

TRUTH AND CONSEQUENCES OF OFFSHORING

Recent studies overstate the benefits and ignore the costs to American workers

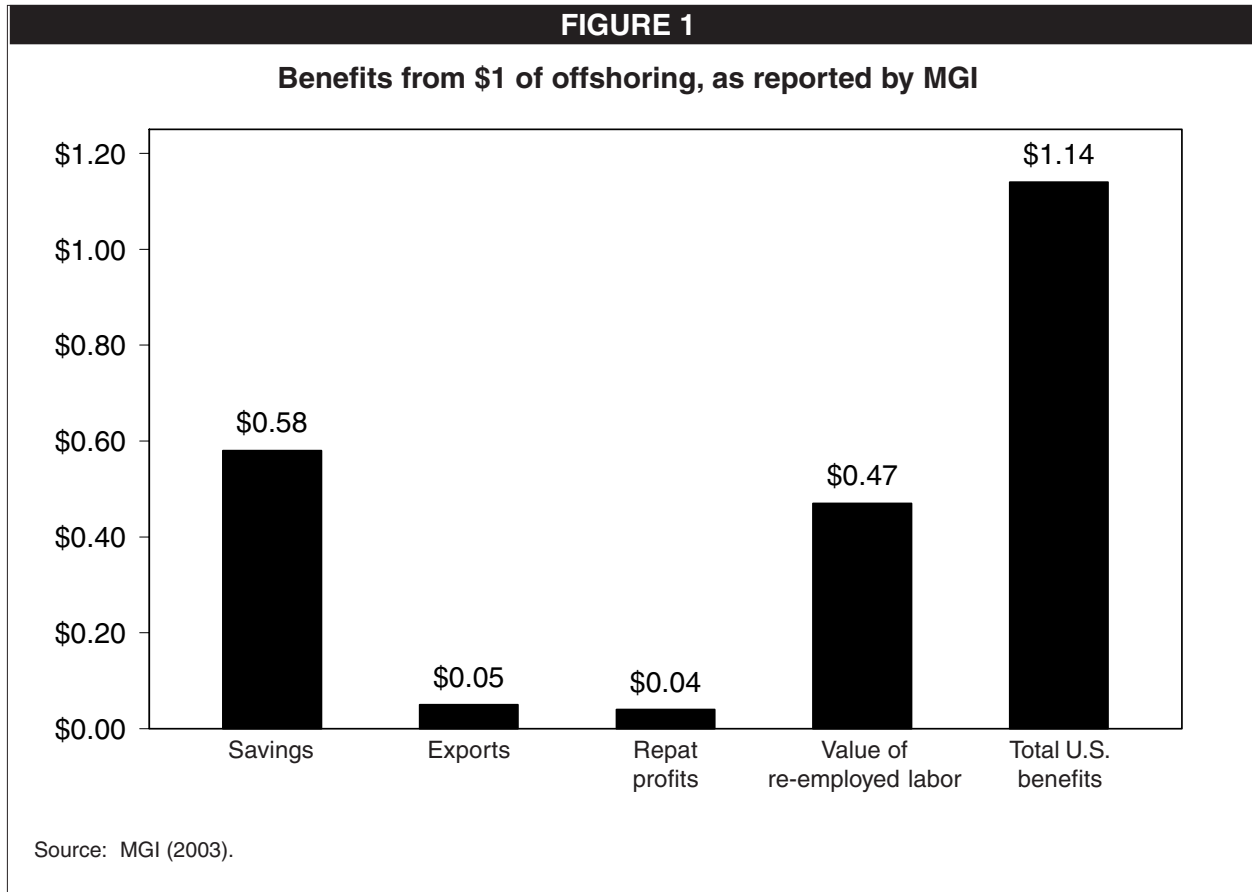
by L. Josh Bivens

Over the past two years, economic observers have focused attention on a new trend in the American economy: increased global competition for white-collar jobs that used to seem well-insulated and secure. While blue-collar labor (particularly in manufacturing) has felt a squeeze from global competition for decades, both in terms of employment security and wage growth, white-collar jobs held by well-credentialed Americans have been largely safe from pressures stemming from the global labor market. Recent reports of companies sending work abroad, ranging from call-center operators to software programmers, have changed this feeling of security.

Such insecurity, especially coming from a group that many assumed would be a prime beneficiary of globalization—i.e., well-credentialed, white-collar workers—has generated a potent political anxiety about the implications of global economic integration for American workers.

In response to this anxiety and an incipient political backlash against offshoring, a number of studies have been released by various organizations touting large economic benefits that will accrue to the American economy through the offshoring of white-collar work. A closer examination of these studies, however, shows that the promised benefits of offshoring are far overstated, while the likely economic costs are not addressed at all. Further, even the potential benefits to the American economy from offshoring are likely to be concentrated in the incomes of a relatively select percentage of American households.

This briefing paper examines three studies claiming that the offshoring of white-collar work will result in large benefits to the U.S. economy. These studies—written by McKinsey Global Institute (MGI), Global Insight (GI), and Catherine Mann in a policy brief for the Institute for International



Economics (IIE)—have been cited often in business reporting about the overall impact of white-collar offshoring on the American economy. However, these findings do not hold up to scrutiny, and in fact, each paper makes excessive claims about the benefits of white-collar offshoring.

Since these studies were released, other research has been done regarding the expected scope and pace of offshoring over the next several years. These more recent studies have often implicitly downplayed the impact of offshoring on developed country workers, with the latest MGI report (*The Emerging Global Labor Market*) asserting: “Offshore employment [in services] will grow gradually, making no sudden impact on labour markets overall in developed countries.” Focusing on the pace of offshoring’s advance, however, is an evasion of the real issues. The potential damage to the labor market prospects of American workers from offshoring remains enormous, and, is largely ignored by studies purporting to tally offshoring’s costs and benefits.

McKinsey Global Institute

The McKinsey Global Institute (MGI) is an independent economics think tank within the McKinsey & Company consulting firm. In 2003 it produced a report titled “Offshoring: Is it a Win-Win Game?” that received much media attention. More recently, this report’s findings are reiterated and explained further

in a short report titled “Exploding the Myths of Offshoring.” The MGI reports identify large economic benefits that individual firms have already reaped from offshoring service production abroad. However, the report fails to make the case that these firm-level benefits will translate into net economy-wide gains. The U.S. economy simply does not operate as a large corporation, and pointing to cost savings realized by individual firms does not imply similar gains to national income.

The most well-known aspect of the MGI reports is a chart used to illustrate the potential benefits to the U.S. economy from offshoring (this chart has been reproduced below as **Figure 1**). What MGI and proponents of offshoring have stressed is the last bar in the figure, which shows \$1.14 in total benefits accruing to the United States from each dollar offshored. The precise breakdown of these benefits is described as follows:

- Fifty-eight cents is saved in corporate costs;
- U.S. exports to the country where employment has been offshored increases by five cents; and
- Four cents is repatriated to U.S. multinationals from the offshored location.

The above calculation totals 67 cents in benefits from each dollar offshored. Then, MGI estimates that workers laid-off in the U.S. will earn 47 cents for every dollar offshored when re-employed into the U.S. workforce generating \$1.14 in total benefits to the U.S. economy from offshoring. One imagines that this figure is meant to be illustrative rather than presenting a last word on the empirical effect of outsourcing. That said, there are a number of things that are useful to note about it.

First, the implicit rate of return from engaging in offshoring (14%) identified in this example is enormous, and likely implausible for the U.S. economy at large. It is based, according to MGI, on a proprietary data set of firms that have already engaged in offshoring to India. As such, it is essentially a self-selected group of firms that have chosen to offshore their labor specifically because offshoring provides the largest economic gains. This rate of return, then, applies only to those firms for which offshoring would have the largest payoff; it is not the *average* payoff that could be expected from a representative U.S. firm sending work offshore.

Second, MGI fails to account for how the increased imports resulting from white-collar offshoring will be financed by the U.S. economy. An individual company need not concern itself with finding exports to offset its imports, but any analysis of the effects of offshoring on the U.S. economy must do so. In MGI’s example from Figure 1, they assume that one dollar of goods previously produced domestically will now be offshored from abroad—meaning that imports into the United States will increase by one dollar. MGI assumes that this generates five cents worth of exports. But the other 95 cents of imports still has to be financed by increasing exports, which transfers resources (that could instead be used to support U.S. consumption and/or investment) to the rest of the world. MGI, by focusing only on a select group of firms instead of the wider economy, enumerates the benefits of offshoring (i.e., cost-savings gained from importing goods that once were produced domestically) while remaining silent on the costs (transferring domestic resources to finance increased imports).

Third, while the firms that have already engaged in offshoring may have reaped large returns, this still does not mean that recent trends toward increased offshoring are an unambiguous windfall for the American economy. While it may make sense for an individual firm to offshore, if this practice becomes widespread enough to result in a rapid increase in foreign productivity in sectors in which the United States is a net exporter, this could actually result in a loss to U.S. income through *terms of trade effects* (as pointed out recently in the *Journal of Economic Perspectives* by Nobel Laureate Paul Samuelson (Samuelson 2004)). This possibility describes precisely the situation that occurs when U.S. companies offshore production in high-skill professions that produce U.S. exports, such as software.

The *terms of trade* of the United States refer to the prices foreign purchasers pay for U.S. exports relative to the prices U.S. residents pay for imports. If U.S. exports fetch ever-higher prices on world markets and/or U.S. import prices drop, the terms of trade for the United States improve—the United States is able to consume more goods given its current income and productivity. If instead U.S. exports fetch ever-lower prices and/or imports become more expensive, U.S. terms of trade deteriorate and its residents are able to consume less given current income and productivity.

To take a concrete example, assume that the United States only exports software programs (as its trading partners are unable to produce these) and that it only imports oil (as the U.S. has none of its own). As oil becomes more expensive, U.S. residents are made unambiguously worse off; they pay more as consumers but do not gain anything as producers. Now, imagine that U.S. trading partners are able to start producing software programs, and the increased supply of these services drives down their price. The United States could then actually be worse off if the loss to domestic producers of software from lower prices swamps the beneficial impact of lower prices to U.S. consumers.

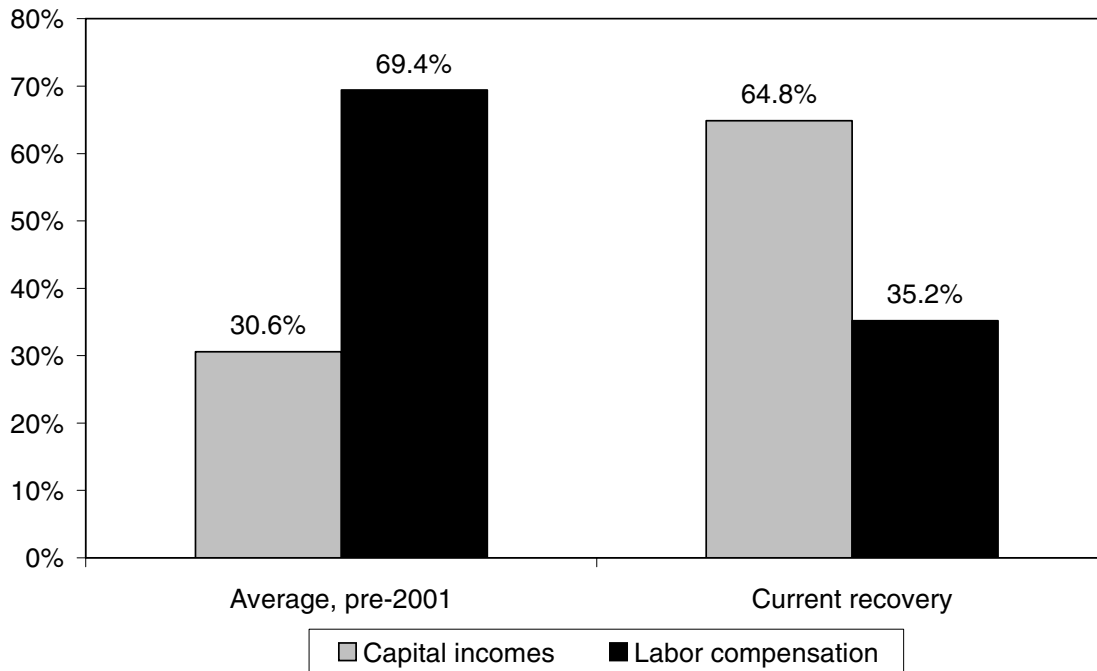
While offshoring of white-collar work may provide benefits to individual firms, if it becomes widespread enough to lead to rapid productivity gains in sectors in which the United States is a prime exporter, the U.S. terms of trade could deteriorate enough to cause actual income losses for the country.¹ Even if this does not occur, the terms of trade effect could still lean against any efficiency gain from offshoring, leading to a smaller economy-wide effect than suggested by the firm-level analysis of MGI.

Fourth, and perhaps most importantly, even MGI's own numbers point to something striking about the pattern of benefits to be reaped from offshoring: *American workers are net losers*. This can be seen by comparing the "savings accrued to U.S. investors and/or customers" (the first bar in Figure 1) to the "value from U.S. labor re-employed" (the fourth bar). The cost savings from offshoring to low-wage locales is 58 cents, while U.S. workers end up with only 47 cents in labor earnings after the fact. This implies a loss of 11 cents for labor earnings from each dollar of production that is offshored, money that is a pure redistribution of income away from U.S. workers. MGI correctly identifies the benefits of this redistribution as accruing to capital incomes (greater profits) or lower prices. If the redistribution goes strictly to capital-owners, then workers are unambiguously worse off (assuming that workers earn little income from capital-holdings). If the latter scenario occurs, and some of this redistribution forces down prices, then workers can recoup some of their lost wages as consumers purchasing at these lower prices.

The degree to which this money goes to price declines (which benefit consumers) versus enhanced corporate profits (which hurt the average worker) is largely unknown. However, it is clearly the case that

FIGURE 2

Shares of corporate-sector income growth, current recovery and average of previous recoveries after 12 quarters



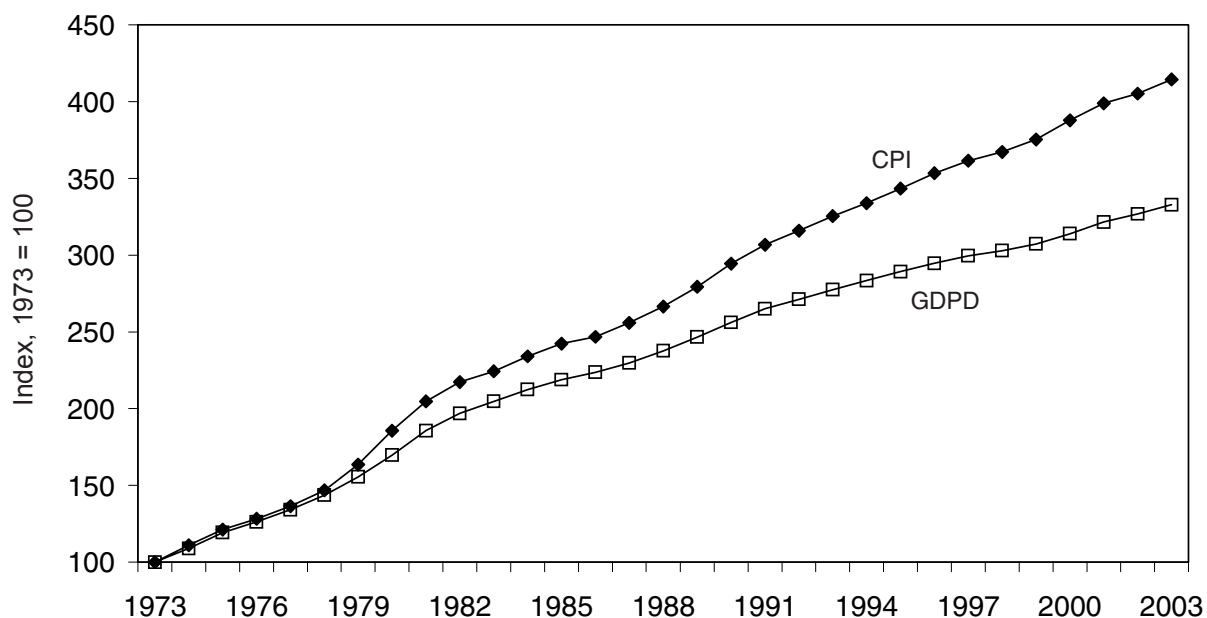
Source: Author's analysis of data from the Bureau of Economic Analysis (BEA).

the current recovery is the most unbalanced on record in regards to wages growth versus growth in corporate profits. **Figure 2** shows the share of corporate sector income that has accrued to capital incomes versus labor compensation up to this point in the current recovery compared to all other recoveries (that have lasted this long) since World War II. While this entire shift in the income distribution is surely not driven by offshoring, these data are exactly in line with what one would expect if offshoring was already a major feature of the U.S. economy.

Further, even if some of the corporate savings manifested as price declines, this would still not necessarily lead to higher living standards for American households. A commonly identified reason for the continued lagging of growth in labor compensation behind growth in productivity in recent decades is the persistent gap between inflation in the prices of goods *consumed* by American households relative to the price of goods *produced* by American workers. **Figure 3** shows two measures of price inflation: the gross domestic product deflator (GDPD) and the consumer price index (CPI). The GDPD tracks the prices of goods produced in the United States while the CPI tracks the prices of goods consumed by American households. As shown in the figure, the CPI has risen much more sharply than the GDPD over the past two decades, meaning that American households tend to consume goods whose prices are rising relatively rapidly.

FIGURE 3

**Two measures of price inflation: Consumer Price Index (CPI)
compared to the GDP Deflator (GDPD)**



Source: Consumer Price Index data from the Bureau of Labor Statistics (BLS) and GDP Deflator from the BEA.

Whether offshoring-induced price declines show up as improved living standards for American households is an open question, dependent upon how intensively these households consume the services that are being offshored.

MGI summary

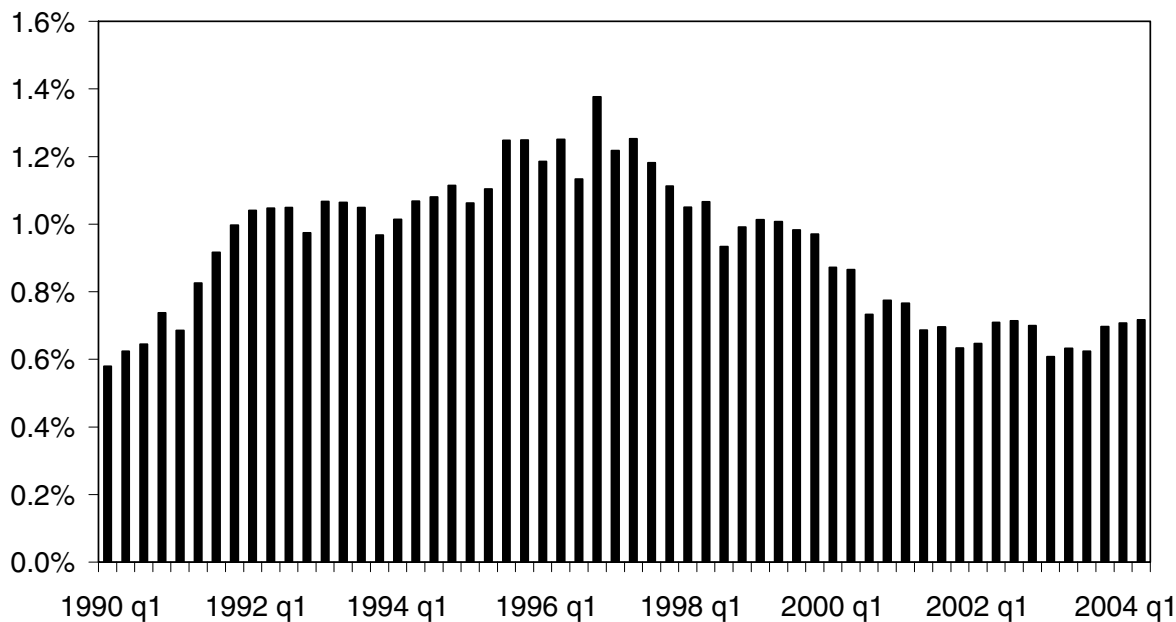
The MGI study makes the assumption that what is good for the subset of U.S. corporations that have already engaged in offshoring of services abroad can be scaled up to predict gains for the U.S. economy as a whole. This ignores offsetting costs to the U.S. economy of terms of trade effects and the need to finance growing imports. Further, even if the U.S. economy reaps efficiency gains from offshoring, these are unlikely to accrue to American workers.

Global Insight

Global Insight (GI), a private consulting firm, was hired by the Information Technology Association of America (ITAA) to study the economic effects of offshoring information technology (IT) services on the American economy. The resulting study, “The Impact of Offshore IT Software and Services Outsourcing on the U.S. Economy and the IT Industry,” has not been made freely available (the executive summary, however, has). In the report, GI used their in-house macroeconomic model to assess the impact of offshoring. In regards to the labor market effects of offshoring, GI claims that their model projects that

FIGURE 4

Service trade surplus as share of GDP, 1990-2004



Source: Author's analysis of BEA data.

offshoring can be expected to boost total employment in the U.S. economy by 589,000 jobs between 2003 and 2008 and result in an increase in real wages of 0.44% over that time.

The GI study is not actually measuring the effect of *offshoring*; rather, it is a prediction about how much rapid cost declines in IT services provision would benefit the U.S. economy. The proposition that offshoring will lead to these rapid cost declines is an *assumption* (not an outcome) of their model.

The most striking GI result is the forecast that offshoring of IT services will cut the growth of IT employment in the United States by 50% over the next five years. In the aggregate, the economy will more than make up this loss through expansion in sectors like construction, transportation and utilities, and health and education services.

While discussion about the full structure of the GI model (or any other macroeconomic model) is outside the scope of this paper, there are a number of modeling issues faced by GI that are described in brief here. First, GI assumes that offshoring offers a 40% reduction in the costs of producing software and other services. This estimate is based largely on the MGI report discussed in the previous section. As pointed out, the MGI report was based on study of firms that had already undertaken offshore production and were thus most likely to see the largest benefits from offshoring. The MGI number was *not* an estimate of the average cost savings that U.S. firms could expect from offshoring, although this is how the GI study uses MGI's data.

Second, GI assumes that declining costs for IT inputs through offshoring will result in lower prices for IT services purchased in the United States, rather than in increased profits for IT firms. The GI study

bases this assumption on the declaration that “it is generally accepted that software is a price-competitive business.” In reality, it is far from obvious that this is the case. In terms of pre-packaged software (Microsoft Windows, for example), patent protection keeps producers from having to lower prices in the face of competition.

Lastly, GI points to a “large and growing trade surplus [in services]” and points to further increases in this surplus (in the form of growing service exports) as another means through which offshoring will aid the U.S. economy. Contrary to GI’s assumptions, however, the service trade surplus is not actually growing when measured in inflation-adjusted dollar terms; instead, it is roughly flat. When measured as a share of GDP, this surplus is unambiguously shrinking, as shown in **Figure 4**.

Given these assumptions, the GI model calculates a set of “baseline” estimates for a range of variables, including employment and wage growth throughout the economy and employment growth in IT-related professions. Then, the GI model is “shocked” with a change in the assumptions relating to IT offshoring: the 40% cost savings is assumed to be 0%, and there is no assumed change in the growth of IT service imports. Given these “shocks,” the differences in growth of the variables examined by GI (including economy-wide and IT-related employment and overall economic wage growth) is subtracted from the “baseline” scenario, giving a measure of how much IT offshoring “changes” these variables. The GI conclusion is that offshoring reduces prices for software, leading to lower economy-wide software prices, more investment in software, and an accompanying rise in productivity.

The most-quoted data from the report are numbers showing that offshoring will raise economy-wide real wages by 0.44% and employment by 589,000 between 2003 and 2008. However, the GI model also predicts that domestic employment growth in IT-related sectors will *fall* by 246,000 due to IT offshoring. The GI report emphasizes that more jobs are created in the IT sector *globally* through offshoring, but it also shows that the number created in the United States drops from 490,000 to 244,000. The GI report does not calculate global employment growth in any other sector besides IT. Of all of the net new jobs created in 2008 due to offshoring, 44% are in two sectors: construction and transportation/utilities.

The last thing to note about the GI results involves putting the numbers they generate for job growth in their proper context. The GI model (like most macroeconomic models) assumes that the economy operates at full employment in equilibrium. GI’s offshoring model, then, assumes that increased service imports cause unemployment in the short term, but that the economy quickly returns to full employment by the end of the simulation period. Given this full-employment assumption, the implication is that the 589,000 jobs created through the impact of offshoring are not jobs that go to workers desperately seeking work. Instead, these are jobs that are created because higher wages resulting from offshoring draw people who had previously opted out of the labor force into taking a paying job. Essentially, the model is assuming that people who may have chosen not to work at a given wage, say \$10, *will* choose to work now that the wage has risen to \$10.04.

GI summary

All told, the estimates generated by the GI model are too high, as they have assumed truly enormous cost savings and assumed that all of these cost savings are passed through to consumers in the form of lower

prices—as well as assuming growing surpluses in service trade in coming years. Further, it is imprecise to label the results of their simulation as “the benefits of offshoring;” rather, any advantages are only the result of very large cost savings in IT software, however realized. Assuming that offshoring will mechanically deliver these benefits is misleading.

Catherine Mann

Catherine Mann, in a policy brief for the Institute for International Economics (IIE), has released the most transparent accounting of the potential benefits from services offshoring. Mann’s 2003 report, “Globalization of IT Services and White Collar Jobs: The Next Wave of Productivity Growth” uses globalization of IT *hardware* as a model for the economic effects of offshoring IT software services and concludes that this service-sector offshoring will yield benefits comparable to those stemming from globalization of computer hardware.

More specifically, the report concludes that: (1) globalization of IT hardware production since 1995 has raised U.S. GDP by \$230 billion; and (2) globalization of software will have the same substantial effect. This report, however, has a number of flaws:

- Mann overestimates the effect of “globalization” (as opposed to technological change) on the rapid price declines of computer hardware.
- Software prices have fallen more slowly since 2000 than during the previous 20 years, even as offshoring has accelerated. Hence, the report’s claim that developments in the IT hardware sector provide a good model for those in IT software are likely incorrect.
- The report greatly exaggerates the effect on GDP resulting from the globalization of hardware production, reporting its claims about the impact of IT hardware globalization on economic growth in a manner inconsistent with all other studies that account for the sources of economic growth.

IT hardware price declines and globalization

Mann’s estimate of the effect of globalization in the IT hardware sector on U.S. economic growth rests on globalization’s contribution to price declines in IT hardware-producing industries. The theory is that these price declines induced firms to undertake greater IT hardware investment and that this extra investment (or *IT capital deepening*) led to higher rates of productivity growth for the U.S. economy. These productivity increases are the source of Mann’s \$230 billion estimate.

It is clearly true that IT hardware saw staggering price declines between 1995 and 2002—prices dropped by 80% in this sector over these seven years (or about 19% annually) according to price measures compiled by the Bureau of Economic Analysis. The vast majority of these sharp declines in the official measures of computer prices results from rapid technological change, as Mann correctly notes.

While acknowledging that technological advance is the primary driver of lower IT hardware prices, Mann sketches out two channels through which globalization could drive IT hardware prices

lower: gaps between *expanded global capacity and production* and *trade deficits in IT hardware*. Neither channel, however, can plausibly have caused as large a price decline as the study estimates.

Expanded global capacity and production

The first “globalization channel” is related to global imbalances between *potential capacity* and *actual production* in producing hardware components. When capacity exceeds production, this excess leads to price declines. Essentially, this is the simple short-run supply/demand story from Economics 101: when supply outstrips demand, prices fall for a period. Mann notes that the price of a key IT hardware component, dynamic random access memory (DRAM) chips, falls when a gap opens between capacity and production. From this, Mann claims that “increased *global capacity* [italics added] of foreign firms and foreign investment by U.S. firms accelerated the decline in DRAM prices.”

The first thing that should be noted about the argument that increased capacity speeds up price declines is how small this potential channel for price changes actually is. Even by Mann’s own estimates, DRAM prices explain only about 15% of a given price decline in personal computers (PCs). So globalization would have to be responsible for a truly staggering price decline in DRAMS to affect PC prices in any serious magnitude. As an example, if globalization alone somehow reduced DRAM prices by 90%, this would imply that IT hardware prices would fall by only 10.5%, the very low end of the Mann’s own estimate for globalization’s impact on IT hardware prices. Globalization-induced declines in DRAM prices just can’t be a large driver of IT hardware price declines in general.

That said, a more fundamental problem is, again, the economic logic that underlies this claim. Mann asserts that globalization has led to an increase in potential capacity in producing DRAM chips, as additional production capacity becomes available on the global market. All else equal, this should lead to a price decline in DRAMS, as capacity growth outstrips actual production. Of course, all else does not remain equal. Over time, increased global *demand* for DRAM production should *increase* prices for these chips. Mann provides no evidence that global *capacity* increases are larger than *demand* increases on a sustained basis.

Mann states that the price effect from increased global capacity was quantified by running a statistical regression using price inflation of DRAMS as the dependent variable and the capacity utilization rate (CUR) of the DRAM producing industries as the independent variable. The report notes that a fall in the CUR causes DRAM prices to fall more rapidly. What it does not show, however, is whether globalization has led to a permanent reduction in the capacity utilization rate—which is necessary to claim that globalization has led to sustainable price declines in DRAMS. If these price declines are not sustainable, then they are an ill-suited model for predicting how the economy will be affected by other sorts of IT trade.

IT hardware trade deficits

In addition to arguing that expanded global capacity and production drives IT hardware prices lower, Mann also reports regression results associating the (net) importation of personal computers into the United States with large PC price declines. From this, she claims that this channel of globalization

(rising IT trade deficits) has driven down hardware prices. It is not obvious what supports this claim. While PC imports and prices may well be *correlated*, one cannot unambiguously assign *causality* from one to the other. The causality would run the other way if falling PC prices cause demand for them to increase and lead to greater imports. While regression analysis can never disentangle causality and correlation, a stronger statement of the theory that trade deficits in IT hardware *cause* price declines needs to be provided to make this a compelling argument, as it is not a standard feature of mainstream trade theory.

Both of these channels of globalization's effect on prices depart sharply from the traditional economists' case for expanded trade. In standard trade theory, price declines for imports should occur because of international specialization based on differential relative costs. Price declines should be wholly unrelated to capacity/output mismatches (which cannot be sustained) or industry measures of *net* imports. More substantial evidence that globalization has led to significant and sustainable price declines for IT hardware is needed to accept Mann's conclusions regarding the contribution of globalization to U.S. GDP.

Fundamental differences between the hardware and software industries

A second flaw in Mann's argument is that it assumes that the globalization of IT hardware is an informative model for assessing the impacts of globalization in the *software* industry. Mann claims that excess capacity and IT hardware trade deficits drove the benefits gained from IT hardware globalization. Neither of these effects is likely to characterize the globalization of the IT software industry: it is not capital-intensive, so excess capacity will play only a small role in its pricing, and the United States is quite unlikely to be a large net importer of software services anytime soon, as it currently runs small surpluses in software services.

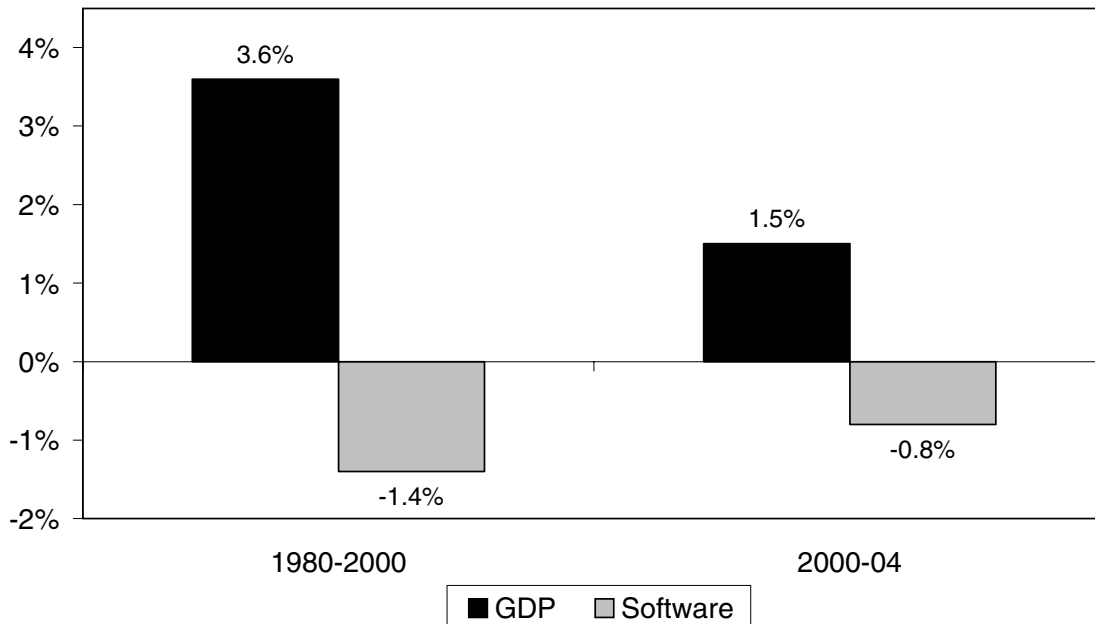
Indeed, later on in Mann's report, this current trade *surplus* in services is emphasized as evidence that the U.S. economy will gain from the global integration of IT services. It seems that Mann is trying to have it both ways: the report argues that trade deficits (or, positive net imports) in IT hardware aid the U.S. economy, but so do trade surpluses (or, positive net exports) in IT services.

Moreover, software is a very labor-intensive industry, and large price declines can be had in this sector only through a large reduction in labor costs. This means either large-scale employment relocation to other nations, or significant wage cuts for software engineers, publishers, and programmers in the United States.

Finally, the pattern of software price declines doesn't fit the story implied by the Mann report, as evidenced by **Figure 5**. From 1980 to 2000, the price of software fell by an average of 1.4% each year. Between 2000 and 2004 (the era associated with the rise in offshoring), its price fell only 0.8% annually. Perhaps even more relevant are the relative price changes: between 1980 and 2000 software prices fell 5% faster than the overall rate of inflation; since 2000 they have fallen only 2.3% faster. So far, at least, greater offshoring in this sector does not seem associated with more rapid price declines.

FIGURE 5

Software price declines and GDP, 1980-2000 and 2000-04



Source: Author's analysis of BEA data.

Mann's figures on productivity gains put in context

The most well-known number in the Mann report is that globalization of the IT hardware sector increased GDP growth by 0.3% annually, which led to a cumulative increase of \$230 billion in output from 1995-2002. In its own words:

...globalized production and international trade made IT hardware some 10 to 30% less expensive than it otherwise would have been. These lower prices translated into higher productivity growth and accumulated \$230 billion in additional GDP (1995-2002). Real GDP growth might have averaged 0.3 percentage points less per year from 1995 to 2002, if globalized production of IT hardware had not occurred (Mann 2003, p. 1).

This extra output was the result of productivity growth that arose from more investment in IT hardware. Again from Mann's report:

Faster productivity growth supported higher GDP growth. All told, the calculations suggest that productivity growth might have been 2.5% instead of 2.8% for the 1995-2002 period and that annual real GDP might therefore have been 0.3 percentage points lower if global integration of IT production had not occurred. The potential difference in GDP growth for the seven-year period cumulates to a conservative \$230 billion (Mann 2003, p. 3).

There is long-standing literature in macroeconomics regarding the very issue the Mann results address: “growth accounting,” or the explanation of the sources of long-run productivity growth. The Mann report references this literature repeatedly, yet in the end provides estimates of the contribution of IT hardware capital-deepening to productivity growth that are vastly out of line with other growth-accounting studies. In short, her estimate of the GDP boost given the U.S. economy by IT hardware globalization is unquestionably inflated.

Standard growth accounting

Mann sketches out the following exposition for translating price declines in IT hardware into gains in GDP:

Calculations are as follows: ‘X’ percent of price decline due to globalization (times) price elasticity of IT investment (equals) change in IT investment’s contribution to productivity growth. Using the growth accounting framework adjusts GDP growth and translates into billions of dollars “gained” due to globalization of IT (Mann 2003, p. 3).

This, however, is incorrect. Multiplying the percent price decline times the elasticity of investment yields only the change in IT investment, not its contribution to productivity growth. The standard formula for assessing how increases in a given capital stock translate into productivity (and GDP) growth over a given period of time runs as follows, assuming that, all else equal, increases in *productivity* translate one for one into increases in GDP:

$$(1) \hat{y} = \theta * \hat{k}$$

Here, y is productivity, k is a measure of capital stock per worker, and θ is equal to the share of capital income in GDP. A “hat” over a variable refers to its growth rate. To give an example, assume that the share of capital income in GDP, θ , is equal to 20%, which is relatively close to the actual share in the U.S. economy. Say that over the course of a decade, investment increases the capital stock used per worker in the U.S. (k) by 10%. What then will be the contribution of this investment to productivity? From (1) we can see that it is 10% (the growth in the capital stock) multiplied by 20% (capital services share in income) or, 0.02 (2%), divided by 10 (the number of years) to get an *average annual* contribution of 0.2%. This *average annual contribution* is the standard way most growth accounting studies present their results.

Mann’s calculations fail to translate the increase in IT investment into a measure of how they contribute to the IT capital stock. A 30% increase in investment does not necessarily translate into a 30% increase to the capital stock. To see why, imagine that the current value of the capital stock is \$100 and the depreciation rate is 10%. Further, imagine that initially annual investment is \$10—enough just to keep pace with depreciation but not enough to add to the capital stock’s value. Now, assume that while depreciation remains the same, there is a 50% increase in investment—it rises from \$10 to \$15. This implies that the value of the capital stock will rise to \$105, an increase of only 5%.

For IT hardware, it turns out that enormous depreciation rates actually make the value of investment close to the value of the capital stock in most years, so a 30% increase in investment will translate into a quite significant rise in the value of the capital stock. However, it will not translate one-for-one into a higher value of the capital stock, and this needs to be taken into account.

Moreover, Mann's calculations also (given all other parameters she identifies) seem to be using far too high a value for IT capital's share in national income. As will be shown below, the small share of IT capital income in total income is a key reason why Mann's estimates of the productivity boost given by globalized IT production are clearly too high.

Mann's numbers and other productivity studies

Over the past five years, a number of studies have been undertaken to identify the determinants of the acceleration of U.S. productivity growth in the late 1990s. All have found substantial contributions from IT capital deepening (that is, extra IT hardware investment)—the channel identified by Mann. Oliner and Sichel (2002), a well-known study on the determinants of productivity, find that IT hardware capital deepening increased labor productivity by 0.54% each year from 1995-2001. If one reads the Mann estimates as annual numbers (as they are, in fact, labeled) centered in the growth accounting literature, one would get the impression that the contribution claimed by Mann (0.3%) for just *globalization's price impact* on IT hardware capital deepening is well over half of the *total contribution* of IT hardware capital deepening to productivity growth in the latter half of the 1990s. Further, Oliner and Sichel (2002) identify the *increase* in IT hardware's contribution in from 1995 to 2001 (relative to the first half of the 1990s) as 0.35% annually, meaning that Mann is essentially arguing that globalization of IT hardware explains the entirety of the increase in IT hardware's contribution to productivity growth in the 1990s.

This cannot be correct. To see why, assume that the *entirety* of this increase in IT hardware capital deepening was driven by falling IT capital prices *and* accept (for the moment) the Mann estimate that 20% of these price declines were globalization driven. Even granting these two assumptions doesn't allow one to get an estimate nearly as high as Mann's regarding the contribution of globalization of IT hardware to overall productivity growth. If price declines alone explain the *entire* increase in capital deepening and globalization is responsible for 20% of these price declines, this implies that the contribution of *globalization-related* price declines in IT hardware to overall productivity would be 0.1% (or, 20% of the 0.54% estimate from Oliner and Sichel (2002)), not the 0.3% that Mann claims. In short, there is a fundamental disconnect between the figures that Mann reports and the existing economics literature on growth accounting estimates of the contribution of IT hardware to U.S. productivity.

Plausible growth accounting with Mann's estimates

Figure 6 below presents a plausible measure of the contribution of globalization to IT hardware capital deepening and the subsequent contribution to aggregate productivity growth, accepting for the moment Mann's assumptions regarding the price impacts of globalization. In her paper, Mann provides estimated values for all but one parameter needed for this exercise: IT hardware's aggregate income share. For this

FIGURE 6**Growth accounting using Mann's assumptions for globalization's price impact**

(1) IT hardware price change, 1995-2002 (observed, BEA data)	11%
(2) Globalization's contribution, 1995-2002 (assumed by Mann)	20%
(3) Average annual price change driven by globalization [(1) * (2)]	2%
(4) Elasticity of IT hardware investment (Bayoumi and Haacker)	1.7%
(5) Globalization impact on average annual percent change, IT hardware investment [(3) * (4)]	3.8%
(6) IT hardware income share, 1996-2001 (Oliner and Sichel)	1.75%
(7) Average annual contribution to productivity growth, globalization of IT hardware [(4) * (5)]	0.07%

Source: Bivens

value, we use estimates from Oliner and Sichel (2002). Following along the rows from top to bottom in Figure 6, we can identify the following steps in figuring the impact of globalization of IT hardware in contributing to productivity growth. For what follows, we assume that one dollar in investment translates into a one-dollar increase in the value of the capital stock, a very generous assumption in terms of maximizing the estimate of globalization's impact.

Step 1: Assuming that Mann uses the midpoint of her estimates, this implies that globalization was responsible for 20% of the observed decline in IT hardware prices from 1995-2002. As hardware prices actually fell by 80% during this time, this implies that prices would be 16% higher at the end of the period absent the effect of globalization. Dividing this by 7 to get the average annual change in prices from 1995-2001 gives us a total price change of 11% per year and a "globalization-induced" price change of just over 2% per year.

Step 2: Mann reports that she used an estimate for the elasticity of IT investment from Bayoumi and Haacker (2002) of 1.7. Multiplying this by globalization's average annual price impact (2%) gives us a value of just under 4%. This represents the percentage increase in IT hardware investment that occurs due to globalization's price effect. We will assume that there is no effect of this price change on labor hours and that it translates one-for-one into increases in the capital stock of IT hardware.

Step 3: To translate this increase in IT hardware capital deepening into an increase in labor productivity, one must multiply 4% by the *share of IT hardware capital services in total national income*. Mann does not provide an estimate of this parameter, but Oliner and Sichel (2002) estimate this as 1.5%. Multiplying 4% by 1.5% implies that the contribution to productivity from IT hardware capital-deepening spurred by globalization is 0.06%. To get a number like Mann's 0.3%, one would need a capital share of IT hardware that is five times greater than the generally accepted estimates.

Mann has clearly used a number for the IT hardware capital services' share in national income that is wholly implausible, as her explicit assumptions regarding price changes and capital deepening just cannot sustain an impact of 0.3%.

Summary of Mann's findings

Overall, Mann's study provides a transparent economic case for the possible effect of globalization of IT services on the U.S. economy. However, the three links in its chain of economic logic are flawed or left unproven. First, the staggering price declines in the IT hardware sector can be fully explained by influences other than globalization. Second, the mechanisms of globalization identified as influencing IT hardware prices will not translate into similar price declines for software and IT services. Lastly, the most-reported number from the study—that globalization of IT hardware increased GDP growth by 0.3% annually from 1995-2001—is clearly incorrect, even granting each of the other assumptions.

Conclusion

The issue of offshoring demands a careful response by policy makers, with the great challenge being to make sure any potential benefits are equitably distributed among firms and workers. Any policy response must therefore be well informed about the costs and benefits of offshoring. Proponents of offshoring and many economists have claimed that its negative impact on the U.S. economy over the past four years has been exaggerated by politicians and others. Even if true, this ignores the fact that offshoring is likely to grow rapidly in the future and could well have large effects on the U.S. economy in years to come. Therefore, balanced analyses about what these effects would be are needed. The three reports examined in this paper exaggerate the size of the benefits offered to American workers by offshoring and gloss over the more troubling distributional consequences.

While offshoring has clearly provided substantial cost savings and improved profits for a number of firms that have engaged in it, one cannot assume that these benefits will scale up for the broader economy. Mainstream international economics teaches that deepening international integration *usually* increases national income, but not always. The offshoring of white-collar work and its consequences (i.e., foreign productivity growth in what is an export sector for the United States) fits in with many of the characteristics of the exceptions.

Further, even if this offshoring does increase national income, American workers will still likely miss out on many of the benefits. Mainstream international economics is equally clear that international integration redistributes more income than it creates. If total U.S. GDP is raised by offshoring, but American workers lose at the expense of corporate profits, then workers are wholly justified in resisting offshoring, at least until they receive some compensation for their losses. Good economic policy should not rest on insisting that American workers sacrifice their own self-interest in terms of lower wages to the larger national interest of increased national income. Policy should also not be driven by studies that mask the costs of offshoring while providing inflated estimates of its benefits. If proponents of offshoring want to reap the potential efficiency gains it offers, a new social contract needs to be proffered to American workers to insure them against the very real risks offshoring poses to their living standards.

Endnote

1. This is an example of the classic fallacy of composition: assuming what is good for some parts is necessarily good for the whole. The most clear-cut example is standing up to see better at a crowded baseball game. If no one else stands, you'll see better. But if everybody else stands up, no one's sight line is improved, and everybody is less comfortable.

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