

The Weight of GDP



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For generations Americans reveled in acres upon acres of massive motor vehicle assembly plants, ever taller skyscrapers, enormous dams, and longer bridge spans. I never ceased being in awe of America's industrial might in the 1950s as I drove along the south shore of Lake Michigan toward Chicago, passing one huge steel mill complex after another. But running parallel, starting in the early postwar years, was a growing view that ever larger and more resource intensive production had an upside limit. I recall walking the streets of downtown Pittsburgh in the late 1950s with coke oven ash crunching under my feet. Pollution and the environment were terms that rarely captured public attention, but that was about to change.

In the years immediately following World War II, belching smoke stacks were symbols of industrial progress. I remember pondering in my youth where all the waste from the coal emitted from our chimneys ended up. I assumed, as did most of my acquaintances, that big blue skies and deep blue seas had an unlimited ability to absorb and cleanse. It was never true of course; industrial production imposed unpriced externalities on society. Industrial polluters were getting the services of waste disposal for "free." But industrial progress was very high on the nation's agenda, and pollution was inexorably tied to progress, hence tolerated. The same view appears to be held widely in modern-day China, although it may be changing.

In 1962, biologist Rachel Carson's *Silent Spring* detailed the effect of the widely used pesticide DDT and other chemicals on the environment. Largely as a result, the Environmental Protection Agency (EPA) was born in 1970. A couple of years later, the Club of Rome commissioned a book, *The Limits of Growth*, evaluating the ever-larger consumption of the world's raw materials and speculating about possible future chronic shortages and inflationary imbalances. That forecast did not materialize, but the notion of ever greater waste creation from economic growth fueled by ever more humungous structures and physical goods remained.

No doubt, the emergence of the environmental movement led to some shift in tastes away from ever greater material

consumption and especially away from consumption most likely to result in a degradation of the natural environment. This likely provided some spur to the downsizing of real output. But by far the more important factor driving down the physical component of output and driving up the conceptual content of output was the discovery of the electrical properties of silicon chips and the development of the integrated circuit. This technological development and all the innovations that followed in its wake revolutionized the structure of advanced economies. The fabrication of integrated circuits required negligible quantities of physical materials such as silicon, a natural resource in widespread abundance.

The discovery of the electrical properties of silicon and transistors created a world in which the creation of economic value has shifted dramatically toward conceptual and impalpable values, with decidedly less reliance on physical heft.

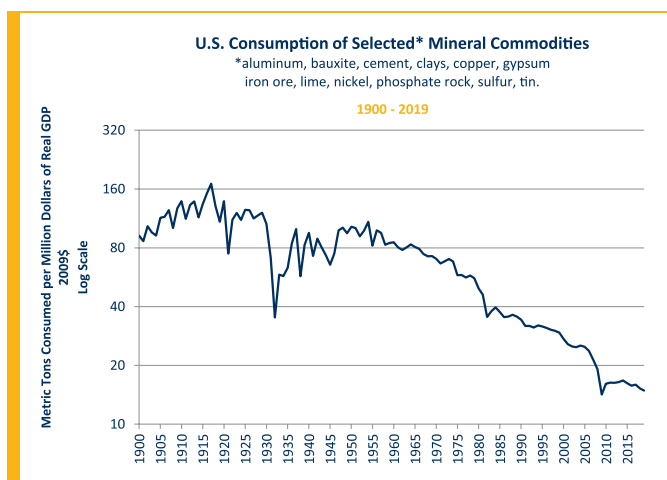
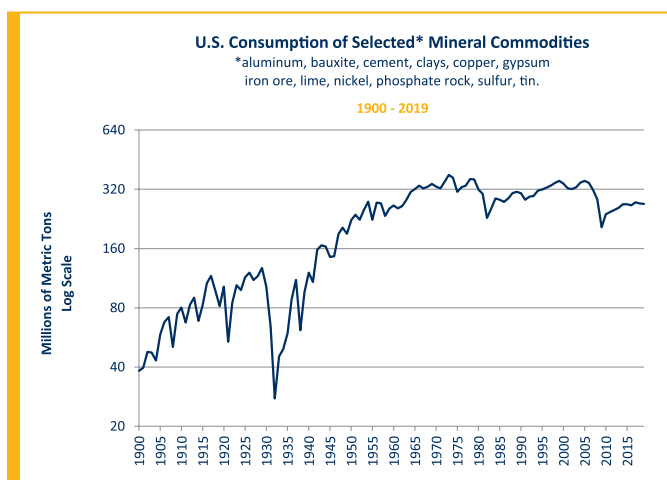
Three quarters of a century ago, our radios were bulky and activated by large vacuum tubes. Years later, owing to the insights that followed from modern electronics, the same function was served by pocket-sized transistor packs. Today we have iPhones that also serve as cameras, flashlights, GPS, portable media players, and docks for a seemingly endless (and growing) list of applications, all in a small handheld device. Moreover, there were other significant technological downsizing developments well beyond the silicon chip. Metal beverage cans are now

rolled to thinner tolerances than was conceivable decades ago. Lightweight fiber optics replaced vast tonnages of copper. Space-heating technology enabled reduction in the fabric weight of apparel because people didn't need to wear warm clothes indoors. Advances in architecture and engineering, and the development and use of lighter but stronger materials, now give us the same working space in newer buildings with far less concrete and steel tonnage than was required decades ago.

Even the physical quantity of goods consumed in creating economic services has been affected. Financial transactions that historically were buttressed with reams of paper are now memorialized electronically. The transportation services industry now moves more goods with greater convenience, while consuming substantially less fuel per ton mile of transportation.

The considerable increase in the economic well-being of most advanced nations in recent decades has come about without much change in the bulk or weight of their gross domestic products. The weight of nonfuel raw materials that are consumed in the United States has not been growing measurably since the late 1970s, with raw tonnages no greater today than they were three or four decades ago. Further, the consumption of these materials per million dollars of real GDP shows a significant downtrend beginning in the 1960s (see charts below). This means that increases in the conceptual components of GDP—that is, those components reflecting advances in knowledge and ideas—explain almost all of the rise in real GDP in the United States, and presumably elsewhere in the industrial world. Services, at constant prices, however, with no physical weight, are roughly the same share of real GDP as they were in 1949, and hence have contributed

only modestly to downsizing. The brunt of the change has been in the downsizing of goods. I will elaborate more on this subject next month.



Alan Greenspan served five terms as chairman of the Board of Governors of the Federal Reserve System from August 11, 1987, when he was first appointed by President Ronald Reagan. His last term ended on January 31, 2006. He was appointed chairman by four different presidents.

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