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Markets and Famines in Pre-Industrial Europe

How markets influence famines is a contentious issue. One tradition, dating back beyond Adam Smith to the French enlightenment, holds that free markets minimize the damage done by harvest failure. Another argues that, on the contrary, well-functioning markets may exacerbate famines, by removing food from locations with insufficient purchasing power to richer, less affected areas. A third tradition holds that markets may not function well during famines, for a variety of reasons. Grain producers might tend to underestimate their prospects and hold back supplies, resulting in intertemporal misallocation. In that case, false hopes of yet higher prices may generate “bubbles” in markets for staple foodstuffs. Or the problem could be spatial, as when local or regional markets become balkanized because bad weather disrupts communications, or because “moral economy” forces—sanctioned, perhaps, by policy measures—intervene to prevent food shipments dictated by market forces. Famine conditions producing “noisy” information about fundamentals could have the same effect. Finally, the absence of competitive markets in normal times might lead to profiteering by such powerful middlemen as flour millers and moneylenders during famines.¹

In *The Wealth of Nations*, Smith made the classic case for free trade in foodstuffs during what he called “dearths.” All dearths or supply shortfalls in Europe for the previous two centuries or more, he asserted, had been due to poor harvests, not to collusion be-

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1 Jean Drèze and Amartya Sen, *Hunger and Public Action* (New York, 1989), 22, 90–91, 143–144, 155; Karl Gunnar Persson, *Grain Markets in Europe 1500–1900, Integration and Regulation* (New York, 1999), 41–42.

tween grain merchants, though sometimes such shortages were exacerbated by warfare. Smith also distinguished between dearths and “famines,” claiming that all European famines during the same period had been due to “the violence of government attempting, by improper means, to remedy the inconveniences of a dearth.” He believed that grain merchants minimized such inconveniences by ensuring both intertemporal and interregional arbitrage. The merchants’ optimal selling strategy would be to even out consumption during the harvest year; those who hoarded supplies too long would be forced to sell at a loss. The smooth functioning of markets during famines also minimizes deviations from an equilibrium price vector. Thus, by reallocating grain from areas in relative surplus to those in relative deficit, the market mechanism is likely to produce a net reduction in the damage done by any harvest failure.²

Smith’s preoccupation was with the influence of markets in the event of a harvest shortfall. That influence hinges on the degree of market integration in normal times. But in backward, famine-prone economies facing high transport costs and (perhaps) cumbersome controls on interregional trade, the scope for trade in non-famine years may be limited. This situation is a reminder of another way in which markets can reduce the probability and gravity of famines: Market integration, by ensuring that different regions pursue their comparative advantage, increases steady-state aggregate output and incomes, thereby reducing the damage done by any given proportionate harvest shortfall. This mechanism is emphasized in the work of French enlightenment writers, but Smith’s concern—as in the historiography of markets and famines generally—was with the impact of famines on the normal functioning of markets.

Malthus and Longfield, an Irish economist, ably re-articulated Smith’s claims. However, others at the time, and later, questioned the ability of merchants and markets to gauge supply correctly in

2 Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations* (New York, 1976; orig. pub. 1776), 526–534. Hoarders might not suffer too much of a loss, since the cost of storage implies a gradual reduction in consumption over the harvest-year. Drèze and Sen, *Hunger and Public Action*, 91. See also Quesnay’s remark about corn: “The pretext of remedying famines in a kingdom, by intercepting the trade in grain between the provinces, gives rise to further abuses which increase suffering, destroy agriculture, and decimate the revenues of the kingdom” (François Quesnay, *François Quesnay et la Physiocratie, II: textes annotés* [Paris, 1958], 494, n., my translation).

such circumstances, including Young, an agronomist, and Dugald Stewart, Smith's first biographer and compatriot. The verdict of empirical analyses on market response during famines is mixed. The official inquiry into the Great Bengali Famine of 1942/43 argued that the rise in food prices was "more than the natural result of the shortage of supply that had occurred." Sen's classic inquiry into the same famine pointed the finger at farmers and grain merchants for converting a "moderate short-fall in *production* . . . into an exceptional short-fall in *market release*" (emphases in original). The famine was due in large part to "speculative withdrawal and panic purchase of rice stocks . . . encouraged by administrative chaos." Such speculation exacerbated the deterioration in the exchange entitlements of the poor, already hit by inflationary rises in the price of food.³

Ravallion's study of the 1974 Bangladesh famine broadly corroborates Sen's findings. He also found evidence of market failure, concluding that excess mortality was, "in no small measure, the effect of a speculative crisis." Rice prices rose dramatically because merchants badly underestimated a harvest that turned out to be normal. Prices then fell back just as fast. Ravallion also found evidence of "significant impediments" to trade between the capital city, Dhaka, and its main sources of supply during this famine. A recent study of famines in the Sudan and Ethiopia during the mid-1980s also deems them to have been exacerbated by weak spatial integration of markets. Price explosions, price controls, and market disruptions were "commonplace," resulting in sharply rising marketing costs and in subregional price trends often becoming

3 See Persson, *Grain Markets*; Emma Rothschild, *Economic Sentiments: Adam Smith, Condorcet and the Enlightenment* (Cambridge, Mass., 2001), 73–80; Thomas R. Malthus, *An Investigation of the Cause of the Present High Price of Provisions* (London, 1800), 12–14; Mountifort Longfield, *Lectures on Political Economy* (London, 1834), 52–58. Young did not blame grain merchants. In *Travels in France*, he stressed their part in minimizing the danger of famine, and denounced the anti-speculator sentiment of the French *cahiers de doléance*. In *The Question of Scarcity Plainly Stated*, prompted by the near famine of 1800, he argued that the harvest shortfall was "great and real [and] a very high price a necessary consequence," against critics who blamed artificial manipulation by hoarders and speculators. But Young did not fully trust merchants' judgment about the size of the harvest, and, as secretary of the Board of Agriculture, urged the necessity of a national agricultural census. See Arthur Young, *Travels in France* (Dublin, 1793), II, 401; *idem*, *The Question of Scarcity Plainly Stated, and Remedies Considered* (London, 1801); Salim Rashid, "The Policy of Laissez-Faire during Scarcities," *Economic Journal*, XC (1980), 497–499 (where Stewart is also cited); John G. Gazley, *The Life of Arthur Young 1741–1820* (Philadelphia, 1973), 416–417.

dependent on conditions within their particular subregion alone. However, formal studies of how markets worked during pre-twentieth-century famines are scarce.⁴

FOUR EUROPEAN FAMINES The incidence and demographic significance of famines in pre-industrial societies remains a contentious issue. In early modern Europe, although malnutrition was endemic, the impact of famine on aggregate death rates was probably exaggerated. However, the four famines considered in this article—all of them prominent in the historiography of famine—exacted large death tolls; were regionally uneven; had weather, or fungus-induced crop failure, as their proximate cause; and resulted in considerable loss of output, as reflected in sharp increases in food prices.⁵

The first two famines occurred in France toward the end of Louis XIV's reign. France was then a formidable military power, but its farming system struggled to feed its huge, mainly rural, population of 22 million. Agricultural output per worker in late seventeenth-century France was less than it had been two centuries earlier, and less than two-thirds of the levels attained in the Low Countries or in England c. 1700. Both famines were exacerbated by military campaigns on France's borders and further afield.

4 Bal Mohand Bhatia, *Famines in India 1860–1965: A Study in Some Aspects of the Economic History of India* (Delhi, 1967), 323–324; Sen, *Poverty and Famines: An Essay on Entitlement and Deprivation* (New York, 1981), 76; Martin Ravallion, *Markets and Famines* (New York, 1987), 19, 111–113; *idem*, “Famines and Economics,” *Journal of Economic Literature*, XXXV (1997), 1219–1221. See also Munir Quddus and Charles Becker, “Speculative Price Bubbles in the Rice Market and the 1974 Bangladesh Famine,” *Journal of Economic Development*, XXV (2000), 155–175. Joachim von Braun, Tesfaye Teklu, and Patrick Webb, *Famine in Africa: Causes, Responses, and Prevention* (Baltimore, 1999), 70–89.

5 The point about the exaggerated impact of famine on aggregated death is forcefully made in Robert W. Fogel, *The Escape from Hunger and Premature Death, 1700–2100* (New York, 2004), 5–6. *Idem*, “Second Thoughts on the European Escape from Hunger: Famines, Chronic Malnutrition, and Mortality Rates,” in Siddiq Osmani (ed.), *Nutrition and Poverty* (New York, 1992), 243–286, characterized famine in early modern Europe as due to anticipated, rather than true, harvest failures. The famines analyzed herein do not fit such a pattern. The ravages of *phytophthora infestans* over an extended period in Ireland are well known. In Finland, “the harvest of 1867 failed seriously: what was left amounted to about half the normal crop” (Yrjö Kaukiainen, “Harvest Fluctuations and Mortality in Agrarian Finland [1810–1870],” in Tommy Bengtsson, Gunnar Fridlitzius, and Rolf Ohlsson (eds.), *Pre-Industrial Population Change: The Mortality Decline and Short-Term Population Movements* [Stockholm, 1984], 241). The admittedly limited quantitative data available suggests that bad weather also severely affected the harvests in France in 1693 and 1708 (Marcel Lachiver, *Les années de misère: la famine au temps du Grand Roi* [Paris, 1991], 118, 308–309).

In the first, excess mortality mounted in the fall of 1693 and would remain high for much of 1694. The estimated death toll of about 1.3 million people represented 6 percent of the population. The “big winter” of 1708/9 led to the second famine considered herein. It struck at a time of grave economic crisis and ongoing warfare between France and most of its neighbors. Mortality began to mount in mid-1709; before the end of 1710, it had reached 0.6 million.⁶

The Great Finnish Famine of 1868, Europe’s last major peacetime subsistence crisis, killed more than 0.1 million people in a total population of 1.8 million. The historical context is one of severe harvest failure in the wake of several years of hardship in a poor and largely agrarian economy. Heavily forested and dotted with large lakes, and with only about one-twelfth of its landmass under cultivation, Finland was sparsely populated. Internal communications, though improving, were poor, particularly in bad weather. There was an increasing trade in grain between St. Petersburg, Tallinn, and Riga and coastal Finland, but away from coastal areas the long-distance carriage of grain was on a small scale. On the eve of the famine, rye, the staple food of the poor, accounted for much more than one-half of grain production. The average yield ratio was only four- or five-to-one. In 1868, mortality was highest in the central provinces of Vaasa and Kuopio and in the remote northern province of Oulu.⁷

The Great Irish Famine (1846–1852) was not just a watershed in Irish history but also a major event in world history, with far-reaching and enduring economic and political consequences. It resulted in the deaths of about 1 million people. Whereas poor

6 Robert C. Allen, “Economic Structure and Agricultural Productivity in Europe,” *European Review of Economic History*, IV (2000), 1–26. For a more benign assessment of *ancien régime* French agriculture, see Philip T. Hoffman, *Growth in a Traditional Society: The French Countryside 1450–1815* (Princeton, 1996). See also David Weir, “Markets and Mortality in France, 1600–1789,” in John Walter and Roger Schofield (eds.), *Famine, Disease and the Social Order in Early Modern Society* (New York, 1989), 201–234. Lachiver, *Les années de misère*, 361, 381–382.

7 John Lefgren, “Famine in Finland 1867–8,” *Intermountain Economic Review*, IV (1973), 17–31; Antti Häkkinen, Vappu Ikonen, Kari Pitkänen, and Hannu Soikkanen, *Kun Hallen nälän tuskan toi. Miten Suomalaiset kokivat 1860-luvun nälkävuodet* [When the Frost Brought the Agony of Hunger: Finland and the Famine of the 1860s] (Helsinki, 1991); Pitkänen, *Deprivation and Disease: Mortality during the Great Finnish Famine of the 1860s* (Helsinki, 1993). For background on Finland, see Kaukiainen, “Harvest Fluctuations,” 235–254; Auvo Kiiskinen, “Regional Economic Growth in Finland, 1880–1952,” *Scandinavian Economic History Review*, IX (1961), 83–104.

grain crops were the proximate causes of the other famines, in Ireland the culprit was the potato. The potato, in the growing of which Ireland had a comparative advantage due to its damp climate, produced twice as much food per acre as grain, but its low yield ratio and its perishability were decided disadvantages. In 1845, *phytophthera infestans*, a plant disease new to Europe, destroyed about one-third of the Irish potato crop, and, in the following year, most of it. After a season's remission, it also ruined the harvest of 1848. Excess mortality would persist for two or three years more in several regions. The Irish famine lasted longer than the other three and, relatively speaking, was the most devastating.⁸

AN ERROR-CORRECTION APPROACH “The Law of One Price” (LOP) stipulates that prices will often deviate from their equilibrium values, but properly functioning markets will arbitrage away significant deviations from equilibrium prices. Did markets in France during the 1690s, in Ireland during the 1840s, or in Finland during the 1860s work as posited by LOP? This study uses an error correction model (ECM) approach to test whether the reaction to emerging disequilibria was slower during a crisis than in normal times. The estimation involves the following simple and familiar representation of the error-correction model:

$$\delta P_{i,t} = a + b\delta P_{A,t} + cFAM1 + dP_{i,t-1} + eP_{A,t-1} + fFAM2 + gFAM3 + u_{it},$$

$$\begin{aligned} \text{where } FAM1 &= FAMDUM \cdot \delta P_{A,t} \\ FAM2 &= FAMDUM \cdot P_{i,t-1} \\ FAM3 &= FAMDUM \cdot P_{A,t-1} \end{aligned}$$

P is the log of price; A is Region A ; and i is any other region. Writing the model in this way offers the intuitive interpretation that agents adjust to $P_{i,t}$ from $P_{i,t-1}$ in response to changes in P_A (with b measuring the short-run effect). Moreover, the model posits the long-run relation $P_i = (e/d)P_A$. Changes in P_i are caused by shocks to P_A , and the extent to which the system is out of equilib-

8 Joel Mokyr, *Why Ireland Starved: An Analytical and Quantitative History of the Irish Economy 1800–1850* (London, 1985; orig. pub. 1983.); Ó Gráda, *Black '47 and Beyond: The Great Irish Famine in History, Economy and Memory* (Princeton, 1999); James S. Donnelly, Jr., *The Irish Potato Famine* (London, 2001); Austin Bourke, “The Visitation of God”: *The Potato and the Great Irish Famine* (Dublin, 1993); Sherwin Rosen, “Potato Paradoxes,” *Journal of Political Economy*, CVII (1999), S294–S313.

rium is represented by the lagged error correction term. Since P_A is expected to adjust upward if P_i is higher in the previous period, we expect $d < 0$. The ratio (e/d) measures the equilibrium ratio between P_i and P_A ; in the absence of transport and other transaction costs $d = e$.⁹

The impact of the periods of severest harvest failure and famine—1693/94 and July 1708 to June 1710—on the adjustment process is captured by the coefficients on the interaction terms FAM_1 , FAM_2 , and FAM_3 . The expression $c > 0$ would mean that markets were better synchronized during the crisis, whereas $f < 0$ and $g > 0$ would imply slower adjustment than in normal times.

The towns and cities included in the analysis of France are Paris, Toulouse, Angoulême, Grenade-sur-Garonne, Pontoise, Rozay-en-Brie, Albi, and Montbazon. Four of these places were significant centers at time: Paris had a population of about 0.5 million, Toulouse 40,000, Angoulême 10,000, and Albi 10,000. Toulouse and Paris would have had little or no trade in grain during this period, nor would Toulouse and Angoulême, though they were linked by navigable rivers and access to the major port city of Bordeaux. Three of the other pairs—Paris/Pontoise, Paris/Rozay, and Toulouse/Grenade—referred to markets within short distances of each other. Pontoise, a town of a few thousand people on the river Oise, was one of the main grain markets in the Paris basin; Grenade was only a short distance down-river from Toulouse. Rozay-en-Brie, in the heart of one of France's main grain-producing regions, also supplied the Paris market. Montbazon was a small market town about ten km from Tours. The choice of towns in this study was constrained by the need for monthly wheat price data.¹⁰

9 Cantillon, writing in the 1720s, was probably the first to denote the LOP as describing both an equilibrium condition and an adjustment process: "The price difference between the capital and the provinces must pay for the costs and risks of transport, or otherwise cash will be sent to pay the balance and this will go on until prices in the provinces reflect the level of these costs and risks" (Richard Cantillon, *Essai sur la nature du commerce en général* [Paris, 1997], 84). For a good introduction to ECM, see George Alogoskoufis and Ron Smith, "On Error Correction Models: Specification, Interpretation, Estimation," in Les Oxley, Donald A.R. George, Colin J. Roberts, and Stuart Sayer (eds.), *Surveys in Econometrics* (New York, 1995), 139–170. Before estimating an ECM, the individual price series had to be tested for stationarity. In every case, the hypothesis that the individual series had a unit root could be firmly rejected. Estimation with differences in the logs of prices and the gaps between the logs of price pairs produced results very like those reported herein.

10 The data (for which I am grateful to Weir and Jean-Michel Chevet) refer to market or *mercure* prices. Gaps were very few and these were plugged by simple interpolation.

The model yields the results described in Table 1, which are as might be expected about these markets in normal years. First, the b 's are all positive, ranging from 0.204 for Montbazou/Paris from 1680 to 1699 to 0.843 for Grenade/Toulouse from 1700 to 1712, and the d 's are all negative, ranging from -0.043 for Angoulême/Toulouse from 1680 to 1719 to -0.649 for Grenade/Toulouse from 1680 to 1699. Moreover, the spread of coefficient values is consistent with distance and communications. The closer the markets to each other, the stronger were the co-movements and the bigger the adjustments to disequilibria. Moreover, the values of d/e , representing the equilibrium price ratios between P_A and P_B , are broadly plausible: Prices were highest in the receiving areas. In addition, the c 's are mostly positive, in some cases emphatically so, and none of the negative c 's is statistically significant. Evidence of stronger co-movements during the famine months may reflect the power of the famine "signal" to the background noise. Eleven of the fourteen f 's in Table 1 are negative, indicating faster adjustment in crisis months. The values are weakly determined for the most part, however (as are the g 's), suggesting that responses varied little between normal and crisis years. Finally, dividing the forty-year period into two suggests that the reaction of wheat prices in 1709/10 was stronger than in 1693/94.

Table 2 reports the results of estimating the adjustments of six grain markets to price movements in Paris between 1680 and 1698 as a system of seemingly unrelated regressions (SURE). The standard Breusch-Pagan test emphatically rejects independence ($\chi^2(15) = 267.3$), but the outcome is basically as in Table 1, except that the coefficients are nearly always better determined. These French data imply markets that were better integrated than the historiography indicates, and fail to support the hypothesis that markets for grain performed "worse" during the two famines than in normal times.

The Finnish data refer to rye, then by far the most important of Finland's grain crops, from October 1858 to December 1873. Table 3 describes the seven of Finland's eight provinces with respect to price movements in the province Viipuri, using both single-equation and SURE estimation. Viipuri was chosen as a likely market leader because it was coastal, next to Russian markets, and therefore most likely to be the channel for outside market influ-

Table 1 Pairwise Error-Correction-Model Estimates

COEFFICIENTS	ANG/TOUL	GREN/TOUL	BAZ/TOUL	PONT/PARIS	BAZ/PARIS
a	0.203	-0.483*	-0.334*	-0.480*	0.461
b	0.269*	0.886*	0.245*	0.512*	0.164*
c	0.132	-0.007	0.312*	0.111	0.122*
d	-0.062*	-0.543*	-0.116*	-0.218*	-0.254*
e	0.031	0.574*	0.146*	0.251*	0.111*
f	-0.067	-0.236*	-0.194	-0.385*	0.041
g	0.091	0.236*	0.207*	0.383*	-0.016
N	395	395	395	227	227
F	18.6	209.8	27.0	64.3	17.8
COEFFICIENTS	ANG/TOUL	GREN/TOUL	BAZ/TOUL	PONT/PARIS	BAZ/PARIS
a	-0.020	-0.177	-0.357*	-0.478*	-0.002
b	0.235*	0.349*	0.787*	0.721*	0.380*
c	-0.003	0.224*	-0.034*	0.291*	-0.013
d	-0.055*	-0.195*	-0.645*	-0.492*	-0.393*
e	0.064	0.143*	0.648*	0.516*	-0.388*
f	0.013*	0.028	0.302*	-0.272	0.118
g	0.009*	0.076	0.357*	-0.272	-0.087
N	239	156	239	156	197
F	4.8	16.9	124.5	45.1	7.8
COEFFICIENTS	BAZ/TOUL	BAZ/TOUL	BAZ/ANG	BAZ/PARIS	
a	0.231	-0.510	0.206*	-0.348	
b	0.190*	0.241*	0.121	0.391*	
c	0.421*	0.255	-0.227	0.306	
d	-0.134*	-0.285*	-0.122*	-0.236*	
e	0.088*	0.281*	0.087	0.252*	
f	-0.365*	-0.023	0.019	-0.302*	
g	0.401*	0.086	0.495*	0.348*	
N	239	156	239	156	
F	17.2	15.4	5.4	23.1	

* significant at the 1% level.

NOTES Ang = Angoulême; Baz = Montbazon; Par = Paris; Pont = Pontoise; Gren = Grenade; Toul = Toulouse; Alb = Albi; n = 239 (1680–1699); n = 227 (1680–1698); n = 395 (1680–1712); n = 156 (1700–1712); n = 197 (1696–1712).

ences. Again, separate estimation and SURE yield similar outcomes, though the Breusch-Pagan test rejects independence even more emphatically ($\chi^2(21) = 613.3$) than in the French case, and estimation is consequently more efficient. As in France nearly two centuries earlier, prices were more synchronized during the famine

Table 2 Comparing SURE and Separate-Estimation Results

	FRANCE (1680-1698)			
	SURE ESTIMATION (ML)		SEPARATE ESTIMATION (OLS)	
	COEF.	Z	COEF.	T
Angoulême				
a	-0.116	-0.75	-0.120	-0.76
b	0.143	2.62	0.140	2.52
c	-0.108	-1.73	-0.106	-1.67
d	-0.115	-4.60	-0.095	-3.52
e	0.101	3.87	0.086	3.14
f	0.080	1.67	0.069	1.35
g	-0.075	-2.31	-0.064	-1.87
Grenade				
a	0.379	2.16	0.167	0.94
b	0.070	1.14	0.058	0.95
c	0.259	3.68	0.259	3.70
d	-0.192	-6.05	-0.099	-2.81
e	0.082	3.66	0.046	1.98
f	-0.160	-2.39	-0.113	-1.52
g	0.089	2.33	0.060	1.43
Toulouse				
a	0.624	3.15	0.349	1.73
b	0.066	0.99	0.0/9	0.77
c	0.214	2.76	0.4/2	2.45
d	-0.195	-5.95	-0.0/5	-3.11
e	0.070	2.93	0.0/9	1.75
f	-0.106	-1.49	-0.1/9	-0.11
g	0.060	1.44	0.1/7	0.07
Montbazou				
a	0.502	3.02	0.461	2.72
b	0.165	2.94	0.164	2.89
c	0.135	2.06	0.122	1.83
d	-0.263	-5.71	-0.254	-5.19
e	0.113	4.08	0.111	3.85
f	-0.030	-0.32	-0.041	0.41
g	0.025	0.46	0.016	-0.27
Pontoise				
a	-0.481	-2.33	-0.480	-2.29
b	0.526	6.60	0.512	6.30
c	0.096	1.06	0.111	1.20
d	-0.257	-4.74	-0.218	-3.58
e	0.286	5.31	0.251	4.22
f	-0.352	-4.29	-0.385	-4.31
g	0.353	4.40	0.383	4.40

Table 2 Continued

	FRANCE (1680-1698)			
	SURE ESTIMATION (ML)		SEPARATE ESTIMATION (OLS)	
	COEF.	Z	COEF.	T
Rozay				
a	-0.373	-2.31	-0.439	-2.63
b	0.331	5.55	0.354	5.76
c	0.066	1.00	0.043	0.63
d	-0.106	-1.79	-0.164	-2.49
e	0.122	2.20	0.174	2.84
f	-0.388	-5.53	-0.342	-4.44
g	0.343	5.62	0.304	2.63

Table 2a Correlation Matrix of Residuals in SURE Estimation

	DGREN	DBAZ	DTOUL	DPONT	DANG	DROZ
dgren	1.0000					
dbaz	0.2473	1.0000				
dtoul	0.7659	0.2876	1.0000			
dpont	0.1197	0.1339	0.1225	1.0000		
dang	0.3384	0.1114	0.3148	0.0974	1.0000	
droz	0.0859	0.0418	0.0246	0.3909	-0.0395	1.0000

NOTE Breusch-Pagan test of independence: $\chi^2(15) = 267.25$; $Pr = 0.0000$.

than during other periods. The case for slower responses during the famine is rejected by the generally small and weakly determined values of f and g .¹¹

Though the Irish famine was due to the failure of the potato, the behavior of grain markets is nevertheless of interest. Indian meal (or maize) and oatmeal were the closest substitutes for the potato. Contemporary critics accused grain merchants of taking undue advantage of the situation and of making enormous profits through overcharging. Data on grain and oatmeal prices in Ireland are plentiful. Estimating a variant of the ECM described above with weekly oats prices between early June 1846 and the end of 1847

¹¹ Elsewhere I examine the outcome of treating Vaasa as market leader and the reaction of prices in the remote northern province of Oulu to movements in the other seven provinces. See Ó Gráda, "Markets and Famines: Evidence from Nineteenth-Century Finland," *Economic Development and Cultural Change*, XLIX (2001), 575-590. The outcome corroborates the results reported in Table 3.

Table 3 Error-Correction-Model Estimates for Finnish Provinces (1858–1873)

	SURE ESTIMATION (ML)		SEPARATE ESTIMATION (OLS)	
	COEF.	Z	COEF.	T
Oulu				
a	0.280	-0.30	0.360	0.39
b	0.474	3.79	0.463	3.66
c	0.980	3.96	0.876	3.46
d	-0.153	-3.72	-0.127	-2.58
e	0.159	2.79	0.127	1.98
f	-0.204	-2.60	-0.101	-1.10
g	0.224	2.49	0.104	1.00
Vaasa				
a	0.225	0.40	-0.058	-0.10
b	0.331	4.37	0.327	4.32
c	0.462	3.08	0.376	2.49
d	-0.117	-5.41	-0.073	-2.81
e	0.111	3.57	0.078	2.28
f	0.061	0.90	0.200	2.43
g	-0.071	-0.97	-0.223	2.53
Mikkeli				
a	-2.376	-2.75	-2.340	-2.62
b	0.462	4.34	0.464	4.28
c	0.716	3.46	0.726	3.43
d	-0.250	-5.33	-0.276	-5.33
e	0.350	5.39	0.376	5.33
f	-0.236	-1.59	-0.162	-0.98
g	0.231	1.52	0.154	0.91
Uusimaa				
a	-0.080	-0.13	0.171	0.28
b	0.441	5.38	0.375	4.43
c	0.463	2.96	0.504	3.16
d	-0.265	-6.15	-0.137	-2.37
e	0.266	5.18	0.128	1.95
f	-0.276	-2.68	-0.345	-2.55
g	0.337	3.00	0.401	2.72
Kuopio				
a	-0.041	-0.06	0.018	0.03
b	0.424	4.78	0.414	4.58
c	1.253	7.34	1.267	7.29
d	-0.224	-5.27	-0.198	-4.01
e	0.236	4.90	0.207	3.83
f	0.046	0.58	0.082	0.91
g	-0.062	-0.74	-0.100	-1.06

Table 3 Continued

	SURE ESTIMATION (ML)		SEPARATE ESTIMATION (OLS)	
	COEF.	Z	COEF.	T
Turku				
a	1.260	1.87	1.139	1.70
b	0.349	3.82	0.340	3.73
c	0.556	2.98	0.340	1.76
d	-0.217	-6.63	-0.169	-3.76
e	0.165	4.02	0.123	2.44
f	0.107	1.81	0.246	3.06
g	-0.094	-1.41	-0.261	-2.93
Häme				
a	-0.598	-0.52	0.004	0.00
b	0.647	4.10	0.581	3.60
c	0.964	3.14	0.846	2.68
d	-0.370	-8.13	-0.288	-4.62
e	0.390	5.57	0.285	3.31
f	-0.166	-1.48	-0.005	-0.03
g	0.196	1.62	0.021	0.13

Table 3a Correlation Matrix of Residuals

	DOUL	DVAAS	DMIK	DUUS	DKUOP	DTURK	DHÄM
doul	1.0000						
dvaas	0.4798	1.0000					
dmik	0.1771	0.3397	1.0000				
duus	0.4421	0.4287	0.3412	1.0000			
dkuop	0.4574	0.3825	0.2462	0.3398	1.0000		
dturk	0.3454	0.5561	0.2428	0.5554	0.3894	1.0000	
dhäm	0.2276	0.4227	0.2446	0.6014	0.2474	0.7014	1.0000

NOTE Breusch-Pagan test of independence: $\chi^2(21) = 647.356$; $Pr = 0.0000$.

indicates strong co-movements and quick adjustment to disequilibria. A comparison of the cities Cork and Dublin, for example, implies that more than half of the response to a change in the Dublin price occurred within two weeks. A comparison of movements in the price of oats in Dublin and Cork with those in London over a longer period also implies the rapid erosion of disequilibrium gaps.¹²

Considering the evidence of this section as a whole, the out-

¹² Ó Gráda, *Black '47*, 141-143.

come is broadly supportive of well-integrated markets both in normal and famine times. Co-movements between pairs of markets continued to be strong in crisis years, and, in general, the speed of adjustment was as fast.

A SPATIAL PERSPECTIVE The LOP states that in a well-integrated market, persistent price differences between regions stem largely from transport costs. Let T be a vector of the (constant) costs of shipping grain from a region to the most expensive region, and P_N and P_F be vectors of normal and famine grain prices, respectively. Then the LOP implies that in equilibrium, the standard deviation of prices across regions, s , will reflect T . Normally P_F will exceed P_N : Such was certainly the case generally herein. Thus, unless T changes, in well-functioning markets, arbitrage will produce $\sigma(P_F) < \sigma(P_N)$. Alternatively, the coefficient of variation in prices (CV) should fall during famines. Note, however, that the bad weather often associated with famine conditions (for example, France in 1708/9, Finland in 1868, or Ireland during the winter of 1846/47) might increase T , as would the disruption of trade by legislation or “moral economy” forces. To find no, or little, rise in the spatial spread of prices during famines would be consistent with markets not becoming segmented.¹³

The contrasting outcomes in the maize markets of Botswana and Kenya during crises of the early 1980s are noteworthy in this context. In Botswana, where the average price of maize meal rose from 3.53 to 4.74 pula per bag between August 1980 and April 1983, the coefficient of variation across eighteen markets fell from 0.07 to 0.05. In Kenya, however, where the average retail price of maize rose from 2.42 to 4.61 Kenyan shillings per kilo between January and November 1984, the coefficient of variation across eighteen markets trebled from 0.15 to 0.45.¹⁴

Regional price data are available for all four famines described herein. Coefficients of variation for those famines, for those in Kenya and Botswana, and for two others are given in Table 4.

13 For a simple example of LOP, see Ó Gráda, “Markets and Famines: A Simple Test with Indian Data,” *Economic Letters*, LVII (1997), 241–244.

14 The Kenyan data derive from Drèze and Sen, *Hunger and Public Action*, 144, 155. Drèze and Sen are highly critical of “the detrimental effects” of trade restrictions in Kenya “on the entitlements of vulnerable groups in drought-stricken areas,” which they contrast with the effectiveness of the “highly competitive retail network” operating in Botswana.

First, annual data on a broad cross-section of French towns and cities were consulted for insight into whether grain markets became more or less segmented during the famines of 1693/94 and 1709/10. Note that even in normal times, the coefficients of variation were high. A disruption of normal patterns in times of crisis is suggested by the impact on the correlation between wheat prices in the forty towns in year t and year $t+1$. From 1671 to 1750, the average year-to-year correlation was $+0.797$, with a standard deviation of 0.152 . However, the correlation plummeted from $+0.770$ in 1692/93 to $+0.322$ in 1693/94 and $+0.392$ in 1694/95 before recovering to $+0.722$ in 1695/96. It dropped from $+0.950$ in 1706/7 to $+0.271$ and $+0.233$ in the following two years, rising to $+0.599$ again in 1709/10. The coefficients of variation of wheat prices rose both in 1693/94 and in 1709. The implied disruption of markets was greater during the famine of 1709 than in 1693/94; in both cases it was minor compared to that in Kenya during the 1980s.¹⁵

In the case of Ireland, most of the potatoes grown there before the famine were for domestic or local consumption. One of the potato's disadvantages was its relative costliness to transport; Hoffman and Mokyr reckon that one-fourth of the potato's value "evaporated" with every ten miles that it traveled. Nevertheless, Ireland enjoyed an active local trade in potatoes before the famine, and most towns had their potato markets.¹⁶

Table 4 reports evidence from two sets of regional prices. The first summarize data contained in a parliamentary report on potato prices in almost 400 Irish towns between 1840 and 1846. The numbers are not ideal for our purpose, because they extend only as far as the harvest of 1845, the first to be affected by blight. More-

15 The underlying database for France, which was kindly supplied by Weir, refers to forty towns and cities. For details, see Chevet and Ó Gráda, "Grain Prices and Mortality: A Note on La Michodièrre's Law," *European Journal of the History of Economic Thought* (forthcoming). Across the eight statistical provinces that constituted the Kingdom of Prussia in 1871, the coefficient of variation of wheat prices averaged 0.074 from 1841 to 1870 and that of rye prices 0.117 (estimated from Royal Statistical Bureau, "Durchschnittspreis in den Kalenderjahren 1816 bis 1870," *Zeitschrift des Königlich Preussischen Statistischen Bureaus* [Berlin, 1871], XI, 235–243). Ó Gráda and Chevet, "Market Segmentation and Famine in *ancien régime* France," *Journal of Economic History*, LXII (2002), 706–733.

16 Elizabeth Hoffman and Mokyr, "Peasants, Potatoes and Poverty: Transactions Costs in Prefamine Ireland," in Gary Saxonhouse and Gavin Wright (eds.), *Technique, Spirit and Form in the Making of the Modern Economy: Essays in Honor of William N. Parker* (Greenwich, Conn., 1984), 115–145.

Table 4 The Spatial Variation in Prices

LOCATION	DATES	CV
Finland (Rye)	1859–64	0.049
	<i>1867–68</i>	<i>0.049</i>
	1870–73	0.059
Ireland (Potatoes)	1840–45	0.32
	<i>1846</i>	<i>0.29</i>
Ireland (Potatoes)	<i>1848</i>	<i>0.12</i>
	1849–51	0.18
France (Wheat)	1690–93	0.287
	<i>1694–95</i>	<i>0.438</i>
	1696–99	0.230
France (Wheat)	1705–08	0.352
	<i>1709–10</i>	<i>0.438</i>
	1711–14	0.234
France (Wheat)	1736–39	0.220
	<i>1740</i>	<i>0.391</i>
	1741–44	0.315
Botswana (Grain)	Aug. 1980	0.07
	<i>Apr. 1983</i>	<i>0.05</i>
Kenya (Grain)	Jan. 1984	0.15
	<i>Nov. 1984</i>	<i>0.45</i>
Germany (Potatoes)	<i>1816–17</i>	<i>0.356</i>
	1818–27	0.186
Germany (Rye)	<i>1816–17</i>	<i>0.311</i>
	1818–27	0.158
Germany (Wheat)	<i>1816–17</i>	<i>0.188</i>
	1818–27	0.099
India (Rice)	1938/9–1942/3	0.210
	<i>1943/4</i>	<i>0.337</i>
India (Wheat)	1938/9–1942/3	0.152
	<i>1943/4</i>	<i>0.234</i>

NOTE Famine years are italicized.

over, because they refer to the highest prices paid, they may not fully reflect a range of qualities and varieties across the country. In mitigation, however, because they refer to the prices paid in a single week in January, they have the advantage of controlling for seasonal variation. In general, the observed interregional price gaps are smaller than what transport costs would indicate, suggesting

that trade in potato substitutes, such as grain, helped to arbitrage away disequilibrium differences.

The second data set refers to a different, smaller sample of towns with potato markets. It includes 1848, when the ravages of blight were particularly severe. The standard deviations in the two panels are not strictly comparable. However, the coefficient of variation was lower in 1846 than in the preceding years, and in 1848 lower than in the years immediately following—a state of affairs seemingly more consistent with orderly than with segmented markets in the wake of the blight.¹⁷

Two features of the Finnish data in Table 4 are apparent—the low coefficients of variation throughout, and the rise in the coefficient of variation during the famine of 1867/68. In Finland, both before and after the famine of 1867/68, grain prices were normally highest in the northern provinces of Oulu and Kuopio, the mean price of rye in Oulu being on average 10 to 15 percent higher than that in Vaasa or Häme. However, during the famine years, the proportionate price rises were greatest in the southwest, and, as a result, levels in Uusimaa, Turku, and Häme provinces were exceeded only by those in Oulu. The severe harvest shortfalls in the southwest in 1867/68 may account for the increases, and the poverty of Kuopio and Oulu for the failure of prices in those provinces to rise in tandem. In Kuopio and Oulu, an entitlements' failure may have compounded the problem caused by poor harvests. However, the widening gap between prices in the southwest and in Viipuri (Viborg) in 1867/68 leaves unresolved the question why more grain did not flow west from Viipuri during the famine.¹⁸

The 1870–1873 data in Table 4 show the earlier pattern re-establishing itself again in the wake of the famine. In normal times, small interprovincial movements in grain seem to have been enough to maintain the pattern observed before and after 1867/68. At the height of the crisis, however, interprovincial trade or imports from outside Finland may have been insufficient to maintain

17 Far greater segmentation between regional markets for potatoes in bad years is suggested by early nineteenth-century German data. Across Prussia's eight statistical regions, the coefficient of variation of potato prices during the famine of 1816/17 was double the average from 1818 to 1827 (estimated from data in Royal Statistical Bureau, *Zeitschrift*, XI, 235–243).

18 Kaukiainen, "Harvest Fluctuations."

the kind of equilibrium price vector assumed in our model. Indeed, some interprovincial flows may have been reversed. The lack of data on internal trade and the cost of transport preclude firm conclusions on this score.¹⁹

Thus did these European famines involve rises, albeit modest ones, in the regional variation in prices during crises relative to immediately preceding or succeeding years. The fivefold rise in the standard deviation of prices across Kenya during 1984 offers some perspective, as does the situation in what would later become Germany-Prussia in 1816/17, during what Post dubbed “the last great subsistence crisis in the Western world.” At the time, poor harvests led to high prices and excess mortality in northern and western Germany, while harvests in East Prussia were bountiful. However, trade between different parts of Germany-Prussia was far from free: In List’s oft-cited account, “numerous customs barriers cripple[d] trade and produce[d] the same effects as ligatures which prevent the free circulation of the blood.” Under the circumstances, the spatial variation in prices was bound to increase. As Table 4 makes plain, the coefficient of variation of potato and rye prices across Prussia’s eight statistical regions during the famine of 1816/17 was double the average of that from 1818 to 1827.²⁰

Similarly, in 1943/44, during India’s Great Bengali Famine, the coefficient of variation of India’s rice prices increased sharply above the average of preceding years (from 0.210 to 0.337). Only part of this rise, however, was due to the near quadrupling of Calcutta’s prices in 1943/44 (without Calcutta the numbers are 0.219 and 0.299). The price of rice was also high in Delhi and in Dibrugarh (North West Frontier Province) in 1943/44. The varia-

19 An alternative scenario is also plausible (compare Mette Ejrnaes and Persson, “Market Integration and Transport Costs in France 1825–1900: A Threshold Error Correction Approach to the Law of One Price,” *Explorations in Economic History*, XXXVII [2000], 149–173). The interprovincial differences in grain prices before 1867 seem to have been much smaller than those suggested by transport costs, perhaps because in normal years, other goods substituted for grain shipments between the provinces and labor were less expensive to move than grain. If so, a crisis-induced rise in grain shipments between regions might well have increased the spatial variation in prices.

20 John D. Post, *The Last Great Subsistence Crisis in the Western World* (Baltimore, 1977). Friedrich List’s account is cited in William O. Henderson, *The Zollverein* (London, 1984; orig. pub. 1939), 22–23. The data in Table 4 derive from Royal Statistical Bureau, *Zeitschrift*, XI, 235–243.

tion in wheat prices across ten markets, excluding Bengal, also rose in 1943/44.²¹

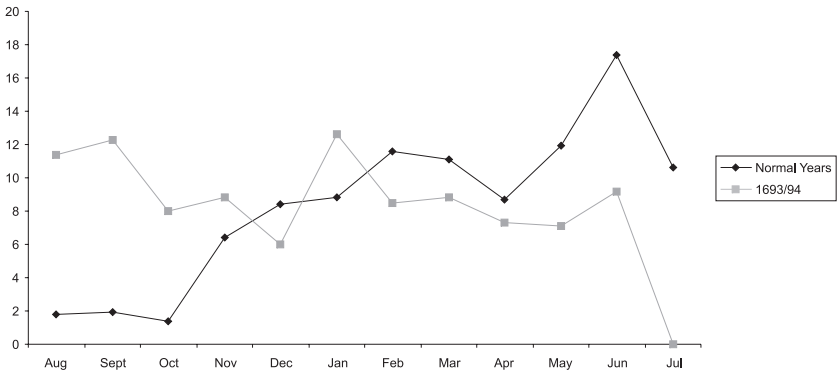
SEASONALITY AND STORAGE Smith believed that corn (wheat and rye) merchants were best placed “to divide the inconveniencies of [a scarcity] as equally as possible through all the different months, and weeks, and days of the year.” The findings of Sen, Ravallion, and others suggest that, on the contrary, speculative hoarding can exacerbate famine situations. Their findings suggest an asymmetry in speculators’ expectations about the state of the harvest; they tend to be too pessimistic when there is a harvest shortfall. Hard historical evidence on storage is scarce. But in normal years, a farm like the Chartiers’, a large-scale family-run enterprise at Choisy, near Paris, would be expected to work with grain merchants to produce something akin to consumption smoothing throughout the season—in the case at hand, small off-farm disposals between July and November. Figure 1 compares monthly off-farm corn sales in normal harvest-years and in 1693/94 shows the Chartiers disposing of *more* of their corn in the early months of the famine harvest-year than in normal seasons. This strategy is hardly consistent with hoarding. Alas, one Chartier swallow does not make a summer, and farm records as rich as theirs are the exception.²²

An insight associated with McCloskey and Nash, though traceable to a 1957 paper by Samuelson, sheds further light on the role of hoarding during the famines analyzed herein. McCloskey and Nash sought to infer storage costs and interest rates in medieval and early modern Europe from the seasonality patterns observed in grain prices. Their argument followed from the simple premise that those merchants and farmers who store grain must in equilibrium be rewarded for the opportunity cost of tied-up funds and losses from wastage during the storage period. A saw-tooth price seasonality pattern is indicated, in which low prices in the wake of a harvest give way gradually to a maximum before a new harvest occurs. The more important seasonal costs are the fixed

21 The rice prices refer to the twelve markets reported in Henry Knight, *Food Administration in India, 1939–47* (Stanford, 1954). The wheat prices exclude Cuttack (Orissa Province), for which there is no data in 1943/44. On high prices in Delhi and Dibrugarh, my source is Knight, *Food Administration*, 308.

22 Smith, *Wealth of Nations*, 533–534; Sen, *Poverty and Famines*; Ravallion, *Markets and Famines*; Jean-Marc Moriceau and Gilles Postel-Vinay, *Ferme, entreprise, famille: grande exploitation et changements agricoles, XVII^e-XIX^e siècles* (Paris, 1992), 225–226.

Fig. 1 Sales of Wheat at Choisy in the 1690s (Monthly Percentages)



SOURCE Jean-Marc Moriceau and Gilles Postel-Vinay, *Ferme, entreprise, famille: grande exploitation et changements agricoles, XVIIe-XIXe siècles* (Paris, 1992), 226.

ones, such as for storage facilities and security, which are less sensitive to increases in the quality of the harvest. Hence, abstracting from other complications, well-functioning market seasonality would at most produce the same proportionate increases in prices in bad years as in good.²³

Suppose that during a famine, hoarding by some farmers reduced the proportion of the crop delivered to market after harvest to a proportion less than that in non-crisis years. Prices would rise proportionately early in the season, and fall disproportionately between then and when the following harvest's crop was imminent. Thus, lower-than-normal seasonal price rises during the crisis might indicate that producers were holding onto stocks in hopes of much higher prices at the end of the season. On the other hand, a seasonal price rise faster than usual could reflect either the desperation of consumers or the fear of producers that their food stocks might deteriorate (see below) or be requisitioned. Hoarding during famines, in other words, implies smaller increases than usual from seasonal trough to peak.

In reality, this presumption is complicated by the presence of

23 Donald N. McCloskey and John Nash, "Corn at Interest: The Extent and Cost of Corn Storage in Medieval England," *American Economic Review*, LXXIV (1984), 174–187; Paul A. Samuelson, "Intertemporal Price Equilibrium: A Prologue to a Theory of Speculation," *Weltwirtschaftliches Archiv*, LXXIX (1956), 181–219.

carry-over stocks of grain from one harvest to the next; in practice, there is considerable variation or “noise” in the month-to-month and seasonal movements. Table 5 compares the average rises in wheat prices between September in year t (at the beginning of the harvest year) and June in year $t+1$ (before prices are affected by the next harvest) in eight French towns between the 1680s and the 1710s. The outcome shows only weak traces of the seasonality pattern noted by McCloskey and Nash. On average, prices rose a little over the season, but they were subject to huge year-to-year variation. In the famine years of 1693/94 and 1708/9, however, the rises greatly exceeded the average, in 1708/9 soaring two or more standard deviations above it. The particularly sharp seasonal price rises during the two famines do not support the view that farmers or others hoarded early in the season in the hope that prices would rise later.²⁴

Table 6 compares Finland’s average rises in rye and barley prices between September in year t and June in year $t+1$ during “normal” years (1859/66 and 1869/73) and during the famine year of 1867/68 in rural districts belonging to the provinces of Oulu, Uusimaa, Vaasa, Kuopio, and Mikkeli. The outcome shows the seasonality pattern noted by McCloskey and Nash. In the average “normal” year, both rye and barley prices were about 10 percent higher in June than in the previous September, but the rise was subject to considerable year-to-year variation. Nevertheless, the rises during the famine year of 1867/68 were exceptional—double to treble the average, and double to quadruple the standard deviation of price rises in other, non-famine years. These sharp increases do not rule out the possibility that farmers or others hoarded early in the season in hopes that price would rise later, but surely they make it less likely.

Potatoes seem an ideal crop for this kind of simple framework, since they had no carry-over from one year to the next. Indeed, before the Irish Famine, the prices of different potato varieties before the crisis were subject to marked seasonality. Moreover, the seasonal rise in prices was *greater* during the crisis than in normal times. Although this fact does not rule out speculation or hoarding on the part of potato suppliers, it certainly argues in that

24 On the considerable noise in seasonal movements, see, for example, Persson, *Grain Markets*.

Table 5 The Seasonal Rise in Wheat Prices, 1680–1719, Monthly Data

	PARIS*	ANGOULÊME	ROZAY	TOULOUSE	M'BAZON [#]	PONTOISE	GRENADE
Mean increase (%)	0.9	10.8	2.4	7.3	13.7	7.6	12.2
Standard deviation	28.1	35.9	49.0	28.8	49.2	47.4	31.1
Increase in 1692/93 (%)	80.4	27.0	44.7	37.0	22.5	84.6	39.1
Increase in 1693/94 (%)	21.5	29.8	40.4	53.1	50.0	40.0	61.8
Increase 1708/9 (%)	—	171.8	256.5	108.9	248.1	242.7	112.5

* 1680/98.

1680–1715, 1698/99 missing.

Table 6 The Sept.-June Rise in Rye and Barley Prices in Finland

	OULU	UUSIMAA	VAASA	KUOPIO	MIKKELI
Rye					
Mean increase (%)*	9.6	8.1	11.3	12.2	13.8
Standard deviation*	13.0	9.2	8.3	11.9	13.1
Increase in 1867-8 (%)	22.9	31.5	29.0	38.1	43.7
Barley					
Mean increase (%)*	14.6	7.2	15.1	12.2	13.0
Standard deviation*	14.4	7.0	10.9	10.0	7.3
Increase in 1867-8 (%)	40.9	30.4	56.4	38.1	39.9

* Excluding 1867/68

direction. In these data, actions speak louder than intentions, but it seems clear that some traders sold quickly for fear that their supplies would not keep. In corroboration of price data, Cork city newspaper reports referred to the quantities of potatoes traded in six city markets between 1842 and 1848. On the eve of the famine, the outcome reveals a market that spread sales well over a harvest season beginning in early autumn. Comparing the pattern in 1845/46, after the first attack of potato blight, with those in 1842/43, 1843/44, and 1844/45 indicates that the proportion of sales early in the season was higher than before. In 1846/47, sales were again proportionately higher early in the season.²⁵

This article began with Smith's assertion that in the two centuries prior to 1776, no famine had arisen in "any part of Europe . . . but for the violence of government attempting, by improper means, to remedy the inconveniences of a dearth." However, the French famines of 1693/94 and 1708-1710, the famine in Ireland during the 1840s, and that in Finland during the 1860s represent cases in which the catastrophic nature of harvest failures overwhelmed functioning markets. Any blame incurred by the state would be for inadequate entitlement transfers from rich to poor, not for undue meddling with food markets. Oddly, Smith, for all his allegedly wide reading, ignored the major French famines of 1693/94 and 1709/10, even though he claimed to have "pretty exact accounts" of several dearths and famines. Whether a better under-

25 Ó Gráda, *Ireland Before and After the Great Famine: Explorations in Economic History* (Manchester, 1993; orig. pub. 1988), 116-121; *idem*, *Black '47 and Beyond*, 147-149.

standing of the history of European famines would have caused him to modify his position must remain a moot point.²⁶

During these famines, markets worked more smoothly than might have been expected on the basis of a reading of qualitative and impressionistic accounts. Though a spatial perspective on grain prices produced some evidence of slightly greater segmentation of markets during the famines, an error-correction approach to regional price movements shows that in every case, the short-run effect captured by the co-movement of grain prices was more powerful during the famines than during otherwise normal harvests. It also yielded strong evidence of a quicker-than-normal response to emerging disequilibria. Moreover, the data failed to support the claim that hoarding was more common during the famines than in normal years.

Taken together, the results of this study do not rule out a further role for markets in exacerbating these crises. As Sen wrote, decreased purchasing power in the worst-affected regions could have aggravated one or more of the crises because markets were so well integrated. Markets were not panaceas; even if they worked like clockwork, they could not have overridden mismatches between entitlements and market positions. These fundamental issues are often obscured by an undue focus on the functioning of markets. Even though the issue of why market responses in pre-industrial Europe differed so much from those in twentieth-century southern Asia or Africa remains largely unsettled, it would seem that a restricted agriculture, further hampered by inadequate policy responses from authorities, rather than a failure of the markets for food staples, was mainly responsible for famine.

26 Smith, *Wealth of Nations*, 526.

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