Are Food Price Differences in EU Member States a Result of the Penn Effect?

Panos Fousekis*

Abstract

Panel data from 14 EU member states and non parametric techniques are used in this paper to investigate the relationship between food prices and real per capita incomes. The empirical results suggest that the Penn Effect largely holds for Total Food prices but not for the prices of certain among the seven disaggregate food commodities considered. In particular, for Cereals, for Fats and Oils, and for Other food products poorer countries are likely to face prices no lower than those prevailing in richer ones.

Keywords: *Food Prices, Living Standards, EU*

JEL Classification: Q11, C14

Introduction

The completion of the Single Market and the establishment of the EMU are two important steps in achieving European economic integration. The Single Market has facilitated the free movement of people, goods, and capital, while the EMU reduced the exchange rate volatility and the risks of cross-border activities, and increased transparency thanks to prices expressed in a common currently. In addition, initiatives have been undertaken towards tax harmonization and other structural reforms in product markets to enhance competition and to reduce distortions caused by different forms of government intervention. Despite the distinct efforts to integrate national markets, it is generally recognized that cross-country price dispersion (a key indicator of the degree of integration) in the EU has been persistent, and rather stable over time (e.g. European Commission 2001a, 2001b, and 2004).

The large and persistent cross-country price differences for virtually identical products suggest that the European markets are still away from the efficient (integrated) ones in which prices tend to uniformity. This naturally has been the focus of intense public debate (European Commission 2001b, and 2004). Multiple factors are thought to play a role in preventing the Law of One Price (LOP) from holding true in the EU. These include macroeconomic factors such as differences in living standards as well as microeconomic factors such as transportation and distribution costs, imperfect competition, and product differentiation (European Commission 2001b).

This paper examines the relationship between food prices and real per capita incomes in the EU. In the International Economics literature, the term "Penn Effect" refers to the tendency of consumer price levels in wealthier countries to be higher than those in poorer ones (e.g. Dorbrinsky, 2003; McDonald and Ricci, 2001; Dornbusch, 1988). The

* Associate Professor, Department of Economics, Aristotle University of Thessaloniki

Penn Effect has both supply and demand side explanations. The former relates to the so-called Balassa-Samuelson Effect (Samuelson, 1964) which emphasizes the role of inter-country differences in the relative productivity of the tradable and non tradable sectors. The later views price differences as a result of differences in relative money abundance.

The Penn Effect is considered to be a good thing for poorer countries since it allows them to attain welfare levels higher than those suggested by their relative position in the cross-section distribution of nominal per capita incomes. Empirical evidence of the Penn Effect has been typically pursued through simple regression equations relating general price levels to real per capita incomes or productivities (e.g. Dowrick, 2002; Bahmani-Oskooe and Rhee, 1996). The regression analysis, however, with its dominant focus on the "average" or "representative" country is not quite informative about the welfare implications of the "Penn Effect". What one really wants to know is not whether an increase in the real per capita income of the "representative" country will result in an increase in its general price level but whether there would be poor countries (not necessarily all of them) that would end up with price levels similar to that in rich countries experiencing, thus, a deterioration of their relative position in terms of living standards. Also, the pre-occupation with general price levels (commonly represented by Consumer Price Indexes) may mask important differences among countries with regard to commodity groups an aggregate price index is made of. For example, the Penn Effect may be relevant for entertainment or housing but not for food or vehicles.

For a more informative analysis of the Penn Effect in food prices of the EU member states this paper relies on non parametric techniques and in particular on the estimation of stochastic kernels (that means, density functions of relative food prices conditional on relative real per capita incomes). An empirical analysis appears to be timely because if price convergence for food (a current policy objective) is achieved without convergence in living standards the laggards within the EU are likely to experience a deterioration in their relative position, ceteris paribus. In what follows, Section 2 presents the data and Section 3 the methodology. Section 4 contains the empirical results, while Section 5 offers conclusions.

The Data

The present study utilizes panel data on relative (to EU15) prices of food and relative (to EU15) per capita incomes from 14 EU member states over the period 1995 to 2005. The price data come from the Eurostat Database-Agriculture and Fishery; the per capita income data come from the publication Europe in Figures (various years). Per capita incomes are expressed in real terms (Purchasing Power Standards (PPS)) to eliminate differences in price levels allowing, thus, for meaningful comparisons of the standards of living among sets of countries. The EU member states included are Belgium (BE), Denmark (DK), Germany (DE), Ireland (IE), Greece (GR), Spain (ES), France (FR), Italy (IT), Netherlands (NL), Austria (AT), Portugal (PT), Finland (FL), Sweden (SE), and the United Kingdom (UK). The study considers Total Food as well as seven disaggregated food commodities (Meat, Fish and Sea Food, Milk, Cheese and Eggs, Cereals, Fats and Oils, Fruits and Vegetables (including Potatoes), and Other Food Products (including Sugar, Jam, Chocolate, and Confectionery).

Table 1 presents relative prices and relative per capita incomes in PPS (averages for the period 1995 to 2005). It appears that prices differ widely among the member states and this holds for Total Food as well as for the disaggregated food products. For example, 1 Euro spend in Portugal buys 1.52 (1.29 divided by 0.85) times the Total Food the same amount of money buys in Denmark or 1 Euro spend in Ireland buys 1.16 (1.10 divided by 0.95) times the Fish and Sea Food the same amount of money buys in France.

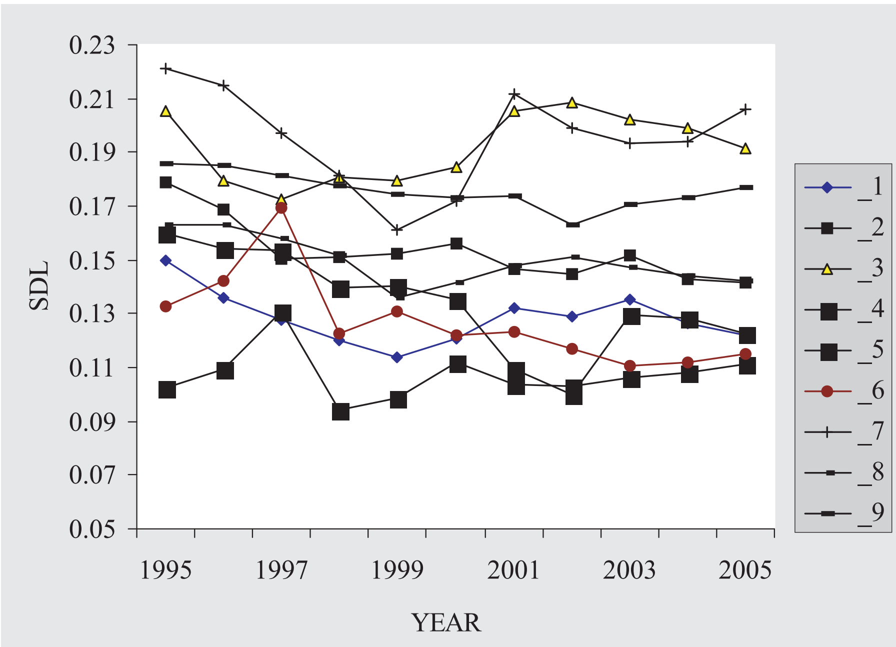
Table 1. Relative Food Prices and Relative Per Capita Incomes (average values, 1995-2005)

	Relative Prices				
Country	*Total Food*	*Meat*	*Fish and Sea Food*	*Milk, Cheese, Eggs*	*Cereals*
BE	1.02	1.06	1.17	1.06	0.98
DK	1.29	1.31	1.20	1.10	1.33
DE	1.01	1.12	1.13	0.87	1.02
GR	0.86	0.70	0.91	1.02	0.91
ES	0.85	0.73	0.85	0.89	1.03
FR	1.09	1.12	1.10	1.07	1.09
IE	1.05	0.98	0.95	1.17	1.02
IT	1.02	0.98	1.08	1.14	0.99
NE	0.95	1.08	0.95	0.95	0.88
AT	1.05	1.03	1.11	0.97	1.08
PT	0.85	0.76	0.95	0.92	0.87
FL	1.12	1.06	0.92	1.04	1.29
SE	1.16	1.12	1.01	1.09	1.26
UK	0.99	0.99	0.95	1.06	0.86

	Relative Prices			*Relative Per Capita Income (in PPS)*
Country	*Fats and Oils*	*Fruits and Vegetables*	*Other*	
BE	1.02	0.95	0.96	1.07
DK	1.19	1.39	1.43	1.13
DE	0.92	1.06	0.93	1.03
GR	1.12	0.74	1.14	0.68
ES	0.93	0.84	0.93	0.84
FR	1.09	1.09	1.05	1.03
IE	0.93	1.15	1.08	1.11
IT	1.03	0.99	1.05	1.02
NE	0.84	0.95	0.89	1.12
AT	1.10	1.03	1.06	1.13
PT	0.95	0.75	1.12	0.70
FL	1.11	1.22	1.20	1.02
SE	1.20	1.19	1.29	1.06
UK	0.95	1.08	1.00	1.03

A comparison of relative prices to relative per capita incomes in PPS may provide an indication of whether the 'Penn Effect" is present in the cost of food in the EU. With regard to Total Food, high prices can be generally observed in richer countries (a notable exception is Netherlands). Things, however, are somehow different for certain disaggregated food commodities. For example, Greece although at the bottom of the cross-section per capita income distribution faces higher prices than the EU15 for Milk, Cheese, and Eggs, for Fats and Oils, and for Other, while Belgium which is among the richer countries enjoys prices below the EU15 for Fruits and Vegetables and Other.

Given that convergence in prices is among the objectives of the Single Market and the EMU, it is interesting to examine whether the dispersion of food prices has been reduced over time. Figure 1 presents the evolution the Standard Deviation of Logarithms (SDL) which is a commonly used measure of relative dispersion (e.g. Sen, 1997) both for food prices as well as for real per capita incomes. The dispersion of Total Food Prices decreases in the first years of the period considered and increases in the most recent ones. The same is true for almost all disaggregated food commodities (exceptions being Cereals where there is a clear downward trend in dispersion and Fats and Oils where dispersion increases initially and decreases afterwards).



(1: Total Food, 2: Cereals, 3:Meat, 4: Fish and Sea Food, 5: Milk, Cheese, and Eggs, 6: Fats and Oils, 7:Fruits and Vegetables, 8: Other, 9: Per Capita Income)

Figure 1. Measures of Relative Dispersion for Food Prices and Real Per Capita Incomes

The value of the SDL measure for Total Food is everywhere below that for real per capita incomes. This suggests that the distribution of relative prices for Total Food is more concentrated around its average value than it is the distribution of relative incomes. This holds for all disaggregated food products but Meat and Fruits and Vegetables.

Methodology

Let y be the relative per capita income (in PPS) and p be the relative price of food. Let also the joint density function of y and p be $f(y, p)$ and the marginal density function of y be $\varphi(y)$. The marginal density function of p conditional on y (stochastic kernel) is then the ratio of $f(y, p)$ to $\varphi(y)$, that is,

$$g(p/y) = \frac{f(y,p)}{\varphi(y)} \quad (1)$$

where $\varphi(y)$ is obtained as

$$\varphi(y) = \int f(y,p)dp \quad (2).$$

The stochastic kernel provides the likelihood a member state which occupies a certain part of the cross-section distribution of relative real per capita incomes will end up to a certain part of the cross-section distribution of relative food prices (for example, the likelihood that a relatively rich member will face a relatively high or a relatively low price level).[1]

The whole information relating to the Penn Effect can be read off the graph of the conditional density of p given y and its associated contour plot. Specifically, when the probability mass of g runs parallel to the positive diagonal there is strong evidence of the Penn Effect since richer (poorer) countries are likely to face higher (lower) food prices. Clockwise shifts in the stochastic kernel indicate a tendency for convergence in the distribution of the cost of food commodities with richer (poorer) countries having a high probability of ending up with relatively low (high) food prices. In the extreme case, the probability mass is located along a parallel to the axis of the y values suggesting that all countries are likely to end-up with very similar food prices, regardless of their real per capita income (no evidence of the Penn Effect). Finally, peaks in the stochastic kernel (separated by valleys with vanishing probability mass) indicate the existence of "basins of attraction" (Durlauf and Johnson, 1995) which encourage the formation of clubs, that means, groups of countries which are rather homogenous in terms of their food prices relationship to real per capita income.

The Empirical Results

The investigation of the Penn Effect requires estimation of joint density functions for relative food prices and relative real per capita incomes. This has been implemented here as suggested by Wand and Jones (1995). In particular, an estimate of a joint density function for points y and p has been obtained as

$$\hat{f}(y,p) = \frac{(\sum_s k((y-y_s)/h_x)k((p-p_s)/h_y)}{nh_x h_y} \quad (3)$$

where k stands for the Gaussian kernel, n for the number of observations, and h_y and h_p for the Sheather and Jones (1991) bandwidth parameters. The estimations (which are available upon request) have been carried out using S-Plus routine *kde2d* from the library of Venables and Ripley (1999).

Figure 2 presents the contour plot associated with the stochastic kernel for Total Food.[2] The probability mass runs parallel to the positive diagonal for all relative real per capita income levels but the very low ones (below 0.75) where there is a clockwise shift in the kernel. As a matter of fact, the contour plot indicates that countries with relative incomes below 0.9 are likely to end up with very similar (around 0.85) relative Total Food prices. One may conclude, therefore, than there is evidence of the Penn Effect for the prices of Total Food in the EU member states with a possible exception Greece, Portugal, and Spain which lie at the bottom of the cross-section distribution of real per capita incomes. The probability mass is very thin for relative income levels in the neighborhood of 1 and there are two distinct peaks at the top and the bottom of the income distribution. These may suggest formation of two clubs. The first includes member states with incomes below that for EU15 which face relative Total Food prices in the neighborhood of 0.85, while the second one includes countries with the highest standards of living which face Total Food prices about 20 percent higher than those for EU15.

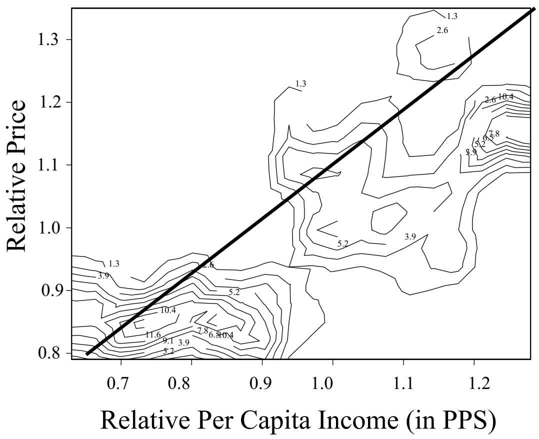


Figure 2. Contour Plot for Total Food

Figure 3 presents the contour plot associated with the stochastic kernel for Meat. There is a notable clockwise shift in the kernel for income values above 1.1 suggesting that that the price level for Meat is not much influenced by the standards of living as we move closer to the top of the cross-section distribution of incomes. At the bottom of the income distribution the picture is not altogether clear. The probability mass runs parallel to the positive diagonal for values below 0.8 something which is consistent with the Penn Effect; member states, however, with relative real per capita incomes in the neighborhood of 0.9 are likely to enjoy relative prices as low as those for members with relative incomes below 0.7. The probability mass is vanishing in the neighborhood of 1 suggesting (as in the case of Total Food) club formation.

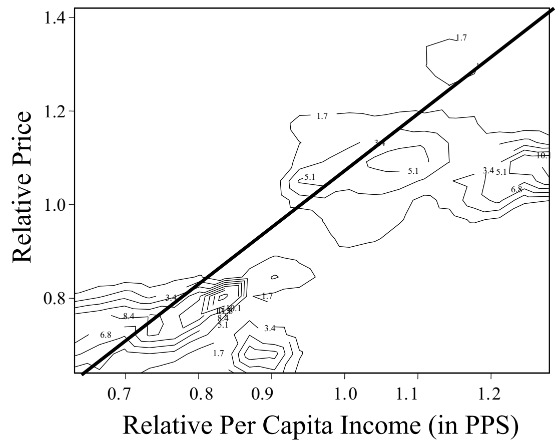


Figure 3. Contour Plot for Meat

Figure 4 presents the contour plot associated with the stochastic kernel for Fish and Sea Food. Clockwise shifts in the kernel are notable at the very bottom (neighborhood of 0.7) of the cross-section distribution of income as well as for relative real per capita incomes above 1.1. The poorest among the member states are likely to face Fish and Sea Food prices higher than those in member states with relative incomes in the neighborhood of 0.9.

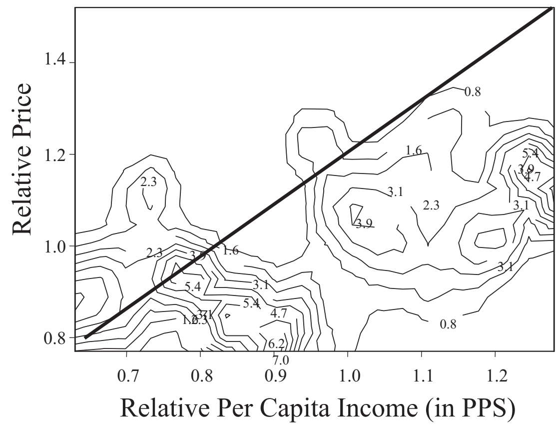


Figure 4. Contour Plot for Fish and Sea Food

Figure 5 presents the contour plot associated with the stochastic kernel for Milk, Cheese, and Eggs. Here, evidence of the Penn Effect is present only at the very top of the income distribution. Indeed, the poorest among the member states are likely to face prices for these commodities as high as member states with relative incomes well above the EU15 one. A notable feature of the stochastic kernel for Milk, Cheese, and Eggs is the considerable dispersion of relative prices which are likely to be associated with a given relative income level. For example, members with relative real per capita income in the neighborhood of 1.1 appear to be equally likely to face relative prices as high as 1.2 and as low as 0.9.

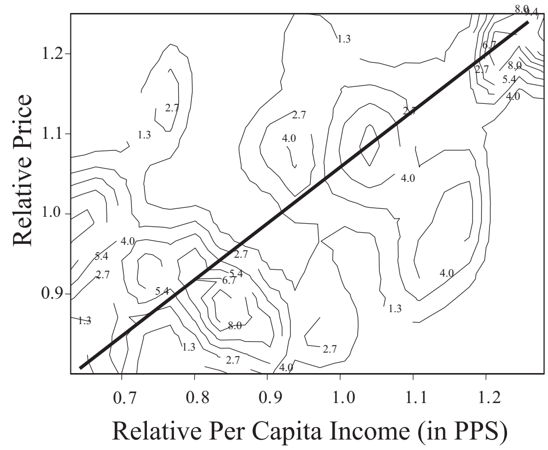


Figure 5. Contour Plot for Milk, Cheese, and Eggs

Figure 6 presents the contour plot for Cereals. Clockwise shifts in the kernel are notable for almost the whole range of relative incomes with a possible exception the interval 0.7 to 0.8. Members states with relative real per capita incomes of 0.9 (or lower) are likely to face prices for Cereals as high as members with relative per capita incomes of 1.2 (or higher), something which is not of course consistent with the Penn Effect.

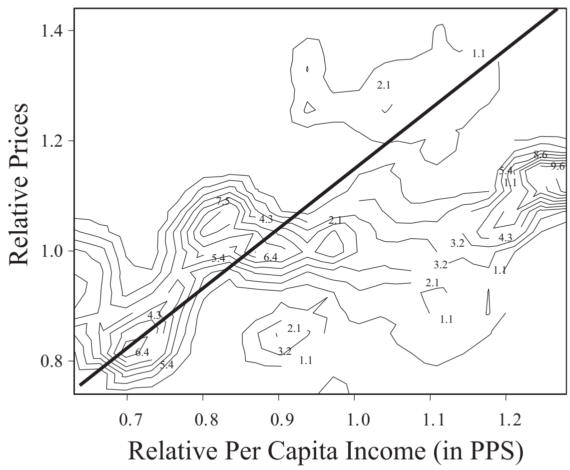


Figure 6. Contour Plot for Cereals

Figure 7 presents the contour plot for Fats and Oils. Although there is a considerable dispersion of relative prices which are likely to be associated with a given relative income level, the picture that emerges is one in which the Penn Effect is absent. Indeed, the probability mass runs parallel to the horizontal axis for the whole range of relative per capita incomes and the poorest member states are likely to face prices equal (and even higher) to those in the richest ones.

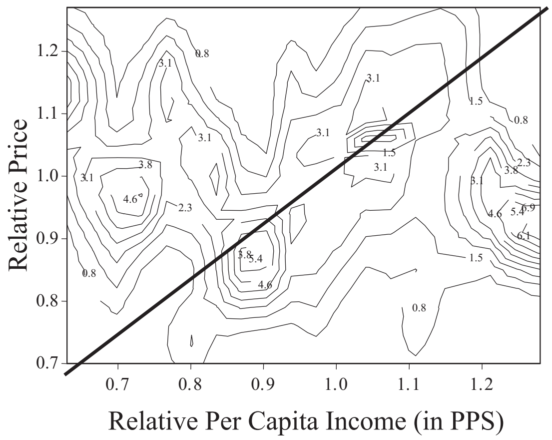


Figure 7. Contour Plot for Fats and Oils

Figure 8 presents the contour plot for Fruits and Vegetables. The probability mass runs parallel to the positive diagonal everywhere except for the incomes at the very top of the income distribution. Compared to other commodities considered in this study, Fruits and Vegetables provide the clearest evidence in favor of the Penn Effect in food prices.

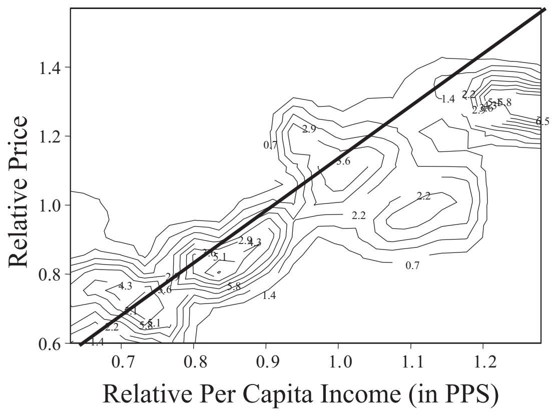


Figure 8. Contour Plots for Fruits and Vegetables

Figure 9 presents the contour plot for Other. Clearly, the evidence here is against the presence of the Penn Effect. Member states with real per capita incomes close to that of the EU15 are likely to face prices considerably lower than those in the poorer states; the later are likely to end up with prices very similar to member states at the top of the distribution of real incomes.

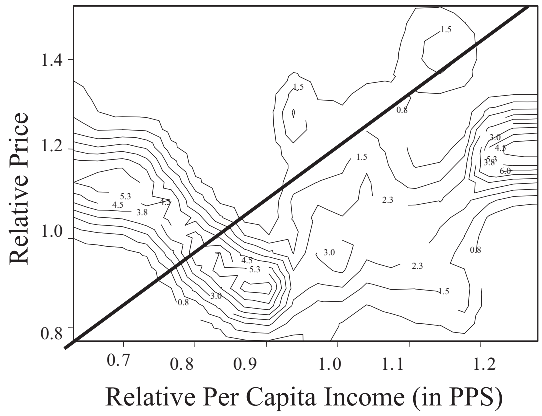


Figure 9. Contour Plots for Other

Conclusions

The present paper examines the relationship between relative food prices and relative real per capita incomes in order to assess whether price differences among the EU member states are just a result of the Penn Effect. The empirical analysis relies on panel data from 14 countries states over the period 1995 to 2002 and non parametric techniques (estimation of stochastic kernels).

The distribution of relative prices for Total Food is largely consistent with the Penn Effect (that means, higher Total Food prices are much more likely to occur in member states with higher living standards). This result, however, is largely an artifact of commodity aggregation since for a number among the seven disaggregated food products considered (e.g. Cereals, Fats and Oils, and Other) poorer members are likely to face prices no lower than those prevailing in richer ones. Given that considerable inequality of real per capita incomes still exists in the EU, the pursuit of food price convergence may deprive the laggards among the member states from the advantage of enjoying lower food prices, deteriorating their relative position in terms of living standards, ceteris paribus.

As mentioned in the Introduction, real per capita income is one among a large number of price determinants at the national level. Other determinants may be imperfect competition, transportation and distribution costs, and product differentiation. Future research may investigate the role of such microeconomic determinants shedding, thus, more light in the elaborate issue of price divergence in unified European markets.

Notes

1. Stochastic kernels have been used extensively in convergence literature since they provide information on the so-called intra-distribution dynamics, that means, mobility of countries in an evolving cross-section distribution of incomes (e.g. Quah, 1997; Bianchi, 1997; Johnson, 2000).
2. Contour plots are easier to read than the graphs of kernels themselves. Therefore, the graphs of the estimated kernels are delegated into the Appendix.

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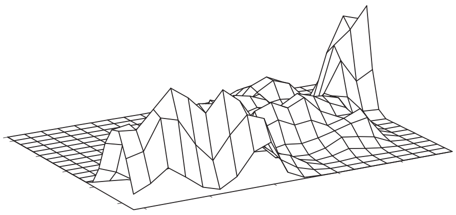
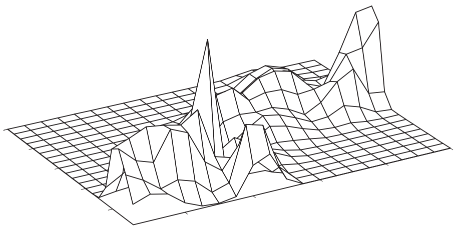
Appendix

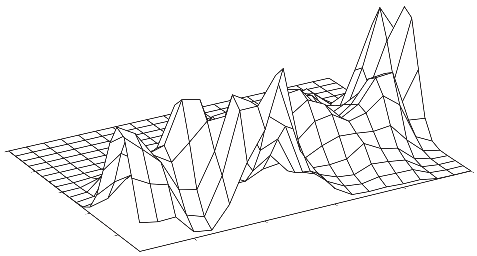
Stochastic Kernels



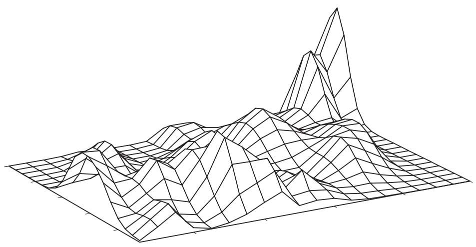
F.1. Total Food



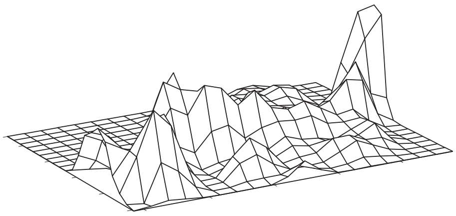
F.2. Meat



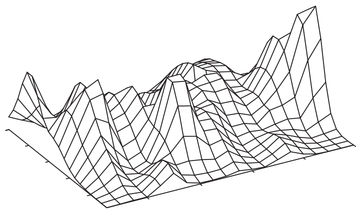
F.3. Fish and Sea Food



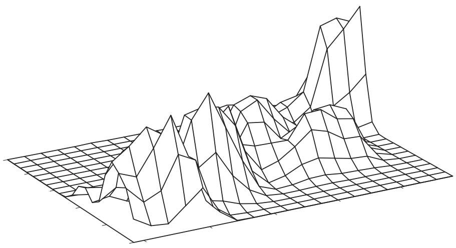
F.4. Milk, Cheese, and Eggs



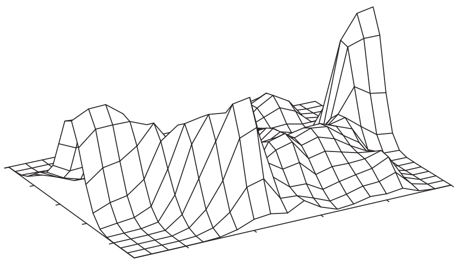
F.5. Cereals



F.6. Fats and Oils



F.7. Fruits and Vegetables



F.8. Other