THE EFFECTS OF LOW-VALUED TRANSACTIONS ON THE QUALITY OF U.S. INTERNATIONAL EXPORT ESTIMATES: 1994-1998

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CES 04-11 August, 2004

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July 29, 2004

Abstract – This paper uses data from the U.S. Census Bureau Annual Survey of Manufactures (ASM) to examine the effects that a growth of low-valued transactions likely has on the quality of export estimates provided in the U.S. International Trade in Goods and Services (FT-990) series. These transactions, valued at less than $2,500, do not legally require the filing of export declarations. As a result, they are often not captured in the administrative records data used to construct FT-990 estimates. By comparing industry-level estimates created from the ASM to related FT-990 estimates, this paper estimates that the undercounting of low-valued transactions in the FT-990 export series increases by roughly $30 billion over the period of 1994-1997. It also finds that regression analysis provides little insight into the undercounting issue as results are primarily driven by industries whose contributions to total manufacturing exports are small.

I. Introduction

This paper uses the data collected in the Annual Survey of Manufactures (ASM) over the period of 1994-1998 to provide insight into the quality of export estimates provided in the U.S. International Trade in Goods and Services (FT-990) series. Rather than being based on data collected in the ASM, the FT-990 estimates are based on administrative records data collected by the Census Bureau Foreign Trade Division (FTD). The quality of the FT-990 series is important because it is used to measure the U.S. trade deficit and construct the Bureau of Economic Analysis (BEA) estimates of Gross Domestic Product.

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This paper reports the results of research and analysis undertaken while the author was a research affiliate at the Center for Economic Studies at the U.S. Census Bureau. It has undergone a Census Bureau review more limited in scope than that given to official Census Bureau publications. Research results and conclusions expressed are those of the author and do not necessarily indicate concurrence by the Census Bureau, the U.S. Bureau of Economic Analysis, or the U.S. Department of Commerce. It has been screened to insure that no confidential information is revealed.

Mounting evidence from statements made by express couriers and results presented in cross-country trade reconciliation studies suggests that estimates of the total value of exports for more recent years in the FT-990 understate the true value of exports by 3 to 10 percent [7]. This is a range that causes some concern. As presented in testimony to the U.S. Trade Deficit Commission in November of 2000, the amounts of undercounting associated with this range are potentially large enough to overstate the U.S. trade deficit in 1997 by as much as one-third [11]. In addition, these amounts of undercounting might be large enough to qualify as a primary cause for the increasing discrepancy between the BEA estimates of U.S. economic growth as measured by production and growth as measured by income over the period of 1994-1998. Although these two measures should be equal by concept, the income measure grows at an average annual rate of about 0.5 percentage points faster than the product measure over this time period.

One of the primary reasons that the quality of the estimates in the FT-990 series is likely to have deteriorated over this time period is that many more export transactions are not being captured in the administrative records data collected by the FTD. In particular, the development of e-commerce and the growing ease in which goods can be shipped internationally via express couriers has likely led to large increases in the number of low-valued export transactions [7]. These transactions, valued at less than $2,500, do not legally require the filing of export declarations. As a result, they are often not captured in the administrative records data maintained by the FTD. Although results from surveys of low-valued export transactions are used to adjust preliminary export estimates so that the final FT-990 estimates can be representative of the true level of all export activity, the adjustments for more recent years are essentially based on surveys that were conducted more than ten years ago. As the FTD

acknowledges, it is unlikely that these adjustments accurately represent the total value of low-valued export transaction in the current economy [7].

There are apparent limitations in the coverage of exports in the data collected in the ASM as well. For instance, Bernard and Jensen [1] find that estimates of export totals created from the data collected in the ASM are typically about 30 percent lower than related totals reported in the FT-990 series. It is believed that the primary reason for these differences is that plants report exports to the extent that they are aware of the ultimate destination of their shipments. Many shipments might be made to a central warehouse or to a wholesaler that ultimately export these goods without the manufacturing plant's knowledge [9].

Even though the coverage of exports in the data collected in the ASM might be less than perfect, this does not imply that estimates produced from these data are essentially useless. If evidence suggests that the degree of undercoverage of exports in the ASM is relatively constant over long stretches of time, then changes in ASM-based estimates over time can be used to examine changes in the quality of the export estimates provided in the FT-990. In addition, the ASM data might be used to understand developments in exporting activity at the plant-level that could suggest additional ways to examine changes in the quality and coverage of exports between the two data collection programs.

The results presented in this paper indicate that the data collected in the ASM can indeed shed some light on the quality of the FT-990 export estimates. By examining the differences between the two sets of estimates over the period of 1991-1998, the results suggest that the quality of the FT-990 estimates deteriorate over the period of 1994-1997 due to the undercounting of low-valued export transactions. This paper also presents the results of plant-level regression analysis that indicate that

export growth in the ASM is actually lower for plants in low-valued transaction industries than that in other industries even after controlling for plant size and geographic location. However, the usefulness of these results is limited as they are primarily driven by industries that do not contribute much total manufacturing export values. Lastly, this paper discusses some of the difficulties associated with drawing reasonable conclusions for the period of 1991-1993 due to the sample design used to construct the ASM.

II. Methodology

The analytical results presented in this paper relate to two separate sets of empirical exercises. The first set involves the direct comparison of export estimates created form the ASM-portion of the Census Bureau Longitudinal Research Database (LRD) with related estimates in the FT-990.[1] This examination intends to shed light on whether the quality of the FT-990 estimates is substantially affected in later periods by an undercounting of low-valued export transactions. The second set involves the use of regression analysis to examine whether plants classified in low-valued transaction industries experience more export growth relative to other plants, after controlling for plant size and geography. This last examination intends to shed further light on the coverage of exports in the FT-990 by

[1] One of the main reasons that the Annual Survey of Manufactures (ASM) data from the Longitudinal Research Database (LRD) is used for this study is because the export data in the 1993-96 ASMs had not been previously edited to produce tabulations for publication. Thus, a large portion of the work associated with this paper involved editing the export data contained in the ASM. Since preliminary results indicated that the tabular analysis was the strongest portion of this study, emphasis was placed on the integrity of the tabulations.

determining the types of plants that are reporting the most export growth in the ASM over the period examined in this study.

The remainder of this section begins by discussing the choice of time period and definition of low-valued transaction industries used in this paper. Afterwards, the methodology employed for this paper is discussed in more depth.

A. Choice of time period

Although data since 1991 form the basis for some of the results presented in this paper, the data used for the main analysis are limited to 1994-98. This choice is guided by a few considerations. First, a comparison of total export estimates for manufacturing based on data collected in the ASM to related estimates presented in the FT-990 series over the period of 1976-87 already exists in Bernard and Jensen [1]. Thus, the general relationship between the coverage of exports in the two data collection programs over the period of 1976-87 is already known. Although it might be advantageous to establish a "historical baseline" for the exports reported for industries associated with low-valued transactions through the use of earlier years of data, there are additional considerations associated with the collection of data in the ASM that guides the choice of time period for this paper.

There are two particular sets of limitations placed on the scope of this paper due to the specific nature of the data collected in the ASM. First, industry classification data collected after 1996 are primarily based on the North American Industrial Classification System, where as industry classification data collected prior to 1997 are based on the Standard Industrial Classification (SIC) system. Some

industry codes based on the SIC system, however, do exist in the micro data for the years of 1997-1998. This feature of the data collection efforts precludes a meaningful comparison of industry-based estimates over time periods that span across the time period of 1998-1999. [2, 3] Thus, this project does not consider the use of data collected after 1998. Second, an extensive use of export data collected in the 1984-1993 ASMs is problematic in the context of the research presented in this paper.

The reason that the use of data from the 1984-92 ASMs is considered problematic is because of a "drift" problem that is present in the originally published statistics created from these surveys. The drift problem refers to the finding that the originally published totals of many variables collected in the 1987 and 1992 ASMs are substantially lower than their corresponding totals in the Census of Manufacturers (CMs) for the same given years. An interagency task force comprising members of the Board of Governors, the BEA, and the Census Bureau was created to investigate this problem and provide recommendations. According to their findings, many plants were first identified as manufacturers in 1992, despite having been in the manufacturing sector for up to four years. These plants are not represented in the original aggregate estimates due to their lack of industry classification. In addition, the plants of many new companies were initially classified as non manufacturing in 1992. These plants were not subject to the Census Bureau's birth supplementation routines, contributing to a

[2] In theory, it is possible to employ a technique similar to the one used by Klimek and Merrell [5] to classify plants that exist in the ASM collections after 1998 by SIC codes. However, the work considered for this paper did not include the application of this type of technique because it is the author's opinion that it would require a very large amount of work that would likely outweigh the potential gains of examining a additional year or two of data within the context of the study. Further, it would introduce more uncertainty regarding the quality of the estimates as random sampling based on historic product ratios is used to assign many SIC codes to plants.

[3] Although Standard Industrial Classification (SIC) data exist in the micro data after 1996, the quality of these data are unknown. It seems reasonable to expect that the Census Bureau focused on editing the North Atlantic Industrial Classification Syatem (NAICS) codes more than SIC codes because the NAICS codes form the basis for industry estimates published after 1996.

further departure of the aggregate estimates from those of a truly representative sample of the universe of U.S. manufacturing plants. Beginning with the 1993 ASM, the Census Bureau introduced procedures to address both of these issues [10].[4]

The ASM survey panel also rotates between the years of 1993 and 1994, creating sample limitations associated with the use of 1993 data at least for the regression analysis. However, some tabular-based results are presented that use data for the years of 1991-1993. These results are presented in order to demonstrate the difficulties associated with drawing any inferences from these data in the context of the analysis used in this paper.

B. Definition of low-valued transaction industries

Much of the analysis in this study relies on the identification of export activity associated with "low-valued transaction industries." For the purposes of this paper, a low-valued transaction industry is defined as an industry in which the following three criteria are met: (1) a majority of the products produced by the industry are easy to physically ship via express couriers in packages valued at less than $2,500; (2) a majority of the products produced by the industry are associated with the development of e-commerce over the sample period (*i.e.*, orders placed over the Internet must be larger than 15 percent of the value of total shipments of manufacturing plants in the industry in 2000); and (3) a

[4] The Census Bureau also followed the recommendation of the task force by revising the aggregate estimates of many variables for the years of 1988-1992 through the use of a "smoothing" procedure based on CM totals for years of 1987 and 1992 [10]. Comparing total export estimates based on these data which have been changed through the smoothing procedure would muddle the interpretation of the results by eliminating much of the variation between the years that might truly exist.

majority of the products produced by the industry are not associated with the regulations of many countries that place limits on their shipment via physical mail (*i.e.*, most goods produced in the industry are not considered to be hazardous materials or biological products).

The specific definition of low-valued transaction industries for used in this paper includes the last two criteria because they narrow the definition down to the identification of only those industries in which the growth on low-valued transactions could reasonably affect export coverage in the FT-990 series. They also narrow the definition down to those industries where the inherent ability to ship its goods via express couriers could reasonably have an effect on export growth.

The importance of the last two refinements to the definition of low-valued transaction industries can be seen through a few examples. Screw machine products might be easy to physically ship through the mail. However, the lack of well-developed e-commerce markets for these products implies that the exporting of these products is likely done through large shipments that require the filing of export declarations. Similarly, shipments of pharmaceutical, food, and chemical products are likely to be exported in shipments that require the filing of export declarations because they are more likely to be exported in large shipments over land or sea. Thus, it is expected that the exports associated with these goods are almost fully included in the underlying data used to construct the FT-990 export estimates.

The industries which are classified as low-valued transaction industries for the results presented in this paper are listed in Table 1. Two characteristics of these industries are worth mentioning. First, the presence of e-commerce in these industries has increased rapidly since the Internet became available for the conduct of commercial activity in 1994. In fact, the value of total e-commerce orders is between 17.1 and 24.0 percent of the total value of shipments for each of these industries in 2000

[6]. Second, the products produced by these industries constitute nearly 25 percent of total manufacturing exports in 2000, at least according to the FT-990 series.

C. Comparison of export estimates

The first analytical portion of the project investigates the coverage of exports in the data collected in the ASM by computing estimates of export activity based on these data and comparing them to related estimates provided in the FT-990 series over time. In particular, three sets of comparisons of estimates are made: the total value of exports for all of manufacturing; the total value of exports for plants in all low valued transaction industries; and the total value of exports for each of the specific industry groups associated with the individual end-use categories listed in Table 1.

The purpose of the first set of comparisons is to investigate whether it appears that the coverage of exports in the ASM has remained relatively constant in relation to the coverage of the FT-990 over the period of 1994-98. Given the likely reasons that plants might understate the value of their exports in the ASM, the aggregate comparisons are interpreted in unison with estimates of the percentage of plants associated with multi-unit firms and the value of interplant transfer over time. A stable value for these variables across time would support the notion that differences between the two series of export estimates are most likely due to changes in the coverage provided by the FT-990 series.

The purpose of the second set of comparisons is to suggest whether the coverage of exports in the FT-990 has recently declined due to an increase in low-valued transactions. By comparing estimates for these industries as a whole to those listed in the FT-990, evidence is provided to suggest

whether the difference in the estimates for manufacturing as a whole is merely the result of declining export coverage for low-valued transactions in the FT-990 estimates. An alternative explanation could be that the difference is the result of more general trends associated with the coverage of exports in the ASM as a whole. In addition, a larger growth in the difference between the export estimates for low-valued transaction industries in relation to other industries would support the notion that the differences are primarily due to a deterioration in the quality of the FT-990 estimates.

The purpose of the last set of estimates is to determine which of the specific industries associated with each individual end-use category listed in Table 1 are the primary determinants for the difference in export coverage across the two series over time.

D. Regression analysis

The last set of empirical results presented in this paper attempts to shed further light on the differences between the trends in the two sets of export estimates by presenting the results of regressions that examine whether there is a systematic difference in the growth rate of exports between plants which are and are not in industries associated with low-valued transactions over the time period of 1994-1998. Many of these regressions account for both plant size and geographic location. This analysis is intended to shed further light on the findings associated with the previous portion of the

project by providing an understanding of the systematic differences in export growth reported at the plant level.

The regression results are based on a linear model that has the following general form:

$$g_{it} = \alpha_1 + \alpha_2 I_{it} + \alpha_3 \mathbf{S}_{it} + \alpha_4 \mathbf{G}_{it} + \varepsilon_{it}$$

where g_{it} represents the growth rate in exports for a plant indexed by i in time period t; I_i represents a dummy variable that equals 1 if a plant is in a low-valued transaction industry, 0 otherwise; $\mathbf{S}_i$ represents a set of dummy variables that indicate a size class to which a plant belongs; $\mathbf{G}_i$ represents a set of dummy variables that indicate the particular geographic area in which a plant is located; ε_{it} represents a normally distributed error term, and $\alpha_1, \ldots, \alpha_4$ represent a set of parameters to be estimated. An estimated value α_2 of that is significantly different from zero would support the hypothesis that the export growth of plants in low-valued transaction industries is inherently different that those of other plants. More exact definitions of the variables used in the estimations are discussed in the results section of this paper.

III. Data

This section provides a detailed discussion of the data used to generate the results that are presented in the next major section of this paper. It begins by discussing the FT-990 and ASM data

collection programs and ends by discussing some general considerations associated with the use of these data.

A. Description of FT-990 data

The FT-990 estimates are compiled by the FTD of the Census Bureau from various electronic and paper sources. The sources include data from the Automated Export System (AES), Shipper's Export Declarations (SEDs), and Statistics Canada.[5] In 1997, these collection efforts included the coverage of more than 19 million export transactions annually. Approximately 32.4 percent of these transactions are captured through AES and 31.4 percent captured through SEDs. The remaining portion are captured through data exchange with Canada (*i.e.*, Canadian estimates of imports arriving from the U.S. are used as estimates of U.S. exports to Canada.)[8].

Although the administrative data collected by the FTD form the base of the estimates published in the FT-990, there are adjustments made to tabulations of the administrative records data before arriving at the published estimates. As previously mentioned, adjustments are made to capture the value associated with low-valued transactions that are not captured in the administrative records data. Since export declarations do not need to be filed in cases where the merchandise in the shipment is valued less than $2,500 ($250 for quota items), these transactions usually do not make it into the administrative data collected by the FTD. Thus, the FTD uses the data from surveys of low-valued

[5] The Automated Export System (AES) replaced the Automated Export Reporting Program in January 1, 2000. The main difference between these two programs is that the AES incorporates on-line edits and refers questions back to the filer for verification.

transactions to adjust its initial estimates. Although the Census Bureau periodically updates these estimates, they are still essentially based on surveys that are at least ten years old. As a result, it is likely that these adjustments do not fully reflect recent changes in export pattens such as those resulting from the rise of air express trade and "just in time" order processing.[6] As the FTD acknowledges, little is known about the effects that these changes have on the quality of the FT-990 estimates.

There is also another characteristic associated with the FT-990 data collection efforts that is worth mentioning in the context of this paper. Although the electronic filing of export declarations was initiated in 1995, it was not available at all ports or for all modes of export transportation until 1997. Electronic filing of export declarations allows exporters to electronically file their data in one of two manners: (1) at the summary level, where the sum of only shipments valued at more than $2,500 by commodity line are included, (2) at the detailed level, where all shipments by commodity line are included. As of January 2003, about 85.9 percent of eligible export shipments were filed via AES with about 15 to 20 percent filed at the detailed level [2]. Although the growth in detailed export declarations adds additional uncertainty to the degree to which export undercounting in present in the FT-990, the more widespread use of AES is likely to reduce export undercounting as the use of detailed electronic filing increases over the time period of the study.

[6] The Census Bureau has not collected data on export transactions below $1,000 and $2,500 since the mid 1980's and 1989, respectively [7].

B. Description of ASM data

A substantial portion of the data used in this study comes from the ASM portions of the LRD. The LRD is a series of data sets containing annual data on U.S. manufacturing plants collected in the CM during census years (*i.e.*, 1963, 1972, 1977, 1982, 1987, 1992, 1997) and the ASM during the period of 1977-2001. The sample for the CM consists of all manufacturing firms located within the U.S. during the year in question with more than a minimal number of employees.[7] The samples for the ASM are based on the data collected from the previous CM and consist of panels of plants with sample rotation occurring every two years after a CM. Plants that are associated with firms that constitute roughly eighty percent of the total value of shipments in the industry are included in each panel with certainty, and plants associated with smaller firms are randomly sampled and given a weight equal to the inverse of their sampling probability.

C. General considerations:

Although the ASM files contain sample weights, estimates of total exports resulting from their use cannot be appropriately compared to estimates from the FT-990 without the consideration of some differences resulting from the design of the two data collection programs. First, the coverage of exports

[7] To be more exact, the 1963 CM sample includes all plants with ten or more employees. In 1967, the selection procedure was revised and the number of employees that a firm must have to be sent a survey form varied across industries. The cutoff values for each industry are usually set with the aim of having at least 90 percent of the total value of shipments based on survey responses rather than imputed data.

in the ASM is limited because many manufacturing plants do not know the ultimate destination of their shipments. Second, the sample weights for continuing plants are not updated during the progression of a panel and they are not based on the consideration of administrative record cases (*i.e.*, small establishments that are not included in the sampling framework for the CM.) Third, estimates based on the ASM do not include the transportation costs or trade margins that are implicitly included in the FT-990 estimates.

Because sample weights are not updated during the progression of a panel and they are not based on on consideration of administrative records cases, published ASM estimates include additive adjustments to correct for sampling error and the exclusion of small plants that are not included in the sampling frame.[8] Although these adjustments have a number of implications for a comparison with published ASM and produced LRD estimates, their importance to the comparisons made in this study is that the suitability of the sample weights deteriorates over the life of the panel and cumulative multi-year errors frequently show up in the LRD figures during the first year of a new ASM panel. In addition, cumulative multi-year changes can sometimes enter the data in CM years.

There are also adjustments that need to be made in comparing ASM and FT-990 export estimates because these two sources provide measures of exports that are valued at different prices. The FT-990 estimates implicitly include sale margins and transportation costs that are not included in the ASM data. However, transportation and wholesale margin ratios can be created from data provided in the BEA Annual Input-Output Accounts and used to convert purchaser-valued exports to

[8] A discussion of the the imputations that are made to formulate published ASM estimates in this paper is limited to that which is important to the interpretation of results presented in the next section. More detailed information regarding these adjustments can be found in Davis, Haltiwagner and Schuh [3].

producer-valued exports for disaggregated sets of manufacturing industries. By multiplying FT-990 industry-level estimates by ratios of producer prices to purchase prices, where the producer price is equal to the purchase price less transportation costs and wholesale and retail trade margins, a series of producer-priced estimates can be generated that can be more appropriately compared to ASM-based estimates.

IV. Results

This section presents the results of the two sets of empirical exercises that are mentioned in the methodology section. It begins by discussing the results associated with the comparison of industry-level export estimates across series and finishes by discussing the regression results.

A. Tabulations:

The comparison of related export estimates supports the notion that the coverage of exports in the FT-990 series indeed decreases over the period of 1994-1997. However, evidence as to the degree of undercounting in the other periods considered in this paper is inconclusive due to limitations associated with the ASM data. In particular, an unexplainable result in 1992 and the panel rotation use by the Census Bureau for the ASM preclude drawing strong conclusions for the earlier periods. In

addition, evidence suggest that comparisons are difficult to make in 1998 due to likely changes in the coverage of exports in the ASM over the period of 1997-1998, along with other mitigating developments.

Table 2 presents evidence that reiterates the point that developments in low-valued transaction industries have the potential of creating undercounting in the FT-990 export estimates over the period of 1994-1998. One notable feature associated with the producer-priced export estimates that are presented is this table is that the value of exports associated with low-valued transaction industries averages about 24.8 percent of the total value of exports in the manufacturing sector over the period. Another notable feature is that the value of exports of the computer accessories, semiconductors, and telecommunications equipment industries are usually more than twice as large as the value of exports associated with each of the other low-valued transaction industries. Thus, it is large changes in the coverage of these specific industries that could have substantial impacts on the quality of the FT-990 export estimates.

Although three detailed industries contribute a large amount to the value of total exports that are reported in the FT-990 estimates, Table 3 demonstrate these industries do not necessarily contribute large amounts to the value of total exports that are reported in the ASM. In particular, Table 3 specifically shows that the relative coverage (*i.e.*, the value of exports as reported in the ASM divided by the total value of exports reported in the FT-990) is much lower on average for many of the specific industries that contribute a large amount to the value of total exports that are reported in the FT-990 estimates.

In order to understand the differences in coverage between the two export series over time, Figure 1 presents the value of indexes created from the data in Table 3. These indexes are calculated as the ratio of exports reported in the ASM to those reported in the FT-990 in a given year divided by the analogous ratio for 1994. Thus, an increase in an index indicates that reported exports in the ASM have increased more than reported exports in the FT-990 over time. The year of 1994 was chosen as the base year for the index because it is the first year of the only full panel of ASM data considered in this paper.[9] Thus, indexes over the period of 1994-1998 are not influenced by different coverage that are a result of the standard 5-year panel rotation associated with the ASM. The indexes are carried back through 1991 to demonstrate why these earlier years of data are not used in the main analysis of this study.

There are two findings that seem to immediately stand out in Figure 1. First, the relative coverage of exports in the ASM is substantially greater for low-valued transaction industries as a whole in the year of 1992 relative to other years. It is not absolutely clear why this jump occurs, but it seems unlikely that it is solely due to a decrease in the coverage of low-valued transactions in the FT-990.[10]

[9] The year that the new ASM panel starts also happens to correspond with the year in which the Internet became available for the conduct of commercial activity.

[10] All ASM data used in this paper passed through the author's own editing algorithm to mitigate the influence that previous editing might have on the study results. Although this procedure seemed to work well for other years, its effectiveness for export data collected for 1992 is questionable.

Second, the relative coverage of exports in the ASM noticeably drops in 1993 to levels below those in the data prior to 1992. It is also not absolutely clear why this drop occurs.[11]

The results from Figure 1 also support the notion that undercounting of exports in the FT-990 series has increased over the period of 1994-1997. This can be seen by the increase in the relative coverage of low-valued transactions over this period. Assuming that the coverage of total exports in the ASM remains relatively constant across time, the data in Figure 1 imply that low-valued transactions not captured in the FT-990 series grow to $30.4 billion over the period of 1994-1997.[12] This figure represents about 6.0 percent of the total value of exports in 1997 as reported in the FT-990 and converted to producer prices. It also falls well within the range of undercounting suggested by the Census Bureau through other studies. The statistics presented in Table 3 for the growth in the relative indexes by industry indicate that the main result for low-valued transaction industries is driven by the computer accessories and semiconductors industries. Although the growth in the index for books and other printed material is also large, Table 2 indicates that this industry does not contribute very much to the total value of manufacturing exports.

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[11] One possible explanation is that the 1993-1996 ASM export data made available to the author for editing did not differentiate missing values from actual zeros. Thus, the data that were not previously edited by the Census Bureau (*i.e.*, 1993-1996) might be influenced a bit by an erroneous over-population of zeros in the final data sets created by the author. Although this have some effect on the levels of export estimates, the results presented in Figure 1 suggest that this is likely a minor issue as there is no noticible jump in the relative coverage of exports between the years of 1996-1997. There is also no evidence that this problem would effect changes in levels between years other than 1992-1993 and 1996-1997.

[12] This statistic is formed as the product of the value of exports reported in the ASM for 1997 times the ratio of the value of exports reported in the FT-990 series in 1994 to the value of the value of exports reported in the ASM in 1994. Thus, it assumes that the amount by which exports are undercounted in the ASM data remains relatively constant over the period of 1994-1997. Evidence supporting this assumption is presented in the next paragraph of the main text.

Further evidence from the LRD corroborates the suggestion that it is the coverage of exports in the FT-990 exports estimates and not the coverage of exports in the ASM that decreases over the period of 1994-1997. Table 4 presents estimates of the percentages of establishment associated with multi-unit firms and ratios of interplant transfers to total value of shipments by industry groups across time.[13] The argument is that if these variable increase over time, then the coverage of exports in the ASM is likely to decrease as plants become less aware of the final destination of their shipments through increasingly complicated organizational structure. These statistics, however, remain relatively stable across time with the notable exception of 1998.[14]

Table 4 also demonstrates one of the reasons that it is difficult to conclude that growth in the electronic filing of export declarations decreases the degree to which exports are undercounted in the FT-990 estimates for 1998. The increase in the percentage of plants associated with multi-unit firms in the ASM suggests that the results relating to the relative coverage of the two export series might be driven at least in part by declining export coverage in the ASM during this year.[15]

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[13] The association of a plant with a multi-unit firm can be defined in one of two ways by using data in the Longitudinal Research Database. First, it can be defined as a plant that is associated with another manufacturing plant. Second, it can be defined as a plant that is associated with another establishment in the Economic Census. This second definition includes the consideration of related wholesale, retail or auxillary establishments. The second definition is used in the table, because it more closely relates to the notion that firms might ship output to related establishment without knowing that their ultimate destination is outside of the United States.

[14] Futher evidence to support the notion that export coverage in the ASM has not changed over time could possibly be provided by looking at wholesale activity associated with each of the low-valued transaction industries. Unfortunately, the author does not have access to these data, at least at the micro level.

[15] It could be the case that the increase in the values that occurs around 1997 and 1998 in Table 4 are related to cumulative changes that are introduced during a census year. If this is indeed the case, then the primary results that export undercounting increased over the period of 1994-1997 are still supported by the data. This is because slowly decreasing coverage in the ASM would work against the finding that its coverage has increased in the ASM than in the FT-990 series during the period of 1994-1997.

There is also another possible explanation for the downturn in the relative coverage indexes in Figure 1: the financial crisis in Asia that began in mid-1997 and lasted through 1988. Although many of the computer-related goods in the low-valued transaction industries are heavily exported to Asia, it is unclear from the available data whether a disproportionate share of these transactions did not required the filing of export declarations. As a result, it is unclear to what degree this event affects the undercounting measures presented in this paper.

A. Regression results:

This section presents the results of regressions that are intended to shed additional light on the differences in coverage of exports between the ASM and FT-990 series. The results indicate that exports have grown slower at the plant level in low-valued transaction industries than in other industries even after controlling for plant size and geographic location. These results, however, are primarily driven by the larger number of plants associated with the apparel and published materials industries which do not contribute much to the total value of exports associated with manufacturing as indicated in Table 2. Additionally, the regression specifications considered for this paper explain very little of the variation in plant-level export growth. These last two findings indicate that regression analysis provides very little insight into the movement of the aggregate export series.

Summary statistics for the data underlying the regression results are presented in Table 5. The measure of export growth that is used as a dependent variable for the regression results presented in this paper is calculated as the difference in exports across two adjoining years divided by their average

value.[16, 17] All other variables used in the regression analysis are dummy variables indicating whether a plan is in a given industry or size classification. It is also worth noting that all industry and size classifications are based on beginning-of-period values, and the data cover the period of 1994-1998.

There are two noteworthy characteristics associated with the data summarized in Table 5. First, the high number of observations reflects the fact that establishments that had zero exports were maintained in the sample used for the regression analysis. This is because the main interest is in understanding the exporting experiences of all manufacturing plants, rather than just the experiences of those with positive exports in at least one of the two adjoining years. Second, a substantially large percentage of plants associated with low-valued transactions are in the apparel and printed material industries. In fact, 15.8 percent of the total number of observations are associated with these two industries, whereas only 18.9 percent of the total number of observations are associated with low-valued transaction industries overall. Thus, one would expect that export growth in these two industries should dominate any results relating to the effect that being in a low-valued transaction industry has on export growth, despite the fact that they do not contribute much to the total value of manufacturing exports reported in the FT-990.

The regression results presented in Table 6 confirms the expectation that the measured effects of being in a low-valued transaction industry on export growth is driven by the experiences of plants in the apparel and published materials industries. In particular, the results indicate that plants associated

[16] If a plant has zero exports in two adjoining periods, then a value of zero was assigned for its export growth rate. This allows for its inclusion in the regression analysis.

[17] The same general regression specifications as those reported in this paper were run with the use of a measure of export growth that was defined as a difference in the natural logarithm of exports across two adjoining years. While the coefficient values generally changed as would be expected, the qualitative results were very similar.

with low-valued transactions experience lower export growth over the period of 1994-1998 relative to other plants in the manufacturing sector. The results also indicate that this is even the case after controlling for plant size. Once one looks at the results that include the detailed industry data, however, one notices that only four industry estimates are significant at even the 10 percent level of significance. As can be seen by comparing columns two and three of the table, the large and positive growth rates for two of these industries, computers and semiconductors, are dominated by the smaller and negative growth rates associated with the apparel and published material industries upon aggregation.

There are a few other notable characteristics associated with the results presented in Table 6. First, the results from both columns two and three indicate that exports grow faster at plants with 20 to 49 employees that plants with a larger number of employees over the period of 1994-1998. This finding lends some support to the notion that a further availability of inexpensive express courier services has allowed many smaller companies to start exporting some of their goods. Second, the adjusted R-squared statistics indicate that almost none of the variation in export growth across plants is explained by the dependent variables. While it was not expected that a high amount of variation could be explained by such a limited set of variables with a limited amount of variation, the results are still a bit surprising.

The results of one particular set of robustness checks are presented in Table 7. The regressions results in these models are based on the same exact specifications as those presented in Table 6 with the exception that fixed effects for geographic location have been added. In particular, these models also included dummy variables (not reported) indicating whether a plant was located within a particular

BEA economic area.[18] The limited impact that geographic location has on explaining export growth across plants is striking. The coefficient estimates and t-statistics across models for the other variables are almost identical to their counterparts in Table 7. In addition, F-tests indicated that the joint significance of these areas was highly insignificant.[19]

V. Conclusions

This paper uses the export data contained in the ASM to determine whether these data provide reasonable insight into the quality of the export estimates provided in the FT-990 series. It does so for the period of 1991-1998 in two separate sets of empirical exercises. First, it compares export estimates created from two separate sources of data for various industries over the entire period. Particular attention is payed to industries where low-valued transactions are likely to be under represented in the FT-990 export estimates. Second, it performs regression analysis to see if plant-level relationships can provide any insight into the behavior of the more aggregate estimates over the period of 1994-1998.

The comparison of aggregate tabulations provide the most insight into the quality of the FT-990 export estimates. In particular, they provide evidence that supports the notion that the coverage of low-valued transactions in the FT-990 export estimates decreases over the time period of 1994-1997.

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[18] Definitions of Bureau of Economic Analysis economic areas can be found in Johnson [4].

[19] In addition to the inclusion of BEA economic areas, regressions were estimated using a variable indicating whether a plant was located in a BEA economic area that bordered Canada or Mexico. The results were qualitatively similar.

However, evidence is also presented that conclusions related to the quality of the FT-990 export estimates in 1991-1993 cannot reasonably be drawn due to ASM panel rotation and an unexplained jump in relative export coverage in 1992. In addition, conclusions related to the FT-990 estimates for 1998 are also difficult to draw. Although there is some evidence that the adoption of the electronic filing of export declarations improves the FT-990 estimates in years following 1996, the degree to which the estimates might be improved are possibly obfuscated by other factors that are likely influencing the quality of the ASM and FT-990 data over time. In particular, a possible decline in the coverage of exports in the 1998 ASM might explain at least some of the results for 1998. It is also unclear what effects the 1997-1998 financial crisis in Asia might have on the relative coverage between the two series.

The regression results provide an example of how understanding plant-level developments might not tell one much about movements in aggregate estimates. One particular result from the regression analysis is that plant-level export growth associated with low-valued transaction industries is actually lower than that associated with other manufacturing industries over the period of 1994-1998. This result, however, is primarily due to the finding that the sample of low-valued transaction industries is dominated by only a few industries that do not greatly contribute to the total value of manufacturing exports.

The results of both sets of empirical exercises demonstrate that the ASM data can be used to provide insight into the quality of the FT-990 export estimates. However, one must be careful to interpret results in the context of the limitations imposed by the underlying data.

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Table 1. – LOW-VALUE TRANSACTION INDUSTRIES

Variable	Descrpition	End-Use Category	SICs
APPAREL	Apparel, household goods – textile	40000	2251-2394
BOOKS	Books, printed materials	40110	2711-2289
COMPUTERS	Computers	21300	3571
COMPUTER ACCESSORIES	Computer accessories	21301	3572; 3575; 3577
MEASURING & TESTING	Measuring, testing, control equipment	21160	3822-5; 3829
SEMICONDUCTORS	Semiconductors	21320	3674
TELECOMMUNICATIONS	Telecommunications equipment	21400	3661; 3663; 3669
TV'S, VCR'S, ETC.	TV's, VCR's, etc.	41200	3651

The end-use category refers to the commodity classification used in the Foreign Trade Division press releases.

The SIC category refers to the primary industry which manufactures the commodities as classified by the Standard Industrial Classification system.

Table 2. – STATISTICS FOR ADJUSTED FEDERAL TRADE EXPORT ESTIMATES, 1994-1998

Industry	Variable	
	Average percent of the total value of exports	Average annual growth rate
Aggregate industries		
LOW-VALUE TRANSACTION	0.248	0.110
OTHER MANUFACTURING	0.751	0.074
TOTAL MANUFACTURING	1.000	0.083
Detailed industries		
APPAREL	0.015	0.109
BOOKS	0.008	0.026
COMPUTERS	0.020	0.014
COMPUTER ACCESSORIES	0.063	0.112
MEASURING & TESTING	0.022	0.124
SEMICONDUCTORS	0.070	0.140
TELECOMMUNICATIONS	0.044	0.124
TV'S, VCR'S, ETC.	0.005	0.156

Estimates are based on author's calculations using data from the U.S. Census Bureau Federal Trade 990 (FT-990) program and trade margin data from the Bureau of Economic Analysis Input-Output Accounts; all statistics are based on exports valued at producer prices.

Table 3. – STATISTICS FOR RELATIVE COVERAGE OF THE ANNUAL SURVEY OF MANUFACTURES AND FEDERAL TRADE EXPORT ESTIMATES, 1994-1998

Industry	Variable	
	Average relative coverage [(a)]	Growth in relative coverage index [(b)]
Aggregate industries		
LOW-VALUE TRANSACTION	0.431	0.100
OTHER MANUFACTURING	0.719	0.016
TOTAL MANUFACTURING	0.647	0.021
Detailed industries		
APPAREL	0.467	- 0.033
BOOKS	0.585	0.319
COMPUTERS	0.714	- 0.047
COMPUTER ACCESSORIES	0.327	0.575
MEASURING & TESTING	0.589	- 0.159
SEMICONDUCTORS	0.357	0.215
TELECOMMUNICATIONS	0.465	0.045
TV'S, VCR'S, ETC.	0.346	- 0.632

Estimates are based on author's calculations using data from the U.S. Census Bureau Federal Trade 990 (FT-990) program, data on trade margins form the Bureau of Economic Analysis Input-Output Accounts, and Annual Survey of Manufacturers data from the Longitudinal Research Data.

(a) Average relative coverage is defined as the annual ASM estimate divided by the annual FT-990 estimate that has been converted to producer prices.

(b) Growth in relative coverage index refers to the difference in the relative coverage index between 1994 and 1998. The index is defined as the average reative coverage in a given year divided by the average relative coverage in 1994.

Table 4. – SUMMARY STATISTICS FOR CHARACTERISTICS ASSOCIATED WITH UNDERCOUNTING IN THE ANNUAL SURVEY OF MANUFACTURERS, 1994-1998

Industry	Year 1994	1995	1996	1997	1998
Precent of multi-establishments					
LOW-VALUE TRANSACTION	0.229	0.221	0.226	0.257	0.315
OTHER MANUFACTURING	0.311	0.313	0.323	0.348	0.402
TOTAL MANUFACTURING	0.292	0.291	0.301	0.328	0.383
Interplant transfers/total value of shipments					
LOW-VALUED TRANSACTION	0.008	0.007	0.007	0.013	0.014
OTHER MANUFACTURING	0.012	0.011	0.013	0.016	0.034
TOTAL MANUFACTURING	0.011	0.010	0.011	0.015	0.030

Estimates are based on author's calculations using data from the Annual Survey of Manufactures portion of the Longitudinal Research Database.

Table 5. – SUMMARY STATISTICS FOR VARIABLES USED IN REGRESSION ANALYSIS

Variable	Mean	Std. Dev.
Dependent Variable		
EXPORT GROWTH	0.027	0.750
Aggregate industries		
LOW-VALUE TRANSACTION	0.189	
OTHER MANUFACTURING	0.911	
Detailed industries		
APPAREL	0.066	
BOOKS	0.092	
COMPUTERS	0.005	
COMPUTER ACCESSORIES	0.004	
MEASURING & TESTING	0.009	
SEMICONDUCTORS	0.004	
TELECOMMUNICATIONS	0.009	
TV'S, VCR'S, ETC.	0.001	
Number of employees		
LESS THAN 20	0.232	
20 TO 49	0.194	
50 TO 99	0.163	
100 TO 249	0.207	
250 TO 499	0.121	
500 OR MORE	0.083	
Observations =	228418	

Based on author's calculations using data from the Annual Survey of Manufactures portion of the Longitudinal Research Database; standard deviations are only provided for continuous variables.

Table 6. – EXPORT GROWTH REGRESSION RESULTS WITHOUT GEOGRAPHIC FIXED EFFECTS

Variable	Eq. (1) Coefficient (t-statistic)	Eq. (2) Coefficient (t-statistic)	Eq. (3) Coeficient (t-statistic)
Aggregate industries			
LOW-VALUE TRANSACTION	- 0.015* (- 3.67)	- 0.014* (-3.53)	–
Detailed industries			
APPAREL	–	–	- 0.022* (- 3.44)
BOOKS	–	–	- 0.017* (- 3.09)
COMPUTERS	–	–	- 0.061* (- 2.70)
COMPUTER ACCESSORIES	–	–	0.00 (0.01)
MEASURING & TESTING	–	–	0.020 (1.18)
SEMICONDUCTORS	–	–	0.088* (3.35)
TELECOMMUNICATIONS	–	–	0.004 (0.24)
TV'S, VCR'S, ETC.			0.072 (1.58)
Number of employees			
20 TO 49	–	0.020* (4.09)	0.019* (3.95)
50 TO 99	–	0.014* (2.76)	0.013* (2.59)
100 TO 249	–	0.005 (0.95)	0.003 (0.73)
250 TO 499	–	0.014* (2.76)	0.013* (2.24)
500 OR MORE	–	0.013* (2.11)	0.011+ (1.67)
CONSTANT	0.030* (17.25)	0.020* (5.96)	0.021* (6.19)
Observations =	228418	228418	228418
Adjusted R^2 =	0.00	0.00	0.00

t-statistics in parenthesis.

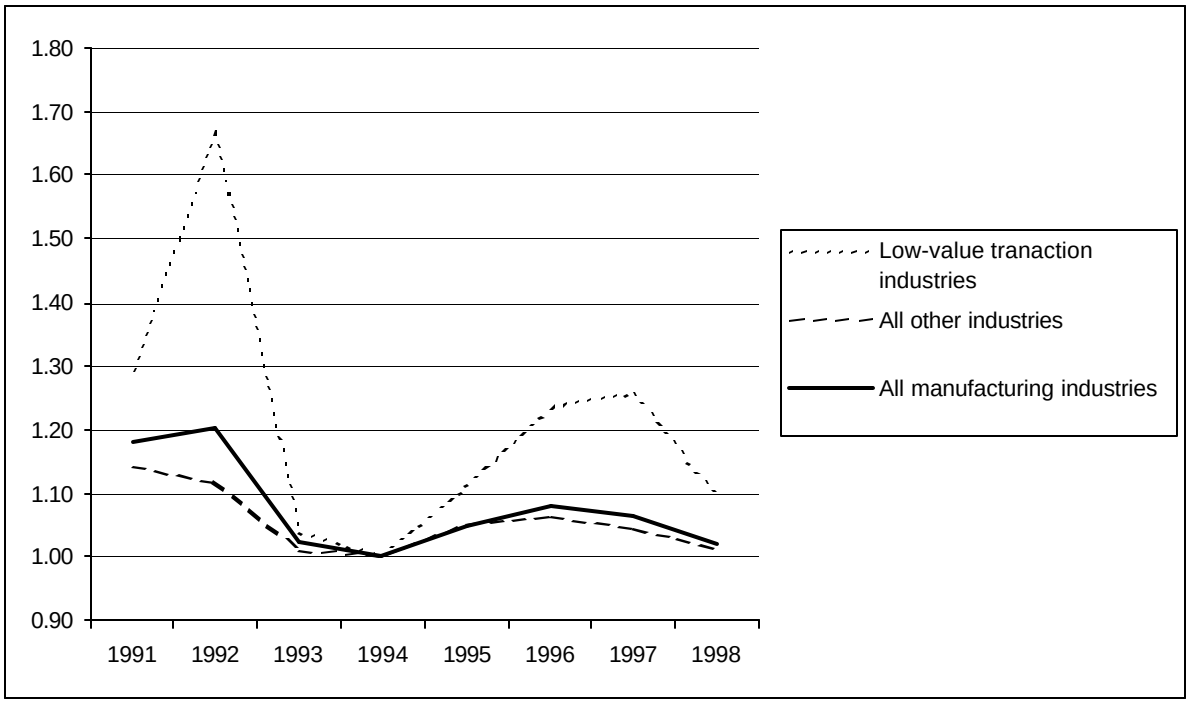
* denotes significant at the 5 percent level and + denotes significant at the 10 percent level.

Table 7. – EXPORT GROWTH REGRESSION RESULTS WITH GEOGRAPHIC FIXED EFFECTS

Variable	Eq. (1) Coefficient (t-statistic)	Eq. (2) Coefficient (t-statistic)	Eq. (3) Coeficient (t-statistic)
Aggregate industries			
LOW-VALUE TRANSACTION	- 0.014* (- 3.38)	- 0.013* (-3.26)	–
Detailed industries			
APPAREL	–	–	- 0.021* (- 3.15)
BOOKS	–	–	- 0.017* (- 2.98)
COMPUTERS	–	–	- 0.060* (- 2.64)
COMPUTER ACCESSORIES	–	–	0.00 (0.02)
MEASURING & TESTING	–	–	0.020 (1.20)
SEMICONDUCTORS	–	–	0.088* (3.33)
TELECOMMUNICATIONS	–	–	0.006 (0.35)
TV'S, VCR'S, ETC.			0.072 (1.57)
Number of employees			
20 TO 49	–	0.019* (3.87)	0.018* (3.73)
50 TO 99	–	0.013* (2.47)	0.012* (2.30)
100 TO 249	–	0.003 (0.61)	0.002 (0.36)
250 TO 499	–	0.012* (2.09)	0.010+ (1.82)
500 OR MORE	–	0.011+ (1.76)	0.008 (1.29)
CONSTANT	0.030* (17.08)	0.021* (6.22)	0.021* (6.19)
Observations =	228418	228418	228418
Adjusted R^2 =	0.000	0.000	0.000
F-statistic =	0.688	0.676	0.672

t-statistics in parenthesis.
* denotes significant at the 5 percent level and + denotes significant at the 10 percent level.
Estimated equations also include fixed effects for Bureau of Economic Analysis economic areas.

Figure 1. – INDEXED DIFFERENCES BETWEEN ANNUAL SURVEY OF MANUFACTURES AND FEDERAL TRADE EXPORT ESTIMATES BY INDUSTRY, 1991-1998



Estimates are based on author's calculations using data from the U.S. Census Bureau Federal Trade 990 program, data on trade margins form the Bureau of Economic Analysis Input-Output Accounts, and Annual Survey of Manufacturers data from the Longitudinal Research Data.