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Lessons from the unusual impacts of an abnormal winter in the USA

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Economic impacts from the near record warm and snow-free winter of 2001–2 in the United States were assessed to ascertain their dimensions and relevance to issues like climate prediction and climate change. Unusual impacts resulted and embraced numerous sectors (heating/energy use, construction, tourism, insurance, government, and retail sales). Many outcomes were gains/benefits totalling \$19.6 billion, with losses of \$8.2 billion. Some economists identified the sizable positive impacts as a factor in the nation's recovery from an on-going recession stemming from the terrorist attacks on 11 September 2001. Understanding the impacts of such a winter reveals how climate predictions of such conditions could have great utility in minimising the losses and maximising the gains. The results also have relevance to the global warming issue since most climate models project future average winter temperature and snowfall conditions in the United States to be similar to those experienced in 2001–2.

1. Introduction

Weather conditions over most of the contiguous United States from November 2001 through February 2002 were unusually warm, snow-free, sunny and dry. These conditions had major effects on the nation's economy, resulting in both gains and losses.

Awareness of the impacts of the seasonal extremes of the winter of 2001–2 has relevance to defining the values of climate predictions capable of forecasting such outcomes (National Research Council 1999). Defining the impacts also has potential value for the climate change issue since similar conditions are expected to occur frequently in a future warmer climate (Meehl et al. 2000). Most climate models indicate that winters in the mid- to high latitudes will be relatively much warmer than the departures in the other seasons. Analysts of the potential extremes under global warming have recommended attention to possible impacts of such events, which are seen as more difficult for society to adjust to than slow gradual shifts in temperatures or precipitation (Changnon et al. 2000).

The National Oceanic and Atmospheric Administration (NOAA 2002a) reported that November 2001–January 2002 was the warmest such period on record since 1895, being 2.4 °C above the national long-term average. More than 55% of the contiguous United States had below average precipitation, and snowfall was only 55 to 70% of normal throughout the northern United States. Midwestern cities like Chicago and Detroit reported record high numbers of hours of sunshine.

February continued the trend, being warm and dry throughout most of the nation, resulting in a uniquely warm, dry, snow-free and sunny four-month period. Climatological winter (December–February) was rated the nation's fifth warmest in the past 100 years, and many states in the Midwest and Northeast had their warmest winter on record (NOAA 2002b). National temperature departures above the 1895–2002 averages were 2.9 °C in November, 1.7 °C in December, 2.2 °C in January, and 1.3 °C for February 2002.

Absolute, unequivocal measures of the weather's effect on the US economy are impossible to obtain because of other major interactive factors that affect the economy. In 2001–2, these factors included the disastrous terrorist attacks on September 11, the collapse of a major company (Enron), and business incentives, including federal tax cuts, offered to aid recovery from the on-going recession. Nevertheless, for those sectors that are highly weather sensitive, economic measures showed significant differences compared with values in prior, near-normal weather years. These differences helped measure the lower expenditures on heating, reduced costs of all forms of transportation, higher retail sales income from new home sales, shifts in income for tourism, minimal weather insurance losses, and expenditures on enhanced construction activities. Sources used to derive the estimates of the economic impacts that occurred during the winter of 2001–2 include data and information in business journals and government reports, output from models incorporating weather and economic impacts for certain sectors, and assessments of leading economists and business experts.

2. Evolution of the impacts

During the last quarter of 2001 (October–December), several economic measures reflected the impact of the mild November–December weather. For example, the stock market reacted favourably with the Dow Jones gaining 13%, and the NASDAQ composite going up by 30% over the prior quarter (Greenspan 2002a). People went outdoors to shop more often than in normal colder winters. One result was that retail and food service sales jumped 0.2% in November (percentage gains over prior month values), then 0.6% in December, and by 1.2% in January (US Commerce Department 2002a). A useful indicator of the status of the US economy is the Gross Domestic Product (GDP), and in the fourth quarter of 2001 the GDP was 1.7% above that for the third quarter and at its highest rate for two years (US Commerce Department 2002a). Personal spending was 6% higher in the fourth quarter than in the third. The US Commerce Department (2002b) concluded that increased consumer spending was not all due to the weather. Other factors noted included several incentives used to help the economy recover from the recession, including lower interest rates, no-interest on financing offers, heavily discounted merchandise, and refinancing of home mortgages. Nevertheless, the chief economist for the Mortgage Bankers Association of America reported that the fourth-quarter conditions had improved partly because the winter had been so mild (Duncan 2003). Very little severe winter weather occurred and this caused total insured property losses to fall to less than \$500 million, the lowest fourth-quarter value in the past 10 years (Kerney 2002a).

Economic impacts continued during the first quarter (January–March) of 2002 as mild conditions persisted into January and February. Positive shifts were identified as being the result of three conditions: (a) the reactions and adjustments of the business sector to the societal activities that had changed after the September 11 event; (b) an unprecedented liquidation of inventories; and (c) the mild winter (Greenspan 2002d). Alan Greenspan, Chairman of the powerful US Federal Reserve Board, reported that the lower heating costs had added billions of dollars to consumers' disposable income. This quarter also saw a record number of house sales attributed to the mild weather, and vehicle sales also set first-quarter records (Hunt 2003). The record high temperatures reduced energy demand and kept natural gas prices well below normal (Greenspan 2002d).

The mild weather in January and February also had a major effect on all facets of housing (Greenspan 2002c). Construction of new homes increased by 6.3% in January (a rate of 1.68 million units), and rose to 7.4% in February, the highest level since the mild El Niño winter of 1997–8 (Changnon 1999). Sales of new homes in February rose 5.3%, and sales of existing homes totalled 6.05 million units in January and 5.58 million units in February, both near record levels.

The National Association of Realtors (Lereah 2002) attributed the near record construction of new homes and the sales of homes to the mild winter, but also noted that new building supplies had become limited, slowing the potential growth. The US Commerce Department (2002c) reported that residential investments in the first quarter were 15.7% above the seasonally adjusted normal rate. Retail sales were up 1.2% in January, the largest monthly increase since March 2000 (US Commerce Department 2002d). Greenspan (2002d) noted that oil prices were rising into March, but acknowledged that the low prices of natural gas resulting from the mild winter kept overall energy costs stable and offset the gasoline prices rises.

Spending by consumers, which accounts for two-thirds of all economic activity in the United States, increased by 0.5% in January, and then went 0.6% higher in February 2002 (US Commerce Department 2002d). Incomes were reported to have increased by 0.5% in January, and then by 0.6% in February, the largest expansions since October 2000. In January and February 2002, consumers increased spending on expensive items, such as cars, by 1.7%. Spending on non-durable goods such as food and clothing went up 1.1% in January and then in February up 0.3% over January. The unseasonably warm weather led shoppers to purchase spring clothing in February, but several major suppliers reported inadequate supplies of spring clothing to meet demand because of the exceptionally large January–February sales (Chandler 2002).

Expenditures on services increased by 0.4% in January and by 0.6% in February, and spending on tourism rose by 0.4% in January and by 0.6% in February (*New York Times*, 18 March 2002). However, many tourist sites in the East and Midwest suffered financially from the lack of snow, whereas ski resorts in the western United States where snowfall was adequate made above-average profits. Payroll type employment rose in February 2002, the first increase in nine months, and the US Labor Department (2002) further reported that the good weather had helped boost construction employment by 8% and caused re-openings during January and February of 13 car manufacturing plants that had closed due to the recession in the autumn of 2001.

The nation's GDP during January–March 2002 was 5.8%, a very high rate and the highest for more than two years (US Commerce Department, 2002e). The Commerce Department further reported that the economy had grown much faster than expected, increasing by a 1.7% rate in the final three months of 2001. More typical winter weather occurred in March 2002, which had several winter storms and below normal temperatures. This brought reversals in several positive economic trends seen during November–February, reinforcing the value of the mild winter. For example, construction spending fell 0.9% in March after being up 0.7% in February, and new housing starts declined 7.8%

due to the inclement March weather (US Commerce Department 2002e).

In summary, the various weather impacts during November 2001–February 2002 fall in two classes. One class consists of direct effects, those almost totally due to the weather, and the other class is more mixed, the result of a combination of weather and other key economic factors. The more direct weather impacts include the costs of heating, reductions in transportation problems, lower road/highway maintenance costs, increased construction, and reduced insurance losses. The mixed impacts include retail sales, home sales, and tourism during the four-month period.

3. Financial impacts by sectors

The major economic impacts totally attributable to the weather extremes were the changed costs of energy production and heating. Extremely high prices for natural gas and electricity had developed during the prior (2000–2001) winter, and these led many major users to set early season gas contracts at prices that were high in comparison with the low prices that developed during the mild winter (Keener 2002; *Wall Street Journal*, 9 September, 2001). The winter's low heating bills were a bonanza for consumers, and these price declines added more than \$50 billion (at an annual rate) to household purchasing power in November–December (Greenspan 2002a). However, major utilities experienced reduced sales and thus lost large incomes. One East Coast utility firm reported a revenue loss of \$92 million, an 18.3% decrease from expected sales (Keener 2002). One of the nation's major power producers in the Midwest reported retail sales and wholesale margins down by 14%, with revenue being \$178 million less than in the prior year (American Electric Power 2002). Consumers and businesses greatly benefited from the reduced costs for heating, thus providing more financial resources for other purposes. A national energy use-cost model developed to assess weather effects from 1950 to 1998 (Changnon & Hewings 2001) was employed to estimate the national impact of the 2001–2002 winter. The resulting calculations revealed that the lower costs across the nation amounted to \$7.4 billion.

The construction industry realised major profits from the mild winter. Part of the construction bonanza was due to the fact that the ground was not frozen in the northern United States. The Commerce Department (2002e) reported that housing starts jumped 6.3% in January to a seasonally adjusted rate of 1.68 million units, the highest monthly level in two years, and in February, housing starts had reached their highest level since 1948 (Lereah 2002). Construction spending rose in December, January, and February by 0.5% to 1.0% per month with spending at an annual rate of \$875 billion (Greenspan 2002b). These winter increases represented

additional income to the industry amounting to \$1.5 billion (US Labor Department 2002). However, some desired construction was limited by the lack of supplies. Those stockpiled for winter were at normal low levels.

The lack of bad weather led to positive impacts for the property insurance industry. Only one winter storm catastrophe occurred, an ice storm covering five states and causing losses of \$265 million. The total first quarter weather-caused losses experienced by the property insurance industry was \$580 million, the industry's lowest first quarter loss in over a decade (Kerney 2002b). The November–February losses due to national weather extremes were only \$645 million, which was \$3.8 billion less than average. National flood losses during the four-month period were \$0.5 billion, \$1.3 billion below average.

The mild winter weather led to greater retail sales and increased home buying, but some of these activities were also a reflection of the post-September 11 downturn with government leaders strongly encouraging the nation to spend and resume life as normal. The expenditures for homes and retail products during the November–February period were \$4.6 billion above expected average levels (Lereah 2002; Hunt 2003). However, sales of winter clothing and snow-related equipment were down and represented losses nationally of \$90 million (*Wall Street Journal*, 7 March 2002).

The nation's transportation sector benefited greatly from the mild, largely storm-free winter. Airlines experienced very few delays, and the reduced fuel and operating costs were valued at \$145 million for the four months (Hunt 2003). Surface transportation systems also benefited with essentially no weather problems for the trucking and railroad industries. Collectively, their operating and fuel costs were estimated as \$110 million less than costs under normal winter conditions (Hunt 2003).

At the end of the winter, federal, state and local highway/street departments reported sizable reductions – 65% to 80% below average – in the costs of snow removal and salting of streets and highways. For example, the Illinois Department of Transportation (2002) normally spends \$49 million annually on these activities but spent only \$15 million in 2001–2002, and the city of Chicago spent only \$2.6 million compared with an average of \$23 million. National gains were estimated by transportation officials as \$750 million. Those in the private sector who provide services to remove snow were hurt by the lack of business, a national loss estimated at \$40 million (*Wall Street Journal*, 7 March 2002).

Impacts of the unusual winter on the tourist industry were mixed. Ski resorts in the warm and snow-free Northeast and Midwest suffered major losses, whereas

resorts in parts of the central and northern Rockies had enough snow and experienced above average business. Tourist travel to southern resorts was reduced. Some parts of the tourist industry were winners, but many sectors lost, resulting in a net national loss estimated at \$270 million (Hunt 2003). The dry winter weather also led to 13% reductions in the yields of winter wheat, calculated as a loss of \$354 million (*Farm Week*, August 2002). In a similar study of anomalous weather impacts, Sulak et al. (2000) found quite diverse impacts in 1995 on the UK economy.

4. Summary and lessons

The sectoral gains and losses from the mild, almost snow-free winter in the United States are listed in Table 1. The gains totalled \$19.6 billion, although the gains listed for retail sales were partly due to other economic factors, not just the weather. Hence, the retail sales gain shown is in reality somewhat less. The winter losses totalled \$8.2 billion. The reduction in heating costs was a benefit to consumers and commercial interests, but to the utility industry, it was a major loss.

The unusual weather of winter 2001–2 produced large and generally positive impacts on the nation’s economy at a critical time. Economists reported that the mild weather and its impacts were factors that kept the United States from falling into a major recession. For example, in testimony before Congress, Federal Reserve Chairman Alan Greenspan (2002d) identified the weather as an important factor positively affecting

the nation’s weak economy. A market expert (Barnhart 2002) reported that the favourable weather conditions in most parts of the country had played an important role in pulling the US economy out of its post-September 11 recession.

What are some key lessons for the meteorological community from these findings? Availability of accurate climate predictions capable of forecasting such a future winter would have benefits by reducing losses in some sectors and by maximising benefits in others. For example, the utility industry, which suffered a \$7.4 billion loss in reduced sales could use a prediction of a mild up-coming winter to decide to purchase weather derivatives, a form of insurance to cover losses from seasonal extremes (Zeng 2000). The construction industry could improve its benefits by acquiring larger building supplies before the mild winter demand began. Retail firms could acquire larger stocks of spring clothing to meet the unusual increased demand. Winter tourist areas could prepare for minimal business and purchase pre-season insurance cover to meet expected losses. Major savings could occur in many institutions by using the predictions to shift from signing typical pre-winter contracts to purchase natural gas at a pre-set higher price. The price of natural gas falls as a mild winter occurs, and purchases during the season would result in major savings over making autumn contract purchases.

Another lesson relates to the fact that the impacts of the warm winter of 2001–2 can be considered an indication that a future climate with warmer winters in the United States would provide similar positive outcomes. However, future winters may not be as dry as that in 2001–2. A recent national assessment of the impacts of changed climates due to global warming (National Assessment Synthesis Team 2001) found many positive economic outcomes. However, it is not reasonable to expect that society in 2060 (or any other future year) will behave the same or react to weather as it did during the winter of 2001–2. Conditions seen as limiting efforts to extend recent impacts into the future include future shifts in technology society, and infrastructure (Nordhaus 1993). Given the average winter conditions of 2060 (or some later years) are similar to the extremes experienced in 2001–2, one should expect somewhat different financial outcomes as society adjusts to a changing climate.

Table 1. *Estimated gains and losses resulting from the weather during the November 2001–February 2002 period in the contiguous United States.*

GAINS
• Reduced heating costs – \$7.4 billion
• Sales of merchandise, vehicles, and homes – \$4.6 billion*
• Construction income – \$1.5 billion
• Reduced insurance payments for weather losses – \$3.8 billion
• Reduced losses from lack of snowmelt floods – \$1.3 billion
• Reduction in highway/street snow removal – \$750 million
• Reduced costs to airlines and the trucking and railroad industry – \$255 million
LOSSES
• Energy production – \$7.4 billion
• Tourist industry – \$270 million*
• Snow equipment and winter clothing sales – \$90 million*
• Damage to winter wheat – \$354 million
• Snow removal – \$40 million

* –Indicates values significantly affected by other economic factors such as lowered mortgage and interest rates, business and government incentives to spend, and fears relating to the September 11 terrorist attacks.

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