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Urbanization, Diet Change, and Transformation of Food Supply Chains in Asia

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1. Introduction

A lot has been written in recent years about technological change on Asia's farms and the enabling context for that technological transformation, in the development of agricultural factor markets (such as land, variable input, and credit markets), in the "upstream segment" of the food supply chain. But far less attention has been paid to the midstream segments of the food supply chain – in processing, wholesale, logistics – and in the downstream segments, in retail, and restaurants and other "food away from home" (FAFH) purveyors. Yet the **midstream and downstream segments of the food supply chain form from 50 to 70% of the value added and costs in the overall food chain, and thus the prices paid by consumers** for food security in Asia. Moreover, much attention has been paid to rural areas per se, with the focus on farms, but relatively little has been paid to the changing size and nature of the urban market in Asia; yet the **urban market now constitutes about 60-70% of the food consumed in Asia**. Finally, by far the lion's share of the debate on food in Asia has focused on grains, and on rice in particular. But we show that **cereals constitute only a quarter to a third of food expenditure**, thus paying far too little attention to the other two-thirds to three quarters of food expenditure which is in non-grain foods.

This report works to redress the imbalance in the debate and focuses on urbanization, diet diversification, and the (correlated) transformation of the midstream and downstream segments of the food supply chains in Asia. These have been conceptually linked to each other and to upstream transformation in a recent article on the "five interlinked transformations" of the agrifood system occurring rapidly in Asia (Reardon and Timmer, 2014): (1) urbanization together with rapid income growth; (2) diet change; (3) agrifood system transformation (especially in the midstream and downstream segments); (4) rural factor market transformation (in input and credit supply chains into farming); and (5) intensification of farm technology (the agricultural transformation). The five transformations are occurring in waves over countries of developing Asia, with the waves roughly correlated with the initial level of income (as a proxy for "development") and degree of "openness" from liberalization of FDI, trade, and domestic markets. The five transformations are linked in mutually causal ways in all directions – the transformation is of an integrated system rather than piecemeal, independent changes. This means the transformation has the potential to be rapid and complex.

This report focuses then on the first three of the above transformations, with sections 2, 3, and 4 dedicated to them, and section 5 as a conclusion for implications for innovation strategies. The report brings together substantial new and reviewed evidence of a rapid transformation.

2. The Urbanization of Asia

We use "level of urbanization" to mean a static observation of the share of the urban population in total population. We use "rate of urbanization" to mean the annual growth rate of that share. By "concentration of urbanization" we mean the tightness of the spread of the

urban population over cities and towns. We use data from the United Nations World Urbanization Prospects (http://esa.un.org/unup/), the most complete and accessible database available for Asia. We first examine urbanization's levels and rates, and then its concentration in Asia.

2.1. Urbanization Levels and Rates

First, overall, Asia is urbanizing rapidly. According to the United Nations (2011), Asia had an urban share of 18% in 1950 and 44% in 2010, with a projection of 56% by 2030 and 64% by 2050; it is also estimated that the Asian *rural* population rose from 1.63 billion in 1970 to 2.31 in 2011, but that it will decline absolutely to 2.17 in 2030 and 1.83 billion in 2050 (cited in Hazell 2013).

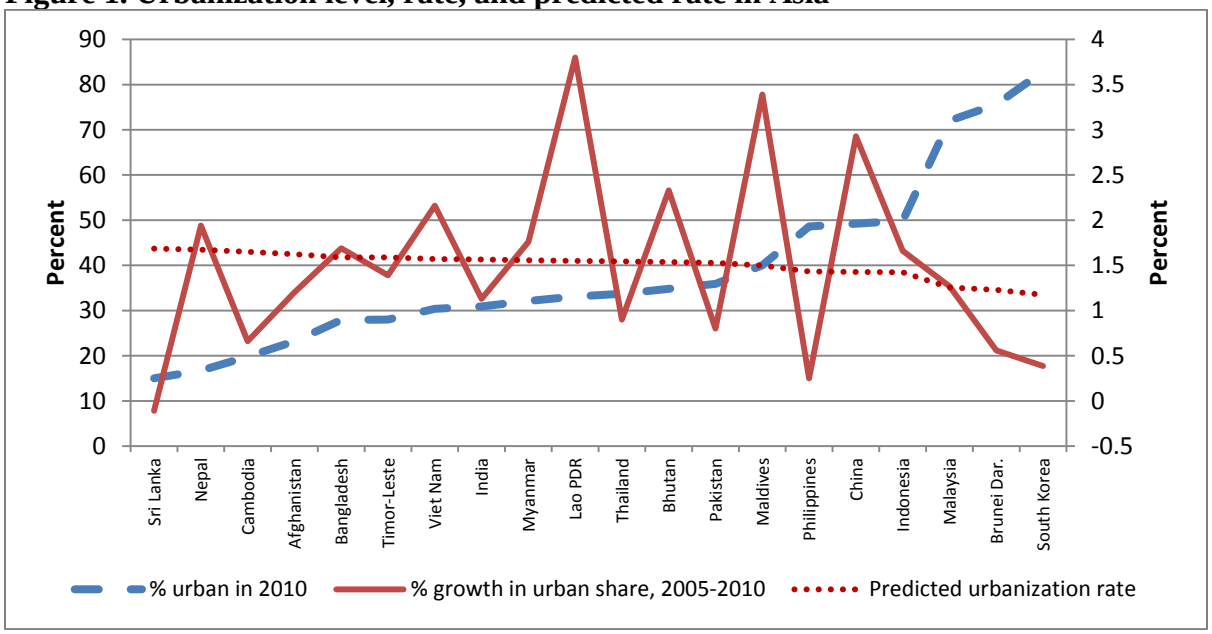
Second, while overall rates of urbanization are high, Figure 1 shows that the level of **urbanization varies greatly across sub-regions**. This roughly follows the average level of development as proxied by income. Using population weighted averages across countries, we find in 2010 that South Asia is the least urbanized (32% in 2010), followed by Southeast Asia at 44%, and East Asia the most urbanized, at 54%.

Rates also differ across sub-regions; again, roughly speaking, the **rates vary with the rate of income growth hence development**. East Asia has the highest urbanization level yet appears far from "urban saturated," as it also has the highest urbanization rate, at 2.38% between 2005 and 2010. Again, Southeast Asia is in between, at a rate of 1.42%. On the other extreme, South Asia has the lowest urbanization level, and is thus far from what one expects to be its urban saturation point, but has a low urbanization rate of 1.05%.

Third, however, Figure 1 shows that the robust average patterns across sub-regions mask **significant variation over countries inside sub-regions**. The variation observed is partly a function of overall income and thus level of development of the sub-regions. The variation within sub-regions over countries is then driven by a wide range of factors including income but beyond income - such as patterns of development (controlling for levels), agrarian structure, and so on; a detailed examination of these determinants is beyond our scope. There is large cross-country variation, from 15% in Sri Lanka (like Western Europe in 1700) up to 89% in South Korea (like Western Europe or the US today). Within East Asia, South Korea's urban share was 83% in 2010, while China's was 49%. In Southeast Asia, countries with similar urbanization levels of 20% to 30% had highly different urbanization (growth) rates – Cambodia's was merely 0.5 while its neighbors had much higher rates – Vietnam with 2% and Laos with 3.8%. In South Asia, Nepal's annual urbanization rate from 2005 to 2010 was 1.9%.

Fourth, however, despite great cross-country variation, but in line with the "clumping" by sub-region, **some clear patterns show: in particular, the urbanization rate shows a slightly negative, but statistically insignificant relationship (p=0.561) with the urbanization level**, with the predicted urbanization rate falling only from 1.7% to about 1.2% across countries. That it falls is not very interesting, as one would expect progressive saturation (as Tschirley et al. (2013) found in Africa); what is surprising is that that it falls so little, that the decline is not statistically significant, and that even the most urbanized countries have a fairly high urbanization rate – they are not yet "urban-saturated."

Figure 1. Urbanization level, rate, and predicted rate in Asia



2.2. Urbanization's Concentration

There has been much attention in the discussion of urbanization in Asia given to the rise of the megacities: cities of more than a million rose from 26 in 1950 to 226 in 2010 and are projected to rise to 359 by 2025. But there has been little treatment of how concentrated urbanization is – that is, what share of urbanization is in megacities and what share is in smaller cities and towns. This is important for consideration of urbanization's effects on the agrifood system, as research suggests that a more diffuse pattern of urbanization has a different, and likely greater, effect on rural areas than does a highly concentrated pattern (World Bank 2009).

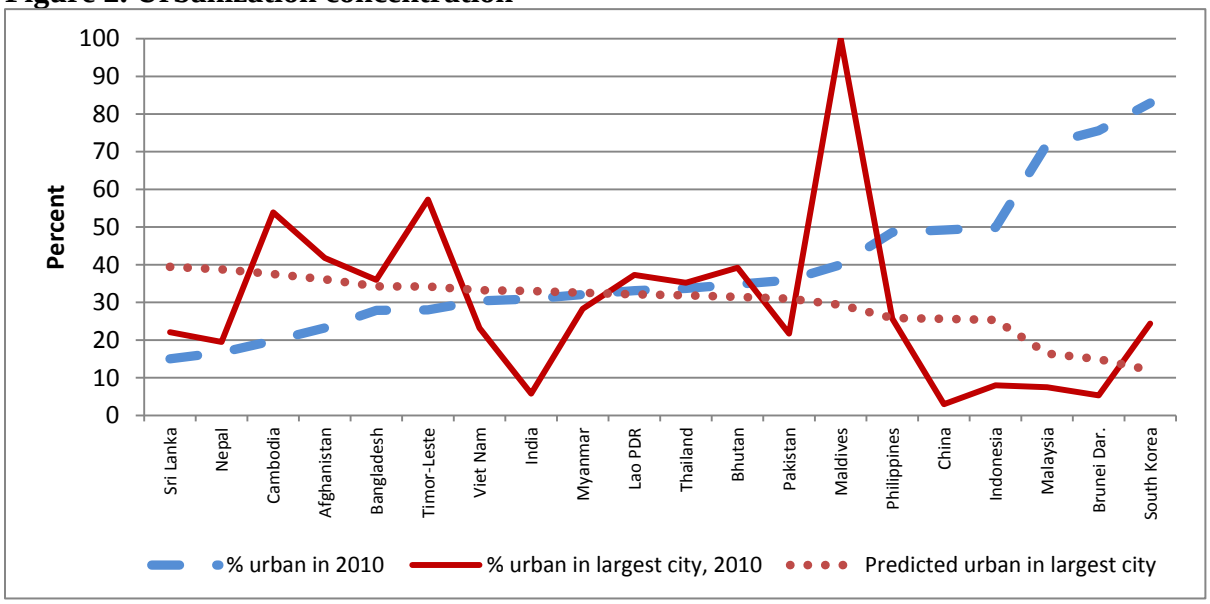
To explore this, we examine urbanization concentration using three indicators: (1) the share of a country's total urban population that resides in its largest city; (2) the shares that reside in large cities (over 1 million), large towns and smaller cities (100,000 to 1 million), and smaller towns (below 100,000); and (3) a Herfindahl Index (HI) that computes the concentration of urban population across all settlements above a defined size (the latter two using data from www.citypopulation.de). This index varies from zero to one, with values near zero indicating highly un-concentrated or diffuse urban growth, and values near one indicating the opposite. The data show several patterns.

First, Figure 2 provides data on the share of urban population in the biggest city. These data show that **urbanization becomes less concentrated as the level of urbanization (urban share of total population) rises.** The estimated value (of the share in the largest city) falls from 40% to about 12% across these countries[1]. Notably, the top six countries in terms of

[1] This relationship is not quite statistically significant (p=0.144) due to one observation: the very high share of urban population in the largest city of the Maldives. Excluding this observation, the relationship is highly statistically significant.

urban shares all have the percentage of the urban population in the largest city under 26%.

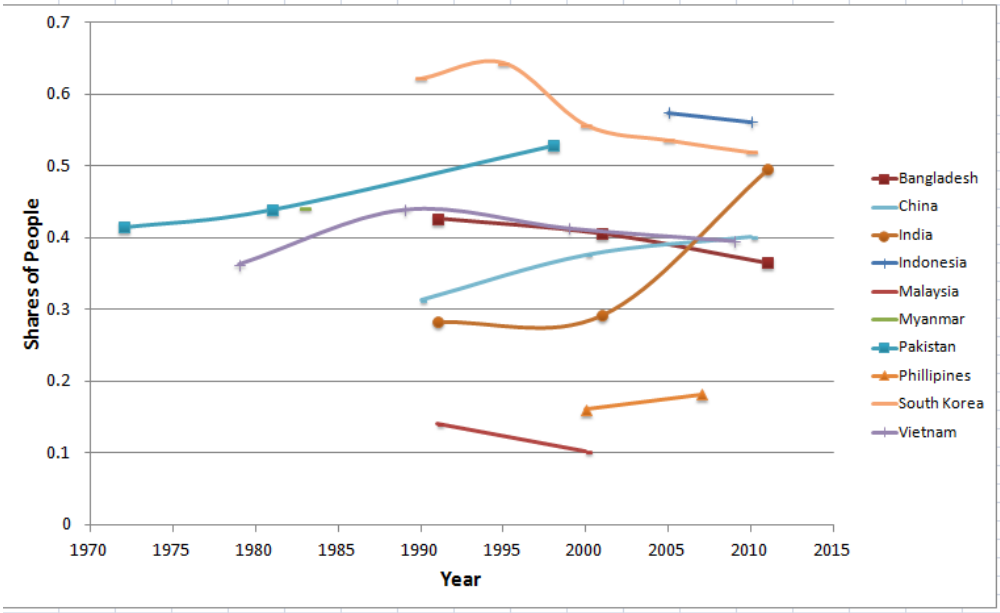
Figure 2. Urbanization concentration



Second, Figure 3 shows the shares that reside in cities in different population ranges (in three classes of 20,000 – 100,000, 100,001 to 1,000,000, and the megacities, over 1,000,000) against time for all census years for all countries available on www.citypopulation.de . The pattern in the data shows a **slight downward trend over time in the lowest town/city size category, no clear over-time pattern in the middle, and a mixed picture in the top category**; for the latter, three countries (among which are the two giants, China and India), show a clear trend toward more of the urban population in megacities; by contrast, apart from the Philippines, the other countries actually show a declining trend in the share of urban population in megacities, in contrast to the conventional image. For example in South Korea and Bangladesh, the share of urban population in cities with over 1,000,000 people dropped (from 43% to 37% in Bangladesh and from 62% to 52% in South Korea). Some of this share went to medium size cities (27% in 1991 to 32% in 2011 for Bangladesh and 28% in 1990 to 38% in 2010 for South Korea).

Third, the decline of the Herfindahl index provides the most robust evidence of declining concentration of urban population, though the decline is modest in size (but evident in many countries). Of the 14 countries with more than one year of data, only two showed increasing concentration according to the HI – Afghanistan and Cambodia. All other countries showed slow declines and, by the late 2000s or 2010s, had indices lying between 0.01 and about 0.10. These are very low levels of urbanization concentration. It is possible that these low levels of concentration are related to the high population densities found in Asia and the rapid growth of small rural towns into cities in the past decade or two.

Figure 3. Share of urban population in towns and cities above 1,000,000



2.3. Thinking beyond population to judge urbanization's true size and effect in the food economy

Population shares, alone, underestimate the importance of urbanization for the food economy. Urban consumers have lower shares of food in total household expenditure compared with rural residents – but have sufficiently higher incomes that urban consumers often spend more on food per person than do rural consumers. India exemplifies this: Ablett et al. (2007) note that by 2006, while only 29% of population was in cities, urban consumers accounted for 43% of all market expenditures on food consumption (due to higher average incomes than in rural areas). In more urbanized countries **of East and Southeast Asia, urban consumers are responsible for roughly two-thirds even to three-quarters of all food expenditures** (Reardon and Timmer 2014).

Moreover, **urbanization rates *per se* abstract from the "type of city" – that is whether its growth is linked or not to the surrounding rural area**. This point applies the well-known concept of production and consumption linkages to consideration of the nature of town and city development (see Renkow 2007). This is a way in which the **de-concentration of urbanization important**. On the one hand, the urban area may have developed as an emanation from those linkages, where the urban areas at least initially are built on clusters of services, upstream and downstream, to the agricultural areas. On the other hand, the urban area may develop as an enclave with respect to the surrounding rural area (like "entrepot" cities such as Singapore) or mining towns in hinterland agricultural areas. In the latter case, urbanization *per se* may have little effect on the local agricultural economy.

3. Diet Change in Asia

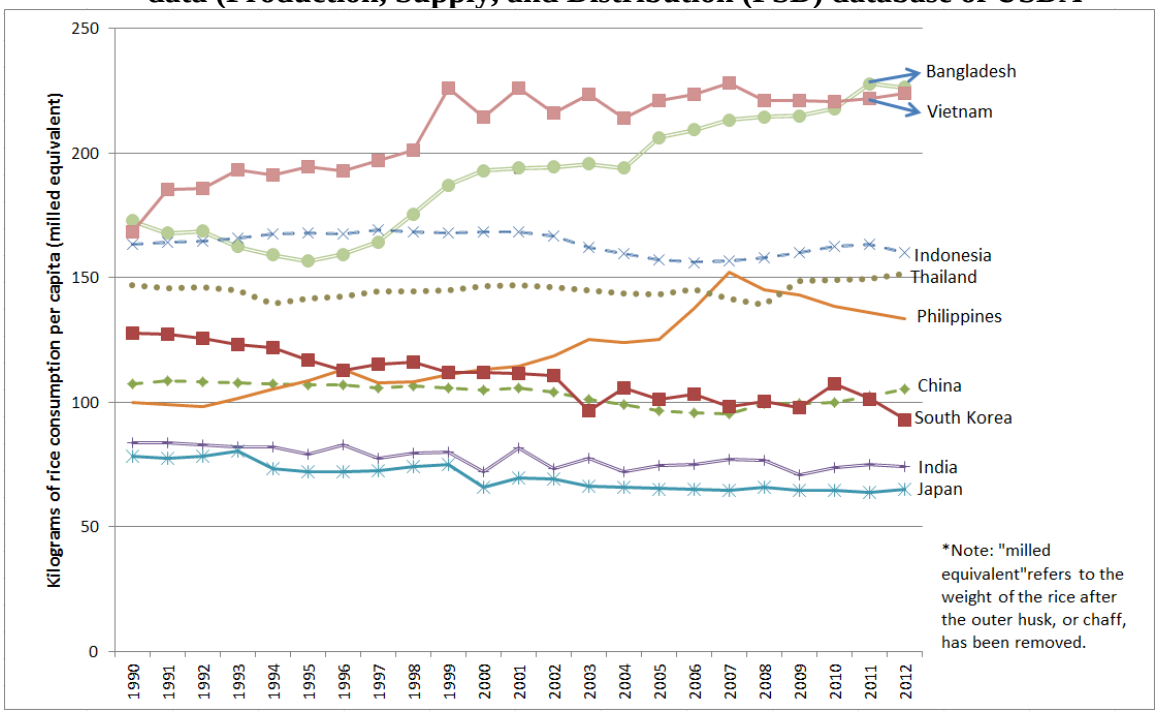
3.1. Background and Definitions

As incomes rise, consumption of non-grain products (fruit, vegetables, meat, fish, eggs, milk, edible oils, et alia) rise disproportionately, compared with grains and other starchy staples (per the internationally verified statistical regularity, "Bennett's Law" (Bennett 1954)). Lifestyle changes that accompany urbanization increase the opportunity cost of women's time, leading to changes in product composition of demand. Both increasing incomes and urbanization are prevalent across Asia, thus leading to diversifying (beyond grains) diets. The changes in diet include an increase in the level and shares of: (1) non-grains including vegetables and fruits, animal proteins (meat, fish, eggs, milk), and pulses/oilseeds; animal protein demand in turn creates derived intermediate demand for feed-grains for animals; (2) processed products to cook at home; and (3) prepared foods bought away from home. Diet diversification is linked with urbanization. Consumption of non-grains is growing faster and/or further in urban areas than in rural areas in Asia.[2]

The **corollary to the rise in non-grains is that the share and in some cases the level of cereals for direct consumption is declining**. There is emerging evidence that these shifts have been occurring in Asia over the 1990s and 2000s (Pingali 2007) and the evidence of how far they have gone is presented below. Yet rice remains important in Asia. Using USDA estimates of per capita rice consumption, Figure 4 confirms the importance of rice in the diet of most Asian consumers, while showing that absolute levels of consumption have been stable or declining in most countries of the region since at least the late 1990s. This trend in consumption levels of rice suggests clearly that the *share* of rice has been declining (Timmer et al., 2010). Household survey data supports the trend of declining, yet still significant, consumption of rice (Timmer et al., 2010, and Timmer, 2013). The decline in relative (and even absolute) importance of rice is expected to continue for some time because: (1) the income elasticity of rice demand is falling over time as incomes rise in Asia, and is now significantly negative for Asia as a whole; (2) as rural-to-urban migration occurs, rice consumption shifts downward; and (3) rice demand seems to be lower among younger age groups.

[2] In India, for instance, Dev et al. (2004) show, in constant 1999/2000 rupees (per capita per month), that: (1) cereal consumption per capita in rural areas dropped from 137 rupees to 109 from 1983 to 1999, while in urban areas they dropped from 120 to 107; by contrast, (2) fruit and vegetable expenditures jumped from 18 to 38 in rural, and from 55 to 74 in urban areas; (3) dairy jumped from 31 to 43 in rural, and 55 to 74 in urban areas; (4) meats, eggs, and fish actually stayed steady during that period, at about 17 in rural areas and 28 in urban areas; and (5) overall food expenditure nudged up in rural areas from 278 to 289, and in urban areas, from 357 to 410 (although the share of food in total expenditure declined, per "Engel's Law").

Figure 4. Rice consumption per capita in major Asian countries, 1990-2012, using USDA data (Production, Supply, and Distribution (PSD) database of USDA



Source: Reardon and Timmer, 2014 based on USDA data

3.2. The most up-to-date view: LSMS data on the Diet "Commercialization" in Asia

We use the most recent national household level LSMS data[3] to analyze food budget shares of Nepal and Bangladesh from South Asia and Vietnam and Indonesia from Southeast Asia. We highlight differences across countries, across rural-urban residence, and across income strata.

The findings are summarized in Table 1 below, which shows data aggregated by commercialization, degree of processing, and product broad category[4]. The Annex repeats Table 1 but with specific item detail for the latter. Table 1 shows for each country four rows that depict the share of own-produced food in total food consumption (home consumption); this is also counted as unprocessed food. Then there are three rows showing only purchased foods; these are discussed in the next section.

Table 1 is shown next and the results are surprising.

[3] Years are 2010/11 for Nepal, 2010 Bangladesh, 2008 for Vietnam, and 2007 for Indonesia.

[4] See the method annex (separate cover) for further description of how items were mapped into the food group aggregation, along with a full mapping of all food items from the LSMS surveys into these categories. Note also that our model distinguishes among 26 food groups, including wheat alone, but that we aggregated into nine categories for ease of presentation. We nevertheless will sometimes make reference to individual food items that do not appear individually in the tables.

Table 1. Shares in Total Food Expenditure (in value terms) by Rural/Urban and Terciles by Country

Bangladesh 2010								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	14.1%	20.3%	21.0%	4.9%	4.0%	3.2%	19.4%	3.7%
1.b. Unprocessed	21.5%	21.7%	21.8%	24.7%	25.9%	26.9%	21.7%	26.2%
1.c. Processed Low	54.2%	45.6%	41.9%	56.2%	53.2%	50.5%	45.5%	52.4%
1.d. Processed High	10.2%	12.4%	15.4%	14.3%	16.9%	19.4%	13.4%	17.7%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	53.6%	45.3%	36.0%	43.6%	32.4%	23.6%	42.4%	30.0%
3. Vegetables/fruit	13.8%	14.5%	14.5%	14.5%	14.9%	16.4%	14.4%	15.6%
4. Legumes	2.2%	2.4%	2.6%	3.1%	3.5%	3.0%	2.5%	3.1%
5. Animal Proteins	16.3%	22.4%	30.1%	22.2%	31.6%	39.5%	25.0%	33.9%
6. Oils & Animal Fats	4.7%	4.6%	4.4%	5.2%	5.1%	4.3%	4.5%	4.7%
7. Sugar & Spices	7.0%	7.8%	8.3%	7.2%	7.7%	8.3%	7.9%	7.9%
8. Beverages	1.3%	1.9%	2.6%	2.3%	2.8%	3.1%	2.1%	2.8%
9. Food Away From Home	1.0%	1.2%	1.5%	1.9%	2.0%	1.8%	1.3%	1.9%
10. Other Foods	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Indonesia 2010								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	23.8%	19.0%	18.3%	12.8%	11.3%	11.2%	19.7%	11.5%
1.b. Unprocessed	15.1%	17.1%	17.1%	17.0%	17.6%	15.6%	16.7%	16.4%
1.c. Processed Low	42.5%	42.4%	39.1%	45.6%	41.5%	33.9%	40.9%	38.1%
1.d. Processed High	18.5%	21.5%	25.4%	24.6%	29.6%	39.3%	22.7%	34.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	40.1%	36.6%	29.8%	34.8%	29.1%	22.1%	34.2%	26.3%
3. Vegetables/fruit	17.3%	17.3%	16.9%	16.0%	15.7%	13.8%	17.1%	14.7%
4. Legumes	5.9%	5.5%	4.9%	6.2%	5.4%	3.6%	5.3%	4.6%
5. Animal Proteins	14.7%	18.6%	23.2%	15.9%	21.3%	24.4%	19.9%	22.0%
6. Oils & Animal Fats	6.1%	5.8%	5.5%	5.2%	5.1%	4.2%	5.7%	4.6%
7. Sugar & Spices	6.7%	6.2%	5.7%	6.1%	5.2%	4.3%	6.1%	4.8%
8. Beverages	3.4%	3.3%	3.7%	3.7%	4.3%	5.3%	3.5%	4.8%
9. Food Away From Home	1.2%	2.0%	3.7%	2.8%	4.3%	9.2%	2.7%	6.7%
10. Other Foods	4.5%	4.7%	6.7%	9.3%	9.6%	13.1%	5.6%	11.5%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Nepal 2010								
	Rural T1	Rural T2	Rural T3	Urban T1	Urban T2	Urban T3	Rural	Urban
1.a. Own Production	45.0%	44.8%	38.7%	21.7%	15.6%	10.1%	42.0%	14.5%
1.b. Unprocessed	10.1%	11.4%	13.4%	18.5%	20.5%	20.9%	12.0%	20.2%
1.c. Processed Low	33.4%	29.0%	26.8%	38.5%	28.3%	23.7%	29.0%	28.6%
1.d. Processed High	11.5%	14.8%	21.1%	21.3%	35.6%	45.4%	17.0%	36.7%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	46.6%	38.8%	29.9%	38.4%	26.9%	23.0%	36.4%	27.8%
3. Vegetables/fruit	12.0%	13.7%	14.7%	13.8%	15.3%	14.9%	13.8%	14.8%
4. Legumes	4.2%	4.5%	4.7%	6.3%	5.7%	4.9%	4.5%	5.5%
5. Animal Proteins	15.7%	19.8%	24.3%	18.9%	24.6%	26.3%	21.0%	24.1%
6. Oils & Animal Fats	6.9%	7.0%	7.6%	6.8%	7.5%	7.1%	7.3%	7.2%
7. Sugar & Spices	7.4%	7.6%	7.7%	7.8%	7.9%	7.5%	7.6%	7.7%
8. Beverages	5.2%	5.1%	5.4%	4.2%	4.6%	5.3%	5.3%	4.8%
9. Food Away From Home	1.7%	2.8%	4.7%	3.3%	5.8%	8.3%	3.4%	6.3%
10. Other Foods	0.4%	0.6%	0.9%	0.6%	1.7%	2.8%	0.7%	1.9%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Vietnam 2010								
	Rural T1	Rural T2	Rural T3	Urban T1	Urban T2	Urban T3	Rural	Urban
1.a. Own Production	45.1%	29.1%	20.7%	9.6%	2.9%	1.7%	28.5%	3.5%
1.b. Unprocessed	5.0%	6.8%	7.8%	9.4%	10.5%	10.7%	6.9%	10.4%
1.c. Processed Low	39.2%	47.4%	50.3%	59.4%	55.1%	51.0%	47.1%	53.7%
1.d. Processed High	10.7%	16.7%	21.1%	21.6%	31.5%	36.7%	17.6%	32.4%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	48.0%	35.4%	28.5%	31.4%	20.3%	14.9%	34.8%	19.5%
3. Vegetables/fruit	8.2%	8.2%	8.7%	8.8%	9.4%	9.8%	8.5%	9.5%
4. Legumes	1.8%	1.8%	1.6%	1.5%	1.2%	1.0%	1.7%	1.1%
5. Animal Proteins	26.9%	33.9%	37.4%	34.9%	37.6%	41.3%	34.1%	39.0%
6. Oils & Animal Fats	3.0%	2.8%	2.4%	2.4%	1.9%	1.6%	2.7%	1.8%
7. Sugar & Spices	4.0%	4.0%	4.0%	3.7%	3.3%	3.0%	4.0%	3.2%
8. Beverages	2.7%	3.3%	4.1%	2.8%	3.3%	3.7%	3.5%	3.4%
9. Food Away From Home	4.3%	9.0%	11.6%	13.0%	21.4%	22.9%	9.2%	20.7%
10. Other Foods	1.1%	1.5%	1.7%	1.5%	1.7%	1.9%	1.5%	1.8%
Total	100%	100%	100%	100%	100%	100%	100%	100%

While conventional wisdom has it that farm households feed themselves mainly from their own production, our data show that the reality is the opposite: the share of own-production in total food consumption is low, hence the commercialization of food consumption is high: for Bangladesh, 19%[5], Indonesia, 20%, Nepal 42%, and Vietnam, 28%. Seen the other way around, these data show the extreme reliance by rural households on the food market, expressed as shares of purchased food in total: Bangladesh and Indonesia, about 80%, Vietnam, 72%, and Nepal, 58%. One can say that Nepal is the poorest and least market-developed of the study countries and yet even there, nearly two-thirds of rural households' food is from the market!

While we do not show this with farm size classes (that might be a more clear relation, presumably positive), there is no consistent pattern in terms of reliance on own production for food comparing top and lowest terciles of total expenditure – as it goes from 1.5 in Bangladesh to about 1 in Indonesia and Nepal and then 0.5 in Vietnam.

This shows how far the commercialization process has gone in rural food consumption and production. This can be for several reasons: (1) rural nonfarm income is important to Asian rural households, roughly about 40% of income (Haggblade et al., 2007); it is used to buy food among other things; (2) marketed surplus rates in many farm areas in Asia are very high; of course for fruits and vegetables they are high, with marketed surplus rates for potatoes in Bangladesh, China, and India at more than 90% (see Reardon et al., 2012a); but even for the quintessential "food security" product like rice the commercialization rate is high, even in poor areas.

Reardon et al. (2014) show that shares of marketed output in total output for paddy averaged 68% (but only 57% for marginal farmers) in Bangladesh, 95% (similar over all farm strata) in Heilongjiang/China, 88% for the sample (but only 73% for marginal farmers) in Jiangxi/China, 92% on average (but only 77% for the marginal) in Western Uttar Pradesh/India, 92% on average and interestingly similar over all strata in the poor Eastern Uttar Pradesh/India, and approximately 97% in the Mekong River Delta/Vietnam but only 37% in Red River Delta/Vietnam; (3) Horticulture and fish production is important for many Asian households and is typically sold for cash to buy food and nonfood items.

3.3. Transformation through Processed Food in the Asian Diet

Table 1 shows for each country four initial rows; recall that the first of them shows the share of own-produced food in total food consumption (home consumption); this is also counted as unprocessed food. Then there are three rows showing only purchased foods; with the first of those three rows being unprocessed (hence the total share of unprocessed is the sum of that row and the home-production row being the sum of the unprocessed foods. Then the second of the three shows low-processed food purchases (like flour), and the last row shows highly processed food purchases (like noodles). To our knowledge, no analysis of LSMS data has shown the food data in this way. The rest of the table is broken down by product category.

[5] We triangulated this finding for Bangladesh with a parallel analysis kindly done to supply this information by Ricardo Hernandez of IFPRI of a broad and newer data set from Bangladesh, the BIHS data set collected by IFPRI in 2013.

The degree of processing is defined by the following criteria. First, regarding number of ingredients, "low processed" is just with one ingredient (like husked and polished rice); high processed is with multiple ingredients (like cookies with several ingredients). Second, regarding degree of processing, low processed is with just alteration of the form (e.g., paddy milled into rice); high processed is with additional processing steps added (cooking, extruding, freezing, adding chemicals or flavors, and so on, like potato chips). Third, with respect to packaging, low processed is merely with paper or simple plastic bag or wrap, while high processed is with more complex packaging like bottle or can. Any item with two or three of the above variables meeting the high processed category is then categorized as high processed; with one or zero of the variable meeting high processed category is put into the low processed category.

Several fascinating points emerge from Table 1 on processed food share.

First, contrary to the view that the diets of rural households have little processed food, we find the share of processed food high:

(a) in rural **Bangladesh** the total share is **59%** (with low processed 78% of total processed and high processed 22% of the total);
(b) in **rural Indonesia** the processed share of total food expenditure is **64%** (with low processed 64% and high processed 36% of total processed);
(c) in rural Nepal the processed share is **46%** (with low processed 63% and high processed 37% in total processed);
(d) in rural Vietnam the processed share is **65%** (with low processed 71% and high processed 29% of the total).
e) **the simple averages over the above four countries for rural areas are overall 59%, with low processed 69% of the total processed and 31% high processed). The overall processing share rises with development level (with Nepal excluded, the processed share is 63%);**
f) i**nterestingly, the high processed share is not correlated with country development level, nor even regional cuisine.**

Second, even more striking is the share of processed foods in urban total food expenditure:

(a) in urban **Bangladesh** the total share is **70%** (with low processed 74% of total processed and high processed 26% of the total);
(b) in **urban Indonesia** the processed share of total food expenditure is **72%** (with low processed 53% and high processed 47% of total processed);
(c) in **urban Nepal** the processed share is **64%** (with low processed 42% and high processed 58% in total processed);
(d) in **urban Vietnam** the processed share is **87%** (with low processed 61% and high processed 39% of the total).
e) **the simple averages over the above four countries for urban areas are overall 73% (versus rural having 59%), with low processed 58% (versus rural having 69%) of the total processed and 42% (and rural having 31%) high processed).** The overall processing share still (as in urban) rises with development level at about the same incline as before (around 1.4 ratio between highest and lowest processed share over countries).

While Vietnam is moving somewhat ahead of the middle of the pack, the whole set of four countries is following a similar path where urban areas have higher processing shares overall and higher high-processed shares within that than in rural.
f) There is little correlation between high processed share and development levels, with Vietnam cities have a lower-than-average share and Nepal cities having a higher-than-average share of processed in high-processed.

It is interesting to compare the findings for these countries with data on India from Morisset and Kumar (2008). Except in the overall processed food share, their results are not strictly comparable to ours as they use a different categorization, but still the **comparison shows that our results for the above four countries are roughly similar to those for India**. They divided the food consumption basket into different levels of processed food and showed the following patterns for 2004/05:

(a) Primary products are those consumed without processing include fruits and vegetables, eggs, and fluid milk at the farm. Non-processed products form only 16.8 percent of food consumption in urban areas and 15.3 in rural areas. **Thus, roughly 83–85 percent of Indian food products are consumed processed.**
(b) "First-processing products with low value added" are defined by them as products that undergo minimal processing, such as de-husking, milling, drying, and grinding. Value addition is estimated at 0–5 percent. These products form 34.8 percent of food expenditure in urban and 43.9 percent in rural areas.
(c) "First-processing products with high value added" undergo more complicated processing and have a larger value added—between 5 and 15 percent. There is no adding of ingredients, and products are not mixed. Examples are dairy products, such as butter and curd, as well as meat, fish, and sugar. These products form 38.2 percent of food expenditure in urban areas and 35.1 percent in rural areas.
(d) "Second-processing products" are those that have as an input a first-processed product and to which another product (a flavor, a preservative, or another ingredient) is added. Examples include biscuits, bread, ghee, ice cream, and jam. These form 10.2 percent of urban food expenditure and 5.7 percent of rural.

The key points of the above are then: (1) processed food is already important in rural areas, nearly 60% of total food expenditure, and high processed foods are even already 30% of that "pie"; this is a far cry from conventional wisdom, and is fairly robust over countries; (2) processed food is even more important in urban areas (at 73%), as is the share of high processed foods (at 42%). Food processing is thus not an "emerging" food trend but is already very well established.

Table 1 also shows **further transformation via further processing - with the rise of Food Away from Home (FAFH).** In the 1960s, about 5% of food in the US was consumed "away from home" (primarily in restaurants and market stands and kiosks and pushcarts), versus around a quarter in the mid-1990s and 50% today. Table 1 shows that the share of FAFH in total food expenditure is still modest in all but Vietnam; In Bangladesh urban and rural areas it was 1.9% and 1.3%; in Indonesia 6.7% and 2.7%; in Nepal it is 6.3% and 3.4%, with these first three like the US in the 1950s and 1960s, and in Vietnam, 21% and 9%, like the US in the 1980s.

In all of the countries, FAFH expenditure is sharply correlated with income, so it is still somewhat of a luxury (even if in some places like Vietnam urban workers are relying on noodles stands): the ratio of upper tercile to lower tercile expenditures on FAFH is 1:1 and 1.5:1 in urban and rural Bangladesh; 3.3 in urban and 3.1 in rural in Indonesia; around 2.3:1 for both urban and rural in Nepal; and 2:1 in urban 3.3 in rural Vietnam.

3.4. Transformation through Product Diversification

First, the data on the **share of cereals in total food expenditure shows diversification away from grains has progressed far** in:

- **urban areas**, in a simple average over the four countries, the cereal share in total expenditure in value terms, including purchases and home-production/consumption, is only **26%;** note that the distribution is fairly tight: 30% in Bangladesh, 28 in Nepal, 26 in Indonesia, 20 in Vietnam[6]**;**
- **rural areas, 37%;** the distribution is even tighter in rural areas over countries (42% in Bangladesh, 36 in Nepal, 34 in Indonesia 35 in Vietnam)

Turned around, this means the share of non-grain foods in total expenditure averages 74% and 64% in urban and rural areas of these four countries. Non-grain food's extreme majority in food expenditure is in strong contradiction with the near exclusive focus on cereal in general and rice in particular in the food security debate in Asia.

Note how closely the food expenditure composition trend of Bangladesh, Nepal, Indonesia, and Vietnam **matches the experience of India**, noted in Reardon and Minten (2012):

> "The **share of cereal consumption in the urban food basket has declined from 36 percent in 1972 to 23 percent in 2006**. In the same period, the **share of cereals in rural areas declined from 56 to 32 percent** (Indiastat). Just weighting by urban and rural population (thus abstracting from income differences), we find that roughly 29 percent of India's food economy was in cereals in 2006, versus roughly 52 percent in 1972. Yet the food security debate tends to focus narrowly on grain. Nongrain food (dairy, pulses, fruits, vegetables, meat, and fish) are 71 percent of India's food consumption and are important sources of calories, protein, and vitamins. These foods share center stage with grains for food security. (Reardon and Minten, 2012)

Second, as **Bennett's Law** (enshrined subsequently from Bennett 1954) predicts, the share of cereals in total expenditure for the upper income (proxied by total expenditure) stratum is far lower than that for the lowest stratum.

[6] The share of cereal in urban Vietnam might be somewhat underestimated as FAFH is not disaggregated by product in the survey, and it is a high share, 20%, of total expenditure. While the latter is much lower (9%) in rural areas, that might also mean that the cereal share for Vietnam is a little underestimated for rural areas too.

- Averaging over countries in **urban areas**, the share of cereals in total expenditure for the **richest tercile is 21%, and for the poorest tercile, 36**%
- And for **rural areas, for the richest tercile, 33%, and for the poorest, 47%**.

It is striking, however, that even for the poorest tercile in urban and rural, non-grain expenditures are still the majority of expenditure. Thus, getting non-grain products productivity and access is important to the poor in basic food security terms.

Third, Table 1 (annex) shows that rice's share of total cereal in the four countries dominates

- In **urban areas, rice has 79% of cereal expenditure** (but with **strong variation over these "rice" countries** from 61/74% in Indonesia/Nepal and 84/96 in Bangladesh/Vietnam);
- In **rural areas, rice has 82%, surprisingly close to the urban rice share (again, there is large variation over the "rice countries**," with 69/70% in Indonesia and Nepal, and 91/98 in Bangladesh/Vietnam)

Only Bangladesh and Vietnam have stayed mainly "rice as the cereal" countries, while in other hitherto "rice focused" countries like Indonesia especially, the share of rice in cereals dropped to only 60-70%. Much of the rest is in **wheat, whose rise in consumption in Southeast Asia** in the past several decades has been spectacular, linked to convenience, and imported (Timmer 2013 for Southeast Asia and Senauer et al. 1986). In India and China, of course the adoption of wheat (from its cradle in Western Asia (the fertile crescent in what are today Syria/Iraq).

But Table 1 shows that **the penetration of wheat products is much higher among the richer stratum compared with the poorer** – so that wheat's share in total cereals is for example 22% for the upper stratum in urban Indonesia but 9% for the poor stratum; in Indonesian rural areas, it is 22% to 6; in Bangladesh, it is 17% to 7 and 9 to 5 in urban and poor areas comparing richer to poorer terciles. It is thus more of a luxury than rice; this could be linked to the richer stratum having more regular employment away from home and thus a great opportunity cost of time and inducement to eat noodles and bread.

Fourth, overall, animal proteins (meat, fish, eggs, milk) expenditures (in value terms) rival cereals in urban areas and second to cereals in rural areas. The shares are stunning. Animal proteins are 30% of urban and 25% of rural total household food expenditure! (Compare that with 26% urban and 37% rural for the share of cereals.) The patterns are interestingly similar across the countries, with somewhat higher figures than the average for urban Bangladesh (34% and urban and rural Vietnam (38% and 34) but the rest are near or only a little below the average.

It is fascinating that the "Bennett's Law effect" is not nearly as large as we expected: dividing the share of animal proteins in expenditure for the highest tercile by the lowest tercile, we find that the average is only about 1.5 over the countries and rural and urban! The outliers are 1.8 in Bangladesh and 1.1 in urban Vietnam. **So the old image in Asia of the poorest tercile forced to a diet nearly without animal protein is now reversed.**

Moreover, the data show just how **important fish is in the food budget**: it is the leader in the animal protein category in Bangladesh (half of the animal protein budget), Indonesia (a quarter to a third of the animal protein budget), and Vietnam (second only to pork at about a third). Except in Nepal, **fish is a third to a half as important as rice expenditure** in rural and urban areas.

Further, **dairy was important (but traditional) for Nepal** (with a tenth of all food expenditure on it); fascinating is that dairy is **becoming significant but new and non-traditional for Indonesia**, with 3 and 6% for rural and urban areas overall food expenditure. **This shows the malleability of food habits, as did the penetration of wheat.**

While **poultry and eggs are expected, per conventional wisdom, to be the lead animal protein, it is in general bested by fish in all the countries and by pork and fish in Vietnam. Their share is amazingly similar across countries and both rural and urban areas, at a mere 6% of total food expenditure**.

Fifth, horticultural products (vegetables and fruit) are important in total food expenditure in all the countries and areas, with similar shares: surprisingly, Bangladesh, Indonesia, and Nepal all have (in both rural and urban areas) about 15% (with tiny variations around that) of vegetables/fruits in total food expenditure. Vietnam has but 9-10%, but this outlier may well, again, be explained by its LSMS not having disaggregated FAFH where doubtless there are some expenditures on fruits and vegetables.

As surprising is the fact that there is little inter-tercile differentiation in these shares: this is an important finding – the richer and poorer have a similar propensity to spend on horticultural products.

It is thus of interest to "unpack" the overall category and see if there is differentiation in composition by sub-category. The most obvious candidate is fruit, as that is usually considered a "luxury."

On the one hand, our data do show that **the share of fruit in the combined vegetables/fruit category is about 1.3:1.0 between urban and rural areas**. It is amazing (in terms of inter-country consistency of composition) that the share of fruit in that category is roughly the same (about a third) in urban areas in Bangladesh, Indonesia, and Nepal, and about a quarter in rural areas of those three countries. The outlier is again Vietnam, higher than the other countries, with 42% and 34%; but again this may be because the fruit share is pushed up by some of vegetable consumption being "hidden" in the FAFH category; likely Vietnam's is like Indonesia's and we are observing an interestingly regular relationship over the countries in this behavior.

On the other hand, our data show that in general, as one would expect with the "luxury" hypothesis, that the **share of fruit is higher for the richest tercile compared with the poorest**. Interestingly, that ratio does not differ much between rural and urban areas per country, but differs over countries, with the greatest inequality in Bangladesh (around 2.5 to 1), then clustered around 1.6 to 1 in the other countries.

The counterpart to the above is that the share of vegetables in the category is higher in rural areas and among the poorer strata, as expected. We singled out potatoes in the annex version (except for Indonesia where they were included in the questionnaire with other tubers) of the table given that potatoes (in their great majority fresh/table, not processed, contrary to conventional wisdom about the form potato is being consumed in Asia) are in the top few individual vegetables in production and consumption in all the countries except Vietnam. **In the South Asian cases, potatoes are about 15-20% of the fruit/vegetable category.** While they are of equal importance to the different terciles in rural areas of those countries, they are **twice as important for poor in urban areas in both Bangladesh and Nepal.**

Sixth, in the world over **pulses/beans are considered the "poor man's meat." The survey data show that for the study countries in urban and rural Asia this food source (pulses, beans, nuts, tofu) is now minor, 3-5%, in terms of share of total food expenditure**: it is but 3% in Bangladesh, 5% in Indonesia and Nepal, and only 1.7% in rural Vietnam and 1.1% in urban Vietnam[7].

3.5. Projecting Future Demand Scenarios

In this section we present a scenario-based projection analysis of food expenditures through 2040. Appendix A provides a summary of the methods used in the projection model. We imagine alternative futures by designing four different scenarios based on three variables: the rate of growth in real per capita expenditure (a proxy for income), the distribution of that growth across households in terciles of the expenditure distribution (inequality of growth), and its distribution across rural and urban areas (urban bias). The four scenarios and the settings of each of these variables are shown in Table 2.

The scenario "Business as Usual" (BaU) is based on patterns observed in Nepal, Bangladesh, Vietnam, and Indonesia (the four countries for which we have LSMS data and which form the empirical basis of our model) in their most recent surveys in the late 2000s (that is, the data presented in the subsections above in this section). During the decade of the 2000s, real per capita GNI in purchasing power parity grew an average of 4% per year in those countries. We define inequality-increasing growth as growth in which the upper tercile of the income distribution enjoys more of the annual percentage growth than the bottom tercile; the opposite occurs in inequality-decreasing growth. The empirical pattern of growth inequality was determined as neutral in BaU by analyzing the evolution of income distribution in our four countries over the past 15 years using Povcal[8] data.

We define positive urban bias as growth in which urban households enjoy greater annual percentage income growth than rural households, with negative urban bias being the opposite.

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[7] Again, the Vietnam figure might be an underestimate because the LSMS included data on FAFH but did not say what it is; it probably contains some tofu in various forms; our guess is that the Vietnam pulses/beans/tofu figure is probably more like Indonesia's but cannot test this.
[8] PovcalNet is an online data source of the World Bank that provides national income shares for 20-tiles of population (20 groups of equal size, 5% each of the population) using LSMS data for every country during every year in which such a survey was conducted.

We also set urban bias as neutral in BaU based on historical data from the Povcal data base.[9]

Table 2. Simulation Scenarios

Scenario	Mean Per Capita Income Growth	Inequality of Growth	Level of Urban Bias
Business as Usual (BaU)	4%	Neutral	Neutral
BaU with unfavorable environment	2%	Neutral	Neutral
Equitable Growth	5%	Decreasing	Negative
Equitable Growth unfavorable environment	3%	Decreasing	Negative

BaU with unfavorable environment assumes the same pattern of growth (income inequality and urban bias neutral) but with unfavorable macro-economic and other conditions that reduce average annual growth to 2% per capita in real terms.

Equitable Growth (EG) assumes that Asian governments adopt policy and public investment approaches that drive broader distribution of income gains, both across the income distribution and across rural and urban areas. Specifically, we assume that growth becomes inequality- and urban bias decreasing, with average yearly percentage growth in the top tercile only two-thirds of that in the bottom tercile and with urban areas enjoying growth only two-thirds of that in rural areas. Finally, we assume in this scenario that average income growth is slightly higher than in BaU – 5% vs. 4% - based on research that suggests that policies and public investments that promote more equitable growth and asset distribution can also drive higher average growth.

We first present results on income levels and distribution in 2010 and 2040 under the four scenarios outlined in Table 2. We then focus on the implications of each scenario for (a) changing consumption patterns as captured by food budget shares and expenditure elasticities, and (b) changes in the total real value of food expenditures in each country, driven by changing patterns and levels at the household level, recognizing rising populations, and the urbanization of those populations.

Highlights of the impact of the four scenarios on income levels are as follows (Table 3). (1) BaU maintains (by design) relative income disparities between urban and rural regions, with a typical rural resident earning approximately half the income of the typical urban resident; rural/urban disparities are highest in Nepal and lowest in Bangladesh. (2) Under the two EG scenarios, the rural:urban income ratio rises dramatically, to a range of 61% (EG with shock in Nepal) to 91% (EG in Bangladesh). (3) BaU also maintains current disparities across the income distribution, in which the bottom tercile earns only 25% to 30% as much as the highest tercile, while under EG these ratios rise to a range of 32% (EG with shock in Vietnam) to 45% (EG in Bangladesh).

[9] Due to data limitations, however, we based this calculation on data from China, India and Indonesia. PovcalNet provides rural/urban breakdowns only for these countries; in general, time series with rural/urban income breakdowns remain quite difficult to find in published data.

Table 3. Income levels (real USD) for 2010 and 2040

	Nepal	2040				**Banglades h**	2040			
	2010	BaU	BaU w/ shock	EG	EG w/ shock	2010	BaU	BaU w/ shock	EG	EG w/ shock
National										
tercile 1	$1.08	$3.49	$1.95	$6.12	$3.10	$0.86	$2.78	$1.56	$4.87	$2.47
tercile 2	$1.82	$5.92	$3.30	$8.47	$4.64	$1.37	$4.44	$2.48	$6.33	$3.47
tercile 3	$3.82	$12.38	$6.91	$14.44	$8.57	$2.87	$9.32	$5.20	$10.83	$6.43
Ratios										
Rural/Urban	0.47	0.47	0.47	0.71	0.61	0.60	0.60	0.60	0.91	0.77
T1/T3	0.28	0.28	0.28	0.42	0.36	0.30	0.30	0.30	0.45	0.38
	Vietnam	2040				**Indonesia**	2040			
	2010	BaU	BaU w/ shock	EG	EG w/ shock	2010	BaU	BaU w/ shock	EG	EG w/ shock
National										
tercile 1	$1.37	$4.44	$2.48	$7.84	$3.96	$1.22	$3.96	$2.21	$7.00	$3.53
tercile 2	$2.44	$7.90	$4.41	$11.39	$6.22	$2.15	$6.97	$3.89	$10.05	$5.49
tercile 3	$5.44	$17.65	$9.86	$20.74	$12.27	$4.80	$15.56	$8.69	$18.27	$10.81
Ratios										
Rural/Urban	0.53	0.53	0.53	0.80	0.68	0.56	0.56	0.56	0.85	0.72
T1/T3	0.25	0.25	0.25	0.38	0.32	0.25	0.25	0.25	0.38	0.33

Note:(1) Business as Usual (BaU); (2) BaU w/ Unfavorable Environment; (3) Equitable Growth;
(4) Equitable Growth w/ Unfavorable Environment.

Table 4 (too long for the text so it is presented in Annex B at the end of the document) presents food budget share results by 2040 based on the different scenarios. The same structure of table is used as in Table 1 (showing processing level composition, and product category composition of total food expenditure by rural versus urban and by country. The following are the salient points. There are a lot of details in Table 4 and when one compares it all with Table 1 there are many interesting points; but we hone down to four key "emblematic" findings.

First, and not shown in Table 4, we found that the **share of all food in total expenditure falls as incomes rise, in accord with Engel's Law**. The budget share devoted to foods varied across nations and significantly across scenarios. EG (with the highest income growth) showed the greatest drop in the budget devoted to food, highlighted by Vietnam's total food budget share falling from 39% to 23%. The scenario with the least change was BaU with unfavorable environment (which had the lowest growth), highlighted by Bangladesh where the total food budget share declined only from 53% to 45%.

Second, Table 4 shows the **projected (continued) drop in the share of own-produced food in rural total food expenditure over the next 3 decades, implying continued commercialization of the diet**. It is not abrupt but gradual; in the Business as Usual scenario, most drop about 5%; note that this cuts somewhat deep in the cases of Bangladesh, Indonesia,

and Vietnam where the share is already in 2010 in the 19, 20, and 29% range; for Nepal it means a drop from 42 to 37%. The growth scenario just accentuates a bit this trend, with for example Nepal dropping to 34%.

Third, Table 4 shows the **projected (continued) rise in the share of processed food in both rural and urban total food expenditure in the next 3 decades**, **implying continued processing transformation of the diet.** It is again fairly gradual, averaging again about 5% increase, which brings the simple average, under the growth scenario, so that the share of processed in rural areas averages 63% and in urban, 74%. The gains are somewhat more for high processed compared with low processed foods, as one would expect. With the low growth scenario this shift is slowed down to half the rate.

Fourth, Table 4 shows the **projected (continued) rise in the share of animal proteins and fruits and vegetables, somewhat faster even than the above two trends**. Take the case of animal proteins. Keeping in mind that the stagnation scenarios bring slower change, we focus on the economic growth scenario. **The share of animal products in rural areas in the four countries jumps from a simple average of 25% to 37%, and in urban areas, from 30% in 2010 to 35% in 2040** – in short, urban and rural diets converge in this regard (something that is a "normal idea" to a Western European or American of today as that is what they saw occur in this past century).

Fifth, in general, the poorest strata of today, over these projected decades, shift into the behavior of the richer strata of today, and the latter shift more and more into what Pingali (2007) called the "Westernized" diets of higher processed, more diverse, more meat and horticulture product consuming diets. Note that apart from the ingress of wheat, very little of this shift is based on imports.

Sixth, not shown in the Table 4 so as not to overwhelm with detail, we found that the fall of the share of rice in the diet and the share in cereals continues in the projected three decades under the (likely) growth scenario – by nearly half in Bangladesh and Vietnam and by 20% to 25% in Nepal and Indonesia. Even under BaU with macroeconomic shocks (the lowest and least equitable growth scenario) rice budget shares fall sharply in every country.

4. Third Transformation: Food System Transformation in Asia[10]

The food system transformation is taking place along several lines in Asia. Most important is the transformation of the "post farm-gate" segments of the supply chain: wholesale / brokerage / logistics / cold chain, processing, and retail. About 50-70% of the total costs of food (depending on the product and the situation) to the urban consumer are incurred in these segments. The transformation of the post farm-gate segments is intimately connected with urbanization, because the majority of food supply chains in Asia already are from rural to urban, and many of the post farm-gate activities are in towns, secondary and primary cities.

Here we briefly review key evidence on the food system transformation in Asia, drawing from

[10] We draw from Reardon and Timmer (2007, 2014).

Reardon and Timmer (2012) and Reardon et al. (2012b); most of the evidence comes from the 2000s as the food system transformation has been relatively recent.

There has been a **dual revolution in food, comprising**:

> a) **A "Modern Revolution**" - large scale, largely retail and second-stage processing sector focused transformation, with an important component of Foreign Direct Investment (FDI) (Reardon and Timmer 2007);
>
> b) **A "Quiet Revolution**" – mainly small and medium scale, largely first-stage processing and wholesale as well as upstream agricultural services –mostly based on domestic capital (Reardon et al. 2012a).

Reardon and Timmer (2007) emphasize that there have been two **"broad phases" of agrifood industry transformation over the past 50 years (in both Asia and Africa): "pre-liberalization/pre-globalization" (mainly 1960s- mid 1980s) and "liberalization/ globalization**" (mainly mid- 1980s to now). Contained within those two stages are the successive transformations of the three segments of the agrifood industry. The timing of the transformation of each segment is approximate, as it differs by region and country: (1) transformation of wholesaling, in two waves, with a public-sector driven stage mainly in the 1960s-1990s, and a private-sector driven stage mainly in the 2000s; (2) transformation of processing, with a public sector phase mainly up through the 1970s, and then a private sector stage mainly in the 1980s to now; (3) and then the transformation of retailing, with a small public sector stage in the 1960s-1980s (or lasting longer in some cases such as India), then a private sector stage mainly in the 1990s-2000s.

Overlaying the above two broad phases are a series of waves of transformation of food systems. The first wave tended to be the Asian developing countries that started their post-WWII growth spurt earlier, urbanized and started industrializing somewhat earlier – in particular, East Asia outside China. The start of wholesale sector transformation (with major public investment in wholesale markets) started in the 1960s-1980s, processing transformation occurred with FDI liberalization and the start of privatization in the mid-1980s to early 1990s, and retail transformation "took off" from the early 1990s.

The second wave tended to be the countries that had their growth and urbanization spurts later and/or had strong internal pressure to limit FDI; these limits were often more for retail FDI than processing FDI. Hence one found that in much of Southeast Asia (outside Vietnam, Cambodia, Laos and Myanmar), wholesale sector transformation started in the 1970s, processing transformation took off in the 1980s but retail transformation did not start until the mid to late 1990s.

The third wave tended to be countries that had their growth and urbanization spurts mainly in the 1990s/2000s, and/or had lagged liberalization into the 1990s. This was the case of China, India, and Vietnam, among others. Wholesale sector transformation mainly occurred (in its wholesale market investment phase) variously over the 1970s to the 1990s; processing transformation then occurred somewhat before retail, with the latter mainly in the late 1990s and into the 2000s, with China starting well before India and Vietnam.

A fourth wave includes other South Asian and Southeast Asian countries, like Bangladesh and Cambodia, that are in the initial phases of processing and retail transformation. Moreover, diffusion of the transformation (in all three segments) tended to occur earliest in more urban and later in more rural areas, and earliest and fastest in processed, then semi- processed, then fresh products.

There has been rapid transformation of the wholesale/logistics segment. This started with rapid growth, then transformation, and then in some cases decline, of the public wholesale market sector. State wholesale markets were substantial investments by cities or provinces, and were put in place in waves mainly from the 1960s on, starting with main cities, then secondary cities, and so on. A typical pattern was a hub-and-spokes model, with a set of primary wholesale markets in big cities and then "feeder" or secondary wholesale markets in smaller cities and rural areas, such as one finds in China, Indonesia, and India.

The large investments in public wholesale markets partially transformed this segment - substantially "de-fragmenting" and integrating markets, by providing "economies of agglomeration" and channeling wholesaling activity previously carried out by field brokers into a network of covered markets with *in situ* wholesalers, and thus also altering its technology and organization. By imposing regulations, it changed its institutions, at least for the portion that passed via the regulated markets.

The massive proliferation (even into towns) of wholesale markets, the extension and improvement of rural roads, and the regulatory liberalization of their operations in most countries **opened the door to progressive "dis-intermediation" in the rural areas and in supply chains.** Two important trends are involved. First, the regulatory changes (such as in some states in India) that have liberalized the wholesale sector have also favored direct private sector relations with farmers – such as (incipient) development of contract farming by processors and collection centers by supermarket chains.

Second, the diffusion of wholesale markets in towns near or in rural areas, and the improvement of road systems leading from rural areas to urban wholesale markets, **has spurred the decline of village traders in diverse settings, progressively replaced by direct purchase from farmers by wholesale market traders** who often formerly had to procure via village trader networks (see Reardon et al. 2012a for cases of rice and potatoes in India, China, and Bangladesh).

Wholesale market traders based in towns and cities now dominate trade at this level, buying directly from farmers and "dis-intermediating" the supply chain by displacing the traditional village trader. For rice, village mills have declined rapidly in the past decade--if persisting, they are relegated to custom milling for local farmers for home consumption. Instead, small but especially medium and larger scale mills have risen to dominance and are located in the towns. By contrast, less-dynamic areas are starting to follow the above trends, but they are doing it with a long lag and much more slowly than the dynamic areas.

There has even been an incipient emergence of various "off-market" actors operating outside of wholesale market places and specializing in meeting the sourcing requirements of modern processors and supermarkets. The first of the modern wholesale actors are the

"dedicated wholesalers" (such as Bimandiri in Indonesia). These wholesalers are dedicated to either one company or a segment (such as modern retail, processing, or HORECA (hotels, restaurants, catering) or exports), tend to be specialized in a category, and handle procurement relations suppliers.

The second of the modern wholesale actors are modern logistics companies. Commonly they undertake a variety of logistics tasks – wholesaling (intermediation), warehouse management, ICT system integration into retail and distribution systems of companies, cold chain development, and packaging. FDI has been an important driver of the rise of this second type of firm; this was spurred with the liberalization of FDI in "distribution" (logistics and wholesale) as part of general liberalization in the 1990s and 2000s.

There has also been rapid transformation of the agrifood processing sector in Asia, as shown on the demand side with our new data in section 3. **The general debate about food systems fails to realize how large a share of food in developing Asia undergoes some processing.** Morisset and Kumar (2008) show for Indian urban areas that only 17% of food undergoes no processing (like fresh whole fruit); that share is 15% in rural areas. In India that means about 85% of all food undergoes some processing: grain milled, made into bread or polished rice; milk churned, fermented; and so on. Of course, a high share can be classed as "first processing" with low value added (up to 5%), with 35% of urban food, and 44% of rural food, in this category; first processing high value added (5-15%, is some 38 and 35% respectively. Second-processing food reaches only 10 and 6% of food in urban and rural areas.

Note that both of these figures – about 85% of food in India undergoing some processing, and 35% to 44% of food being classed as "first processing" with low value added – are consistent with section 3, if we consider that rice is the main component of consumed own production and that it has to be processed before being eaten.

The processed food sector has grown quickly in the past several decades, just as it is projected to grow rapidly into the future. This growth is mainly in the first-stage high value added and the second stage processed food subsectors, such as milled and second-stage processed cereals, dairy, processed meat and fish, and condiments. These trends are driven by increases in income, urbanization, women increasing their participation in labor markets outside the home and wanting to save time cooking, improvements in packaging and processing technologies, and eventually by diversification of the variety of processed foods, abetted by modern retail (Gehlhar and Regmi 2005).

The public-sector role in food processing has always been limited (more so than it seems when viewing the large role it had in public policy debate), and today is very small. Although the parastatal grain processing sector has been important in urban food security debates for decades, the government's direct role in inducing food processing transformation has been limited in most countries, even in its heyday in the 1960s/1970s. It was mainly confined to grain sold to urban markets. In that period, the urban population share and the marketed share of grain were far lower than today. The local small-scale (and thus not parastatal) share of grain processing was higher. And the parallel market (not via parastatals) was typically far larger than the government channels. There was then rapid privatization of grain parastatals in most countries in the late 1980s or 1990s.

Only a few countries' governments still had substantial food processing operations into the 2000s. For example, in Asia it is only India that maintains a substantial presence via its grain parastatal; even that only procures 20% of India's grain output (and 40% of the market, which is even higher than in the 1970s). The numbers are far lower in other Asian countries (Rashid et al., 2007), and far lower yet in most countries of other regions of the world.

Since the late 1980s (earlier than the supermarket revolution in most cases), there has been rapid growth in the private-sector food processing sector in developing Asia - combined with rapid consolidation, multi-nationalization, and technological, institutional, and organizational change. In many countries, with structural adjustment in the 1980s and 1990s, state grain mills and slaughterhouses were privatized or eliminated, and import licenses disbanded. The private sector has made significant investment in processing. This led to two competing lines of consequences.

On the one hand, there was a proliferation of small and medium scale enterprise (SME) grain mills and dairy, meat, fish, and produce processing, encouraged by market de-regulation, competing for the gap left by the demise of public sector operations and de-licensing of processing, and diversifying products for growing urban and rural markets. Such proliferation was observed for example in rice mills and potato cold stores in India, Bangladesh, and China (Reardon et al. 2012a).

On the other hand, privatization led not only to domestic private sector bids, but due to widespread liberalization of foreign direct investment (FDI) in processing, a wave of FDI, as well as domestic private and domestic state investments in large-scale plants. The FDI came first mainly from Western Europe and the US, with global firms like Nestle, Kraft, and Danone, seeking less saturated markets with higher profit rates (Gehlhar and Regmi, 2005), then Japan, and eventually from regional multinationals such as Thailand's CP (Charoen Pokphand) or Singapore's Wilmar into China and other Southeast Asian countries and India. In 2012, CP created the largest shrimp processing firm in the world in Indonesia. The consequence was that foreign firms formed a major share of the large processing sector in a number of first and second wave countries by the 2000s, while that process appears to be just starting in third wave countries like China and India in the 2000s.

There has been rapid consolidation in developing Asia food processing, again, in the sequence roughly of the three waves. Regulations affecting the segment appeared to accelerate the pressures on SMEs. Examples include re-zoning of cities to reduce congestion, application of business registration laws to increase municipal revenues, and application of food safety and hygiene regulations to food. The new generation of food safety laws emerging in developing countries, such as the ones in China and India, may further accelerate consolidation in the processing sector, since food safety practices often have large economies of scale. There is evidence that this occurred in the US with the impact of the food law of 1908 on food SMEs through the 1910s, such as with the exit of 90% of dairy SMEs in the main eastern cities (Levenstein, 1988). While the "pie" of the sector was increasing rapidly, the massive investments by domestic and foreign firms, creating or enlarging large-scale processors, has resulted in the disappearance of many small firms.

Finally, the retail segment has transformed very rapidly, especially in the past decade. As

with processing, many governments had several types of public sector *cum* cooperative retail ventures, mainly in the 1970s/1980s and even into the 1990s/2000s in the cases of India, Vietnam and China. At the end of that period, with structural adjustment or liberalization, most of these public retail firms were dismantled or privatized, although some continued into the 1990s/2000s and "morphed" into semi-private competitors with modern, fully private chains.

In the 1990's and 2000s the "take-off" of private-sector modern retail occurred – what has become known as the "supermarket revolution" (Reardon et al. 2003). In broad strokes, the diffusion of modern food retail has rolled out in three waves over Asian countries (Reardon et al. 2012b). There was a slow initial spread and then "suddenly" a takeoff. Inside a country, typically the diffusion has spread in the following two sets of paths: (1) from large cities to small cities and finally into rural towns in adapted formats, and from upper to middle to poorer classes; (2) from processed foods to semi-processed foods to fresh produce. These paths are essentially the same as occurred "historically" (in the 20th century) in developed countries; for example, it took almost 40 years for US supermarkets to start selling vegetables, as consumers had been accustomed to buying them only in wetmarkets, from hawkers, and from tiny shops.

The descriptive work on these trends has also found the gradual diffusion of modernization in retail and processing company procurement systems, mainly in semi-processed and processed foods (that form 85% of supermarkets' sales, reflecting, as noted above, the consumption basket), and recently and incipiently, in fresh produce procurement. The modernization provides a cost advantage to the large and an acceleration of consolidation inside the modern retail segment, even at early stages. This allowed the driving down of prices (such as has been observed in Delhi, see Minten et al. 2010). **The foremost impact of the transformation of retail has been on the processing sector**, as some 85% of the food sold is processed to some degree. There is emerging evidence that supermarket chains' buying direct from processors is excluding small processors.

Direct purchase of fresh produce by supermarkets from farmers is still rare in most Asian countries, except where there are larger agribusiness producers on the supply side (such as supermarket chains in Indonesia buying directly from large potato production companies). Rather, supermarket chains tend either to still buy from wholesale markets, or to buy fresh produce from specialized/dedicated wholesalers (as in the Bimandiri case in Indonesia) who in turn strive to buy from sets of preferred suppliers.

We note that each segment of the food supply chains of Asia is transforming; but also note that overall the supply chain itself is restructuring. It is at once "lengthening geographically" and "shortening intermediationally." The former implies that food markets are integrating over districts in a zone and zones in a state and states in a country; it also implies "de-seasonalization" of the market, such as Reardon et al. (2012a) show for the potato market in India, Bangladesh, and China. This lengthening represents the increase in the "merchant catchment area" of the cities as each grows in population and thus food market reach; this was demonstrated for Europe and China in the middle ages and renaissance period by Braudel (1982) and one sees it in Asia today. Intermediational shortening by contrast implies dis-intermediation ("fewer hands in the chain"): this is not just the cutting out of village traders, but retailers starting to buy direct from large processors, processors from farmers in emerging contract farming, and large retailers and large processors procuring ingredients via specialized wholesalers.

Beside the food supply chain transformation being influenced by urbanization and diet change as we discuss above, **the chain's transformation itself influences transformation both downstream (in urban food markets and diet composition) and upstream (in factor markets and in farming**). First, supply chain transformation affects urban food markets and diet transformation. On the one hand, supply chain changes of the types noted above can reduce urban food costs (via dis-intermediation and investments in large scale operations with economies of scale and larger procurement zones due to longer supply chains). Modern procurement systems can reduce food prices relative to traditional systems, such as Minten et al. (2010) show for Delhi's supermarket chains. Long supply chains, especially if they draw from a variety of regions that have little co-variation in climate risk and shocks, can also decrease instability of supply.

On the other hand, (geographically) longer supply chains feeding cities carry risk for cities. A long supply chain may decrease seasonality of the food supply, but can exposes the city's food supply to climate shocks (such as floods along the route) and energy cost shocks (that weigh more heavily on supply chains with higher transport costs to begin with). Most modeling suggests that, with ongoing climate change, extreme weather events are likely to become more common and energy prices to continue rising. These shocks can be mitigated by investments such as: (a) more energy efficient equipment, (b) greater scale economies to outweigh energy costs; (c) greater storage capacity such as larger distribution centers with greater cold storage area; d) redundancies in supply chain facilities to handle outages, such as CP's building redundant port facilities inland to handle primary port outage in Thailand.

Food safety (and bio-terrorism) vulnerability also increases with longer supply chains and more massive scale of operation, especially obviously for fresh perishable products. The rapid climb in the urban consumption of the latter, combined with change in supply chains, exacerbates that vulnerability. It is unlikely that Asian cities will opt out of supply chain investments that help drive the kind of transformation we note above, in favor of going "backward" to short local supply chains that are sharply seasonal and more expensive (and possibly more energy using) per ton/mile of food supply. Rather, what seems to be a probable continuation of supply chain transformation, combined with these frightening and costly vulnerabilities, imply large investments in cold chain, diversity of routes, scale, and so on – all of which will magnify and further hasten the structural transformation toward larger scale enterprises.

Second, supply chain transformation is closely linked (in both directions) with the development of upstream factor markets (that in turn condition farm development) in several ways: (a) supply chain finance, both traditional and nontraditional (Miller and Jones, 2010), is a direct rural credit supply (often in credit-output "tied" markets; however, with supply chain transformation there is evidence for example in India and Bangladesh of the demise of trader credit to farmers, even while it persists at other levels of the supply chain); (b) off-farm employment demand, as rural processing and distribution services are an important part of rural nonfarm employment (and thus a major source of investable cash to farmers); (c) a direct source of inputs like farm machinery, manufactured in cities (and sometimes featuring traders "backhauling" food products).

Third, supply chain transformation directly conditions farm segment transformation in

several ways: (a) most importantly, the degree of development of the supply chains conditions farm profitability in general and the potential for commercialization; this is why we find the latter highly developed in the rice value chains feeding large cities in India, Bangladesh, Vietnam, and China (Reardon et al. 2014); (b) the "depth" of the market, a function of the development of the supply chain, conditions market risk faced by farmers. Of course it is possible that supply chains also bring from the city processed foods or competitive fresh foods from other regions and form a source of competition risk for local farmers. That can induce competitive investment, just as it can induce the exit of asset-poor farmers or those with poor access to rural services markets.

5. Conclusions and implications for innovations

5.1. Conclusions

This report has made several points.

First, urbanization has progressed far and is continuing in the region. The urban food economy is already the majority of the overall food market. This means rural-urban food supply chains are central to national food security, rather than the marginal topic they were several decades ago. Urbanization is increasingly taking place in a de-concentrated way, so that the rise of rural towns and secondary cities means that urbanization's effect on rural areas is increased.

Second, diet diversification has progressed far in Asia, to the point where processed foods and non-rice foods such as animal proteins and fruit and vegetables, are the majority of the diet in expenditures in value terms. Projection analysis over several decades only reinforces this view. The trend toward food away from home in restaurants and kiosks is emerging. Among processed foods the share of highly processed foods is rising. Perishable foods are increasing in the diet, like fish in particular and certain meats (especially pork in some countries and mutton in others, and to a secondary extent, poultry in all) as well as dairy. Rice's share is already a minority and is declining over the next several decades.

Third, the agrifood supply chain from farms to urban areas is transforming rapidly, with the rapid rise of supermarkets, large-scale processors, wholesale markets but also wholesale and logistics companies, cold storage firms, and fast food chains. There is both multinationalization and concentration in these post-farmgate sectors. But there is also a "Quiet Revolution" of the emergence of 10s of thousands of small and medium enterprises (SMEs) in the supply chain, multiplying services. Food supply chains are lengthening geographically as food markets integrate, but shortening "intermediationally" as small rural brokers disappear and are pushed aside by larger wholesalers buying directly from rural areas and even modern specialized wholesalers and large processors and retailers starting to buy direct from the countryside.

5.2. Implications for Investments and Technology Innovations of particular interest to HESN

First, the rise of the importance of rural-urban supply chains, and their lengthening,

provides an opportunity to increase marketed volumes while raising quality and diversifying products from rural areas. Nearly all (about 95%) of food demand is met by domestic supplies, and some two-thirds of those domestic supplies now pass via rural-urban supply chains. This **implies the rapidly rising importance of investments and innovations in**

- **logistics**
- **dry warehousing, and**
- **cold storage capital and technologies in the supply chain.**

Second, the lengthening of the supply chain, combined with an increasing share of perishable foods in the diet, imply that supply chains in Asia will be **increasingly vulnerable to, and in need for innovations to reduce the impact of "shocks" from**

- **climate crises** (along the long supply trajectories); Krechowicz et al (2010) assess the impact of climate change on Asia's food and beverage sector and conclude that likely price increases will have major implications for company profitability and level of demand among consumers;
- **energy cost increases** (that affect cooling and transport and processing and water pumping) **demanding energy-efficient machines and lower cost grids and solar energy;**
- **water cost increases** (as perishable crops require a lot of water) **implying finding more efficient but affordable water system**s like solar pumps for simple drip systems;
- **food safety threats** (as perishable products are prone to bacteria residues from handling and totting and putrefaction and preservatives and pesticides used) **implying better first stage processing techniques and packaging and cold chain.**

Third, the lengthening of the supply chain, combined with increases in the share of perishables in the diet, and combined with the rise of private and public standards for quality and safety and the spread of supermarket chains and large processors, all imply the need for:

- **increased and better packaging of individual products for safety and shelf life and branding**
- **increased and better food technology (processing and preserving)**
- **increased packing and bagging in bulk or of sets of products, and the need for improvements in palletization, containerization, and tracking and logistics to handle the greatly increased volumes**

Fourth, the rise of processed foods and consumption of animal proteins and lipids implies an increasing threat of obesity (Popkin, 2012). This implies the need for:

- **Investments in the supply chain logistics to deliver safe and cheap <u>fresh</u> fruits and vegetables and meat and fish** to minimize the processing level;

- **Innovations in technology to deliver more nutritious versions of processed foods**, such as efforts underway to add and/or maintain nutrients in milled rice.

Fifth, there will be an increasing and massive demand for women's labor with these trends; this implies the boon of employment, but also the need for:

- **training in skills in the relevant activities listed below**
- **credit for investments in production and marketing and processing of fruits and vegetables and fish, undertaking value added products with small scale processing, local logistics, and food preparation in Food-away-from-Home restaurants and stalls**

Sixth, policies and regulations and public investments will be needed to optimize the "enabling environment for private sector investments" along the supply chains. Keep in mind that by far the lion's share of investments in these supply chains are made by SMEs all along the chain, so that the environment for their investments to continue and multiply is crucial, while keeping welcoming the policy environment for regional and extra-regional firms to invest. There are a variety of policies but a few key ones are as follows:

- The **overall macroeconomic policy environment** needs to be conducive to grass-roots investments as well as FDI;
- Increasingly, the **commercial laws and regulations** concerning contracts, IPR, brands, labeling, litigation, and so on, are critical to the growth of these investments;
- **Micro-finance and other financial sector** regulations are crucial to maximizing the credit supply to fuel these investments;
- **"Hard infrastructure" such as roads and power grids and wholesale markets** were found in our studies to be extremely important to the transformations in these chains, such as the rapid rise of cold storages for potatoes in Uttar Pradesh serving the giant Delhi market.
- **Agricultural and food technology research** and related fields such as solar power and storage engineering are critical to finding innovative solutions to the issues noted above.

Seventh, finally, while we have offered these pages to emphasize the great changes downstream and midstream in the supply chains and the rise of cities and the changes in diet, we have never forgotten the **crucial role that farmers and their suppliers, the input sectors, play in feeding these supply chains**; as we noted, they form some 30 to 50% of the costs and value of food in these economies. We will not delve into the needed innovations in and policies and investments to support the farm and input sectors as that is beyond the scope of this paper, but are treated elsewhere.

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Appendix A: Summary of methods used in the projection model

The model projects the evolution of average food budget shares and total expenditure over the dimensions discussed above: processing level and food group. All projections are broken down by rural/urban and, within each, by income tercile. Terciles are computed separately for urban and rural areas. We used rural and urban populations and projections for 2010 to 2040 from the United Nations to account for population growth and urbanization. Values for 2010 total per capita national income are acquired in real (constant 2005) terms from The World Bank's Povcal database. Applying rural:urban expenditure ratios from the national LSMS data sets to the Povcal data, we were able to estimate 2010 rural and urban real levels of expenditure by tercile level of income. Budget shares for each item grouping at each level of income by urban and rural designation were acquired from the LSMS data sets and were treated as the 2010 budget shares within the projection exercise. Midpoint ARC expenditure elasticities were derived from the LSMS data sets corresponding to all initial budget shares. Recognizing that elasticities have a non-linear relation with income, we estimated simple relationships between elasticity and the log of total expenditure (a proxy for income) across all four countries; we did this separately for urban and rural level for each item grouping. We then applied this estimated relationship to current and projected incomes to allow the elasticity measurements to adjust appropriately with income growth. Combining initial budget shares, income projections, population projections and calculated elasticities we were able to project food budget shares of our aggregated food items to 2040.

See Tschirley et al (2013) for more detail on methods used in the model applied to East and Southern Africa, which were then adapted for the Asia projections.

Annex B

Table 1 with Detail:

Table 1. Shares in Total Food Expenditure (in value terms) by Rural/Urban and Terciles by Country

Bangladesh 2010								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
2. Cereals	**53.6%**	**45.3%**	**36.0%**	**43.6%**	**32.4%**	**23.6%**	**42.4%**	**30.0%**
Rice	50.3%	41.8%	31.8%	39.7%	28.1%	18.0%	38.6%	25.1%
Maize	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wheat	2.9%	2.7%	3.1%	3.2%	3.1%	4.0%	2.9%	3.6%
Other Cereals	0.5%	0.7%	1.1%	0.7%	1.1%	1.6%	0.9%	1.3%
3. Vegetables/fruit	**13.8%**	**14.5%**	**14.5%**	**14.5%**	**14.9%**	**16.4%**	**14.4%**	**15.6%**
Vegetables	8.6%	8.4%	7.5%	8.8%	8.5%	7.4%	8.0%	8.0%
Fruit	2.1%	3.4%	4.7%	2.7%	4.3%	7.4%	3.8%	5.6%
Potatoes	3.1%	2.7%	2.3%	3.0%	2.1%	1.6%	2.6%	2.0%
Other Tubers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4. Legumes	**2.2%**	**2.4%**	**2.6%**	**3.1%**	**3.5%**	**3.0%**	**2.5%**	**3.1%**
Pulses (with nuts)	2.2%	2.4%	2.6%	3.1%	3.5%	3.0%	2.5%	3.1%
Tofu	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5. Animal Proteins	**16.3%**	**22.4%**	**30.1%**	**22.2%**	**31.6%**	**39.5%**	**25.0%**	**33.9%**
Mutton & Goat	0.1%	0.4%	0.6%	0.2%	0.4%	0.8%	0.4%	0.5%
Beef	1.1%	2.1%	4.4%	2.2%	4.9%	8.1%	3.0%	6.0%
Other Meat	0.1%	0.2%	0.2%	0.2%	0.2%	0.1%	0.2%	0.1%
Aquatic Products	10.9%	13.0%	14.7%	13.1%	16.2%	17.6%	13.4%	16.3%
Dairy Products	1.4%	2.3%	3.8%	1.7%	3.2%	4.6%	2.9%	3.6%
Poultry	1.7%	3.0%	4.7%	3.0%	4.6%	5.9%	3.6%	5.0%
Eggs	1.0%	1.3%	1.7%	1.8%	2.3%	2.4%	1.5%	2.2%
6. Oils & Animal Fats	**4.7%**	**4.6%**	**4.4%**	**5.2%**	**5.1%**	**4.3%**	**4.5%**	**4.7%**
7. Sugar & Spices	**7.0%**	**7.8%**	**8.3%**	**7.2%**	**7.7%**	**8.3%**	**7.9%**	**7.9%**
Sugar and Sweets	1.1%	1.7%	2.5%	1.5%	2.0%	3.0%	2.0%	2.4%
Spices	5.9%	6.1%	5.8%	5.8%	5.7%	5.3%	5.9%	5.5%
8. Beverages	**1.3%**	**1.9%**	**2.6%**	**2.3%**	**2.8%**	**3.1%**	**2.1%**	**2.8%**
Non-Alcoholic	1.3%	1.9%	2.6%	2.3%	2.8%	3.1%	2.1%	2.8%
Alcoholic	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
9. Food Away From Home	**1.0%**	**1.2%**	**1.5%**	**1.9%**	**2.0%**	**1.8%**	**1.3%**	**1.9%**
10. Other Foods	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Indonesia 2010

	Rural T1	Rural T2	Rural T3	Urban T1	Urban T2	Urban T3	Rural	Urban
2. Cereals	**40.1%**	**36.6%**	**29.8%**	**34.8%**	**29.1%**	**22.1%**	**34.2%**	**26.3%**
Rice	31.0%	25.7%	19.5%	24.9%	18.4%	11.8%	23.9%	15.9%
Maize	1.2%	1.0%	0.5%	0.5%	0.4%	0.3%	0.8%	0.4%
Wheat	2.4%	3.2%	3.5%	3.3%	4.1%	4.8%	3.2%	4.4%
Other Cereals	5.6%	6.7%	6.3%	6.1%	6.1%	5.2%	6.3%	5.6%
3. Vegetables/fruit	**17.3%**	**17.3%**	**16.9%**	**16.0%**	**15.7%**	**13.8%**	**17.1%**	**14.7%**
Vegetables	12.2%	11.6%	10.6%	10.7%	9.6%	7.5%	11.3%	8.6%
Fruit	3.4%	4.0%	4.9%	4.0%	4.8%	5.4%	4.3%	5.0%
Other Tubers (potatoes included)	1.7%	1.6%	1.4%	1.4%	1.2%	0.9%	1.5%	1.1%
4. Legumes	**5.9%**	**5.5%**	**4.9%**	**6.2%**	**5.4%**	**3.6%**	**5.3%**	**4.6%**
Pulses (with nuts)	0.9%	1.1%	1.2%	0.8%	0.9%	0.8%	1.1%	0.8%
Tofu	5.0%	4.4%	3.6%	5.5%	4.5%	2.8%	4.2%	3.7%
5. Animal Proteins	**14.7%**	**18.6%**	**23.2%**	**15.9%**	**21.3%**	**24.4%**	**19.9%**	**22.0%**
Pork	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Beef	1.4%	2.0%	2.8%	1.5%	2.4%	3.6%	2.3%	2.9%
Other Meat	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Aquatic Products	7.0%	7.6%	7.9%	5.5%	6.1%	5.7%	7.6%	5.8%
Dairy Products	1.4%	2.1%	3.9%	2.9%	4.8%	7.3%	2.8%	5.8%
Poultry	2.3%	3.7%	5.1%	2.9%	4.5%	4.5%	4.1%	4.2%
Eggs	2.6%	3.1%	3.5%	3.2%	3.5%	3.2%	3.2%	3.3%
6. Oils & Animal Fats	**6.1%**	**5.8%**	**5.5%**	**5.2%**	**5.1%**	**4.2%**	**5.7%**	**4.6%**
7. Sugar & Spices	**6.7%**	**6.2%**	**5.7%**	**6.1%**	**5.2%**	**4.3%**	**6.1%**	**4.8%**
Sugar and Sweets	5.0%	4.5%	4.2%	4.3%	3.7%	3.0%	4.5%	3.4%
Spices	1.6%	1.7%	1.5%	1.8%	1.5%	1.2%	1.6%	1.4%
8. Beverages	**3.4%**	**3.3%**	**3.7%**	**3.7%**	**4.3%**	**5.3%**	**3.5%**	**4.8%**
Non-Alcoholic	3.3%	3.1%	3.5%	3.7%	4.2%	5.1%	3.3%	4.6%
Alcoholic	0.1%	0.1%	0.2%	0.0%	0.2%	0.2%	0.2%	0.1%
9. Food Away From Home	**1.2%**	**2.0%**	**3.7%**	**2.8%**	**4.3%**	**9.2%**	**2.7%**	**6.7%**
10. Other Foods	**4.5%**	**4.7%**	**6.7%**	**9.3%**	**9.6%**	**13.1%**	**5.6%**	**11.5%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Nepal 2010								
	Rural T1	Rural T2	Rural T3	Urban T1	Urban T2	Urban T3	Rural	Urban
2. Cereals	**46.6%**	**38.8%**	**29.9%**	**38.4%**	**26.9%**	**23.0%**	**36.4%**	**27.8%**
Rice	29.9%	26.4%	21.7%	28.4%	20.6%	16.7%	25.0%	20.6%
Maize	6.8%	4.1%	2.4%	1.5%	0.7%	0.5%	3.9%	0.8%
Wheat	7.7%	6.8%	5.0%	8.2%	5.4%	5.7%	6.2%	6.2%

Other Cereals	2.2%	1.5%	0.7%	0.3%	0.2%	0.1%	1.3%	0.2%
3. Vegetables/fruit	**12.0%**	**13.7%**	**14.7%**	**13.8%**	**15.3%**	**14.9%**	**13.8%**	**14.8%**
Vegetables	7.0%	7.7%	7.8%	7.6%	8.1%	7.5%	7.6%	7.7%
Fruit	2.4%	3.2%	4.4%	3.4%	4.7%	5.3%	3.5%	4.7%
Potatoes	2.6%	2.9%	2.6%	2.9%	2.4%	2.1%	2.7%	2.4%
Other Tubers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4. Legumes	**4.2%**	**4.5%**	**4.7%**	**6.3%**	**5.7%**	**4.9%**	**4.5%**	**5.5%**
Pulses (with nuts)	4.2%	4.5%	4.7%	6.3%	5.7%	4.9%	4.5%	5.5%
Tofu	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5. Animal Proteins	**15.7%**	**19.8%**	**24.3%**	**18.9%**	**24.6%**	**26.3%**	**21.0%**	**24.1%**
Mutton & Goat	2.5%	3.3%	5.0%	2.9%	4.9%	5.2%	3.9%	4.5%
Beef	1.4%	1.3%	1.6%	1.5%	2.0%	1.9%	1.5%	1.8%
Other Meat	0.8%	0.9%	0.7%	1.0%	0.4%	0.3%	0.8%	0.5%
Aquatic Products	1.8%	2.1%	2.1%	2.4%	1.6%	1.5%	2.1%	1.7%
Dairy Products	5.7%	8.1%	10.1%	6.3%	9.6%	10.8%	8.5%	9.4%
Poultry	2.9%	3.3%	3.9%	4.0%	4.7%	4.9%	3.5%	4.6%
Eggs	0.5%	0.7%	1.0%	1.0%	1.5%	1.8%	0.8%	1.5%
6. Oils & Animal Fats	**6.9%**	**7.0%**	**7.6%**	**6.8%**	**7.5%**	**7.1%**	**7.3%**	**7.2%**
7. Sugar & Spices	**7.4%**	**7.6%**	**7.7%**	**7.8%**	**7.9%**	**7.5%**	**7.6%**	**7.7%**
Sugar and Sweets	2.3%	2.9%	3.4%	3.0%	3.8%	3.8%	3.0%	3.6%
Spices	5.1%	4.7%	4.3%	4.7%	4.2%	3.6%	4.6%	4.1%
8. Beverages	**5.2%**	**5.1%**	**5.4%**	**4.2%**	**4.6%**	**5.3%**	**5.3%**	**4.8%**
Non-Alcoholic	0.4%	0.7%	1.2%	0.8%	1.9%	2.6%	0.9%	2.0%
Alcoholic	4.8%	4.4%	4.3%	3.4%	2.8%	2.7%	4.4%	2.9%
9. Food Away From Home	**1.7%**	**2.8%**	**4.7%**	**3.3%**	**5.8%**	**8.3%**	**3.4%**	**6.3%**
10. Other Foods	**0.4%**	**0.6%**	**0.9%**	**0.6%**	**1.7%**	**2.8%**	**0.7%**	**1.9%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

	Vietnam 2010							
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
2. Cereals	**48.0%**	**35.4%**	**28.5%**	**31.4%**	**20.3%**	**14.9%**	**34.8%**	**19.5%**
Rice	46.9%	34.7%	27.8%	30.5%	19.5%	14.1%	34.0%	18.7%
Maize	0.8%	0.2%	0.2%	0.1%	0.1%	0.1%	0.3%	0.1%
Wheat	0.3%	0.5%	0.5%	0.8%	0.7%	0.6%	0.5%	0.7%
Other Cereals	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
3. Vegetables/fruit	**8.2%**	**8.2%**	**8.7%**	**8.8%**	**9.4%**	**9.8%**	**8.5%**	**9.5%**
Vegetables	5.4%	5.0%	5.0%	5.5%	5.3%	4.8%	5.1%	5.1%
Fruit	2.1%	2.7%	3.3%	2.9%	3.7%	4.6%	2.9%	4.0%
Potatoes	0.4%	0.4%	0.4%	0.4%	0.3%	0.3%	0.4%	0.3%

Other Tubers	0.3%	0.1%	0.1%	0.1%	0.0%	0.0%	0.1%	0.0%
4. Legumes	**1.8%**	**1.8%**	**1.6%**	**1.5%**	**1.2%**	**1.0%**	**1.7%**	**1.1%**
Pulses (with nuts)	0.6%	0.5%	0.4%	0.3%	0.2%	0.1%	0.5%	0.2%
Tofu	1.2%	1.3%	1.2%	1.2%	1.0%	0.8%	1.3%	0.9%
5. Animal Proteins	**26.9%**	**33.9%**	**37.4%**	**34.9%**	**37.6%**	**41.3%**	**34.1%**	**39.0%**
Pork	9.7%	12.3%	13.3%	12.3%	12.7%	12.1%	12.2%	12.3%
Beef	1.0%	1.3%	2.1%	1.6%	3.0%	4.6%	1.6%	3.6%
Other Meat	0.6%	0.9%	1.2%	1.0%	1.2%	1.4%	1.0%	1.3%
Aquatic Products	9.2%	11.6%	11.6%	12.0%	11.2%	9.9%	11.1%	10.6%
Dairy Products	0.9%	1.5%	2.6%	2.8%	3.8%	6.8%	1.9%	5.2%
Poultry	4.2%	4.8%	5.2%	3.7%	4.4%	5.2%	4.9%	4.7%
Eggs	1.2%	1.3%	1.4%	1.5%	1.4%	1.3%	1.3%	1.3%
6. Oils & Animal Fats	**3.0%**	**2.8%**	**2.4%**	**2.4%**	**1.9%**	**1.6%**	**2.7%**	**1.8%**
7. Sugar & Spices	**4.0%**	**4.0%**	**4.0%**	**3.7%**	**3.3%**	**3.0%**	**4.0%**	**3.2%**
Sugar and Sweets	1.2%	1.4%	1.5%	1.3%	1.2%	1.2%	1.4%	1.2%
Spices	2.8%	2.7%	2.5%	2.4%	2.1%	1.7%	2.6%	2.0%
8. Beverages	**2.7%**	**3.3%**	**4.1%**	**2.8%**	**3.3%**	**3.7%**	**3.5%**	**3.4%**
Non-Alcoholic	1.2%	1.7%	2.1%	1.5%	1.7%	2.0%	1.8%	1.8%
Alcoholic	1.5%	1.6%	2.0%	1.2%	1.6%	1.8%	1.8%	1.6%
9. Food Away From Home	**4.3%**	**9.0%**	**11.6%**	**13.0%**	**21.4%**	**22.9%**	**9.2%**	**20.7%**
10. Other Foods	**1.1%**	**1.5%**	**1.7%**	**1.5%**	**1.7%**	**1.9%**	**1.5%**	**1.8%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Annex B.

Annex B, Projections detailed Table

Table 4. Shares in Total Food Expenditure (in value terms) by Rural/Urban and Terciles by Country

Bangladesh 2040 - Business as Usual								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	12.9%	17.7%	17.4%	2.0%	1.8%	1.7%	16.4%	1.8%
1.b. Unprocessed	24.2%	24.1%	23.7%	28.1%	28.7%	29.0%	24.0%	28.7%
1.c. Processed Low	47.6%	40.1%	37.4%	47.8%	45.4%	44.2%	40.7%	45.4%
1.d. Processed High	15.3%	18.1%	21.5%	22.1%	24.2%	25.2%	18.9%	24.2%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	39.1%	31.3%	24.3%	27.8%	21.1%	17.4%	30.1%	20.9%
3. Vegetables/fruit	14.4%	14.8%	14.7%	15.4%	15.4%	17.6%	14.6%	16.4%
4. Legumes	3.1%	3.0%	2.9%	3.2%	3.3%	2.8%	2.9%	3.1%
5. Animal Proteins	27.8%	34.2%	39.8%	34.3%	41.5%	44.1%	35.2%	41.1%
6. Oils & Animal Fats	4.2%	3.9%	3.7%	5.6%	4.9%	3.9%	3.9%	4.6%
7. Sugar & Spices	7.0%	7.7%	8.3%	7.1%	7.4%	8.3%	7.8%	7.8%
8. Beverages	2.0%	2.8%	3.7%	3.3%	3.6%	3.7%	3.0%	3.6%
9. Food Away From Home	2.3%	2.3%	2.5%	3.2%	2.8%	2.2%	2.4%	2.6%
10. Other Foods	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Indonesia 2040 - Business as Usual								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	20.6%	15.6%	14.5%	5.5%	5.3%	6.3%	16.4%	5.9%
1.b. Unprocessed	16.4%	18.2%	17.8%	19.1%	19.1%	16.3%	17.6%	17.7%
1.c. Processed Low	36.5%	36.5%	34.2%	39.0%	35.4%	29.7%	35.6%	33.3%
1.d. Processed High	26.5%	29.7%	33.4%	36.4%	40.2%	47.7%	30.4%	43.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	28.9%	26.0%	21.2%	25.2%	22.0%	17.8%	24.7%	20.6%
3. Vegetables/fruit	16.6%	16.7%	16.5%	15.5%	15.3%	13.8%	16.6%	14.6%
4. Legumes	6.0%	5.4%	4.6%	5.3%	4.6%	3.2%	5.2%	4.1%
5. Animal Proteins	22.6%	26.0%	28.3%	20.7%	24.9%	24.6%	26.1%	23.9%
6. Oils & Animal Fats	5.1%	4.8%	4.6%	4.8%	4.5%	3.5%	4.8%	4.0%
7. Sugar & Spices	7.9%	6.9%	6.1%	5.8%	5.1%	4.4%	6.8%	4.9%
8. Beverages	4.7%	4.6%	5.2%	4.4%	5.0%	5.8%	4.9%	5.3%

9. Food Away From Home	2.4%	3.6%	5.6%	3.7%	5.2%	10.3%	4.1%	7.4%
10. Other Foods	5.8%	5.9%	8.0%	14.5%	13.6%	16.5%	6.7%	15.2%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Nepal 2040 - Business as Usual								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	41.2%	39.5%	32.2%	10.2%	8.0%	5.9%	37.0%	7.7%
1.b. Unprocessed	11.5%	12.8%	14.6%	22.0%	21.8%	21.2%	13.2%	21.6%
1.c. Processed Low	30.1%	26.4%	24.6%	35.1%	24.4%	20.4%	26.6%	25.5%
1.d. Processed High	17.2%	21.4%	28.7%	32.7%	45.9%	52.4%	23.2%	45.2%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	31.8%	26.8%	20.7%	26.7%	18.8%	17.8%	25.7%	20.5%
3. Vegetables/fruit	11.5%	12.9%	13.9%	13.5%	14.8%	15.2%	12.9%	14.6%
4. Legumes	4.9%	4.9%	4.8%	5.9%	5.2%	4.7%	4.9%	5.2%
5. Animal Proteins	28.9%	30.8%	31.9%	30.2%	32.4%	28.5%	30.7%	30.2%
6. Oils & Animal Fats	5.7%	5.8%	6.4%	6.4%	6.6%	6.2%	6.0%	6.4%
7. Sugar & Spices	7.2%	7.4%	7.7%	7.3%	7.7%	8.0%	7.4%	7.7%
8. Beverages	6.4%	6.3%	6.9%	4.8%	5.2%	6.2%	6.6%	5.5%
9. Food Away From Home	3.1%	4.5%	6.7%	4.3%	6.9%	9.7%	5.0%	7.4%
10. Other Foods	0.5%	0.7%	1.1%	0.9%	2.4%	3.7%	0.8%	2.5%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Vietnam 2040 - Business as Usual								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	41.7%	25.2%	16.9%	4.5%	1.5%	1.0%	25.9%	1.9%
1.b. Unprocessed	5.8%	7.6%	8.4%	10.8%	11.1%	11.1%	7.5%	11.0%
1.c. Processed Low	36.3%	43.4%	46.5%	52.9%	46.9%	44.8%	42.9%	47.2%
1.d. Processed High	16.2%	23.9%	28.2%	31.8%	40.5%	43.1%	23.7%	40.0%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	32.1%	22.9%	18.6%	18.3%	12.2%	10.1%	23.4%	12.5%
3. Vegetables/fruit	8.0%	7.9%	8.4%	8.0%	9.0%	10.6%	8.1%	9.5%
4. Legumes	1.7%	1.6%	1.4%	1.2%	1.0%	0.9%	1.5%	1.0%
5. Animal Proteins	39.2%	42.4%	43.0%	47.6%	43.5%	40.0%	41.8%	42.7%
6. Oils & Animal Fats	2.5%	2.3%	2.0%	2.0%	1.6%	1.4%	2.2%	1.6%
7. Sugar & Spices	3.9%	3.8%	3.9%	3.2%	3.0%	3.2%	3.9%	3.1%
8. Beverages	3.5%	4.0%	5.3%	2.9%	3.5%	4.4%	4.4%	3.8%

9. Food Away From Home	7.6%	13.4%	15.5%	14.7%	24.1%	27.0%	12.8%	23.5%
10. Other Foods	1.3%	1.7%	2.0%	2.0%	2.2%	2.6%	1.7%	2.3%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Table 4. Shares in Total Food Expenditure (in value terms) by Rural/Urban and Terciles by Country

Bangladesh 2040 - Business as Usual - Low Expenditure Growth								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	13.7%	19.3%	19.5%	3.1%	2.7%	2.3%	18.1%	2.6%
1.b. Unprocessed	22.9%	22.9%	22.7%	26.6%	27.4%	28.0%	22.8%	27.5%
1.c. Processed Low	51.0%	43.0%	39.7%	52.3%	49.6%	47.5%	43.2%	49.1%
1.d. Processed High	12.4%	14.9%	18.0%	18.0%	20.3%	22.2%	15.8%	20.8%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	46.9%	38.6%	30.3%	35.2%	26.3%	20.3%	36.5%	25.2%
3. Vegetables/fruit	14.2%	14.7%	14.6%	15.2%	15.2%	16.9%	14.6%	16.0%
4. Legumes	2.7%	2.7%	2.7%	3.2%	3.4%	2.9%	2.7%	3.1%
5. Animal Proteins	21.5%	28.0%	35.0%	28.2%	36.7%	42.2%	29.8%	37.7%
6. Oils & Animal Fats	4.5%	4.3%	4.1%	5.6%	5.1%	4.2%	4.3%	4.7%
7. Sugar & Spices	7.0%	7.7%	8.3%	7.3%	7.6%	8.2%	7.8%	7.8%
8. Beverages	1.6%	2.3%	3.0%	2.8%	3.2%	3.3%	2.5%	3.2%
9. Food Away From Home	1.5%	1.7%	2.0%	2.6%	2.3%	2.0%	1.8%	2.2%
10. Other Foods	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Indonesia 2040 - Business as Usual - Low Expenditure Growth								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	22.5%	17.5%	16.7%	8.5%	7.8%	8.5%	18.3%	8.3%
1.b. Unprocessed	15.8%	17.7%	17.5%	18.3%	18.5%	16.0%	17.2%	17.2%
1.c. Processed Low	39.6%	39.5%	36.8%	42.7%	38.7%	31.9%	38.4%	35.9%
1.d. Processed High	22.1%	25.2%	29.0%	30.5%	35.0%	43.6%	26.2%	38.6%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	34.6%	31.3%	25.6%	29.6%	25.3%	19.9%	29.6%	23.3%
3. Vegetables/fruit	17.0%	17.0%	16.6%	15.9%	15.5%	13.7%	16.8%	14.7%
4. Legumes	6.1%	5.5%	4.8%	5.8%	5.0%	3.4%	5.3%	4.3%
5. Animal Proteins	18.5%	22.4%	25.9%	18.5%	23.3%	24.9%	23.0%	23.2%
6. Oils & Animal Fats	5.7%	5.3%	5.1%	5.1%	4.9%	3.8%	5.3%	4.4%

7. Sugar & Spices	7.3%	6.6%	5.9%	6.0%	5.1%	4.3%	6.5%	4.8%
8. Beverages	4.0%	3.8%	4.3%	4.1%	4.7%	5.5%	4.1%	5.0%
9. Food Away From Home	1.8%	2.8%	4.6%	3.3%	4.7%	9.7%	3.3%	7.1%
10. Other Foods	5.1%	5.3%	7.2%	11.7%	11.5%	14.7%	6.1%	13.2%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Nepal 2040 - Business as Usual - Low Expenditure Growth								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	43.6%	42.7%	36.0%	15.2%	11.4%	7.8%	40.0%	10.8%
1.b. Unprocessed	10.8%	12.0%	13.9%	20.5%	21.3%	21.1%	12.6%	21.0%
1.c. Processed Low	31.8%	27.7%	25.8%	37.4%	26.6%	22.1%	27.9%	27.3%
1.d. Processed High	13.9%	17.5%	24.3%	26.9%	40.7%	48.9%	19.6%	40.9%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	38.9%	32.7%	25.3%	32.3%	22.7%	20.2%	31.0%	24.0%
3. Vegetables/fruit	12.0%	13.5%	14.4%	13.8%	15.0%	14.9%	13.5%	14.7%
4. Legumes	4.7%	4.8%	4.8%	6.2%	5.5%	4.8%	4.8%	5.4%
5. Animal Proteins	22.0%	25.1%	28.2%	24.3%	28.7%	28.0%	25.7%	27.3%
6. Oils & Animal Fats	6.4%	6.5%	7.0%	6.7%	7.1%	6.7%	6.7%	6.8%
7. Sugar & Spices	7.4%	7.6%	7.7%	7.6%	7.8%	7.6%	7.6%	7.6%
8. Beverages	5.8%	5.7%	6.0%	4.5%	4.9%	5.6%	5.9%	5.1%
9. Food Away From Home	2.3%	3.6%	5.6%	3.8%	6.3%	8.9%	4.2%	6.8%
10. Other Foods	0.4%	0.6%	1.0%	0.7%	2.0%	3.2%	0.8%	2.2%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Vietnam 2040 - Business as Usual - Low Expenditure Growth								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	43.9%	27.6%	19.1%	6.7%	2.1%	1.3%	27.5%	2.6%
1.b. Unprocessed	5.3%	7.1%	8.1%	10.2%	10.8%	10.9%	7.2%	10.7%
1.c. Processed Low	37.8%	45.5%	48.6%	56.7%	51.3%	48.0%	45.1%	50.7%
1.d. Processed High	13.0%	19.8%	24.2%	26.4%	35.8%	39.8%	20.2%	36.0%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	40.3%	29.2%	23.6%	24.5%	16.0%	12.3%	29.3%	15.8%
3. Vegetables/fruit	8.2%	8.1%	8.6%	8.4%	9.1%	10.0%	8.3%	9.4%
4. Legumes	1.8%	1.7%	1.5%	1.4%	1.1%	0.9%	1.7%	1.1%
5. Animal Proteins	32.9%	38.2%	40.4%	41.4%	41.1%	41.7%	38.0%	41.4%
6. Oils & Animal Fats	2.8%	2.6%	2.2%	2.3%	1.8%	1.5%	2.5%	1.7%

7. Sugar & Spices	4.0%	3.9%	3.9%	3.5%	3.1%	3.0%	3.9%	3.1%
8. Beverages	3.1%	3.6%	4.6%	2.9%	3.4%	4.0%	3.9%	3.6%
9. Food Away From Home	5.7%	11.0%	13.4%	14.0%	22.6%	24.5%	10.9%	21.9%
10. Other Foods	1.2%	1.6%	1.8%	1.8%	1.9%	2.2%	1.6%	2.0%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Table 4. Shares in Total Food Expenditure (in value terms) by Rural/Urban and Terciles by Country

Bangladesh 2040 - Equitable Growth								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	11.3%	15.9%	16.1%	1.6%	1.6%	1.7%	14.5%	1.6%
1.b. Unprocessed	25.8%	25.1%	24.2%	28.8%	28.9%	29.0%	24.9%	28.9%
1.c. Processed Low	43.2%	37.6%	36.1%	45.3%	44.3%	44.2%	38.7%	44.5%
1.d. Processed High	19.8%	21.5%	23.6%	24.4%	25.2%	25.1%	21.8%	25.0%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	29.3%	25.2%	21.4%	24.5%	20.0%	17.4%	25.0%	20.1%
3. Vegetables/fruit	14.2%	14.7%	14.7%	15.4%	15.5%	17.6%	14.5%	16.4%
4. Legumes	3.5%	3.1%	2.9%	3.2%	3.3%	2.8%	3.1%	3.1%
5. Animal Proteins	36.2%	39.4%	42.0%	37.3%	42.5%	44.1%	39.4%	41.8%
6. Oils & Animal Fats	3.7%	3.6%	3.6%	5.5%	4.8%	3.9%	3.6%	4.6%
7. Sugar & Spices	6.9%	7.6%	8.4%	7.0%	7.3%	8.3%	7.7%	7.7%
8. Beverages	2.6%	3.4%	4.2%	3.6%	3.7%	3.7%	3.5%	3.7%
9. Food Away From Home	3.6%	3.1%	2.9%	3.5%	2.9%	2.2%	3.2%	2.8%
10. Other Foods	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Indonesia 2040 - Equitable Growth								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	17.0%	13.2%	12.9%	4.1%	4.6%	6.1%	14.3%	5.1%
1.b. Unprocessed	17.0%	18.5%	18.0%	19.4%	19.2%	16.4%	17.8%	18.0%
1.c. Processed Low	32.2%	33.3%	32.5%	36.2%	34.0%	29.4%	32.7%	32.5%
1.d. Processed High	33.9%	34.9%	36.6%	40.3%	42.2%	48.2%	35.2%	44.4%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	21.2%	20.8%	18.3%	22.6%	20.8%	17.5%	20.1%	19.8%
3. Vegetables/fruit	16.2%	16.6%	16.5%	15.3%	15.3%	13.9%	16.4%	14.6%
4. Legumes	5.7%	5.2%	4.5%	5.0%	4.4%	3.2%	5.1%	4.0%

5. Animal Proteins	27.7%	28.9%	29.3%	21.8%	25.2%	24.5%	28.7%	24.1%
6. Oils & Animal Fats	4.3%	4.3%	4.3%	4.5%	4.3%	3.4%	4.3%	3.9%
7. Sugar & Spices	8.4%	7.2%	6.2%	5.8%	5.1%	4.5%	7.2%	5.0%
8. Beverages	6.1%	5.8%	6.1%	4.7%	5.1%	5.9%	6.0%	5.3%
9. Food Away From Home	3.6%	4.7%	6.4%	4.0%	5.4%	10.3%	4.9%	7.2%
10. Other Foods	6.7%	6.6%	8.5%	16.4%	14.5%	16.7%	7.3%	16.0%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Nepal 2040 - Equitable Growth								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	37.0%	36.1%	30.1%	8.6%	7.4%	6.0%	34.3%	7.2%
1.b. Unprocessed	12.5%	13.4%	14.8%	22.4%	21.8%	21.2%	13.6%	21.8%
1.c. Processed Low	28.3%	25.3%	24.0%	33.8%	23.9%	20.5%	25.8%	25.5%
1.d. Processed High	22.3%	25.2%	31.0%	35.3%	46.8%	52.2%	26.3%	45.5%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	24.8%	22.5%	18.8%	24.6%	18.2%	18.0%	22.0%	20.0%
3. Vegetables/fruit	10.7%	12.3%	13.6%	13.3%	14.8%	15.2%	12.2%	14.5%
4. Legumes	4.9%	4.9%	4.8%	5.8%	5.2%	4.7%	4.9%	5.2%
5. Animal Proteins	36.3%	35.0%	33.3%	32.6%	32.9%	28.5%	34.8%	31.2%
6. Oils & Animal Fats	4.9%	5.2%	6.1%	6.2%	6.5%	6.2%	5.4%	6.3%
7. Sugar & Spices	6.8%	7.3%	7.6%	7.2%	7.7%	7.9%	7.2%	7.6%
8. Beverages	7.1%	6.9%	7.4%	4.9%	5.3%	6.1%	7.2%	5.5%
9. Food Away From Home	3.9%	5.3%	7.2%	4.5%	7.0%	9.7%	5.5%	7.3%
10. Other Foods	0.5%	0.7%	1.1%	0.9%	2.4%	3.7%	0.8%	2.5%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Vietnam 2040 - Equitable Growth								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	37.3%	22.4%	15.5%	3.6%	1.3%	1.0%	24.5%	1.7%
1.b. Unprocessed	6.4%	7.9%	8.6%	11.1%	11.1%	11.1%	7.7%	11.1%
1.c. Processed Low	34.7%	41.3%	45.2%	50.3%	45.6%	44.7%	40.7%	46.3%
1.d. Processed High	21.7%	28.4%	30.7%	35.0%	42.0%	43.3%	27.2%	40.9%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	22.9%	17.7%	15.9%	15.4%	11.3%	10.0%	18.7%	11.7%
3. Vegetables/fruit	7.8%	7.6%	8.3%	7.7%	9.0%	10.6%	7.9%	9.4%
4. Legumes	1.6%	1.4%	1.3%	1.2%	1.0%	0.9%	1.4%	1.0%

5. Animal Proteins	46.0%	45.4%	44.1%	50.5%	43.7%	39.9%	45.1%	43.7%
6. Oils & Animal Fats	2.2%	2.1%	1.9%	1.9%	1.5%	1.4%	2.0%	1.6%
7. Sugar & Spices	3.8%	3.7%	3.9%	3.1%	3.0%	3.2%	3.8%	3.1%
8. Beverages	4.2%	4.6%	5.9%	2.9%	3.6%	4.4%	4.9%	3.8%
9. Food Away From Home	10.1%	15.6%	16.6%	15.2%	24.7%	27.1%	14.3%	23.5%
10. Other Foods	1.5%	1.8%	2.0%	2.1%	2.3%	2.6%	1.8%	2.4%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Table 4. Shares in Total Food Expenditure (in value terms) by Rural/Urban and Terciles by Country

Bangladesh 2040 - Equitable Growth - Low Expenditure Growth								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	12.8%	18.0%	18.3%	2.4%	2.3%	2.2%	16.7%	2.3%
1.b. Unprocessed	24.3%	23.9%	23.3%	27.5%	27.9%	28.2%	23.8%	28.0%
1.c. Processed Low	47.5%	40.7%	38.4%	49.8%	48.0%	46.8%	41.5%	47.9%
1.d. Processed High	15.4%	17.4%	20.0%	20.3%	21.8%	22.8%	18.0%	21.9%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	38.8%	32.7%	26.7%	30.8%	24.2%	19.6%	31.8%	23.6%
3. Vegetables/fruit	14.4%	14.8%	14.6%	15.4%	15.3%	17.0%	14.6%	16.1%
4. Legumes	3.1%	2.9%	2.8%	3.2%	3.4%	2.9%	2.9%	3.1%
5. Animal Proteins	28.1%	33.0%	37.9%	31.7%	38.7%	42.8%	33.8%	38.9%
6. Oils & Animal Fats	4.2%	4.0%	3.9%	5.6%	5.1%	4.1%	4.0%	4.7%
7. Sugar & Spices	7.0%	7.7%	8.3%	7.2%	7.5%	8.2%	7.8%	7.8%
8. Beverages	2.0%	2.7%	3.4%	3.1%	3.4%	3.4%	2.8%	3.3%
9. Food Away From Home	2.3%	2.2%	2.3%	2.9%	2.5%	2.0%	2.3%	2.4%
10. Other Foods	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Indonesia 2040 - Equitable Growth - Low Expenditure Growth								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	20.3%	15.8%	15.2%	6.3%	6.5%	7.7%	16.8%	7.1%
1.b. Unprocessed	16.5%	18.2%	17.8%	18.9%	18.8%	16.1%	17.5%	17.5%
1.c. Processed Low	36.0%	36.8%	35.1%	40.3%	37.1%	31.2%	35.9%	34.9%
1.d. Processed High	27.2%	29.3%	32.0%	34.5%	37.6%	44.9%	29.7%	40.5%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	28.0%	26.5%	22.6%	26.6%	23.6%	19.2%	25.4%	22.1%

3. Vegetables/fruit	16.5%	16.7%	16.5%	15.7%	15.4%	13.7%	16.6%	14.7%
4. Legumes	6.0%	5.4%	4.7%	5.5%	4.8%	3.4%	5.3%	4.3%
5. Animal Proteins	23.2%	25.7%	27.6%	20.0%	24.2%	24.9%	25.7%	23.7%
6. Oils & Animal Fats	5.0%	4.8%	4.7%	4.9%	4.7%	3.7%	4.9%	4.3%
7. Sugar & Spices	7.9%	6.9%	6.0%	5.9%	5.1%	4.3%	6.8%	4.9%
8. Beverages	4.8%	4.5%	4.9%	4.3%	4.8%	5.6%	4.7%	5.1%
9. Food Away From Home	2.6%	3.6%	5.3%	3.6%	5.0%	9.9%	3.9%	7.1%
10. Other Foods	5.9%	5.9%	7.7%	13.6%	12.5%	15.2%	6.6%	14.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Nepal 2040 - Equitable Growth - Low Expenditure Growth								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	41.2%	40.3%	34.0%	12.4%	10.0%	7.4%	38.1%	9.6%
1.b. Unprocessed	11.5%	12.6%	14.3%	21.3%	21.5%	21.1%	12.9%	21.3%
1.c. Processed Low	30.1%	26.7%	25.1%	36.3%	25.8%	21.8%	27.1%	27.0%
1.d. Processed High	17.2%	20.4%	26.6%	29.9%	42.6%	49.6%	21.9%	42.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	31.9%	28.0%	22.7%	29.3%	21.2%	19.7%	27.1%	22.8%
3. Vegetables/fruit	11.5%	13.0%	14.1%	13.7%	14.9%	15.0%	13.0%	14.6%
4. Legumes	4.9%	4.9%	4.8%	6.1%	5.4%	4.8%	4.9%	5.3%
5. Animal Proteins	28.9%	29.6%	30.3%	27.4%	30.2%	28.2%	29.7%	28.6%
6. Oils & Animal Fats	5.7%	5.9%	6.7%	6.6%	6.9%	6.6%	6.2%	6.7%
7. Sugar & Spices	7.2%	7.5%	7.7%	7.5%	7.7%	7.6%	7.5%	7.6%
8. Beverages	6.4%	6.1%	6.5%	4.7%	5.0%	5.7%	6.3%	5.2%
9. Food Away From Home	3.1%	4.3%	6.2%	4.1%	6.5%	9.1%	4.7%	6.9%
10. Other Foods	0.5%	0.7%	1.0%	0.8%	2.1%	3.3%	0.8%	2.2%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Vietnam 2040 - Equitable Growth - Low Expenditure Growth								
	Rural T1	**Rural T2**	**Rural T3**	**Urban T1**	**Urban T2**	**Urban T3**	**Rural**	**Urban**
1.a. Own Production	41.5%	25.6%	17.8%	5.3%	1.8%	1.2%	26.8%	2.3%
1.b. Unprocessed	5.8%	7.5%	8.3%	10.6%	10.9%	10.9%	7.4%	10.8%
1.c. Processed Low	36.2%	43.7%	47.3%	54.4%	49.4%	47.2%	43.1%	49.4%
1.d. Processed High	16.5%	23.2%	26.7%	29.7%	37.9%	40.7%	22.8%	37.5%
Total	100%	100%	100%	100%	100%	100%	100%	100%
2. Cereals	31.4%	23.7%	20.4%	20.5%	14.2%	11.7%	24.5%	14.4%

3. Vegetables/fruit	8.0%	7.9%	8.5%	8.1%	9.0%	10.1%	8.2%	9.3%
4. Legumes	1.7%	1.6%	1.4%	1.3%	1.0%	0.9%	1.6%	1.0%
5. Animal Proteins	39.7%	41.9%	42.1%	45.4%	42.4%	41.5%	41.4%	42.6%
6. Oils & Animal Fats	2.5%	2.3%	2.1%	2.1%	1.7%	1.5%	2.3%	1.7%
7. Sugar & Spices	3.9%	3.8%	3.9%	3.3%	3.1%	3.0%	3.9%	3.1%
8. Beverages	3.6%	4.0%	5.0%	2.9%	3.4%	4.1%	4.3%	3.6%
9. Food Away From Home	7.8%	13.0%	14.7%	14.5%	23.2%	25.0%	12.3%	22.2%
10. Other Foods	1.4%	1.7%	1.9%	1.9%	2.0%	2.3%	1.7%	2.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%