



Urbanisation, rural transformations and food security

The view from China

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This paper discusses who eats what in China and why, with a focus on understanding the evolving axes of inequality with regard to access to affordable, safe and nutritious food in the context of changing rural–urban linkages. The production, distribution and consumption of food has changed in the context of rapid economic growth, urbanisation and industrialisation, leading to denser and more complex rural–urban linkages. The paper discusses policies aimed at ensuring adequate food provision and the regulation of quality and safety, as well as synergies and tensions between them such as the need to keep prices low while at the same time ensuring safety and nutritional quality.

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Summary

This paper discusses who eats what in China and why, with a focus on understanding the evolving axes of inequality with regard to access to affordable, safe and nutritious food in the context of changing rural–urban linkages.

After noting the multiple dimensions of food security (quantity, nutritional quality and balance, safety and cultural significance), the Introduction discusses what is special about the China context, including limited land and water resources, fragmented land holdings and extremely rapid urbanisation and industrialisation. Section 2 reviews the legacy of the socialist period, which was characterised by an overriding concern with ensuring basic food security and nutrition in the context of widespread poverty. Rural–urban linkages were minimal at the time, the production and distribution of food was managed by the state, and the bifurcated residence system established different systems of provisioning for rural and urban households. Urban households had guaranteed food supplies underpinned by rationing, while rural populations were largely dependent on what they could provide for themselves. However, fiscal transfers and social protection policies cushioned poor populations and mitigated regional inequalities to some extent.

Section 3 discusses the ways in which the production, distribution and consumption of food have changed in the context of rapid economic growth, urbanisation and industrialisation. Food production has increased in terms of quantity and diversity; and food-processing, distribution, retail and catering industries have burgeoned. In combination with rural–urban migration, and improved transportation and communications, these have fostered denser and more complex rural–urban linkages.

Section 4 sketches what we know about patterns of consumption. Basic food security has been more or less guaranteed in terms of caloric intake, although iron and vitamin deficiencies remain a problem in some areas. However, over nutrition and high consumption of fat and sugar are quickly replacing under nutrition as the major policy concern due to their contribution to rising rates of obesity and diabetes. Industrialisation, urbanisation and intensification of agriculture, along with the rapid expansion of production and food processing have also generated new risks related to food safety that are causing great public anxiety. The diversification of supply chains has also generated new inequalities regarding access to safe and nutritious food that cannot be captured by simple categories of rural, urban and migrant.

Section 5 discusses policies emanating from different systems aimed at ensuring adequate food provision and the regulation of quality and safety, as well as synergies and tensions between them. It notes the importance of food-specific initiatives and also broader social welfare policies in protecting potentially vulnerable populations, particularly the low-income rural and urban poor, against traditional food insecurity. However, while noting China's success in this respect it highlights tensions between keeping prices low while at the same time ensuring safety and nutritional quality. The report also points to the challenges of balancing the interests of the food industry with those of public health. China shares these challenges with many other countries, but it has the advantage of having food and health maintenance cultures that potentially provide greater support for policies that encourage a healthy, sustainable diet.

1

Introduction: multiple dimensions of food security

The Food and Agriculture Organisation (FAO) of the UN defines food security as existing “... *when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life*” (FAO 1996). This definition emphasises that food security has several dimensions that relate not only to the availability of adequate quantities of food but also to its quality and cultural significance.

The interactions between these various dimensions of food security are complex and, while they may often be complementary, there are also times when pursuing one goal may lead to tensions and tradeoffs with regard to others. For example, an emphasis on improving safety may increase the price of food due to the costs of compliance with standards, making food less affordable for the poor; while an emphasis on quantity alone may lead to a neglect of nutritional quality and diversity of choices. These interactions can have long-term consequences if poor people end up with access largely to food that is ‘safe’ but of low quality in nutritional terms, leading to micronutrient and other deficiencies, or if diets are sufficient in caloric terms but shift towards being centered on foods that contribute to obesity, diabetes and heart disease. Different approaches to food security can also have implications in terms of environmental sustainability and animal

welfare, although these lie beyond the scope of this report (see Garnett and Wilkes 2014 for a discussion).

This paper discusses interactions between the different dimensions of food security in the context of China, with a focus on understanding the axes of inequality with regard to access to affordable, safe and nutritious food, and the factors that are driving major patterns and trends in food consumption. In keeping with the overall goals of the project, the emphasis is on the way in which food security intersects with processes of urbanisation and rural transformation and with changing rural–urban linkages.

Before continuing, it is important to note some aspects of China’s situation that are different from other countries and that shape its food system and rural–urban linkages more generally. First, China faces considerable natural resource constraints. It must feed a fifth of the world’s population with only seven per cent of the world’s arable land. Water resources are also tight, at approximately 2,000 cubic metres per person annually, compared with a global average of about 6,200m³ per person per year (World Bank 2012). These factors create an incentive for intensive agriculture to ensure food security, and create strong competition for land and water between agricultural, industrial and residential uses.

Second, the Mao era has left a complex legacy, which includes continued state ownership of land and restrictions on population mobility. These have maintained quite strong, although changing, linkages between rural and urban areas even in the context of rapid urbanisation. Third, unlike some other countries, urbanisation in China has gone hand in hand with rapid industrialisation. This has provided employment opportunities for former agricultural workers, raised incomes and increased government revenue, but it has also generated serious environmental pollution that has had negative effects on the agricultural environment, with implications for crop yields, nutritional quality and food safety. In addition to changes in land use that affect food production, agriculture–industry interactions are therefore an important rural–urban linkage in the Chinese context. Fourth, although the balance between the state and the market has shifted in favour of the latter in the reform period, in China the government still plays a much bigger role than it does in most other countries, both in the economy and in attempting to shape public attitudes and behaviour regarding food. This is reflected not only in policies relating directly to food (ensuring supplies, adequate nutrition and safety) but also in other policies (for example, income supports for the poor and nutritional guidelines) that affect consumer purchasing power and practices.

Lastly, in considering China, it is important to bear in mind the enormous diversity within the country and even within regions and rural or urban areas, both in levels of development and also in the types of food that are produced and consumed. China's sheer size means that differences across regions in the natural environment, in the food produced and in diets are equivalent to those between northern and southern Europe (Wu and Li 2015; Gale *et al.* 2002). Average statistics are therefore often of little use in understanding the situation regarding any given place or population. The very pace of change also means that much research and policy lags behind the actual situation on the ground.

This report draws on a wide range of academic and grey literature relating to the various dimensions of food security and rural–urban linkages. Given constraints of time and space, it was not possible to conduct a comprehensive review of these many different sources. The goal has, rather, been to map the broad territory of our knowledge about these issues and examine the way in which different trends and policies intersect. In this spirit, references have been kept to a minimum.

2

Background: the legacy of the Mao era

China's economy in 1949

When the Chinese Communist Party (CCP) came to power in 1949, China was emerging from decades of domestic and international conflict. It was, by any standard, a poor country, with a per capita GDP less than half the average for Asia at US\$ 60 in 1990 dollars (Du *et al.* 2014). Even compared to other countries on the eve of industrialisation, China lagged behind: in 1952, it was not only poorer than India but also poorer than England and Wales in 1801, and poorer than Japan in 1870 (Bramall 2008: 55). Life expectancy had been rising in cities but was still only about 35 years on average (Du *et al.* 2014), lower than the UK in the mid-19th century (Bramall 2008: 57).

The economy was in crisis. Wars had destroyed industrial capacity, and agriculture had been disrupted by conscription and the flight of population to the cities. By 1949, agricultural output was only about two thirds of the highest previously recorded level (Du *et al.* 2014) and hunger was a serious problem. Although no good data are available, accounts of this period assume that many people died directly of hunger and others indirectly through increased susceptibility to disease. High rates of infanticide (mostly of girls) can also be attributed to families' inability to feed them, although it more generally reflected the custom of patrilocal marriage, which made raising girls to adulthood unaffordable in hard times. China was a land of frequent famines, in which "*Have you eaten?*" was the standard greeting.

At the time of the revolution, more than 80 per cent of the labour force was employed in agriculture, which provided half of GDP (Bramall 2008: 55). It is hard to measure inequality during this period due to the lack of good data and regional variation, but Goodman (2014: 10) estimates that more than 50 per cent of the land was in the hands of 10 per cent of the population.

Collectivisation of food production and distribution

In this situation, the development priorities of the government were to secure basic needs for the whole population, while at the same time accumulating capital for industrialisation and economic growth. Food security was pursued largely through the collectivisation of production. After being redistributed to individual households during land reform in the early 1950s, land was later progressively collectivised, first into cooperatives and then into people's communes. Rural residents worked in return for labour points that could be cashed in to purchase food and other necessities. The degree to which peasants were able to supplement their food supply through production on private plots and raising poultry and pigs varied with policy swings during this period. At the peak of collectivisation during the Great Leap Forward, private production was almost entirely prohibited and food was provided free of charge in communal canteens.

Distribution was also transformed. The CCP had encouraged peasants to set up supply and marketing cooperatives (SMCs) in its base areas as early as the 1920s, and these were expanded as a way to replace private enterprises in rural areas after the revolution. SMCs operated a system of unified procurement, in which major agricultural products, especially basic cereals, had to be sold to the state at administered prices, and they also sold consumer goods and agricultural raw materials such as pesticides, fertilizers and seeds to peasants. SMCs were therefore an important linkage between rural and urban areas, facilitating the exchange of agricultural and industrial goods in the absence of market mechanisms but also determining what was bought and sold and at what price (Wan *et al.* 1988). The system was intended to ensure the supply of necessities in a situation of scarcity, and for most of the time it did this, although at the cost of limiting the range and quality of goods available. However, reliance entirely on a bureaucratic distribution mechanism also risked disaster in the event of its failure, which occurred when the government failed to reduce quotas in light of radical drops in production during the Great Leap Forward.

In urban areas, private business was also brought progressively under the control of the state, and by 1956 had been almost entirely collectivised. State-owned enterprises and other work units (*danwei*) provided not only secure employment but also housing, education and medical care. Within urban areas, food was supplied at set prices in state-owned stores and markets, with a rationing system introduced in 1955 for staple foods and for oil, meat and other products. Many state-owned workplaces ran canteens for their staff and workers. In both rural and urban areas, limited transportation networks and lack of refrigeration meant that food supplies were mostly limited to local and seasonal fresh products supplemented by dry and preserved goods. But regardless of how it was produced and where it was consumed, food continued to be in short supply and diets were dominated by staples (coarse grains and rice). Even in privileged Beijing, in winter the staple vegetables were cabbage and leeks, which were inexpensive and could be easily stored. Meat and other animal products were a luxury enjoyed mostly at festivals and family celebrations.

Under this new regime, food production steadily increased until the late 1950s, when it was interrupted by a combination of natural disasters and the policies of the Great Leap Forward. Between 1958 and 1962, during the Leap and its aftermath, the country suffered serious food shortages: intake of cereals fell by 18.9 per cent, intake of animal source foods by 42.1 per cent and edible oil intake by 55.2 per cent (Du *et al.* 2014).

It is impossible to accurately assess the number of people who died of hunger and estimates range from 12 to 38 million people (Bramall 2008: 126); however, demographic statistics show the broad outlines of the disaster: the population growth rate had increased from 16 per 1,000 in 1949 to 23.2 in 1957, but it fell to 17.2 per 1,000 in 1958, 10.2 in 1959 and -4.6 in 1960, before returning to 27 per 1,000 in 1962 (Du *et al.* 2014). Even in wealthy cities, the impact of hunger is clear in statistics on child development. In Jinan, 14-year-old schoolboys – a relatively affluent population given the cost of schooling – were on average 5.8 centimetres shorter and 4.8 kilogrammes lighter in 1962 than in 1956 (Du *et al.* 2014).

Despite the upheaval of the Cultural Revolution, food production recovered between 1962 and 1978 and this is reflected in dietary data: intake of cereals increased by 25.8 per cent and intake of animal source foods and edible oil doubled (Du *et al.* 2014). Where earlier gains in production had been achieved largely through the intensification of traditional farming methods and mechanisation, the 1960s also saw the beginning of more widespread use (and production) of chemical fertilizers and pesticides as well as the introduction of higher yield seeds resulting from investment in agricultural research.

Inequality and rural–urban linkages

In terms of inequalities with regard to food security during this period, urban areas were privileged by rationing and by the low prices for basic cereals imposed by the government. These effectively subsidised urban consumption at the expense of rural producers and also enabled the government to siphon off the surplus from agricultural production to invest in industry. In rural areas, access to food was determined partly by what could be grown locally, but also by ability to work and earn labour points and by class status. Urban residents were sorted into multiple work grades underpinned by as many as 62 class descriptors (Goodman 2014: 13–17). Priority was generally given to people with disadvantaged class backgrounds (poor peasants and workers), while those with ‘bad’ backgrounds (rich and middle-rich peasants and formerly wealthy urban residents) had more limited opportunities and were periodically persecuted during political campaigns. Despite policies aimed at improving gender equity, in rural areas girls would be fed less than boys, whose labour was needed for farming and who would remain at home while daughters married out.

In addition to direct state management of food production and distribution, it is important to note that food security was also affected by social protection policies. For urban residents, grain rations were allocated regardless of ability to work (although expected to be repaid). Rural people were expected to be self-sufficient in food, but from 1956, the Five Guarantees (*wubao*: food, clothing, housing, medical care and burial) supported rural households that lacked able-bodied workers (Bramall 2008: 237). More generally, fiscal and grain transfers cushioned reliance on local resources to some extent, and other policies, including the siting of some new industries in central and western China in the 1950s, and later rural industrialisation, aimed to reduce interregional and rural–urban inequalities (Bramall 2008: 110). Nonetheless, serious gaps remained between urban and rural areas, and between provinces in terms of GDP and health and education indicators (see Bramall 2008: 174–210 and 235–237).

In terms of rural–urban linkages, another important phenomenon to note during this period is the strict control of population mobility between rural and urban areas. Although relatively free population migration was allowed in the early years after 1949, in order to recruit labour for newly fledged industries, from 1958 the residence registration (*hukou*) system was used to restrict rural–urban migration, partly through controlling access to food rations and public services in urban areas. This had the effect of preventing the growth of cities through migration and meant that industrialisation proceeded largely without urbanisation after 1958. For example, the population of Shanghai in 1977 was actually less than it was in 1957 (Tian and Lin 1986: 308–310).

During this period, then, cities were dependent on rural areas for food but there were few direct rural–urban linkages. Rural residents were primarily engaged in food production and urban residents barely at all. Producers and consumers had no direct contact, and especially in mountainous regions, many of China's villages lacked transportation or communication links with urban centres. The distribution of food was tightly managed by the government, with little opportunity for demand not sanctioned by the state to influence production or consumption. At the same time, China's economy was largely isolated from international trade, so nearly all food was produced domestically. The exception was the period following the great famine, when China imported significant amounts of grain from Canada.

Food safety and quality

In terms of food safety, the primary risks at this time would have been from poor sanitation and biological contamination of food during production, transport and storage. However, environmental pollution was building up in certain regions as China industrialised. During this period, industry was largely concentrated around Shanghai and in the northeast, and pollution was already very serious in areas such as the Huai river valley (Economy 2004). The exception to this concentration of industry was the relocation of some plants to remote rural areas in the hinterland, to promote development and in the interests of security under the Third Front (*sanxian*) policy. The exploitation and processing of minerals were also pursued in areas with large mineral deposits, concentrated in the northeast and through Hunan into the southwest (Bramall 2007). In the absence of any pollution control, land around these industrial facilities was quite seriously contaminated by heavy metals and sometimes whole watersheds were affected. However, there is no systematic data about how this affected food safety; the first Total Diet Study was not conducted until 1990.

Most of the increase in agricultural production during this period was the result of opening up new land for cultivation, the building of collective irrigation systems and the introduction of high-yielding rice varieties, as well as more intensive farming methods. Agricultural inputs, including chemical pesticides and veterinary drugs, were being developed and coming into more widespread use from the 1960s but were not yet seen as a significant problem for food safety. Food safety in rural areas, referred to as 'food hygiene' (*shipin weisheng*), was just one of 14 basic health responsibilities conducted by 'sanitation and anti-epidemic stations' (*weisheng fangyizhan*) and focused mostly on food handling and storage, while safety in food-processing industries and distribution was the responsibility of the ministries who directly supervised them (primarily the Ministry of Light Industry and Commerce). Although in many economic sectors quotas and targets led to the production of shoddy goods, under the planned economy, profits did not provide an incentive for deliberate adulteration or manufacturing of fake food products as they do now. Most food safety incidents involved accidental contamination and occurred in the home (Liu 2010).

3

Reform: urbanisation, rural transformations and changing rural–urban linkages

The period from 1978 to 2008 saw very rapid economic growth and rising living standards. Between 1978 and 2008, both rural and urban per capita incomes increased more than sixfold (UNDP 2010) and China's score on the Human Development Index rose from 0.423 in 1980 to 0.719 in 2013 (UNDP 2014). China became the second largest economy in the world, and moved into middle-income status. During this period, both urban and rural areas underwent profound changes, and the nature of the relationship between them also changed, with more complex linkages and the blurring of the formerly hard distinctions between urban and rural livelihoods and lifestyles. However, average statistics obscure considerable regional and rural–urban variation and inequality across all of these dimensions.

Agricultural reform and increased production

Reform began in rural areas with the contracting out of land to farmers, who were still obliged to meet quotas for production of cereals and certain other key products but, beyond this, were free to produce what they wanted for themselves or for the market. Agricultural production

expanded rapidly, with grain productivity doubling from 1980 to 2010 (Carter *et al.* 2012). There have also been large increases in the production of higher-value livestock, aquaculture products and horticultural produce. The gross value-added output of crop production grew at 2.9 per cent per annum over the same period, while the aquatic and fisheries sector grew by 6.8 per cent and livestock by 5.9 per cent (Carter *et al.* 2012). These large gains in productivity have been attributed partly to market stimuli, but also to an increase in the use of chemical inputs in the horticultural sector and to the scaling up of production and the introduction of new animal feeds and genetics in the livestock sector (Carter *et al.* 2012).

As a result of these changes, both the volume and variety of food available have expanded enormously. At the same time, production has become more specialised and more geographically concentrated. Overall, there has been a shift from mixed crop/livestock farming to monocultural agriculture and to larger-scale raising of livestock. This has increased output and led to patterns of production based on regional comparative advantage. In combination with the transfer of rural labour out of agriculture, it has also reduced local self-sufficiency in food.

While these transformations are common to many other countries, Chinese agriculture has retained some unusual characteristics. Farmland is owned by the state, with *land use rights* contracted to households for 30-year terms, which are shorter than those for urban residential and industrial land (Huang *et al.* 2012). On the one hand, this provides a safety net for rural migrant workers in the event of unemployment, and many did return during the financial crisis of 2008. Along with other factors, the option of return migration is seen as having limited the formation of shanty towns and informal settlements common to many other developing countries. In combination with restrictions on settlement in cities (see below), this system of land tenure also maintains stronger rural–urban linkages than in many countries and some degree of self-sufficiency in food.

However, the low returns to agriculture in relation to other occupations means that many rural people choose not to farm if they have an alternative, with the result that land is left idle. At the same time, farmers have been unable to convert their land into cash to purchase urban housing or invest in businesses, and the lack of clear property rights has led to government expropriation of rural land for development projects from which farmers have benefited little, often receiving a fraction of the price at which their land is later recontracted to developers. Issues around land grabs and inadequate compensation for expropriated land have been a major source of conflict in rural areas (SCIO 2015; World Bank/DRC 2014; Zhu and Reidinger 2011).

The contracting out of farmland to individual households also created highly fragmented land holdings; the majority of agricultural production is carried out by around 200 million smallholders working on very small holdings with an average of 0.6 hectares. Because an effort was made to allocate land of different quality fairly across households, these holdings are often made up of smaller, non-contiguous plots, 60 per cent of which have an average size of less than 0.1 hectares (Keeley 2013). Although it has many farmers, China therefore does not have many family farms as exist in most parts of the world. The small scale of land holdings is seen as limiting capital investment and technical upgrading – which would benefit agricultural yields – as well as preventing efficient irrigation (Huang *et al.* 2011). Analysis of food safety also often points to the number of smallholders as an impediment to the monitoring and regulation of the use of pesticides and other inputs (for example, Gale and Hu 2012). A range of policies have been introduced to address these issues in different ways and these are discussed in Section 5 below, but the underlying principles of state ownership and household contracts for small plots of land remain.

Food processing, distribution and retailing

Changes in the structure of agricultural production have been accompanied by changes in the food-processing and distribution systems. With the phasing out of restrictions on private enterprise, the sector exploded in the years following reform. For example, between 1984 and 1985 more than 560 collectively and 520 privately owned food factories were created in Beijing, almost twice the number in the previous state-owned sector (Liu 2010). The processed food market has continued to grow rapidly and was valued at US\$ 140.4 billion in 2011 (Bradbury 2012), although declining from its 2010 peak due to slowing overall growth and rising costs for labour, ingredients and compliance with food safety standards (GAIN 2013). Nonetheless, food processing is an important employer and contributor to GDP (8.8 per cent in 2010) and the sector now has its own Five-Year Plan that aims to promote development of large-scale enterprises, improve their spatial distribution, and encourage coordination between agricultural production, processing and marketing. There are targets for building enterprises and brands in particular sectors, including meat and dairy (NDRC 2012).

The number of large firms has grown: in 2010, there were 27 food-processing companies with sales of more than US\$ 1.65 billion, 15 more than in 2005. International companies based in Asia, Europe and the US are also actively investing in China (see Garnett and Wilkes 2014). Despite this, overall, the food-processing sector continues to be dominated by small firms. Enterprises employing fewer than 300 people made up about 93 per cent of all businesses in 2007, while almost two thirds of businesses had fewer than ten employees. Many firms operate without formal credentials: in 2007, half of all businesses had improper business licences and 164,000 were unlicensed (data cited in Thompson and Hu 2007). As with small farms, many analysts consider that the large number of small players contributes to poor capacity for technical innovation and infrastructure development. The speed with which small companies move in and out of markets also makes it hard to develop effective traceability systems (Gale and Hu 2012). More broadly, industry fragmentation may result in highly competitive markets, which can be a concern for food safety if profit margins are too tight (Wang *et al.* 2009). However, the actual relationship between scale and safety remains unclear (some large firms have been involved in food safety incidents), and is most likely not linear or uniform across product types.

Food retailing has also seen significant change, with traditional wet markets now coexisting with an increasing number of large and small supermarkets. While general retail sales grew at 10 per cent per year in the 2000s, the supermarket sector grew by 30 per cent. By 2004, supermarkets accounted for about 30 per cent of urban food retail sales (Zhang and Pan 2013), and international stores, including Carrefour and Walmart, have a presence in most major cities. More food is also consumed outside the home in restaurants, fast food outlets and at street stalls. Out-of-home food consumption grew 159-fold between 1978 and 2008 (Hawkes 2008), and international fast food companies, including McDonalds and KFC, are pervasive in major cities, alongside Chinese outlets. Rural townships and villages have also seen the diversification of food sale venues, with outdoor markets supplemented by small food and general stores as well as trucks that circulate around villages selling grains, vegetables, fruit, meats and soy products.

The food-processing, distribution and retailing sectors are important sources of employment and revenue, especially in agricultural areas where they offer higher added-value than agriculture alone. They have been particularly important in spurring growth in less-developed regions in western and central China and, in areas where pollution from heavy industry has caused environmental degradation, these industries are seen as a cleaner alternative.

Urbanisation, rural transformations and rural–urban linkages

A major factor affecting patterns in food consumption is the incredibly rapid growth of China's cities. China's urban population grew from 191 million in 1980 to 636 million in 2010. The urbanisation rate passed 51 per cent in 2011, up from 19 per cent in 1979 (Yeh *et al.* 2011), and is projected to reach 70 per cent by 2030 (World Bank/DRC 2014). The total number of cities in China grew from 193 in 1978 to 655 in 2008, and the number with more than one million people grew from 13 to 58. The urban built-up area increased fivefold between 1981 and 2008 (Yeh *et al.* 2011). However, although the numbers involved are unprecedented, the pace of urbanisation in China is slower than in Japan and Korea at their peak, and the urbanisation rate is still low in relation to GDP (World Bank/DRC 2014).

Rural and urban areas are now much more closely linked by infrastructure and information networks. The rapid development of roads and railways has facilitated the movement of both goods and people. Since 2000, China's expressway network has grown by more than

16 per cent a year to become the second largest in the world. The 12th Five-Year Plan aimed to have all townships and 90 per cent of villages connected to roads (KPMG 2011), and rapidly expanding urban metro and light rail systems often now reach out to surrounding county towns. Bringing electricity to rural areas was a major part of China's poverty alleviation strategy from 1994 and coverage is now more than 98 per cent (Luo and Guo 2013), making refrigeration possible and improving communications: at the end of 2012, 67.3 per cent of rural households had a refrigerator. The penetration of rural China by television (116 sets per 100 households in 2012) and mobile phones (197 per 100 households) has vastly increased flows of information (NBS 2014a). So has the internet: in 2014, internet coverage in urban areas was 62.8 per cent and 28.8 per cent in rural areas, up from 26 per cent and 7.4 per cent, respectively, in 2007 (CINIC 2015). In addition to providing information, the internet has also become a platform for selling food products. More than one million individual farmers are selling food on the Taobao site alone (Wang Xu, personal communication, 26 June 2015). Improved transportation and communications have also stimulated tourism in rural areas. In 2014, 1.2 billion, or 30 per cent of all tourists, went to rural areas, including two million farm stays, generating 320 billion yuan for 33 million farmers (SCIO 2015).

Urbanisation in China has some particular characteristics that should be noted. An urbanised area is defined in China's 2000 census as one with more than 1,500 people/km² and the urban population is defined as those who have been resident for six months or more (Yeh *et al.* 2011). This seems straightforward, but not all people who live in 'urban areas' have the same rights to employment or public services and benefits. These depend on their household registration (*hukou*), which includes both their place of origin and also their rural or urban status. China's towns and cities therefore include people with at least four different kinds of status. The first is people who were born in the city or who have managed to acquire a local *hukou* (urban and local). This category includes people who have changed their *hukou* through study (university students get temporary local *hukous*) or employment, and also formerly rural people who urbanised in situ – estimated to be 40 per cent of the urban population (World Bank/DRC 2014). The second is people who migrated from another city but have not changed their *hukou* (urban but not local). The third is migrants from the surrounding rural areas of the urban jurisdiction (local and rural); and the last is migrants from other rural jurisdictions (non-local and rural).

Over the last 35 years, employment opportunities generated by industrialisation and the expansion of the urban construction and service sectors, along with overall regional income differentials and the gradual

relaxation of controls on movement, have stimulated rural–urban migration on a massive scale. Official statistics report that there were 274 million ‘peasant workers’ in 2014, of whom 168 million were working away from their homes (NBS 2015). As a result, up to 40 per cent of the population of many cities is composed of people who continue to have rural residence status (World Bank/DRC 2014) and many others live in cities for shorter periods. The flip side of this is that many people who are registered in rural areas are not there most of the time. A person’s rural or urban household registration status is also no longer a good indication of occupation or lifestyle. The expansion of the rural industrial and service sectors means that many people with a rural *hukou* no longer farm; by 2009, only 38 per cent of the workforce worked in agriculture (including those working part time) (Carter *et al.* 2012).

Moving between rural and urban areas, migrants are a crucial, human rural–urban linkage. The vast majority of rural–urban migrants (80 per cent in 2014) are between the ages of 20 and 50 and work in manufacturing (31 per cent) and construction (22 per cent), with the rest (42 per cent) in the service sector, including the food distribution, retail and catering industries (NBS 2015). Although the gaps are narrowing, in general, migrants are lower paid, work longer hours and live in worse housing conditions than local residents: in 2013, 41 per cent said they worked more than eight hours a day on average and 84 per cent said they worked more than 44 hours a week (NBS 2014b). Although whole family migration is becoming more common, as access to education in urban areas becomes easier, many migrants maintain two households, sending remittances home to support children and elderly parents in the countryside or county towns, further reducing their disposable income. As a result, many migrants are both legally and socially marginalised, especially in large metropolises where *hukou* policies are more restrictive than in smaller towns and cities (Yeh *et al.* 2011; World Bank/DRC 2014). A series of policies to integrate migrants into urban social protection regimes have been rolled out in recent years, and cities are experimenting with different approaches, including temporary residence permits that can eventually be translated into full *hukou* status; but rights to settlement and access to some public services and certain types of employment are still tied to a person’s residence registration. However, migrants from other cities are also affected by these restrictions and some scholars argue that regional inequalities in access to benefits and public services are now at least as important as the rural–urban gap (Zhang forthcoming 2016).

The other major demographic changes in the post-reform period have been a dramatic fall in fertility and population ageing. Official statistics show a fertility rate of only 1.6, and much of the population born after population control policies were introduced in

the 1980s grew up as only children. Meanwhile, life expectancy has risen to 75 years (UNDP 2014) and this, combined with lower fertility and changes in population structure, is causing rapid population ageing. The share of the population aged 60 and over is now 12 per cent but is predicted to rise rapidly and reach 31 per cent by 2050. The spatial distribution of age groupings has also changed, as out-migration has concentrated young people of working age in urban centres and left a higher share of the elderly population, and in some cases also young children, in rural areas (Banister *et al.* 2010).

These interrelated changes in rural and urban areas, and in linkages between them, have implications for food security across all dimensions through their impact on the agricultural environment and modes of production, as well as through changes in diet, demand for certain types of food, access to markets of different kinds and willingness and capacity to pay. In terms of production, the physical growth of cities and towns has swallowed up vast tracts of land formerly used for agriculture. Between 2001 and 2011, the amount of land in China classified as urban construction land increased by 17,600 square kilometres – an increase of 58 per cent, most of it on newly expropriated rural land (World Bank/DRC 2014). This puts greater pressure on remaining arable land and creates pressure for higher output per unit, which leads to over-intensive farming methods that are detrimental over the long term.

The combination of population ageing, urbanisation and industrialisation has also transformed the demographic structure of China’s rural areas, reducing the labour force available for agriculture, which must compete with the industrial and service sectors for the shrinking number of workers. Even if they remain in the countryside, many working age people have already left agriculture, and farming is now often the responsibility of women with young children and the elderly or is conducted in short bursts when migrants return for planting or harvesting. Along with more specialised production, the lack of full-time adult farm labour makes rural residents more dependent on markets for their food, and is also thought to be one factor driving the use of labour-saving chemical fertilizers and pesticides (SAIN 2012b).

The removal of millions of people from the direct production of food has also stimulated the new industries of commercial food production, processing, transportation and retail, which are now penetrating rural as well as urban areas. Higher rural incomes, as well as better transportation and communications, have also led to changes in rural purchasing and eating patterns, with the result that these are now much more similar to those in cities than in the past. While the expansion and diversification of food markets increases supply and diversity, the implications for quality and safety are more complex and not well understood.

Demographic shifts and changes in the spatial distribution of various age cohorts also affect demand for certain food products and ability to pay. For example, migrants are regarded by many to be a potentially vulnerable population in the urban context because their low incomes, long working hours and poor housing conditions limit their choice in terms of what they eat and how it is prepared. As discussed above, migration contributes both to the decline in self-produced food, by reducing the agricultural workforce, and to the purchase of food away from home. Migrants' sensitivity to price probably also contributes to demand for very cheap food at the expense of quality, while their economically marginal position means that they are obliged to work in the informal sector or as small-scale vendors (Yeh *et al.* 2011). Population flows are therefore an important rural–urban linkage that reflect and drive urbanisation and the transformation of rural areas, with implications for the production and consumption of food that are not yet well understood.

Industrialisation, environmental pollution and food safety

One negative side effect of rapid economic growth has been environmental pollution from industrialisation and the intensification of agriculture. The fact that China's development strategy in the early reform period encouraged rural industrialisation (Bramall 2007) means that pollution of the agricultural production environment has been more severe than in many other countries. In 2014, 28.8 per cent of water monitored in the major river systems and 38.7 per cent of that in major lakes was Grade IV or below (unfit for human consumption or most agricultural purposes); 61.5 per cent of groundwater was reported to be of 'quite bad' (45.5 per cent) or 'extremely bad' (16.1 per cent) quality (Ministry of Environmental Protection 2015). In 2009, 32.5 million *mu*¹ of land were said to be irrigated with polluted water and two million *mu* covered in solid waste, for a total affected area amounting to more than one tenth of China's arable land (cited in CCICED 2010). A national soil survey conducted between 2005 and 2013 found that more than 16 per cent of soil was polluted to some degree, and 19 per cent of arable land exceeded standards for heavy metals or pesticide residues (Ministry of Environmental Protection and Ministry of Land Resources 2014), although a later report based on a survey by the Ministry of Land Resources found that 91.8 per cent of farmland was free of heavy metals (Ministry of Land Resources 2015). However, acid rain, over-intensive farming and the heavy

use of chemical fertilizers means that soil quality is also degraded in many parts of the country, making heavy metals more mobile and increasing food safety risks, while at the same time reducing the nutritional quality of food (CCICED 2015). Meanwhile, agriculture itself has also become an important source of pollution, including from crop burning, chemical fertilizers and pesticides. Livestock waste can contain heavy metals and other chemicals from feed as well as antibiotics, which contribute to the development of drug-resistant bacteria (see FORHEAD 2014 for detail).

However, although concern about the implications of environmental pollution for food safety is high, and rightly so, it is important to avoid a simple extrapolation from environmental quality indicators to food safety. The extent to which pollution of various kinds affects food safety depends not only on its severity but also on other factors, including soil quality, climate, the timing and combination of inputs and the nature of the crops grown (FORHEAD 2014). These factors are discussed further below.

Uneven growth and diverse pathways

In considering the ways in which the factors above affect food security, it is important to remember that they interact very differently in different places. Just in terms of economic development, which affects purchasing power, there is enormous unevenness along the lines of region, economic structure and urban–rural status. In 2013, the per capita GDP of China's richest provincial-level city, Tianjin, was 99,607 yuan, almost four times that of Guizhou (22,922 yuan) and nearly three times that of the surrounding province of Hebei (38,716 yuan) (NBS 2014a), although of course the cost of living is also different. Both overall and within regions, rural incomes are lower and access to health, education and other services is poorer than in urban areas (UNDP 2010). The recent extension of social protection schemes to rural areas has narrowed the gap somewhat, and in some places acquiring an urban *hukou* is no longer seen as desirable by all rural residents. However, due to differences in resources and local implementation strategies, these benefits are not uniform across the country.

More importantly, even within rural and urban categories there is enormous variation. In wealthy rural areas along the coast, residents may earn much of their income from renting out housing to migrant workers or factories, while some poor villages in the west of China are still dependent on subsistence farming. The amount of land per household, opportunities for local

¹ A *mu* is 666 square metres, or 797 square yards.

off-farm employment and the level of mechanisation in agriculture also vary considerably by region and type of crops grown, as does access to finance and markets (see, for example, IFPRI 2014)). The development of transportation networks and communications is also uneven across regions and within rural and urban categories: for example, in 2014 internet penetration ranged from a high of more than 75 per cent in Beijing to a low of less than 34.1 per cent in Jiangxi (CINIC 2015).

Similarly, although migrants are often regarded as a universally vulnerable population, their access to food and ability to pay are also strongly affected by the type of work that they do and by their living conditions, which vary considerably. For example, migrants who work in manufacturing plants often live in dormitories and eat in workers' canteens, and household workers often eat with the families for whom they work, while small vendors are more likely to purchase food or cook for themselves (see NBS 2014b for statistics on variation in migrants' occupations and living situations). The percentage of migrants in different occupations differs considerably by region and city depending on industrial structure (Holdaway 2014). Distance from home also matters in food consumption patterns: migrants who live near enough to their places of origin may be able to bring homegrown food back to the city (and also take food home to their families), while those who work further away are entirely dependent on what they can afford to buy in urban markets. Whether or not families migrate together or are separated will also affect their consumption patterns due to the need to send remittances home. More generally, there is considerable variation in household structure both within and across rural areas. For example, official statistics show the child dependency ratio varying from just over 1.3 in Liaoning to more than 3.2 in Guangxi, Guizhou and Tibet (NBS 2014a), and the actual difference may be greater due to unreported children.

Environmental pollution also has strong regional and local characteristics that need to be understood in order to assess food safety and nutritional quality in particular locations, because risks vary greatly with the nature and intensity of the industrial and agricultural activities involved. For example, heavy metal pollution is concentrated in areas with large mineral deposits and those that have had mining and related industry (Ministry of Land Resources 2015; Ministry of Environmental Protection and/ Ministry of Land Resources 2014; Hu *et al.* 2014). There are also clear regional patterns in the use of chemical fertilizers and pesticides. In 2010, the highest use was in Shandong, Hubei, Henan, Hunan, Anhui, Jiangxi, Guangdong, Jiangsu, Hebei and Heilongjiang, which are the largest producers of cereals, cotton, fruit and vegetables, have the most commercialised agricultural sectors and are relatively wealthy (Sun *et al.* 2012).

Different types of urban, rural and migrant communities therefore face different issues in terms of the various dimensions of food security, which we discuss further below. Existing patterns are now also changing as economic growth slows and China seeks to move to higher-value production activities and a cleaner development pathway. The big challenge in understanding interactions between food security, urbanisation and rural transformations, then, is not in describing the major, macro level trends, but in understanding the ways in which these interact to produce different constellations of problems in different locations and for different populations. This is a research endeavour that is in the early stages.

4

Who is eating what and why?

Data on food supply, safety and nutritional value

This section discusses what we know about access to adequate supplies of safe, nutritious food in China and analyses, as far as possible, the tensions between these three dimensions of food security. A major challenge in doing this is that the availability of information about each dimension differs considerably, partly because government priorities and sampling strategies have changed over time and partly because data are collected by different agencies for different purposes. Because food security and avoiding health problems associated with under nutrition and nutritional deficiencies were of primary concern while China was a predominantly poor country, a wealth of data are available on these issues from regular government surveys of rural and urban populations and, since 1989, from the China Health and Nutrition Survey (Zhang *et al.* 2014). In contrast, it is only fairly recently that food safety has become an issue of concern, and other than the Total Diet Study (TDS), which provides analysis of levels of certain chemicals (including heavy metals and pesticide residues) and antibiotics in food (Wu and Li 2015; Chen, J 2013), there is relatively little direct data on the exposure of different populations to particular food safety risks (see FORHEAD 2014 on food safety data).

The other major point to note is that even in very comprehensive surveys, rural and urban populations have generally been sampled separately, reflecting the long-standing administrative divide. This makes it easy

to overlook ways in which the two populations may be similar and to neglect other variables that may be more important than rural or urban residence status. Furthermore, migrants are therefore often misclassified or left out of these surveys, and only in recent years have there been nationwide surveys specifically of this population (NBS 2015; NBS 2014b). In fact, the rapidity of urbanisation and the variation in both urban and rural levels of development and economic structure means that there is often not a sharp distinction in lifestyles and food consumption patterns between the two types of communities. Many 'urban' residents were very recently rural and still maintain strong links to the countryside, while changing rural livelihoods, improved communications and the penetration of distribution networks into rural areas means that many 'rural' people have occupations and consumption patterns that would formerly have been considered 'urban'. For all these reasons, urbanisation is probably better seen as a scale than as a dichotomy (Jones-Smith and Popkin 2010).

Food security and the price of food

Although China has gone a long way towards eliminating hunger, pockets of food insecurity remain. The UNDP estimated that in 2010 about seven per cent of the population was living in poverty as defined by the Multidimensional Poverty Index, with 80 per cent of counties targeted for poverty alleviation concentrated in the northwest and southwest of the country. About 11 per cent of the population still lives below the income

poverty line of US\$ 1.25 per day (UNDP 2014), and if applying the US\$ 2 poverty line used by most middle-income countries, about a third of the population is still poor (UNDP 2011).

This means that for those who are not self-sufficient, the price of food remains an issue and Chinese food prices have been quite volatile. From 1993 to 1996, retail grain prices tripled and meat prices more than doubled, rising faster than other prices even in a generally inflationary period. From 1997 to 2000, food prices generally fell, with the decline sharpest for grains. Prices were generally stagnant from 2000 to 2003. They began rising sharply again in late 2003 and early 2004, with grain prices surging by 30–40 per cent (Gale *et al.* 2005). However, overall, although the price of food has risen, it has risen more slowly than income. Spending on food doubled in rural areas between 2000 and 2013, but the proportion of income spent on food (the Engels coefficient) fell over the same period from 49 per cent to 37 per cent in rural areas and from 39 per cent to 35 per cent in urban areas (NBS 2014a). Limited research has found that when food prices went up, most households shifted to cheaper food products but maintained their caloric intake, although it is unclear whether the food consumed was equally good in terms of nutrition and safety (Gale *et al.* 2005).

While previously they were ensured a stable food supply by the government rationing system, urbanites have become almost entirely dependent on the market. The transition was gradual, with rationing phased out during the 1980s, although the government has continued to control prices through the maintenance of food reserves and various subsidies for particular populations, including the poor, the elderly and children. This is further discussed below. Urbanites now purchase food in a number of very different places, from supermarkets, including some run by international firms, to small supermarkets and convenience stores, wet markets, farmers markets and the internet.

Formerly almost completely self-sufficient, in keeping with global trends (Tacoli and Vorley 2015), rural people are also more dependent on markets than in the past. Analysis of the rural survey shows that cash purchases of food by rural Chinese households increased 7.4 per cent per year from 1994 to 2003. Grains, beans and potatoes (83 per cent) and vegetables (70 per cent) were most likely to be self-produced, followed by meat and poultry. Sugar, alcohol, tobacco and fish products were mostly purchased. Gale *et al.* (2005) attribute these changes to higher incomes, but also to improvements in transportation, the availability of

refrigeration and access to markets. Other factors probably include the transfer of labour out of agriculture, greater specialisation in production, and economies of scale that make household production uneconomic. For example, many rural families no longer raise chickens or pigs because it is labour intensive to do so and not cost-effective.

However, it is notable that even high-income rural households still relied on self-grown food for 43 per cent of their consumption compared with 54 per cent for the lowest-income groups. At the same time, the increase in cash food expenditures was fastest among the poorest households (those in the lowest ten per cent of households ranked by total per capita household expenditure), rising from 30 per cent in 1995 to 46 per cent in 2001 compared with an increase of only four per cent among high-income households (Gale *et al.* 2005). Access to markets expands the range of foods available to rural people, but reliance on bought food potentially makes them more vulnerable to economic shocks and raises questions about the relationship between quality and price.

Once again, there are important regional differences. The cash share of food expenditures was as high as 95 per cent in rural parts of the Beijing municipality and exceeded 70 per cent in other municipalities and wealthy coastal provinces, but it was only between 40–50 per cent for most western provinces and autonomous regions. Guizhou, one of China's poorest provinces, had the lowest cash share of expenditures, at 37 per cent. There are also differences in the extent to which particular products are commercialised by region, reflecting not only income but also the concentration of production. Rural households in China obtained just 35 per cent of calories and 32 per cent of protein from purchased foods, but 58 per cent of fat. The purchase of food away from home by rural people has also increased dramatically, probably partly as a result of migration, tripling from 3.2 per cent of rural food spending in 1995 to 11.2 per cent in 2003 to reach 18 per cent of rural cash expenditures (see Gale *et al.* 2005 for further analysis). This situation suggests that targeted support in the form of food coupons for regions and households that are food insecure may make more sense than across the board price subsidies, as these disguise the real costs (including the environmental externalities) of production. Artificially suppressing prices might also encourage middle-income groups to consume more of certain foods (meat, for example), than is healthy.

Changing composition of diets and related health problems

Instead of absolute hunger, China now increasingly faces problems of both under and over nutrition, which can overlap in the same populations. These are related to changes in the composition of diets, which have become more varied, with a reliance on grains giving way to a greater consumption of protein and fat. Consumption of edible oils and animal products, including meat, eggs, milk and dairy products, fish and aquaculture products has also increased (see Figures 1 and 2, and Garnett and Wilkes 2014 for further details). Sugar consumption has also increased dramatically, rising from a minimal level in 1989, to 40g/capita/day by 2012, partly due to increased consumption

of sweet beverages (Popkin 2013). Consumption of processed foods has also been increasing, particularly in urban areas. However, salt consumption had declined to 10.5g/day in 2012, down by 1.5g from 2002 (NHFPC 2015).

As Figure 1 shows, there are differences in consumption of key food categories between rural and urban areas that are generally attributed to different average income levels. Figure 2 indicates that rates of growth in several food categories have been higher in rural than in urban areas. Historical comparison suggests that current rural consumption lags behind urban consumption by 20–30 years and that the gap is closing ever more quickly. This has led some observers to argue that, overall, China is experiencing a classic nutritional transition and that the previous low-fat content of the diet has been largely due to income rather than cultural influences (Popkin 2013).

Figure 1. Per capita consumption (kg) of key food categories in rural and urban areas, 1985 and 2010

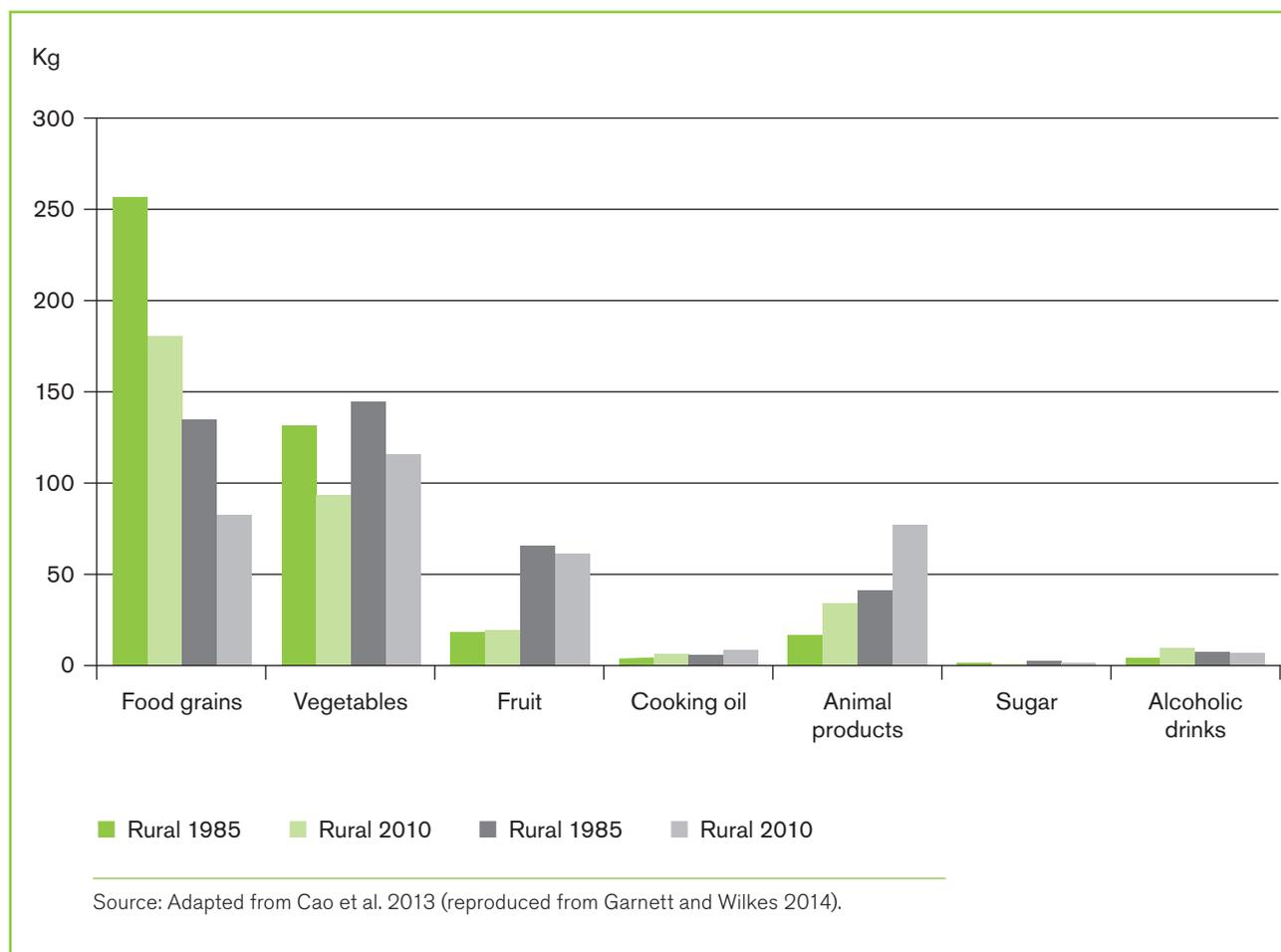
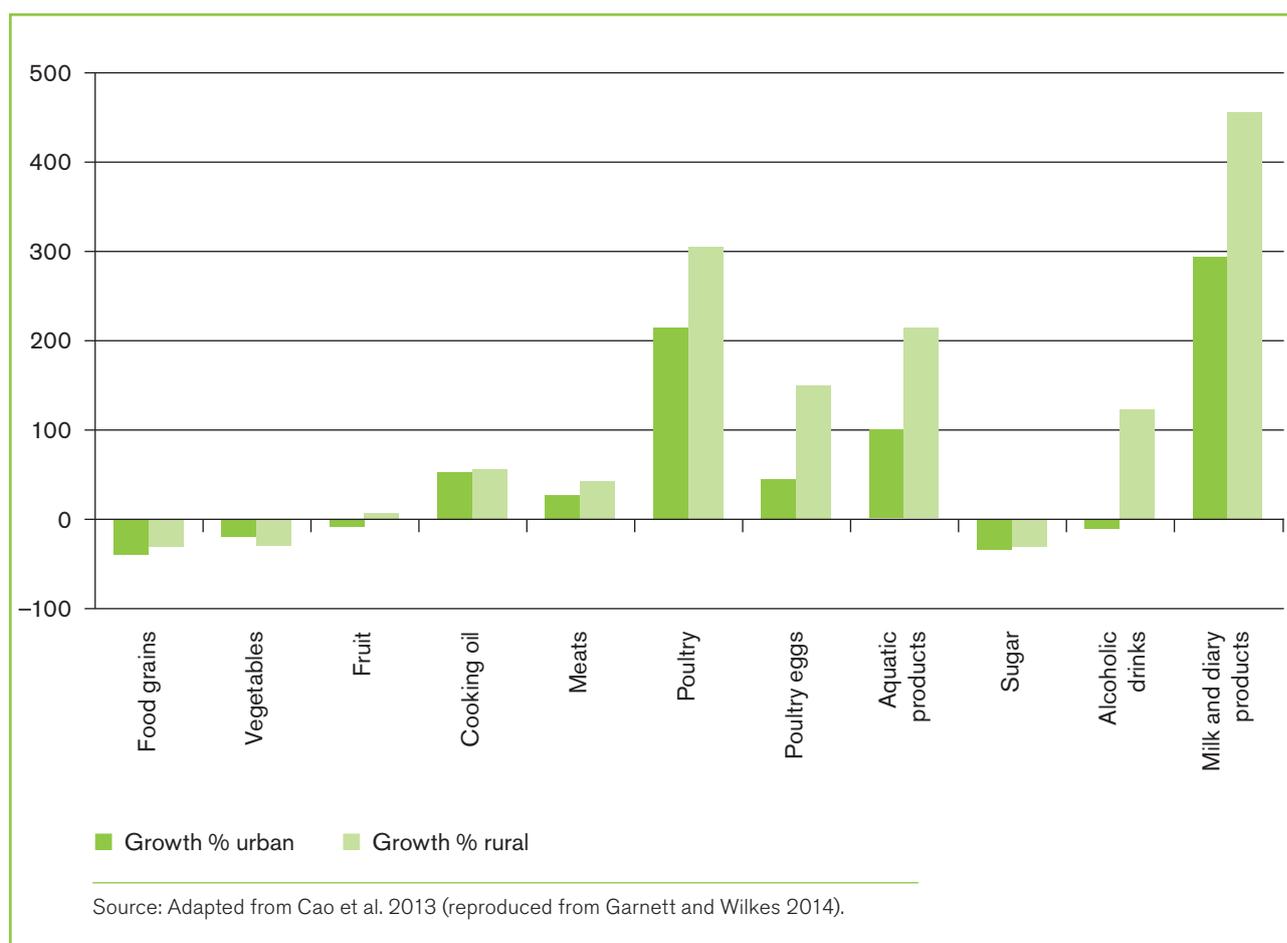


Figure 2. Growth rate (%) in rural and urban purchases of key food categories, 1985–2010



However, trends in higher-income Chinese societies such as Taiwan suggest that due to dietary preferences, meat consumption is likely to level off at a considerably lower point than in high meat consumption countries such as the US (FAPRI data cited in PwC 2015). The type of meat consumed is also different, with poultry and pork dominating and beef and lamb far behind. There is also regional variation in dietary composition that is unrelated to income but is based on patterns of production and food traditions. For example, beef and lamb are consumed much more widely in north and northwest China than in southern and eastern regions, while people in coastal regions naturally eat more aquatic products. Wheat and maize are consumed more in the north and rice in the south (Wu and Li 2015). These patterns of consumption have implications for exposure to health problems associated with nutrition and food safety and for nutritional guidelines, which should arguably be adjusted to reflect the differentiated nature of China's nutritional transition and regional priorities for intervention.

The challenge of responding to China's complex nutritional transition is evident in changes in the burden of disease associated with diets. Partly as a result of improved nutrition, China has continued to see consistent improvements in many key public health indicators. Life expectancy at birth was 75.5 years in 2010 (up from 69.3 in 2000), and healthy life expectancy was 67.1 (up from 61.7). However, despite the greater availability of food, malnourishment persists in some parts of China and deficiencies in micronutrients such as calcium, iron and vitamins A and D are still quite widespread (NHFPC 2015; Wu and Li 2015). The National Family Planning and Health Commission reports that in 2012, six per cent of the adult population was malnourished (*yinyangbuliang*) and that 3.2 per cent of children and youth were stunted and nine per cent underweight, although all of these indicators had seen decreases of 2–4 per cent since 2002. The rate of anaemia among people over the age of six was 9.7 per cent, down 10.4 per cent from 2002. Rates of anaemia among children aged 6–11

and pregnant women had fallen by 7.1 per cent and 11.6 per cent, respectively, since 2002, but were still at five per cent and 17.2 per cent. These problems are concentrated in poor rural areas, mostly in mountainous areas of southwest China (NHFPC 2015). Clearly, there remains a need to address these deficiencies, but it needs to be targeted at these regions and populations in order to be effective and conserve resources.

Increasingly, however, the vast majority of the recent literature on nutrition focuses on rising caloric intake in relation to activity levels, and on the consumption of fat and sugar as drivers of obesity, diabetes, hypertension and other diet-related illnesses (NFPHC 2015; Popkin 2013; Zhang *et al.* 2011a). Caloric intake has declined in absolute terms, but not sufficiently to offset the effect of more sedentary lifestyles. Animal-based foods also make up more of the diet, leading to higher intakes of fat: they account for more than 30 per cent of protein intake on average, and more than 20 per cent for low-income groups. In 2009, more than 62 per cent of urban residents derived more than the recommended 30 per cent of their energy from fat, and the proportion was more than 45 per cent for rural citizens (Zhang *et al.* 2011b). In 2012, 30 per cent of Chinese adults were overweight and 11.9 per cent obese, up 7.3 per cent and 4.8 per cent, respectively, from 2002 (NFPHC 2015). One study found that from 1993 to 2009, abdominal obesity, which has a strong association with higher cardiovascular risk, increased from 8.5 to 27.8 per cent among men and from 27.8 to 45.9 per cent among women, across all age groups and regions and more rapidly in rural than in urban areas (Xi *et al.* 2012).

There are worrying trends in children's dietary habits. From 1991 to 2009, children's daily energy intakes steadily declined, but not enough to offset decreases in activity. The proportion of children consuming a diet with more than 30 per cent of energy from fat also rose from 20 per cent to nearly 50 per cent, and increases in fat intake were highest among low-income urban groups and high-income rural groups (Cui and Dibley 2012). In 2012, 9.6 per cent of children aged 6–17 were overweight and 6.4 per cent obese, up 5.1 per cent and 4.3 per cent, respectively, from 2002 (NFPHC 2015). Between 1993 and 2009, the prevalence of abdominal obesity increased by nearly 200 per cent (from 3.9 per cent to 11.4 per cent) for boys and by more than 100 per cent (from 5.9 per cent to 12.1 per cent) for girls (Liang *et al.* 2012).

The Global Burden of Disease Study identifies diet as the leading risk factor shaping Disability Adjusted Life Years (DALYs) and as playing an important role in cardiovascular diseases, cancer and diabetes. Cancer is now the leading cause of death in China, followed by cerebro-vascular diseases and heart disease (IHME

2013). Diabetes is also on the rise. A 2010 study estimated that 11 per cent of the population suffers from diabetes and a further 50 per cent shows some pre-diabetic symptoms (Xu *et al.* 2013). Although the prevalence of diabetes is higher in urban areas overall and in middle-income and poor regions, in economically developed parts of the country there is no significant difference in diabetes prevalence between urban and rural residents. Around one per cent of Chinese children aged 7–17 may be diabetic and nearly 15 per cent are pre-diabetic. More than one third of children in this age group have indicators of diabetes, high cholesterol or high blood sugars (Yan *et al.* 2012). Chinese and other Asians appear to have a high genetic predisposition to diabetes – developing the condition at lower Body Mass Index (BMI) levels than Caucasians (Lee *et al.* 2011); and while other lifestyle-related factors may exacerbate the risk, addressing the dietary component will obviously be a crucial part of any successful policy response.

Overall, these trends suggest that as in developed countries, obesity, diabetes and other diet-related diseases are generally becoming associated with poverty rather than wealth. However, there are also regional differences in risk factors for diet-related diseases, including average BMI levels, that are not explainable by differences in economic status and that are probably due to regional diets and differences in activity level related to climate. Generally, people in northern regions are more likely to be overweight, while those in the south, regardless of income, tend to have lower BMIs and a higher prevalence of underweight (Zhuo *et al.* 2009). The childhood obesity problem is also particularly acute in the northern metropolitan areas of China where, in 2005, 32.5 per cent of boys and 17.6 per cent of girls aged 7–18 were overweight or obese – much higher than the national average (Hu *et al.* 2011). This situation again argues for targeted nutritional guidelines.

Food safety²

In addition to diseases associated with overeating and unhealthy diets, food safety has been the other major diet-related health problem to emerge in recent years. Food safety encompasses a wide range of problems that vary from product to product, and present very different kinds and levels of threat to human health from sources including bacteria, viruses and parasites, chemicals, growth hormones and veterinary drugs. These problems reflect strains on China's food system that stem from the processes of urbanisation and industrialisation discussed above, including the coexistence of industry/mining and agriculture, the intensification of agricultural production, the rapid expansion of certain product sectors, longer supply

²This section draws extensively on the 2014 FORHEAD report, *Food Safety in China: A mapping of problems, policy and research*.

chains and the consumption of more processed food. As with nutritional problems, food safety also has important geographic and demographic aspects that need to be considered when designing appropriate policies, and there are also interactions and tradeoffs between these two dimensions of food security.

Although it is an issue of enormous public concern and a rapidly expanding field of research, food safety is a new topic in China and there is a lack of reliable data to enable an assessment of the scale and distribution of many problems. The field is very fragmented and characterised by a combination of aggregate data and small case studies, neither of which provides an accurate picture of the actual risks to which particular populations or localities are exposed. Research from different disciplines and systems uses different samples and methods, and cannot be easily matched or analysed in an integrated way. With the exception of rapid onset illnesses and the Total Diet Study, most health data do not allow the isolation of health risks through food from other pathways of exposure. As a result, environmental quality or input data are often used as proxies for health impacts, but this can give a misleading impression of the prevalence of problems. The problems of heavy metals, pesticides and the excessive and illegal use of food additives are discussed below in some detail, as examples. (FORHEAD 2014).

Heavy metals in food

Among China's food safety problems, contamination of the agricultural production environment by heavy metal (HM) pollution stands out as a problem that is more severe than in many other countries, and it has received a lot of attention recently in both the Chinese and international media. However, although HM pollution is indeed a serious problem, many media accounts present the risks to health through food as more generalised than they are. In doing so, they distract from the need to understand the complex interactions that drive the problem and which can offer guidance on how to address it most effectively.

HM pollution can be caused by mining, metal smelting and industrial processes; also by certain pesticides and manure from animals whose feed contains HMs, as well as household waste. Cadmium is seen as presenting the greatest risk because it has high mobility, accumulates easily in staple foods, including rice and leafy vegetables, and causes serious health problems, primarily affecting the bones and kidneys. Because of the importance of rice in the Chinese diet, China's standard for acceptable levels of cadmium in food is stricter than international standards (0.2mg Cd/kg compared to 0.4mg Cd/kg) (Wu and Li 2015:98). Lead is also a serious concern because of its impact on children's cognitive development, as are mercury and arsenic.

An underlying problem in understanding the actual severity of the problem in China is that not many good data are available. The Total Diet Study (TDS) provides some information on levels of HMs in food, but the sample is based on dietary variation and rural–urban and socioeconomic status, not on the distribution of the drivers of risk, and it includes only three sites for most provinces. Meanwhile, smaller studies have mostly been conducted in places where pollution was known to be serious and the findings cannot easily be generalised (see FORHEAD 2014).

Over four studies, the TDS shows that lead intake saw a steady decrease from an average daily exposure of 86.3mg in 1990 to 50.5mg in 2007. This is below the original provisional tolerable weekly intake (PTWI) set by the Joint FAO/WHO Expert Committee on Food Additives (JECFA). However, this PTWI was withdrawn in 2010 in light of evidence that lead is damaging to health at almost any level. In addition, the 2007 TDS found that over 20% of children and approximately 10% of those aged 13 and over had lead exposure levels above the withdrawn PTWI and concludes that it is “urgent to reduce lead levels in food” (Wu and Li 2015:93). In contrast to lead, cadmium exposure rose over the four TDS studies, from an average daily intake of 13.8mg in 1990 to 20.5mg in 2007 (Wu and Li 2015:102). This average is below the JECFA provisional tolerable monthly intake (PTMI). However, the study found that 30% of children and adolescents and approximately 20% of those aged 13 and over had exposure levels above the PTMI, which is again a cause for great concern (Wu and Li 2015:99).

In the absence of comprehensive, specific data on what people actually consume, most discussion of food safety risks from HM pollution has tended to extrapolate from information about levels of HMs in soil, such as the soil surveys by the Ministry of Environmental Protection and Ministry of Land Resources (MLR 2015; MEP MLR 2014). The information that has been released is very general, merely stating that problems are concentrated in particular provinces and in areas with mining and heavy industry. But even if more detailed information about levels of HMs in soil were available and made public, this would still not in itself be an accurate indicator of health risks through food. This because the accumulation of HMs by crops is affected by the acidity, organic content and moisture level of the soil as well as by climate conditions. Furthermore, different types of grains and vegetables, and even cultivars of the same plant, have different propensities to absorb HMs. Studies have shown that rice cultivars and hybrids can vary by up to a factor of ten in their propensity to accumulate HMs, even when grown in exactly the same field (Shi *et al.* 2009).

These interactions mean that patterns of risk from HMs through food in China are very complicated. There is

significant variation in all the drivers: background levels of minerals, industrial activity and mining, relevant soil conditions and types of crops and cultivars. The TDS findings reflect this, showing very different levels of exposure and different food exposure sources in different provinces (Wu and Li 2015). Unfortunately, there is generally considerable overlap between concentrations of HM deposits and China's major rice-growing regions, but there is also considerable variation in soil quality and acidity within those regions of concern, partly due to the distribution of acid rain but also to whether soil quality has deteriorated as a result of over-intensive farming and the use of chemical fertilizers (CCICED 2015). In terms of the types of rice grown, *Japonica*, which is more commonly grown in the northeast of China, generally has a lower tendency to absorb cadmium than *Indica*, which is more common in the south, but some high-yield *Japonica-Indica* hybrids known as 'super rice' have a higher propensity to absorb HMs than either of them. Finally, risks will be concentrated or dispersed depending on whether people consume the rice they grow themselves or sell it.

Given this, it is impossible to make a full analysis of which populations are most exposed to HM pollution through food. However, it seems that severe risks are fairly localised to people living in the vicinity of mines and industries or close to markets where products from these places are sold. This is why Hunan, which is a major rice-producing and exporting province but also one with large mineral reserves and related extractive and processing industries, has become a target of HM risk management policies (Pang *et al.* 2013). Other populations are probably exposed to much lower levels of risk. It is not necessarily the poorest regions or people that are most vulnerable, as some very poor areas have no industrial pollution and have relatively fertile soil where people continue to grow most of their own food, while other areas are heavily contaminated by mining or industrial pollution and have soil that may or may not also be seriously degraded from years of intensive agriculture, making HMs more mobile. At the same time, rich areas may have a history of industry that has left serious legacy pollution. That said, within any given context, affluent consumers or their suppliers will be able to purchase selectively, choosing certified organic or imported products. The 2007 TDS sheds some light on these complexities by revealing the different levels and sources of exposure to various heavy metals across provinces (Wu and Li 2015).

Chemical pesticides

Chemical pesticides are another source of food safety concern. China is the world's largest consumer of pesticides, and usage increased more than 2.4 times between 1990 and 2010 to reach more than 17 million tonnes. Studies have found that insecticide application rates are often 2–3 times the recommended dosage (Sun *et al.* 2012) and, as a result, large quantities of pesticides enter the soil or surface water and residues remain on crops.

Heavy use of inputs has been driven by efforts to increase production, often in the context of monocultural agriculture that reduces natural predators. Overuse is also attributed to a lack of information about effective and safe levels, cheap prices and the promotion of pesticides by agricultural outreach stations (Sun *et al.* 2012). The greater range of crops being grown and the wide range of pesticides available make it more difficult for farmers to be informed, and perceived or actual insecticide resistance can lead farmers to apply greater quantities (Sun *et al.* 2012). Organochlorine pesticides (OCPs), which include dichloro-diphenyl-trichloroethane (DDT), were originally the major concern. By 1985, an estimated 14 million hectares of farmland had levels that were above national standards. However, as with HM pollution, average statistics disguise considerable regional variation in both application and soil pollution rates: for example, the mean application rate of 8.19 kg/ha in 2001 obscured averages rates of 12.91, 7.26 and 3.43 kg/ha in east, central and western China, respectively (Sun *et al.* 2012).

Data on health effects of pesticides through food are quite limited. The most comprehensive information again comes from the 2007 TDS. This found that dietary intake of the banned pesticides DDT and HCB had declined by 99.3% and 99.9% respectively since 2000, and that exposure levels to most other pesticides were within acceptable levels. The TDS researchers are generally more optimistic about the situation regarding pesticide exposure than they are with regard to HM (Wu and Li 2015:111-136), and recent government statistics reported that monitoring in 152 large and medium-sized cities across 31 provinces in the first quarter of 2015 found a 94.3 per cent pass rate for vegetables (MOA 2015a). However, the 2007 TDS nonetheless detected OCPs in aquatic products, meats and cereals in some regions (Zhou *et al.* 2012) and other studies have tested products at the point of sale and found that serious problems still exist with certain products in certain places (see FORHEAD 2014 for details). The 2007 TDS also draws attention to a rapid rise in dietary intakes of organophosphate pesticides (OPPs) since the previous study, although not yet exceeding the standard (Wu and Li 2015:129).

Additive-related problems

The increase in processed foods has led to more problems with additives, including both the misuse of allowed food additives and the use of illegal chemicals. Additives are used for a variety of reasons, including extending product life, enhancing aesthetic appeal and increasing weight. They may also be used to mimic nutritional content in order to meet standards, as was the case in the 2008 milk–melamine scandal. Other cases have included the use of illegal additives to make fake meat products (GAIN 2013) as well as pork tainted with clenbuterol; noodles containing ink, industrial dyes and paraffin wax; and sodium borate used to make cheap pork resemble beef (GFSF 2011).

Research that discusses food additives in China has tended to focus on food crime (Cheng 2012) or the use of illegal additives in food production (see, for example, GFSF 2011). Most studies also cover a limited number of additives and health impacts (Xue and Zhang 2013) and are restricted to acute poisoning, excluding illnesses with longer onset periods. This means that we do not have a clear picture of the extent of health

problems due to additives or of the distribution of risks. Most likely, the major factors affecting exposure to risk are levels of consumption of processed foods, income level and local capacity to regulate food-processing environments. Local dietary patterns also affect the distribution of risks; for example, the diets of children in northern China were found to be very high in aluminium, probably due to the high levels of consumption of wheat-based products in which the additive is used in north China (Health News 2013). Again the 2007 TDS illuminates some of these patterns (Wu and Li 2015).

Food safety is therefore a complex issue, with different problems affecting different foods and with significant regional variation. This calls for careful analysis of how the various drivers (environmental conditions, agricultural practices, the structure of industry and dietary patterns) interact in order to inform targeted policy interventions. While the need for integrated research has been recognised (FORHEAD 2014), problems in sharing and matching data have so far impeded progress.

5

The current policy landscape

The changing landscape of food production and consumption – and the transformations in rural–urban linkages that have both driven and accompanied this – is partly a reflection of government policies. This section briefly reviews rural–urban linkages policy and recent developments, before considering in more detail a number of policy streams most relevant to the various dimensions of food security.

Rural–urban linkages policy

Rural and urban development policies in China were of course always linked, even in the Mao era, both explicitly through the planned production and distribution of food, and indirectly through the biased allocation of resources to urban areas and restrictions on mobility. As discussed above, rural–urban linkages deepened and became more varied as economic reform facilitated the movement of people and goods across rural–urban boundaries and increased the number of actors involved. In policy terms, the promotion of industry in rural areas and the more general transfer of labour out of agriculture, as well as the gradual reduction of restrictions on migration and the promotion of urbanisation, have reduced the formerly pronounced differences in occupational structure and lifestyles between rural and urban areas in some parts of the country. Nonetheless, for many years, urban and rural development policy remained largely separate streams, and although the gap has narrowed in recent years, significant inequality persists between rural and urban

areas in terms of income and infrastructure, and access to public services, benefits and credit.

Since the 16th National Congress of the Chinese Communist Party in 2002, policy has begun to explicitly address the question of how to interrelate and integrate rural and urban development and also tackle rural–urban inequality (Ye 2009). This effort is commonly referred to by two terms: *chengxiang zonghe fazhan* (integrated rural–urban development) and the more elusive *chengxiang yitihua*, which literally means ‘making cities and countryside into one unit’. The principle of rural–urban integration has been pursued through initiatives in specific policy streams, some of which are discussed below, but it may be helpful to highlight a few key dimensions here.

The first is the focus on the ‘modernisation’ of agriculture as a central part of overall national development. Policy documents emphasise the need to pursue technical upgrading and the development of higher-value products. The second is the need to reduce disparities in income, benefits and access to services between rural and urban populations, through the diversification of employment opportunities in rural areas, investment in rural education and social protection, and rural land reform and improved access to credit. The third is the integration of migrant workers into urban areas by expanding their rights to equal employment opportunities, benefits and public services (see Ye 2009 for a discussion).

Although these overarching policy principles indicate the government's recognition of the importance of rural–urban linkages and the need for integrated development, this agenda nonetheless has to be pursued through specific policy streams. The rest of this section discusses those that aim to address the different dimensions of food security and their interactions, pointing out the relationship to rural–urban linkages where possible. The most directly relevant are food security policy, food safety policy and nutrition/health policy. However, the type, quality and price of food available are also affected by agricultural policy and by policies related to the food-processing and retailing sectors. Because these have implications for all dimensions of food security, they are discussed first. In the Chinese context, environmental protection and industrial and land use policies more generally are also important because industrialisation has had negative effects on the agricultural production environment in many parts of the country. In considering ability to pay for food, it is also important to consider social protection policies, including direct income supports, and also policies that reduce the costs of other necessary expenditures such as health, education and housing.

It is not possible to cover this large territory in detail here, but the broad outlines are sketched below.

Land, agricultural production and food distribution policies

As discussed in Section 1, the large number of small, non-contiguous landholdings has been seen by many observers as holding back the modernisation of agriculture, limiting technical upgrading and increasing the value of agricultural production, as well as presenting a challenge for food safety. The inability of farmers to sell their land has also prevented them from leveraging it as capital to buy urban housing or start businesses. Since the early 2000s, a series of policies have attempted to address these problems and more generally reduce rural–urban inequality regarding property rights. In 2002 it became possible to transfer rights to contracted land, and from 2004 to 2014 a series of No. 1 Central Documents addressed rural issues (Li and Hu 2015). Agricultural land reform has been under discussion for many years (Xinhua 2014 provides a list of the key documents) and the No. 1 Document for 2013 addressed this issue very directly, encouraging the clarification of land holdings and the development of mechanisms for the transfer of agricultural land use rights, in order to support the development of larger family farms and agricultural cooperatives, protect farmers against unfair expropriation and reduce the amount of land left idle

due to migration (Xinhua 2014; Keeley 2013). Further major policy documents have called for expansion of the rural land registration system initiated in 2008 (Xinhua 2014) and for the development of mechanisms for the registration and legal transfer of contracted agricultural land, collectively owned rural commercial land and rural housing (known as the 'three land reforms'). Pilot schemes for leasing, mortgaging and franchising rural land are underway with plans for a comprehensive policy by 2017, and in some places farmers have also recollectivised land on their own initiative. However, official policy continues to emphasise that reform will not violate the principles of public ownership of land and maintenance of the red line for farmland (SCIO 2015).

Other policies and initiatives address the issue of multiple smallholders through various forms of vertical supply chain integration, partly as a means to increase the safety of agricultural products. Vertical integration strategies include encouraging large, 'dragon head' enterprises that integrate supply chains by contracting with farmer cooperatives or directly contracting land. These companies then supervise production, providing technical advice and inputs (Keeley 2013). Other forms of vertical integration include direct linkages (*duijie*) between producers and retailers (such as supermarkets) or large institutional purchasers, including universities and large work units. All of these initiatives involve changes in rural–urban linkages, but although various different forms have been identified (Hu 2011), each likely has different implications for producers and consumers and for the different dimensions of food security that are not yet understood (see FORHEAD 2014 for a discussion).

Some consumers are also now seeking to develop direct food supply chains that shrink the distance between producers and consumers. Zhang (2013) identifies several main types: increasing agricultural production in urban areas; community-supported agriculture; direct selling between producers and consumers, whether face-to-face or internet based; various third party guaranteed systems, including third party authentication systems; organic food shops; and periodic small-scale markets operated in car parks and urban residential compounds. However, many such initiatives are recent and no comprehensive data exist on their extent or efficacy in ensuring safe food supplies. It also seems that these approaches generally require investment of time and/or greater expense, making scaling up difficult. With the exception of internet purchases, it seems unlikely that they will ever reach more than a small percentage of the population.

Some – but not all – types of vertical linkage also involve the consolidation of production, for example when large enterprises contract large tracts of land from multiple farmers to produce the same product. At the same time, a certain degree of horizontal consolidation is also

taking place through farmer cooperatives, which have increased substantially to around 20 per cent of villages by 2008, or around 9.5–10 per cent of rural households. Cooperatives often provide technical and marketing services as well as collective purchase of agricultural inputs (Huang *et al.* 2012). They may therefore have advantages in terms of increasing farmers' bargaining power and their access to information and technical expertise. They could also potentially make regulation of product quality and safety easier and lower the costs of compliance, although perhaps at the cost of diversity in the range of products.

However, overall, research has yet to unpack the ways in which production scale affects these various dimensions of food security, and it is not clear that large facilities and companies are always safer. Some have also been involved in food safety incidents – for example, the melamine scandal and the more recent incident when KFC suppliers sourced chickens with excessive antibiotic residues (New York Times 2013). It seems that different kinds of risks are associated with different levels of scale for different products and that many other factors in addition to scale come into play (see FORHEAD 2014 for further discussion).

To some extent, the scale of production is linked to the mode of production, which in turn has complex, and not necessarily convergent, implications for the various dimensions of food security. But again, these relationships remain unclear both in terms of policy goals and the outcome of current practices. Recent policy documents (MOA 2015b) refer to encouraging the development of family farms (which, as mentioned earlier, do not exist in many parts of China due to collectivisation followed by the contracting out of small parcels of land), different forms of production and traditional foods according to local circumstances, as well as integrated farming (for example, rice and fish, hogs and fruit, etc.). However, mechanisation and the 'industrialisation of production' are also key themes in the same documents and these seem difficult to reconcile with small or integrated farming. For example, the 12th Five-Year Plan had as a target large dairy farms of more than 100 animals accounting for 38 per cent of all farms, and 50 per cent of swine farms having a slaughter population of more than 500; and the 2015–2030 Plan for Sustainable Agriculture has a goal of 68 per cent mechanized ploughing by 2020 (MOA 2015b).

Consolidation is also evident in the retail environment. For example, policy has encouraged the development of supermarkets in both urban and rural areas. Some urban wet markets have been put under professional management and informal markets and stalls have been banned in some locations (Reardon *et al.* 2012). In Beijing, some wet markets in older neighbourhoods have been demolished and others refurbished and reopened, but it is unclear why different markets were

handled in different ways and, presumably, the value of the land they occupy is also a factor in whether such markets survive. While it may be motivated partly by concerns about food safety, restricting or prohibiting traditional and informal supply chains may also affect convenience and cost to consumers, as well as affecting employment of small distributors and vendors.

While the narrative of the large number of producers, processors and vendors contributing to food safety problems and preventing the upgrading of supply chains is dominant in the literature, some researchers and advocates are strongly opposed to these initiatives. They see them as part of the overall trend towards the consolidation and mechanisation of agriculture in the context of urbanisation, which would result in the rapid shrinking of the population employed in agriculture and the demise of China's smallholder agriculture. These analysts see large-scale agriculture as environmentally and socially unsustainable in the Chinese context and also as normatively undesirable, because it is likely to result in a decline in the diversity of regional food traditions and agricultural practices (see, for example, Wen 2008).

Some of these researchers have been directly involved in setting up community-supported agriculture and organic farming projects (Shi *et al.* 2011) as well as urban farmers markets and co-ops (Chang 2010). While many of these projects offer valuable experience for farmers seeking to pursue organic agriculture and communities seeking to establish direct links with farmers, it is unclear whether they could be scaled to meet needs for food in urban areas. Doing so would pose significant environmental, economic and social challenges. First, most of China's land does not meet standards for organic agriculture (ECRAN 2012), and although policies are now focused on remediating pollution and improving soil quality (see below), it will take time to do this. Second, even if the costs of certification could be lowered, organic agriculture is labour intensive, and in a context where wages are rising fast, agricultural products would have to command a much higher price for it to be viable on a wider scale. Lastly, it is not clear that a lot of rural people – especially the young – want to remain in agriculture, not just because of the low wages in relation to other occupations but also because it is tiring, physical work.

Unless these challenges can be overcome, and unless practical ways of ensuring food safety and building consumer trust can be found that are cost-effective in the context of large numbers of producers and vendors, organic food is likely to form only a limited proportion of production for some time to come. However, there is now more policy support for organic agriculture in product sectors and parts of the country where it is viable and, more importantly, policy is focused on reducing the use of fertilizers, pesticides and veterinary

drugs, and remediating pollution and improving soil quality, regardless of the scale of production (MOA 2015b). This shift in emphasis should help improve the quality and safety of food available to all consumers.

Food security policy

Given the deep poverty that existed in China at the time of the revolution, ensuring adequate supplies of food has always been a policy priority for the government. Until very recently, food security (*liangshi anquan*) policy focused on ensuring the supply of staple grains, which are defined as rice, wheat, coarse grains, soybeans, pulses, potatoes and sweet potatoes. This included the policy goal of 95 per cent grain self-sufficiency, to be achieved by maintaining the necessary area of land under cultivation, and in a country where the ratio of land to population is extremely tight. The current target is 120 Mha.³

This target is under considerable strain because industrialisation, infrastructure and property development are driving the conversion of agricultural land to other uses. The incentives for this are strong, as infrastructure and property development can contribute as much as 30–50 per cent of local government revenue and are important contributors to economic growth, which continues to be the primary measure of local government performance (ECRAN 2012: 47). Water shortages are another challenge for food security as well as food safety, because industry and household use are increasingly in competition with agriculture. Acidification of the soil due to overuse of nitrogen fertilizers, and contamination of soil and water with industrial and agricultural chemicals are also concerns (ECRAN 2012).

Apart from rice, of which it is a net exporter, China is already unable to meet its grain requirements through domestic production, but it maintains a very large wheat reserve – more than twice that of most countries – in order to stabilise prices in the event of bad harvests. Imports of soybeans, primarily for animal feed, have risen rapidly. China became a net importer of soy in 1996 and 80 per cent is now imported (World Bank/DRC 2014). Between 1980 and 2011, the proportion of corn that is imported went from 43 to 68 per cent; and for wheat, from three to 19 per cent (both are increasingly used for animal feed rather than direct consumption). In 2010, nine per cent of vegetables were imported and six per cent of meat (ECRAN 2012).

While the red line for farmland remains in place, policy documents – including those focused on rural–urban integration – increasingly emphasise the need to balance food security concerns with improving efficiency of production and the quality and safety of agricultural products as well as attention to the production environment (MOA 2015b). Meanwhile, as the quantity of food available has ceased to be a major problem, the price of non-staple foods has become an increasingly important issue for the Chinese government, which intervenes to ensure that prices do not become unaffordable for low-income consumers. Pork and vegetable prices, which are particularly volatile, are monitored and the government deploys a number of strategies to stabilise them, including subsidies for lost livestock and long-term purchase agreements for the importation of soybeans and the maintenance of large carry-over stocks. Since 2007, imported pork is also stored, to be released into the market to dampen price fluctuations (ECRAN 2012). China also maintains a sugar reserve to protect against the effects of global price swings in the cost of foods and beverages containing large amounts of sugar (Popkin 2013). While intended to soften the impact of market shocks on the poor, there is an obvious tension between these subsidies and health-driven efforts to reduce sugar and meat consumption.

Social protection policies

In considering the affordability dimension of food security, it is important to understand the general social protection policies that provide support to low-income families and free up more of their income to spend on food. These have been introduced gradually, as it became clear that the dismantling of the collective economy had undermined the fiscal basis for social protection, especially in rural areas. The urban minimum living allowance (*dibao*) was introduced in some provinces in 1997 and rolled out nationally in 1998. It is funded by central and local governments but heavily subsidised with central funds in western and central China. *Dibao* households receive utilities deductions, food coupons, assistance for children entering college, and other benefits as well as cash. The amount is determined locally and generally set at one fifth of the average per capita income. *Dibao* was extended to rural areas in 2007, supplementing the former *wubao* system. By 2012, urban and rural *dibao* covered 23.4 million urban beneficiaries and 53.4 million rural beneficiaries, accounting for three per cent of the urban and 8.3 per cent of the rural population (World Bank/DRC 2014).

³ Although there is debate about the actual area of cropland in China, largely stemming from issues of measurement and reporting, land available for agricultural production is both limited and of poor quality: less than 10 per cent is suitable for crops and around two thirds is not highly productive (ECRAN 2012: 33).

China now also has very basic old age and medical insurance in both rural and urban areas and free education through secondary school (nine years of schooling is compulsory). Since 2007, the government has attempted to expand social housing through low-cost rental housing, assisted home ownership, public rental housing and shelters. By 2012, these programmes had served 31 million urban households, or 12.5 per cent of urban households, while five million urban households benefited from rental subsidies (World Bank/DRC 2014; Zhang 2012). While all these benefits are at low levels and there is still a long way to go in terms of building a comprehensive social protection system, they nonetheless provide some cushion for low-income families against poverty and reduce competition with food in terms of use of disposable income. While the extent to which access to social protection is tied to the *hukou* is diminishing, some of these programmes (for example, urban *dibao*) are available only to those with a local residence registration, thus excluding migrants (World Bank/DRC 2014).

Some social protection programmes are directly food related. The Food For Work (FFW) programme is financed by the Poverty Alleviation Fund (PAF) and aims to increase the income of farmers in poor areas through employment in infrastructure projects (Zhang 2012). Other programmes target children and the elderly in poor areas. For example, both cities and villages sponsor 'senior tables' (*laonian canzhuo*) at restaurants, or meals on wheels for the elderly and disabled. By 2010, Beijing had set up more than 5,000 such programmes, although there are questions about their sustainability because, despite government subsidies, they still rely heavily on the cooperation of businesses and volunteers (China Centre for Disease Control 2011). From 2001, a food allowance for poor rural students was included in the Two Exemptions and One Subsidy programme for rural compulsory education students in boarding schools, and a quarter of all these students were covered by this policy in 2006. In 2011, the subsidy was increased to 1,000 yuan per year per student and the government introduced a Nutrition Improvement Programme for Rural Compulsory Education Students (NIPRCES), which provided a three-yuan subsidy for free lunches for 23 million children in 100,000 rural schools in 680 poor rural counties at a cost of US\$ 2.5 billion. Food is cooked in cafeterias and provided in lunchboxes, or through subsidies for 'family feeding'. In addition, 15 provinces have introduced local school meal programmes in 485 non-pilot counties, covering 8.5 million rural students in 2012. Although there have been a couple of incidences of food poisoning, raising questions about the ability

of schools to provide safe food, overall evaluations of the programme have been positive (Zhang *et al.* 2015). These programmes should be beneficial for poor rural families but questions remain about children who are not in boarding schools. The situation of rural children who migrate with their parents to cities – a growing number – is also unclear and should be considered.

Nutrition and health policy

China's nutrition policies have evolved over time and have included general guidelines as well as policies to address specific nutritional deficiencies. Initial policies, such as the Food Structure Reform and Development Masterplan for the 1990s (State Council 1993) reflected earlier concerns with food security in terms of quantity and basic nutrition. Strong emphasis was placed on increasing the production of animal products, particularly ruminants that graze and therefore 'save grain', and poultry, which has a better feed conversion ratio than pork.

Policies have targeted particular groups seen as vulnerable, again including school children. The National Soybean Action Plan introduced by the Ministry of Agriculture, Ministry of Health, State Education Commission and China Light Industry Association in 1996 aimed to increase the supply of soy milk and soy products to primary and middle school students, and subsequently a national Student Nutritious Meal Plan was introduced. The 1997 China Nutrition Improvement Action Plan focused on addressing hunger and micronutrient deficiencies among vulnerable groups such as pregnant women, infants and the elderly, and set targets for addressing iron deficiency anaemia and vitamin A deficiency (State Council 1997). To address anaemia, the government promoted animal-derived foods as a source of iron, and in 2004 initiated a soy fortification programme in several provinces, which was subsequently extended nationally (in 2007) and has proved quite effective (Zhang, Zhang and Wang 2012).

In 1997, the China Nutrition Society, a government-supported NGO, introduced the Food Guide Pagoda, which provides a set of dietary guidelines that is broadly similar to WHO recommendations in advocating a diet dominated by grains (250–400g/day), vegetables (300–500g/day) and fruit (200–400g/day), and with a lower intake of animal foods (25–50g/day) and minimal salt (6g/day) and oil (25–30g/day). The Pagoda was revised in 2007 with the recommendation that dairy consumption be increased from 100g to 300g per day, also new advice to drink 1,200 ml of water daily (Ge 2011).

While agencies involved in poverty alleviation continue to pay close attention to nutritional deficiencies and argue that some areas and populations still need to increase their intake of protein in particular (Wei *et al.* 2011), health policy has already begun to shift towards a growing concern about the health consequences of being overweight and having excessively rich diets (Zhai *et al.* 2002). The 2001–2010 China Food and Nutrition Development Plan set specific targets for nutrient intakes among rural and urban men and women and developed agricultural production targets based on population and nutritional requirements. The 12th Five-Year Plan for Control of Chronic Disease addressed for the first time diet-related chronic diseases and called for raising awareness, the implementation of healthy lifestyle campaigns and training of chronic disease specialists. It set targets for dietary intakes of salt, and for health outcomes such as the prevalence of adult and child obesity, at 12 per cent and eight per cent, respectively (Ministry of Health 2012).

The government is in the process of setting new nutrition policy and guidelines and, in 2014, the State Council issued the Outlines for Food and Nutrition Plan for 2014–2020 (General Office of the State Council 2014: 3). The document acknowledges the coexistence of under and over nutrition and the need to coordinate production and consumption with a focus on priority products and regions. It sets targets for lowering fat intake and reducing child stunting (to seven per cent) and anaemia (to ten per cent) and calls for a reduction in the rate of increase in obesity. Development of traditional (soy) and local products is encouraged along with the dairy and livestock sectors. It calls for a focus on improving access to healthy food in poor areas and for rural people and migrants, as well as for pregnant women and infants (encouraging breast feeding) and rural and urban children and the elderly. In 2015, there are plans to release a Chinese Residents' Nutritional Guideline, which will provide advice on what nutrients are commonly deficient in particular populations and how to eat healthily, as well as how to reduce dietary fat to around 25–30 per cent (NHFPC 2015). However, although it calls for strong policies in agriculture, processing and distribution, most of the measures listed refer to public education. It is also unclear how the emphasis on promoting food industry development – especially meat production and food processing – will be balanced with the public health guidelines. However, the document does discuss the need to promote the development of convenient soy-based products, which offer a healthier alternative to meat (NFPHC 2015).

Food safety policy⁴

In response to mounting concern about food safety, a host of new policies have been introduced over the past five years. These include laws and measures specifically conceived of as 'food safety policy' relating to the oversight of food production and testing of foodstuffs, but also other policies relating to industry and supply chain development, industry upgrading, land zoning and the protection and remediation of the agricultural production environment. As discussed below, some of these measures entail the establishment of new kinds of rural–urban linkages by connecting up producers with the processors and distributors and, in some cases, retailers and consumers of food.

Law and institutional reform

The Food Safety Law, first promulgated in 2009, is frequently cited as a major turning point in China's management of food safety, bringing an increasing degree of consolidation of responsibility in a smaller number of government departments and an increase in the use of coordination mechanisms to bring together departmental interests and work. Importantly, policy is now framed in terms of 'food safety' (*shipin anquan*) rather than the more limited concept of 'hygiene' (*shipin weisheng*) (Liu 2010). Major aspects of the law include: the development of surveillance systems and the assessment of food safety risks; large-scale consolidation of food safety standards; changes to the regulation of production and trade of foodstuffs, including encouragement for scale production and development of recall systems; and food testing. The law extends responsibility for food safety to lower levels of government, including the township level (General Office of the State Council 2012). The law was revised in 2015, with stricter licensing requirements and higher fines for violations. It also has several provisions for public and media oversight and social 'co-governance' (*shehui gongzhi*) (NPC 2015).

There have also been important institutional reforms that have consolidated responsibility for food safety under the health system. In 2013, a China Food and Drug Administration (CFDA) with full ministerial status was established. Prior to this, 13 central government departments had some kind of responsibility for various aspects of the supply chain from production, through distribution to sale, with a State Council working group charged with coordinating the work of different ministries (Zhang 2013). This fragmentation of responsibility resulted in overlaps and gaps in both

⁴For more details on food safety, see FORHEAD 2014.

government responsibility and in policy, which were seen as affecting the ability to ensure food safety. The CFDA integrates the responsibilities formerly held by the Food Safety Office and the State Food and Drug Administration (SFDA) as well as the responsibilities of the Quality Inspection Agency for the production environment and of the Commerce Ministry for distribution. The CFDA is responsible for ensuring the effective regulation and management of food and drug safety at every stage from production through distribution to sale, and is responsible for assessing food safety risks and setting food safety standards. The Ministry of Agriculture is responsible for the regulation and management of food safety relating to agricultural products (NPC 2015) and these will be covered by a revision of the 2006 Law on the Quality and Safety of Agricultural Products.

Although these new laws are comprehensive and strict, implementing them will be challenging. Costs relating to personnel, administration, sampling and inspection of products as well as information dissemination and education are to be borne by governments from the county level upwards (NPC 2015). But levels of financial and human resources will differ locally and building capacity will take time. It is not yet clear how implementation is proceeding. Monitoring of agricultural products has certainly increased and the Ministry of Agriculture has begun to produce quarterly reports (MOA 2015a). Some provinces – for example, Fujian – also seem to be emerging as leaders in focusing on food safety and are reporting significant improvements in food safety (Wang and Guo 2014). However, management capacity remains uneven, and public participation in oversight and ‘co-governance’ will be difficult in the absence of good public information. Furthermore, although stronger food safety policy overall is certainly a response to public anxiety, there does not seem to have been any attempt to solicit the input of consumers on specific matters, such as the fate of local markets, which may also have consequences for the price, variety and availability of food as well as for vendors’ livelihoods.

Environmental protection and sustainable agriculture policies

In response to public concern about food safety, policies to improve the safety of the food production environment have been stepped up in recent years. The general trend in environmental protection has been to increase the number of pollutants controlled and to introduce progressively stricter standards and heavier penalties for violations. In the recent revision of the Environmental Protection Law, which took effect in 2015, environmental protection has been included in the appraisal criteria for local officials, personal legal

liability for violators has been introduced and the ceiling on fines has been lifted (NPC 2014). Since 2007, the health impacts of environmental protection have also become a somewhat independent separate policy field, with the establishment of environment and health divisions within the health and environment ministries (see Holdaway 2013 for a summary).

Soil and water are covered by a number of standards. The 1995 Standard for Soil Environment Quality sets three levels of quality standards for ecological protection zones, for agricultural production areas and for forestry, including heavy metals (HMs) and pesticides (GB 15618–1995 1995). Standards for irrigation water set acceptable levels of total Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and HMs, while general water quality standards apply to natural water supplies that are used for agriculture. For naturally occurring water, Grade III and above is classified as safe for common species of fish, and Grades IV and V for general agricultural purposes. However, depending on the levels of particular chemicals, Grade V water might exceed standards for irrigation water (GB 5084–2005 2005). As pointed out above, however, compliance – or failure to comply – with environmental standards is not always a good indicator of food safety.

In addition to specific environmental quality requirements, the government is also acting to separate industry from agricultural and residential areas and make pollution control more effective (and cost-effective) through land use zoning. At the macro level, this is evident in the Main Land Area Zoning (*zhutigongnengqu guihua*) introduced in the 11th Five-Year Plan, which designates particular regions and sub-regions primarily for agricultural production and some for ecological protection, while ‘optimising’ and prioritising industrial development in others. At the county level, the impact of environmental protection policies is evident in the closing of small mines and industries and the concentration of others in industrial parks. However, there are many challenges to the implementation of these zoning regulations at a time when both market incentives and regional planning policies are encouraging the relocation of industry to the hinterland and west of China (CCICED 2012a; CCICED 2012b).

Heavy metal (HM) pollution

Reducing risks from HM pollution has become a policy priority, especially after rice in Guangzhou markets was found to contain excessive levels of cadmium (Hu *et al.* 2014). Testing of rice and other products sensitive to HM contamination is increasing under the food safety measures discussed above. Other policies focus on reducing HM emissions from industry and household waste, including the 12th Five-Year Plan for the Prevention and Control of Heavy Metal Pollution

(Ministry of Environmental Protection 2011), which has been followed by provincial-level plans. Areas of particular concern (for example, Hunan) have seen large-scale investment (Hu *et al.* 2014), and some areas found to be producing crops containing excessive levels have been ordered to stop production (Pang *et al.* 2013). A Soil Environment Protection Law is planned that would establish standards and procedures for risk assessment, protection and remediation (CCICED 2015). However, the scarcity of arable land in China makes it hard to take large areas out of cultivation in order to remove and replace the topsoil, as was done in the US, Europe and Japan, and the cost would be prohibitive. Therefore, although superfund-style remediation projects are being undertaken in some areas – including Hunan province – efforts are also being made to find ways to improve food safety in the short term, by detoxifying the soil through phytoremediation, fixing HMs in the soil, planting different crops or cultivars or improving the soil (Li *et al.* 2015).

All these policies should help to reduce HM risks through food if they can be implemented effectively. Therefore, although public anxiety about HM contamination is rising and very serious problems remain, an overall reduction in risk is probably already underway in early industrialising parts of China. However, the transfer of industry and the potential to exploit the extensive mineral reserves in western China present concerns that pollution may spread there (CCICED 2012a; CCICED 2012b), and preventive action will need to be taken if food safety risks are not to result.

Chemical pesticides

Policies have addressed pesticide use on a number of levels, including overarching attempts to encourage harm-free and organic agriculture, tighter regulation of the certification of new pesticides, and policies designed to bring pesticide use down to safer levels. The Institute for the Control of Agrochemicals (ICAMA) was established in 1963, and DDT and other highly toxic pesticides were banned in 1983. In 1997, the State Council issued Regulations on Pesticide Management, which were revised in 2001. China has ratified the Stockholm Convention of Persistent Organic Pollutants, which went into effect in 2004, and in 2005 set up a National Coordination Group for Implementation of the Stockholm Convention (Lau *et al.* 2012).

The development of certification for organic and minimally treated food began in the 1990s and three standards are now in use. 'Organic' indicates no pesticides or toxic chemicals have been applied for at least two years for annual crops and three years for perennials, with annual inspections and no tolerance for GMO. 'Green food' is comparable to integrated crop management with limited use of farm chemicals,

but also has different grades, the highest of which (AA) is comparable to organic. 'No harm' (*wugonghai*), introduced in 2001, merely certifies that inspected products comply with national standards in terms of environmental quality (including air, water and soil). See Sternfeld (2009) and Paull (2008) for a summary of the development of these systems.

Organic cultivation is concentrated in the northwestern provinces of Inner Mongolia, Heilongjiang, Jilin and Liaoning, and in Jiangxi, Fujian, Hubei, Shandong and Yunnan. Sun *et al.* (2012) report that in 2006, 23.27 million hectares of farmland were certified to produce 'harm-free' produce, accounting for 19.1 per cent of total arable land, and that 3.3 million hectares were certified to produce organic food without synthetic fertilizers and pesticides. More recently, ICAMA (2012) gave a figure of two million hectares under organic cultivation. The 12th Five-Year Plan for food safety aimed to increase the area used for promoting 'no harm', 'green' and 'organic' foods to 60 per cent. However, despite more supportive policies, certification for organic food remains expensive and public trust is low (Sternfeld 2009).

Pesticide persistent organic pollutants are regulated by the Ministry of Health in terms of their levels in food and by the Ministry of Agriculture in terms of certification, labelling and use. In 2008, Measures for the Implementation of the Regulation on Pesticides Administration and Measures for the Administration of Pesticide Labels and Manuals were introduced (see Lau *et al.* 2012 for a list of relevant laws and standards). All new pesticides now have to be registered with ICAMA. Recent measures have focused more closely on health and on food safety, with the Ministry of Health and the Ministry of Agriculture establishing Maximum Residue Limits (MRL) for 12 pesticides in food in 2010, as part of the national food safety standards (ICAMA 2012). In 2012, the Ministry of Agriculture introduced a formula for calculating 'acceptable daily intake' (ADI) levels for pesticides based on lifetime ingestion (ICAMA 2012).

In addition to the supply chain integration methods described above, other measures have sought to reduce pesticide use by trying to separate agricultural extension work from the sale of farm chemicals. There is also more use of integrated pest management (IPM) and pest forecasting systems, although it is not clear that these efforts are sustainable after programmes end (Lu 2010).

Overall, however, a concern with food safety and protection of the agricultural production environment is increasingly integrated into agriculture policy. The Plan for Sustainable Agriculture for 2015–2030 includes a target of zero increase in the use of pesticides and fertilizers by 2020 (MOA 2015b).

Additives

Food additives have also come under tighter regulation. The Ministry of Health produces a positive list of additives that may be used in foods, similar to that issued by Codex Alimentarius, with the scope of use and maximum permissible levels. Since 2009, there have been a number of crackdowns on the improper use of food additives as well as on the use of non-sanctioned additives (MOH 2009). An MOH notice from 2011 states that in 2010, 97,000 additive producers and 3.6 million food production companies were investigated, resulting in the discovery of 5,305 infractions. For the most part, these were dealt with through fines, although 36 cases were referred to the legal system and 23 arrests were made (MOH 2011a). GFSF reports a similar campaign in 2011, which resulted in more than 2,000 arrests and the closing of 5,000 businesses (GFSF 2011: 16). Small companies and restaurants, as well as the sale of milk, the transport and sale of live poultry, and slaughterhouses are considered to be weak links and/or require greater oversight (General Office of the State Council 2011).

Other relevant policies include stronger regulation of companies producing food additives (including registration, oversight, required standards, etc.), the labelling of foods containing additives, mandating record keeping on the part of food-processing companies, and promoting increased management and education by industry and industry associations with the aim of ensuring processing companies use only permitted additives (General Office of the State Council 2011). In the last few years, the MOH has released blacklists of banned and easily misused substances to help guide sub-national governments in their oversight and enforcement work. Sub-national governments are required to report any such substances they discover during oversight work to the national government (National People's Congress 2015).

Policy challenges and barriers to implementation

It is clear from the above that the government is committed to addressing the various dimensions of food security and recognises the complex, interlinked nature of the problem. However, both generic and China-specific challenges remain. Generic challenges include the distribution of responsibilities and competing agendas across multiple agencies – health and nutrition, agriculture, environment, food industry development – and the difficulty of bringing about dietary changes (Bailey and Harper 2015; FORESIGHT 2007).

China-specific challenges include competition for land and water in a country where both these resources are scarce, as well as environmental degradation resulting from industrial, agricultural and household waste. Centre–local fiscal relations also create difficulties. Reforms of the fiscal system since the 1980s has transformed a 'province-collecting, centre-spending fiscal regime' into one in which sub-provincial levels became largely fiscally self-reliant (Saich 2011). Large disparities exist across sub-national jurisdictions (Wong 2009) and local governments often find themselves required to implement central mandates with inadequate funding attached. As a result, differences in local resources lead to uneven implementation capacity and service provision. And while they are under increasingly heavy pressure to enforce environmental standards, local governments are also highly dependent on local industry for tax revenue, making it difficult for them to close down or impose high costs on polluting or unsafe operations. The situation is not helped by the fact that much of the management of food safety is concentrated in relatively weak government departments, such as health and environment.

In general, rural areas have lower capacity than urban areas, but there is a more general continuum from poor and low capacity to relatively rich and high capacity. Wealthy sub-national governments may develop local policy solutions that go beyond national mandates. For example, Shanghai seems to be in the vanguard in terms of food safety management, and the challenges it faces resemble those of a developed country importer. Since the mid-2000s, the city has developed a distinctive model of oversight and policing of food 'imports' (Shanghai Municipal Food and Drug Safety Research Centre 2008). But in many other cases, constrained local revenues will mean a much more limited government response, and improvements in food safety will require significant investment at the county and township level (General Office of the State Council 2012). Limited research suggests that even in highly developed regions, rural areas are much less well funded and staffed than urban ones, reflecting the long-standing administrative divide (Liu and McGuire 2015).

Policy integration and conflict: food security, food safety and nutrition

Addressing the various dimensions of food security requires balancing the need to ensure adequate food supplies and nutrition, especially for low-income groups, while avoiding excessive consumption and unhealthy diets. The desire to increase agricultural production and expand food processing and retailing as economic sectors also has to be balanced with nutritional and food safety concerns, with which they

are sometimes but not always complementary. In terms of both production and distribution, the respective benefits of large-scale, more easily regulated supply chains and more traditional or informal mechanisms need to be considered due to their implications for cost, convenience and diversity, as well for the livelihoods of both the rural and urban poor. Below, we discuss some areas of tension between these different food-related policies.

One example is the growth in consumption of processed foods. These are a significant source of value-added in the food sector, and food processing provides employment for relatively unskilled workers. Processed foods also meet the needs of people who work long hours and may not have the time or facilities to cook. On the other hand, many processed foods are rich in sugar, refined carbohydrates and fat. They often have low nutritional value and may be detrimental to health. In the context of inadequate regulation, processing also opens up opportunities for the inappropriate use of food additives. Promoting the production of healthier processed food is therefore a policy challenge. The restaurant and fast food sectors present similar tradeoffs, being important employers and providing for urban workers but also accounting for a lot of the consumption of fat and sugar and being implicated in food safety problems.

Although both are concerned with health, nutrition and food safety can also sometimes be in tension with each other. The promotion of certain products for their nutritional value, and the introduction of new, higher nutritional and quality standards, can sometimes have unintended consequences as producers competing in tight markets or seeking greater profits use fraudulent methods to meet those standards. This occurred in the case of melamine added to milk to mimic the effects of higher protein content required by nutritional standards. New nutritional guidelines may also lead to a sudden stimulation of demand and rapid increases in production of certain products in the absence of adequate safety measures and regulatory capacity.

Another example of how different policies can come into conflict is the case of rice. Concerns with food security have led to the development and promotion of high-yield, *Indica-Japonica* hybrids ('super rice'), but unfortunately some of these also have a high propensity to accumulate HMs and also have lower uptakes of zinc, which is beneficial to health (see Shi *et al.* 2009). Intensive use of agricultural inputs, in particular fertilizers, in order to increase yields has also contributed to soil degradation, which increases the risks from HMs (CICCED 2010). These interactions need to be understood if policy is to be effective.

Another question relates to balancing safety and nutritional content with affordability for low-income consumers and sustainability for smallholders. Most surveys find that Chinese consumers are willing to pay a premium for product quality, usually indicated by some form of labelling/certification (Xu *et al.* 2012; Wang *et al.* 2008; Ortega *et al.* 2012) or assurance of traceability (Zhang, Bai and Wahl 2012). However, surveys address different populations at different times, use different methods and focus on different products, making it difficult to know where the tipping point between price and quality lies (Ortega *et al.* 2012; Zhang *et al.* 2010). Existing studies may overestimate willingness to pay because they tend to focus on urban consumers (Zhang, Bai and Wahl 2012) and on supermarket shopping (Xu *et al.* 2012). Little targeted research has been done on rural populations or second- and third-tier cities, or on more 'traditional' sales venues such as wet markets.

Furthermore, for poor people, willingness to pay runs into the hard constraint of capacity to pay. For example, one consumer strategy has been to switch to consumption of imported products based on the belief that these are likely safer than domestically produced ones. This has been particularly obvious in the case of milk powder and baby formula (Jacob 2013). An Ipsos survey found that more than 60 per cent of respondents in seven large Chinese cities intended to increase their consumption of foreign brands, and that 28 per cent would increase their purchases of imported foods/brands as a result of food safety scares (Ipsos 2012). However, low-income consumers do not have this opt-out strategy. From the point of view of smallholders, there is also some evidence that increased inspection and testing following the 2009 Food Safety Law is leading to a rise in prices due to increased costs of compliance, although it is unclear by how much (USITC 2011: 5–18). Equally, analyses of the costs of complying with standards such as HACCP find these to be high but bearable for larger processing companies and/or exporters, but out of reach for smaller companies supplying domestic markets on thinner profit margins (Wang *et al.* 2009; Wang *et al.* 2007). The costs of organic certification are even more out of reach for many smallholders, and the lack of trust makes it hard to command a high price for uncertified products (Su 2015).

Although the tension between competing policy priorities is evident in particular cases, there is little systematic analysis of the interactions between different physical and social systems or different policy streams. Nor is there organised interaction among the various agencies involved in developing policy, for instance in the drafting of the new Agricultural Product Safety

Law. Many agricultural experts seem unaware of the different propensities of rice cultivars to absorb heavy metals, while many environmental experts are unaware of the fact that pollution in soil does not transfer directly to rice. Experts focused on food safety rarely consider the nutritional content of food, and sometimes make recommendations that obscure the tradeoffs that exist in some cases (for example, the nutritional benefits of eating fish in relation to the risk from HMs). More integrated research and policy will be needed if these interactions and tradeoffs are to be understood and used to guide policy.

Beyond government

Government aside, China has a comparatively limited governance toolbox in terms of mechanisms for providing information to the public and ensuring accountability. The legal system, insurance sector, and industry and consumer associations remain relatively weak (Thompson and Hu 2007). For example, the extent to which the legal system is playing a role in enforcing food safety in China is unclear, and there appear to be no studies on the role of either consumer or industry groups in relation to food safety. Currently, very few NGOs work on this issue (exceptions are Greenpeace China, PEAC and Woodpecker (*Zhuomuniao*), a Hangzhou-based NGO).

An analysis of these institutions is not possible here, but the following section discusses two other factors that are very important in shaping attitudes and consumption patterns in China: the media and dietary/cultural traditions.

Media

The media are an important influence on consumer demand and purchasing patterns, particularly through food advertising and reports on food safety scandals. By 2006, China was the fourth largest advertising market for food products (Hawkes 2008). As in other countries, many adverts promote foods that are high in salt, sugar and fat, especially to children who then ask their parents to buy these (Kelly *et al.* 2010). At the other end of the spectrum, there is also a noticeable increase in advertising for health foods and supplements, much of it aimed at parents of infants and young children.

Food safety is the other area where media of all kinds have become very active, and in the absence of good public information, the media play a big role in shaping public opinion. Research by the Development Research Council has found that internet searches on food

safety have spiked around media reports reporting problems (DRC forthcoming). New media, in particular microblogs (*weibo*), have become a space in which stories (many of them unverifiable) about extreme food safety incidents circulate. They also serve as a barometer of public opinion used by researchers (Yang 2013) and government alike (DRC forthcoming). Food safety consistently ranks high among the problems of concern to the public and low in terms of satisfaction with government performance (DRC forthcoming).

Media reporting directly affects consumer confidence in products and brands reported to have problems with food safety. In the wake of the 2008 melamine scandal, sales of dairy products declined dramatically (Halliday 2008). In 2013, Yum! Brands (the parent company of KFC) was discovered to have sourced chickens from suppliers who used excessive levels of antibiotics, and the resulting news frenzy resulted in very dramatic declines in sales and in the company's share price (New York Times 2013).

In addition to directly affecting purchasing patterns, media-influenced public opinion also plays an important role in generating incentives for stronger policies to address food security issues. This can be positive, but also carries risks. First, there are considerable differences in both levels and issues of concern between the public and experts. This is partly due to the lack of good public information and the lack of trust caused by scandals, but it is also because media reporting presents a skewed picture of the landscape of food security. First, it focuses on food safety, giving much less attention to risks associated with under and over nutrition; and second, within food safety it tends to favour issues that involve acute health problems, such as food poisoning, or dread diseases, such as cancer, as well as those affecting populations that elicit special sympathy, such as children. Problems with chronic or more indirect effects – for example, antibiotic residues – receive less attention even though they may be much more serious from the point of view of public health (Holdaway and Wang 2014).

Reporting also lacks context about the prevalence and severity of different risks, often suggesting that they are generalised when in fact they are probably specific to certain populations. This contributes to spiralling public anxiety – surveys have found that the public regards food safety as the second greatest risk in daily life, with 92 per cent expecting to be the victim of food poisoning in the next year (cited in Lancet 2012). This can spur demand for government action that involves the unwise allocation of resources. Government's use of media as a

⁵ This section draws on a presentation made by the author to the Chatham House China Expert Stakeholder Meeting on Meat and Dairy Consumption and GHG Emissions. Beijing, 13 May 2015.

source of public opinion data is also worrying because internet use is concentrated among relatively affluent urban populations (CINIC 2015), presenting a biased picture of public concerns in which lower-income and less-educated people are largely unrepresented (Liu and McGuire 2015). The DRC study also found that concerns about food safety and lack of satisfaction with government efforts to address it rose with income and education levels.

Of course, these problems are partly rooted in the lack of publicly available, trustworthy information about the actual nature and extent of food security problems; and partly in the professional incentives of the media to report bad news. More transparency and better communication of risks by the government would help mitigate both of these. Consumer watchdogs might also play a larger role, but few NGOs currently have the scientific and technical capacity to work on food safety problems (Fürst and Holdaway 2015).

Interactions between economic and cultural factors⁵

Most analysis of China's food security focuses on economic factors; in particular, the impact of rising incomes and urban lifestyles on consumption. But a smaller thread considers the impact of cultural influences on consumption patterns. Noting the convergence between rural and urban diets, some observers have argued that China's nutritional transition is basically similar to that followed by earlier developing countries (Popkin 2013) in showing a tendency towards greater consumption of fat and sugar and the associated health risks. Others have argued that the use of food as a vehicle for displaying status and hospitality exerts a negative pressure towards consumption of high-protein foods and luxury foods, and is reflective of a broader shift towards materialism (see, for example, Podoshen *et al.* 2010).

While these observations may be true to some extent, reducing culture to a function of economic circumstances and regarding it as immutable are both overly simplistic positions. Culture is better seen as a complex repertoire of ideas and practices that evolve in dynamic interaction with changing physical and social environments and incentive structures. From this perspective, while it is important not to fall into the opposite trap of idealising 'Asian' culture in opposition to that of the 'West', there are also aspects of Chinese attitudes to and practices around food that point in a more optimistic direction, if policy can support their continuance (Holdaway 2015).

First, food occupies a central place in Chinese culture: as the saying goes, people "... see food as God" (*yishiweitian*). Any visitor soon observes that people spend an enormous amount of time discussing food – its flavour, its texture, the way it is cooked – and regional specialties are a great source of pride. Second, the connection between food and health is much more strongly established than in many other cultures. Chinese medicine, which still exerts a strong influence in health maintenance practices even among people who turn to Western medicine for curative care, holds that "*illness enters through the mouth*" (*bingcongkouru*) and advocates a diet that is based on staples and vegetables, while limiting salt, protein and fat intake, which can cause unhealthy imbalances in the body. Buddhism, which advocates vegetarianism, moderate consumption and occasional fasting is also a positive dietary influence and one that again exerts a sway that goes well beyond the scope of active practitioners (Holdaway 2015).

Third, from a practical point of view, the format of Chinese meals comprises a number of separate dishes (usually some mixed meat and vegetable dishes alongside straight vegetable dishes and staples), which lends itself better to reducing the proportion of meat to healthy levels, compared to Western meals in which a large piece of meat occupies the central place on the plate. Lastly, if they can be sustainably produced, soy and other bean products of all kinds offer healthy and inexpensive alternatives to meat and dairy that are already a familiar and valued part of the diet, and that are not seen as new, inferior substitutes as they are by many in the West. Soy products also lend themselves to fortification, to help address nutritional deficiencies; China has already used soy sauce fortified with iron as a way of combating anaemia, and calcium and vitamins could potentially be added to soy milk, as they are in products targeted at vegetarians in the West (Holdaway 2015).

China now faces the same challenges as other countries in terms of trying to promote healthy diets in the context of rising incomes and the higher economic returns on processed and higher value-added foods. However, from a cultural perspective, it may be better positioned to head off some of the negative trends in diet that have already taken place in other parts of the world, if dietary advice and economic incentives can be introduced fast enough to prevent unhealthy habits from becoming entrenched. At the same time, with rapid dietary changes underway as in many other policy domains, China probably has a window of opportunity in this regard that will not be open forever.

6

Conclusions

This report has shown that over the past 35 years, China has undergone a food security transition that is in some ways similar to that of other countries, but also in many ways unique.

Even prior to reform, when China was still a very poor country, it was – with the exception of the Great Leap Forward – able to ensure a high degree of basic food security for a country at that income level, although this went hand in hand with separate and unequal provision for rural and urban areas.

The past 30 years have seen a dramatic reduction in food insecurity, although pockets of malnutrition remain. At the same time, new problems related to overly rich diets and food safety have emerged. With the re-emergence of markets, rural–urban linkages have become denser and more complex, with much greater variety in the foods produced and the places where they are sold. Certain patterns of inequality in terms of access to safe, nutritious food can be traced, but they intersect in complex ways and do not relate in a simple way to income.

There is a need for continued attention to under nutrition among the rural and urban poor and rural–urban migrants, but the actual level of risk varies widely depending on region, the quality of the agricultural

production environment, occupation and access to markets. At the same time, China needs to, and is, addressing the problem of over nutrition among the middle and wealthy segments of the population, but again the specific risks are different depending on the regional composition of the diet. Food safety risks, which are a source of great public anxiety, also need to be considered in a disaggregated fashion that takes into account not only different income levels but also the production environment and dietary patterns in different parts of the country.

Nutrition and health policy are already quite well integrated, but interactions between nutrition and food safety are less well understood, as are analyses of food safety that are rooted in an understanding of the environmental drivers and industry-specific risks. Both of these would benefit from more detailed investigation of regional and demographic patterns of production and consumption, in order to identify and address specific risks facing particular regions and populations. Some overarching principles are appropriate, but beyond this, ‘one size fits all’ policies will probably waste resources, fail to adequately address the needs of particular populations and be insufficiently responsive to rapidly changing landscapes of risk.

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This paper discusses who eats what in China and why, with a focus on understanding the evolving axes of inequality with regard to access to affordable, safe and nutritious food in the context of changing rural–urban linkages. The production, distribution and consumption of food has changed in the context of rapid economic growth, urbanisation and industrialisation, leading to denser and more complex rural–urban linkages. The paper discusses policies aimed at ensuring adequate food provision and the regulation of quality and safety, as well as synergies and tensions between them such as the need to keep prices low while at the same time ensuring safety and nutritional quality.

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