Convergence in Food Demand and Delivery: Do Middle-Income Countries Follow High-Income Trends?

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This study uses food expenditures and food-sales data from 1990 to 2004 to examine whether food-consumption patterns and food-delivery-mechanism trends are converging across 47 high- and middle-income countries. Results point to a high degree of convergence in global food systems. Middle-income countries appear to be following trends in high-income countries. Convergence is apparent in most important food-expenditure categories and in indicators of food-system modernization such as supermarket and fast food sales.

Past studies of food demand and food retailing suggest growing similarity or convergence between the U.S. and the EU. Blandford (1984) and Hermann and Röder (1995) found evidence of convergence in food-expenditure patterns among OECD countries. Cotterill (1997) argued that global demand for multi-national brands would drive increasing trans-Atlantic convergence in food-consumption patterns. Convergence trends in OECD countries were recently re-examined by Regmi and Unnevehr (2005; 2006). We extend Regmi and Unnevehr's analysis to see whether convergence trends extend to middle-income countries and to food retail-delivery mechanisms.

Consumer preferences, shaped primarily by incomes, changing lifestyles, and evolving cultural trends, largely determine the items available in grocery stores. Growing income levels among consumers in developing countries have resulted in diet upgrades, with increased demand for meats, dairy products, and other higher-value food products (Regmi and Gehlhar 2005). Increasing affluence has also coincided with growth in sales for labor-saving products and for food products possessing specific attributes. As the food marketing and retail sector evolves in middle-income countries, they undergo a "shift from commodity markets to product markets" (Reardon and Timmer 2007).

Changes in the composition of diets and in food preferences are not the only influence of the global food system. Food-product and retail models from high-income countries have become increasingly common in middle-income countries through expansion of multinational retail and food-service chains (Reardon, Henson, and Berdegué 2007, Coyle 2006). Tastes and diets are being shaped by global expansion of modern food retailing, thereby increasing the similarity in the manner in which food is produced, delivered, and consumed around the world. While most studies (Reardon and Timmer 2007) focus on regional transformation of food-marketing systems and their potential impact on local producers, few studies have examined whether in fact there is convergence in the food-delivery system across countries. This paper statistically examines whether converging trends are visible in food-retailing and foodservice sectors across high-income and middle-income countries.

Background

The term "convergence" implies dynamics, or movement toward some common outcome. Convergence has been defined and examined most often as convergence in income levels. Barro and Sala-i-Martin (1992) defined beta convergence, in which the growth rate of lower-income regions or countries is faster than that of high-income regions. In this case, the faster growth rates imply that the lower-income regions will eventually "catch up" with higher-income regions. The concept of convergence has been applied to food expenditures to see if income dynamics and market integration are overcoming historical differences in preferences—for example, in the European Union (Hermann and Röder 1995; Gil, Gracia, and Pérez y Pérez 1995). As income-induced changes occur more rapidly in lower-income countries, food-consumption pat-

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terns across countries trend toward convergence. The common outcome is some universal "saturation" level of demand for food, which is achieved at high income levels.

This paper expands Regmi and Unnevehr's 2005 study to cover 47 countries that are grouped into the original 18 OECD countries, other high-income countries, upper-middle-income countries, and lower-middle-income countries (Table 1). Convergence is tested using β-convergence as defined by Barro and Sala-i-Martin (1992). Convergence tests are extended beyond total food expenditures to examine if convergence trends are visible in food delivery, as evident in sales of different retail and foodservice outlets.

Data and Methodology

Data on 47 countries were obtained from the Euromonitor International. The model used to examine convergence follows Barro and Sala-i-Martin (1992, p. 247):

$$(1) \quad \left(\frac{1}{T}\right)\log(y_{i,t_0+T}) =$$

$$B + \frac{e^{-\beta T}}{T}\log(y_{i,t_0}) + u_{i,t_0,t_0+T} \,,$$

where y_{i,t_0+T} is the expenditure level in the ending year; y_{i,t_0} is the expenditure level in the starting year; T is the duration of the period analyzed; and β, which can be interpreted as some measurement of the speed of convergence, is represented as

$$(2) \quad \beta = -\frac{\ln(T*slope)}{T}.$$

The slope in Equation 2 is the coefficient estimate of $\log(y_{i,t_0+T})$ in Equation 1. The standard error of β, $SE(\beta)$, can be asymptotically estimated as

$$(3) \quad SE(\beta) \approx \left|\frac{1}{T*slope}\right| * SE(slope).$$

A positive β indicates convergence and a negative β indicates divergence, with the speed of convergence reflected by the magnitude of β. Since the rate of change toward convergence can be influenced by structural differences in countries, our analysis defines dummy variables to distinguish three groups of countries from the initial 18 OECD countries included in the analysis by Regmi and Unnevehr (2005): other high-income countries, upper-middle-income countries, and lower-middle-income countries.

Table 1. Countries Included in the Analysis.

OECD countries		Other high-income	Upper-middle-income	Lower-middle-income
Canada	Belgium	Norway	Czech Republic	Brazil
USA	Finland	Switzerland	Hungary	Colombia
Australia	Greece	Singapore	Poland	Peru
Japan	Italy	South Korea	Chile	China
France	Spain	Taiwan	Mexico	Indonesia
UK	Sweden	New Zealand	Malaysia	Philippines
Germany	Denmark	Israel	South Africa	Thailand
Netherlands	Ireland	Kuwait		Algeria[1]
Austria	Portugal	Saudi Arabia		Egypt
		United Arab Emirates		Jordan
				Morocco
				Tunisia

Countries are grouped based on World Bank's classification, using 2003 PPP data.
[1] Excluded in the analysis of packaged foods.

Results

Examination of data trends indicates a break around 1997 and 1998, likely associated with the global financial downturn experienced during that period (WDI 2006). Therefore, in addition to testing β-convergence during this entire period, separate tests are conducted for two periods: 1990–1997 and 1998–2004.

Convergence in Food-Expenditure Trends

Analyses of food expenditures indicate significant convergence for total food, cereals, meats, seafood, dairy, sugar and confectionery, stimulants, and soft drinks over the period 1990–2004 (Table 2). Faster convergence (larger β) is noted for the early 1990s for total food expenditures, and more product groups show significant convergence trends, excluding seafood and dairy, for which the results are not significant. Insignificant or slowing convergence trends during the late 1990s and early 2000s may be the result of financial downturns in some countries. Convergence in total food expenditures remains significant during the later period, albeit at a slower rate, and meat, dairy, sugar, stimulants, and soft drinks show significant convergence. These four dietary components are part of the general trend toward adoption of the less-healthy elements of high-income diets in middle-income countries (Popkin 2006).

Breaking the period into two sub-periods generally improved the model fit, as reflected in higher R^2. The dummy variable for lower middle-income countries was significant and negative in most food-product categories for the entire period and for 1998 to 2004. This indicates that food expenditures in lower-middle-income countries are on a path toward a lower-level steady-state expenditure compared to the OECD countries.[1] This may in part reflect differences in purchasing-power parity that are more pronounced in the lower-middle-income countries but not accounted for in our data.

Data on packaged-food retail sales are only available for 1998–2005. Regression results (and estimated β) imply that significant convergence trends exist for packaged food sales (Table 3). The

magnitude of the estimated β for $\log(y_{i,t_0})$ in Table 3 is smaller than that reported in Table 2 for total food expenditures during the later period, and thus overall food consumption appears to be converging faster across countries than are packaged-food expenditures. Dummy variables for other high-income countries and lower-middle-income countries are significant and negative.

Convergence in Food-Delivery System

Significant convergence trends in food expenditures for high-value products and for packaged food imply growth in a modernized food-delivery system that makes these products available to consumers. Regression results presented in Table 3 support past findings which have also noted the growth in Western-style retailing in middle-income countries (Reardon, Henson, and Berdegué 2007). We examined convergence for retail sales from all standardized retail formats—which include supermarkets, hypermarkets, convenience stores, and large discounters—and for supermarkets alone. The relatively large and highly significant estimated β's indicate rapid convergence trends in food retailing during this recent period.

Growth in food service is another dimension of food-system modernization. Estimated β's for per-capita foodservice expenditures are reported in Table 4 for all foodservice outlets and for fast food outlets. The results indicate significant convergence trends in foodservice sales, but convergence within this category is much more rapid for sales from fast food outlets. 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, this dimension of food-delivery transformation show strong and rapid convergence, but lower-middle-income countries are converging to a lower-level steady-state of per-capita expenditures.

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 level. Table 5 reports the implied half-life for different food-system indicators based on estimates of β from the most recent period. There is remarkable similarity in the half-life estimates for total food service, standardized retail outlets, and

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[1] Complete regression results are available in Regmi, Takeshima, and Unnevehr (2008).

Table 2. Estimated Beta Convergence for Food Expenditures.

Expenditure categories	1990–2004			1990–1997			1998–2004		
	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 & confectionry	0.013	0.006	0.039	0.022	0.009	0.016	0.019	0.010	0.047
Stimulants	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

Table 3. Beta-Convergence Regression Results for Retail Sales.

	Per-capita packaged food expenditures	All standarized outlet sales*	Supermarket sales
Ending year (t_{0+T})	2005	2005	2005
Beginning year (t_0)	1998	1999	1999
Log (y_{i,t_0})	0.128	0.135	0.135
Std.dev	0.007	0.012	0.011
p-value	[.000]	[.000]	[.000]
d_H	-0.031	-0.025	-0.031
Std.dev	0.014	0.025	0.025
p-value	[.032]	[.314]	[.222]
d_{UM}	-0.021	-0.005	-0.038
Std.dev	0.017	0.003	0.035
p-value	[.212]	[.879]	[.275]
d_{IM}	-0.065	-0.082	-0.109
Std.dev	0.022	0.049	0.044
p-value	[.005]	[.101]	[.018]
Constant	0.148	0.307	0.271
Std.dev	0.047	0.086	0.071
p-value	[.003]	[.001]	[.000]
R^2	0.972	0.956	0.959
Adj R^2	0.969	0.952	0.955
P-value	0.000	0.000	0.000
Degrees of freedom	41.000	43.000	42.000
	Beta estimate results		
Log (y_{i,t_0})	0.015	0.036	0.035
Std.dev	0.008	0.014	0.013
p-value (asymptotic)	[.050]	[.013]	[.007]

*Standardized outlets denote supermarkets, hypermarkets, discount stores, and convenience stores.

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 data may not be collected on the same basis, and therefore are not strictly comparable, these results do support the observation that structural changes in food delivery are taking place very rapidly in many countries.

Conclusion

The results point to a high degree of convergence in global food systems. Middle-income countries are indeed following trends in high-income countries, measured across several dimensions of food-system growth and change. Although convergence may have slowed in the recent period, it is still significant and apparent in most important food-system indicators. Convergence is apparent in food expenditures

Table 4. 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_{IM}	-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]	[.000]

Table 5. Estimated Half-Life for Convergence of 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

for most important food categories, such as meats and vegetables, and for high-value products such as sugar and confectionary and soft drinks. While lower-middle-income countries are on a path toward a lower "steady-state" expenditure, especially during the more recent period, they are still participating in the overall convergence trends. Upper-middle-income countries appear to be converging toward the same steady-state level of expenditures as the OECD countries.

Convergence is also strongly apparent in several measures of food-system modernization, including packaged-food expenditures, supermarket sales, and foodservice sales. The pace of change is particularly rapid in the foodservice sector, and within this sector, in fast food sales. Middle-income countries are participating in these trends, in most cases, with no significant difference in the measured path of convergence. Overall, our results provide strong, broad-based statistical evidence to support other observational or partial studies of food system modernization.

References

Barro, R. J. and X. Sala-i-Martin. 1992. "Convergence." *Journal of Political Economy* 100(2): 223–251.

Blandford, D. 1984. "Changes in Food Consumption Patterns in the OECD Area." *European Review of Agricultural Economics* 11(1):43–65.

Cotterill, R. 1997. "The Food Distribution System of the Future: Convergence Towards the US or the UK Model?" *Agribusiness* 13(2):123–135.

Coyle, W. 2006. "A Revolution in Food Retailing Underway in the Asia-Pacific Region," *Amber Waves* 3(4): 22–29.

Gil, J. M., A. Gracia, and L. Pérez y Pérez. 1995. "Food Consumption and Economic Development in the European Union." *European Review of Agricultural Economics* 22(3):385–399.

Herrmann, R. and C. Röder. 1995. "Does Food Consumption Converge Internationally? Measurement, Empirical Tests and Determinants." *European Review of Agricultural Economics* 22(3):400–414.

Popkin, B. 2006. "Global Nutrition Dynamics: the World is Shifting Rapidly toward a Diet Linked to Noncommunicable Diseases." *American Journal of Clinical Nutrition* 84:289–298.

Reardon, T. and P. Timmer. 2007. "Transformation of Markets for Agricultural Output in Developing Countries since 1950s: How has Thinking Changed?" In Evenson and Pingali eds., *Handbook of Agricultural Economics* 3:2807–2855.

Reardon, T., S. Henson, and J. Berdegué. 2007. "Proactive Fast-Tracking Diffusion of Supermarkets in Developing Countries: Implications for Market Institutions and Trade." *Journal of Economic Geography* 7(4):399–431.

Regmi, A. and M. Gehlhar. 2005. *New Directions in Global Food Markets*. AIB-794, ERS-USDA.

Regmi, A., H. Takeshima, L. and Unnevehr. 2008. "Convergence in Global Food Demand and Delivery." USDA Economic Research Service, Economic Research Report No. ERR-56.

Regmi, A. and L. Unnevehr. 2006. "Are Diets Converging Globally? A Comparison of Trends across Selected Countries." *Journal of Food Distribution Research* 37(1):14–21.

Regmi, A. and L. Unnevehr. 2005. "Convergence or Divergence in Food Demand: A Comparison of Trends in the EU and North America." Paper presented at the 11th Congress of the EAAE, The Future of Rural Europe in the Global Agri-Food System. Copenhagen. August 24–27.

World Bank. 2006. World Development Indicators.