and presumably be displaced, as was the case following the price increases of the late 1970s. Those prices reduced the subsequent oil intensity of the U.S. economy by almost half. Much of the oil displacement occurred by 1985, within a few years of the peak in the real price of oil. Progress in reducing oil intensity has continued since then, but at a lessened pace.

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The extraordinary uncertainties about oil prices of late are reminiscent of the early years of oil development. Over the past few decades, crude oil prices have been determined largely by international market participants, especially OPEC. But that was not always the case.

In the early twentieth century, pricing power was firmly in the hands of Americans, predominately John D. Rockefeller and Standard Oil. Reportedly appalled by the volatility of crude oil prices in the early years of the petroleum industry, Rockefeller endeavored with some success to control those prices. After the breakup of Standard Oil in 1911, pricing power remained with the United States--first with the U.S. oil companies and later with the Texas Railroad Commission, which raised allowable output to suppress price spikes and cut output to prevent sharp price declines. Indeed, as late as 1952, U.S. crude oil production (44 percent of which was in Texas) still accounted for more than half of the world total. However, that historical role came to an end in 1971, when excess crude oil capacity in the United States was finally absorbed by rising demand.

At that point, the marginal pricing of oil, which for so long had been resident on the Gulf coast of Texas, moved to the Persian Gulf. To capitalize on their newly acquired pricing power, many producing nations in the Middle East nationalized their oil companies. But the full magnitude of their pricing power became evident only in the aftermath of the oil embargo of 1973. During that period, posted crude oil prices at Ras Tanura, Saudi Arabia, rose to more than \$11 per barrel, significantly above the \$1.80 per barrel that had been unchanged from 1961 to 1970. A further surge in oil prices accompanied the Iranian Revolution in 1979.

The higher prices of the 1970s brought to an abrupt end the extraordinary period of growth in U.S. oil consumption and the increased intensity of its use that was so evident in the decades immediately following World War II. Between 1945 and 1973, consumption of petroleum products rose at a startling 4-1/2 percent average annual rate, well in excess of growth of real gross domestic product. However, between 1973 and 2003, oil consumption grew, on average, only 1/2 percent per year, far short of the rise in real GDP.

Although OPEC production quotas have been a significant factor in price determination for a third of a century, the story since 1973 has been as much about the power of markets as it has been about power over markets. The signals provided by market prices have eventually resolved even the most seemingly insurmountable difficulties of inadequate domestic supply in the United States. The gap projected between supply and demand in the immediate post-1973 period was feared by many to be so large that rationing would be the only practical solution.

But the resolution did not occur quite that way. To be sure, mandated fuel-efficiency standards for cars and light trucks induced slower growth of gasoline demand. Some observers

argue, however, that, even without government-enforced standards, market forces would have produced increased fuel efficiency. Indeed, the number of small, fuel-efficient Japanese cars that were imported into the United States markets rose throughout the 1970s as the price of oil moved higher.

Moreover, at that time, prices were expected to go still higher. Our Department of Energy, for example, had baseline projections showing prices reaching \$60 per barrel--the equivalent of about twice that in today's prices.

The failure of oil prices to rise as projected in the late 1970s is a testament to the power of markets and the technologies they foster. Today, despite its recent surge, the average price of crude oil in real terms is still only three-fifths of the price peak of February 1981. Moreover, the impact of the current surge in oil prices, though noticeable, is likely to prove less consequential to economic growth and inflation than in the 1970s. So far this year, the rise in the value of imported oil--essentially a tax on U.S. residents--has amounted to about 3/4 percent of GDP. The effects were far larger in the crises of the 1970s. But, obviously, the risk of more serious negative consequences would intensify if oil prices were to move materially higher.

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In summary, much of world oil supplies reside in potentially volatile areas of the world. Improving technology is reducing the energy intensity of industrial countries, and presumably recent oil price increases will accelerate the pace of displacement of energy-intensive production facilities. If history is any guide, oil will eventually be overtaken by less-costly alternatives well before

conventional oil reserves run out. Indeed, oil displaced coal despite still vast untapped reserves of coal, and coal displaced wood without denuding our forest lands.

Innovation is already altering the power source of motor vehicles, and much research is directed at reducing gasoline requirements. At present, gasoline consumption in the United States alone accounts for 11 percent of world oil production. Moreover, new technologies to preserve existing conventional oil reserves and to stabilize oil prices will emerge in the years ahead. We will begin the transition to the next major sources of energy perhaps before midcentury as production from conventional oil reservoirs, according to central tendency scenarios of the Energy Information Administration, is projected to peak. In fact, the development and application of new sources of energy, especially nonconventional oil, is already in train. Nonetheless, it will take time. We, and the rest of the world, doubtless will have to live with the uncertainties of the oil markets for some time to come.