The Switch from SIC to NAICS in a Partially-Closed Model of the U.S. Benchmark Accounts: The Implications for Agriculture.

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Introduction

"The Instituto Nacional de Estadistica, Geografia e Informatica (NEGI) of Mexico, Statistics Canada, and the United States Office of Management and Budget through its Economic Classification Policy Committee, have jointly developed a system of classification of economic activities that will make the industrial statistics produced in the three countries comparable. The new North American Industrial Classification System (NAICS)….It was developed to provide a consistent framework for the collection, analysis and dissemination of industrial statistic used by government policy analysts, by academics and researchers, by the business community, and by the public." The quotation is from the forward to the NAICS manual published by the Executive Office of the President, Office of Management and Budget.

This paper compares the 1992 and 1997 U.S. benchmark input-output accounts. Both models examined here maintain the full blown, highly dissaggregated structure of approximately 500 individual sectors/industries in the published open model tables of both years. Both model years have been partially-closed using actual, and in many circumstances, unpublished, National Income and Products Accounts (NIPA) data. Particular attention is paid to the changes that have occurred because of the recent U.S. government-wide switch from Standard Industrial Classification (SIC) of industries and economic activities to a new system that is more consistent with the United Nations and worldwide systems of accounting. The 1997 Benchmark accounts are the first U.S. tables to be released under the new, North American Industrial Classification System (NAICS) system.

Agriculture as a sector has lost detail in the move from SIC to NAICS. There were 17 agricultural sectors in the 1992 SIC-based tables. There are 13 in the 1997 NAICS-based tables, the most recent. Some commodities such as peanuts have moved from one sector in 1992 to another in 1997. Some sectors such as dairy have disappeared as an independent sector and /or been included in another in 1997.

What are the implications? What does this mean in terms of output, income, employment, and multiplier impacts?

After describing the methodology used to partially close the I-O accounts in both years, I use a multiplier and household income analysis to determine who gained and who lost in U.S. agriculture's move from SIC to NAICS in the extended Benchmark U.S. Input-Output Accounts.

Background

The 1997 U. S. benchmark input-output accounts have changed dramatically from the older tables they have replaced. According to the Department of Commerce's Survey of Current Business (SOCB),"The 1997…NAICS-based classifications are more in line with the principle underlying the I-O classifications: Industries are classified in the I-O accounts so that each industry has a unique production function. As a result of the incorporation of NAICS, the 1997 benchmark accounts provide a more detailed presentation of the increasingly important service industries." *[McCulla, Stephanie H.*, and *Moylan, Carol E.*, January 2003, SOCB]

The actual number of industries detailed in the benchmark accounts changed little from 1992 to 1997, 493 in 1992, 490 in 1997. But there is a big difference in the coverage of goods producing versus service providing industries. There were 407 goods producing industries and 86 service providing industries included in the 1992 US benchmark tables. In 1997 those industries were 389 goods producing and 101 service providing, respectively. Reclassification of industries from SIC to NAICS yielded more information about service providing industries, leading to larger numbers of service industries and the shift of some industries from good producing to service providing. As an example printing and publishing has moved from goods producing to service providing due to the changing nature of that industry, i.e. internet publishing, and because the new NAICS information sector of industries is considered a service

sector. Goods producing industries consist of agriculture, forestry, fishing and hunting, mining, construction, and manufacturing. All of the rest of the I-O detail belongs to service industries except public administration and government.

Agricultural production industries have lost some of the detail they had in 1992 and some commodities shifted sectors in the move to NAICS. Dairy was the first input-output sector in 1992 and is now part of the cattle ranching industry. Peanuts moved from the oilseeds sector to the all other crops category in the 1997 benchmark accounts.

Income Derivation

The U.S. Personal Income for 1992 and 1997 was $5,255.7 and $6,915.0 billion respectively. The first step toward building a partially-closed system out of the benchmark accounts is to carve a household-only income row consistent with these published NIPA estimates out of the value added rows of the open I-O accounts. There are three published value-added rows in the open benchmark I/O accounts. The first of these rows, compensation of employees, is included in its entirety in the new household income row. Added to this row are net interest, business transfer payments, farm and real estate rental income, corporate dividends, and nonfarm proprietors income. These accounts, except for some aggregate national totals published in the Survey of Current Business, are derived from unpublished sources at the United States Department of Commerce (USDC), Bureau of Economic Analysis (BEA), NIPA. Few of these accounts are detailed enough to bridge directly to 490 industrial sectors and six others of household, government, scrap, and residual in the base 1997 I/O. But most are published in the standard SIC 2 digit detail for 1992 and 1997. In a curious wrinkle, the detailed and unpublished NIPA income tables for 1997 are not reclassified into the NAICS based categories as have been almost all other NIPA data but remain on a SIC base. This made calculations of the amount of net interest or other unpublished incomes earned

by households in the service sectors where many changes due to NAICS took place less exact than they could have been had those unpublished accounts been revised. The new household income/value-added row consists of employee compensation, net interest, business transfer payments, farmers' profit type income, households' rental income, corporate dividends and nonfarm proprietors' income. Net interest and nonfarm proprietors income to households from industries more detailed than the unpublished tables was apportioned to the sectors by the value of the benchmark Property Type income row (I-O code v00300 in 1997, 90000 in 1992). This value-added row information itself is unavailable in printed hard copy but is published in machine readable form. Total business transfers were apportioned to the I/O sectors by the result of the procedure to distribute net interest. Farm profit –type income was calculated from the United States Department of Agriculture, Economic Research Service (USDA, ERS) farm income accounts. All of rental income was considered to be derived from the management and consulting sector and corporate dividends that could not be bridged directly to individual sectors were distributed by industrial output shares.

Because this personal income data are the NIPA accounts that add to published total domestic personal income for 1992 and 1997, the model "control totals", integrating this data into a new household income row was made less difficult then when using data from outside sources such as the IRS or NY Stock Exchange that has been used by other modelers [*Rose, Adam* et. al. 1999]. These values are then subtracted from the value-added I/O rows of Indirect Business Taxes and Property Type Income. The residual value-added makes up the new exogenous, 'other value added" row. Once this data is collected it must be made to "balance," for one dollars worth of final demand is worth one dollar of value added. Personal Consumption Expenditures (PCE) for Domestic Help and Interest Paid By Consumers becomes the diagonal element of the endogenized household sector income row and consumption column. In essence it is what domestic households pay themselves. The PCE column from the published accounts

from both years becomes their respective household consumption endogenous column, i.e. consumption function. All other final demands are exogenous to the accounting system.

PCE categories in the U.S. tables are estimated by two methods. The direct method, i.e., gasoline and oil purchases by persons are based on unit sales and average prices or the commodity flow method. This method includes identifying commodities purchased by persons or businesses for investment, estimating the total output of such commodities, adding imports and trade margins which in effect converts the unit value of this supply into purchasers prices, excising the exports included in the output, adjusting for inventory change, and finally, deleting any government purchases of commodities.

PCE estimates are also a component of the National Income and Product Accounts (NIPA), which are the official measure of the nations' Gross Domestic Product. PCE estimates of aggregate expenditures represent the market value of such goods and services sold to all U.S. consumers. The BEA conducts comprehensive revisions to the NIPA at approximately 5-year intervals to incorporate changes from the U.S. Census and the Benchmark Input-Output Accounts.

Methodology and Data

In order to accurately and completely measure the impact of changes in policies which affect consumer spending differently across household groups, such as a boost in the level of exports from the agricultural sector and to measure that change on the general economy or the incomes of specific households, one must employ new and complex tools. To successfully measure these activities one must first build a model that has that capability.

From the 1992 and 1997 benchmark Input-Output accounts a "partially closed" I/O model is constructed. Endogenizing both household income rows and personal consumption expenditure (PCE) columns makes household incomes and expenditures part of the transactions or technology matrix which defines the intermediate cost structure of the U.S. domestic economy. The final demands columns of the base year Input- Output Accounts contain the PCE values by industrial sector. All other final demand (OFD), final demand minus PCE, in the I/O accounts are summed and become a new exogenous Other Final Demand column.

A Partially-Closed I/O model

The method used here is a Miyazawa framework I/O analysis, similar to the methodology used to determine the multiplier impacts of agricultural exports [*Schluter* and *Edmondson,* 1994 and *Schluter and Edmondson,* 1989]. The 1992 and 1997 U.S. I/O tables [USDC/BEA, 1998, 2002] provide an economy-wide setting in which to analyze the levels of sectoral output, income, and employment due to a given level or change of economic activity. Specifically, I will examine the changes in employment, output, and income associated with the switch from an SIC based model (1992) to a NAICS based system (1997). First, the Miyazawa process of income formation for the base year (1992, 1997) is derived as:

{1}

$$M = \begin{bmatrix} A & C \\ V & 0 \end{bmatrix}$$

where, A = matrix of technical production coefficients (n x n).
V = matrix of household income payment coefficients by sector (1 x n)
C = represents the coefficients of household consumption (n x 1)
M = 497 square block matrix of 496 intermediate industry sectors and one household
n = 496

r = 1

In 1997, M = 496 square block matrix of 495 intermediate industry sectors and one household
n = 495
r = 1

Alternatively, the Miyazawa model can be expressed mathematically as follows:

$$X = AX + CVX + F$$

where, X = an n' x 1 vector of sector outputs
A = matrix of technical production coefficients (n' x n').
C = represents the coefficients of household consumption (n' x 1)
V = matrix of household income payment coefficients by sector (1 x n')
F = an n' x 1 vector of final demand minus personal consumption
n' = 497 in 1992, 496 in 1997

A 1 x n' household-only value added row becomes matrix C which when joined to A~V creates matrix M, increasing the size of the original A matrix from either 496 in 1992 or 495 in 1997, sectors to an M square matrix of either 497 or 496 sectors. Any final income or expenditures not earned or spent by households becomes exogeneous to the model. Both are 1 by n' vectors of other value-added (ova) and other final demand (ofd).

Sectoral output associated with the remaining final demands for the base year is derived as:

{2} $X = M * f$

where,

X = an n' x 1 vector of sector outputs

f = an n' x 1 vector of final demands less PCE.

n' = 497 in 1992, 496 in 1997

Under an I/O structure, value added is a fixed proportion of output, so that income can be written in a matrix form as:

{3} Income = v*X = v*M*f

where,

v = an n' x n' diagonal matrix of "other" value added, the value added not included in the endogenized household rows, per dollar of sector output coefficients.

Using the above notation, employment in each sector can be derived as:

{4} E = l*M*f

Where, l = an n' x n' diagonal matrix of civilian employment coefficients per dollar of sector output.

E = an n' x 1 vector of sector employment needs, $e_{j',s}$ for meeting the total output required to satisfy activities related to final demands other than PCE.

Exogenous sectoral price deflators are applied to make the "constant dollar" measures of other final demands other than the base years (1992, 1997). A sectoral labor productivity index is also applied to adjust for productivity increases from the base years.

The Multiplier Analysis

Because the commodity and sectoral composition of many of the benchmark I/O categories underwent radical change in the switch from SIC to NAICS it is difficult for the researcher to, when making comparisons, not try to compare apples with oranges. Because ERS is both a supplier and consumer of the input-output data published by BEA it is in a unique position to evaluate and ascertain when and where farm data is used, thereby limiting the possibility of such erroneous comparisons. The agriculture sectors were defined as the first seventeen I/O sectors in 1992, sectors 010100 through 020702. Starting with the dairy sector and ending with the greenhouse/nursery industry. Most of the 1997 agricultural industries in the benchmark accounts were redefined in both size and scope. The first thirteen

Table 1.

Producer, Household, Output, and Employment Multipliers of Common Agricultural Sectors, 1992 and 1997

Sectors	Vegetables	Tree Nuts	Fruit	Greenhouse	Tobacco	Cotton	Sugar	Poultry
1992	**020501**	**020402**	**020401**	**020702**	**020300**	**020100**	**020502**	**010200**
Producer income	5.207	5.861	5.800	4.732	4.045	4.997	4.771	6.481
Household income	2.362	2.796	2.583	2.366	1.383	2.069	2.201	2.376
Total Output	7.569	8.657	8.383	7.099	5.428	7.066	6.972	8.857
Jobs Per $Billion	118761	135836	131539	111383	85168	110868	109398	138977
1997	**111200**	**111335**	**1113A0**	**111400**	**111910**	**111920**	**1119A0**	**112300**
Producer income	4.766	6.900	4.206	4.438	4.106	4.829	4.100	5.701
Household income	2.021	3.423	1.487	2.013	1.519	1.713	1.232	1.983
Total Output	6.787	10.323	5.693	6.451	5.626	6.542	5.332	7.684
Jobs Per $Billion	65458	156909	80248	103667	87862	58679	104496	103997

Table 2.

Producer, Household, Output, and Employment Multipliers of Dissimilar Agricultural Sectors, 1992 and 1997

Sectors	Feed Grains	Food Grains	Grasseed	Forest	Miscellaneous crops	Oil bearing crops	Dairy	Meat animals	Misc. livestock
1992	**020201**	**020202**	**020203**	**20701**	**020503**	**020600**	**10100**	**10301**	**10302**
Producer income	4.018	4.438	5.573	0.000	6.091	3.756	5.738	5.358	5.609
Household income	1.478	1.685	2.650	0.000	2.761	1.287	2.083	1.714	2.097
Total Output	5.497	6.123	8.224	0.000	8.853	5.043	7.821	7.072	7.706
Jobs Per $Billion	96079	86246	129036	0	138907	79125	122716	110971	120910

Sectors	All Grains	All Other Crops	OilSeeds	Cattle Ranching	All Other Livestock
1997	**111335**	**1119B0**	**1111A0**	**112100**	**112A00**
Producer income	4.786	4.222	4.383	5.273	4.667
Household income	1.758	1.434	1.600	1.461	1.090
Total Output	6.544	5.655	5.983	6.733	5.757
Jobs Per $Billion	58019	50943	59109	93539	79489

NAICS based industries, sectors 1111A0 through 112A00, comprise the agricultural sectors in 1997, four less than in 1992. Eight industries remained basically unchanged. Those were vegetables, tree nuts, fruits, greenhouse/nursery, tobacco, cotton, sugar, and poultry [Table 1.]. The 1992 industries which underwent the most change in the switch from SIC to NAICS included food grains and feed grains which were combined into one "grains " sector in 1997. Grass seed and Miscellaneous Crop Production in 1992 were combined with the peanut producing industries to form the 1997 All Other Crops sector of the benchmark accounts. The Oil bearing crops sector in 1992 lost the output of the peanuts producing sector in 1997, and forest products moved form the crops producing category to a new forest and logging sector in 1997. Dairy farm production in 1992 has been folded in to 1997's cattle ranching sector and has disappeared as a separate industry in 1997. Meat animal production which in 1992 included cattle, sheep and hogs has been redefined so that dairy and cattle make up the new cattle ranching sector. Sheep, hogs, goats, fur-bearing animal production, aquaculture, and apiculture are the major industries within the all other livestock production category in 1997 [Table 2.].

Employment Multipliers

When examining the employment multipliers or jobs per billion of output in table 1, most of the job levels in the common agricultural sectors remained fairly constant, the exceptions being vegetables, fruit and cotton. Tree nuts and tobacco saw increases in their employment multipliers. This was unusual in that, because of labor productivity gains in the five years between benchmark tables, an expected decrease in employment requirements per output, as is the case in most sectors on Tables 1 and 2, is the normal result. The absolute levels of employment used to determine the employment coefficients of 'l' in equation {3} saw a slight increase in employment in the vegetable sector and a more than double increase

in the cotton sector. The overall base of farm jobs increased from 2.2 million in 1992 to 2.8 million in 1997. This increase is due not to an actual increase in the number of farm jobs, on the contrary, farm sector jobs are declining, but with a switch to a NAICS based classification of jobs and the addition of new information on hired labor, the self-employed and farm proprietors, the number of farm workers in the base data pool has increased. In 1992 the Bureau of Labor Statistics (BLS) provided data on the number of full-time agricultural workers in the SIC based I/O 01 and 02 sectors. The data came from BLS' Office of Employment Projection and was used in the Department of Labor input-output studies. In 1997, agricultural employment for this project is a combination NAICS based data from the BLS Office of Employment Projections, Covered Employment and Wage (CEW) data also from BLS and USDA-ERS' Agriculture Resource Management Survey (ARMS). While none of these data is a good source for agricultural employment alone together they form a more comprehensive data set than was available in 1992. The Bureau of Labor Statistics, Monthly Labor Review, publishes an employed agricultural civilian workforce of 3.4 million in 1997 which includes part-time and seasonal workers.

The employment multipliers in Table 2 are not very comparable between the benchmark years because the sectors are so dissimilar. Meat animal employment in 1992 cannot be compared to the cattle ranching employment because of the changes into the input structure of the sector due to the removal of sheep and hog production and the addition of dairy. With this change in structure came a change in the employment requirements. If you take a simple average of employment generated per billion of output in the meat production sectors less poultry in 1992, the employment multiplier equals 118,119. The number of jobs per billion of output in 1997 in the meat production sectors less poultry equals 86,514.

Output Multipliers

The output or interrelational multipliers listed in Tables 1 and 2 are the sums of columns of the

newly created partially-closed Miyazawa matrix. The producer income multipliers are the column sums less the endogenized household income row. The act of endogenizing and inverting the households into the Miyazawa matrix makes households part of the producing sectors but the idea is to separate household income effects to enable relative measurement of the additional sector output due to household income and spending. The producer income multipliers are not strictly comparable to an open model total requirements column summation because they already contain the iterative effects of the additional endogenized household income. Comparing the size of the producer multipliers in 1992 and 1997 on Table 1, shows that the inputs, without the household sector, stayed the same relative to total output in all sectors except tree nuts and fruit. The effect of household income in 1997 in the common agricultural sectors of Table 1, as measured by the size of their multipliers, compared with 1992, is lower in every sector except tree nuts. This also is the case in most of the nonconformable categories of table 2 except in grains and oil seed production. Most total output multipliers are smaller in 1997 in both table 1 and 2, except for the large increase in the tree nut sector, when compared to 1992.

The 1992 SIC-based forest products sector shows no output or employment multipliers on table 2 because BEA transferred all intermediate input and thus its production function into the agricultural services sector through redefinition.

An Experiment with Exports

Exports are currently an engine of growth in an otherwise sluggish agricultural economy. Most other sources of demand for agricultural products have remained steady or declined in recent years. A number of factors contribute to these trends. Population growth in the U.S., the main source of additional demand for purchased foods, rises slowly. As peoples' incomes increase, the share of income spent on food declines relative to other less basic consumption. The agricultural sectors are possibly the U.S.'

most efficient and productive. Labor productivity in the farm sector generally is higher than the rest of U.S. industry and agricultural output as measured by the multipliers listed in tables 1 and 2 are on average higher than most other sectoral multipliers. U.S. farm exports to world-wide consumers not only help feed recipients; they also have an impact on industry production through direct and indirect effects, and domestic households through induced effects. These effects are measured in this experiment with the Miyazawa Input-Output (IO) model, where households are endogenized and disaggregated to industry sectors. This IO analysis will use the same final demand vector of U.S. agricultural exports for calendar year 2002 in both the 1992 and 1997 benchmark models to determine the level of trade impacts in terms of jobs, income and output associated with each.

Because the experiment is designed to show the differences in the outputs and impacts measured by the respective models and not as a scholarly accounting of the actual effects upon the domestic economy of trade, the offsetting effects of imports will not be included. As a practical matter, because these are benchmark U.S. models, imports could only be measured by them as if the production of the imported commodities took place in the U.S., subject to the same model constraints as the export commodity basket.

Endogenizing the respective 1992 and 1997 PCE column and household value-added row into the interindustry transactions matrix of each, then shocking the models with the level of exports, yields estimates of direct plus indirect plus induced total output or business activity. Applying a set of employment coefficients per dollar of output, adjusted by a matrix of labor productivity from either 1992 or 1997 to the export year 2002 yields the employment required by this induced level of output. Export levels are deflated to base year values and the resultant output is derived as in equation {2}. That output is then multiplied by a matrix of other value-added (value-added minus household incomes) shares to yield the income (less employee compensation, net interest, corporate dividends and others that have been

endogenized) generated by exports. The income is then re-inflated from either 1992 or 1997 to current (2002) nominal values.

Figure 1, gives a pictorial representation of the standard Miyazawa partially- closed I/O table. This experiment will use only the agricultural exports, as defined by USDA-ERS, portion of the exports column of other final demand as the exogeneous vector which drives these models. Most of the exports in this commodity basket are bridged directly to the crop, livestock and food processing sectors but some pharmaceuticals and organic chemicals are also considered agricultural.

Impacts of agricultural exports in the farm sector

Probably the most important caveat about an experiment such as this and what a reader must know is that in using the partially closed model to analyze exports such as these it is not appropriate to employ such a model unless one is confidant in describing the export activity as new and sustainable. The implied income generated in the households will not take place immediately in the time frame (calendar year) of the exports. Only after much iteration of spending and respending new earned income from exports by households will all of the levels of output, income and employment, i.e. the multiplier effects take place. A second important qualifier of partially closed I/O results involves the assumption, especially in non-base years of analysis, that the households continue to consume at the rates they have in base years no matter the change in levels of production and associated incomes..

This experiment is designed to show the reader the relative effects using the same level of exports in two different partially closed models, one SIC-based and the other NAICS-based. I was unable at this time to consult with a trade analyst or authority who could help me determine how much of the 2002

agricultural trade basket was new and sustainable. I assume that very little of it was since the value of agricultural trade actually declined slightly between 2001 and 2002 (53.7 billion to 53.1 billion).

In a static I/O system, such as the ones being used here, it is the linkages that exist in the base year that are captured. Attempts to move forward from the base year brings those same base relationships in the model forth in the results. Tables 3 and 4 illustrate the situation along the income rows. The income earned by these agricultural sectors reflects not that earned by household, but other incomes, mainly indirect business taxes and property type incomes. The many negative 'other" incomes in 1992 versus only the one in the tree nut sector in 1997, reflects the separate dispositions of incomes in 1992 and 1997. The pieces of the value-added accounts, net interest, corporate dividends and others vary widely in different years.

One would expect output in the common agricultural sectors of Table 3 that remained the same between 1992 and 1997 to be very close and except for the tree nut sector this is the case. The output due to exports in the tree nut sector has fallen because the bridge that BEA supplies to classify commodities by I/O sector has reclassified 1,085.8 million of 2002 port value SIC based tree nut exports in the 1992 benchmark to only 268.5 million NAICS-based port value exports in 1997. Most of the tree nuts exported in 2002 which would have been considered an agricultural product in an SIC classification system are now, under NAICS, considered to be a product of the food processing industries. Direct exports from the tree nut sector have dropped because of reclassification of its products through NAICS to the food processing sectors. Concurrently the output and employment associated with exports from the tree nut sector has also fallen. The drop in the level of output generated by 2002 agricultural exports is associated with the drop in the level of direct exports from the farm sectors. But referring to Table 1, one can see that some of the employment and business multipliers in the NAICS-based table actually

Table 3.

Impacts of 2002 Agricultural Exports in Common Agricultural Sectors, 1992 and 1997 Base Years

Sectors	Vegetables	Tree Nuts	Fruit	Greenhouse	Tobacco	Cotton	Sugar	Poultry
1992	**020501**	**020402**	**020401**	**020702**	**020300**	**020100**	**020502**	**010200**
					Thousands			
Direct Export Value	1,001,708	1,085,838	1,529,256	508,536	147,295	1,445,819	20,985	124,845
Output	1,485,622	1,183,103	1,894,454	840,273	469,895	3,302,583	186,143	1,303,423
Income	33,820	-203,032	-225,667	31,938	174,124	177,385	15,851	-169,654
					Jobs			
Employment	10,154	13,602	28,063	6,543	20,582	9,338	1,651	15,194
1997	**111200**	**111335**	**1113A0**	**111400**	**111910**	**111920**	**1119A0**	**112300**
					Thousands			
Direct Export Value	1,038,424	268,530	1,542,137	457,082	136,961	1,705,299	3,153	212,112
Output	1,266,667	546,270	2,311,690	905,230	412,286	3,849,463	173,943	1,525,708
Income	124,654	-256,303	568,653	98,242	117,751	260,034	54,741	8,186
					Jobs			
Employment	10,751	7,307	28,678	12,802	5,667	30,385	3,000	18,172

Table 4.

Impacts of 2002 Agricultural Exports in Dissimilar Agricultural Sectors, 1992 and 1997 Base Years

Sectors **1992**	Feed Grains **020201**	Food Grains **020202**	Grasseed **020203**	Forest **20701**	Miscellaneous crops **020503**	Oil bearing crops **020600**	Dairy **10100**	Meat animals **10301**	Misc. livestock **10302**
					Thousands				
Direct Export Value	2,458,439	4,906,189	184,731	0	67,537	4,973,046	0	243,668	291,405
Output	3,554,208	7,887,951	216,866	115,081	143,698	8,109,538	737,110	6,984,309	445,585
Income	1,135,339	2,144,203	-29,873	6,608	-28,187	2,936,162	-33,748	668,088	-6,958
					Jobs				
Employment	45,668	51,546	880	286	1,953	59,173	10,416	54,900	11,449

Sectors **1997**	All Grains **1111B0**	All Other Crops **1119B0**	OilSeeds **1111A0**	Cattle Ranching **112100**	All Other Livestock **112A00**
		Thousands			
Direct Export Value	6,731,952	835,694	5,267,596	180,976	701,320
Output	11,857,290	3,070,615	11,444,087	5,572,494	2,881,610
Income	1,349,065	754,562	1,659,432	584,102	742,061
		Jobs			
Employment	92,519	24,342	99,494	68,127	35,017

increased in 1997. The BEA concordance between the U.S. Bureau of Census harmonized trade codes of export commodities and the 1992 SIC based I/O sectors and the concordance for those same Census codes and the 1997 NAICS based I/O sectors is reflected in the differences in the value of direct exports in Table 3. Sugar and poultry export values have also been greatly impacted by the switch to NAICS.

Exports from the government and scrap category were nonexistent in the 1992, but a small value in the 1997 bridge. Some commodities, mostly donated or in-kind foodstuffs, were switched from the food processing sector in 1992 SIC exports to the government sectors in 1997 NAICS. Hence the supporting activity and employment in table 5 in the government and scrap category.

The values of the exports on tables 3 and 4 are not these same as those reported in the U.S. Census trade statistics because in order to examine the impacts of agricultural trade exclusively, one must first strip the port value exports of their trade (wholesale and retail) and transportation margins. Transportation and trade values of 2002 exports are moved to the appropriate transportation and trade sectors in the final demand vectors of each model. Equation {2} is modified, where f = a final demand vector of 2002 agricultural exports, with trade and transportation values subtracted from the commodity sectors and added to the appropriate trade or transportation sector.

The value of exports in the 1997 NAICS ”all other crops” category and the combination of the three 1992 SIC I/O categories, grass seeds, forest and miscellaneous crops it replaced was dramatically changed. These categories because of redefinition are not strictly comparable. Much of the added output of this all other crop sector over the combination of the three 1992 SIC sectors comes from the addition of peanut production and trade to the sector in the NAICS based system. Forest products have been eliminated from agriculture in 1997. But deletion of the peanuts from the Oilseeds sector in 1997 appears not to have significant impacts when compared with the 1992 oil bearing crop sector results.

Economy-wide impacts

When using this type of multiplier analysis to measure "real world" results and not for comparison purposes as is done here, all activity due to the level of exports should come from newly employed resources. If they were not then a correct accounting of additional household income and other effects would be a net of the new level of activity minus the old. Table 5. describes the economy-wide impacts 2002 agricultural trade in all sectors as if all of the trade were from new resources.

Agricultural exports generate employment, income, and purchasing power in both the farm and nonfarm sectors. Of the $53.1 billion of agricultural products exported in 2002, the farm value was $19 billion; processed commodities, $24.8 billion; and transportation, trade and services, $9.1 billion. Households gained $112.2 billion in wages, salaries, and other new incomes in the NAICS scenario and $109.8 in the 1992 SIC experiment. Thirty one percent of all induced economic activity was returned to households as added income in the 1997 bench mark. Thirty two percent was returned to households as added income in the 1992 benchmark.

Each dollar received from farm-based exports in 2002 stimulated another $6.88 (the $53.1 billion of exports stimulated an additional $365.3 billion) in supporting activities to produce and sustain those exports under the NAICS scenario. Using the 1992 benchmark, 53.1 billion of exports generate 341.4 of additional activity a slightly smaller output multiplier of 6.45. Exports generated an estimated 2,040,000 full-time civilian jobs, 1,604,000 jobs in the nonfarm sector, under NAICS. Employment in the farm sector due to the shift to NAICS was 100 jobs smaller when estimating using the SIC based model. The

Table 5

U.S. economic activity generated by agricultural exports as measured by the partially closed 1997 NAICS and 1992 SIC benchmark I/O model.

Item	2002 Exports	
	1997 NAICS Impacts	1992 SIC Impacts
	Billion dollars	
Economic activity generated by agricultural exports	418.4	394.5
Exports	53.1	53.1
Supporting activities	365.3	341.4
Farm	18.0	16.7
Food processing	11.5	13.2
Other manufacturing	50.4	46.1
Trade and transportation	41.8	34.1
Other services	128.6	121.5
Government and scrap	2.8	0
Households	112.2	109.8
	Percent	
Farm share of total income from exports	10	11
Nonfarm share	90	89
Export multiplier (additional business activity generated by $1 of exports)	6.88	6.45
	1,000 jobs	
Employment generated by exports	2,040	1,887
Farm	436	341
Nonfarm	1604	1546
Food processing	85	84
Other manufacturing	172	184
Trade and transportation	392	409
Other services	925	852
Government and scrap	15	0
Households	15	16
Employment per billion dollars of exports	38	36
	Percent	
Share of farm workforce supported by exports	13	10

farm sector bore the brunt of the difference in overall job estimates associated with the separate models. The NAICS-based model estimates an economy–wide increase in employment of 153 thousand jobs over the SIC-based model, 95,000 of which are in the farm sector. Although food processors' purchase raw agricultural products, fuel, containers, and other inputs to produce commodities for export there is very little evidence of change in the food processing sector in Table 5. Service sector output differed little but there were 73,000 more jobs generated in the services sector under NAICS than under the SIC benchmark. According to BEA, ”nearly $200 billion of value –added was shifted from the good-producing sectors to the services producing sectors” in the switch to NAICS. Fifteen new service sectors have been added to the NAICS-based benchmark accounts that did not exist in 1992.

Summary of the partially closed model analysis

Total economy wide output generated by a control vector of final demand, 2002 calendar year agricultural exports, varies less than 8 percent between the 1992 SIC based model and the 1997 NAICS based benchmark. Even though agriculture lost detail and 4 sectors in this experiment farm employment actually increased by 95,000 jobs under the NAICS model. Some of that increase may be due to the new NAICS based employment vector used to construct the employment per output coefficients. This base vector of employment, as discussed earlier, was approximately 400,000 jobs larger in 1997 in the farm sector than in 1992. The aggregated output multiplier for 2002 export trade was practically the same, 6.88 in 1997, 6.45 in 1992.

Tables 1 and 2, which describe the results of the Miyazawa matrix formation of both benchmark years, shows little significant change in the common agricultural sectors with the exception of tree nuts and cotton. Most of the big changes in output and employment multiplier size occur in those new and reorganized sectors which cannot be effectively compared because their contents have changed.

The most divergent results would be the “other income’ generated in the agricultural sectors between 1992 and 1997(Tables 3 and 4). A look at the personal income tables of the U.S. NIPA accounts will quickly show the sources of this year to year volatility. The changes in classification of individual commodities in the export basket of goods had a great influence on the amount of value-added generated and number of jobs created in the individual agricultural sectors. Agriculture in this experiment with exports, generates very nearly the same level of economy-wide output in the NAICS as in the SIC based model. Table 5 shows that supporting activity (output minus the value of direct exports) is slightly higher in the farm, manufacturing, trade and services sectors but lower in the food processing sector. Employment shows a bigger gap. In an attempt to keep the models consistent, I experimented with some other base levels of agricultural employment. That is, the levels of employment used to determine the employment per output coefficients. Through informal talks with labor specialists at the Bureau of Labor Statistics, I was able to procure an unpublished estimate of agricultural employment projected backwards to 1997 that would correspond to the official U.S. NAICS estimates of employment which surprisingly start in 1998. This methodology estimates total agricultural employment of 2,131,000 in 1997. At the same time an estimate using the SIC classifications projected forward from 1992 to 1997 resulted in a total of 2,190,000 full time equivalent jobs in the farm sector. I then reclassified this SIC based estimate into NAICS sectors. These compare to the ERS estimated 1997 employment base of 2,897,100 distributed to the 13 NAICS agriculture sectors and used to determine the employment per output requirements that were used in this experiment.

I then tabulated the results of experiments using the two new employment coefficient vectors created by the unpublished data sets described above. All nonfarm employment, output, and value-added information stayed the same. The results are described in table 5a. below.

Table 5A

U.S. economic activity generated by agricultural exports as measured by the partially closed 1997 NAICS and 1992 SIC benchmark I/O models.

Item	NAICS (projected)	SIC (projected)	2002 Exports 1997 NAICS	2002 Exports 1992 SIC
			Billion dollars	
Economic activity generated by agricultural exports	418.4	418.4	418.4	394.5
Exports	53.1	53.1	53.1	53.1
Supporting activities	365.3	365.3	365.3	341.4
Farm	18.0	18.0	18.0	16.7
Food processing	11.5	11.5	11.5	13.2
Other manufacturing	50.4	50.4	50.4	46.1
Trade and transportation	41.8	41.8	41.8	34.1
Other services	128.6	128.6	128.6	121.5
Government and scrap	2.8	2.8	2.8	0
Households	112.2	112.2	112.2	109.8
			Percent	
Farm share of total income from exports	10	10	10	11
Nonfarm share	90	90	90	89
Export multiplier (additional business activity generated by $1 of exports)	6.88	6.88	6.88	6.45
			1,000 jobs	
Employment generated by exports	1,906	1,876	2,040	1,887
Farm	303	272	436	341
Nonfarm	1604	1604	1604	1546
Food processing	85	85	85	84
Other manufacturing	172	172	172	184
Trade and transportation	392	392	392	409
Other services	925	925	925	852
Government and scrap	15	15	15	0
Households	15	15	15	16
Employment per billion dollars of exports	36	36	38	36
			Percent	
Share of farm workforce supported by exports	9	8	13	10

The first estimation of farm employment generated by agricultural exports from the NAICS (projected backwards) employment based is 303 thousand workers. This is inline with what would be expected if there was a seamless transition from SIC to NAICS and only labor productivity changed in the intervening years. The SIC (projected forward) employment base estimates export related employment of 272 thousand jobs. From this supplemental table one can see that although the generation of employment and income by the individual sectors sometimes vary greatly within the agricultural sector because of the switch to NAICS as evidenced by Tables 3 and 4. Table 5a shows that depending on the base employment you use the farm sector jobs can vary from a low of 272,000 to a high of 436,000 jobs. This compares with the 1992 SIC based estimate of 341,000 jobs. Total domestic supporting activity and income generation by agricultural exports in the dominant and much larger nonfarm economy was not impacted significantly by the change to NAICS.

Figure 1. Miyazawa Partially-Closed Model Input-Output Transaction Table

		PRODUCTION									OTHER FINAL DEMAND		
		Agriculture	Mining	Construction	Manufacturing	Trade	Transportation	Services	Other	Personal Consumption Expenditures	Gross Private Domestic Investments	Net Exports of Goods and Services	Government Purchases of Goods and Services
PRODUCERS	Agriculture												
	Mining												
	Construction												
	Manufacturing												
	Trade												
	Transportation												
	Services												
	Other												
9 INCOME CLASSES	Household Income: Employee Compensation; Net Interest; Business Transfers; Farm/Rental Income; Corporate Dividends; Proprietors Income												
Other Value Added	Indirect Business Taxes; Profit type income and capital consumption allowances												

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