

China's Choice and its implication: Import meat or soybean

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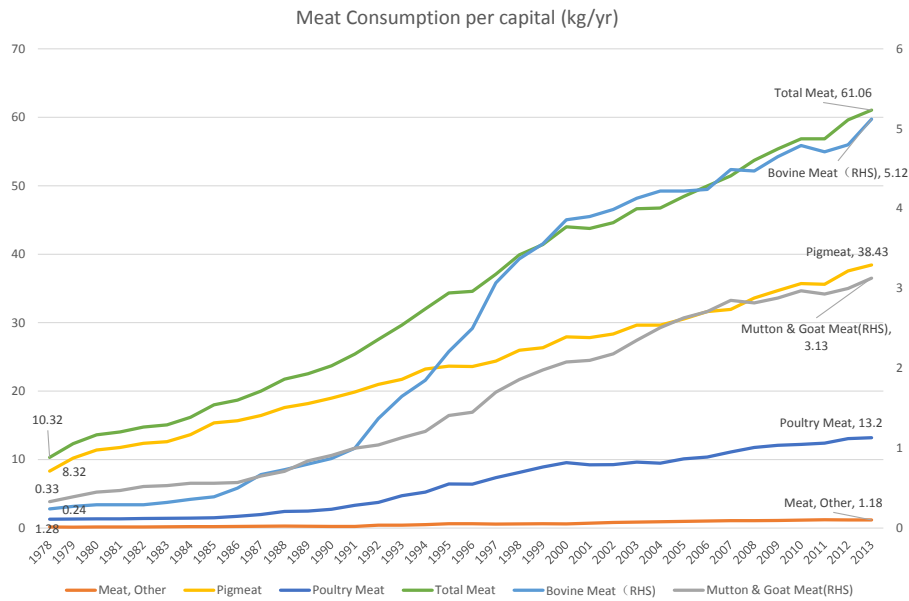
With the increase of population and households' income level, China's demand on meat will continue to rise rapidly. However, due to the shortage of land and water resources etc., in order to meet the expansion of this demand, China has two options: one is to import meat directly, but this will reduce itself-sufficiency rate of meat supply; the other is to extend the capability of livestock farming and supply meat by itself, but this will bring about environment pollution. Each approach has its own pros and cons. This article attempts to evaluate the different options quantitatively based on a global computable general equilibrium model.

The paper is organized as follows: Firstly, the paper will investigate the historical trends of meat consumption in China; Secondly, the paper will describe the consumption and import of soybean in China from the perspective of meat production chain; Thirdly, the CGE model used in this article will be introduced; Fourthly, this article will design different scenarios and simulate them with global CGE model; Finally, the simulation results will be analyzed and the paper will summarize policy

implications.

1. The consumption of Meat in China

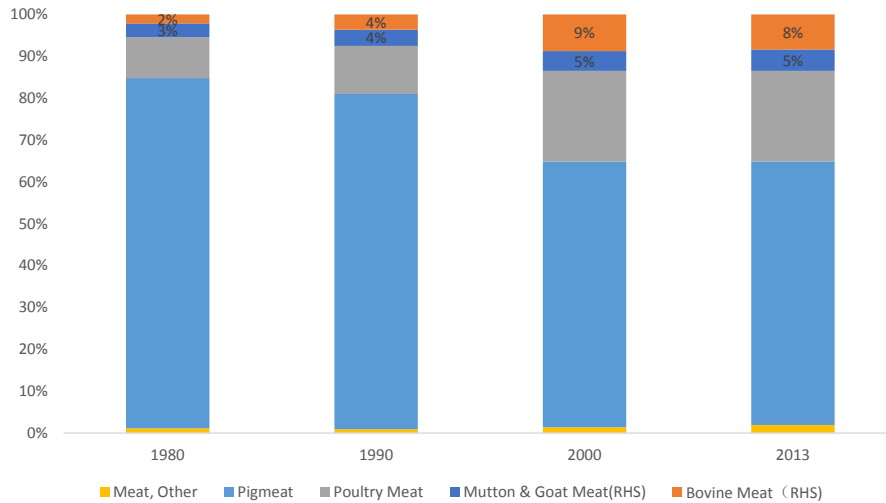
Meat has become more and more important part of people's diet in China. At the beginning of China's Opening-up and Reform, China's animal husbandry is behindhand and the production of livestock is very low. The annual per capita consumption of meat is only about 10kg. And yet, the per capita consumption of beef and mutton is even less, only 0.24kg and 0.33kg. With the reforms, household income increases very quickly and the consumption of animal products keeps growing. In 2013, China's per capita consumption of meat is more than 60kg, six times of that in 1978 and with an annual growth rate of around 6%. Moreover, the consumption of beef and mutton grew faster than other meat. In 2013, the per capita consumption of beef reached 5.12kg, about 21 times of that in 1978 and with an annual growth of about 9%; the per capita meat consumption reached 3.13kg, about 10 times of that in 1978 and with an annual growth of 6.6% .



Data source: FAO

Fig 1 per capita consumption of Meat, 1978-2013

As household's income increases, the consumption structure of livestock has undergone significant changes. The most typical feature is that the proportion of pork in total meat consumption has declined and the proportion of other meat has increased. The share of total meat demand going to pork dropped from 83.7% in 1980 to 62.9% in 2013, while the proportion of poultry increased from 9.8% in 1980 to 21.6% in 2013. Meanwhile, the proportion of beef consumption rose from 2.1% in 1980 to 8.4% in 2013 and the proportion of mutton consumption increased from 3.3% in 1980 to 5.1% in 2013. Overall, the pork is main source of meat consumption in China. Compared with pork and poultry, the proportion of beef and mutton consumption is still low, but it grows very faster.



Data source: FAO

Fig 2 The composition of Meat Consumption in China

China has become a major consumer of meat. China's total meat consumption reached 77.79 million tons in 2011, ranking first in the world, China accounts for 27% of global consumption of meat. For the meantime, China's total consumption of beef and mutton reached 6.44 million tons and 4.01 million tons, ranking first and third in the world respectively. China accounts for 10% of global consumption of beef and 31% of total global consumption of mutton.

Table 1 Top 10 for Meat consumption in the World (2011, Tones)

		Bovine Meat		Mutton & Goat Meat		Meat
1	USA	11664579.46	China	4006026	China	77791962.81
2	Brazil	7693956.86	India	753704	USA	37037000
3	China, mainland	6442805.43	Sudan (former)	475145	Brazil	18309693.65
4	Russian Federation	2329790.14	Nigeria	463731	Russian Federation	9596000
5	Argentina	2237735.3	Pakistan	427376	Germany	7288000
6	Mexico	1914965.83	Turkey	294595	Mexico	7277189.18
7	France	1612051.72	United Kingdom	293157	Japan	6212000

8	Pakistan	1512969.29	Algeria	270204	France	5638000
9	India	1500967.65	Iran	256941	Italy	5262000
10	Italy	1307517.98	Australia	255000	Viet Nam	5178621.78

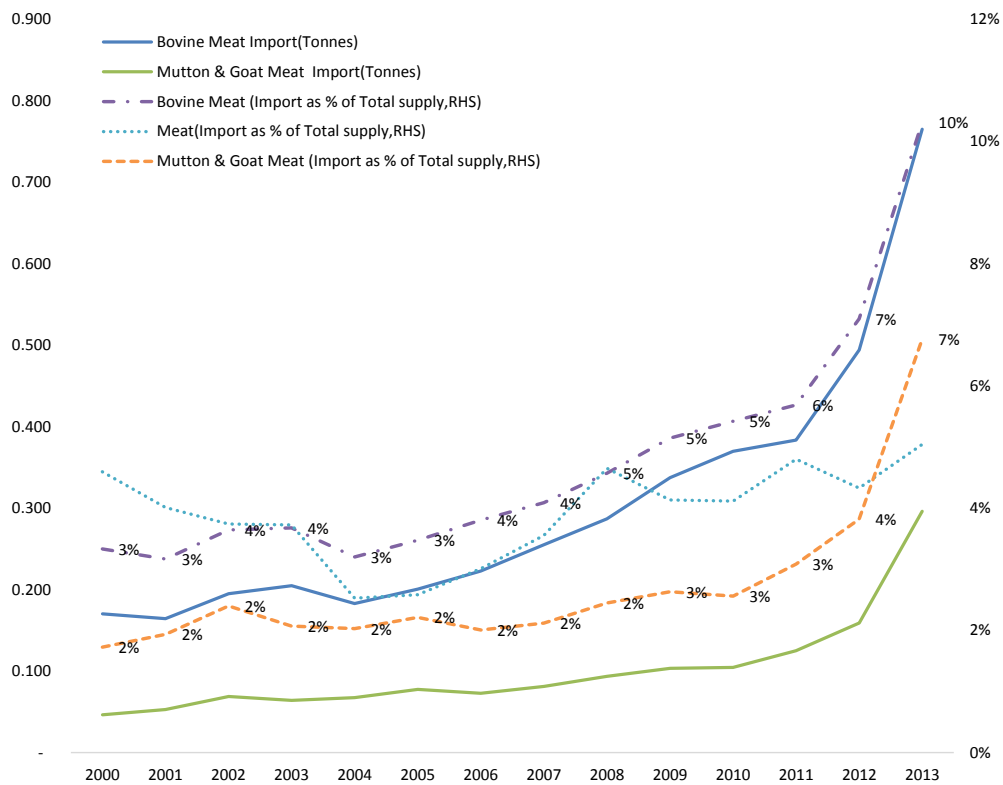
Although China's total consumption of meat is very large, the per capita consumption of meat is still very low and more so for beef compared with many developed countries. In 2011, China's per capita beef consumption is 4.71kg, only about half of the world average and 1/8 of the consumption in the United States. Therefore there are huge potential of meat demand in China.

Table 2 Top 10 for Meat consumption per capita in the World (2011)

		Bovine Meat		Meat		Mutton & Goat Meat
1	Argentina	54.94	China, Hong Kong SAR	153.91	Mongolia	45.11
2	Bermuda	48.21	New Zealand	126.87	Turkmenistan	26.14
3	New Zealand	47.61	Bermuda	123.08	Iceland	21.45
4	Australia	40.57	Australia	121.15	New Zealand	20.52
5	Brazil	39.07	USA	117.61	Oman	14.48
6	USA	37.04	French Polynesia	107.01	Kuwait	13.93
7	French Polynesia	33.9	China, Macao SAR	106.43	Greece	12.76
8	Canada	29.75	Austria	106.37	Mauritania	12.16
9	Luxembourg	29.74	Israel	101.96	Australia	11.21
10	Denmark	29.58	Argentina	101.72	Sudan (former)	10.91
	China, mainland	4.71	China, mainland	56.85	China, mainland	2.93
	World	9.41	World	42.36	World	1.88

With the increase of demand, the market price of beef continues to rise very quickly, from 27RMB/kg in 2007 to about 50RMB/kg in 2015. At the same time, China's import of meat is surging, especially in recent years. The amount of China's import of meat increased from 2.71 million tons in 2000

to 442 million tons in 2013. And, the import of beef increased from 170,000 tons in 2000 rapidly to 765,000 tons in 2013, with an increase of 3.5 times and annual growth rate of over 12%. The Imports of mutton increased from 46,000 tons in 2000 rose to 296,000 tons in 2013, with an average annual increase of 15%. With the rapid growth of imports of beef and mutton, China's foreign dependence ratio of beef and mutton rose rapidly. As for beef, it increased from 3% in 2000 to 10% in 2013, and for mutton from 2% to 7%.



Data source: FAO

Fig 3 The Import of Meat in China

To support the beef industry and increase local production, China's

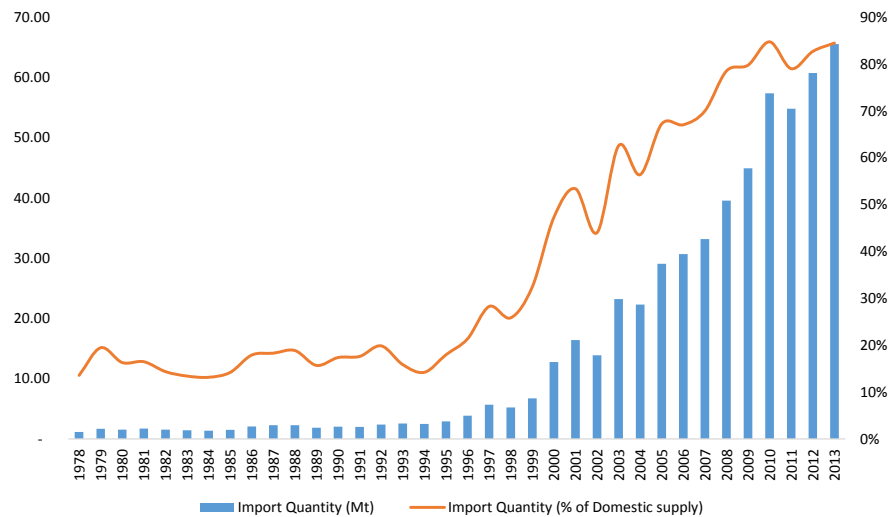
government launched ‘National beef and mutton production development plan (2013- 2020)’. However with urban expansion, agriculture will faces ever more scarce land, labor and water resources and China’s domestic beef production may increase not fast enough to catch up with the accelerating demand, especially in some region.

Therefore, China’s government has two choices: one is to increase the import of meat directly, which will decrease self-sufficiency in meat production; the other is to increase the import of feed/soybean and incent domestic meat production, which will decrease self-sufficiency in soybean production and bring about emission of animal husbandry. In one words, there is a practical question to the Chinese government of whether to import more meat or soybean in the future, which has significant impact on China’s production of meat and soybeans.

2. The consumption of soybeans in China

In addition, China has become main importer of soybean in the world. Soybean consumption in China doubled in the last decade, from 26.7 million tonnes (MT) in 2000 to 77.6 MT in 2013. China’s import of soybean increase from 12.8MT in 2000 to 65.6MT in 2013. With the rapid growth of demand on soybeans, China’s dependence on foreign soybeans

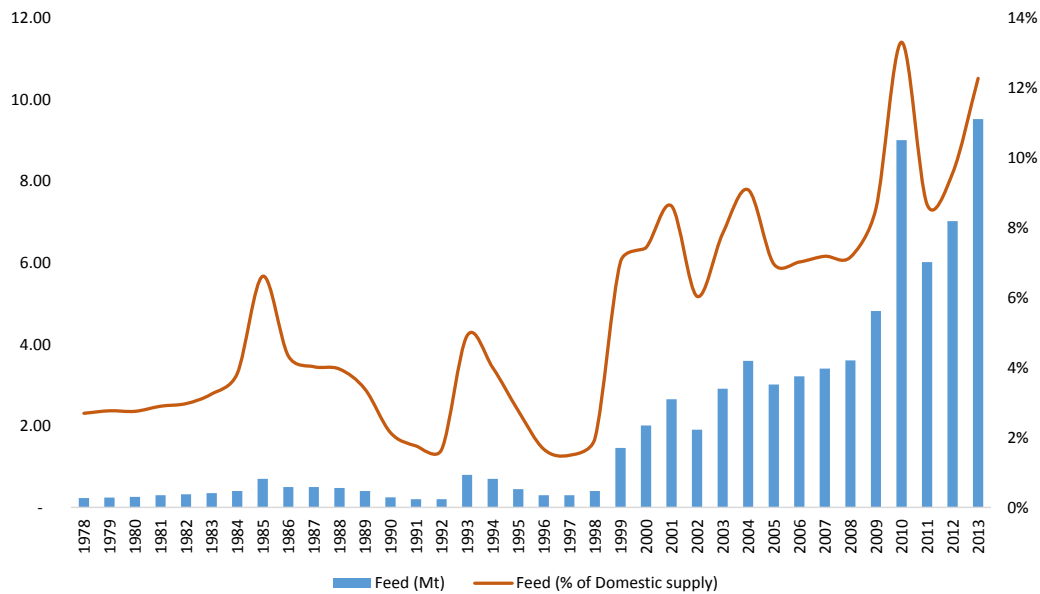
increased very quickly, from around 50% at the beginning of this century to 85% in 2013. Consequently China's choice will also have significant impact on meat/soy exporters in the international market.



Data source: FAO

Fig 4 The Import of Soybeans in China

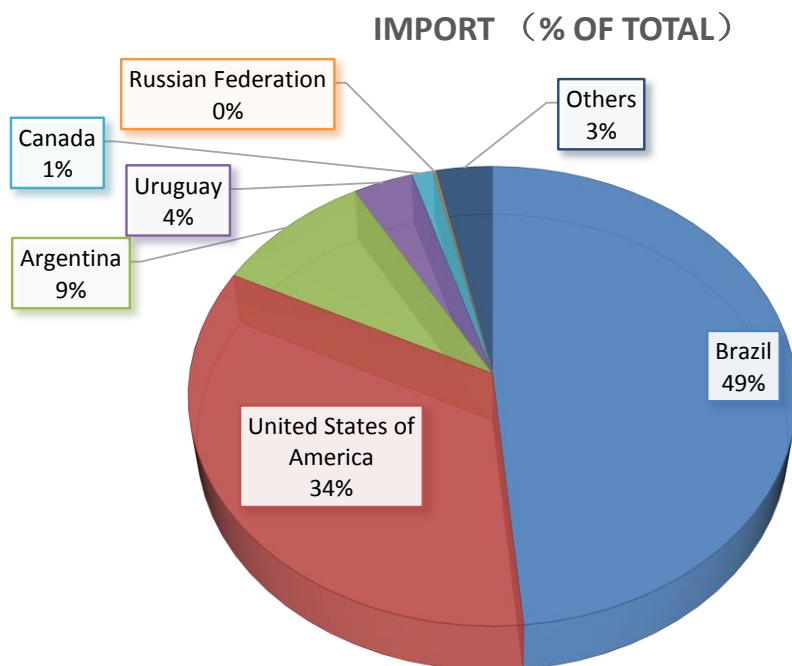
According to the data from China's Ministry of Agriculture, the imported soybean in China mainly serves two purposes: One is for feed meal; the other is for processing soybean oil, i.e. it is used to produce soybean oil. The feed demand on soybeans increased very rapidly. It rose from 2 million tons in 2000 to 9.53 million tons in 2013, with an average annual increase of 13%. The proportion of feed in total demand on soybeans increased very fast, from about 2% at the end of last century to 12% in 2013.



Data source: FAO

Fig 5 Feed Consumption of Soybeans in China

The soybeans imported by China's mainly came from American. The largest source of China's soybeans import is Brazil. In 2013, half of all China's import of soybeans was from Brazil and One-third from the United States.



Data source: FAO

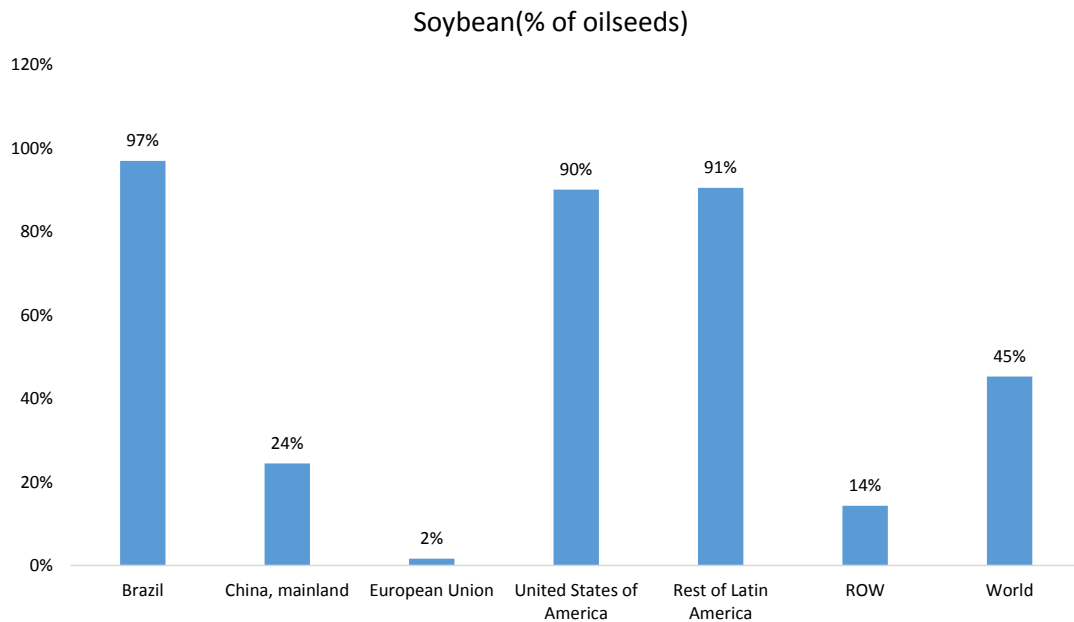
Fig 6 Source of China's soybeans Import

3. The description of the model

The quantitative analyses in this paper make use of global economy-wide CGE models and are based on GTAP (Global Trade Analysis Project) database. The global CGE model can capture the vertical and horizontal linkages between all product markets both within the model's individual countries and regions as well as between countries and regions via their separately identified bilateral trade flows.

This study aggregated 140 regions in GTAP database into six regions: China, Brazil, USA, EU-25, Rest of Latin American, and Rest of the World. Given the close linkage between soybean and meat productions, the model will specify soybean production, import and export. However, there is no independent soybean sector in GTAP database and it is included in "Oil Seeds ('osd')" sector. It is necessary to separate soybeans from oil seeds.

Based on FAO database, this study collected value data for all oil seeds: soybeans, groundnuts in shell, cottonseed, olives, coconuts in shell, palm nuts and kernels, and other oilseeds (See Fig. 7). In addition, the study also collected the cost data of soybeans production for different regions. With these data, this study added a new sector ("soybean") into GTAP database.



Data source: FAO

Fig 7the Value proportion of soybean in all oilseeds

4. The design of scenarios

By setting policy scenarios and simulating them, this study uses the global CGE model to show the impacts of trade/environmental policy on beef and soy bean production and trade.

Two scenarios are designed to simulate the effect of urbanization: BAU and Beef scenario. BAU reflect certain common assumptions. These assumptions are based on foreseeable changes, such as inputs to the Chinese economy that can be projected with reasonable confidence. For example, the increases in population and labor force are all set exogenously, based on projections of official expert agencies of different regions. The BAU scenario will generate a reference development path for the global economy according to what happened in the past and the change of

development condition. BAU scenario will provide a comparative benchmark.

As for Beef Scenario, policy shocks (trade policies or environmental policies) are imposed on the economic system. E.g. China's government impose environmental tax on livestock, i.e. China will import beef than BAU scenario. This study can show the impact of policy shock with the difference between the two scenarios.

5. The Simulation and conclusion

According to the simulation, China's demand on beef will continue to grow very fast in next 10 years. Due to increasing demand, China's domestic beef production will also increase very quickly. This results in the increase of soybeans import. China will continue to be an important export destination for major soybeans suppliers worldwide and Brazil will remain the top supplier of soybeans to China in BAU. In addition, carbon emission, water waste and other pollution in meat production will increase due to the increase demand of beef.

In the Beef scenario, China will shift from importing soybeans to importing meat directly. To some extent, this will ease the severe stresses of the meat production on China's domestic environment.