United States Department of Agriculture

Economic Research Service

Situation and Outlook

SSS-M-294 SA

Feb. 14, 2013

Sugar and Sweeteners Outlook: Special Article

Long-term Projection of U.S. and Mexico Sugar Supply and Use through 2022/23

Stephen Haley, coordinator
shaley@ers.usda.gov

Approved by the World Agricultural Outlook Board.

The U.S. Department of Agriculture (USDA) annually prepares and publishes long-run projections for the U.S. farm sector for the next 10 years. The report is released in February, immediately prior to USDA's annual Outlook Conference. Projections cover agricultural commodities, agricultural trade, and aggregate indicators of the farm sector, such as farm income and food prices. Projection results are used in the preparation of the President's Annual Budget.

The Sugar and Sweetener Outlook of USDA's Economic Research Service (ERS) prepares supply and use projections for U.S. sugar. These projections are reviewed and cleared by USDA's Interagency Commodity Estimates Committee (ICEC) for sugar. Projections are based on the assumption of extension of current policies through the entire projections period. The Sugar and Sweetener Outlook analytic framework works out the implications for supply and use from the expected states of the physical and economic environment in the policy setting. Although the distinction is subtle, supply and use projections are not forecasts but are base points against which to analyze the effect of policy changes or other exogenous influences on the sugar and sweetener sector.

The most important factors affecting U.S. sugar supply and use over the long-term projection period are the U.S. sugar program, the availability of sugar imports from Mexico, and the level of sugar prices in the world market. The following section develops this background, and then the framework for analysis is described and results and implications discussed.

Background Factors Affecting Long-Term U.S Sugar Supply and Use

The U.S. sugar program relies on supply control mechanisms of domestic marketing allotments, price support instruments, and import restrictions to keep U.S. sugar prices above world levels. The main features are shown in table A-1. The 2008 Farm Act made marketing allotments permanent at a level to be not less than 85 percent of estimated sugar deliveries for human consumption. The 2008 Act sets the raw sugar loan rate at 18.75 cents/pound (lb) in fiscal year (FY) 2013. The refined beet sugar loan rate is specified to equal 128.5 percent of the raw cane sugar loan rate. The 2008 Act introduced the Feedstock Flexibility Program, which requires the diversion of sugar from food use to ethanol producers at the beginning of September, if needed, to keep sugar prices above levels at which sugar processors might otherwise forfeit sugar under loan to the Commodity Credit Corporation (CCC).

The 2008 Farm Act states that the raw and refined sugar tariff-rate quotas (TRQs) be established at the beginning of the marketing year at the minimum levels required to comply with international trade agreements approved by the U.S. Congress, with an exception for imported specialty sugar. During the first half of the fiscal year (October 1-March 31), the 2008 Farm Act states that the sugar TRQ must be increased above the minimum levels by the Secretary of Agriculture if a sugar shortage occurs due to an emergency situation such as a natural disaster or war or similar event. The 2008 Farm Act states that after April 1, the sugar TRQ can be increased by the Secretary to provide an adequate supply, but only to a level that does not threaten sugar forfeitures to the CCC.

The sugar provisions of the North American Free Trade Agreement (NAFTA) removed all duties and quantitative restrictions on sweetener trade between Mexico and the United States as of January 1, 2008. For FY 2008-12, annual sugar imports from Mexico to the United States averaged about 1.136 million short tons, raw value (STRV)—constituting about 10.5 percent of U.S. sugar consumption. For FY 2013, imports from Mexico are projected at 1.388 million STRV, about 12.2 percent of projected U.S. sugar consumption.

Mexico's sugar surplus for export is directly affected by the amount of high fructose corn syrup (HFCS) that substitutes for sugar in Mexico's production of beverages and food products. HFCS consumption has grown from 653,000 metric tons (mt), dry weight in 2008/09 to 1.721 million mt in 2011/12. The growth in consumption is expected to stall in 2012/13 at 1.635 million mt because of lower sugar prices and higher HFCS prices due to higher suppliers' net corn costs in production. The upward use trend is expected to restart once corn prices return to their longer term, lower price equilibrium path.

Beginning in FY 2010, U.S. raw sugar prices have been supported by world raw sugar prices higher than legislated loan rate levels (fig. A-1). The Organisation for Economic Co-Operation and Development (OECD) and the Food and Agriculture Organization (FAO) jointly project these world prices to continue above U.S. loan rate levels through 2021/22. These projections, however, remain extremely vulnerable to disturbances from weather, high energy prices, protective government policies, and the unsettled macroeconomic environment. A projection of 2012/13 world prices based on future market quotes puts the average near to and potentially below U.S. price support levels.

Table A-1 -- U.S. long-term sugar projections: incorporating supply-control assumptions for U.S. sugar program

Marketing Allotment Program

Domestic processors get Overall Allotment Quantities (OAQ) allocations equal to no less than 85 percent of projected deliveries for human consumption:
Beet processors allocated 54.35 percent of total OAQ,
Cane processors allocated the remainder.

Domestic price support

Non-recourse loan rate program: processors have option to repay 9-month loans from USDA by forfeiting pledged sugar to USDA - amount forfeited must comply with OAQ allocation.

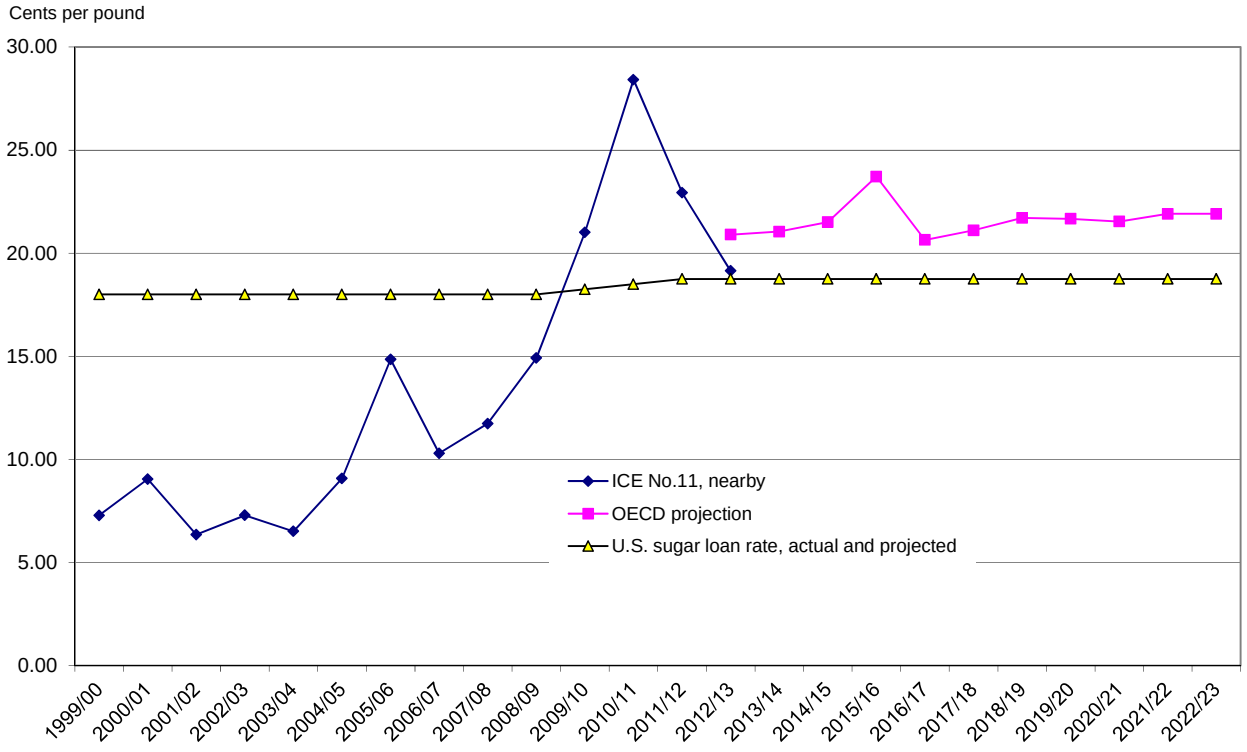
Feedstock Flexibility Program under Farm Act Energy Title: USDA is required to purchase sugar from processors to avoid non-recourse forfeitures. Sugar is required to be re-sold to ethanol producers at whatever price they are willing to pay. Difference between USDA purchase and sales price constitutes a unit subsidy and incurs budget expense.

Limit sugar imports: tariff-rate quotas (TRQs)

TRQs specified at minimum levels to be compliant with obligations to the World Trade Organization (WTO) and currently-implemented Free Trade Agreements (FTAs).

Source: ERS, *Sugar and Sweetener Outlook*.

Figure A-1
World raw sugar prices: estimates based on futures market 1999/00-2012/13, and projections from OECD/FAO



Source: Intercontinental Exchange (ICE); Organisation for Economic Co-Operation and Development (OECD) and Food and Agriculture Organization (FAO).

Framework for Making Long-Term Projections

Given world sugar price uncertainty, the Sugar and Sweetener Outlook has developed two frameworks for making long-term projections (table A-2). The first framework assumes the OECD/FAO world sugar price projections. The margin between U.S. and world prices is a function of the ending sugar stocks-to-use ratio. Because of the short 3-year period of world prices higher than loan rates, the estimated relationship between the price margin and stocks-to-use has low statistical confidence. It is further assumed that the margin has a minimum value of 3 cents/lb—interim margins below 3 cents/lb imply fewer sugar imports from TRQ-supplying countries.

The second framework assumes world prices below loan rates, or essentially a return to pre-FY 2010 price patterns. The third-quarter U.S. raw sugar price is a function of the ending stocks-to-use ratio but cannot fall below the minimum price-to-avoid-forfeiture. This specification implies a potential divergence between total and private stockholding that is resolved by the USDA purchase of sugar for resale with subsidy to ethanol producers. Federal budget expenditure, effectively ruled out in the first framework, becomes possible in the second.

Both frameworks share common elements. The domestic refining margin is a function of ending stocks-to-use and exogenously determined cane sugar refiner capacity utilization. The third-quarter beet sugar spot price is equal to the sum of the third-quarter raw price plus the margin. An annual beet sugar price is estimated as a weighted average of current and previous year third- quarter prices. The return to growing sugarbeets is directly proportional to this annual price. The sugarcane price is proportional to an estimated annual raw sugar price from the current and previous year's third-quarter price. Sugar crop prices relative to alternative crop prices determine changes in sugarbeet plantings and sugarcane harvested area in all growing areas except Florida. (Area for harvest in Florida is exogenously set.)

Sweeteners for consumption are comprised of refined sugar, HFCS, and sugar in net imported products. Per capita sweetener availability over the long term is assumed to be constant at 119 pounds. There is limited substitution between refined sugar and HFCS, dependent on refined sugar prices and cost of producing HFCS. The declining trend in soft drink consumption that has been the primary cause of reduced per capita HFCS consumption since 1999 is assumed to have flattened out.

Table A-3 shows assumptions made about sweetener supply and use in Mexico. Area for sugarcane production is estimated as a function of changes in the real price of sugarcane lagged 2 years. (This estimated relationship has better statistical properties than several examined alternatives.) Sugar yield is assumed to increase according to trend. In sweetener consumption, the trend toward increased HFCS use regains its momentum after 2014/15. Domestic HFCS production is set at 480,000 mt and rest is imported—almost all from the United States.

An important assumption is that Mexico does not import sugar for consumption. The only sugar it does import is for use in its products re-export IMMEX program.[1] Adoption of this assumption contrasts with the long-term projections made last year and the year before. In those cases, Mexico was assumed to import from the world market to maintain ending stocks at 22 percent of annual sugar consumption after having exported sugar to the United States, in order to allow an annual ending U.S. stocks-to-use ratio of 13.5 percent (2 years ago) and 14.5 percent (last year). Not importing for consumption allows a higher domestic price of sugar in Mexico that favors more sugar from domestic production.

The price of estandar sugar varies inversely with ending sugar stock levels relative to consumption. An export trading equilibrium is set when the estandar export parity price (price in cents per pound = 1.06*U.S. raw sugar price + 2.27) is equal to the domestic estandar price. The adjustment is achieved by changes in exports affecting ending

1 IMMEX = Industria Manufacturera, Maquiladora y de Servicios de Exportación

Table A-2 -- U.S. sugar long-run projections of supply and use: specification alternatives and common features

Base - Projected U.S raw sugar prices supported by world raw sugar prices similar to period 2009/10-2011/12

Margin between U.S. and world raw sugar prices is a function of projected ending stocks-to-use ratio:
U.S. raw sugar price = world raw sugar price + margin
Margin = max(36.068 - 1.868*[stocks-to-use ratio], 3 cents per pound)

Implication: domestic price is above the minimum price-to-avoid forfeiture - no projected budget expenditure.

Alternative -- Projected U.S. raw sugar prices supported by domestic price support from sugar loan rate program

U.S.raw sugar price in 3rd quarter is a function of projected ending stocks-to-use ratio:
U.S. raw sugar price = max(44.301*[stocks-to-use ratio]^(-0.2532), minimum price-to-avoid-forfeiture).

Implication: potential diverence between total stocks-to-use and private stocks-to-use resolved by USDA purchase of sugar (subject to marketing allotment limit) for subsidized re-sale to ethanol producers - this implies possibility of budget expenditure.

Common to both specifications

Domestic refining margin is a function of ending stocks-to-use and refiner capacity utilization:
Refining margin = -1.9162*[stocks-to-use ratio] + 0.7893*[cane sugar refining capacity utilization]
Beet sugar spot price = raw sugar price + refining margin.

Sugarbeet price is a function of beet sugar producer price index (ppi), which is a function of weighted average of current-year and previous-year's beet sugar price.

Sugarcane price is function of weighted average of current-year and previous year's 3rd quarter raw sugar price.

Per capita sweetener availability (sugar, high fructose corn syrup (HFCS), sugar in net imported products) is constant at 119 pounds. There is limited price-based substitution between sugar and HFCS.

Source: ERS, *Sugar and Sweetener Outlook* .

Table A-3 -- Mexico sugar and high fructose corn syrup (HFCS) long-term supply and use projections

Production
Area is a fuction of real sugarcane price, lagged 2 years.
Trend growth in sugar yield.
Consumption
Trend toward increased use of HFCS, moderated by sugar-HFCS price tradeoff.
Imports
Only assumed for IMMEX sugar-containing product re-export program.
No imports for domestic consumption.
Exports and Price-determination
Estandar price in third quarter is a function of ending stock-to-consumption ratio and dollar-peso exchange rate.
Exports to the United States by their effect on ending stocks-to-consumption ratio positively affect the third-quarter estandar price.
Exports in trade equilibrium bring estandar export parity price equal to U.S. raw sugar price
(Estandar export parity for estandar in cents/pound = 1.06*raw sugar price + 2.27 cents).
Market year price of estandar sugar is a weighted function of current and 1-year lagged third quarter price.
Ending stocks
Calculated as a residual.
Real sugarcane price
Varies proportionally with peso-denominated estandar price, adjusted for projected inflation from USDA international macro baseline.

Source: ERS, *Sugar and Sweetener Outlook*.

stock levels on a one-to-one basis but in the opposite direction. (Example: 100 mt export increase decreases ending stocks by 100 mt, all else constant.) Fewer stocks increase the estandar price and more stocks decrease it. After exports have adjusted to reach the trading equilibrium, ending stocks are calculated as a residual.

The sugarcane price in Mexico varies directly with the peso-denominated estandar price and is adjusted into real terms. Exchange rate and inflation factors are taken from USDA's international macroeconomic baseline projection.

Results from Base—Support from World Prices

There are two specifications: the first assumes that U.S. sugar prices are supported by world prices (the base), and the second assumes support from domestic price support policies (the alternative). Table A-4 shows U.S. results for both specifications and table A-5 presents average values over the projection horizon. Tables A-6 and A-7 provide corresponding results for Mexico. Discussion in this section focuses on base results; the next section presents a comparison with the alternative.

Projected growth in U.S. beet and cane sugar production over the next decade is modest. Beet sugar production in 2022/23 is projected at 5.319 million short tons, raw value (STRV), about 4.20 percent higher than in 2012/13. Beet sugar production levels in the first 2 years of the forecast are projected low at an annual average of 4.752 million STRV due to lower sugarbeet prices relative to prices for alternative crops. Cane sugar production in 2022/23 is projected at 3.864 million STRV, about 3.87 percent higher than in 2012/13.

Beet sugar production averages 5.8 percent below its average share of the OAQ under the sugar marketing allotment program. In no year does beet sugar production exceed its OAQ share. Cane sugar production averages 18.8 percent below its average OAQ share. Production levels in all cane sugar producing States remain below their OAQ shares.

Sugar deliveries for human use average 11.854 million STRV over the projection period, with annual growth of about 0.7 percent a year. Sugar consumption is strengthened in the early projection period due to higher HFCS prices resulting from higher net corn input prices. These input prices decrease after a few years and sugar deliveries moderate as a result.

Sugar imports from Mexico are projected to average 1.516 million STRV over the next decade, representing about 12.8 percent of U.S. domestic sugar consumption. Two conditions in Mexico underlie this projection. First, beverage and food manufacturers in Mexico continue to expand the substitution of lower cost HFCS (except for the first 2 years of the projection period) for domestic sugar. Second, remunerative prices in Mexico favor modest expansion of sugarcane area and increased sugar production. As discussed earlier, it is not assumed that Mexico will import sugar from third nations to replenish low sugar supplies caused by large exports to the U.S. market.

TRQ sugar imports from U.S. commitments made to the World Trade Organization (WTO) and to several Free Trade Agreements (FTAs) average 1.444 million STRV. As discussed earlier, it is not assumed that TRQ import levels are increased during any year from initially established levels consistent with WTO and FTA minimum access commitments. (This assumption is maintained for the alternative as well.)

The average third-quarter U.S. raw sugar price over the projection period is 27.35 cents per pound, with a high of 33.05 cents in 2015/16. All prices are higher than the 2012/13 projected raw sugar price of 22.12 cents/lb (not shown in the table). The U.S. refining margin is projected to average 9.88 cents per pound, implying a refined beet sugar average price of 37.23 cents per pound.

Projected sugarbeet prices average $61.01 per ton for 2013/14 to 2022/23, 26.7 percent above the average for 2002/03 to 2011/12. Projected sugarcane prices for 2013/14 to 2022/23 average $44.02 per ton, 34.4 percent above the average for 2002/03 to 2011/12.

Table A-4 -- U.S. sugar long-run projections of supply and use: base and alternative specifications

Year	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Base specification - support from world prices										
					1,000 short tons, raw value					
Beginning stocks	2,216	2,136	1,818	1,738	1,817	2,041	2,186	2,197	2,121	2,035
Production	8,461	8,360	8,759	9,016	9,042	8,995	8,983	9,017	9,092	9,183
Beet sugar	4,808	4,695	5,048	5,265	5,281	5,224	5,197	5,212	5,259	5,319
Cane sugar	3,653	3,664	3,711	3,751	3,762	3,772	3,786	3,806	3,833	3,864
Total imports	3,513	3,516	3,288	3,137	3,328	3,478	3,517	3,497	3,469	3,462
TRQ	1,328	1,451	1,454	1,460	1,463	1,397	1,470	1,472	1,473	1,474
Mexico	1,725	1,605	1,374	1,217	1,405	1,621	1,586	1,566	1,536	1,528
Over-quota	0	0	0	0	0	0	0	0	0	0
Other program	450	450	450	450	450	450	450	450	450	450
Sugar syrups	10	10	10	10	10	10	10	10	10	10
Total supply	14,191	14,012	13,865	13,890	14,187	14,514	14,686	14,712	14,682	14,680
Exports	275	275	275	275	275	275	275	275	275	275
Total deliveries	11,779	11,919	11,852	11,798	11,871	12,060	12,214	12,316	12,372	12,406
Deliveries for food and beverage	11,574	11,714	11,647	11,593	11,666	11,855	12,009	12,111	12,167	12,201
Other deliveries	205	205	205	205	205	205	205	205	205	205
Total use	12,054	12,194	12,127	12,073	12,146	12,335	12,489	12,591	12,647	12,681
Ethanol	0	0	0	0	0	0	0	0	0	0
Ending stocks	2,136	1,818	1,738	1,817	2,041	2,186	2,197	2,121	2,035	1,999
Total ending stocks-to-use	17.72	14.91	14.33	15.05	16.80	17.72	17.59	16.84	16.09	15.76
					Cents per pound					
World raw sugar price	21.05	21.51	23.72	20.64	21.11	21.71	21.67	21.54	21.91	21.77
U.S. raw sugar price - 3rd quarter	24.05	29.76	33.05	28.64	25.83	24.71	24.92	26.19	27.96	28.43
Refining margin	7.97	11.47	13.10	10.96	9.01	8.19	8.32	9.12	10.14	10.49
Refined beet sugar spot price - 3rd quarter	32.01	41.23	46.15	39.59	34.84	32.90	33.24	35.30	38.10	38.92
Sugarbeet price (dollars/ton)	54.89	59.65	65.96	66.31	62.04	59.23	58.42	59.32	61.31	62.95
Sugarcane price (dollars/ton)	40.66	45.50	48.38	45.46	43.03	41.97	42.10	43.19	44.72	45.23
Alternative specification - support from domestic price support program										
					1,000 short tons, raw value					
Beginning stocks	2,092	1,921	1,302	961	872	954	1,156	1,324	1,375	1,324
Production	8,439	8,265	8,612	8,831	8,912	8,957	8,976	8,992	9,024	9,070
Beet sugar	4,801	4,669	4,984	5,169	5,223	5,247	5,249	5,247	5,258	5,281
Cane sugar	3,637	3,596	3,628	3,662	3,689	3,710	3,727	3,745	3,765	3,788
Total Imports	3,458	3,355	3,262	3,274	3,387	3,538	3,599	3,591	3,561	3,538
TRQ	1,447	1,451	1,454	1,460	1,463	1,467	1,470	1,472	1,473	1,474
Mexico	1,551	1,444	1,348	1,355	1,463	1,611	1,669	1,659	1,628	1,604
Over-quota	0	0	0	0	0	0	0	0	0	0
Other Program	450	450	450	450	450	450	450	450	450	450
Sugar syrups	10	10	10	10	10	10	10	10	10	10
Total supply	13,989	13,541	13,175	13,066	13,171	13,449	13,730	13,906	13,959	13,931
Exports	275	275	275	275	275	275	275	275	275	275
Total deliveries	11,792	11,965	11,940	11,919	11,943	12,018	12,132	12,256	12,361	12,445
Deliveries for food and beverage	11,587	11,760	11,735	11,714	11,738	11,813	11,927	12,051	12,156	12,240
Other deliveries	205	205	205	205	205	205	205	205	205	205
Total use	12,067	12,240	12,215	12,194	12,218	12,293	12,407	12,531	12,636	12,720
Ethanol	0	0	0	0	0	0	0	0	0	0
Ending stocks	1,921	1,302	961	872	954	1,156	1,324	1,375	1,324	1,211
Total ending stocks-to-use	15.92	10.63	7.87	7.15	7.81	9.40	10.67	10.97	10.47	9.52
					Cents per pound					
Minimum price-to-avoid forfeiture	20.81	20.79	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75
U.S. raw sugar price - 3rd quarter	21.49	23.80	25.69	26.31	25.74	24.55	23.78	23.61	23.89	24.47
Refining margin	7.86	11.12	13.36	14.05	13.42	12.05	11.09	10.88	11.23	11.95
Refined beet sugar spot price - 3rd quarter	29.35	34.92	39.05	40.36	39.15	36.60	34.87	34.49	35.12	36.43
Sugarbeet price (Dollars/ton)	53.48	56.29	60.66	63.11	63.34	61.97	60.24	59.30	59.33	60.08
Sugarcane price (Dollars/ton)	29.39	29.50	34.81	41.70	47.10	38.45	38.48	40.53	42.25	42.86

Source: ERS, *Sugar and Sweetener Outlook*.

Table A-5 -- U.S. sugar long-run projections of supply and use: period averages of base and alternative specifications

	Base	Alternative
	1,000 short tons, raw value	
Beginning stocks	2,030	1,328
Production	8,891	8,808
Beet sugar	5,131	5,113
Cane sugar	3,760	3,695
Florida	1,943	1,943
Louisiana	1,528	1,516
Texas	156	153
Hawaii	134	83
Total imports	3,421	3,456
TRQ	1,444	1,463
Mexico	1,516	1,533
Over-quota	0	0
Other program	450	450
Sugar syrups	10	10
Total supply	14,342	13,592
Exports	275	0
Total delveries	12,059	12,077
Deliveries for food and beverage	11,854	11,872
Reexport products	175	175
Polyhydric	10	10
Feed	20	20
Total use	12,334	12,352
Ethanol	0	0
Ending stocks	2,009	1,240
Total ending stocks-to-use (percent)	16.29	10.04
Beet sugar share of OAQ	5,446	5,454
- production as percentage of OAQ share	94.21	93.74
Cane sugar share of OAQ	4,630	4,637
- production as percentage of OAQ share	81.22	79.68
	Cents per pound	
U.S. raw sugar price - 3rd quarter	27.35	24.33
Refined beet sugar spot price - 3rd quarter	37.23	36.03
	Dollars per ton	
Sugarbeet price	61.01	59.78
Sugarcane price	44.02	38.51

Source: ERS, *Sugar and Sweetener Outlook*.

Table A-6 -- Mexico sugar and high fructose corn syrup projections of supply and use: base and alternative specifications

	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
				1,000 metric tons, raw value						
Base specification										
Beginning stocks	1,060	865	468	333	505	683	777	760	658	543
Area: hectares	731	701	690	714	739	757	745	738	736	747
Sugar Yield	8.542	8.574	8.606	8.638	8.669	8.701	8.733	8.765	8.797	8.829
Sugar production	6,240	6,012	5,939	6,170	6,409	6,585	6,506	6,465	6,472	6,593
Imports	200	200	200	200	200	200	200	200	200	200
Supply	7,500	7,077	6,607	6,702	7,114	7,468	7,483	7,424	7,330	7,335
Disappearance	5,070	5,152	5,028	5,093	5,157	5,220	5,285	5,346	5,394	5,434
Consumption	4,709	4,792	4,667	4,733	4,797	4,859	4,924	4,986	5,033	5,074
Other disappearance	360	360	360	360	360	360	360	360	360	360
Exports	1,565	1,456	1,247	1,104	1,274	1,471	1,439	1,420	1,394	1,386
Ending stocks	865	468	333	505	683	777	760	658	543	515
Stocks-to-consumption	0.184	0.098	0.071	0.107	0.142	0.160	0.154	0.132	0.108	0.101
High Fructose corn syrup	1,580	1,645	1,907	1,991	2,080	2,171	2,262	2,358	2,469	2,589
Estandar price (pesos/50 kg)	380.2	431.1	514.5	538.1	480.0	446.9	439.1	451.7	479.7	508.3
Alternative specification										
Beginning stocks	1,060	1,023	764	591	552	589	676	742	759	734
Area: hectares	731	700	685	705	730	755	763	761	758	757
Sugar yield	8.542	8.574	8.606	8.638	8.669	8.701	8.733	8.765	8.797	8.829
Sugar production	6,240	6,004	5,892	6,090	6,326	6,571	6,666	6,674	6,670	6,682
Imports	200	200	200	200	200	200	200	200	200	200
Supply	7,500	7,227	6,856	6,880	7,077	7,360	7,541	7,616	7,628	7,615
Disappearance	5,070	5,152	5,041	5,100	5,161	5,223	5,285	5,352	5,417	5,476
Consumption	4,709	4,792	4,681	4,740	4,800	4,862	4,925	4,992	5,057	5,116
Other disappearance	360	360	360	360	360	360	360	360	360	360
Exports	1,407	1,310	1,223	1,229	1,328	1,461	1,514	1,505	1,477	1,455
Ending stocks	1,023	764	591	552	589	676	742	759	734	684
Stocks-to-consumption	0.217	0.160	0.126	0.116	0.123	0.139	0.151	0.152	0.145	0.134
High Fructose corn syrup	1,580	1,645	1,894	1,985	2,076	2,168	2,261	2,353	2,447	2,549
Estandar price (pesos/50 kg)	356.2	376.7	414.9	443.5	452.6	445.1	432.1	426.4	429.9	440.3

Source: ERS, *Sugar and Sweetener Outlook*.

Table A-7 -- Mexico sugar and high fructose corn syrup projections of supply and use: period averages, base and alternative specifications

	Base	Alternative
	1,000 metric tons, raw value	
Beginning stocks	665	749
Sugar production	6,339	6,381
Imports	200	200
Supply	7,204	7,330
Disappearance	5,218	5,228
Consumption	4,857	4,867
Other disappearance	360	360
Exports	1,376	1,391
Ending stocks	611	711
Stocks-to-consumption (percent)	12.57	14.61
High fructose corn syrup	2,105	2,096
Estandar price (pesos/50 kg)	466.9	421.8

Source: ERS, *Sugar and Sweetener Outlook*.

There are no sugar loan forfeitures and there are no CCC purchases of sugar for ethanol in the projections because projected raw cane and refined beet sugar prices remain above the minimum prices to avoid forfeiture.

Sugar production in Mexico averages 6.339 million tons, raw value (MTRV), and is projected at 6.593 million MTRV in 2022/23. Area for harvest fluctuates modestly but is above 700,000 hectares in all years except 2015/16. HFCS consumption is up about a million mt over the projection period. It constitutes 33.8 percent of sweetener consumption in 2022/23, compared with 25.1 percent in 2013/14. Exports average 1.376 million MTRV. Ending stocks average about 12.57 percent of sugar consumption, considerably lower than the 21-23 percent range typically considered as optimal. An implication here is that there may be domestic pressure for late-season imports to help bridge the gap between the end of September and the start of the next harvest cycle.

An Alternative View – Support from Domestic Price Supports

There are no large differences between scenario specifications for U.S. production, consumption, and trade. Sugar and sugar crop prices are lower in the alternative, but sugar production and consumption are fairly own-price inelastic. Product and crop prices in both cases are well above costs of production and processing; therefore, there are no pressures for the exit of firms or growers from producing or processing. Sugar production in Hawaii may be an exception to the generalization, but the State is a small producer.

Although sugar prices are lower than in the base, they are still higher than in the period before FY 2010. The prices derive their strength from relatively low ending stocks relative to use. The average ratio for the period is projected at 10.04 percent. Projected ratios are as low as 7.15 percent in 2016/17 and below 8 percent in both 2015/16 and 2017/18. Low-stock situations such as these usually imply pressure to increase TRQ imports, not allowed for in this specification scenario.

The beet sector fares relatively better in the alternative case scenario. Lower stock levels imply higher refining margins, which in turn imply high refined beet sugar prices. Figure A-2 shows that in the 4 years from 2016/17 to 2019/20, beet prices are higher than in the base scenario.

Figure A-3 shows sugar supply sourcing for each of the projection years for both scenarios. In both cases, domestic production is relatively lower at the beginning of the period (lower relative prices) but soon regains modest growth. Not shown in the figure are beginning stock levels, which account for over 90 percent of the difference in total supply between the base (larger total supply) and the alternative (lower total supply).

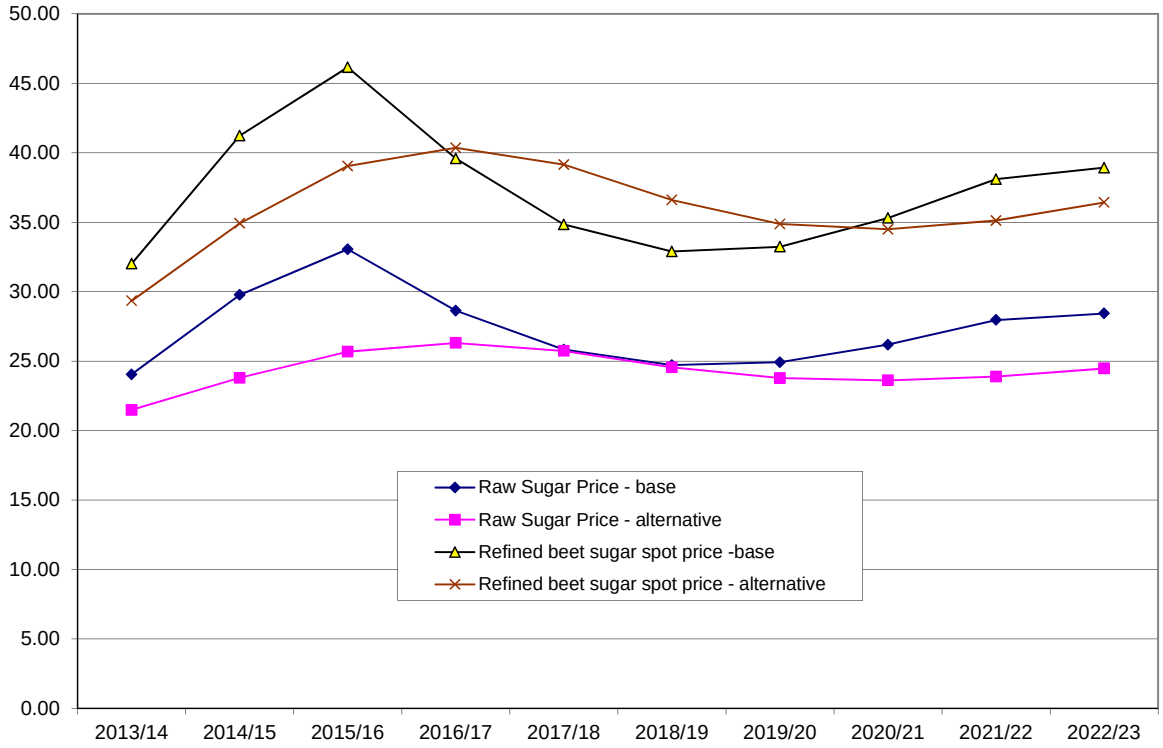
Figure A-4 shows sugar import sourcing. All significant variability comes from fluctuations in imports from Mexico, and these come in the first 4 years of the projections period. Research supports the hypothesis that Mexico sugar production adjusts to changes in prices only after a lag of at least 2 years. The fall in prices currently in evidence has its effect in these early years of the projections period, causing exports to be lower, i.e., decreasing in 2014/15 relative to 2013/14 and not significantly increasing year-over-year until 2017/18. The lowest trade level—U.S. imports from Mexico at 1.217 million STRV (same as Mexican exports at 1.104 million MTRV) in 2016/17 for the base—occurs because of replenishing of Mexican sugar stocks from their low beginning level of 333,000 MTRV.

Mexico sugar production and exports are slightly higher in the alternative specification than in the base. This may seem paradoxical because estandar prices average about 9.7 percent lower in the alternative. However, changes in harvested area are much more strongly correlated with changes in prices than with levels of those prices. Figure A-5 shows area and 2-year lagged estandar sugar prices over the projections period. A gap in area opens in 2019/20 and expands even more in 2020/21 due to base scenario price decreases from 2 years earlier, not evidenced in the alternative specification. As in the U.S. case, prices in both scenarios are much higher than corresponding production costs. Price levels close to costs could imply producer or processor exits, but are not indicated here.

Figure A-2

U.S. sugar long-run projections of third-quarter cane and beet sugar prices, base and alternative specifications

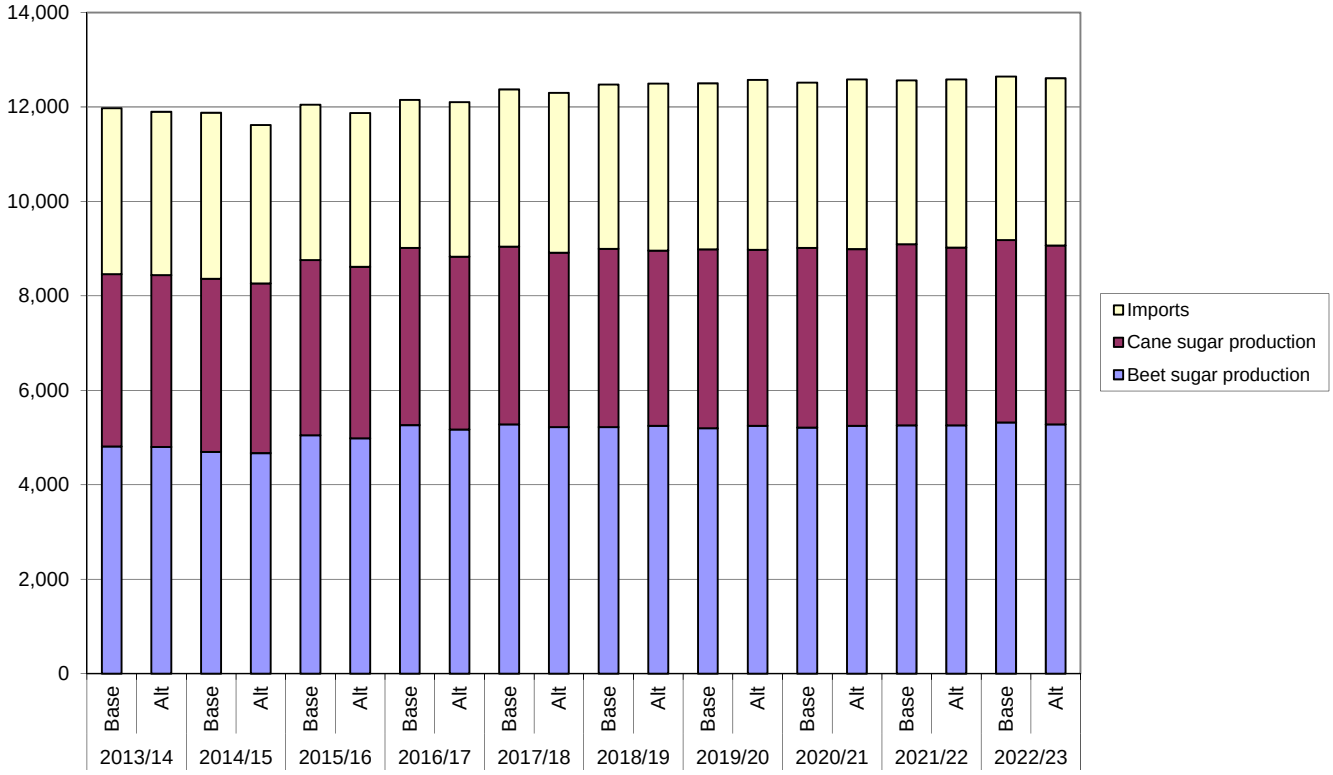
Cents per pound



Source: ERS, *Sugar and Sweetener Outlook.*

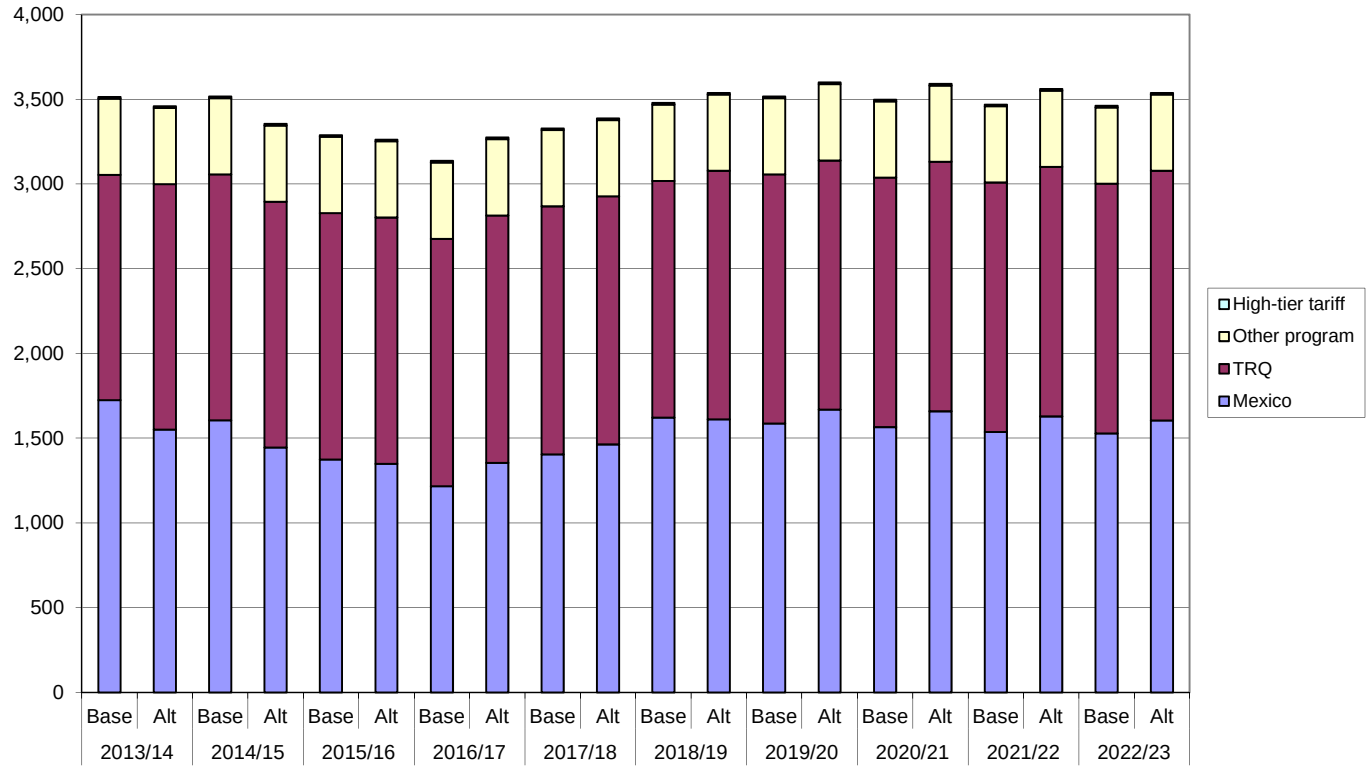
Figure A-3
U.S. sugar projections, sources of supply

1,000 short tons, raw value



Source: ERS, *Sugar and Sweetener Outlook*.

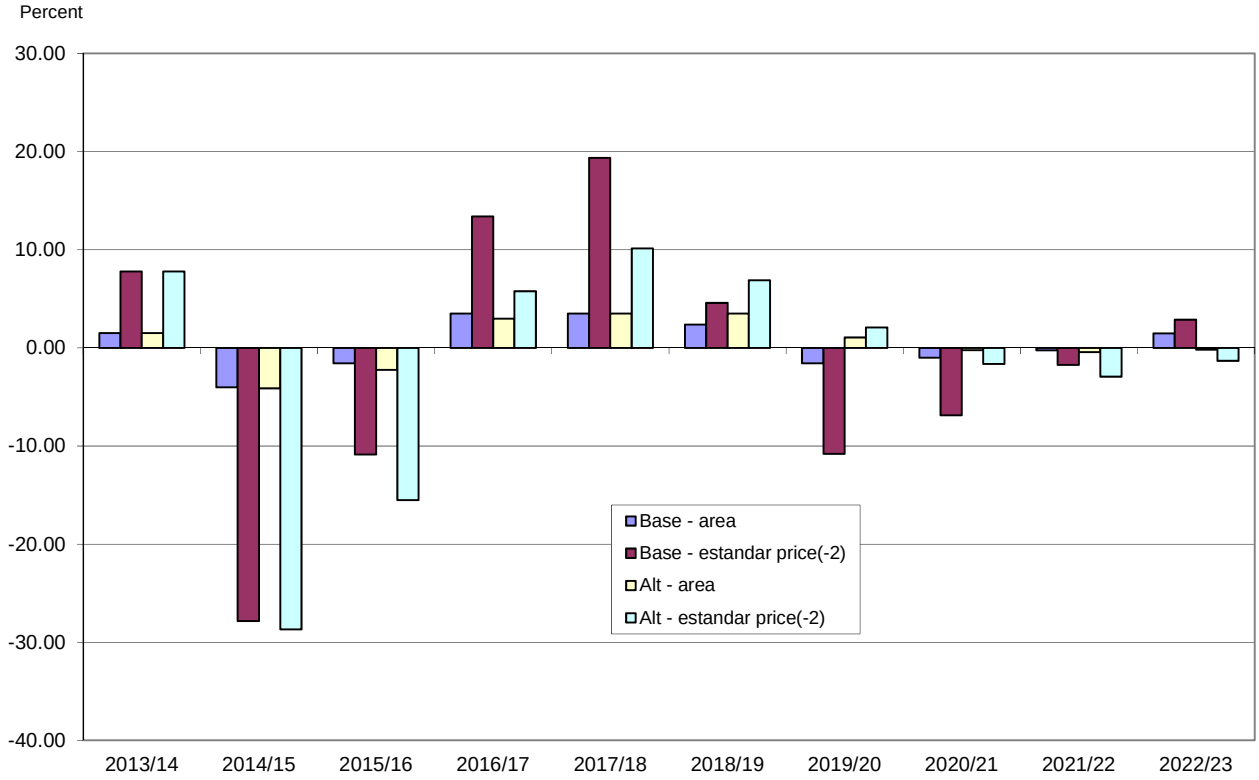
Figure A-4
U.S. sugar projections, import sourcing by type
1,000 short tons, raw value



Source: ERS, *Sugar and Sweetener Outlook*.

Figure A-5

Mexico sugar area as function of lagged changes in estandar sugar price: base and alternative scenarios



Source: ERS, *Sugar and Sweetener Outlook.*

Conclusion: Expected Economic Effects of the 2008 Act

The scenarios described in this chapter constitute the USDA base and alternative long-term sugar supply and use projections for February 2013. One of the chief uses of the long-term projections is to estimate Federal Government budget expense from U.S. sugar program operations. These projections imply no sugar loan forfeitures or CCC purchases of sugar for ethanol because raw cane and refined beet sugar prices are above the minimum prices to avoid forfeiture for the entire projections period. These conclusions appear safe in the base because world prices projected by the OECD and FAO are above sugar loan rate levels and are also above minimum price levels to avoid forfeiture.

The projection results suggest caution. Low projected stocks for Mexico in both specifications and for the United States in the alternative specification suggest the likelihood of pressures to import sugar, probably through TRQ increases in both countries. Additional sugar into Mexico could in turn imply more exports of sugar into the United States.