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Estimating Restrictiveness of SPS Measures for China's Dairy Imports

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Abstract

China has strengthened dairy food safety management with both industrial and trade policies since the melamine incident of 2008. Sanitary and Phytosanitary (SPS) measures constitute the majority of non-tariff measures (NTMs) for China's dairy imports. Both Trade Restrictiveness Indexes (TRIs) and Overall Trade Restrictiveness Indexes (OTRIs) pertaining to SPS measures are greater than tariff rates for China's dairy imports. The top ten countries that export dairy to China experienced different levels of market access barriers, depending on whether they export concentrated milk or cream. SPS related measures are essential for China to develop a safe dairy industry. Supplying China with safe and high quality dairy goods is the best method for dairy exporters to overcome barriers of China's SPS measures.

Keywords: China, dairy, imports, SPS Measures, AVEs, Import Demand Elasticity, TRI, OTRI, MA-OTRI

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Introduction

Dairy food safety has consistently been a key issue for China's dairy industry since the melamine incident of 2008(Qiao et al. 2010; Xiu and Klein 2010; Yu 2012; Jia et al. 2012; Jia et al. 2014). As a result, the Chinese government has regulated the dairy sector by adopting both industrial and trade policies to ensure a sufficient and safe dairy supply. The government continues to strengthen quality and safety inspection of dairy products, regulate dairy market entrance, encourage mergers and acquisitions of dairy firms, and increase investment in research and development (R&D) of dairy sciences. China also supports standard and large scale dairy production with financial assistance in cow breeding, artificial insemination, alfalfa cropping, cow insurance, cow ranch construction, and replacement of milking equipment.

Generally speaking, China has adopted a comparative-advantage-following (CAF) policy in dairy trade to increase dairy imports from the international market. China does not possess a natural endowment advantage in dairy production due to land and water scarcities. China also does not have a comparative advantage in dairy production because currently most dairy farms are small scale and less competitive.

However, to ensure dairy food safety, China has issued many SPS related domestic laws and regulations, which negatively impacts dairy imports. This paper aims to quantify the impact of SPS measures on China's dairy imports by using a trade restrictiveness index model. The next section reviews previous literature regarding methods for assessing trade policies and quantifying SPS measures. Section three describes China's dairy production, consumption, and trade. Section four lists SPS measures for China's dairy imports. Section five explains the suitability of the trade restrictiveness index model and introduces data sources. Section six presents Trade Restrictiveness Indexes (TRIs), Overall Trade Restrictiveness Indexes (OTRIs) and Market Access Overall Trade Restrictiveness Indexes (MA-OTRIs) for China's dairy imports for three critical years. Section seven discusses the results and concludes the paper.

Literature Review

Assessment Methods of Trade Policies

Classical trade theories conclude that free trade is a win-win game for both exporting and importing countries. Free trade enhances specialization, leads to efficient resources allocation, increases production, and provides consumers with more choices and higher levels of consumption utility. Though free trade is beneficial, there are many reasons a country will implement trade policies to restrict exports or imports. For instance, trade policies can protect domestic production, ensure industrial security and food safety, increase environmental quality, support vulnerable groups, raising incomes of interest groups, influence terms of trade, safeguard the health of people, animals and plants, etc. In general, trade policies can be categorized into three types: export promotion, market access barrier, and domestic support.

Quantitative methods for trade policy analysis include inventory measure, price comparison, ex-post econometric regression, and ex-ante simulation (UNCTAD 2013). Each of these methods has its merits and drawbacks. The inventory measure describes coverage ratios and trends of

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trade policies, without considering character differences of trade measures. Comparing the prices of a traded good can reveal how big the trade cost is between the exporting and importing country. However, price comparison may be inaccurate in estimating restrictiveness of trade polices because other factors, such as distance and preferences, also affect trade costs. The ex-post regression method typically implements a gravity model to estimate the impact of trade measures on trade flows while controlling for variables such as gross domestic product, factors representing comparative advantage, distance, language, cultural barrier, and border. However, the results of this ex-post method might not help to inform future trade policies. The ex-ante simulation method is suitable for assessing the impact of newly implemented policies on trade flows without sufficient data for ex-post analysis. Simulation analysis can be performed in a partial or general equilibrium setting. However, coefficients and elasticities in the ex-ante simulation are typically borrowed from previous work, which are not always available (WTO and UNCTAD 2013).

Tariff liberalization alone has generally proven unsuccessful in providing full market access. NTMs play a key role when considering the degree of free trade as NTMs restrict market access (UNCTAD 2013).NTMs are difficult to quantify because they are specific to particular commodity and can differ between countries. As a result, researchers estimate the ad valorem equivalent (AVE) of non-tariff barriers. However, ad valorem tariff rates and AVEs of NTMs alone do not fully represent the restrictiveness of trade policies directly because import demand elasticities also play a key role in determining trade restrictiveness. A trade barrier will not have a substantial impact on an imported good if the good is a necessity to consumers in an importing country (Kee et al. 2009).

Assessment Methods of SPS Measures

Previous literature explored several ways to assess the impacts of SPS measures on trade. Engler et al. (2012) constructed a stringency index of SPS measures and quality-related standards for Chilean fresh fruit exports. Interviews with export representatives were conducted to obtain information on all SPS measures. Grant et al. (2015) developed a novel data base of SPS treatment and used a product-level gravity model to assess the effect of SPS requirements imposed by importing countries on US exports of nine fresh fruits and vegetables. Rich et al. (2009) established a system dynamics model to examine the feasibility of a proposed SPS certification system under a number of scenarios. Neeliah et al. (2013) used firm-level surveys and in-depth interviews in assessing the relevance of the European Union (EU) SPS measures to the Mauritian food sector. Drogué and DeMaria (2012) built a similarity index of Maximum Residue Levels (MRLs) in assessing the impact of pesticide residues on apple and pear trade between thirty-eight exporting countries and forty importing countries.

Estimation results of the impacts of SPS measures on trade flows differ widely. Crivelli and Groschl (2012) estimated a Heckman selection model at the HS4 disaggregated level and found that SPS measures constitute barriers to agricultural trade consistently to all exporters. However, their results show that conditional on market entry SPS measures contribute to trade positively. Fontagne et al. (2015) implemented the specific trade concerns (STCs) to capture the restrictiveness of product standards. In their findings, SPS concerns not only discourage the presence of exporters in SPS-imposing markets, but also have a negative effect on the intensive

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margins of trade. Also, larger firms suffer most from these negative effects of SPS measures. Foletti and Shinga (2014) studied the effect of heterogeneity in Maximum Residue Levels (MRLs) regulation on bilateral trade. They concluded that MRL regulatory heterogeneity diminishes trade at the extensive margin, but increases trade at the intensive margin. Ferro et al. (2015) created a standards restrictiveness index on maximum residue levels of pesticides for sixty-one importing countries. Their results suggest that more restrictive standards are associated with a lower probability of observing trade. But once firms enter the market, standards do not impede exports. Xiong and Beghin (2014) disentangled the effects of MRLs on the import demand and foreign exporters' supply. They found that the MRLs jointly enhance the import demand and hinder foreign exporters' supply.

To the authors' knowledge, there are no specific papers that assess the impact of SPS measures on China's dairy imports. Sun et al. (2014) estimated a gravity model to analyze the effect of changing food standards on China's imports of concentrated milk and cream. They conclude that changes in food standards did not impede China's dairy imports. However, changes in food standards is just one form of the SPS measures, and the results of Sun et al. (2014) leave many questions unanswered.

Thus far, the vast majority of previous studies estimated the impacts of SPS measures from the perspective of exporting countries. This paper assesses the effect of SPS measures on dairy imports of just one country, China. Therefore, the methods developed by previous studies are not applicable to this analysis.

Dairy Production, Consumption, and Trade of China

The Importance of China's Dairy Sector

Though milk was rarely consumed in China historically, it has gradually become a significant part of urban Chinese breakfasts. As incomes increase, Chinese consumers' demand for dairy products will continue to grow (Bai et al. 2014).Dairy products have become one of the main sources of calcium and protein for Chinese consumers. As a result, the Chinese central government aims to ensure thirty-six kilograms of dairy consumption per capita by 2020 (The State Council of China 2014). The increase of China's dairy sector will provide Chinese farmers with more opportunities to participate in a potentially more lucrative, high-value business (Huang et al. 2010).

The Melamine Incident and Governmental Solutions

Chinese dairy farms continue to remain small. Backyard dairy farms with less than four cows account for 75.41% of the total farms, but produce only 22.54% of milk in 2012(Chinese Ministry of Agriculture 2013). Laborers working for backyard dairy farms tend to be under-educated and untrained. If labor input increases by 1%, milk production per cow will decrease by 12% in backyard dairy farms (Yu 2012). The low productivity of small dairy farms (5.23 metric tons of milk per cow per year in 2012) causes milk quality and safety problems. Dairy processors in China have strong oligopsony power over small dairy farms. To stabilize profit, some small dairy farms have adulterated their milk products with water and other chemical elements (Dai

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and Wang 2014). The melamine incident in 2008 was brought about by an absence of quality control and inspection, low level of production standards, a less developed supply chain of the dairy industry, and regulatory failures of milk stations (Xiu and Klein 2010; Sharma and Zhang 2014).

The melamine incident decreased consumer confidence in domestic dairy products. The Chinese government reacted to the melamine incident by shutting down small private milk stations. It attributed the melamine incident to small scale household milk production and encouraged large scale standard dairy production (Zhong et al. 2013). After the melamine incident, the Chinese government put forth marketing management policies that are effective in maintaining dairy participation and herd size. However, the government's post-crisis management policies and production management policies failed to stimulate dairy production (Jia et al. 2012). The Chinese government heavily regulated milk procurement agencies after the melamine incident. Food and drug administration strengthened milk testing, but the principal-agency problems still exist between government agencies and private sectors in China (Jia et al. 2014).

Dairy demand in China increased due to rapid income growth, changes in urban lifestyle, and the development of marketing channels. Multinational dairy firms will play an increasingly important role in China's dairy market (Fuller et al. 2006). Consumer confidence fell after the melamine incident, which gives an advantage to foreign dairy firms in selling dairy goods to China (Cheng et al. 2014).

Dairy Production

During 2000–2007, China's dairy industry had witnessed rapid development with an annual arithmetic growth rate of 23.01%. Raw milk production grew from 8.27million metric tons in 2000 to 35.25 million metric tons in 2007, increasing by 326.24%. In 2013, raw milk production reached 35.31 million metric tons, decreasing by 5.70% from 2012(see Figure 1).

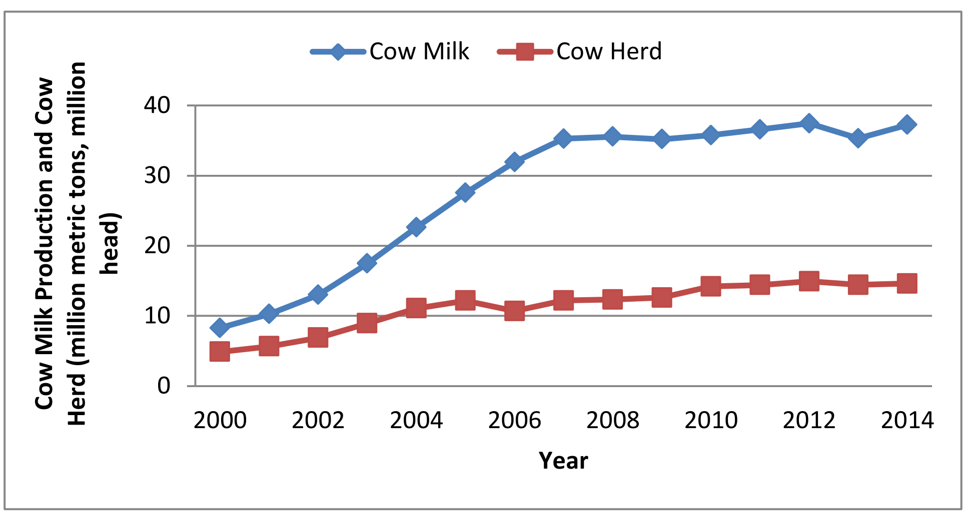

Figure 1. China's cow milk production and herding from 2000–2014.
Source. Ministry of Agriculture (2013) and Li et al. (2015).

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After the melamine incident of 2008, dairy production in China slowed down because of less developed feed industry and epidemic diseases. Due to limited land resources, China can't produce enough roughage such as silage corn and alfalfa for cows. The feed conversion rates in dairy farms of different sizes lay between 0.8 and 1.1, which are less than those of developed countries. China's dairy industry also faces threat of epidemic diseases. Foot and mouth disease is frequently reported by dairy farms in northeast and northwest China. Other epidemic diseases such as Brucellosis, Tuberculosis, Virus Diarrhea and Infectious Bovine Rhinotracheitis etc., are also difficult to control.

China's dairy production is mainly concentrated in the Northern provinces, especially Inner Mongolia, Heilongjiang, Hebei, Xinjiang, Shandong and Henan. In 2012, the top ten dairy producing provinces in the north China produced 83.4% of raw milk for the whole country with 82.3% of national cow stocks. China's dairy industry is still in its initial stage of development, and the dairy productivity is quite low. On average, a milking cow in a large scale dairy farm could only produce 6.45 metric tons of milk in 2012, which was much less than developed countries such as the US and the EU (Chinese Ministry of Agriculture 2013).

China is the world's third largest dairy producer after India and the Unites States. In 2012, China processed 25.46 million metric tons of dairy products, including 21.47 million metric tons of fluid and 3.99 million metric tons of solid dairy goods (Chinese Ministry of Agriculture 2013).Though China's dairy processing industry is growing quickly, it still faces challenges: (1) Dairy production and consumption are unequally located in China. Provinces in the south are economically developed and have strong demand for dairy goods, but dairy production of these south provinces is less than that of north provinces. (2)Processing equipment and machines rely on imports. (3) Dairy producers are not active in using new technologies such as membrane filtration sterilization, inflatable packaging, etc. (4) Dairy product mix is not satisfying. The percentage of fluid dairy products continues to increase. On the contrary, the percentage of dry dairy products continues to decrease (Sino-Dutch Dairy Development Centre 2014).

Dairy production such as butter, cheese, milk powder, condensed milk, and whey cannot meet consumption. China has a trade deficit of the dairy products mentioned above. In 2012, imports of butter, cheese, milk powder, condensed milk, and whey amounted to 48.33, 38.81, 572.88, 5.51, and 378.38 thousand metric tons, respectively. Imports of butter, cheese, milk powder, condensed milk, and whey were separately 60.33, 171.86, 143.81, 7.66, and 2643.79 times the amount of exports.

In 2014, mainland China's dairy firms produced 26.52 million metric tons of dairy products, decreasing by 1.71% from the previous year. Fluid dairy production reached 24.01 million metric tons and accounted for 90.54% of total dairy production. The output of dry dairy production was 2.51 million metric tons, which is 4.17% lower than 2013(see Figure 2).

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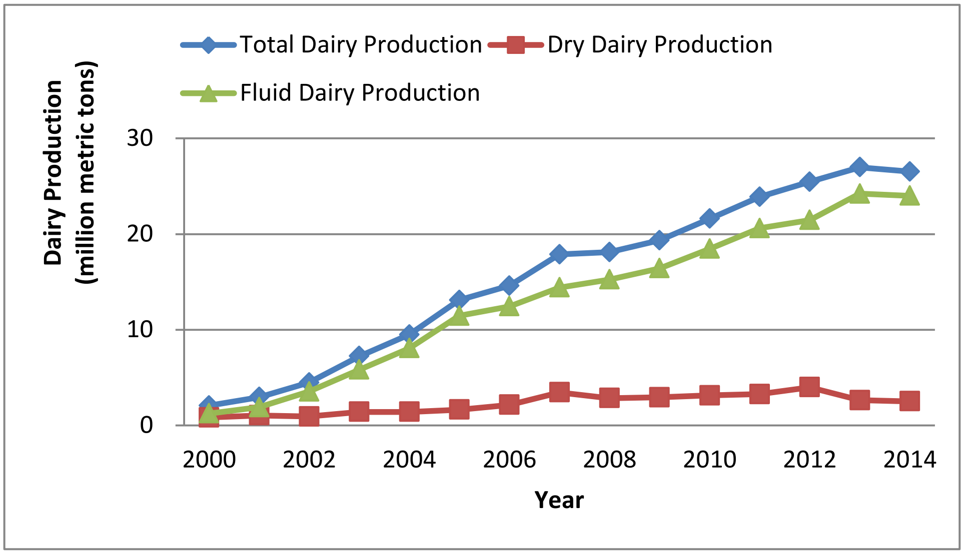

Figure 2. China's dairy production 2000–2014.
Source. Ministry of Agriculture (2013) and Li et al. (2015).

Dairy Consumption

Since 1995, dairy consumption in China has grown at a significant rate, owing to rapid economic growth and increased income. Though Chinese consumers' perceptions of dairy safety had plummeted due to the melamine incident, dairy consumption recovered strongly only nine weeks after the contamination announcement (Wang et al. 2010). Rich, urban Chinese now consume more dairy. Dairy products have already become necessities for many Chinese consumers, especially for children and senior citizens.

A Chinese urban resident typically demands more dairy products than a rural resident due to income difference. In 2014, per capita urban Chinese consumed 18.1 kilograms of fresh milk, increasing by 5.85% from 2013. Rural Chinese only consumed 7.2 kilograms of fresh milk per capita, which is only 39.78% of per capita milk consumption of urban Chinese. Dairy consumption will surely continue to increase because China is currently experiencing fast growth in urbanization. Figure 3 shows the general trends of per capita dairy consumption for rural and urban Chinese dairy consumers between 2000 and 2014.

The Sino-Dutch Dairy Development Centre conducted a dairy consumption survey in 2014 and reported quite different numbers of dairy consumption in China. Per capita dairy consumption by Chinese consumers rose to 35 kilograms in 2014, increasing by 16% from 2010. During the period of 2010-2014, per capita per year dairy consumption of urban Chinese had risen from 36 kilograms to 40 kilograms. Meanwhile, per capita per year dairy consumption of rural residents increased from 19 kilograms to 24 kilograms (Sino-Dutch Dairy Development Centre 2014). Reasons why these survey data are remarkably different from the data published by the Chinese National Bureau of Statistics are stated as followed: (1) Sino-Dutch Dairy Development Centre surveyed consumption of all types of dairy products, while the Chinese National Bureau of Statistics only collected consumption data of fresh milk. (2) Sino-Dutch Dairy Development Centre surveyed householders who are between forty and forty-five years old with relatively

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high incomes and better education. Consumers with higher incomes and better education usually demand more dairy products than those with lower incomes and less education.

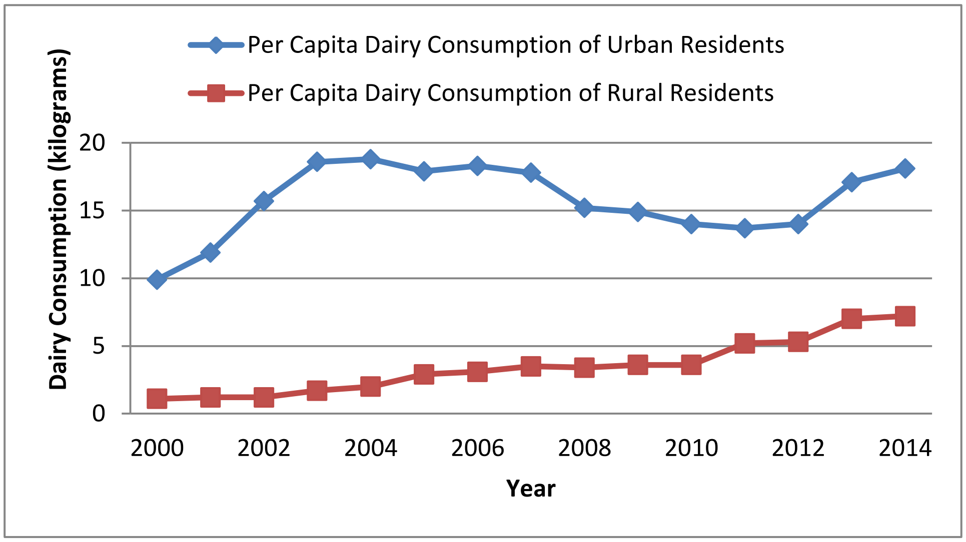

Figure 3. Per capita dairy consumption of Chinese urban and rural residents.
Source. Chinese National Bureau of Statistics, 2015.

Dairy Trade

China's dairy consumption exceeds production and it has a large dairy trade deficit. In 2014, nonfat dry milk consumption in China was equal to 0.30 million metric tons, of which 83.67% was supplied by imports. In the same year of 2014, China produced 1.35 million metric tons of whole milk powder. Total domestic consumption of whole milk powder outweighed production by 0.50 million metric tons (USDA Foreign Agricultural Service 2015).Despite its productivity and resource disadvantages in dairy production, China still exports a small amount of dairy goods. In 2014, dry dairy exports from China reached 13.55thousand metric tons, increasing by 41.5% from 2013. Fluid dairy exports decreased to 26.32 thousand metric tons, which was 0.6% less than the previous year (Liu et al. 2015).

Compared to dairy imports, China's dairy exports are almost insignificant. In 2014, China imported $6.41 billion (all values are in US dollars) of dairy goods, which was 85.38 times the amount of dairy exports (Liu et al. 2015). Dairy imports to China reached a historically high level of 1.93 million metric tons in 2014 with an annual growth rate of 12.8%. Fluid milk imports rose to 0.33 million metric tons, which was 68.8% greater than 2013. Dry dairy imports were 1.48 million metric tons in 2014, increasing by 6.1% from 2013.Imports of infant formula milk powder dropped to 0.12 million metric tons, decreasing by 1.2%. China had a dairy trade deficit of 11.83 million metric tons in 2014. More than 23.5% of Chinese dairy consumption depended on imports (Li et al. 2015).Imports of milk powder grew fastest among all dairy products. Between 2001and 2013, Chinese milk powder imports increased from 59 to 864 thousand metric tons with an annual growth rate of 25.1%.

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Dairy products are expensive due to limited supply in China. Price differences of dairy products between China and the international market encourage more dairy imports for China. The world price of raw milk averaged at $25.40/100 kilograms in January 2016, decreasing by 3.8% from December 2015 (IFCN 2016). By contrast, raw milk price was around $54.03/100 kilograms in China's domestic market in January 2016(Chinese Ministry of Agriculture2016). The domestic milk price of China was almost 2.13 times of the international milk price in January 2016. Regional disparities of dairy production and consumption help dairy imports in the east and southeast China (Wang et al. 2010). Table1displaysthe rapid growth of China's dairy imports at the four-digit tariff line level after the melamine incident of 2008.

Table 1. China's dairy imports at the 4-digit tariff line level (million $USD).

Year	HS0401	HS0402	HS0403	HS0404	HS0405	HS0406
2008	12.38	401.44	2.87	311.99	59.22	73.80
2009	19.70	584.38	4.36	284.22	65.67	69.66
2010	28.19	1395.82	4.20	344.81	91.41	105.45
2011	60.49	1656.94	8.92	571.03	183.62	139.08
2012	118.75	1940.74	24.86	746.20	195.66	186.55
2013	234.38	3605.60	40.14	850.96	226.15	231.09
2014	408.55	4459.59	36.50	788.78	378.01	342.40

Note. *HS0401*-milk and cream, not concentrated nor containing added sugar or other sweetening matter; *HS0402*-milk and cream, concentrated or containing added sugar or other sweetening matter; *HS0403*-buttermilk, curdled milk and cream, yogurt, kefir and other fermented or acidified milk and cream. *HS0404*-whey; *HS0405*-butter and other fats and oils derived from milk, and dairy spreads; HS0406-cheese and curd.
Source. World Integrated Trade Solution (WITS/TRAINS).

The melamine incident resulted in destructive damages to the reputations of domestic milk powder brands. Young parents lost faith in the quality and food safety of domestically made milk powder. They began purchasing more milk powder made by foreign producers. In 2007 the market share of imported milk powder was around 35% but it rose to 60% in 2012 in China. Though some domestic milk powder producers such as Beingmate and Biostime run a successful business and enjoy comparatively large market shares, the raw materials for these companies' products are imported. Because of consumption preferences, Chinese cuisines don't use much butter, whey, and cheese. This explains why imports of butter, whey, and cheese have not increased much during 2008–2014.

New Zealand, the United States, Australia, and France are the top four dairy exporters to China. Dairy imports from these top four countries accounted for 83.69% of China's total dairy imports in 2014. New Zealand has consistently been the largest dairy exporter to China since 2001, followed by the United States, Australia, and France (see Figure 4). In 2014, China imported 0.88 million metric tons of dairy products from New Zealand. Imports of milk and cream (concentrated or containing added sugar, HS0402) reached 0.73 million metric tons, accounting for 82.67% of total dairy imports from New Zealand.

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The Chinese government encourages dairy imports from countries with rich land and water resources by using bilateral preferential agreements. New Zealand–China and Switzerland–China free trade area (FTA) agreements went into effect on October 1, 2008 and July 1, 2014, respectively. Australia and China also signed a bilateral FTA agreement on June 17, 2014. Regional integration will surely enhance China's dairy imports from these three countries. For example, dairy imports from New Zealand amounted to 0.25 million metric tons in 2009, which was 3.15 times that of dairy imports in 2008. The New Zealand–China free trade area agreement promotes two countries' dairy trade as China's dairy imports from New Zealand expanded from 78,440 metric tons in 2008 to 0.88 million metric tons in 2014, rising by 1023.38% with an annual growth rate of 49.65%.

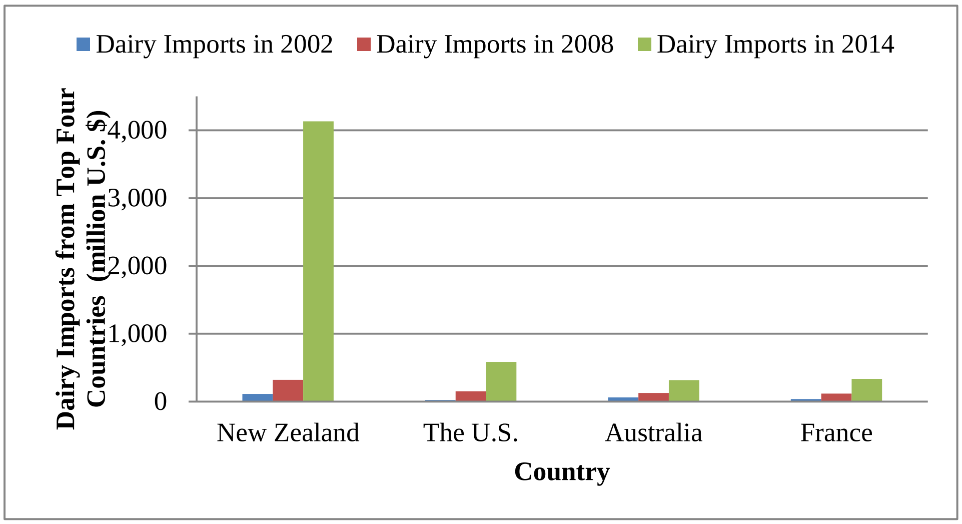

Figure 4. China's dairy imports from top four countries.
Source. World Integrated Trade Solution (WITS/TRAINS).

SPS Measures for China's Dairy Imports

China mainly adopts tariff measures, SPS measures, and bilateral FTAs to manage market access of dairy imports. In order to keep dairy production safe, China issued SPS related measures such as Quality Inspection Regulations for Dairy Products (2008), Development Policy for the Dairy Industry (2009), and Good Manufacturing Practice for Milk (2010).

As of June 30, 2015, China notified the WTO of sixty-one Sanitary and Phytosanitary (SPS) measures and one Technical Barriers to Trade (TBT) on dairy imports. However, only one of the SPS dairy measures has been enacted. The other sixty SPS dairy measures are still at the stage of initiation. Among all dairy exporting regions to China, only the EU expressed a specific trade concern with China's SPS measures for dairy imports. China only uses SPS and TBT measures and does not implement other NTMs such as import licensing, quantitative restrictions, special safeguards, and tariff rate quotas to restrict market access of dairy imports (WTO 2015).

WITS/TRAINS reported that China put forth SPS measures twenty-five times for dairy imports between May 9, 1990 and May 22, 2015. In the same time period, China only implemented two

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TBT measures for dairy imports in December, 2005.These two TBT measures prohibited the use of certain toxic chemical elements and formulated tolerance limits for residues of certain substances. China rarely imposed contingent protective measures for dairy imports, with one exception when volume-based agricultural special safeguard measures (WTO 1995) were imposed to restrict dairy imports from New Zealand in 2011.

Before entering the WTO, China implemented SPS measures for dairy imports twelve times. SPS measures performed as the only form of NTMs for China's dairy imports before 2002. After being accepted as a member of the WTO, China reduced its SPS measures for dairy trade by following free trade rules. From the time when China was accepted into the WTO to September 21, 2008, when the melamine incident was reported, China only implemented SPS measures for dairy imports four times. After the melamine incident, China's SPS measures for dairy imports increased. Between September 22, 2008 and May 22, 2015, WITS/TRAINS recorded nine attempts at implementing SPS measures for China's dairy imports.

Table 2. China's SPS Measures for dairy imports during 1990–2001.

NTM Code	Contents of SPS Measures	Start Year	Affected Partners
A140	Special authorization requirement for SPS reasons	1990	Afghanistan, Bhutan, Myanmar, India, Lao PDR, Mongolia, Nepal, Pakistan, Russia, Vietnam
A840	Inspection requirements	1991	The World
A850	Traceability requirements	1992	Mongolia
A830	Certification requirements	1992	Mongolia
A853	Traceability requirements	1992	Mongolia
A830	Certification requirements	1993	Kazakhstan
A210	Tolerance limits for residues of or contamination by certain (non-microbiological) substances	1994	The World
A110	Temporary geographic prohibitions for SPS reasons	1994	Greece
A830	Certification requirements	1995	New Zealand
A110	Temporary geographic prohibitions for SPS reasons	1995	Russia
A850	Traceability requirements	1996	The World
A120	Geographical restrictions on eligibility	1996	The World

Source. World Integrated Trade Solution (WITS/TRAINS).

Before becoming a member of the WTO, China infrequently applied SPS measures to regulate dairy imports because of the small volume of dairy imports. In 2001, China only imported $216.31 million of dairy products, which increased to $861.70 million by 2008.Between 1990 and 2002, most of the twelve SPS measures on dairy imports mainly affected a few neighboring dairy exporters (see Table 2).

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After entering the WTO, China opened its dairy market to foreign competitors and reduced the SPS measures regulating dairy trade. Dairy imports accelerated during the period 2002-2008 with an annual growth rate of 21.44%.Table 3 presents the four SPS measures implemented during this time period.

Table 3. China's SPS Measures for dairy imports during 2002–2008.

NTM Code	Contents of SPS Measures	Start Year	Affected Partners
A210	Tolerance limits for residues of or contamination by certain (non-microbiological) substances	2002	The World
A110	Temporary geographic prohibitions for SPS reasons	2004	The World
A820	Testing requirements	2005	The World
A210	Tolerance limits for residues of or contamination by certain (non-microbiological) substances	2005	The World

Source. World Integrated Trade Solution (WITS/TRAINS).

After the melamine incident in 2008, China strengthened food safety inspection and quality tests on dairy production. Between August 1, 2008 and March 1, 2015, China published forty-four dairy safety related standards. Most of these standards are instructions for testing chemical elements and nutrients in dairy products. China also imposed SPS measures to regulate dairy imports more frequently than before the melamine incident (see Table 4).

Table 4. China's SPS Measures for dairy imports during 2008–2015.

NTM Code	Contents of SPS Measures	Start Year	Affected Partners
A410	Microbiological criteria of the final product	2010	The World
A420	Hygienic practices during production	2010	The World
A83	Certification requirements	2010	The World
A210	Tolerance limits for residues of or contamination by certain (non-microbiological) substances	2011	The World
A220	Restricted use of certain substances in foods and their contact materials	2011	The World
A410	Microbiological criteria of the final product	2011	The World
A820	Testing requirements	2011	The World
A310	Labeling requirements	2012	The World
A64	Storage and transport conditions	2015	The World

Source. World Integrated Trade Solution (WITS/TRAINS).

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Methodology and Data

Trade Restrictiveness Index Model

China reduced tariff rates for dairy imports after the melamine incident but increased the frequencies of SPS measures to control dairy imports. China also strengthened domestic support to the dairy sector by subsidizing alfalfa cropping, large scale and standard dairy production, and large dairy firms' acquisitions of small firms (Qian et al. 2011; Jia et al. 2012). Both market access and domestic support measures may affect China's dairy imports. Major dairy exporting countries such as New Zealand and the United States may face potential market access difficulties in increasing sales to China's market due to SPS measures and other NTMs.

This paper takes SPS measures as the only form of market access barrier for China's dairy imports by isolating it from the occasional presences of other NTMs. China has seldom employed TBTs, special safeguard measures, and other NTMs to restrict dairy imports. Accordingly, China's dairy trade policies consist of tariff rates, SPS measures, and domestic support.

SPS measures and domestic support in China's dairy trade policies take on many forms, and analysts cannot sum these measures directly to assess their impacts on China's dairy imports. First, one has to transform these SPS and domestic support measures into AVEs of tariff rates. Then, the addition of tariff rates and AVEs of SPS and domestic support measures constitute barriers to dairy trade in China. The restrictiveness of trade policies for China's dairy imports depends on import demand elasticities of dairy products in China's consumption market. High tariff rates and AVEs of SPS measures may not impede China's dairy imports when dairy imports are inelastic.

This paper follows the trade restrictiveness index method developed by Kee et al. (2009). The trade restrictiveness index model is preferred to the other methods in literature because it is grounded in economic theory. Kee et al. (2009) estimated import demand elasticities of around 4,900 goods by applying the GDP optimization function. However, one drawback of the trade restrictiveness index method is its inability to disentangle domestic dairy support policies at the six-digit tariff line level.

The functional specification that Kee et al. (2009) derived to estimate the TRI is

$$(1)\ \ln m_{n,c} = \alpha_n + \sum_k \alpha_{n,k} C_c^k + \beta_{n,c}^{Core} Core_{n,c} + \beta_{n,c}^{DS} \ln DS_{n,c} + \varepsilon_{n,c} \ln\left(1 + T_{n,c}\right) + \mu_{n,c}$$

where $m_{n,c}$ is the imported quantity of good n in country c; α_n are tariff line dummies that capture any good-specific effect; C_c^k are k variables of country characteristics; $Core_{n,c}$ is a dummy variable indicating the presence of a core NTM; $DS_{n,c}$ is the volume of agricultural domestic support; $\varepsilon_{n,c}$ is the import demand elasticity of good n in country c; $T_{n,c}$ refers to the overall level of protection imposed by country c on good n, which is the addition of AVE and the tariff rate of good n in country c.

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Differentiate (1) with respect to $Core_{n,c}$ and $lnDS_{n,c}$ gives

$$(2)\ \frac{\partial \mathrm{lnm_{n,c}}}{\partial \mathrm{Core_{n,c}}} = \frac{\partial \mathrm{lnm_{n,c}}}{\partial \mathrm{lnp^{d}_{n,c}}} \frac{\partial \mathrm{lnp^{d}_{n,c}}}{\partial \mathrm{Core_{n,c}}} = \varepsilon_{\mathrm{n,c}} \mathrm{ave^{Core}_{n,c}}$$

$$(3)\ \frac{\partial \mathrm{lnm_{n,c}}}{\partial \mathrm{lnDS_{n,c}}} = \frac{\partial \mathrm{lnm_{n,c}}}{\partial \mathrm{lnp^{d}_{n,c}}} \frac{\partial \mathrm{lnp^{d}_{n,c}}}{\partial \mathrm{lnDS_{n,c}}} = \varepsilon_{\mathrm{n,c}} \mathrm{ave^{DS}_{n,c}}$$

where $\mathrm{p^{d}_{n,c}}$ is the price index of good *n* in country $c, ave^{Core}_{n,c}$ and $ave^{DS}_{n,c}$ are the ad valorem equivalents of core NTMs and domestic support imposed on good *n* in country *c*, respectively. $ave^{Core}_{n,c}$ and $ave^{DS}_{n,c}$ can be calculated by solving (2) and (3):

$$(4)\, ave^{Core}_{n,c} = \frac{1}{\varepsilon_{n,c}} \frac{\partial lnm_{n,c}}{\partial Core_{n,c}} = \frac{e^{\beta^{Core}_{n,c}-1}}{\varepsilon_{n,c}}$$

$$(5)\ ave^{DS}_{n,c} = \frac{1}{\varepsilon_{n,c}} \frac{\partial lnm_{n,c}}{\partial lnDS_{n,c}} = \frac{\beta^{DS}_{n,c}}{\varepsilon_{n,c}}$$

Equations of TRI, OTRI and MA-OTRI

Kee et al. (2009) defined the TRI and the OTRI, respectively, as

$$(6)\mathrm{TRI_C} = \left(\frac{\sum_{\mathrm{n}} \mathrm{m_{n,c}} \varepsilon_{\mathrm{n,c}} \mathrm{T^2_{n,c}}}{\sum_{\mathrm{n}} \mathrm{m_{n,c}} \varepsilon_{\mathrm{n,c}}} \right)^{\frac{1}{2}}$$

$$(7)\ \mathrm{OTRI_C} = \frac{\sum_{\mathrm{n}} \mathrm{m_{n,c}} \varepsilon_{\mathrm{n,c}} \mathrm{T_{n,c}}}{\sum_{\mathrm{n}} \mathrm{m_{n,c}} \varepsilon_{\mathrm{n,c}}}$$

Next the MA-OTRI of good *n* experienced by the exporting country *c* in the importing country *p* is defined on a bilateral basis with *p* indicating China.

$$(8)\ \mathrm{MA-OTRI_c} = \frac{\sum_{\mathrm{p}} \sum_{\mathrm{n}} \mathrm{m_{n,c,p}} \varepsilon_{\mathrm{n,p}} \mathrm{T_{n,c,p}}}{\sum_{\mathrm{p}} \sum_{\mathrm{n}} \mathrm{m_{n,c,p}} \varepsilon_{\mathrm{n,p}}}$$

Stringent trade policies reduce trade volumes by increasing trade costs and the prices of traded commodities. The area of a *Harberger Triangle* represents the dead weight loss ($\mathrm{DWL_c}$) of welfare for an importing country:

$$(9)\ \mathrm{DWL_c} = \frac{1}{2} (\mathrm{TRI_c})^2 \mathrm{GDP_c} \sum_{\mathrm{n}} \mathrm{s_n}\, \varepsilon_{\mathrm{n,c}}$$

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where $\mathrm{GDP_c}$ is the gross domestic product of the importing country and s_n is the share of good *n* imports in $\mathrm{GDP_c}$. s_n is negative because imports reduce GDP in a demand-side GDP equation.

Data

This paper employs AVEs and import demand elasticities for China's dairy imports from Kee et al. (2009). The authors did not estimate the AVEs and import demand elasticities for China's dairy imports for three reasons: (1) China is the only importing country analyzed. (2) The panel data for country specific prices and endowments in the imports-share function in Kee et al. (2009) are not available, which make estimation of the AVEs and import demand elasticities for China's dairy imports impossible. (3) Import demand elasticities usually do not change over a short period of time.

AVEs and import demand elasticities estimated in Kee et al. (2009) cover nine dairy products at the six-digit tariff line level (see Table 5). AVEs and import demand elasticities for the other eleven dairy goods at the six-digit tariff line level were not estimated by Kee et al. (2009) due to data limitation. Data of China's dairy imports and tariff rates are retrieved from the website of the World Integrated Trade Solution (WITS/TRAINS).

Table 5. Tariff rates, Import Demand Elasticities, and AVEs for China's imports of nine dairy products.

HS Code	Applied MFN Tariff Rate in 2002 (%)	Applied MFN Tariff Rate in 2008 (%)	Applied MFN Tariff Rate in 2014(%)	Preferential Rate for New Zealand in 2014 (%)	Preferential Rate for Switzerland in 2014 (%)	Import Demand Elasticities	AVEs
040110	19	19	15	0	13	-8.12	0
040120	19	19	15	4.5	13	-4.32	0
040221	17	17	10	4	10	-1.61	0.62
040229	17	17	10	4	8	-10.09	0
040310	26	26	10	0	9.2	-76.82	0
040410	6	6	2	0	2	-0.85	0
040490	32	32	20	0	20	-158.33	0
040620	27	27	12	0	9.8	-2.89	0
040690	27	27	12	3	9.8	-7.40	0
Arithmetic Average	21.11	21.11	11.78	1.72	10.53	NA	NA
Weighted Average	12.70	11.91	9.09	3.94	11.59	NA	NA

Note. *HS040110*-milk and cream, of a fat content, by weight, not exceeding 1%; *HS040120*-milk and cream, of a fat content, by weight, exceeding 1% but not exceeding6%; *HS040221*-milk and cream, concentrated, not containing added sugar or other sweetening matter; *HS040229*-milk and cream, concentrated, other; *HS040310*-yogurt; *HS040410*-whey and modified whey, whether or not concentrated or containing added sugar or other sweetening matter; *HS040490*-whey and modified whey, other; *HS040620*-grated or powdered cheese, of all kinds;*HS040690*-other cheese.

Source. Tariff rates are from WITS/TRAINS. Import demand elasticities and AVEs are from Kee et al. (2009).

Table 5 also lists preferential tariff rates for China's dairy imports from New Zealand and Switzerland. Preferential tariff rates for dairy imports from Australia are not reported because the Australia-China FTA has not passed in the Australian parliament. However, China set the

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average preferential tariff rate for dairy imports from New Zealand at 2.24%when New Zealand-China FTA took effect in 2008. Also, note that preferential tariff rates for dairy imports from Switzerland average 10.34%, which is only 13.85% lower than China's average most-favored-nation (MFN) tariff rate.

China's applied MFN tariff rates for twenty dairy goods (HS040110-HS040690) at the six-digit tariff line level averaged 24.48%in 2002. The weighted average tariff rate of these twenty dairy goods was equal to 13.55% in 2002. The applied MFN tariff rates for China's dairy imports remained unchanged through 2008, but the weighted average tariff rate increased to 14.37%. The melamine incident damaged consumer confidence with domestically produced dairy goods, especially infant formula milk powder. To stabilize the domestic dairy supply, China liberalized its dairy market further by reducing tariff rates for dairy imports in 2009. By 2014, the average MFN tariff rate for China's dairy imports was lowered to 12%. At the same time, the weighted average tariff rate for dairy imports decreased to 9.52%.

Results

This paper calculates TRIs, OTRIs, and MA-OTRIs for China's dairy imports for nine dairy goods at the six-digit tariff line level in three critical years, i.e., 2002, 2008 and 2014. The TRI, OTRI, and MA-OTRI for China's dairy imports in 2002 establish a benchmark of China's dairy trade policies shortly after its accession to the WTO, while the TRI, OTRI and MA-OTRI for 2008reveal the progress that China achieved in opening up its dairy market by following WTO rules. Finally, the three trade restrictiveness indexes for 2014showhow China responded to the melamine incident by utilizing trade policies such as SPS measures.

TRIs for China's Dairy Imports

The TRI represents the uniform tariff equivalent for the current structure of protection that leaves the importing country's welfare unchanged (Kee et al. 2009). In 2002, the TRI for China's dairy imports reached 40.71% (see Table 6), which was 82.23% greater than the average MFN tariff rate and 220.04% greater than the weighted average tariff rate, respectively.

Table 6. The TRIs for China's dairy imports in critical years.

Year	TRI Tariffs Only	TRI Tariffs and SPS Measures	Dead Weight Loss Tariffs Only Million $USD	Dead Weight Loss Tariffs and SPS Measures Million $USD
2002	0.1876	0.4071	2.7365	12.8864
2008	0.2606	0.3960	6.2030	14.3232
2014	0.1319	0.4934	7.4517	104.2706

Though tariff barriers for China's dairy imports decreased because of WTO accession, non-tariff barriers still exist, especially for imports of concentrated milk and cream. Kee et al. (2009) reported that AVEs of NTMs for HS040210 (milk and cream, in powder, granules or other solid forms, of a fat content, by weight, not exceeding 1.5 %) and HS040221 (milk and cream, concentrated, not containing added sugar or other sweetening matter) were equal to 56.05%and 61.94%, respectively. The AVEs of these two dairy products are much higher than ad valorem

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tariff rates. Because SPS measures are the main type of NTMs for China's dairy imports, SPS measures were more restrictive than tariff rates.

Table 5 shows that, except for HS040410, imports of the other eight dairy products at the six-digit tariff line level are price elastic. Price increases brought about by the restrictiveness of tariff and SPS measures will impede China's dairy imports remarkably. As a result, Chinese consumers will have to substitute domestic dairy products for the imported ones when dairy imports are restricted. Stringent dairy trade policies represented by SPS measures will encourage domestic dairy production and increase producers' surplus at the expenses of consumers.

Column 2 of Table 6 presents the TRIs of tariffs for China's dairy imports in 2002, 2008, and 2014, respectively. Column 3 of Table 6 lists the TRIs of tariffs and SPS measures for China's dairy imports for each of the three critical years. Kee et al. (2009) reported that TRIs (tariffs) and TRIs (tariffs and NTMs) for China's general imports were equal to 0.211 and 0.343, respectively. Therefore, compared with general imports, China's dairy imports are more restrictive.

Between the years2002-2008, the TRI (tariffs and SPS measures) declined to 39.60% from 40.71%. This decrease in TRIs implies that China continued to open up its dairy industry and China's trade policies became less restrictive. Participation in the multilateral trading system resulted in China further liberalizing its dairy trade. Frequencies of SPS measures and other NTMs decreased in this time period. Though import demand elasticities and ad valorem tariff rates were unchanged between 2002 and 2008, the TRI (tariff only) increased from 18.76% to 26.06% because of the Chinese consumers' strong demand for the imported dairy products with higher income.

The melamine incident resulted in a substantial decline of the Chinese consumer confidence in the dairy industry. Young Chinese mothers responded by reducing purchases of domestic infant formula milk powder. High income consumers switched to dairy goods from developed countries. The central government realized that the melamine incident not only hurt consumers' welfare, but also threatened national dairy security. The government liberalized its dairy trade polices after the melamine incident by reducing the tariff rates for dairy imports. The average MFN tariff rate for dairy imports decreased from 24.48% in 2008 to 12% in 2009. Lower tariff rates stimulated dairy imports. The TRI (tariffs only) decreased dramatically from 26.06% in 2008 to 13.19% in 2014, which was only 9.92% greater than the average MFN tariff rate.

Another effect of the melamine incident was that China began using SPS related measures more frequently to regulate both dairy production and imports. The original purpose of imposing these SPS related measures was to ensure dairy food safety, but SPS measures did impede China's dairy imports and reduce consumers' welfare. The TRI (tariffs and SPS measures) for China's dairy imports increased to 49.34% in 2014, 311.19% greater than the average MFN tariff rate. Tariff and SPS barriers for China's dairy imports caused a dead weight welfare loss of $104.27 million in 2014. However, tariff barriers for China's dairy imports gave rise to a dead weight welfare loss of only$7.45 million in the same year of 2014. Compared with tariff barriers, SPS measures exerted a larger negative effect on dairy imports and welfare.

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OTRIs for China's Dairy Imports

The OTRI represents the uniform tariff equivalent that could replace existing protections while leaving imports unchanged (Kee et al. 2009). In 2002, the OTRI for China’s dairy imports reached 31.29%, which was 47.12% and 146.39% greater than the average MFN tariff rate and the weighted average tariff rate, respectively (see Table 7). Kee et al. (2009) reported that OTRI (tariffs only) and OTRI (tariffs and NTMs) for China's general imports were equal to 0.140 and 0.204, respectively. The OTRIs (tariffs only) for China's dairy imports estimated in this paper are comparable to the OTRIs (tariffs only) for general imports estimated by Kee et al. (2009). But the OTRIs (tariffs and SPS measures) for China's dairy imports are much greater than the OTRIs (tariffs and NTMs) for general imports. Table 7 reconfirms that SPS measures do restrict China's dairy imports.

Table 7. The OTRIs for China's dairy imports in critical years.

Year	OTRI (Tariffs Only)	OTRI (Tariffs and SPS Measures)
2002	0.1783	0.3129
2008	0.2441	0.3358
2014	0.1235	0.3994

During 2002-2008, though MFN tariff rates for dairy imports remained unchanged, the OTRI (tariffs and SPS measures) for dairy imports increased from 31.29% to 33.58%. China only implemented SPS measures four times and TBT measures two times for dairy imports in this time period. These small numbers of SPS and TBT measures increased the overall trade restrictiveness for China’s dairy imports by7.32%.

The OTRI (tariffs and SPS measures) for China’s dairy imports continued to rise after the melamine incident, reaching 39.94% in 2014, which was 239.05% greater than the average MFN tariff rate. In the short amount of time between September 22, 2008 and May 22, 2015, China implemented SPS measures nine times for dairy imports. China also adopted one special agricultural safeguard measure for dairy imports from New Zealand on July 1, 2011. Both SPS measures and special agricultural safeguard impede China's dairy imports, not taking other determinants of imports into consideration.

Chinese legislatures and government agencies continue to publish new food standards for the dairy industry in order to guarantee dairy food safety and quality. These dairy food standards can form SPS measures for dairy imports. The earliest dairy food standard traces back to the Method of Test for Milk and Milk Products that took into effect on June 4, 1969. From December 1, 1985 to March 1, 2015, China promulgated sixty-seven food standards for dairy production and imports. Ten food standards for dairy exports were also issued. These food standards are relevant to testing methods, green dairy food production, dairy marketing, maximum residue limit of chemical elements, Hazard Analysis and Critical Control Point (HACCP) system, and Good Agriculture Practice (GAP) in dairy firms. Following the melamine incident, China issued forty-one dairy food standards, which accounted for 60.29% of the total between October 1, 2008 and March 1, 2015 (Zhejiang Institute of Standard 2015).

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MA-OTRIs for Major Dairy Exporting Countries to China's Market

China's strong demand for dairy products provides major dairy exporting countries with opportunities to expand their exports. At the present time, China imports most of its dairy goods from New Zealand, the United States, Australia, and France. The Chinese government wants to realize dairy security by exploring new sources of dairy imports from the international market. Between 2002 and 2014, the top ten dairy exporters to China included Argentina, Australia, Denmark, France, Germany, Ireland, New Zealand, the Netherlands, Switzerland, and the United States.

The market access difficulties of these top ten dairy exporters to China's market vary. Ireland, Switzerland, and the United States enjoyed the lowest level of market access barriers in exporting dairy goods to China. However, the MA-OTRIs of Argentina, Australia, Denmark, Germany, and the Netherlands are greater than the average MFN tariff rate of 12%. Meanwhile, the MA-OTRI of France is almost equal to China's average MFN tariff rate (see Figure 5).

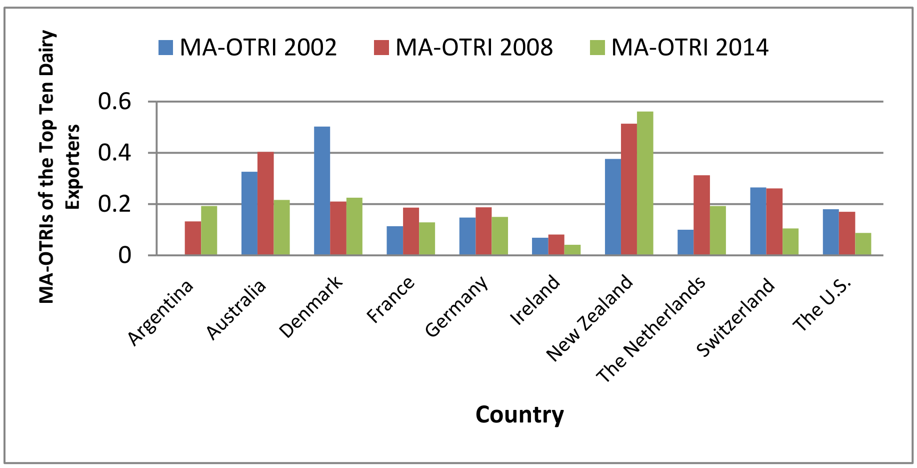

Figure 5.MA-OTRIs for the top ten dairy exporters to China in critical years.

The arithmetic averages of MA-OTRIs (tariffs only) and MA-OTRIs (tariffs and NTMs) for China's general imports reach 0.0204 and 0.066, respectively (Kee et al. 2009). The MA-OTRI (tariffs only) and the MA-OTRI (tariffs and SPS measures) for China's dairy imports were equal to 0.1186 and 0.1905, respectively, in 2014. The Estimated MA-OTRIs in Figure 5 indicate that China's dairy imports are more restrictive than general imports. Dairy exporters face comparatively high market access barriers to China.

Market access barriers for dairy imports from Denmark decreased dramatically between 2002 and 2014. In 2014, the MA-OTRI of Demark was 0.2256, which was 44.81% of the MA-OTRI in 2002. Closer bilateral economic cooperation at the government and firm level explains rapid increase in market access for Danish dairy exports to China. The Danish government helps its dairy firms' exports to China. The Danish Agriculture and Food Council and the Chinese Ministry of Agriculture established a Sino-Denmark Dairy Research and Development Centre in 2012. With this platform of dairy technology innovation, dairy firms in both countries are able to

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cooperate in areas such as dairy farm management, dairy safety management, and human capacity building.

Danish dairy firms have realized the importance of China's market and are trying to expand dairy sales to China. As the largest dairy producer in Denmark, Arla Foods implemented successful marketing strategy in China by establishing a close cooperative relationship with Hunan-based Engnice in 2012.In the Chinese domestic market, Engnice's brand of "SMILE" uses 100% of imported milk powder from Denmark. Arla Foods is also dedicated to exporting whey and cheese to China. In 2014, Arla Foods and Mengniu Group set up a joint cheese innovation center. Arla Foods also cooperates with China National Cereals, Oils, and Foodstuffs Corporation (COFCO) in investing in China's dairy industry. In 2012, Arla Foods became the third largest shareholder of Mengniu Group (a subsidiary company of COFCO). Denmark's dedication has paid off. In 2014, Danish exports of concentrated milk and cream to China reached $31.89 million, 1,129.81 times that of 2008. Danish whey exports to China equaled $7.25 million in 2014, 5.40 times that of 2008. China's cheese imports from Denmark amounted to $8.95 million in 2014, increasing by 462.98% from 2008.

Interestingly, New Zealand has the highest MA-OTRIs among the top ten importing countries. New Zealand is the largest supplier of concentrated milk and cream to China. In its total dairy exports to China, the proportions of concentrated milk and cream were equal to 65.78%, 41.84%, and 73% in the respective year of 2002, 2008 and 2014. There are two reasons that can explain high MA-OTRIs for New Zealand: (1) China imports milk powder from New Zealand mainly for baby and child consumption. Sanitary requirements and standards for infant milk imports are higher than those of adult dairy products. (2) Though the New Zealand-China free trade area agreement took effect in 2008, China can still use other forms of trade policies to restrict dairy imports from New Zealand. In August 2013, China put an embargo on lactalbumin powder imports from New Zealand because of a botulin toxin contamination report of Fonterra. China did not lift this embargo until November2014. China also imposed a special safeguard measure on dairy imports from New Zealand. According to the New Zealand-China free trade area agreement, the trigger criterion for imports of concentrated milk and cream from New Zealand is 0.14 million metric tons during 2015. But only by January 5, 2015, Chinese firms had declared 0.18 million metric tons of imports to customs. Beginning on January 7, 2015, imports of concentrated milk and cream from New Zealand applied to MFN tariff rates other than preferential tariff rates. Quotas of dairy imports from New Zealand were also quickly used up between 2009 and 2014. Non-tariff barriers such as SPS measures, safeguard measures, licensing and quota systems made dairy exports of New Zealand to China unstable.

Concluding Remarks

China's dairy demand is exceedingly large. To ensure dairy security, China has to continuously increase the production capacity of its own dairy industry and improve both domestic and foreign trade policies. Dairy consumption in China will continue to grow but China does not have a comparative advantage or a natural endowment advantage in dairy production. Opening up the dairy market to international competitors will lead to a net welfare gain for China. The melamine incident makes dairy food safety a hot issue in China. To ensure dairy safety, China has issued many SPS related domestic measures. SPS measures have already become the major type of NTMs that determine the TRIs, OTRIs and MA-OTRIs for China's dairy imports. Though

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unintentionally, these SPS related domestic measures may reduce China's dairy imports and reduce consumers' welfare.

Findings of this paper include: (1) SPS measures are the main type of NTMs for China's dairy imports. (2) SPS measures are more restrictive than tariff rates for China's dairy imports and caused significant welfare losses to China. (3) Major dairy exporters still face high market access barriers to China.

The limitations of this paper are twofold. First, the import demand elasticities taken from the literature do not vary with time and only cover nine of twenty dairy products at the six-digit tariff line level. Second, statistics of NTMs by WITS/TRAINS is limited. This databank misses or neglects the existence of other NTMs for China's dairy imports such as licensing, quotas, and domestic support on dairy production. Future work may be done in the following four directions: (1) Collect and sort out all NTMs relating to China's dairy trade, especially domestic support policies. (2) Estimate new import demand elasticities and AVEs for all twenty dairy products at the six-digit tariff line level. (3) Analyze the restrictiveness of China's dairy trade policies on a bilateral basis. (4) Analyze the restrictiveness of China's dairy trade policies at the firm level.

In the short run, SPS measures restrict and reduce China's dairy imports if other determinants such as income and price are not considered. Domestic dairy producers benefit from SPS measures for dairy imports. Consumer welfare decreases due to income and substitution effects. In general, SPS measures cause a net welfare loss for China. In the long run, SPS measures for China's dairy imports may decrease competitiveness of its domestic dairy producers. SPS measures make resource allocation efficiency low in domestic dairy production. Meanwhile, SPS measures for China's dairy imports may have positive impacts on large foreign dairy exporters with popular brands. Once these large dairy exporters assimilate extra adjustment costs in meeting China's SPS standards, they will enjoy a greater market share in China's dairy market.

China needs to import more dairy goods. Free dairy trade increases welfare to both the exporting countries and China. It is not rational for China to unnecessarily distort the dairy market with trade policies such as SPS measures. Less regulated dairy imports do not conflict with China's national food security strategy and can secure a robust, consistent food supply.

China's SPS measures for dairy imports should be made in compliance with international standards. The World Organization for Animal Health (OIE), International Plant Protection Convention (IPPC), and Codex Alimentarius (CAC) have already published standards for dairy production. These standards provide benchmarks for Chinese SPS measures. Although China does not need to adopt all of these international standards, they could stand as a key framework from which to construct future dairy trade policy. Foreign direct investment and green-box financial support are two good substitutes for SPS measures.

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