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Consequences of further opening of the Korean dairy market

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Abstract

This paper develops a simulation of Korean dairy policy that is tailored to the data, institutions, and policies in South Korea. It compares potential effects of changes in trade and domestic policy to baseline projections to 2015. Beverage milk continues to be supplied from domestic sources, implying imports compete in the manufacture of tradable products. We model manufactured dairy product supply, demand, and trade on a milk fat and non-fat-solid component basis reflecting product fungibility over the 10-year horizon used for our trade policy analysis. We find that if the domestic price support is removed with no change in trade policy, the market price of raw milk falls by about 2% and raw milk production declines by 4.5%. Under substantial tariff cuts of 30–40% with no effective change in domestic dairy policy, Korean fat and non-fat-solid prices fall by 7% and 11%, fat and non-fat-solid imports rise by 9% and 7% and Korea raw milk production falls by about 2% relative to the baseline. Prices of Korean farmer-owned dairy inputs, labor, and capital fall by about 1%.

Keywords: Dairy; Korea; Trade; Policy

Introduction

In recent decades, Korea has been a growing agricultural import market as its economy has expanded and its markets have opened somewhat. At the same time, many

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Korean agricultural tariffs remain high and tariff rate quotas restrict imports for many products. Dairy products are among those for which relatively high trade barriers remain.

This paper uses detailed information about domestic dairy policies and institutions, internal market developments, and trade policies in Korea to assess the likely effects of policy changes for Korean dairy products (Song and Sumner, 1999). Our model compares the future effects of trade policy changes to baseline projection under which Korean demand for dairy products continues to expand. We incorporate the important feature that use of fluid beverage milk will continue to be supplied by the domestic dairy industry. That means that imports compete with the domestic milk production in excess of fluid use that is available for manufacture of tradable products.

We model processed milk product supply, demand, and trade on milk component basis to reflect the fungibility of products in the 10-year horizon that is the focus of our trade policy analysis. More import access for imported dairy products implies lower prices for consumers and Korean producers, and lower government support implies lower producer prices and smaller production. We quantify the magnitude of these effects, and the implications for domestic production.

Background on the Korean dairy supply, demand, prices, and policy

Production and consumption

Dairy products were introduced into Korea as "western" foods in recent decades. The domestic dairy production industry began in earnest in 1962 when South Korea, under state sponsorship, imported dairy cows. The industry, which produced 48,000 tons of raw milk in 1970, has grown to produce 2.5 million tons of raw milk in 2002. The number of dairy cows increased rapidly until the early 1990s. Since then, increased output is due mainly to rapid increases in production per cow, which has grown by 2% per year and is now about 83% of the U.S. average. Herd size per farm has also grown rapidly from under 10 cows per farm in 1985 to 47 cows per farm in 2002.

With these changes, average cost of production has fallen by 30% in real terms since 1983. Feed costs comprise about 51% of total production costs, which is similar to other regions, such as California, with intensive concentrate-based rations. Imported feed accounts for about 70% of livestock feed in Korea, implying that the cost of imported feeds accounts for almost 36% of total costs.

Milk consumption in Korea has also shown rapid expansion. During the period 1975 through 2002, total consumption of dairy products increased by almost 20 times, from 162,000 tons to 3.06 million tons (in raw milk equivalent terms). Per capita consumption grew from 4.6 kg to 64.2 kg. Until the middle of the 1990s, more than 70% of total consumption was in fluid use, but by 2003, non-fluid use has increased to 50% of total consumption. Fluid milk consumption is supplied solely from domestic sources, while about one-half of non-fluid consumption is supplied from imports.

Pricing and marketing of raw milk

Dairy production is heavily supported by the Korean government. The producer support equivalent for Korean dairy was 68% in 2003 (OECD, 2004). Behind high tariffs and tight tariff rate quotas, the government also provided a variety of domestic support measures. Most importantly, the government requires that raw milk be purchased from farmers at prices above the competitive market price. These prices are set in reference to the production costs, so that, on average, farmers are guaranteed a positive net margin. Although farm efficiency has improved, the guaranteed price has never been adjusted downward.

An industry "Dairy Committee," authorized in 1999, replaced the direct government role in administering domestic dairy policy, but the essence of the policy did not change. The Dairy Committee sold milk in excess of that used for fluid products to processors through open bidding or forward contracts at prices below the guaranteed farm price. With mounting financial burden, at the end of 2002 the Dairy Committee began an informal two-tier price policy, which pays farmers a price lower than the government-set base price for the raw milk that exceeds the farmer's "normal" production (based on previous years' production).

In 2005, policy remained unsettled and adjustments are under way. These include introduction of formal marketing quotas and a gradual decline in the price of above-quota production. However, the fixed government-set price for milk used for fluid products remains a feature of the expected policy regimes. Below we model the future domestic policy as a two-price system and abstract from details of program administration.

Trade policy and import patterns

Until 1994, Korea maintained strict import quotas for most dairy products. With the Uruguay Round WTO agreement, Korea formally opened the dairy market, providing minimum access (MMA) quotas, relatively low within-quota tariff rates, and very high over-quota tariff rates. Annual imports ranging 4–9% of total domestic consumption in the pre-WTO era increased sharply to 19% by 1996. Import growth has been slow since then (up to 21% of domestic consumption in 2002). Rapidly increasing import items include cheese and formulated infant powder. Cheese imports grew at an annual rate of 19% since 1995. In 2004, cheese accounted for almost 40% of all dairy imports by value.

All imported dairy products are subject to either a single rate of tariff or a two-tier tariff rate quota system. During the 10-year Uruguay round implementation period (1995–2004), over-quota tariff rates fell each year, but the lower within-quota tariffs did not fall. The tariff rates vary significantly across products. For example, skim milk powder has a tight quota for which the lower tariff of 40% and an over-quota tariff of 176% apply (in 2004). Butter has an 89% over-quota tariff. At the other end of the spectrum, formulated butter (which is about 70% milk fat) has a single tariff of 8%. Cheese imports have a single tariff of 36%. These tariff patterns account for the high imports of cheese and formulated butter relative to the imports of products such as skim milk powder and butter. For example, in 2003, Korea imported only 1380 tons of butter, but 13,161 tons of formulated butter.

All important dairy products imported under a tariff rate quota far exceeded the quota quantity and had a substantial proportion of imports paying the high tariff rates. This means we can model the import barriers effectively as ad valorem tariffs using the high tariff rate as the marginal rate for the imports of the products that exceed the MMA amount. However, given the tiny quota quantities and high over-quota tariffs, imports of butter and skim milk powder remain small relative to the imports of similar manufactured dairy products and relative to overall consumption. The import data suggest clearly that import demand for these high-tariff products shifted to similar products such as formulated butter, whey powder, and mixed powder that face much lower import barriers. With the substitution across products, demand may be best thought of as associated with dairy components such as fat and non-fat solids that are used to manufacture final products, rather than specific final products themselves. Based on this observation, we pursue our simulation modeling on such a component basis.

Modeling Korean dairy markets, policy, and trade prospects

The simulation model necessarily abstracts from many details, but maintains key market features, domestic supply of fluid milk and two domestic raw milk prices, separate demand for raw milk for fluid use and non-fluid use. We begin with three quantities of outputs, fluid milk (Q_{fl}), the fat component (Q_{fat}), and non-fat-solid (NFS) component (Q_{nfs}) of manufactured dairy products. Domestic production of raw milk (X) is sold at the high price, p^{H}, for fluid use (X_{fl}) and at the low price, p^{L}, for non-fluid use(X_{pro}), and farmers receive a weighted average of these prices. Fixed proportions of fat (α_{fat}) and NFS (α_{nfs}) produced from raw milk are 4% and 9%, respectively. Korea is a small country in the world market and component imports enter the country under the ad valorem tariffs.

The following system describes the Korean dairy market:

$$Q_i = D^i(p_i; \boldsymbol{z_i}), \quad i = \text{fl, fat, nfs} \tag{1}$$

$$p_{\text{fl}} = (1+\omega)p^{\text{H}} \tag{2}$$

$$p_j = (1+\pi_j)\hat{p}_j, \quad j = \text{fat, nfs} \tag{3}$$

$$Q_{\text{fl}} = X_{\text{fl}} \tag{4}$$

$$Q_j = \alpha_j X_{\text{pro}} + M_j, \quad j = \text{fat, nfs} \tag{5}$$

$$X = X_{\text{fl}} + X_{\text{pro}} \tag{6}$$

$$p^X(p^{\text{H}}, p^{\text{L}}) = \frac{\partial C(\boldsymbol{w}, X)}{\partial X} \tag{7}$$

$$p^{\text{L}} = \sum_j \alpha_j p_j, \quad j = \text{fat, nfs} \tag{8}$$

$$v_n = \frac{\partial C(\boldsymbol{w}, X)}{\partial w_n}, \quad n = 1, \ldots, N \tag{9}$$

$$w_n = G(v_n; \boldsymbol{h}_n), \quad n = 1, \ldots, N \tag{10}$$

Eq. (1) describes output demand, where $\boldsymbol{z_i}$ represents a vector of demand shifters. Eq. (2) determines the market price for fluid milk (p_{fl}) assuming that p_{fl} is the constant proportion of the price of raw milk with ω representing the marketing margin. Eq. (3) determines the market prices for components, p_{fat} and p_{nfs}, as a function of the imported price, $\hat{p}_j$, and the ad valorem tariff, π_j. Eqs. (4) and (5) represent the market equilibrium and Eq. (6) is the identity for domestic production. In Eq. (7), the marginal cost of raw milk is equated to the weighted average of the milk prices (p^X). Eq. (8) defines the low milk price (p^{L}) as the sum of component values (p^{H} is pre-determined). Eqs. (9) and (10) together describe the input market equilibrium with a set of derived input demand and supply equations, where v_n and w_n are the quantity and price of input n and $\boldsymbol{h}_n$ is a vector of input supply shifters.

Totally differentiating Eqs. (1)–(10) and using log differentials to convert to elasticity form yields the following linear elasticity model (Muth, 1964; Sumner et al., 1999)

$$EQ_i = \sum_k \eta_{ik} Ep_k + \lambda_i z_i, \qquad k = \text{fl, fat, nfs}, \quad i = \text{fl, fat, nfs} \tag{1$'$}$$

$$Ep_{\text{fl}} = Ep^{\text{H}} \tag{2$'$}$$

$$Ep_j = E\hat{\pi}_j, \quad j = \text{fat, nfs} \tag{3$'$}$$

$$EQ_{\text{fl}} = EX_{\text{fl}} \tag{4$'$}$$

$$EQ_j = s_j^Q EX_{\text{pro}} + (1 - s_j^Q) EM_j, \quad j = \text{fat, nfs} \tag{5$'$}$$

$$EX = s_{\text{fl}}^X EX_{\text{fl}} + (1 - s_{\text{fl}}^X) EX_{\text{pro}} \tag{6$'$}$$

$$Ep^X = \sum_n \gamma_n Ew_n \tag{7$'$}$$

$$Ep^{\text{L}} = s_{\text{fat}}^p Ep_{\text{fat}} + (1 - s_{\text{fat}}^p) Ep_{\text{nfs}} \tag{8$'$}$$

$$Ev_n = \sum_{k=1,\ldots,N} \gamma_k \sigma_{nk} Ew_k + EX, \quad n = 1, \ldots, N \tag{9$'$}$$

$$Ew_n = \rho_n Ev_n + \boldsymbol{\mu}_n E\boldsymbol{h}_n, \quad n = 1, \ldots, N \tag{10$'$}$$

The following notation is used: operator E represents a proportional change; η and λ with an appropriate subscript represent demand elasticities with respect to the own price and to each demand shifter; $\hat{\pi}_j = (1 + \pi_j)$; s with an appropriate subscript and superscript describes a share, i.e., $s_{\text{fat}}^Q = \alpha_{\text{fat}} X_{\text{pro}}/Q_{\text{fat}}$, $s_{\text{nfs}}^Q = \alpha_{\text{nfs}} X_{\text{pro}}/Q_{\text{nfs}}$, $s_{\text{fl}}^X = X_{\text{fl}}/X$, and $s_{\text{fat}}^p = \alpha_{\text{fat}} p_{\text{fat}}/p^{\text{L}}$; γ_k is the cost share of input k; σ_{nk} is the Allen elasticity of substitution between inputs n and k; ρ_n is the inverse supply elasticity of input n; and $\boldsymbol{\mu}_n$ is a vector of supply elasticities related to $\boldsymbol{h}_n$.

Baseline and parameter specifications

We consider the impact of reduced import barriers in the year 2015, which is the end of the implementation period for trade policy changes. Of course, with negotiations underway it is impossible to know the date at which policy changes will be fully implemented, but based on WTO negotiations so far and we believe this date to be a reasonable estimate (WTO, 2005). Baseline projections for 2015 rely on two sources. We extend by one year published Food and Agricultural Policy Research Institute (FAPRI) baseline projection for Korea (FAPRI, 2005) and we apply our own projections, based on analysis of recent Korean data and trends, for information unavailable from FAPRI.

Table 1 presents required baseline projections and model parameter values. Outputs include milk components, and, of course, neither supply and demand parameters nor quantities and prices are directly available for components. Hence, we were required to infer the component information from available data and parameters on raw milk and milk products.

To arrive at price elasticities of output demand, η_{ik}, we first estimated product demand equations for dairy products including fluid milk, cheese, butter, and infant formula (for details, see Lee et al., 2005). While we used our own estimate, −1.37, for the own demand

Table 1
Parameters and baseline projections specification

Output and raw milk related parameters			
Output demand elasticity matrix (η)			
	Fluid	Fat	NFS
Fluid	−1.37	0	0
Fat	0	−0.424	−0.083
NFS	0	−0.105	−0.172
Quantity shares			
	$s^{Q}_{\text{fat}} = 0.15$	$s^{Q}_{\text{nfs}} = 0.12$	$s^{X}_{\text{fl}} = 0.93$
Value shares			
	$s^{P}_{\text{fat}} = 0.311$		

Input related parameters		
Factor cost shares (γ)		
Labor = 0.18	Feed = 0.50	Capital = 0.32
Input substitution (σ)		
Labor/feed = 0.1	Labor/capital = 1.0	Capital/feed = 0.3
Inverse input supply elasticity (ρ)		
Labor = 0.67	Feed = 0.25	Capital = 0.5

2003 Benchmark and 2015 projected baseline data		
	Year 2003[a]	Year 2015
Raw milk production (tons)	2,366,000	2,641,000
Fluid milk consumption (tons)	2,023,000	2,451,000
Fat consumption (tons)	39,336	50,410
NFS consumption (tons)	113,304	141,345
Price for fat ($/ton)		$2,450
Price for NFS ($/ton)		$2,400
Tariff for imported fat	30.5%	30.5%
Tariff for imported NFS	41.9%	41.9%

Sources: Authors' econometric estimates, MAF data, and FAPRI projections.
[a] Data under 2003 are reported when they are relevant to the construction of the baseline data.

elasticity for fluid milk, we had to convert the product-specific elasticities into component elasticities using share data (Alston et al., 2005).[2] In specifying the cross demand elasticities, zero substitutions between fluid milk and the components are assumed. Demand for fluid milk represents direct consumption for drinking, whereas the components are demanded by intermediate firms that manufacture dairy and other food products. This suggests relatively low substitution between the components used in processed product and those in beverage milk, and for simplicity, we assumed zero substitution ($\eta_{\text{fl,fat}} = \eta_{\text{fl,nfs}} = 0$) (Heien and Wessells, 1988). We also assume that these output demand elasticities are constant over time and not a function of the policy shifts.

Our definition of fluid milk includes drinking as well as fermented milk. Fermented milk that is consumed widely in Korea is made directly from raw milk and accounts for about 25% of fluid milk consumption in raw milk equivalent terms. To calculate the share of fluid milk, we added fermented milk to FAPRI's fluid milk projections under the assumption that fermented milk maintains its 25% share of all fluid milk in 2015.

[2] The estimate of −1.37 is highly elastic compared to −0.63 by Heien and Wessells (1988) who estimated U.S. demand, but is in the similar magnitude compared to −1.48 by Shin and Jung (2003) who used Korean data.

The shares of domestically produced components (s^Q_{fat} and s^Q_{nfs}) are calculated from data on the amount and component composition of each imported product and the amount of domestic raw milk components used for processed products.[3] To calculate the value share of each component in non-fluid milk price (s^p_{fat} and s^p_{nfs}) we used the FAPRI butter price projection for fat and the FAPRI non-fat dry milk price projection for NFS.[4]

Factor cost shares, γ_k, are constructed using 2003 input data (MAF and Korea Dairy Committee, 2003). However, little information is available on the Allen elasticities of input substitution, σ_{nk}. We expect little input substitution between feed and other inputs, and set the substitution parameters related to feed relatively low (see Table 1).[5] Finally, the model requires supply elasticities for inputs into dairy production (ρ_n^{-1}). Given the small share of the dairy sector in Korean agriculture and long run adjustments considered here, we may expect relatively elastic input supply curves facing the dairy industry. For instance, homogeneous farm labor means zero adjustment costs associated with shifting across industries and in turn almost perfectly elastic labor supply in the dairy market. The same consideration applies to capital inputs. Given such theoretical consideration, we set input supply to be relatively elastic, 1.5 for labor and 2.0 for capital. We used a substantially large feed supply elasticity of 4.0 facing the dairy industry because Korea is a small country importer and most feed is imported. We assume that the parameters related to inputs do not change over time and are not functions of the trade policies.

To arrive at component tariffs, using the marginal tariff rate which was applied to each of the 13 imported products in 2003, we calculated the average component tariff weighted by the component share (for details, see Lee et al., 2005).

Policy scenarios

We examine two trade policy scenarios that allow for additional import access to the Korean market in 2015 with no change in domestic policy and one domestic policy scenario that eliminates domestic price support with no change in trade policy. The first two are labeled as the "Doha scenario" and the "Free trade scenario" and the third as the "Domestic reform."

Under the Doha scenario, Korea's high over-quota dairy product tariffs decline by 50% by 2015 and the much lower within quota tariffs and single tariffs decline by 25% by 2015. This scenario is consistent with the kind of formulas under discussion in the current negotiations under which the higher tariffs will be cut most (WTO, 2005; Jean et al., 2005). The free trade scenario is provided for comparison as benchmark for what would be expected if Korea were to completely open its border for dairy product imports with zero tariffs.

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[3] s^Q_{fat} $(=\alpha_{\text{fat}}X_{\text{pro}}/Q_{\text{fat}})$ is calculated by setting $Q_{\text{fat}} = (\alpha_{\text{fat}}X_{\text{pro}} + \sum_i a_i g_i)$ where a_i and g_i represent the fat ratio and the total imports of product i. First, to calculate Q_{fat}, we considered 13 dairy products using 2003 import data. To project this into 2015, we used FAPRI information. FAPRI projects consumption of only four processed products, butter, cheese, nonfat dry milk, and whole milk powder. We converted this into component consumption and calculated the rate of change in component consumption. We then applied these rates of change to our 2003 component consumption. The share s^Q_{nfs} is calculated using the same method (for detail, refer to Lee et al., 2005).

[4] To obtain the fat value, FAPRI's projected butter price was inflated by (1/0.85) because butter is roughly 85% fat and 15% water. Once p_{fat} and p_{nfs} are obtained, based on p^{L} $(=0.04p_{\text{fat}}+0.09p_{\text{nfs}})$, the component value shares (e.g., $s^p_{\text{fat}} = \alpha_{\text{fat}}p_{\text{fat}}/p^{\text{L}}$) can be easily calculated.

[5] Hoque and Adelaja (1984) estimated the Allen elasticities of input substitution in US milk production. Their estimates were 0.08 for labor and feed, 0.27 for feed and capital, and 2.94 for labor and capital. We used their estimates as guidance.

These scenarios impose no changes in the government-set fluid milk price policy in Korea. We expect such a policy to be maintained under WTO rules for reducing the aggregate measure of support (AMS) or under the ‘‘blue box’’ (WTO, 2004; WTO, 2005).

To translate the assumed reductions in product tariffs into reductions in component tariff and implied price declines for fat and NFS in Korea, we calculated the component tariff rates as weighted averages of product tariffs (weighted by component shares in each product). With a 50% cut for the high tariffs and a 25% cut for the low tariffs, the resulting component tariffs in 2015 are 20.9% for fat and 25.9% for NFS. This is equivalent to a 31.5% decline in the implied tariff for fat and 39% decline in the implied tariff for NFS from the current (2004) level of tariffs.

Although we are mainly focused on trade policy, one important question involving the Korean dairy market concerns any possible reform of the domestic price support policy. To gain some insight on this issue, we also investigate the regime of no domestic price policy by asking how the market variables would change if the government does not fix the price of raw milk. Note that the small country assumption implies that component prices (and thus p^{L}) are insulated from any changes in the domestic market. Thus, any domestic policy shock, for instance, a change in p^{H}, would affect output and import quantities (X, X_{pro}, and M_i), but not p_{fat} and p_{nfs}.

Simulation results

Table 2 reports the simulation results presented as percentage changes from the baseline projected values. We focus on the Doha scenario, with the free trade scenario provided for comparison. The Doha tariff reductions cause a 7.3% reduction of the fat component price and 11.4% reduction of the NFS price in Korea through Eq. (3′). Use of fat for manufactured products increases by 4% and use of NFS increases by 2.7% through Eq. (1′). The price of raw milk used for manufactured products falls by 10.1% as determined by the reduced prices of imported components. Of course, the price of raw milk used in fluid products is set by the government and does not change.

Domestic raw milk production falls only modestly, by 1.8%. With constant fluid milk consumption and most domestic milk used for fluid products, the decline in raw milk production implies a significant decline in domestic raw milk used for manufactured products and for the Doha scenario this decline is 25.3%. Reduction in raw milk used for manufactured products and increased use of overall milk fat and NFS for manufactured products imply that component imports must increase. Our results indicate that imports of fat increase by 9.2% and imports of NFS increase by 6.6%.

Changes in component quantity and price under the Doha scenario indicate that the implied own price demand elasticities for fat and NFS are -0.55 and -0.24 (these differ little under the free trade scenario). Likewise, the implied raw milk supply elasticity, using the implied changes in the weighted average of raw milk prices, was 2.55, which is elastic, as expected in the long run.

Although our Doha scenario imposes significant tariff reductions, the effects on input market prices and quantities are modest. Use of each input falls by about 1.8%. The model implies a decline of about 1% in the prices of labor and capital used for dairy production. These inputs are supplied by farmers and price declines imply the magnitude of the impact on farm income. Such modest changes are consistent with the importance of the use of raw milk in fluid products for which there is no price change.

Table 2
Simulation results

	Variables	Proportional change in 2015		
		Trade reform with no change in domestic policy		Domestic reform with no change in trade policy[c]
		Doha scenario[a]	Free trade scenario[b]	
Quantity use	Fluid milk	0	0	0.027
	Fat	0.040	0.125	0
	NFS	0.027	0.076	0
Prices	Fluid milk	0	0	−0.019
	Fat	−0.073	−0.237	0
	NFS	−0114	−0.296	0
Raw milk variables	Raw milk production	−0.018	−0.049	−0.045
	Raw milk for fluid use	0	0	0.027
	Raw milk for processed use	−0.253	−0.694	−1.0
	Low price of raw milk	−0.101	−0.278	0
Component imports	Fat	0.092	0.270	0.176
	NFS	0.066	0.181	0.136
Input demand	Labor	−0.017	−0.046	−0.042
	Feed	−0.018	−0.050	−0.046
	Capital	−0.018	−0.048	−0.045
Input prices	Labor	−0.011	−0.031	−0.028
	Feed	−0.005	−0.013	−0.012
	Capital	−0.009	−0.024	−0.022

[a] High over-quota dairy product tariffs decline by 50% and the much lower within quota tariffs and single tariffs decline by 25% by 2015.
[b] Zero tariffs are imposed.
[c] Domestic price support for raw milk is eliminated.

As expected, complete free trade causes larger impacts on the Korean dairy economy than does the partial liberalization of the Doha scenario. Elimination of tariffs from manufactured dairy products implies the price declines of 23.7% for milk fat and 29.6% for NFS. In this case the import of fat rises by 27% and the import of NFS rises by 18.1%. The quantity of raw milk used for manufactured products falls by 69.4% and the price of raw milk used for manufactured products falls by 27.8%. Despite these large shifts in percentage terms, the quantity of raw milk produced falls by only 4.9%. Even in the free trade scenario, the prices of farmer supplied inputs, labor and capital, fall by modest 3.1% and 2.4%.

Our third scenario involves domestic policy reform. In the context of our model, domestic policy reform can be equivalently viewed as how much the government lowers the high milk price to achieve the price level that would prevail under no price policy. As the government reduces high milk price support, the most important effect would be the reduction in the amount of raw milk for processed use and the single price in the market would be achieved when this quantity of processed raw milk becomes zero. This is because the fluid market will almost surely continue to obtain its supply only from the domestic source. Therefore, the scenario of eliminating domestic price support can be incorporated by setting the processed raw milk to be zero, or equivalently setting domestic production equal to domestic fluid use. As reported in Table 2.

Table 3
Sensitivity analysis

	Input supply elasticity		Simulation results under alternative elasticity			
	Initial value	Alternative value	Raw milk production	Raw milk for processed use	Imports of fat	Imports of NFS
Simulation results at initial input supply elasticities[a]			−0.018	−0.253	0.092	0.066
Labor	1.5	1	−0.016	−0.226	0.087	0.062
		2	−0.019	−0.272	0.096	0.068
Feed	4	2	−0.015	−0.216	0.086	0.060
		6	−0.023	−0.334	0.107	0.077
Capital	2	1	−0.013	−0.188	0.081	0.057
		3	−0.021	−0.294	0.099	0.071

[a] These are provided for reference purposes.

Our results in Table 2 indicate that the market price for raw milk in the absence of price support policy would be 2% lower than the government-fixed price and raw milk production would decrease by 4.5%, suggesting that the resulting change may not be drastic.

Finally, a discussion concerning sensitivity analysis is in order. The specification of parameters was guided by substantial empirical information, except for elasticities related to input supplies and input substitution. In light of this, sensitivity analysis is particularly relevant to these input supply elasticities. We investigated a range of values around the current parameter value for each input elasticity, and the simulation results are summarized in Table 3 for selected key variables. In general, we expect that higher (lower) input supply elasticities entail larger (smaller) effects. In our sensitivity analysis, we altered the input supply elasticities by 33% for labor and 50% for capital and feed. Among all variables, raw milk production tends to be affected most in proportional terms, either increasing or decreasing by at maximum 30% for the ranges of input elasticities investigated. We also conducted the similar analysis with the input substitution elasticities. However, substantial changes in input substitution elasticities entailed little changes in simulation results. Thus, we do not report these results in the table.

Concluding remarks

Korean dairy product consumption has grown rapidly for several decades and this growth is expected to continue. This paper has developed and applied a model of South Korean dairy trade policy reform built upon detailed considerations of Korean dairy data and trends, market institutions, and government policy. The key results are that liberalization would cause significant increases in imports, lower prices of processed dairy products for Korean consumers, but relatively small reductions in returns to resources owned by Korean dairy farmers. Korean dairy farmers are expected to continue to supply the growing market for beverage milk and this helps to reduce the impact of additional import access.

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