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Upjohn Institute Press

Introduction

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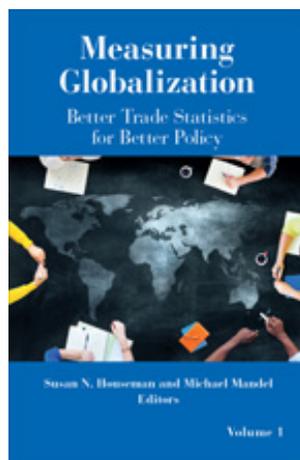
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Introduction

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Economic and trade liberalization in developing countries, coupled with technological advances that have greatly lowered trade and communication costs, have fueled an explosion in the volume of international trade since the 1990s. Trade liberalization and technological advances also have enabled a tremendous expansion in the types of international transactions, including trade in services and intangibles and the development of complex global supply chains. The accompanying expansion of multinational companies has blurred the boundaries of national economies, and the production of manufactured goods and some services increasingly has shifted to emerging economies. While international trade in goods and services has long been expanding, the speed and scope of recent changes have given rise to the term "globalization."

Among the most pressing policy questions in the United States and other advanced economies are those concerning the impact of globalization: Has globalization fostered productivity growth and well-being in advanced economies? Or have the forces of globalization weakened key national industries, resulted in widespread worker dislocation and wage stagnation, and worsened inequality? Understanding the impacts of globalization is critical to fashioning appropriate policies in a rapidly changing world. But understanding its impacts requires good data, and national statistical systems were not designed to measure many of the transactions occurring in today's global economy.

The chapters in this volume and its companion, *Measuring Globalization: Factoryless Manufacturing, Global Supply Chains, and Trade in Intangibles and Data,* identify biases and gaps in national statistics, examine the magnitude of the problems they pose, and propose solutions to address significant biases and fill key data gaps. The chapters originally were presented as papers at a research conference in 2013 funded by the Alfred P. Sloan Foundation, and their authors include

researchers from academic institutions and statistics agencies in the United States and other countries.

Shifts in the location of production and associated trade patterns have been driven to a large degree by lower prices in emerging economies. The research in this volume focuses on biases in price indexes that may arise from the growth of globalization, building on work presented at an earlier Sloan-funded conference in 2009.[1] Price indexes likely fail to capture price drops that consumers and businesses enjoy when they shift purchases to lower-cost foreign suppliers—a general problem termed "sourcing substitution bias" that results in an understatement of real import growth and an overstatement of real gross domestic product (GDP) and multifactor productivity growth. Another source of bias arises from the fact that the use of imports in the economy is not tracked. Errors in the allocation of imports to industries and final consumption, which is required in the construction of key industry statistics, may have become more important as the volume and uses of imports in the United States and other advanced economies have grown. Such errors can lead to biases in input price indexes and associated biases in measures of real output and productivity growth. The decline of transportation costs also may have imparted a bias to price indexes for imports, particularly low-cost imported products.

Another source of bias to price indexes may arise when price changes associated with a new product or model are not observed. To avoid such biases for domestic product prices, the U.S. Bureau of Labor Statistics has used hedonic indexes to adjust prices for changes in product attributes, particularly for products experiencing rapid technological advances. With the growing volume of imports in technologically advanced product lines, the fact that hedonic indexes have not been used for imported products may be imparting a significant bias to import price indexes in certain product segments. At the same time, adjusting prices of domestically produced products for quality improvements has meant that price deflators in certain industries—in particular computers and semiconductors—are rapidly falling, and, correspondingly, their real value-added is rapidly increasing. As a result, relatively small industries (in nominal terms) drive measures of real GDP and productivity for aggregate manufacturing. One consequence of the use of hedonic indexes has been widespread misinterpretation of real output and productivity growth measures in U.S. manufacturing.

In addition to examining the theoretical nature of price-index biases that have been exacerbated by the growth of globalization, the chapters in this volume estimate the magnitude of various biases to price indexes and to real output and productivity growth in the United States and other countries. The findings point to a number of significant concerns, and the authors propose concrete solutions to address the biases, which include changes in the way some price indexes are constructed and the introduction of a new price survey.

The second conference volume extends the analysis to several other measurement issues arising from the growth of globalization. The fragmentation of production has given rise to so-called factoryless goods producers (FGPs): firms that design and market products but outsource the manufacturing of their products, often overseas. Several chapters consider the implications of a proposal to reclassify U.S. FGPs in the manufacturing sector. The growth of global supply chains often renders traditional international trade statistics misleading. Other chapters review new data on trade in value-added, which are designed to more accurately depict the volume of international trade and the stages of production performed in each country. Chapters in the second volume also examine the classification of output of multinational corporations in national statistics and, with the advent of the Internet, the explosion of international trade in data.

BIASES TO PRICE INDEXES: THEORY

In "Sourcing Substitution Bias and Related Price Index Biases," Alice Nakamura, Erwin Diewert, John Greenlees, Leonard Nakamura, and Marshall Reinsdorf provide a thorough examination of biases to price indexes, with a special emphasis on biases resulting from the growth of international trade. A set of price index biases Nakamura et al. collectively label "sourcing substitution biases" arise from the methodology the U.S. Bureau of Labor Statistics and statistical agencies in other countries use in constructing price indexes. In particular, the BLS collects periodic price quotes for very specific products (e.g., a 10.75-ounce can of Campbell's soup) sold by a specific retail outlet in the

case of the Consumer Price Index (CPI), sold by a producer in the case of the Producer Price Index (PPI), or purchased by an importer in the case of the Import Price Index (MPI). The price changes reflected in the CPI, PPI, MPI, and other price indexes are essentially computed as weighted averages of the price changes of product-seller (or purchaser) observations (e.g., the price change of a 10.75-ounce can of Campbell's soup sold at the Walmart outlet in Kalamazoo, Michigan) as collected in BLS surveys.

As Nakamura et al. explain, this methodology implicitly assumes that the "law of one price" always holds: any observed difference in prices between apparently similar products is assumed to be the result of differences in product quality. Yet, the law of one price is routinely violated. Sourcing substitution bias arises when buyers shift from a high-cost supplier to a low-cost supplier of a good or service. Because price indexes are generally derived as weighted averages of price changes of specific products within the surveyed establishments, price drops that purchasers enjoy when shifting from a high- to a low-cost supplier are not captured. The rapid growth of low-priced big-box retailers such as Walmart and the decline of high-priced small retail stores raised concerns in the past that growth of the CPI was systematically overstated (see, for example, Reinsdorf [1993] and Diewert [1998]). So-called outlet substitution bias is one type of sourcing substitution bias.

The dramatic growth of emerging economies, most notably China, since 2000 and associated shifts in the location of production have raised concerns about other types of sourcing substitution biases. The growing share of U.S. imports coming from emerging economies reflects a shift in production away from high-cost suppliers in the United States and other advanced economies to low-cost suppliers in emerging economies. The cost savings enjoyed by consumers or businesses from these shifts to low-cost overseas suppliers is not captured in the import price index, resulting in an upward bias in this index. In addition, as emphasized in several chapters in this volume (Alterman; Fukao and Arai; Houseman, Bartik, and Sturgeon; and Nakamura et al.), the import price index is used to construct industry input price indexes, which in turn are used to compute the growth of industry real value-added. Upward bias to the import and input price indexes from shifts in sourcing from either high-cost domestic or foreign suppliers to low-cost foreign suppliers

results in an upward bias to aggregate and industry real GDP growth and certain productivity measures. Nakamura et al. point out that price index biases arising from shifts in sourcing cannot be addressed simply by altering the formula used to construct the price indexes; the price drop associated with the shift to a low-cost supplier is not measured under current procedures, and no amount of reweighting of observed prices will fix the problem.

A closely related problem for price indexes arises from the introduction of new products or models, as is discussed in chapters by Nakamura et al., Brian Kovak and Ryan Michaels, and Mina Kim and Marshall Reinsdorf. In order to compute a price change for a specific product sold or purchased by a specific establishment, it must be in the sample for two periods. When new products or models are introduced into price samples, typically it is assumed that the price change for the new item is the same as that for closely related ongoing products—a procedure called "linking in." Often, however, price changes coincide with model changes. For example, a company may embed a price increase into a new model; to some degree the higher price of the new model may reflect higher product quality and to some degree a pure price increase. Because new models are likely to be subject to the linking procedure when they are added to price samples, the price increase in this example is missed, a problem called "product substitution bias" (Nakamura and Steinsson 2012).

Conversely, Kim and Reinsdorf point out that, particularly for products undergoing rapid technical improvements, the linking in procedure may result in a substantial overstatement of price index growth. Unlike in other BLS price indexes, hedonic methods to adjust for changes in product attributes, and thereby avoid linking in, are not used in the construction of import and export price indexes. Consequently, these indexes are especially subject to this type of bias.

Similarly, when businesses and consumers shift purchases to a lower-cost foreign product, the product typically is not identical to the one for which it is substituted. Indeed, the import price index, which is based on a survey of importers, treats country of origin as a product characteristic. This practice virtually assures that if an importer shifts its purchases of particular products, say, from Japan to China in response to lower Chinese prices, the Chinese products will be linked into the

sample and the price drop for importers missed, no matter how close in specification the Chinese and Japanese products.

The common justification for the assumption that the law of one price always holds, which underlies current price index methodology, is that arbitrage eliminates any price differences. Building on earlier work in which they find large, systematic, and persistent cross-country price differences among semiconductor wafers with identical product specifications (Byrne, Kovak, and Michaels 2013), Kovak and Michaels argue that trading frictions may interfere with arbitrage. In "Assessing Price Indexes for Markets with Trading Frictions: A Quantitative Illustration," they develop a theoretical model describing the price dynamics of incumbent and new suppliers when buyers face high short-term costs in switching suppliers. Their theory is motivated by the stylized facts of semiconductor wafer production in which it is prohibitively expensive for wafer design firms to switch contract manufacturers for a specific design because of high manufacturing setup costs. In the short term, the incumbent supplier gouges firms that cannot switch. Over time, the prices of old and new suppliers converge. Importantly, their model can explain changes in relative prices when no change in the characteristics of the product or service provided by the suppliers has occurred.

Several chapters examine potential sources of bias to price indexes that are unrelated to sourcing substitution or to the introduction of new models or products. Benjamin Bridgman examines transportation costs for imported and exported goods and their implications for price indexes. Usually, the lower a good's price, the larger the share of its total price made up by transportation or specific trade costs. Most notably, with transportation costs generally falling over time, the price indexes of lower-priced goods from emerging economies like China will rise more slowly than those for higher-priced products from advanced economies, all else being the same. Falling transportation costs, therefore, will tend to result in an overstatement in the growth in real (quantity of) imports from emerging economies relative to advanced economies. The size of trade costs is particularly high in final goods prices, but Bridgman notes that as trade costs fall, this source of bias will become less important.

As discussed in chapters by Jon Samuels, Thomas Howells, Matthew Russell, and Erich Strassner and by Kyoji Fukao and Sonoe Arai, a different type of bias to the input price index may arise from the fact

that statistics agencies generally do not track the destination of imports in the economy. Instead, agencies must make assumptions about how imported goods and services are allocated between final demand and intermediate uses in industries. Typically, statistics agencies assume an industry's use of an imported item is proportional to its overall use of the input in the economy—the so-called import comparability or import proportionality assumption. For instance, if an industry accounts for 10 percent of the use of a particular product, then it is assumed that it uses 10 percent of the imports of that product. Input price deflators are constructed for each industry as a weighted average of domestic and import prices. If the allocation of imported and domestic inputs to an industry is incorrect and if price trends of imported and domestic inputs differ, industry input price indexes could be significantly biased. Because input price indexes are used to compute an industry's real value-added and certain productivity growth measures, these statistics could be biased as well. As Fukao and Arai note, however, if one industry is using relatively more of an imported input, another industry will be using relatively less. As a result, the biases across industries will tend to cancel each other out and so have little effect on the accuracy of aggregate GDP or productivity measures.

EMPIRICAL EVIDENCE OF THE EFFECTS OF PRICE BIASES

The work in this volume significantly extends empirical research presented at the 2009 conference on the magnitude of biases to U.S. price index, real output, and multifactor productivity growth measures arising from the shift in sourcing to lower-priced foreign manufactured goods. In order to estimate these biases, researchers must make assumptions about the quality-adjusted price gaps for goods in advanced and emerging economies when shifts in sourcing occur. Reinsdorf and Yuskavage (2014) utilized apparent inconsistencies between, on the one hand, the Consumer Price Index—which the authors point out should be less prone to sourcing substitution bias—and, on the other hand, the Producer and Import Price Indexes to estimate the bias to the Import Price Index for manufactured goods. They find evidence of substantial

upward biases to import price indexes in durable goods and selected nondurable goods. Although the implication of these biases for aggregate real GDP growth is modest, Reinsdorf and Yuskavage estimate that aggregate multifactor productivity growth was overstated by about 10 percent between 1997 and 2007.

Other prior research used case study evidence along with microdata on import prices to assess price differences between manufactured goods produced in emerging economies, in intermediate countries, and in the United States and other advanced economies. Under various assumptions about the price gap, Houseman et al. (2011) estimate that between 1997 and 2007, real value-added in U.S. manufacturing was overstated by 0.2 to 0.5 percentage points and multifactor productivity by 0.1 to 0.2 percentage points. Although the bias to real value-added growth was a relatively small share of measured growth in the computer and electronic products industry, it may have accounted for somewhere between a fifth and a half of the growth in the rest of manufacturing.

In this volume, authors use a variety of other evidence on price declines associated with the shift in sourcing to low-cost foreign suppliers in order to estimate biases to price indexes and to real output and productivity growth in the United States and other countries. The Japanese government collects unique data on the prices of products sold in Japan as compared to other countries, including the United States and China. In their chapter, "Biases to Manufacturing Statistics from Offshoring," Fukao and Arai find substantial price gaps for inputs sold in developing countries and Japan, not only in products such as apparel and textiles but also in machinery. They estimate that large price gaps and growth of imported intermediates resulted in substantial underestimates of real input growth and overestimates of multifactor productivity growth, especially in Japan's machinery sector.

In the appendix to "Measuring Manufacturing: How the Computer and Semiconductor Industries Affect the Numbers and Perceptions," Timothy Bartik, Timothy Sturgeon, and I use prior estimates of the bias to real value-added growth for U.S. manufacturing (Houseman et al. 2011) to estimate the biases to manufacturing real value-added growth for each U.S. state. Over the decade ending in 2007, we find that adjusting for sourcing substitution bias lowers manufacturing real value-added growth rates by 0.1 to 0.7 percentage points, with the largest adjustments occurring in Michigan, Kentucky, Ohio, and Indiana.

The biases to manufacturing examined in our chapter could result from a shift in sourcing of intermediate inputs from high-priced domestic suppliers to low-priced foreign suppliers (offshoring) or from high-priced foreign suppliers to low-priced foreign suppliers (shifts in import sourcing). Two chapters in the volume—"Import Sourcing Bias in Manufacturing Productivity Growth" by Robert Inklaar and "Import Allocation across Industries, Import Prices across Countries, and Estimates of Industry Growth and Productivity" by Samuels et al.—focus solely on the latter source of bias.

Inklaar examines what he terms "import sourcing bias" in the manufacturing sector in all major trading countries from 1995 to 2008. To estimate cross-country price differentials for specific products, Inklaar computes unit values of imports from United Nations Comtrade data. He acknowledges that this approach has certain drawbacks. One is that, whereas the methodology used by statistics agencies assumes that all cross-country price differences are attributable to product quality differences, the use of unit values assumes the opposite extreme: None of the observed price differences reflect product quality differences. Moreover, because unit values are computed on fairly aggregated product categories, there is likely to be considerable heterogeneity in the products included in them. Despite these caveats, the average price differentials that Inklaar finds are generally in line with case study evidence, and they fall over the period studied. For the advanced European countries, the median price differential from importing a particular product from another advanced EU country versus a new EU country (the latter having been former Soviet bloc members) or from another emerging economy (such as China) was 30 to 35 percent in 1995. That price gap had fallen to 10 percent for new EU countries and to 20 percent for other emerging economies by 2008.

Inklaar estimates that annual multifactor productivity growth for manufacturing sectors in 20 advanced countries was, on average, overstated by 0.18 to 0.34 percentage points, representing 13 to 25 percent of MFP growth over the period. Evidence of import sourcing bias was considerably higher in advanced European countries than in the United States. Using Inklaar's methodology, Samuels et al. also report little import sourcing bias for U.S. manufacturing. Not surprisingly, Inklaar finds no evidence of import sourcing bias in emerging economies.

Although Inklaar's findings should be interpreted with caution, they suggest that import sourcing bias could be significant in many countries.

Using detailed data on prices and product characteristics for specific items, the chapters by Kovak and Michaels and by Kim and Reinsdorf are not subject to these concerns and also report large cross-country differences in prices, even after carefully controlling for differences in product quality. Kovak and Michaels use detailed proprietary transaction price data between firms that specialize in the design and marketing of semiconductor chips and foundries that specialize in fabricating chips for these firms. They find large cross-country differences in the transaction prices for chips with identical specifications, although the prices display some convergence over time. Nonetheless, the authors acknowledge that at least some part of the observed price differentials could be the result of differences in the services provided by the fabricators, such as the rate at which chips are rejected for quality reasons. In an industry such as semiconductors that is characterized by high switching costs in the short term, Kovak and Michaels argue that cross-country price differentials observed late in the product cycle reflect time-invariant quality differences. Adjusting for quality differences, their simulations suggest that semiconductor price indexes substantially understate the true price decline because price drops associated with switching to lower-cost providers in countries such as China are not captured.

In "The Impact of Globalization on Prices: A Test of Hedonic Price Indexes for Imports," Kim and Reinsdorf use hedonic price index methodology to control for cross-country differences in product attributes and to test for the existence of substantial biases in import price indexes. The authors note that both rapid technological change and shifts in sourcing across countries are likely to result in biased import price indexes. Products from different countries or products with substantially new attributes are treated as different products, and under the matched model procedures used in the construction of import price indexes, price changes associated with a shift in sourcing to a lower-cost country or with the introduction of a new product are missed. Hedonic price indexes adjust for quality differences between products, allowing price changes associated with the introduction of new products or shifts in product sourcing to be taken into account. While other BLS price indexes sometimes use hedonic adjustments to avoid these price index biases, hedonic indexes have not been used to adjust import prices.

The purpose of this chapter is to demonstrate the feasibility of hedonic indexes for import prices, using televisions and cameras as test cases.

Kim and Reinsdorf supplement information on product characteristics collected as part of the import price survey with information about these products available on the Web. They find evidence of significant biases in import price indexes for these product groups, both of which were characterized by substantial technical advances and shifts in country sourcing. For televisions, they estimate an upward bias in the import price index of 2.2 percentage points per year, of which 1.3 points derive from undermeasured gains from new technology and 0.9 points from unmeasured price declines from country substitution; for cameras they estimate an upward bias of 10.5 percentage points per year, with 5.8 points deriving from technology and 4.7 points from country sourcing changes.

The chapter by Kim and Reinsdorf underscores the importance of accounting not only for shifts in sourcing but also for technological change in those products when constructing price indexes. Failure to properly account for technological improvements in imported products could result in a significant understatement in the real growth of imports and correspondingly in an overstatement of measures of domestic real output and productivity growth. By implication, consistent use of hedonic price index methodology for domestic and imported products is critical.

The use of hedonic indexes raises other concerns, however, as is illustrated in my chapter with Bartik and Sturgeon. The U.S. CPI and PPI use hedonic indexes to adjust for quality improvements in products subject to rapid technological change, most notably computers and semiconductors. Although adjusting for improvements in product quality is appropriate, we argue that it has led to substantial misinterpretation of U.S. manufacturing statistics. In recent decades, measured real GDP growth in U.S. manufacturing has exceeded or kept pace with aggregate GDP, except during recessions, and many have pointed to these growth statistics as an indicator of manufacturing's strength in the United States. Virtually all of that growth, however, is attributable to the computer and semiconductor industries. Although these industries account for a small share of nominal manufacturing output, their prices, when adjusted for product improvements, are rapidly declining, and their real value-added growth substantially outpaces that in other

industries, thus explaining the outsized effect these industries have on aggregate manufacturing statistics. Hedonic price indexes are highly sensitive to methodology used. Moreover, using proprietary data on global production of computers and semiconductors, we show that the United States was declining as a location of production for these products, even while they were driving the apparent robust growth in U.S. manufacturing.

Other problems may arise from the fact that countries generally do not track the destination of imports in the economy. The chapters by Samuels et al. and Fukao and Arai examine possible biases to input price indexes, real value-added, and multifactor productivity resulting from inaccuracies in the allocation of imported inputs to final demand and to industries as intermediate inputs. Samuels et al. find that, compared to the standard import comparability assumption, allocating imports to final and intermediate uses based on broad economic categories—as proposed by Timmer (2012)—does result in a substantially different allocation of imports to intermediate uses for some product categories. This alternative allocation does not incorporate any new information about import uses in the economy but instead simply varies the assumption about their use. In contrast, Japan collects information on the destination of imports in the economy. Fukao and Arai exploit this information to test how real input and multifactor productivity growth for Japanese industries vary under import allocations based on survey data, as compared to allocations based on the import comparability assumption, which is used in most countries. They find substantial over- and underestimates of real input and productivity growth at the detailed industry level, although they note that, by construction, these errors will tend to cancel each other out in the aggregate economy.

It is important to note that errors in the allocation of imports at the industry level have potentially important implications for economic impact analyses commonly conducted with these data. Analysts often use industry data to predict the effects of increases or declines in an industry's output on employment and income at the local, regional, or national level. These effects depend critically on industry input-output relationships, which govern the spillover effects on employment and income in supplier industries. The employment and income effects of policies targeting a particular industry, for instance, will be lower as the imported inputs used by the industry become greater.

SOLUTIONS

To address biases that rapid technological progress and globalization have likely exacerbated, several chapters propose fundamental changes to the way various price indexes are constructed. Nakamura et al. recommend that in many circumstances the BLS depart from its standard practice of collecting single-point-in-time price quotes for specific products from specific establishments. They point out that the advent of UPC codes and electronic communications enables firms to easily supply the universe of transaction prices on specific items over the course of the month. Averaging these transaction prices within establishments would eliminate biases to price indexes that result from sales promotions. Averaging UPC transaction prices across establishments would be necessary to address outlet substitution bias in the CPI, the form of sourcing substitution bias that occurs when buyers shift purchases to stores offering lower prices. Some have argued that pure transaction price data do not reflect auxiliary attributes that products acquire as a result of where the products are sold; for example, some consumers may find shopping at a small but higher-priced store less time consuming or otherwise more pleasant than at a low-priced big-box store. As the authors point out, however, international guidelines explicitly state that the unpaid time consumers take in shopping should not be taken into consideration in constructing price indexes.

While the averaging of transaction prices for UPC codes would help address outlet substitution bias in the CPI, it would not deal with other types of sourcing substitution bias, including biases stemming from shifts in purchases to low-cost foreign suppliers. This is because no matter how similar the products, UPC codes are unique to a producer—domestic or foreign. To address biases in import price indexes, Kim and Reinsdorf propose using hedonic indexes in lieu of matched model indexes, which miss price changes that occur whenever new models are introduced or importers shift to lower-cost foreign suppliers. The authors demonstrate that information already collected as part of the BLS import prices program, when supplemented with publicly available information on the Internet, is sufficient to implement hedonic indexes, and that biases in matched model indexes can be sizable.

The use of hedonic indexes in computing import price indexes would only address sourcing substitution biases associated with shifts from a high- to a low-cost foreign supplier. To more completely address sourcing substitution bias in input price indexes, William Alterman, the former BLS assistant commissioner for international prices, proposes a new price index that would be based on a survey of input purchasers. As noted, input price indexes miss price declines whenever firms shift from high- to low-cost suppliers of intermediate inputs; these shifts could be from a high- to a low-cost domestic supplier, from a high-cost domestic supplier to a low-cost foreign supplier, or from a high-cost foreign supplier to a low-cost foreign supplier. When such price drops are not captured, the growth of the industry's input price index, real value-added, and certain productivity measures are overstated. In theory, input purchasers could report a price change, even when they source the input from a new supplier. In "Producing an Input Price Index," Alterman reports findings from an initial examination of the feasibility of constructing an input price index for materials inputs. Although some technical issues along with budget constraints pose significant challenges to the introduction of a new price survey, Alterman concludes that fielding a sample of materials purchasers is possible and that, in general, businesses can periodically report prices on input purchases. Nakamura et al. and Kim and Reinsdorf point out that, if implemented, such a survey would need to collect data on product characteristics so that prices could be adjusted for changes in product attributes whenever models or suppliers change.

Alterman acknowledges that the proposed input price bias is not a panacea. It would not, for instance, capture price declines when firms outsource or offshore work previously done in-house. This is because data on the price for work previously done in-house would not exist and so could not be compared to the price from an arm's-length transaction. Moreover, because in official statistics aggregate GDP is computed from the expenditure side as the sum of final consumption, investment, government purchases, and net exports—not as the sum of value-added across industries—a fully implemented input price index would address biases from sourcing substitution to real GDP and productivity measures for industries, but not for the aggregate economy. The use of hedonic indexes for import prices, as proposed by Kim and Reinsdorf,

would address some of the bias to both aggregate and industry real GDP measures from sourcing substitution. Information from biases to the input price index or from discrepancies between movements in the CPI, PPI, and MPI, as discussed in Reinsdorf and Yuskavage, potentially could be used to better address biases to aggregate output and productivity measures.

Adjusting prices for changes in product quality, however, also may mean that products experiencing rapid technological change will dominate movements in aggregate statistics, as Bartik, Sturgeon, and I illustrate with the outsized effect that the computer and semiconductor industries have on real GDP growth in U.S. manufacturing. To mitigate confusion and misinterpretation of the data, we argue that statistical agencies should make clear the influence certain industries have on aggregate statistics—for example, by also publishing subaggregates without these industries.

The case of U.S. manufacturing raises broader questions about how to measure competitiveness in a global economy and in an era of rapid technological change. Traditionally, economists and policymakers have looked to real output and productivity measures to assess an industry's competitiveness. Yet the United States was declining as a location for production of computers and semiconductors even while these industries accounted for the robust output and productivity growth in U.S. manufacturing. My coauthors and I argue that international data on the location of production are necessary to assess the global competitiveness of a particular industry or sector in a country.

In addition, the fragmentation of production raises difficult classification issues. For example, although the competitiveness of the United States as a location for the production of computers and semiconductors has declined, much of the product design work and marketing remains in the United States. These activities usually are counted in the research or wholesale trade sectors, though they traditionally are integral parts of manufacturing. These developments arguably necessitate a rethinking about how activities in the economy are classified.

The companion to this volume examines these issues in greater depth. Several chapters focus on a recent proposal to classify so-called factoryless goods producers in manufacturing, explaining the rationale for the proposal, the current prevalence of FGP activities in the United

States, and the likely effect of such a change in classification on manu-facturing statistics. The second volume also reports on recent efforts to develop data sets measuring trade in value-added. Value-added of a product produced in a global supply chain may be counted multiple times in international trade statistics, which measure gross flows of imports and exports. Electronic components, for example, produced in Japan may be exported to China for assembly into final consumer goods. The value-added of the electronic components will be counted once in Japan's exports and again in the Chinese exports of consumer electron-ics. Similarly, bilateral trade statistics can be misleading: Imports from a particular country may contain substantial amounts of value-added from other countries, and the import content of a country's exports may be sizable. Data on trade in value-added are needed to understand what is made where and, ultimately, to assess the competitiveness of national industries and activities in the supply chain. Advances in technology and communications that have allowed the explosion of trade in manu-factured products have permitted the rapid expansion of multinational companies and of trade in services and intangibles, many of which were previously regarded as "untradeable." Chapters in the second volume also examine the thorny issue of attributing output from multinational companies to the countries in which they operate as well as evidence that trade statistics greatly understate cross-border flows of data, raising concerns about recent policies in some countries to discourage these flows.

Note

1. The conference "Measurement Issues Arising from the Growth of Globalization" was held November 6–7, 2009. Summaries of the conference research and of its research papers are available at http://research.upjohn.org/externalpapers/7/ and http://research.upjohn.org/reports/130/, respectively.

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Measuring Globalization

Better Trade Statistics
for Better Policy

Volume 1

Biases to Price, Output, and
Productivity Statistics from Trade

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2015

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