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Sugar and Sweeteners Outlook: Special Article

Indeterminacy in Measuring U.S. Sugar Deliveries for Human Consumption

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Approved by the World Agricultural Outlook Board.

The Sugar and Sweetener Outlook (SSO) believes that the direct consumption import component of U.S. sugar delivery estimates reported in the Sweetener Market Data (SMD) for human consumption are biased and underreported. This problem arose after the implementation of the sweetener provisions of the North American Free Trade Agreement (NAFTA) in January 2008. The share of deliveries directly imported as refined sugar by entities that do not report to the U.S. Department of Agriculture (USDA) increased dramatically (last two columns, table A-1). Although the USDA records an estimate of these deliveries in its Sweetener Market Data (SMD), these estimates do not match with similar estimates made by the SSO. The SSO works with USDA's Foreign Agricultural Service (FAS) in analyzing primary trade data for isolating imports by those who report to the USDA and by those who do not. These latter entities are called "nonreporters."

The data do not match for two reasons. First, imports are not necessarily counted in the same month by SMD and SSO. SSO reporting is derived from primary trade data from U.S. Customs and Border Protection (CBP). CBP records all sugar imports when they officially enter into U.S. customs territory. This means that SSO records sugar going to SMD reporters and nonreporters in the same delivery month.

Data reported to SMD by cane sugar refiners, on the other hand, are recorded when ships, barges, or other transport vehicles are unloaded at the refinery entry point. This may occur in the same month in which the sugar clears customs, but often it is recorded in the following month. SMD then calculates nonreporter deliveries by subtracting the sum of refiners' imports for a particular month from total imports for the same month as reported by FAS using CBP and U.S. Census import data. (Table A-2 sets out the procedures used by FAS and the Farm Service Agency (FSA) that compiles the SMD.) The problem is that a good portion of sugar imports that refiners report as having entered in one month may have been counted by CBP and Census as having entered the previous month.

Table A-1 -- Sugar deliveries for human consumption, by supply source

Fiscal year	Total domestic deliveries - food use	Domestic food use deliveries - beet sugar processors	Domestic food use deliveries - cane processors/refiners	Direct imports by SMD nonreporters	Direct imports: percent of total
		1,000 short tons, raw value			Percent
1991/92	8,772	3,821	4,901	49	0.6
1992/93	8,930	4,114	4,767	48	0.5
1993/94	9,196	4,256	4,877	63	0.7
1994/95	9,218	4,279	4,880	59	0.6
1995/96	9,445	4,139	5,262	44	0.5
1996/97	9,565	3,903	5,641	20	0.2
1997/98	9,672	4,288	5,361	23	0.2
1998/99	9,873	4,419	5,427	28	0.3
1999/2000	9,993	4,465	5,490	38	0.4
2000/01	10,000	4,686	5,248	65	0.7
2001/02	9,785	4,285	5,425	76	0.8
2002/03	9,505	4,256	5,177	71	0.7
2003/04	9,678	4,607	4,987	84	0.9
2004/05	10,019	4,684	5,207	128	1.3
2005/06	10,184	4,360	5,209	615	6.0
2006/07	9,913	4,562	5,157	194	2.0
2007/08 1/	10,394	4,894	5,086	414	4.0
2008/09	10,512	4,303	5,408	801	7.6
2009/10	10,917	4,466	5,637	814	7.5
2010/11	11,193	4,681	5,528	984	8.8
2011/12	11,141	4,544	5,609	988	8.9
2012/13 (5-months)	4,619	1,904	2,337	379	8.2

1/ Sugar provisions of the North American Free Trade Agreement (NAFTA) fully implemented on January 1, 2008.
Source: U.S. Dept. of Agriculture: Farm Service Agency, Sweetener Market Data (SMD).

Table A-2 -- USDA sugar import data sourcing

USDA agency/ import type	Agency source	Measurement
Foreign Agricultural Service (FAS): Import Policies and Export Reporting Division		
A. Raw and refined sugar tariff-rate quotas (TRQs) :minimum access commitments under World Trade Organization (WTO) and Free Trade Agreements (FTAs), and specialty sugar TRQ	U.S. Customs and Border Protection (Customs)	converted to raw value by Customs
B. Re-export program imports	FAS Ag Licensing System updates daily from Customs. Data is adjusted when re-export licensees report to FAS licensing software.	Initial import numbers are commercial weight and not adjusted. Re-export licensees make pol adjustments to convert to raw value.
C. Imports from Mexico under the North American Free Trade Agreement (NAFTA) and high-tier tariff imports.	U.S. Census Bureau, Foreign Trade Division	Converted to raw value by FAS. Sugar from Mexico is multiplied by 1.06. High-tier tariff sugar is converted to raw value by multiplying by 1.07.
Farm Service Agency (FSA): Sweetener Market Data (SMD)		
D. Quantity of raw foreign sugar purchased, either directly by the SMD reporter as "importer of record" or from a SMD non-reporter who is the "importer of record." This sugar must have already been physically cleared through U.S. Customs and Border Protection for processing.	See: http://www.fsa.usda.gov/Internet/FSA_File /sugar_data_user_manual.pdf - "CCC-835 On-Line Reporting Instructions" for listing of cane refiners, cane processors, and beet processors who report to the SMD.	Raw value = ((measured polarization - 92)* 0.0175+0.93)*actual weight: for sugar from sugarcane testing at a polarization of 92 or above. For sugar measuring less than 92, divide weight of total sugar content (i.e., sucrose and invert sugars) by 0.972.
E. Quantity of refined foreign sugar purchased, either directly by the SMD reporter as "importer of record" or from a SMD non-reporter who is the "importer of record." This sugar must have already been physically cleared through U.S. Customs and Border Protection for processing. Refined sugar does not required further refinement by the SMD reporter.		Refined sugar not meant for further processing is converted to raw value by multiplying actual weight by 1.07.
F. Imports by SMD nonreporters: calculated as difference between total sugar imports reported by FAS in raw value and converted from metric to short tons, and total sugar imports reported by SMD reporters.		

Source: U.S. Dept. of Agriculture: Farm Service Agency, Dairy and Sweeteners Analysis Branch.

The top panel of table A-3 shows FAS import data from CBP and Census since the beginning of fiscal year (FY) 2008. The middle panel shows the corresponding SMD refiners' import data. The bottom panel shows the resulting calculated nonreporter data. As can be seen, there are numerous negative entries that are a consequence of the timing mismatch in the two underlying data series. This randomness makes the interpretation of monthly sugar delivery data less reliable for discerning consumption trends and projecting annual delivery totals.

A second problem comes from differing methodologies for converting sugar import data into raw equivalent value. Refined sugar is at least 99.5 percent pure sucrose, while raw sugar measures something less than that, sometimes lower than 92 percent. In order to have equivalent measurement units to sum or to compare quantities across sugar of differing sucrose levels, sugar reporting uses a 96 pol standard. (Table A-2 describes some of the technical detail of the conversion factors employed.)

It is not clear that CBP/FAS and SMD methodologies provide the same results. Preliminary SSO analysis implies that SMD conversion factors provide for a larger upward adjustment to reach raw value equivalence than the CBP/FAS factors. The problem, therefore, is that the present method of calculating nonreporter imports yields a lower value that it would if the conversion methods yielded closer results.

SSO Analysis of FAS and Census Import Data

In order to measure the extent of the problem (and also to provide an alternative series for discerning delivery trends and making projections), the SSO has worked with FAS personnel in analyzing CBP data to separate out sugar imports going to SMD reporters from those going to nonreporters. The analysis includes examination of tariff code classifications, port entries, import volumes, and other pertinent data factors.

Table A-4 shows the results applied to publicly available sugar import data from the U.S. Census Bureau. The top panel shows total sugar imports; the second shows raw and refined sugar imports going to SMD importers; the third shows sugar going to nonreporters; and the fourth panel shows the monthly nonreporter shares. These data are not adjusted to raw value equivalence. The SSO uses a factor of 1.07 to convert the data to raw value equivalence in analyzing sugar delivery trends for forecasting. More of the detail behind the conversion is provided below.

Table A-3 – Sugar imports in USDA's Sweetener Market Data (SMD), by SMD reporters and non-reporters

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
						Short tons, raw value							
A = Total sugar imports: Foreign Agricultural Service													
2007/08	190,824	209,426	194,594	149,320	203,131	171,404	293,999	245,552	207,103	187,880	320,021	246,845	2,620,099
2008/09	404,024	277,159	254,279	242,504	156,084	294,097	339,521	322,635	206,062	303,000	166,168	117,179	3,082,710
2009/10	310,818	212,671	176,867	200,004	138,923	233,431	244,169	220,568	226,562	314,751	462,398	577,922	3,319,083
2010/11	294,265	284,986	197,786	173,914	300,412	379,863	278,763	470,022	314,565	253,033	286,753	503,922	3,738,285
2011/12	435,587	185,319	309,038	244,077	243,399	291,556	321,689	341,344	356,428	249,773	263,408	390,444	3,632,063
2012/13	182,362	275,471	259,073	195,923									912,828
B = SMD: Imports by sugar processors and refiners who report to SMD													
2007/08	194,592	214,694	205,748	169,895	168,061	123,786	168,314	194,610	229,753	144,675	255,507	136,027	2,205,662
2008/09	193,838	190,357	212,415	122,328	204,869	171,488	241,240	213,636	213,215	224,681	107,601	186,027	2,281,695
2009/10	237,448	144,984	113,131	152,411	152,199	172,653	175,372	191,495	171,586	227,509	374,074	391,736	2,504,598
2010/11	252,663	148,886	142,616	215,396	188,198	289,163	204,567	357,284	271,661	127,728	254,212	302,297	2,754,671
2011/12	236,622	234,841	214,682	218,452	151,746	229,950	268,829	219,386	198,839	228,953	190,317	251,830	2,644,447
2012/13	102,157	147,367	246,136	123,711									619,371
C = A - B: Imports by SMD nonreporters													
2007/08	-3,768	-5,268	-11,154	-20,575	35,070	47,618	125,685	50,942	-22,650	43,205	64,514	110,818	414,437
2008/09	210,186	86,802	41,864	120,176	-48,785	122,609	98,281	108,999	-7,153	78,319	58,567	-68,848	801,015
2009/10	73,370	67,687	63,736	47,593	-13,276	60,778	68,797	29,073	54,976	87,242	88,324	186,186	814,485
2010/11	41,602	136,100	55,170	-41,482	112,214	90,700	74,196	112,738	42,904	125,305	32,541	201,625	983,614
2011/12	198,965	-49,522	94,356	25,625	91,653	61,606	52,860	121,958	157,589	20,820	73,091	138,614	987,616
2012/13	80,205	128,104	12,937	72,212									293,458

Source: U.S. Dept. of Agriculture: Farm Service Agency, Sugar Monthly Import and Re-Export Data Report Archives; U.S. Dept. of Agriculture, Farm Service Agency, Sweetener Market Data (SMD).

Table A-4 -- U.S. Census Bureau sugar imports, by SMD reporters and non-reporters, as estimated by Sugar and Sweetener Outlook.

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
						Short tons, tel quel							
D = Total sugar imports: U.S. Census Bureau.													
2007/08	220,770	172,585	183,571	153,582	193,351	141,521	280,237	230,982	158,966	234,352	310,746	234,958	2,515,621
2008/09	340,550	273,205	290,631	198,383	209,235	256,616	294,096	346,889	177,951	283,098	172,791	121,571	2,965,016
2009/10	301,808	209,729	165,638	182,885	193,739	220,203	219,656	190,256	232,467	294,464	458,210	546,832	3,215,886
2010/11	232,926	253,967	187,614	259,635	263,405	359,790	280,379	433,558	315,285	239,697	340,951	357,843	3,525,050
2011/12	465,679	259,273	238,115	319,201	199,996	244,762	343,197	335,722	338,051	218,174	265,727	350,638	3,578,534
2012/13	204,623	276,384	239,038	231,285									951,329
E = Sugar imports by sugar processors and refiners who report to SMD, estimated by Sugar and Sweetener Outlook from U.S. Census imports													
2007/08	181,254	129,571	164,289	131,589	162,075	105,571	244,008	167,126	114,691	182,726	196,373	112,219	1,891,493
2008/09	181,507	152,338	198,466	117,153	142,732	191,024	211,227	199,734	101,108	199,712	101,951	76,041	1,872,993
2009/10	252,130	157,656	132,769	141,756	157,581	176,058	171,328	135,277	164,346	229,966	337,435	409,440	2,465,743
2010/11	143,733	164,856	113,779	175,196	187,900	253,605	175,016	326,135	212,261	156,443	227,527	243,187	2,379,638
2011/12	301,338	173,020	162,073	239,371	138,157	152,990	252,084	234,656	266,747	143,955	197,853	102,979	2,365,223
2012/13	113,398	200,310	175,353	160,146									649,206
F = D - E: Imports by SMD nonreporters, estimated by Sugar and Sweetener Outlook													
2007/08	39,516	43,015	19,282	21,993	31,276	35,949	36,228	63,856	44,275	51,625	114,373	122,739	624,128
2008/09	159,043	120,867	92,166	81,230	66,503	65,592	82,869	147,156	76,843	83,386	70,840	45,530	1,092,024
2009/10	49,678	52,073	32,869	41,129	36,158	44,145	48,328	54,979	68,121	64,498	120,775	137,391	750,144
2010/11	89,193	89,111	73,834	84,440	75,505	106,185	105,363	107,423	103,024	83,254	113,424	114,656	1,145,412
2011/12	164,341	86,253	76,042	79,829	61,838	91,772	91,113	101,065	71,304	74,218	67,874	247,659	1,213,311
2012/13	91,225	76,074	63,685	71,139									302,123
G = 100*F/D: Imports by SMD nonreporters, estimated by Sugar and Sweetener Outlook, as percentage of total imports													
2007/08	17.9	24.9	10.5	14.3	16.2	25.4	12.9	27.6	27.9	22.0	36.8	52.2	24.8
2008/09	46.7	44.2	31.7	40.9	31.8	25.6	28.2	42.4	43.2	29.5	41.0	37.5	36.8
2009/10	16.5	24.8	19.8	22.5	18.7	20.0	22.0	28.9	29.3	21.9	26.4	25.1	23.3
2010/11	38.3	35.1	39.4	32.5	28.7	29.5	37.6	24.8	32.7	34.7	33.3	32.0	32.5
2011/12	35.3	33.3	31.9	25.0	30.9	37.5	26.5	30.1	21.1	34.0	25.5	70.6	33.9
2012/13	44.6	27.5	26.6	30.8									31.8

Source: U.S. Census Bureau; Economic Research Service, Sugar and Sweetener Outlook.

Table A-5 collects and reports monthly nonreporter import data in a single location. The top panel shows SMD nonreporter data from table A-3. The middle panel shows FAS sugar imports, raw value, multiplied by the corresponding nonreporter share coefficients from table A-4. The bottom panel shows the nonreporter imports from the U.S. Census from table A-4 converted into raw value by multiplying by 1.07. Fiscal year totals are shown in the second-to-last right-hand column. The FAS and U.S. Census totals are generally higher than the current SMD series. This seems especially true in the first 2 years, where the totals are 42 to 60 percent higher. The third year, FY 2010, shows rough equivalence, but totals for FY 2011 and FY 2012 are between 23 and 31 percent higher.

The right-hand column shows the implied method used for estimating total sugar deliveries (i.e., the sum of beet sugar deliveries from processors, cane sugar deliveries from processors and refiners, and refined sugar nonreporter imports). Total delivery estimates using FAS and U.S. Census nonreporter import deliveries show very similar results, and both provide higher delivery totals than SMD of between 2.1 and 3.5 percent for all years except FY 2010. All FY 2010 results are close to each other.

Table A-5 -- Alternative estimates of sugar imports by SMD nonreporters, and implications for sugar consumption, 2012/13

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total Non-reporter imports	Total deliveries for human consumption 1/
						Short tons, raw value								
SMD current = C														
2007/08	-3,768	-5,268	-11,154	-20,575	35,070	47,618	125,685	50,942	-22,650	43,205	64,514	110,818	414,437	10,394,327
2008/09	210,186	86,802	41,864	120,176	-48,785	122,609	98,281	108,999	-7,153	78,319	58,567	-68,848	801,015	10,512,414
2009/10	73,370	67,687	63,736	47,593	-13,276	60,778	68,797	29,073	54,976	87,242	88,324	186,186	814,485	10,916,598
2010/11	41,602	136,100	55,170	-41,482	112,214	90,700	74,196	112,738	42,904	125,305	32,541	201,625	983,614	11,192,757
2011/12	198,965	-49,522	94,356	25,625	91,653	61,606	52,860	121,958	157,589	20,820	73,091	138,614	987,616	11,140,792
2012/13	80,205	128,104	12,937	72,212									293,458	293,458
ERS share coefficients applied to FAS sugar import estimate = .01*G*A														
2007/08	34,156	52,197	20,439	21,383	32,858	43,540	38,007	67,884	57,683	41,388	117,787	128,948	656,270	10,636,160
2008/09	188,686	122,616	80,638	99,296	49,610	75,172	95,669	136,867	88,982	89,248	68,125	43,885	1,138,792	10,850,191
2009/10	51,161	52,803	35,097	44,979	25,928	46,797	53,721	63,738	66,391	68,941	121,879	145,203	776,638	10,878,751
2010/11	112,681	99,995	77,837	56,561	86,113	112,110	104,756	116,457	102,789	87,886	95,394	161,461	1,214,040	11,423,183
2011/12	153,722	61,651	98,691	61,042	75,259	109,317	85,403	102,758	75,181	84,968	67,282	275,775	1,251,047	11,404,223
2012/13	81,301	75,823	69,023	60,262									286,408	286,408
ERS share coefficients applied to U.S. Census sugar import estimate, converted to raw value = 1.07*F														
2007/08	42,282	46,026	20,631	23,532	33,466	38,465	38,764	68,326	47,375	55,239	122,379	131,331	667,817	10,647,707
2008/09	170,176	129,328	98,617	86,916	71,159	70,183	88,670	157,456	82,222	89,223	75,799	48,717	1,168,465	10,879,864
2009/10	53,155	55,718	35,170	44,008	38,689	47,235	51,711	58,827	72,889	69,013	129,230	147,009	802,654	10,904,767
2010/11	95,436	95,349	79,003	90,351	80,790	113,618	112,739	114,942	110,236	89,082	121,364	122,682	1,225,590	11,434,733
2011/12	175,845	92,291	81,365	85,418	66,167	98,196	97,491	108,140	76,296	79,414	72,625	264,995	1,298,243	11,451,419
2012/13	97,611	81,399	68,143	76,119									323,272	323,272

1/ SMD beet sugar deliveries + SMD cane processor/refiner deliveries + total non-reporter imports.

Source: U.S. Census Bureau; Economic Research Service, *Sugar and Sweetener Outlook* .

SSO Analysis of SMD Import Data: Method

The SSO believes that the SMD estimate of direct consumption imports going to SMD nonreporters is underestimated and biased. In the discussion above, it has been hypothesized that there are mismatches in the recording of the months in which imported sugar enters into the United States and in the raw sugar conversion factors. A mathematical expression for this relationship for sugar imported by refiners who all report to SMD (SMD_reporter) with respect to the same data reported by FAS (FAS_reporter) is:

SMD_reporter = $\alpha 1 * \beta * FAS\_reporter + \alpha 2 * \beta * FAS\_reporter(-1$: previous month)

The $\alpha 1$ is the share of FAS imports in one month recorded as a SMD import in the same month. The $\alpha 2$ is the share of FAS sugar from the previous month reported by SMD as an entry. If there were no issue with the raw sugar conversion factor, then we would expect the sum of the αi to equal 1. If there were no timing issues (as assumed in the SMD approach), then $\alpha 1$ would have a value close to 1.0, and $\alpha 2$ would have a value indistinguishable from zero. The β coefficient makes the adjustment for differing methods of conversion to raw value. Because the SSO maintains that the CBP/FAS method involves a lower upward adjustment from actual weight to raw value, it is expected that the value β is greater than 1.00.

Table A-6 details the steps in deriving a relationship between SMD's estimate of nonreporter imports (SMD_nonreporter) and that of the FAS data (FAS_nonreporter). If there were no timing mismatch issue ($\alpha 2 = 0$) and no raw conversion issue ($\beta = 1.00$), then both estimates would be the same.

Table A-6 -- Derivation of model equation

	α_i - share coefficient
	β - raw equivalent conversion coefficient: test whether = 1
Given:	SMD_reporter = $\alpha 1 * \beta * FAS\_reporter + \alpha 2 * \beta * FAS\_reporter(-1)$
Goal:	Derive estimation equation for SMD_nonreporter that is consistent with SMD_reporter equation
#1	SMD_nonreporter = SMD_total - SMD_reporter
#2	SMD_total = β*FAS_total
#3	SMD_nonreporter = β*FAS_total - SMD_reporter
#4	FAS_total = FAS_reporter + FAS_nonreporter
#5	SMD_nonreporter = β*FAS_reporter + β*FAS_nonreporter - SMD_reporter
#6	SMD_nonreporter = β*FAS_reporter + β*FAS_nonreporter - $\alpha 1 * \beta * FAS\_reporter - \alpha 2 * \beta * FAS\_reporter(-1)$
#7	SMD_nonreporter = β*(FAS_reporter*(1 - α1) - α2*FAS_reporter(-1)) + FAS_nonreporter)
#8	$\alpha_1 + \alpha_2 = 1 \rightarrow \alpha_2 = 1 - \alpha_1$
#9	SMD_non_reporter = $\beta * \alpha 2 *$(FAS_reporter - FAS_reporter(-1)) + β*FAS_nonreporter

Source: Economic Research Service, *Sugar and Sweetener Outlook*.

Table A-7 details model estimates based on the hypothesized relationships in table A-6. The two-equation "Alternative" approach is the one used in the models for estimation. Because the model is non-linear, the goal of the estimation is to find a minimum value of β such that it cannot be rejected so that α1 + α2 =1. Also, the hypothesis that α2 is greater than zero is tested, as is whether α2 from the first equation (reporter) is equal to α12 from the second equation (nonreporter).

A second equation (SSO approach) is estimated and tested in the same manner. The difference is that the SSO uses sugar imports reported by the U.S. Census. (Therefore, we have Census_reporter and Census_reporter(-1) as independent variables.) These imports are actual weight—that is, not adjusted for reporting in raw value equivalence. It is expected the value of β will be greater than the value from the "Alternative" model. The αi relationships should be close to those of the "Alternative" approach.

Table A-7 -- Estimating nonreporter imports: econometric approaches

Definition

α_i - share coefficient

β - raw equivalent conversion coefficient: test whether = 1.00

Current SMD approach

$\alpha_1 = 1$; $\alpha_2 = 0$; $\alpha_{12} = 0$; $\beta = 1$

SMD_reporter = FAS_reporter

SMD_nonreporter = FAS_total - SMD_reporter

Alternative approach

Select minimum β such that $\alpha_1 + \alpha_2 = 1$, $\alpha_2 = \alpha_{12}$.

SMD_reporter = α1*β*FAS_reporter + α2*β*FAS_reporter(-1)

SMD_non_reporter = β*α12*(FAS_reporter - FAS_reporter(-1)) + β*FAS_nonreporter

Sugar and Sweetener Outlook approach

$\beta = 1.07$, $\alpha_1 + \alpha_2 = 1$, $\alpha_2 = \alpha_{12}$.

SMD_reporter = α_1*β*Census_reporter + α_2*β*Census_reporter(-1)

SMD_non_reporter = β*α_{12}*(Census_reporter - Census_reporter(-1)) + β*Census_nonreporter

Source: Economic Research Service, *Sugar and Sweetener Outlook*.

SSO Analysis of SMD Import Data: Results

Table A-8 shows estimation results for the "Alternative" modeling approach. First, the lag coefficient α2 is statistically greater than zero, and its value in the first equation (α2) is indistinguishable from its value in the second equation (α12). The smallest value of β that establishes the statistical significance of α1 + α2 =1 is 1.0395. This value is greater than the value of 1.0000 that would result if the raw value weight conversions were the same.

Table A-9 shows the results of using actual weight U.S. Census sugar import data. Conclusions emanating from the interpretation of the αi coefficients are the same as in the "Alternative" case. The difference, as expected, is that the minimum β value is higher: 1.0635 compared with 1.0395.

Table A-8 -- Alternative approach: econometric results 1/

Two-equation model: select minimum β such that Table A-6 (null hypothesis below) conditions are met. 2/

Eq. no. 1: SMD_REPORTER = C(1)***1.0395***FAS_REPORTER + C(2)***1.0395***FAS_REPORTER(-1)
EQ. no. 2: SMD_NONREPORTER = C(12)***1.0395***(FAS_REPORTER-FAS_REPORTER(-1)) + C(13)***1.0395***FAS_NONREPORTER

	Coefficient	Std. Error	t-Statistic
C(1)	0.6801	0.0526	12.9404
C(2)	0.3263	0.0540	6.0377
C(12)	0.3260	0.0536	6.0802
C(13)	1.0051	0.0219	45.8605

Equation: SMD_REPORTER = C(1)*1.0395*FAS_REPORTER + C(2) *1.0395*FAS_REPORTER(-1)

R-squared	0.5043	Mean dependent var	203,005
Adjusted R-squared	0.4963	S.D. dependent var	59,913
S.E. of regression	42,519		
Durbin-Watson stat	2.2429		

Equation: SMD_NONREPORTER = C(12)*1.0395*(FAS_REPORTER-FAS_REPORTER(-1)) + C(13)*1.0395*FAS_NONREPORTER

R-squared	0.5771	Mean dependent var	77,474
Adjusted R-squared	0.5702	S.D. dependent var	65,371
S.E. of regression	42,857		
Durbin-Watson stat	2.2345		

Null Hypothesis: C(1)+C(2)=1,C(2)=C(12),C(13)=1

Test Statistic	Value	df	Probability
Chi-square	5.9874	3	0.1122

1/ Regression method: Seemingly Unrelated Regression; Sample period: Oct. 2007 through Feb. 2013 = 64 observations.
2/ C(1) = α_1, C(2) = α_2, c(12) = α_{12}.

In its proposal to track sugar deliveries using Census import data, SSO proposed using a raw sugar conversion factor of 1.07. This is close to the minimum of 1.0635. Using the coefficient valued at 1.07 allows all the statistically confirmed relationships involving all the αi.

In spite of these confirmation results, it is important to note that the variance-reducing explanatory power of the equations in both Alternative and SSO models is not all that high. The statistical parameter that captures this relationship is the adjusted R-squared. The R-squared of the four estimated equations falls between 0.4936 and 0.5771. This means that only about half of variability with respect to differences with the SMD approach is being explained. There are other factors about which our knowledge is lacking.

Conclusions

This analysis has shown that SMD estimates of sugar imports by SMD nonreporters are biased and underreported. It is not clear what should be done about the problem, other than being aware of it. The SSO will continue its import analysis and use the implications for forecasting U.S. sugar demand.

It is important to note that this analysis probably has minimal bearing on forecasting found in the World Agricultural Supply and Demand Estimates (WASDE). Having recognized this problem and others in SMD reporting several years ago, the Interagency Commodity Estimates Committee for sugar (ICEC) decided to replace sugar deliveries for human consumption with domestic sugar use. Domestic sugar use is total use (total supply less ending stocks) less exports. This includes deliveries for human use and all other miscellaneous factors. Miscellaneous factors include differences in import reporting sources (especially relevant for this analysis), refining losses, inventory adjustments, and intra-industry sugar transfers.

Table A-9 -- Sugar and Sweetener Outlook approach: econometric results 1/

Two-equation model: select minimum β such that Table A-6 (null hypothesis below) conditions are met. 2/

Eq. no. 1: SMD_REPORTER = C(1)*__1.0635__*CENSUS_REPORTER + C(2)*__1.0635__*CENSUS_REPORTER(-1)
EQ. no. 2: SMD_NONREPORTER = C(12)*__1.0635__*(CENSUS_REPORTER-CENSUS_REPORTER(-1)) + C(13)*__1.0635__*CENSUS_NONREPORTER

	Coefficient	Std. Error	t-Statistic
C(1)	0.7029	0.0629	11.1681
C(2)	0.3104	0.0629	4.9329
C(12)	0.3067	0.0613	5.0066
C(13)	0.9889	0.0176	56.0971

Equation: SMD_REPORTER = C(1)*1.0635*CENSUS_REPORTER + C(2) *1.0635*CENSUS_REPORTER(-1)

R-squared	0.5245	Mean dependent var	203,426
Adjusted R-squared	0.5168	S.D. dependent var	60,298
S.E. of regression	41,917		
Durbin-Watson stat	2.2908		

Equation: SMD_NONREPORTER = C(12)*1.0635*(CENSUS_REPORTER-CENSUS_REPORTER(-1)) + C(13)*1.0635*CENSUS_NONREPORTER

R-squared	0.5018	Mean dependent var	77,333
Adjusted R-squared	0.4936	S.D. dependent var	58,608
S.E. of regression	41,706		
Durbin-Watson stat	2.2978		

Null Hypothesis: C(1)+C(2)=1,C(2)=C(12),C(13)=1

Test Statistic	Value	df	Probability
Chi-square	5.9044	3	0.1164

1/ Regression method: Seemingly Unrelated Regression; Sample period: Oct. 2007 through Feb. 2013 = 64 observations.
2/ C(1) = α_1, C(2) = α_2, c(12) = α_{12}.