Sanitary and Phytosanitary Measures in China: Efficiency and Challenge: A Case Study of Swine Industry

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Abstract The Sanitary and Phytosanitary (SPS) measures are technical regulations, standards, and requirements closely related to food safety, plant and animal health, and environmental safety, aiming to prevent disease, pests, pathogens and other alien risk from entering China. Pork is favorite meat for Chinese consumers; its safety directly concerns the safety of whole food supply chain with rapid increasing of pork import. This paper analyzed SPS management system of swine and pork import, and evaluated SPS efficiency of swine industry in China from SPS notification number, swine health situation, and pork import standard. The study found that as for SPS notification number and chemical residue control standard, China's SPS protection level is relatively high, while the control level of swine diseases is still low. In China, SPS management system has the problem of involving multiple authorities and poor coordination among them, leading to some standards lacking scientific basis and low enforcement.

Key words SPS measures, SPS notification, Control system, Control standards

1 Introduction

With development of international trade and liberalization of agricultural trade, incidental risks with trade of agricultural products are increasing. Various animal diseases and plant insect pests spread from one country to another or even the whole world (Buzby, 2003). The avian influenza started in America and Europe in the 1990s, but has brought huge losses to China's breeding industry (Liu , 2011). Pine wood nematode originates in North America, spreads to China with wooden package of cargos imported from Japan, and presents considerable threat to China's forest ecosystem (Cao, 2007). Water hyacinth, also introduced from abroad, has spread in large area of Dian Lake, Lake Tai, Huangpu River, and East Lake in Wuhan, only the annual manual salvage cost is up to 100 million yuan (Xu *et al.* , 2006). According to China Weekly Quality Report issued on June 1st, 2009, there were at least 283 exotic species in China, leading to annual economic loss up to 200 billion yuan. Besides, animal epidemics and anthropozoonoses such as rinderpest, bovine spongiform encephalopathy (BSE), and African swine fever happening and prevailing in some countries and regions may spread to China at any time, and then it will pose grave threat to China's livestock and poultry breeding industry, consumer health, and environmental safety. What's worse, if diseases of exotic animals and plants are combined with local diseases, inset pests, and genes, it will bring greater danger and direct threat to China's industrial security and national security.

In order to resist risks in agricultural product trade, many countries have formulated more stringent quarantine measures. To regulate application of quarantine measures after agro-products liberalization, the Uruguay Round passed the *Agreement on the Application of Sanitary and Phytosanitary Measures* (SPS Agreement) at the same time with the Agreement of Agriculture. The SPS Agreement provides WTO members with the right to use SPS measures to protect human, animal or plant life or health. Each WTO member is entitled to maintain a level of protection it considers appropriate to protect human, animal or plant life or health within its territory. With implementation of WTO agreements , global average tariff of agricultural products is cut down considerably, from 20.2% in 1995 to 12.5% in 2013 (estimated according to TRAINS database of WTO, http://stat.wto.org), while SPS notification number rose from 197 to 1276 in the same period (estimated according to TRAINS database of WTO, http://stat.wto.org), with annual growth rate about 12.4%. These reflect that SPS measures have replaced traditional protection measures like tariff and become major trade protection tools.

Since China's accession to the WTO, foreign trade has been developing vigorously, and especially, import of agricultural products is increasing substantially. In 2002 - 2013, export value of agricultural products rose from 12.41 billion USD to 117.91 billion USD, annual growth up to 22.7% (data source monthly export data of agricultural products issued by the Ministry of Commerce http://www.cccfna.org.cn). China has become the global largest importer of agricultural products since 2012. Without doubt, China is a country with large population but insufficient land and water resource. With advance of urbanization and rising of per capita income, the contradiction between food supply and constant increase of demands is becoming greater, which determines that the trend of large import volume of agricultural products is irreversible. Pork is favorable and popular meat in China. With the open of Chinese market, pork trade experienced a dramatic

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change. China switched to a net importer of pork in 2008 from a net exporter, which it has kept for 30 years. The trade deficit rose from 250 million USD in 2008 to 780 million USD in 2013. Since Chinese swine industry has lost the competitive in both price and safety & quality (Gale *et al.*, 2011, Dong and Qiu, 2014), pork import is expected to grow constantly. Provided that, we concern for whether China has built effective protection system of sanitary and phytosanitary in swine industry, and how the system function to attain the appropriate level of protection.

2 SPS measures in China's swine industry

SPS measures are methods, standards, processing and production methods, inspection and test, certification and approval procedure, quarantine, statistics, sampling, and risk assessment methods formulated on the basis of consumer food safety, plant and animal health and environmental safety. SPS measures are applied to protect human or animal life from risks arising from additives, contaminants, toxins or disease-causing organisms in their food; to protect human life from plant or animal-carried diseases; to protect animal or plant life from pests, diseases, or disease-causing organisms; to prevent or limit other damage to a country from the entry, establishment or spread of pests (SPS agreement, 1995).

Swine industry is related to the first three types of risk, so SPS measures for swine industry are mainly to protect swine health and pork safety. Therefore, SPS system in swine industry can be divided into swine health safeguard system and pork safety assurance system.

2.1 Swine health safeguarding system In order to ensure animal health in China and prevent diseases or pathogen possibly brought by importing live animals, in accordance with *Law of People's Republic of China on the Entry and Exit Animal* and *Plant Quarantine* (1991) and *Regulations for the Implementation of the Law of the People's Republic of China on the Entry and Exit Animal and Plant Quarantine* (1996), China implemented the license management and quarantine system for pork import. According to the law, import enterprise should not import live pigs or swine embryo or semen without swine import license. According to bilateral agreement between China and trade partners, and swine disease control situation of counterpart country, China issues import license for swine with specific source (countries free from swine diseases). For some regions, if disease control is uncertain, it needs test and inspection in advance. General Administration of Quality Supervision, Inspection and Quarantine (GAQSIQ) of the People's Republic of China in cooperation with veterinary department of the Ministry of Agriculture assign veterinary experts to exporter for quarantine. Only when the disease control situation is acceptable, GAQSIQ may include the region into reliable source region of swine importers. Quarantine refers to test after isolation of 45 days for breeding swine. According to *List of Quarantine Diseases for the Animals Imported to the People's Republic of China* (2013), diseases in OIE list A include 15 types, in which foot and mouth disease, swine vesicular disease, classical swine fever, African swine fever, and Nipah virus encephalitis. B diseases include 147 types, 13 of which are related with swine. For meat swine, no quarantine is required and site inspection is acceptable. Besides, when there is severe animal disease in foreign countries and it is possible to introduce into China, it is allowed to forbid entry of means of transport from this epidemic-stricken area or block related ports. No matter site inspection or quarantine, once A diseases are inspected, all animals together with the accompanying animals should be returned or killed and body destroyed; once B diseases are inspected, all animals should be returned or killed, and accompanying animals may be quarantined for observation. Through levels of management and quarantine, it is expected to ensure imported swine does not contain epidemic or toxic substances, so as to protect safety and health of entire swine.

2.2 Pork safety assurance system In order to prevent imported pork and pork products contain pathogens, China mainly implements following types of management over import of pork and pork products. (i) Registration management of export enterprises. Foreign enterprises intended to export pork to China must firstly register in AQSIQ. After assessing quality and safety management system of potential exporting countries, or signing quarantine agreement with those countries or regions, AQSIQ determines quarantine requirements and related licenses, as well as enterprises qualifications for export. (ii) Import enterprise registration system. Domestic import enterprises must register in AQSIQ or local quality supervision, inspection and quarantine authorities. Import of pork and pork products shall not be handled before implementing registration management. (iii) Import license management. The AQSIQ implements quarantine approval system for import of meat products. Receivers of import of meat products shall handle quarantine approval procedure and obtain animal and plant quarantine license before signing trade contract. AQSIQ may assign veterinary experts to make preliminary inspection of meat products to the export country or region according to related provisions. (iv) Import and quarantine in the designated ports. Import of meat products needs quarantine certification documents required by AQSIQ, and meat products should be imported from designated ports and should be stored in refrigerated warehouse or other places registered in AQSIQ. Imported meat products should be supplied with official quarantine certificates of the export countries or regions. Major standard of quarantine is whether pork and pork products are introduced from epidemic-stricken regions of OIE disease A list. If they are imported from epidemic-stricken regions, they should be immediately destroyed or returned; if they are imported from non-epidemic-stricken regions, it is required to test biological safety, chemical safety and physical pollution of pork and pork products. Biological test is mainly to inspect whether meat products are contaminated during slaughtering or transport, whether they contain pathogens or parasites, such as trichina, Listeria monocytogenes, and salmonella; chemical pollution test is to inspect whether breeding of swine contains prohibited chemicals or whether chemical residue exceeds scope of national standards of

China. For example, Ractopamine is prohibited chemical in China and its permitted residue is zero. Once pork and pork products contain Ractopamine, China will immediately return the cargo. Physical pollution test is to inspect whether meat products contain damaged needles. Unacceptable products in test will be issued with quarantine treatment notification. Under one of following circumstances, imported products will be returned or destroyed: no valid import animal or plant quarantine license; no certificate issued by competent authorities of export country or region; imported meat products produced by enterprises without official registration; unacceptable in physical safety, health, or environmental protection.

3 Efficiency of China's SPS system

From the above introduction, we know that SPS protection system for China's swine industry is well established, and management is also regulated. However, efficiency of SPS system is mainly reflected in the protection level, *i. e.* the notification number and content of each notification. The more notification number means the more SPS measures formulated and revised and the higher SPS protection level, while the wider scope of each notification means the higher standard requirement and higher SPS protection level. For swine industry, disease control situation is also directly related with protection level. On this basis, we will evaluate efficiency of China's SPS system from SPS notification number, international recognition of China's disease control, and pork import standard. The first indicator reflects changes of SPS measures or notification number, while the second and third indicators reflect quality of notification level.

3.1 SPS notification Since accession to the WTO, China started to implement notification of SPS measures in accordance with transparency principle of WTO. In 2002-2013, the total SPS notification number of China about swine and swine products were only less than the United States and European Union, higher than Japan and Australia. However, China's notification number is concentrated in 2002 and 2009, while it is blank in 2004 – 2008 and after 2011. The discrete degree of China's notification number is much higher than other five countries, and the standard deviation is higher than USA (6.7), EU (5.6), Japan (3.1), Australia (2.7), and Canada (3.5). On the one hand, China's SPS number of swine and swine products is not stable and reflects imperfect SPS notification mechanism. In comparison, the USA, EU, and Japan are relatively perfect in SPS notification and traceability mechanism, the time lag for unacceptable imported products is short and so it avoids increase of losses. On the other hand, quarantine technologies of the USA, EU, and other countries are relatively advanced, enforcement of quarantine standards is high, so it is able to promptly discover potential risks, and effectively protect animal health and food safety of their countries.

3.2 International recognition of disease control OIE is the world organization for animal health, which established in 1924 for diagnosis and control of animal epidemic diseases. By the end of 2014, OIE has already 180 members. Apart from formulating international standards for prevention and control of world animal diseases, OIE also provides guidelines and advices about prevention and control of animal diseases, animal welfare, and food safety. Its standards have great influence on international trade and are international standards recognized by SPS Agreement for animal health and animal products. In 2007, China become a member of OIE, which helps China's animal epidemic control enter the international path.

Table 1 SPS notification comparison of WTO members in swine and swine products (unit: pieces)

Year	China	USA	EU	Japan	Australia	Canada
2002	73	36	10	4	3	2
2003	4	26	19	5	1	5
2004	17	23	30	4	4	5
2005	0	25	18	5	8	9
2006	0	10	23	7	7	4
2007	0	21	28	9	2	2
2008	0	25	25	9	4	7
2009	54	17	19	10	9	9
2010	2	16	16	11	2	11
2011	4	22	20	10	4	4
2012	0	21	27	12	8	11
2013	2	30	21	13	6	1
Total	156	272	256	99	58	70
Annual average	13.0	22.7	21.3	8.3	4.8	5.8
Standard deviation	24.4	6.7	5.6	3.2	2.7	3.5

Data source: SPS information management system of WTO: http://spsims.wto.org/web/pages/search/notification/Search.aspx
Note: categories in WTO involving swine and swine products include HS01, HS02, HS04, HS15, and HS16.

Recognition of disease and pest free of OIE is a mark of animal disease control level of a member country. By now, China has obtained OIE recognition of free of rinderpest, pleuropneumonia, African horse sickness (AHS), and bovine spongiform encephalopathy (BSE). However, China's swine disease control is still to be improved. At present, swine breeding in China is faced with foot and mouth disease (FMD), porcine reproductive and respiratory syndrome (PRRS), classical swine fever (CSF), pneumonia, streptococcus suis, pseudorabies, and porcine epidemic diarrhea (PED). These diseases not only influence fluctuation of pork price (Woolsey and Zhang, 2011), but also are likely to infect to imported swine, because imported swine is not adapted to living environment of China and lacks immunity to diseases. In July 2013 and July 2014, the Ministry of Agriculture of China notified to OIE about FMD infection of swine in Tibet and Jiangsu. China has been recognized by OIE as a FMD epidemic area. Although government implements subsidies for swine breeders in ear tag system, mandatory immunity, and deep burial of bodies, to avoid infection of diseases, these measures are greatly dampened in the implementation (Liu , *et al.* , 2007). Frequent occurrence of epidemic diseases promotes use of various antibiotics. As a result,

many epidemic diseases are hard to be cured due to higher and higher resistance to drugs. At the same time, bacterial viruses resulted from environmental pollution become more and more, such as swine Escherichia coli and salmonella (Liu and Gao, 2004). During 2001 – 2014, Japan detained 48 batches of China's pork and pork products, in which 54.2% were due to excessive Escherichia coli; the EU recalled 240 batches of pork and pork products, 72.9% of which were due to excessive bacterial colony (data source: arranged according to China's technical barriers to trade website http://www. tbtsps. cn/page/tradez/Wdetainderecall. action). Even though, AQSIQ implements strict quarantine system for import of pork and pork products, China still has 10 years gap with recognition and diagnosis of diseases, which directly influences efficiency of enforcement. For example, the death rate of China's swine is up to 8 – 10%, and the annual loss due to death of livestock and poultry reaches 26 billion yuan (Xu, 2002).

3.3 Pork import standard In the quarantine standard for import of pork and pork products, biological bacteria and chemical residue are major inspection items. From Table 2, we can see that China is more lenient in control of salmonella than other countries, possibly because existing quarantine for swine slaughtering is loose. Many authorities just affix stamp but do not make actual inspection. In transport of pork, some has realized cold chain transport, while some are still traditional hot chain. The control over pathogens is not very strict. If taking excessively strict measures for imported products, it will go against the non-discrimination principle.

However, China takes higher standards for control of chemical residual, the listed 16 chemicals are consistent with international standards, some even higher than international standards. Compared with EU, USA, Canada, Australia, and Japan, China's pork import standard has little gap, but in control of sulfanilamide, China exceeds all countries and becomes the most strict country. These show that China is not low in overall protection level as to biological bacteria and chemical residual control.

Table 2 Comparison of countries in regulations of salmonella for pork import

Country	Imported products	Regulations on control of salmonella
Japan	Fresh, cooled, frozen, and processed pork	Salmonella test should be negative; the Ministry of Health and Welfare reserves the right of rechecking arrived goods and rejects entry of cargoes with positive test result.
Russia	Fresh, colled, frozen, and processed pork	Before exporter signs and issues export test certificate, the exporter should also present negative result of salmonella. Once positive result is found, cargoes will be rejected.
Mexico	Pork and pork products	No special requirement for salmonella
Hong Kong	Pork and pork products	Pork products must pass laboratory test of microorganisms, refuses entry of any positive result products
EU	Fresh pork	Finland and Sweden require test of salmonella before export, reject positive result products, but no special regulation about processed pork products
Canada	Pork and pork products	No special regulation about salmonella, but having right to recheck biological indicators
USA	Pork and pork products	Salmonella test shall be negative, no entry of positive result products
China	Pork and pork products	No special regulation about salmonella
South Korea	Pork and pork products	No special requirement for salmonella

Data source: Dong Yinguo, *Influence of SPS Measures on Pork Trade and Compliance Measures of China*, China Agriculture Press, 2005.9.

Table 3 Comparison between China and other developed countries in chemical residues (unit: ppm)

Name of drug	International standard (2012.7)	USA (2004.5)	EU (2010.7)	Canada (2014.2)	Japan (2006.5)	Australia (2014.12)	China (2014.4)
Bacitracin (microorganism)	–	0.50	No for swine	0.50	0.50	No for swine	0.50 *
Ceftiofur	1.00	0.25 *	1.00	1.00	1.00	No for swine	0.50
Nalectin	–	Prohibited	–	–	–	–	0.00 *
Enrofloxacin	–	No for swine	0.10	No for swine	0.05	–	0.10
Erythromycin	No for swine	0.10 *	0.20	0.10	0.05	0.30 *	0.40
Gentamicin	0.10	0.10	0.05	0.10	0.10	–	0.10
Lincomycin	0.10	0.10	0.05	0.10	0.20	0.20	0.05 (skin)
Neomycin	0.50	1.20	0.50	0.50	0.50	0.50	0.50
Oxytetracycline	0.20	2.00	0.10	0.20	0.20	0.10	0.10
Penicillin	0.05	0.00 *	–	0.05	0.05	–	0.05
Spectinomycin	0.50	No for swine	0.30	No for swine	0.50	1.00 *	0.30
Streptomycin	0.60	0.50	–	0.50	0.60	0.30 *	0.50
Spiramycin	0.20	–	0.25	–	0.20	–	0.02
Sulfonamides	No special instructions	0.10 *	–	0.10	0.02	–	Prohibited * *
Tylosin	0.10	0.20	0.10	0.20	0.10	0.10 *	0.10
Virginiamycin	–	0.10	–	–	0.10	0.10 *	0.10

1. Source of data: International standards come from Codex Alimentarius Commission (http://www. codexalimentarius. net); American data come from FAO database (http://www. mrldatabase. com); EU data come from http://eur-lex. europa. eu (July 2010). Canadian data come from http://www. hc-sc. gc. c (December 2014); Australia data come from http://www. comlaw. gov. au; Japanese data come from http://www. m5. ws001. squarestart. ne. jp; China's data come from No. 235 Notification of the Ministry of Agriculture of China and FSIS of the Ministry of Agriculture of the USA.
2. * denotes residue in edible tissues.
3. * * denotes http://www. fsis. usda. gov/wps/portal/fsis/topics/international-affairs/exporting-products/export-library-requirements-by-country/Peoples-Republic-of-China.

4 Challenges of China's SPS system

On the surface, China has set relatively complete SPS protection barriers for pork and pork products, manifesting higher protection level, especially in control of chemical residue. However, this system is faced with some challenges.

4.1 High cost for coordinating multiple authorities Currently, the connection authority of swine industry with WTO/SPS is SPS Notification and Enquiry Center of the Ministry of Commerce, the connection with OIE is Veterinary Bureau of the Ministry of Agriculture. Domestic standards are formulated by the Veterinary Bureau of the Ministry of Agriculture, while standards for import of animals and animal products are formulated by AQSIQ. According to WTO's principle of non-discrimination, requirements for imported products are also applicable to domestic enterprises. In the case, there will the problem of consistency between animal product standard formulated by the Ministry of Agriculture and imported pork and pork products formulated by AQSIQ. Inconsistency between them will result in standards for imported products higher than domestic enterprises, which goes against principle of non-discrimination. Risk assessment of animal and animal products is performed by Department of Animal and Plant Inspection and Quarantine of AQSIQ, while food safety standards related to animal products are formulated by National Health and Family Planning Commission, and risk evaluation of food is undertaken by Bureau of Import and Export Food Safety of AQSIQ and Department of Food Safety Supervision III of China Food and Drug Administration. These indicate that departments related to import of pork and pork products includes the Ministry of Agriculture, AQSIS, National Health and Family Planning Commission, and China Food and Drug Administration. Multiple departments' supervision means unclear responsibilities and coordination between departments needs high cost. This is also a great drawback of China's segmented management. For many years, China constantly makes reform of organizational structure, but as long as there are multiple authorities, it is difficult to tackle this drawback. Only when there is only a department, the responsibility will be clear.

Table 4 Domestic authorities of swine industry connecting with SPS, CAC, and OIE

	Connection authorities	Formulation/notification of standards	Risk evaluation/enquiry point
SPS commission	The Ministry of Commerce		
Codex Alimentarius Commission (CAC)	China Food Code Coordination Team. The Secretariat is in National Health and Family Planning Commission and the contact point is in the Ministry of Agriculture	National Health and Family Planning Commission	Bureau of Import and Export Food Safety of AQSIQ and Department of Food Safety Supervision III of China Food and Drug Administration
World Organization for Animal Health (OIE)	Veterinary Bureau of the Ministry of Agriculture	Veterinary Bureau of the Ministry of Agriculture formulates national standards for residual limit and detection methods of veterinary drugs; AQSIQ formulates standards and requirements for imported animals and animal products.	Department of Animal and Plant Inspection and Quarantine of AQSIQ

Data source: arranged on the basis of data in websites of related commissions and ministers.

4.2 Some standards lacking scientific evidence According to WTO/SPS Agreement, any SPS measure must be based on scientific risk assessment, and measures without scientific evidence should not be used any more. In China, the risk evaluation of pork and pork products is AQSIS. According to *Risk Analysis Management Regulations on Imported Animals and Animal Products* (No. 40[2002] of AQSIQ), AQSIQ engages in risk management of imported animals and animal products, while the Ministry of Agriculture formulates national standards of animal products. Poor communication between two departments leads to national standards formulated by the Ministry of Agriculture possibly higher than international standards but lacking support of scientific risk assessment. For example, Ractopamine is a type of lean meat powder, mainly used in feed of livestock and poultry, to promote growth of pig and cattle and increase the rate of lean meat of pork and beef, but the safety of its use has international controversy. Some countries with the USA as representative consider that Ractopamine is safe in certain range, and its use is lawful, and persuade 26 countries to support maximum residual of Ractopamine (10 ppm for major meat products). This standard was approved by Codex Alimentarius Commission in 2012, and the USA challenges China's SPS standard with international standard as basis.

China considers that use of Ractopamine will harm physical health because Chinese people are different in pork consumption. Western people do not eat pig viscera, while many Chinese people eat pig viscera. However, Ractopamine is mainly accumulated in pig viscera, especially liver, which increases safety risk of eating pig viscera. At the same time, 60 – 70% of swine in China is bred by separate households. The dosage and withdrawal of drugs are difficult to handle, and it is hard for government authorities to supervise them. This is different from large-scale and factory-based breeding. For this, the Ministry of Agriculture, Ministry of Public Health, Ministry of Commerce, Ministry of Industry and Information Technology, and AQSIS of China jointly issued notification to prohibit production and sales of Ractopamine from December 5, 2011.

The actual problem lies in that although both China and the EU consider Ractopamine limit standard is not reasonable and Swiss and Norway support such opinion, but the USA follows international standard. In this sense, China's standard is higher than international standard. In accordance with WTO principle, SPS measures higher than international standard must be supported by

scientific evidence or scientific risk assessment. Otherwise, SPS measures will have to be canceled. In such context of controversy, if AQSIQ can prove that metabolism and accumulation of Ractopamine in human body will harm physical health even in the range of residue limit, China's SPS measures are appropriate and protection measures are proper. Otherwise, if it proves that residue limit has safety risk but it is not enough to harm the public health, it will show that China's SPS measures are excessive. Therefore, whether Ractopamine residue limit is reasonable and whether China's SPS standard is proper, it needs support of scientific testing data.

4.3 Low enforcement of chemical standard When formulating national standards, developed countries will not only issue maximum residue limits of chemical, but also issue sampling and detection method of residue. Since China is defective in SPS management system, such as formulation and implementation of standards and separation of risk evaluation authorities, products with potential risks may have no standard or the existing standards lack implementation conditions and supervision methods. For example, in 1999, China formulated maximum residue limit standards for 109 veterinary drugs, but only 39 of which have test methods and only 20 of which can be effectively monitored. In the *Veterinary Drug Maximum Residue Limits in the Food of Animal Origin* revised by the Ministry of Agriculture in 2002, 134 veterinary drugs and chemical substances are specified with maximum residue limits. By now, only about 50 drugs actually apply standard methods, and the rest 60% have no detection methods (Dong, 2011). As a result, when quality supervision and quarantine department detects imported products as per these standards, it will find that it is not feasible. That means the standard performs no practical function, and protection level of standard can not be reached at all. Some experts (Finger, 2011) stated that constantly raising existing safety standard level or implementing new SPS measures or performing related safety risk evaluation will be difficult or costly, developing countries will fail to afford, and it is difficult to realize in risk evaluation technologies. Therefore, in this sense, China should make further effort in setting and implementation of SPS standards, to actually protect safety of animals and the whole food supply chain through controlling introduction of diseases.

5 Conclusions and policy recommendations

We studied swine health safeguard system and pork and pork product safety assurance system of SPS protection system of China's swine industry, and evaluated the efficiency of SPS protection system from SPS notification number, international recognition of swine diseases control, and standard of pork import. We found that overall notification level of China's SPS measures is not low, but mainly concentrated in several years, showing high fluctuation. In swine disease control, China has realized transparency of OIE information, but the control level of swine diseases is still not recognized by the world, especially there is a great gap in diagnosis and prevention of swine diseases. In quarantine standard of imported pork, China is more lenient than developed countries in control of biological diseases and bacteria, while the standard of China in chemical residue is relatively high. China's SPS protection level is still not reaching the level as stated in standards. Because of many departments involving in SPS affairs, the coordination cost is high, standard formulation, standard implementation, and risk evaluation authorities are separate, some standards lack scientific evidence, and some standards are infeasible to implement. In view of these, we came up with following recommendations for improving SPS protection system of China's swine industry.

5.1 Straightening out management mechanism of China's SPS protection system It is recommended to change China's domestic and foreign trade management system, and solve the problem of separation of domestic and foreign trade. According to international experience, agricultural authorities should manage all affaires of animals and animal products, including control of animal diseases, evaluation of animal related risks, and formulation and revision of standards for animals and animal products. China should learn international experience, coordinate responsibilities of agricultural authorities and state quality inspection and quarantine department, to make protection of imported products consistent with domestic products, and provide scientific basis for formulation of national standards. It is expected to increase efficiency of formulation and implementation of SPS measures, bring into full play function of SPS measures in preventing risks, protect life health and safety of our people, and protect animal and plant health and ecological and environmental safety of our country.

5.2 Strengthening risk assessment and enhancing revision and notification of SPS measures At present, there are few laws and regulations in China about SPS measures for pork, and existing laws and regulations are old and fail to effectively protect diseases and extraneous risks. For example, the *Law of the People's Republic of China on the Entry and Exit Animal and Plant Quarantine* was formulated and implemented in 1992, but no revision has been made. According to SPS Agreement, every SPS measure implemented by China should have scientific basis, and those without scientific basis should be canceled. Otherwise, it will lead to trade conflict. Therefore, China must strengthen risk evaluation and provide SPS standard with scientific core for import of pork, to make effective protection level consistent with nominal protection level.

5.3 Strengthening animal disease diagnosis and control China has established official veterinary system according to requirement of OIE, but it still remains in the concept. The Ministry of Agriculture should popularize vertical official veterinary system at the request of OIE, strengthen cooperation with OIE and member countries, formulate China's disease control plan, input financial funds and human resources to improve China's swine disease diagnosis and control technologies, raise SPS protection level, ensure health of entire swine group, and make effort to obtain certifi-

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sults show that urbanization will promote consumption growth and the consumption growth will promote urbanization process. Impulse response analysis and variance decomposition analysis results indicate that growth of urbanization in short period will exert reverse response to resident consumption growth, but urbanization will pull resident consumption and promote economic development in the long run. Besides, after a long time, the effect of urbanization process on urban resident consumption will be greater than rural resident consumption. In line with the above conclusions, we came up with following recommendations:

(i) Increasing income of residents. The key for expanding consumption lies in increasing income of residents. Thus, the key for promoting China's population urbanization lies in solving employment problem and increasing income. To fundamentally influence or even change consumption ideas of rural residents, it is required to solve poverty problem of farmers. Once wealth increases, but the absolute value of deposit will not be changed, the relative value will drop and consumption will rise.

(ii) Practically implementing various social security policies. Social security is an essential lever for coordinating social economic development in the process of urbanization. It plays an important role in ensuring rural farmers to enjoy equal development rights. At present, there are great difficulties in eradicating urban and rural dual structure. Only when their social security problem is solved, may they reduce deposit and expand consumption, and accordingly promote economic growth.

(iii) Attaching great importance to long term and promoting benign urbanization process. Urbanization is not solely moving rural people to cities, but more important, it is to solve the worry of farmers. The key for urbanization lies in people, thus absorbing rural surplus labor and solving their employment, children education, and medical care problems are key works of local government, rather than pursuing short-term benefit and launching image projects.

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