Results

Regmi and Unnevehr (2005) indicate a declining CV for 18 high-income countries, implying convergence, from 1990 to 2004, for total food expenditures and for expenditures on cereals, meats, fish, and vegetables. In examining the CV for 47 high- and middle-income countries, strong convergence trends are apparent for total food expenditures, and expenditures on cereals, meats, and possibly fish and vegetables. However, the declining CV trend is uneven from 1990 to 2004. A break in declining CV around 1997 and 1998 is likely associated with the concurrent global financial downturn, when gross national income declined in most countries in our analysis (WDI, 2006). Annual average growth for 1998-2004 is significantly lower than for 1990-97 for all groups of countries (fig. 2). Therefore, in addition to testing β convergence during this entire period, the data are broken into two time periods, 1990-1997 and 1998-2004, which are separately tested for β convergence in food expenditures.

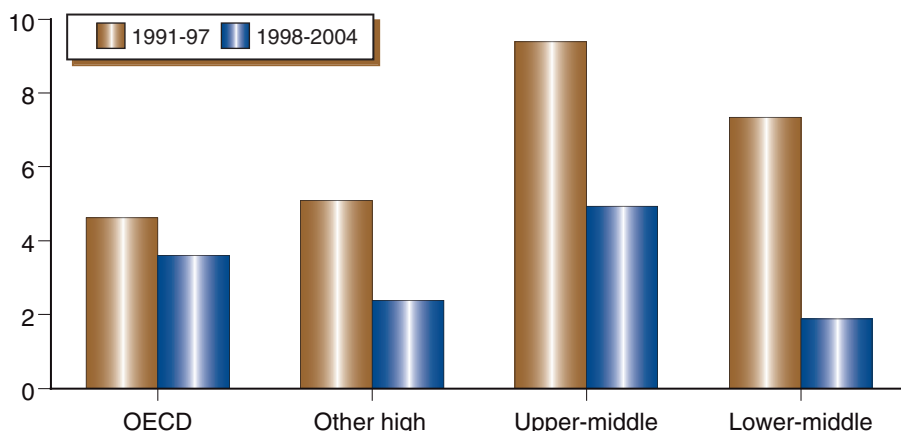## Convergence in Food Expenditures

Beta convergence analyses on food expenditures indicate significant (at the 5-percent level) convergence across all 47 countries for total food, cereals, meats, seafood, dairy, sugar and confectionery, caffeinated beverages, and soft drinks (table 3) over 1990-2004. Faster convergence (larger β) is evident in the earlier time period (1990-97) for total food expenditures and most product groups (excluding seafood and dairy, for which the results are not significant). The large estimated β for meats reflects the well-documented effects of Bennett's Law. The large values of β for vegetables, sugar and confectionary, and other high-value products like soft drinks may reflect faster consumption growth in middle-income countries due to more modern food delivery and global income growth.

Insignificant or slowing convergence trends during 1998-2004 may be the result of slower income growth. Convergence in total food expenditures,

Figure 2

Annual average growth in gross national income (GNI)

Percent

Source: World Development Indicators 2006, World Bank.

Table 3
Estimated beta convergence for food expenditures

Expenditure Categories	1990-2004 (t_{0+T}) = 2004 and t_0= 1990			Divided into 2 time periods (t_{0+T}) = 1997 and t_0= 1990			(t_{0+T}) = 2004 and t_0= 1998		
	β	Std.dev	p-value	β	Std.dev	p-value	β	Std.dev	p-value
Total food	0.039	0.013	0.002	0.068	0.018	0.000	0.044	0.019	0.019
Cereals	0.021	0.006	0.001	0.019	0.009	0.029	0.018	0.012	0.131
Meats	0.022	0.007	0.004	0.042	0.012	0.000	0.033	0.011	0.003
Seafood	0.012	0.006	0.042	0.014	0.009	0.121	0.006	0.008	0.502
Dairy	0.017	0.007	0.015	0.012	0.009	0.185	0.020	0.009	0.029
Oil & fats	0.012	0.008	0.145	0.033	0.012	0.005	-0.003	0.010	0.776
Fruit	0.015	0.009	0.074	0.024	0.013	0.063	0.021	0.012	0.091
Vegetables	0.014	0.009	0.107	0.039	0.013	0.002	0.006	0.015	0.703
Sugar & confectionery	0.013	0.006	0.039	0.022	0.009	0.016	0.019	0.010	0.047
Caffeinated beverages	0.020	0.005	0.000	0.030	0.008	0.000	0.019	0.009	0.030
Soft drinks	0.029	0.009	0.001	0.037	0.011	0.001	0.026	0.013	0.056
Other food	0.009	0.005	0.092	0.020	0.009	0.028	0.001	0.008	0.875

though slower, remains significant. Among product groups, convergence remains significant for meat, dairy, sugar, and caffeinated beverages.

Lack of noticeable convergence trends in some product groups—such as oils and fats, fruits, and "other" foods—could be due to the heterogeneity of income-led demand growth among different products within the food group, or to persistent differences in preferences among countries that prevent convergence. The oils and fats category contains products that are inferior and those that are preferred as incomes grow, and the mix of such income-led preferences may vary across countries. The type and amount of fruit eaten, for example, may still be shaped by local varieties and availability.

Breaking the time period into two, in general, improved the model fit, as reflected in higher R^2 within each time period versus the entire period (see appendix A for regression details). The dummy variable for lower middle-income countries was significant and negative in most food product categories for the entire time period (1990-2004) and for 1998-2004 (table 4). This indicates that food expenditures in lower middle-income countries are moving toward a lower steady-state expenditure level, than that of the 18 high-income countries. The dummy variable for other high-income countries was significant and negative for some categories only in the later time period. The dummy variable for the upper middle-income countries was significant and negative only for total food expenditures in 1998-2004; it was significant and positive in the early time period (1990-97) for dairy and oils/fats, possibly indicating higher prices for these items in these countries.

In summary, differences among the 47 countries in the underlying costs of food or structure of the food sector were most apparent for the lower middle-income countries, which may reflect less modern food systems and lower labor costs in the food sector. Structural differences—indicated by significant

Table 4
Direction and significance of coefficients on dummy variables for food expenditure regressions

Expenditure categories	1990-2004			Divided into 2 time periods					
	(t_{0+T}) = 2004 and t_0= 1990			(t_{0+T}) = 1997 and t_0= 1990			(t_{0+T}) = 2004 and t_0= 1998		
	d_H	d_{UM}	d_{LM}	d_H	d_{UM}	d_{LM}	d_H	d_{UM}	d_{LM}
Total food	-NS	-NS	-S	+ NS	-NS	-S	-S	-S	-S
Cereals	-NS	-NS	-S	-NS	-NS	-NS	-NS	+NS	-S
Meats	-NS	+NS	-S	+NS	+NS	-NS	-S	-NS	-S
Seafood	-NS	-NS	-S	+NS	+NS	+NS	-NS	-NS	-S
Dairy	-NS	+NS	-S	+NS	+S	+NS	-S	-NS	-S
Oil & fats	-NS	-NS	-NS	+NS	+S	-NS	-NS	-NS	-NS
Fruit	-NS	-NS	-S	+NS	+NS	-NS	-NS	-NS	-S
Vegetables	-NS	-NS	-S	+NS	-NS	-NS	-NS	-NS	-S
Sugar & confectionery	-NS	-NS	-S	-NS	+NS	-NS	-S	-NS	-S
Caffeinated beverages	-NS	-NS	-S	+NS	+NS	-NS	-S	-NS	-S
Soft drinks	-NS	-NS	-S	-NS	+NS	-NS	-NS	-NS	-S
Other food	-NS	-NS	-S	+NS	+NS	-NS	-NS	-NS	-S

Note: NS denotes not significant and S denotes significant at the 5-percent level.

coefficients on the country dummy variables—were also more apparent in the later time period, when trends in economic growth may have differed more widely across income groupings. It is striking, however, that upper middle-income countries, like Mexico and Poland, appear to be on a path toward convergence with high-income countries for most expenditure categories.

Since data on retail sales of packaged food were only available for 1998-2005, two-period regression was not feasible for this expenditure category. Still, estimated β indicate significant convergence for packaged food sales, reflecting the growth in modern retail food delivery systems in middle-income countries (table 5). Dummy variables for other high-income countries and lower middle-income countries are significant and negative, as in the later time period for many other food expenditure categories. The magnitude of the estimated β (0.015) is smaller than that reported for total food expenditures during the later time period (0.044). Thus, overall food consumption appears to be converging faster across countries than packaged food expenditures. This may reflect the differing pace of change in food delivery systems across country categories, which we examine next.

Convergence in the Food Delivery System

Significant convergence in food expenditures for high-value products and packaged food implies growth in a modernized food delivery system that makes these products available to consumers. Recent studies by Reardon et al., 2007 have also noted the growth in modern retailing in middle-income countries. Regression results (table 6) support such findings. We examined convergence for retail sales from all standardized retail formats—supermarkets, hypermarkets, convenience stores, and large discounters—and for supermarkets alone. The relatively large and highly significant estimated β (0.036 for all outlets and 0.035 for supermarkets alone) indicate rapid

Table 5

Beta convergence regression results for per capita packaged food expenditures

Ending year (t_{0+T})	2005
Beginning year (t_0)	1998
$\log(y_{i,t_0})$	0.128
Std.dev	0.007
p-value	[.000]
d_H	-0.031
Std.dev	0.014
p-value	[.032]
d_{UM}	-0.021
Std.dev	0.017
p-value	[.212]
d_{LM}	-0.065
Std.dev	0.022
p-value	[.005]
Constant	0.148
Std.dev	0.047
p-value	[.003]
R^2	0.972
Adj R^2	0.969
P-value	0.000
Degrees of freedom	41.000
Beta estimate results	
$\log(y_{i,t_0})$	0.015
Std.dev	0.008
p-value (asymptotic)	[.050]

convergence trends in food retailing during 1999-2005. Although the dummy variables were negative, the only significant dummy was for supermarket growth in lower middle-income countries. Thus, convergence is occurring toward a similar steady-state level of per capita expenditures in all standardized retail outlets for both high- and middle-income countries.

Growth in foodservice is another dimension of food system modernization. Estimated β on per capita foodservice expenditures are reported in table 7 for 1999 to 2004 for all foodservice and for fast-food outlets within this category. Significant convergence in foodservice sales over 1999-2004 is apparent, but is much more rapid for sales from fast-food outlets (table 7). The dummy variable for lower middle-income countries is significant and negative in both equations; upper middle-income countries have a significant negative dummy for fast food only. Thus, foodservice sales show strong and rapid convergence, but middle-income countries are converging to a steady state of per capita expenditures that is lower than for high-income countries. This may reflect a lower cost structure for foodservice in countries with lower wage costs.

The β estimates can provide the "half-life" of progress toward convergence, i.e., the number of years required for progress halfway toward the steady-state

Table 6
Beta convergence regression results for per capita retail sales by outlet type

	All standarized outlet[1] sales	Supermarket sales
Ending year (t_{0+T})	2005	2005
Beginning year (t_0)	1999	1998
log(y_{i,t_0})	0.135	0.135
Std.dev	0.012	0.011
p-value	[.000]	[.000]
d_H	-0.025	-0.031
Std.dev	0.025	0.025
p-value	[.314]	[.222]
d_{UM}	-0.005	-0.038
Std.dev	0.003	0.035
p-value	[.879]	[.275]
d_{LM}	-0.082	-0.109
Std.dev	0.049	0.044
p-value	[.101]	[.018]
Constant	0.307	0.271
Std.dev	0.086	0.071
p-value	[.001]	[.000]
R^2	0.956	0.959
Adj R^2	0.952	0.955
P-value	0.000	0.000
Degrees of freedom	43.000	42.000
Beta estimate results		
log(y_{i,t_0})	0.036	0.035
Std.dev	0.014	0.013
p-value (asymptotic)	[.013]	[.007]

[1]Standardized outlets denote supermarkets, hypermarkets, discount and convenience stores.

level. Table 8 reports the implied half-life for different food system indicators, based on estimates of β from the most recent time period. There is remarkable similarity in the half-life estimates for total foodservice, standardized retail outlets, and total food and meat expenditures. Convergence in fast-food sales appears to be occurring much more rapidly than convergence in any other type of expenditure. Packaged food expenditures are converging much less rapidly, which we did not expect, given other trends. While all of these different data may not be collected on the same basis, and therefore may not be strictly comparable, these results do support the observation that structural advances in food delivery are taking place very rapidly in many countries.

Similarity in Product Preferences

New product introductions further demonstrate how food trends permeate global markets. We group product attribute claims into six categories (see appendix C for full list). Examination of labels on new products in 15 coun-

Table 7

Beta convergence regression results for per capita foodservice expenditures

		Total foodservice	Fast food expenditures
Ending Year (t_{0+T})		2004	2004
Beginning Year (t_0)		1999	1999
$\log(y_{i,t_0})$		0.166	0.134
	Std.dev	0.011	0.010
	p-value	[.000]	[.000]
d_H		-0.020	-0.017
	Std.dev	0.020	0.025
	p-value	[.310]	[.492]
d_{UM}		-0.042	-0.098
	Std.dev	0.025	0.030
	p-value	[.102]	[.002]
d_{LM}		-0.084	-0.158
	Std.dev	0.030	0.035
	p-value	[.009]	[.000]
Constant		0.268	0.376
	Std.dev	0.073	0.049
	p-value	[.001]	[.000]
R^2		0.959	0.947
Adj R^2		0.955	0.942
P-value		0.000	0.000
Degrees of freedom		42.000	42.000
		Beta estimate results	
$\log(y_{i,t_0})$		0.038	0.080
	Std.dev	0.013	0.015
	p-value (asymptotic)	[.005]	[.005]

Table 8

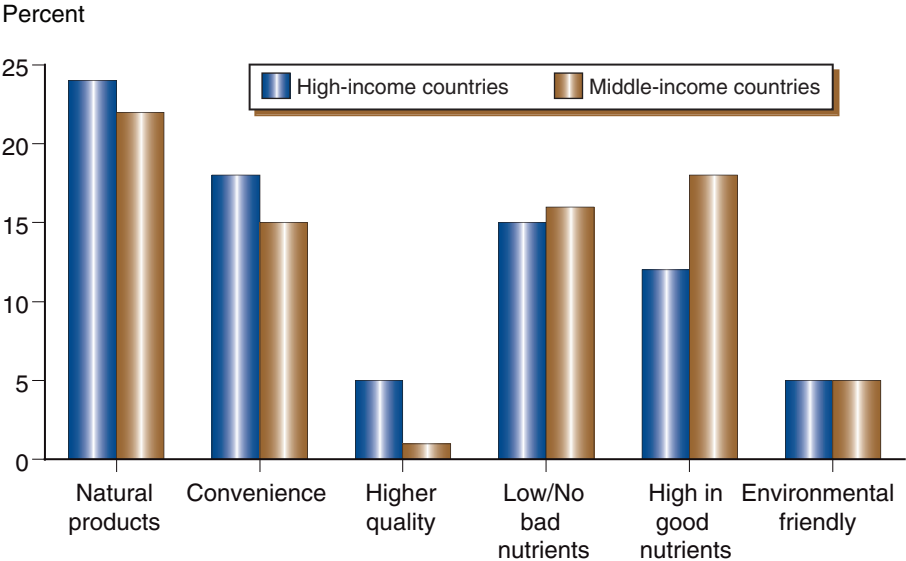**Estimated half life for convergence of different food system indicators**

	Years	Beta estimate	Half life (years)
Total foodservice	99-04	0.038	18
Fast food	99-04	0.080	9
All standardized retail outlets	99-05	0.036	19
Supermarkets	99-05	0.035	20
Total food expenditures	98-04	0.044	16
Meat expenditures	98-04	0.033	21
Packaged food expenditures	98-05	0.015	46

tries (see table 1 for country names) indicate that attribute claims are similar on new food products introduced to consumers in high- and middle-income countries. The share of labels with attribute claims indicating "natural," "convenient," or "high quality" tends to increase with the affluence of a given market (fig. 3). For example, while convenience accounted for 27 percent of all label claims in Japan, it accounted for only 12 percent of total claims in Mexico and 6 percent of claims in Egypt. This is expected given the higher opportunity cost of time in high-income economies. Labels claiming healthful nutrients such as added vitamins and minerals showed a reverse trend. For example, claims of healthful nutrients accounted for 51 percent of all claims in Indonesia, 33 percent in Hungary, and 27 percent in Japan. Even though preferences in developing countries are evolving toward those of consumers in high-income countries, many consumers in developing countries prioritize obtaining adequate nutrition. Consumers in high-income countries, who may take adequate nutrition as a given, focus more on avoiding unwanted nutrients (e.g., low fat) or on other attributes like organic sourcing.

Other claims such as those targeting demographic groups, indicating private labels, or touting vegan (no animal product) content were also more common in high-income countries. The shares of these labels ranged from 0 to 14 percent. The presence of these claims in a given market may reflect conditions pertinent to the market. For example, the more frequent targeting of demographic groups in high-income countries may be a function of an older population in these countries.

In spite of differences among countries or across categories, the similarity of product claims on packaged food introductions in both high- and middle-income countries is striking. This speaks to a more general convergence in food preferences, which underlies the results obtained for high-value food product expenditures.

Figure 3

Percent share of different label claims

Percent

Source: Euromonitor, Inc, 2006.