

Economic Crises and the European Revolutions of 1848*

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Abstract

Recent historical research tends to view the 1848 revolution in Europe as caused by a surge of new liberal ideas and by long-term socioeconomic problems.

However, many contemporary observers interpreted much of what was going on as a consequence of the serious shortfall in food supply that had shaken large parts of the continent in 1845-47, and the subsequent economic slump, i.e. short-term causes. Applying standard quantitative methods to a dataset of 27 European countries, we show that it was mainly economic misery and the fear thereof that triggered the European revolutions of 1847/48.

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Introduction

In the 1990s, the acceleration of economic and political integration in Western Europe and the democratization of Eastern Europe led to an increasing interest in the turbulent years of 1848/49, when large parts of the continent experienced a striving for political participation and self-determination.¹ The recent anniversary year gave rise to a wealth of literature, especially in countries for which the revolution of 1848 meant a first step towards more democratic political institutions, for instance in countries such as Germany, Austria, Hungary, or Romania. Many of these studies reflect the trend in historiography from social history to cultural history. Whereas in the 1970s and 1980s long-term *and* short-term socioeconomic determinants played a pivotal role in explaining the 1848 revolutions, short-term economic factors tend to be marginalized in recent publications. To be sure, even after the culturalistic turn most historians concede that long-term structural socioeconomic problems contributed to rising popular discontent, but surprisingly few authors stress the importance of the deep economic crisis that immediately preceded the revolutionary events. Instead, many attribute much of the revolutionary activity to the spread of liberal and democratic ideas among Europeans. This is true for a number of monographs, which mention short-run economic factors not at all or only in passing, as well as for many edited volumes, which often do not contain a single paper on the economic crisis preceding the events of 1848.² To some extent

¹ See, e.g., Kaelble, "Viele nationale Revolutionen".

² We systematically checked monographs and paper collections covering the 1848 revolution on a national level in English, German, and Latin languages published since the mid 1990s for discussions of short-term socioeconomic developments such as the increase of food prices 1845-47 or the economic downturn 1846-48 preceding the 1848 turmoils. Höbelt, *1848*, and

this is also true for an alternative view that points towards the inflexible and increasingly outdated political institutions of the time, which were ill suited to cope with the societal problems of early industrialization. Issues at stake were the material deprivation of large parts of the rural population (pauperism) and state intervention in individual affairs, for instance, through the military draft system and discretionary taxation.³

Bruckmüller and Häusler, *1848*, who analyze the revolution in Austria, do not discuss economic factors at all. Neither do Schroeder, *Transformation*, or Broers, *Europe*, or the contributions on Hungary in Fischer, *Ungarische Revolution*. In the account of Judson, *Wien*, of the revolution in Austria socioeconomic factors are rarely mentioned. For Switzerland, the contributions in Hildbrand and Tanner, *Zeichen*, do not refer to economic factors. Some of the work on Switzerland collected in Ernst, Tanner, and Weishaupt, *Revolution*, does mention economic factors, but economic factors are not found causal for the revolution. Even in the abundant German anniversary literature the economic crisis is almost totally neglected. See Dipper and Speck, *1848*, Dowe, Haupt, and Langewiesche, *Europa 1848*, Gall, *1848*, Hardtwig, *Revolution*, Jansen and Mergel, *Revolution*, Lill, *Revolution*, Mommsen, *Ungewollte Revolution*, Rill, *1848*, Timmermann, *1848*, and Langewiesche, *Revolutionen*. Notable exceptions are Sperber, *European Revolutions*, Hahn, "Sozioökonomische Ordnung", Hein, *Revolution*, Lévêque, *Ébranlement*, and Stürmer, *Crise*. In contrast, earlier accounts of the 1848 revolutions analyzed long and short-term socioeconomic factors in great detail, see, e.g., Stearns, *Revolutions*, pp. 11-35, Charles, Louise, and Richard Tilly, *Rebellious Century*, Siemann, *Deutsche Revolution*, Pinkney, *Decisive Years*, Wehler, *Deutsche Gesellschaftsgeschichte*, pp. 681f., and Price, *Revolutions*, pp. 7, 24-26.

³ For an overview, see Sperber, *European Revolutions*, pp. 47-49.

However, while ideas and institutions undoubtedly contribute to our understanding of the necessary preconditions for the European revolutions of 1848, they fail to explain the timing, simultaneity, or regional distribution of the events. Here a more economic perspective might be helpful. Many contemporary observers interpreted much of what was going on as a direct consequence of the serious shortfall in basic food supplies that had shaken the continent in 1845-47 and triggered famine and hunger riots throughout Europe, especially in Ireland, Flanders, and Silesia.⁴ A radical variant of this argument interprets the revolutions of 1848 in the broader context of class conflicts – a view championed by Karl Marx and Friedrich Engels and later refined by Jürgen Kuczynski.⁵ However, this materialistic view is by no means confined to Marxist historiography. Another early example is Ernst Engel, the well-known nineteenth-century Prussian statistician, who maintained that the economic crisis was what "triggered the bomb" in many parts of Europe.⁶ This strong emphasis on economic factors is also reflected in one strand of the Anglo-Saxon literature, ranging from W.W. Rostow, Eric Hobsbawm, and George Rudé to Charles, Louise, and Richard Tilly.⁷ It is supported by a number of empirical studies of social disorder in the 1840s, which stress the importance of economic motives.⁸ For France, Ernest Labrousse explicitly linked the revolutions of 1789,

⁴ Sigmann, *1848*, pp. 183-85.

⁵ Kuczynski, "Wirtschaftliche und soziale Voraussetzungen."

⁶ Engel, "Getreidepreise," p. 251 (our translation).

⁷ Rostow, *British Economy*, Hobsbawm, "Economic Fluctuations", Rudé, "Why was there no Revolution", Charles, Louise, and Richard Tilly, *Rebellious Century*, Richard Tilly, *Zollverein*. Also see Stearns, *Revolutions*, pp. 32-35, Price, *Revolutions*, pp. 17-22, and Sperber, *European Revolutions*, pp. 105-07.

⁸ See, e.g., R. Tilly, "Popular Disorders," pp. 11-20, Bergmann, "Ökonomische

1830, and 1848 with changes in agricultural output and prices.⁹ However, the disillusion with empirical social history and the subsequent ascendancy of cultural history has led to a curious neglect of the short-term economic crises of 1845-48.

By contrast, our findings suggest that it is precisely the analysis of the pre-revolutionary economic crises that is most helpful in explaining the timing, simultaneity, and regional distribution of the European turmoil of 1848. In other words, even though ideas and institutions undoubtedly shaped the events of the late 1840s, it was economic misery and the fear thereof that triggered the European revolutions. This resurrection of the economic view of the 1848 revolutions is based on the high correlation between the geographic distribution of economic distress and political turbulence across Europe. In fact, after identifying the countries that were hit by a significant food supply shock in 1845-47 and discussing evidence of a propagation mechanism that prolonged the crisis well into 1848, we find that there is an almost perfect geographical match between economic crises and revolutionary activities throughout Europe. We also show that institutions, namely the existence or absence of a repressive political regime, while adding little to the explanation of the occurrence of revolutionary activity, had a significant influence on the form such activity took. Revolutions tended to be more violent if the regime was repressive.

The paper proceeds as follows. Section 2 investigates the size and significance of the grain price shock which hit most European countries in the second half of the 1840s. To grasp the extent to which these shocks were indeed unexpected, we estimate the forecast errors of standard adaptive expectations models for a dataset encompassing wheat prices for 27 countries between 1820 and 1850. It turns out that most European countries experienced a

Voraussetzungen", idem, *Wirtschaftskrise*, and Gailus, *Straße*.

⁹ Labrousse, "1848."

severe price shock in 1847. Section 3 explores the propagation mechanism that extended the crisis well into 1848. We find evidence that falling consumption and investment demand transformed the negative supply shock in the agricultural sector into a lagged demand shock in manufacturing. Section 4 constructs the last building block of our argument by drawing a connection between political activity and its possible economic causes. Section 5 concludes.

The Supply Shock in the Agricultural Sector, 1845-47

The resurrection of the economic view of the 1848 revolutions relies heavily on the occurrence of a pre-revolutionary economic crisis across Europe. But what defines an economic crisis? What sort of crisis will trigger political activity by individuals? And which individuals?

A possible starting point is the concept of a revolution. With respect to the revolutions of 1848, two characteristics stand out among the many definitions available: (i) the use of violence, or the credible threat of using it as a means to change the political system, and (ii) collective action, that is, active involvement of “the crowd” in that attempted political change.¹⁰ In the following, we will define a revolution either as widespread violence targeted at changing the political system or as immediate and substantial constitutional reform implemented to prevent imminent collective action or violence to that end. The potential or actual involvement of a large number of individuals has important consequences for our

¹⁰ Kimmel, *Revolution*, pp. 4-7, and Goldstone, *Revolution*, pp. 7-12. We follow the broader definitions of Kimmel which do not require that a revolution necessarily be successful. This broad definition is similar to the notion of revolution in Ch. Tilly, "Revolutions," pp. 519-24 and what he defined later as a “revolutionary situation”, Ch. Tilly, *European Revolutions*, p. 10.

question here. Obviously, our understanding of why a revolution did or did not take place should not be based solely on an analysis of elites and their economic situation. While lawyers, publishers, journalists, doctors, and academics were undoubtedly important protagonists during the 1848 upheavals across Europe, they would not have been able to act revolutionarily on their own. It was the lower classes who “provided the muscle”. As a consequence, our focus shifts from the well-known revolutionary protagonists to the average man or woman, especially in the capitals, where revolutionary activities were most pronounced.¹¹

A causal nexus between the economic situation of the ordinary population and possible participation in revolutionary activities requires there to have been a severe popular fear of a deteriorating socioeconomic situation. Siegenthaler has explained why and how economic discontent beyond a certain threshold tends to trigger political action.¹² Under the conditions of the restoration, i.e. the absence of effective democratic institutions, this was likely to take the form of revolutionary activity in the above defined sense. The question is how to measure both discontent and threshold.

Clearly, the economic view suggests a microeconomic approach. Households feel the ups and downs of macroeconomic activity through changes in their real budgets. While this is as true today as it was during the first half of the nineteenth century, the channels through which an economic crisis would influence the family budget were different then. On the expenditure side, lower-class households around 1850 still spent between two thirds and three quarters of their incomes on nourishment.¹³ The bulk of the food purchased consisted of grain products

¹¹ Labrousse, "1848," p. 77. Quote from Stearns, *Revolutions*, p. 12.

¹² Siegenthaler, *Regelvertrauen*, pp. 157-164.

¹³ Phelps Brown and Hopkins, "Seven centuries," p. 297: England 1790 81 per cent, 1904-13

and potatoes, which rendered household budgets very sensitive to changes in the prices of these goods. This sensitivity was greater the smaller the overall size of the budget, as low-income households tend to allocate even larger portions of their budgets to food-related expenditures (Engel's Law).¹⁴ In addition, the ability of households to avoid any squeeze on their budgets by substituting between different types of grain was limited. For the period 1816-50, the literature on Prussia reports correlation coefficients of 0.87 for wheat and rye prices and 0.67 for wheat and potato prices.¹⁵ This high integration of local grain markets in this period is illustrated by Figure 1. It plots bimonthly percentage changes in wheat prices over the previous year against a similar series for rye prices between 1820 and 1850 for the Prussian district of Arnsberg.

Figure 1 about here

In principle, data on grain prices should allow us to obtain an idea of the time path of household expenditures prior to 1848. Getting a grip on the possible determinants of the revenue side of household budgets is somewhat more difficult. On the one hand, it is well

78 per cent; Maddalena, *Prezzi*, p. 330: all households in Milan 1847 63 per cent; Abel, *Agrarkrisen*, p. 245: Berlin 1800 73 per cent; Saalfeld, *Lebensverhältnisse*, pp. 236-39: Prussian rural workers 1847 59 per cent, urban workers 1837 and 1847 67 per cent. Rural workers will have produced more food on their own than urban workers.

¹⁴ According to Drame et al., *Siècle*, p. 20, the price elasticity of demand for wheat hovered around 0.6 throughout nineteenth-century France.

¹⁵ See Bass, *Hungerkrisen*, p. 62. Similar results for Cologne 1818-50 are reported by Ebeling and Irsigler, "Entwicklung," p. 306.

known that nominal industrial wages were fairly stable in the first half of the century.¹⁶ To the extent that this is a valid stylized fact, the easily accessible data on grain prices would also provide us with data on real wages and, thus, the purchasing power of fully employed dependent workers. On the other hand, there is hardly any reliable information on effective working hours or un(der)employment, which makes it almost impossible to compute a meaningful income series.¹⁷ A feasible solution for non-agricultural employment is to turn to Okun's Law and try to draw inferences about employment from the overall level of industrial activity.¹⁸ We have good reason to believe that this "law" was also valid for the nineteenth century (in fact, more so than today), and data on industrial production, at least on a sectoral level, are available for a number of countries.

Summing up, it seems possible to put together a sufficiently accurate picture of the economic well-being of households prior to the political turmoil which shook Europe around 1848. Figure 2 takes a first step. It displays time series for grain prices for four large European economies. With the exceptions of Oldenburg and Russia (both rye prices), all 27 series are wheat prices. All series were transformed into grams of fine silver per hectolitre, the classical unit in price history.¹⁹ Whenever possible, we tried to gather data for the country's capital, the

¹⁶ See for Germany Gömmel, *Realeinkommen*, p. 27, and Gerhard, *Löhne*, for Belgium, France, and Great Britain Mitchell, *International Historical Statistics*, p. 181.

¹⁷ This point has already been discussed by Hobsbawm, "Machine Breakers," p. 4.

¹⁸ See, for a similar approach to the analysis of pre-revolutionary eighteenth-century France, Weir, "Crise économiques," p. 938.

¹⁹ See Braudel and Spooner, "Prices," p. 394. Abel, *Agrarkrisen*, pp. 290-95, used grams of silver per kilogram of wheat. In the first half of the nineteenth century, nearly all European currencies were still on silver or bimetallic standards.

likely center of political activity. The regional price series differ only slightly from the national averages, however.²⁰

Figure 2 about here

Figure 2 reveals both similarities and variations across Europe. Whereas the wheat price patterns of France and Prussia look very similar, the English and especially the Swedish experience look different. The English series shows the impact of the easing of the Corn Laws in 1842 as well as their abolition in 1846. Notwithstanding these and other idiosyncrasies, however, the series for France, Prussia, and England appear to share a number of regularities. One of them is the price increase and thus, presumably, a decrease in living standards for the majority of the population during the 1845-47 period. This should not come as a surprise. There is evidence of a convergence of European grain markets by this time due to less costly land and sea transportation.²¹ Figure 3 further illustrates the phenomenon by comparing the coefficient of variation between a set of five continental European regions and Prussia since the early 1820s.

Figure 3 about here

²⁰ For Austria, France, Prussia, and Sweden, where both national and capital series are available, the coefficient of correlation between both series is on average higher than 0.90 and never smaller than 0.80. Some regional series show a somewhat larger standard deviation than the national averages. See Appendix for details on the data.

²¹ See, for the impact of the Corn Laws on British wheat prices and European wheat-price convergence, Williamson, "Impact," pp. 124-9.

Given its large territory and different climatic zones, Prussia can be regarded as a fairly highly integrated economic area at this period.²² Compared with this benchmark, the prolonged period of convergence within Europe is quite remarkable. Starting at levels four times larger, by the 1840s the regions had reached roughly comparable levels of market integration. But there are also discrepancies in the time paths portrayed in Figure 2 above. While in France and Prussia the years 1845-47 are marked by a dramatic increase in grain prices, the price movements in England and Sweden in these years do not stand out as particularly irregular. This discrepancy may be important. Consider a household that, based on past experience, takes the precautions necessary to insure itself against "regular" and thus in principle foreseeable swings in the cost of living. Clearly, as long as a price increase stays within the expected range, we would not expect an extraordinary (or political) reaction. If, however, an exceptional price "shock" severely and unexpectedly diminished the real budget of a large part of the population, such a backlash seems much more likely.

The argument lends itself to a more formal exposition. We can picture households at any given time t as forming expectations about the cost of living in period $t+1$ based on an adaptive expectations model

$$(1) \quad p_{t+1}^e = \hat{\alpha}_t + \sum_{j=0}^n \hat{\delta}_{t,j} p_{t-j},$$

where p^e and p are expected and actual wheat (or rye) prices and the lag length n is assumed to be constant. The time dependent parameters $\hat{\alpha}_t$ and $\hat{\delta}_t$ are OLS coefficients from an autoregressive model estimated with the present and past observations on p available at time t :

²² Fremdling and Hohorst, "Marktintegration," pp. 100f.

$$(2) \quad p_t = \alpha + \sum_{j=0}^n \delta_j p_{t-1-j} + \varepsilon_t.$$

ε is a random variable following standard assumptions. That is, households update their estimates for $\hat{\alpha}$ and $\hat{\delta}$ in every period t to produce the best available forecast about p_{t+1}^e , the following period's price level. But the forecast will not be perfect. We can then define a price "shock", i.e. a highly unanticipated and irregular price movement in the sense introduced earlier, as a significant (scaled) forecast error

$$(3) \quad e_{t+1} = \frac{p_{t+1} - p_{t+1}^e}{\theta(\cdot)},$$

where θ is a scaling factor that increases in the sample length t and the $(1 \times n)$ vector of observations on p used to forecast p_{t+1} , \mathbf{p}_{t+1} . If we define $\theta \equiv [1 + \mathbf{p}_{t+1}'(\mathbf{P}_t' \mathbf{P}_t)^{-1} \mathbf{p}_{t+1}]^{1/2}$, with \mathbf{P}_t being the $(t \times n)$ matrix of observations used to forecast p in all previous periods $(n+1, \dots, t)$, e_{t+1} is just the standard recursive residual from equation (2).²³ As

$e_{t+1} \sim N[0, \sigma_\varepsilon^2]$, a significant deviation of the scaled forecast error from zero indicates both a "shock" in the sense defined above and a structural break in the model.

Computing the scaled forecast errors e_{t+1} for our set of 27 countries is a straightforward exercise once the lag length n is determined. We set $n = 5$ for each country, which allows the AR process – and, thus, the forecasters – to cover both cyclical and non-cyclical regularities in the time series.²⁴ The majority of the data runs from 1820 to 1850. With the exception of

²³ See, e.g., Greene, *Econometric Analysis*, pp. 216f.

²⁴ Business cycles in wheat prices and similar data were well known to contemporaries. They are also quite obvious in the present data. For evidence on cycles in grain prices see, for instance, Bauernfeind and Woitek, "Agrarian Cycles."

Finland, all series involved are stationary.²⁵ Figure 4 presents the computed forecast errors and the respective 2-standard-error bands for the four countries already selected for Figure 2.

Figure 4 about here

The interpretation of the results is fairly easy. If at any point in time the graph deviates positively (or negatively) from zero, the actual price level of this period exceeded (or fell short of) the (assumed) expectations of households. If a deviation is larger than two times the standard errors of the model used to compute the forecast, we observe a significant shock.

It turns out that the results are very much in line with the discussion of the time series displayed earlier in Figure 2. While both France and Prussia feature a significant positive price shock in 1846-47 (as well as a corresponding negative shock as prices returned to normal in 1848), England and Sweden do not. The reason for this is that even though both countries experienced higher prices prior to 1848, these increases stayed within the confines of the normal ups and downs of the cost of living. This is obvious in the case of Sweden, but it is also true for England. In England, it is only the fall in prices after the good harvest of 1847

²⁵ Based on standard ADF tests. The price series for Baden, Hesse, Saxony, Sweden, and Wurttemberg are only stationary around a trend. However, recalculating the AR models with difference-filtered data or introducing a trend into the estimated model does not change the results. The same is true for the Finnish series. Only Hesse remains a borderline case. The complete data set (grain prices as well as computed forecast errors) for the sample is available on request.

that is extraordinary enough to qualify as a shock relative to expectations – albeit a positive one.²⁶

Before we move on, a brief discussion of the threshold that divides price movements into “normal” ups and downs and “shocks” is called for. Our 2-standard-error criterion is purely statistical, i.e., it builds on the conventional notion of statistical significance. From a strictly historical perspective this might seem somewhat arbitrary. However, the statistical criterion does not seem an unreasonable approximation of any real-world threshold and might very well be viewed as a benchmark for a more historical rule of thumb. For instance, simply focusing on the number of pre-revolutionary years in which grain prices were above their average value leads to a very similar profile of shocks across countries (see Table 3, col. (iii) below). Such a rule does, however, ignore the role price expectations might have played for the accumulation of buffer stocks and, ultimately, for the impact the agrarian crisis had on households. Also note that the 2-standard-error criterion of the forecast model leads to very robust results. Any other threshold value in an interval of ± 0.18 around 2 produces the very same distribution of pre-1848 shocks among the countries in our sample. We will return to this issue in Section 3.

From Figure 4 – and from similar figures for the other 23 countries in our sample²⁷ – it follows that a number of European countries did indeed suffer a significant positive shock to their cost of living prior to the 1848 revolution. It is tempting to jump ahead and compare the regional distribution of these findings with the occurrence of political turbulence across the area under investigation. But there is the problem of timing. Even though there is a certain amount of variance in the point in time at which the grain crisis hit the economies in our data

²⁶ Ireland (for which we do not have comparable data) was a very different case. See for a comparable approach Solar, "Great Famine," pp. 114-18.

²⁷ All additional figures are available on request.

set, in virtually every case the year 1848 itself was characterized by sizable price decreases, not increases. To some extent this might be an artifact of the frequency of the data. To see whether this is the case, Figure 5 shows monthly wheat prices for the region around Paris and for Berlin.

Figure 5 about here

In both cases, wheat prices were at a low level at the beginning of 1845. The price increase which followed accelerated in mid-1845, paused briefly around the turn to 1846, and then continued until mid-1847 when a third consecutive bad harvest was expected all over Europe.²⁸ Thus, what consumers experienced in both countries was far more than a short “blip”, instead, it was a seemingly incessant price increase for two and a half years. Moreover, although prices were falling, they were still somewhat higher in late 1847 and early 1848 than on average during the previous grain price cycle of 1838-45.²⁹ However, when political unrest started to spread across Europe in early 1848, the situation as measured by the cost of living had definitely improved in both countries. Even in Berlin, where prices were on the rise again later in the year, the surprisingly good harvests in the autumn of 1847 helped household expenditures to get back to their average levels during the first half of 1848.

To some extent the time lag between the peak of the food price crisis and the political unrest is not totally unexpected. The reason is that people who face starvation are physically weak and focus their activities on finding food. It is only after they have regained their

²⁸ Boot, *Commercial Crisis*, p. 66.

²⁹ The dominant agrarian cycle has a length of eight years, see Bauernfeind and Woitek, "Agrarian Cycles."

physical forces and digested their recent crisis experience that they start to (re)act politically.³⁰

From this perspective, the time lag between the food price peaks and the outbreak of the revolution at the beginning of 1848 does not necessarily come as a surprise. But there is an additional economic link between the two events.

Propagation of the Crisis to the Industrial Sector, 1847/48

In fact, one of the reasons why so many contemporary observers such as, for instance, the economist Wilhelm Roscher, insisted on a close connection between economic crisis and political unrest was the lagged propagation of the agricultural crisis into other sectors of the economy.³¹ Most economies in mid-nineteenth-century Europe were still greatly influenced by fluctuations in agriculture. With a majority of households earning close to the subsistence level, price increases in the basic food sector translated into lower demand for all other goods and, thus, for manufacturers.³² This propagation probably took place with a time lag, as some households could turn to their savings to smooth consumption. However, it seems plausible to presume that eventually lower household demand (the consumption channel) and, in addition, low investment demand (the investment channel) would turn an agricultural crisis such as the pre-1848 grain price shock into a crisis in the manufacturing sector as well.

³⁰ Stearns, *Revolutions*, p. 34, see also Tocqueville, *Ancien régime*, p. 219.

³¹ Roscher, *Kornhandel*, pp. 61-65.

³² See for France Labrousse, "Panoramas," who relies on monthly data, and the simulations of Lévy-Leboyer and Bourguignon, *French Economy*, pp. 227-31, which show a time lag of one year. For the Prussian textile industry, see Blumberg, *Textilindustrie*, pp. 200-05, 382, who uses quarterly data. See for the general crisis of crafts in 1847/48 Kuczynski, *Lage*, vol. 1, pp. 178f., idem, *Lage*, vol. 11, pp. 85-97, and Bergmann, *Wirtschaftskrise*, pp. 50, 63-70.

Before we proceed to explore the evidence on the consumption channel, let us discuss how the food crisis influenced business attitudes and investment behavior. Several forces possibly had an impact on investment financing conditions via credit demand and credit supply. During a negative food supply shock, purchasing power is shifted from (net) food consumers to (net) food producers. As nutritional status declines toward or even falls below the subsistence level, demand becomes price-inelastic. This was the case in 1845-47, when net food consumers, especially urban lower and middle classes, were forced to reduce their savings.³³ While their savings fell, savings by net food producer presumably increased. But since food producers will have spent at least some of their extra profits on extra purchases of other goods, the overall effect of the price increase on credit demand must have been positive. By contrast, credit supply contracted under the rules of specie standard. England, for instance, for which we have several accounts, experienced a gold drain because her balance of trade turned negative, thus inducing gold outflows which led to a contraction of domestic money supply.³⁴ A third factor which also resulted in a tightening of the credit market was misspeculation. When expectations concerning the coming harvest switched from gloomy to optimistic and massive corn imports from Russia and the United States were reaching the markets, prices plummeted in mid-1847 and many traders were in desperate need of credit. This further increased interest rates increased all over Europe.³⁵ In fact, the available data underestimates

³³ See, for instance, Obermann, "Wirtschafts- und sozialpolitische Aspekte," for evidence on dissaving in Prussian lower- and middle-class households.

³⁴ Described in detail by Boot, *Commercial Crisis*, ch. VI. See also Ward-Perkins, "Commercial Crisis."

³⁵ See for monthly London market and bank rates Ward-Perkins, "Commercial Crisis," p. 94. Nearly all European yearly series of short-term interest rates show a local maximum in 1847,

the strain put on borrowers because most available interest rate series are regulated bank rates which were not always adjusted to market conditions. In addition, borrowers were often subject to credit rationing.³⁶

While most of the available European interest rate series show a local maximum in 1847, the impact of tighter financial conditions was felt as early as the second half of 1846 and, due to the planning lags involved in investment demand, well into 1848. Indeed statistical evidence seems to suggest a negative impact of lagged interest rates on the manufacturing sector.³⁷

While such exercises are seriously hampered by the quality of the interest rate data (see above), they seem to be in line with the available anecdotal evidence. For instance, we know that numerous firms failed between the second half of 1846 and the end of 1848, especially in the textile sector, and that contemporaries saw lack of credit as one of the main factors behind this.³⁸ The visible slowdown in railway track investment in France, Germany, and, to a somewhat lesser extent, England also points in that direction. The profitability of (the mostly

for UK, France, the Netherlands (maximum 1846), Belgium (max. 1848), Prussia, and Switzerland see Homer, *History*, pp. 208, 230, 242, 252, 265, 270.

³⁶ So for some interest rates were infinitely high. See for England Boot, *Commercial Crisis*, p. 49, and for Prussia Obermann, "Wirtschafts- und sozialpolitische Aspekte," p. 163, and Lichter, *Preußische Notenbankpolitik*, p. 22. In England, the commercial crisis was immediately overcome when the Bank of England was allowed to lend at a bank rate over eight per cent, see Ward-Perkins, "Commercial Crisis," p. 78, and Boot, *Commercial Crisis*, p. 52.

³⁷ We comment on selected econometric results in fn. 42 below.

³⁸ See, e.g., Labrousse, "Panoramas," pp. viii-x, Obermann, "Wirtschafts- und sozialpolitische Aspekte," pp. 162-7, and Wehler, *Deutsche Gesellschaftsgeschichte*, pp. 648-52.

privately owned) German railway companies dropped during the crisis and eventually investment was scaled back to meet the financing constraints. By contrast, most French railways had been nationalized and it was lack of public funds due to the food crisis which made the government cancel railway investment programs. In both countries, this affected the metals and mining sectors seriously from early/mid-1847 onwards through 1848.³⁹ In conclusion, it would seem that the deterioration of financing conditions in the wake of the agrarian crisis 1845-47 had a sizable lagged real effect on firm failures and investment behavior that transmitted the crisis across sectors and into the critical year of 1848.

Turning from the investment to the consumption channel, we can apply a somewhat more direct test for the existence of a propagation mechanism. Although there are no reliable data on household demand for manufactured goods, it seems reasonable to rely on grain prices as a proxy for the changes in household demand. The question to be addressed is whether there is evidence for a lagged propagation of the grain crisis into manufacturing and, following Okun's Law, possibly to employment. As a first step, we subject the data at hand to a standard Granger causality test. In a nutshell, the test asks how much of the growth path of, say, French manufacturing output can be explained by lagged values of French grain prices and vice versa.⁴⁰ In both cases the possible determinants are added to an AR model of the endogenous

³⁹ See Labrousse, "1848," *idem*, "Panoramas", and Spree and Bergmann, "Konjunktuelle Entwicklung," pp. 314-21. The growth of the German rail-network did not accelerate again before the 1850s. Ward-Perkins, "Commercial Crisis," p. 87 and Boot, *Commercial Crisis*, pp. 20, 81, point out that continued railway investment stabilized the UK economy by late 1847.

⁴⁰ For the calculations in Table 1, we used the price data described in Appendix 3. Replacing the price data for capital cities by national averages leads to only very slight deviations. The same is true for the regression results in Table 2 (see below).

variable. Causality in the sense of the test should be interpreted conservatively. For instance, the rejection of the null hypothesis of “no causality” in the case of lagged grain prices influencing production would suggest that the former series precedes the latter and helps in forecasting it. Table 1 presents our results. The model is symmetrical, i.e., the first row reports the number of lags for the AR process as well as the number of lagged exogenous variables included. The period under consideration is again 1820-50.

Table 1 about here

The main message of Table 1 is that grain prices are indeed Granger causal for manufacturing in some countries, and the other way around in no single country. The results for Austria and the Netherlands are somewhat weak, but still suggestive. The results for England fall in the same category, but here we should not be surprised given England’s leading role in the process of industrialization. In general, the evidence clearly suggests that changes in grain prices preceded changes in the growth rate of non-agricultural activity. The results lend credibility to the claim that the economic crisis of 1845-47, initiated by bad harvests, extended into 1848 by triggering a crisis in the manufacturing sector. Or did it? After all, the existence of a Granger causal relationship between grain prices and manufacturing does not necessarily imply that a significant shock (in the sense defined above) to the former series also causes a significant shock to the latter.

In order to see whether there are significant shocks in the available production data following significant shocks in grain prices, we again make use of the method established in Section 2. Figure 6 presents forecast errors from a model similar to equation (2) for the data used in Table 1. Again, we set the lag of the AR part uniformly to $n = 5$ across all countries even

though some of the data series are rather short: the French, Prussian, and Habsburg series start only in 1820, 1828, and 1830, respectively. The remaining series, however, run from 1815-50.⁴¹

Figure 6 about here

Austria, France, Hungary, and Prussia show a significant negative shock to output growth in manufacturing in 1848, whereas England and Sweden, which were also spared a shock in grain prices, do not. The borderline case is the Netherlands, which experienced a grain price shock but not a manufacturing shock. Thus, except for that case, we find that all countries included in the manufacturing dataset that were hit (or not hit) by a significant positive shock in grain prices 1846-47 also found themselves suffering (or exempt) from a significant negative industrial production shock in 1848.⁴²

Even though Figure 6 adds considerably to the evidence produced by the Granger tests discussed above, there are still reasons why the propagation argument might not yet be convincing. First, the results concerning production could themselves be influenced by the revolutionary activity of 1848. After all, workers protesting in the streets are not at their

⁴¹ All series are stationary according to standard ADF tests. In the case of The Netherlands the series is stationary around a trend. The results are robust with regard to changes in the lag length of the AR model used to compute the forecasts and standard errors.

⁴² Again the statistical rule identifying “shocks” is quite robust. Table 3 below reveals that lower thresholds for the forecast errors work equally well. See also footnote 49. See Figure 4 for the grain price forecast errors in the case of England, France, Prussia, and Sweden. All other figures are, as already mentioned, available on request.

workbenches. Second, statistical significance does not guarantee that the strength of the connection between the agricultural and the manufacturing sector was sufficient to explain the downturn in production. Describing the correlation between the variables in which we are interested using a simple multivariate regression model addresses both problems. Our exercise includes England, France, Prussia, the Habsburg countries, the Netherlands, and Sweden. We estimate two variants of the following equation:

$$(4) \quad \hat{y}_t = \alpha + \sum_{i=1}^m \beta_i \hat{y}_{t-i} + \delta p_{t-1} + \lambda REV_t + \varepsilon_t.$$

Equation (4) basically describes an AR model with an added structural component.

The \hat{y} stands for growth rates in manufacturing (in per cent), p are grain prices (in grams of fine silver per hectolitre), and REV is a time dummy variable that is 1 in 1848 and 0 otherwise.⁴³ The discussion of Granger causality above suggests that grain prices enter with a lag. The dummy variable takes account of the possibility that the downturn in economic activity in 1848 might have been a consequence of the revolution and not of the supply shock in the agricultural sector. Table 2 presents OLS estimates of equation (4).

Table 2 about here

⁴³ We use $m = 4$ to economize on d.f. We also experimented with one-period lagged nominal and real interest rates as explanatory variables for England, France, and Prussia. Where significant, interest rates had a negative impact on output growth. The results with regard to grain prices and the revolution dummy were similar to the results presented in Table 2. Additional results available on request.

Let us first consider columns (i) without the revolution dummy. From what has been said about the consumption channel which may have linked the agricultural sector with manufacturing, we should expect the grain price coefficients to be negative and significant. Indeed the sign of the impact of grain prices is as anticipated in all cases, and lacks statistical significance at conventional levels only in the cases of England, the industrial leader, and the Netherlands.

Given that some of the time series are rather short, the performance of the consumption channel is quite robust with regard to the introduction of the *REV* dummy (columns (ii)). The dummy variable has at least a marginally significant negative impact for France, Hungary, and Prussia, while the impact on the Swedish and English series is positive. Austria shows a non-significant negative sign for *REV*. But while the revolution played some role in shaping manufacturing activity, an important part of the explanation of the slump in production in 1848 obviously still derives from lagged grain prices. The negative sign of the variable remains unchanged across countries and, with the exception of Austria and Hungary, at least marginally significant. In the case of England the grain price variable even becomes significant at the five percent level after the introduction of 1848 dummy variable. The results for the Dutch data remain unchanged.⁴⁴

What was the quantitative impact of the 1847 grain crisis on manufacturing? Take, for instance, Prussia and France, which display a significant price variable in both columns. Prices in Prussia (France) increased by 27.12 (37.85) grams fine silver from 1846 to 1847. Based on the estimated δ coefficients in Table 2, column (ii), this translated into a decrease in 1848 manufacturing levels of about 7.86 (3.03) percentage points or about 32.67 (23.03) per

⁴⁴ Note that to the extent that the revolution is in fact *endogenous* to the economic crisis we should rely on a model excluding the 1848 dummy.

cent of the actual 1848 decline in manufacturing. Based on column (i) the decline explained by the grain crisis is even larger (47.31 and 46.06 per cent, respectively). In England, the negative impact of the grain price rise on growth in the manufacturing sector remained in the two-percentage-point range (and too low to force an overall decline in real activity). We can conclude that the quantitative impact of the grain crisis on the industrial sector was considerable in France, Prussia, and the Habsburg countries, but not in more highly industrialized England.

Crisis and Revolution

Section 2 established the existence of a regional pattern of significant shocks to grain prices and, thus, to the cost of living in a number of European countries between 1845 and 1847. Section 3 then linked the grain crisis to the manufacturing sector, helping to explain the propagation of the initial shock into 1848. But we still have to connect our economic findings with the political data.

It is not altogether straightforward to determine which countries experienced a revolution or not. For the non-German countries we follow the consensus in the literature, according to which France, the Italian states, Switzerland, Austria, Bohemia, and Hungary experienced widespread violence and thus clearly revolutions in any sense of the word. In the broader sense defined above (see Section 2) Belgium, Denmark, and the Netherlands, which were able to avoid widespread violence only by undertaking immediate and substantial constitutional changes, also qualify as revolutionary countries.⁴⁵ By contrast, the other Scandinavian states, England, Russia, and Spain neither experienced widespread political violence, nor saw their

⁴⁵ A possibly critical case could be the Netherlands which Stearns, *Revolutions*, p. 1, would not include in the second group.

governments forced to change the constitution significantly. For Ireland, which experienced severe agrarian crime, but arguably no revolutionary action, we could not find reliable grain price data for our sample period.⁴⁶

For the German states, an evaluation is much more difficult. The German historiography of 1848 has long been determined by the Prussia-centered perspective of German unification. But in the 1840s the German states were fully independent entities with quite different political paths, some with constitutions (as in southern Germany), others without constitutions and more or less repressive (such as Prussia). As with the other European countries, we can divide German territories into three groups. Widespread violence occurred in Baden, Bavaria, Hamburg, Hesse-Darmstadt, Mecklenburg-Schwerin, Prussia, Saxony, and Württemberg. Ruling elites which gave in to the threat of violence from the crowd protesting in the streets or raiding manorial domains in the countryside can be found in Bremen, Brunswick, and Oldenburg. In each of these states, the ruler immediately granted constitutional changes. Among the German states in our sample, not one failed to experience either political violence or immediate reform.⁴⁷

⁴⁶ See Ó Gráda, *Ireland*, and for data sources Solar, "Great Famine," pp. 114f., 120. Note, however, that the absence of data seems equally spread across the different categories. For instance, we also lack grain price data for Romania, which experienced severe political turmoil. For the different states see Stearns, *Revolutions*, Price, *Revolutions*, Kaelble, "1848," p. 262f., and Goldstone, *Revolution*, p. 285. The two Italian countries in our sample, Lombardy and the Papal States, both experienced strong revolutionary turmoil, see Sperber, *European Revolutions*, pp. 109f., 222.

⁴⁷ See Valentin, *Geschichte*, vol. 1, for the 1848 revolutions in the German states.

Our findings are summarized in Table 3, which covers nearly the whole of Europe with the exceptions of Iceland, Ireland, Portugal, a few Italian and some smaller German states, and the European countries of the Ottoman Empire. For these countries we were not able to find compatible grain price data extending back to the 1820s.

Table 3 about here

The data in the first five columns refer to the grain prices in these countries. Column (i) reports the average wheat or rye prices 1838-45, and column (ii) the maximum price between 1845 and 1848. Column (iii) reports for how many of the years 1845-47 the price was higher than the average price 1838-45. In column (iv) the maximum price forecast error of the years 1845 to 1848 is divided by the corresponding standard error. Whether the deviation of the actual from the forecasted price between 1845 and 1848 was a “shock” in the sense defined above (deviation larger than +2 standard errors), is indicated in column (v). Columns (vi) to (viii) repeat the shock analysis for those countries for which we have production data. If the deviation between actual and forecasted industrial growth is less than -2 standard errors, we speak of a production shock in column (viii).

The next step is to confront these data with the political data in the last two columns. Column (ix) indicates whether or not the political atmosphere in early 1848 was repressive, and column (x) indicates whether or not a country experienced a revolution. For countries with immediate and substantial constitutional changes but no widespread violence, the “yes” is in parentheses.

Now we are able to give an answer to the question of whether the European revolutions of 1848 were caused or at least strongly influenced by short-term economic factors. Comparing

columns (viii) and (x) we find that, with the exception of the Netherlands, in those countries which experienced a negative industrial production shock, there was a revolution as well. By contrast, in England and Sweden there was neither an industrial production shock nor a revolution. It is reassuring that, very much in line with the analysis in the preceding section, the occurrence and absence of shocks in food prices and manufacturing are highly correlated. However, evidence for just seven countries may not be totally persuasive.

Therefore, in a second step, we make fuller use of our data set. To do this, we compare columns (v) and (viii) which register the occurrence of shocks in grain prices and manufacturing. With the exception of the Netherlands, we find that only countries with a price shock in 1845-48 experienced a manufacturing shock in 1848, and vice versa. The finding adds further weight to the hypothesis explored in Section 3 that a propagation mechanism existed which extended the shock waves of the agrarian crisis into 1848. Consequently, we can compare the earlier price shocks in column (v) directly with the political data for 1848 in column (x) even for those countries for which we do not have production data. The result is surprisingly clear-cut. There is a nearly perfect regional match between the existence of a grain price shock and a revolution: among the 21 states which experienced revolutionary turmoil, 20 had been hit by a grain price shock between 1845 and 1847. Only Denmark is an outlier. By contrast, of the six countries without a revolution, only one, Norway, showed signs of a price shock in the grain market.⁴⁸

⁴⁸ These results are in line with those of Goldstone, *Revolution*, pp. 343-48, who finds a high geographical correlation between population pressure and state crises in Europe between 1750 and 1850. Note, however, that our results are immune to the criticism that the explanatory variable (in our case the price shocks) is endogenous.

The outcome is also remarkably robust with regard to the underlying definition of economic “shocks”. As pointed out earlier, the 2-standard-error threshold is primarily a statistical rule of thumb. However, a comparison of columns (iv) and (x) reveals that indeed any threshold value between 1.82 and 2.18 would have resulted in the same proportion of 25 out of 27 countries fitting the economic view.⁴⁹ The robustness of the result strongly suggests a positive correlation between the likelihood of the occurrence of a revolution and the size of the price shock in our sample. Indeed, a simple logit model exercise reveals that an increase in the pre-revolution grain price forecast error significantly increases the probability of revolutionary activity (violent and non-violent).⁵⁰

⁴⁹ Similarly, column (vii) shows that any threshold between 0 and -2.01 will separate countries with or without shocks in industrial production in a way that is compatible with the economic view (except for the Netherlands).

⁵⁰ We estimated a ML-binary logit model for the occurrence of a revolution with a constant and the grain price forecast error in 1847 for the 27 countries or regions in our sample. The LHS variable is constructed as a dummy that takes the value 1 when column (x) in Table 3 shows either a “yes” or a “(yes)” and 0 otherwise. The estimated coefficient for the grain price forecast error is 1.83 with a s.e. of 0.57 (significant at the 4 percent level). This translates into an increase in the probability of a revolution for a one-unit increase in the 1847 forecast error from zero of about 21 percentage points. A one-unit increase from a forecast error level of one (two) increases the probability of a revolution by about 46 (23) percentage points. McFadden- R^2 is 0.18. The standard deviation of the 1847 forecast errors is 0.88. Using the grain price forecast error as listed in Table 3, which for some countries deviates from the 1847 figure, does not change these results. Details available on request.

Also note that less sophisticated measures of the depth of the agrarian crisis lead to comparable findings. For instance, a comparison of columns (iii) and (x) shows that the number of years in the period 1845-47 in which a country suffered from relatively high grain prices is a remarkably good indicator of the likelihood of the occurrence of revolutionary activity in 1848, too. With the exception of Denmark and Spain, politically stable countries were spared price rises of more than one year. By contrast, countries with a revolution endured a minimum of two years of above-average prices before 1848.

Figure 7 about here

Is there anything we can say about the outliers? First, regional factors might play a role. The two countries which do not fit the hypothesis that the economic crisis triggered the revolution according to the expectations-based shock criterion summarized in column (v), Denmark and Norway, as well as the Netherlands for which the production data summarized in column (viii) do not fit, are part of the North Sea area. Moreover, all cases in which countries experienced price shocks but only moderate, i.e. non-violent, revolutions are also in this region (see Figure 7). Second, institutional and political factors could be important. An obvious candidate is poor relief, which might have improved the credibility of a regime. However, we found it very difficult to gather comparable information for our sample countries. The most comprehensive comparative study in this respect is that of Lindert, who compares 10 European countries. It is at least noteworthy in our context that he finds that poor relief per capita in England and the Netherlands were by far higher than in the other countries.⁵¹

⁵¹ See Lindert, "Poor relief," pp. 113-18.

An institutional factor which can be assessed, however, is whether a regime was repressive or not. It is interesting that, as column (ix) in Table 3 indicates, the aforementioned North Sea countries were all governed by non-repressive or liberal regimes. To pursue this idea, we employed the logit model for explaining the likelihood of overall revolutionary activity (discussed above) and a model explaining *violent* revolutionary activity alone. We find that, while an increase in the grain price forecast error significantly increases the likelihood of both violent and non-violent activity, the presence of a repressive political regime only affects the probability of violent activity. The violent type of revolutionary activity was significantly more likely to occur under repressive political regimes.⁵² Our findings thus support the idea that the character of the regime helped to shape the type of political upheaval in 1848, but that it was the economic crisis that triggered the event.

Conclusion

Many historians investigating the 1848 revolutions in Europe emphasize the force of ideas as their leading cause. The economic crisis starting with the bad harvest of 1845 is regarded at

⁵² Including a dummy variable that takes the value 1 when column (ix) in Table 3 indicates the presence of a repressive regime and 0 otherwise in the above-mentioned model explaining the occurrence of a revolution (violent and non-violent) produces no significant effects. The ML-binary logit model for the occurrence of just violent revolutionary activity includes a constant, the grain price forecast error in 1847, and the dummy variable indicating the presence of a repressive regime. The LHS variable is constructed as dummy that takes the value 1 when column (x) in Table 3 shows a “yes” and 0 otherwise. Both the estimated coefficient for the grain price forecast error (1.43) and the repressive regime dummy (2.52) were significant at least at the 4 percent level. McFadden- R^2 is 0.26. Details available on request.

most as one of numerous enabling factors. In view of the analysis put forward in the present paper, this view severely underestimates the political dynamics resulting from the extreme short-term economic fluctuations of 1845-48. A more pointed statement of this economic view would be that it was economic misery rather than "ideas" that caused the outbreak of revolutions in early 1848.

As an initial step, we establish that there exists a propagation mechanism that links the agricultural crisis of 1845-47 with the subsequent industrial crisis in 1848. Using a number of standard time series tools, it can be shown that in the period 1820-50 there was a systematic and significant relationship between the agricultural and the industrial sectors in France, Prussia, Austria, Hungary, and Sweden, but not in England, the world's leading and most highly industrialized economy, nor in the Netherlands. There is evidence that an increase in grain prices – a good proxy for the cost of living at the time – led to a decline in manufacturing activity after a certain lag. Thus, the dramatic increase in the prices of basic foods in 1845-47 must have had a strong negative effect on production and employment in the industrial sectors by 1848, the year of political unrest. This result is potentially important. It allows us to draw inferences directly about the occurrence of revolutionary activity from the rich data on European grain prices.

In a second step, we demonstrate the regional pattern of the economic shocks that hit or did not hit the European countries prior to the revolutions of 1848. A "shock" is defined as a significant forecast error based on an adaptive expectations model. It turns out that this criterion helps to predict revolutionary activity: if a country was subject to a shock in 1845-48, it also experienced a revolution and if not, it did not. Using the much sparser available data on manufacturing we find that France, Prussia, Austria, and Hungary suffered a shock-like decline in industrial production in 1848 paralleled by significant revolutionary activity. While

this result is very much in line with the economic view of the 1848 events, it is based on a rather small number of observations. However, making use of the link established above between the agricultural and the manufacturing sector, we can turn to grain prices for help. In fact, the regional pattern of grain price shocks is very similar to that for manufacturing: if a country was subjected to a grain price shock between 1845 and 1847, then it experienced a revolution in 1848. Of 21 countries subject to a grain price shock, 20 follow this crude, but obviously powerful rule, Norway being the peaceful exception. Among the remaining six countries which did not suffer strong grain price increases, only Denmark experienced far-reaching, and in our sense revolutionary, constitutional reform. These results are very robust with regard to the underlying definition of an economic shock. We conclude that the occurrence of an economic shock in the later 1840s was an important factor in triggering the 1848 revolutions across Europe.

While institutions, namely the presence or absence of a repressive political regime, add little to the explanation of the occurrence of revolutionary activity as such, we find that they did exert a significant influence on the form this activity took. The revolutions of 1848 tended to be violent in nature if the regime was repressive. We conclude that the presence of repressive regimes did not trigger events but did help to shape them.

The same could be said about the role of ideas. The peasants and artisans of the 1840s, suffering a severe deterioration in their socioeconomic status, needed some kind of political alternative – realistic or not – before they would become revolutionaries. At the time, these alternatives were offered by peasant leaders who appealed to the traditional and customary law – Thompson's "moral economy"⁵³ – and by politically discontented citizens who favored the new ideas of liberalism and democracy. In contrast to the crises of 1816/17, when there

⁵³ Thompson, "Moral Economy."

was still hope that the forces of restoration would not dominate, the crisis of 1845-48 took place in the context of a much larger and more popular variety of political alternatives that called for immediate action.⁵⁴ At least here we see historical singularities. The fact that ideas served as a catalyst for an upheaval initiated by economic factors transcends a narrow economic approach. But although the economic crises did not provide the brains, they did provide the muscles. The opinion leaders, who pursued their ideals in an undemocratic and often repressive political environment, needed violence (or the credible threat of it) as a political instrument, and only the "crowd" could provide it. Hobsbawm has termed this "bargaining by riot".⁵⁵ We conclude that without the economic crisis of 1845-48, which so obviously endangered the economic welfare of so many and discredited the *ancien régime*, there would not have been the critical mass to support these new ideas. Hence the explanation of European revolutions of 1848 should not neglect short-term economic factors.

⁵⁴ The similar food price increase of 1854/55 created neither famine nor social unrest, see Charles, Louise, and Richard Tilly, *Rebellious Century*.

⁵⁵ Hobsbawm, "Machine Breakers," p. 57.

Appendix

Data Sources

Political data (intensity of repression, intensity of revolution) are taken for Germany and the Austrian Empire from Huber, *Deutsche Verfassungsgeschichte*, chs. VII and VIII, and Valentin, *Geschichte*, chs. 4, 6, and 7. For the European states, see Stearns, *Revolutions*, Price, *Revolutions*, Sperber, *European Revolutions*, and the articles in Dowe, Haupt and Langewiesche, *Europa*, ch. I. Numerous other historical works were consulted which are not in the list of references. Please contact the authors for a list.

Grain price data would ideally be an average for the harvest year, weighted by sales and expressed in, well, Euros. The currency problem can quite easily be overcome by transforming recorded local prices per local unit into grams of fine silver per hectolitre. For the conversion of currencies, measures of capacity, and measures of weight we used Klimpert, *Lexikon*, at times checked by and supplemented with data in other literature on the subject. As both the levels and the volatility of the data are strongly influenced by the way the average is calculated, we ignored series for the harvest year or ones which relied only on one or two dates per year. This, for example, is the case for the Lisbon price series of Magalhães Godinho, *Prix*, pp. 76-78. Very probably the only series which is partially weighted by sales is the one for France, where the weighting was (supposed to be) done at the very first level of recording, i.e. the *mairies*, see Drame et al., *Siècle*, ch. 4. Whenever possible, we tried to find data for the country's capital because these were the prices actually observed (and responded to) in the political centre. If not stated otherwise, the data are available annually from 1815 to 1850. The abbreviations in parentheses are the country codes used in Figure 7. Country codes in capitals stand for violent revolutions, in lower cases for no revolution.

1. Austria (AUS; Lower Austria, contains Vienna): Földes, "Getreidepreise," p. 484; mining and industrial production 1830-50 Komlos, *Habsburg Monarchy*, pp. 294f.
2. Baden (BAD; Mannheim, Heidelberg): "Getreidepreise in Deutschland," p. I.297.

3. Bavaria (BAV; Munich): Seuffert, *Statistik*, p. 124.
4. Belgium (Bel): Seuffert, *Statistik*, p. 401.
5. Bohemia (BOH; Prague): Schebek, *Collektiv-Ausstellung*, pp. 99-101.
6. Bremen (Bre): Gerhard and Kaufhold, *Preise*, pp. 204f.
7. Brunswick (Bru): Soetbeer, *Beiträge*, p. 8.
8. Denmark (Den; Copenhagen, 1819-50): Weisz, "Getreidepreise," p. 397, wheat prices 1819-32 extrapolated by using rye prices from Földes, "Getreidepreise," p. 489. The correlation between the wheat and rye series 1833-50 is 0.72.
9. England (eng; London): Rostow, *British Economy*, p. 125, cf. also Weisz, "Getreidepreise," p. 350; British industrial production Crafts and Harley, "Output Growth," p. 727.
10. Finland (fin): Földes, "Getreidepreise," p. 492.
11. France (FRA; département Seine-et-Oise, surrounds Paris): Labrousse, Romano, and Dreyfus, *Prix*, 196f.; industrial production 1820-50 Lévy-Leboyer and Bouguignon, *French economy*, table A-IV.
12. Hamburg (HAM): "Getreidepreise in Deutschland," p. I.296.
13. Hesse (HES; 1822-50): *Mittheilungen der hessischen Zentralstelle*, p. 334.
14. Hungary (HUN; Pest, 1819-50): Földes, "Getreidepreise," p. 485; mining and industrial production 1830-50 Komlos, *Habsburg Monarchy*, p. 294f.
15. Lombardy (LOM; Milan): Maddalena, *Prezzi*, p. 379.
16. Mecklenburg (MEC; Rostock): "Getreidepreise im Grossherzogthum Mecklenburg," pp. 26, 28.
17. Netherlands (Net; Utrecht): Posthumus and Ketner, *Inquiry*, pp. 422f.; industrial production Smits, Horlings, and van Zanden, "Measurement," pp. 62f.
18. Norway (nor; 1820-50): Földes, "Getreidepreise," p. 518.
19. Oldenburg (Old; rye prices 1817-50): "Durchschnittspreise," p. 5.
20. Papal States (PAP; Rome): Földes, "Getreidepreise," p. 482.
21. Prussia (PRU; Berlin): 1815 Seuffert, *Statistik*, p. 386; 1816-60 Engel, "Getreidepreise," p. 257; woolen weaving production 1828-50 Blumberg, *Deutsche Textilindustrie*, p. 382.
22. Russia (rus; Moscow, rye prices): Mironov, *Chlebnie ceny*, pp. 235-37.
23. Saxonia (SAX; Dresden 1820-50): *Mittheilungen des statistischen Vereins*, pp. 66f. (1820-31, obvious misprint for 1821 corrected), Seuffert, *Statistik*, p. 375 (1832-50).
24. Spain (spa; Barcelona): price index (1913=100) from Sardà, *Política Monetaria*, pp. 303-05, rebased in prices by Consejo Superior Bancario, *Dictamen*, pp. 39, 109. Obvious misprint for 1848 corrected.
25. Sweden (swe; Stockholm): Jörberg, *History of Prices*, pp. 124-27; industrial production Schön, *Historiska nationalräkenskaper*, table II.
26. Switzerland (swi): *Historische Statistik*, p. 480.
27. Württemberg (WUR): Mährlen and Trüdinger, "Durchschnittspreise," II.120f.

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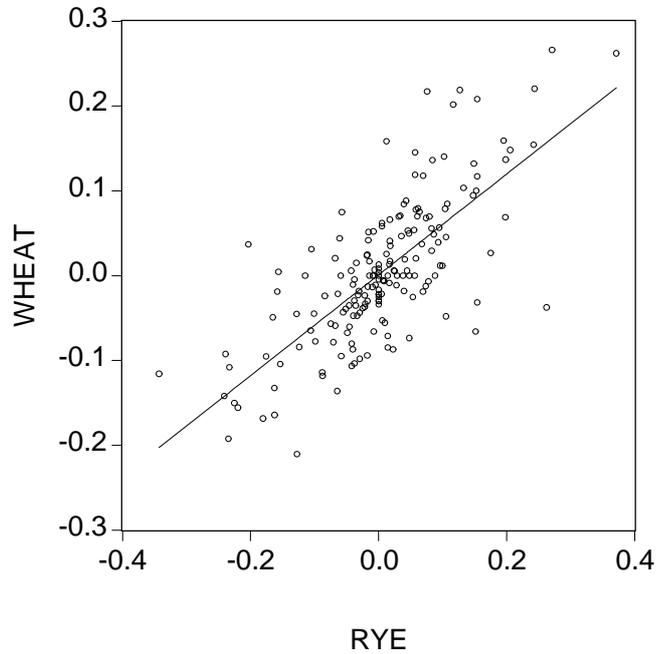
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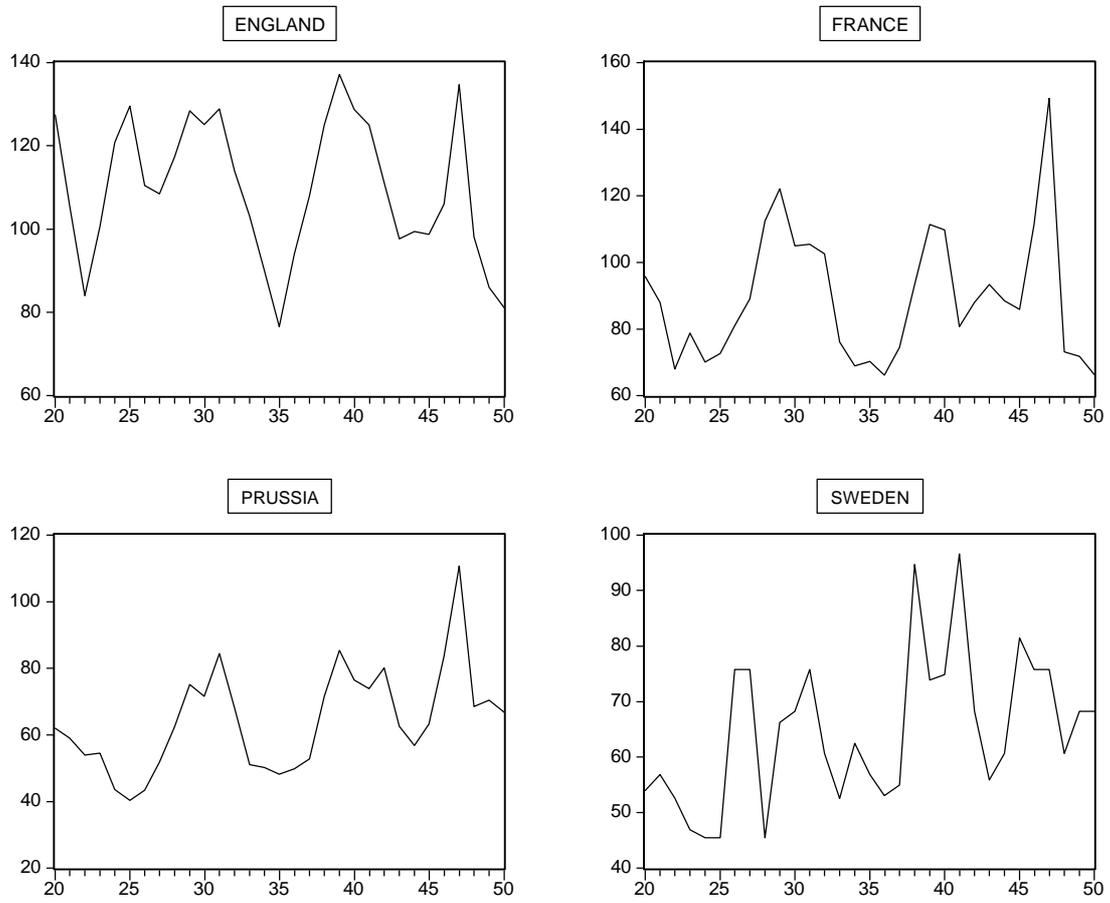
Figure 1: Integration of Prussian Grain Markets, 1820-50



Notes: Growth rates are the annual first differences of the original price series in logs. For illustrative purposes, Figure 1 omits an outlier (-0.43, -0.56). The full (the abbreviated) sample produces a highly significant coefficient of correlation of 0.77 (0.73). Due to seasonality in rye and wheat prices, the coefficient for the raw data is much larger: 0.93 (full sample).

Source: Kopsidis, *Marktintegration*, Table Vg/1 ff.

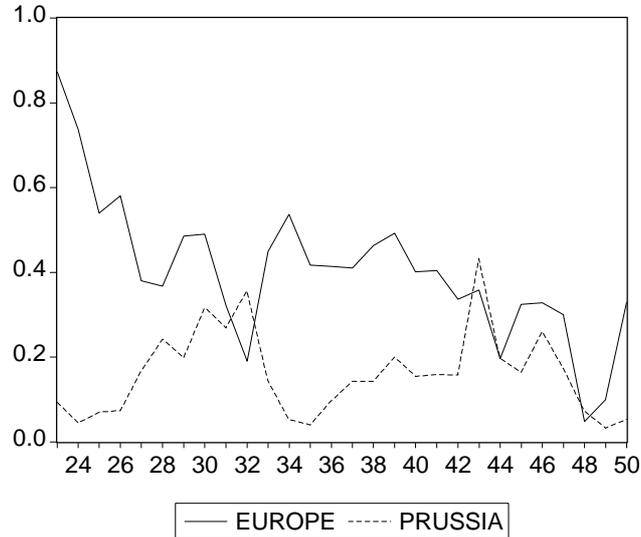
Figure 2: European Wheat Prices, 1820-50



Notes: All series are transformed into grams of fine silver per hectolitre. The series are for London, the region around Paris, Berlin, and Stockholm county.

Sources: see Appendix.

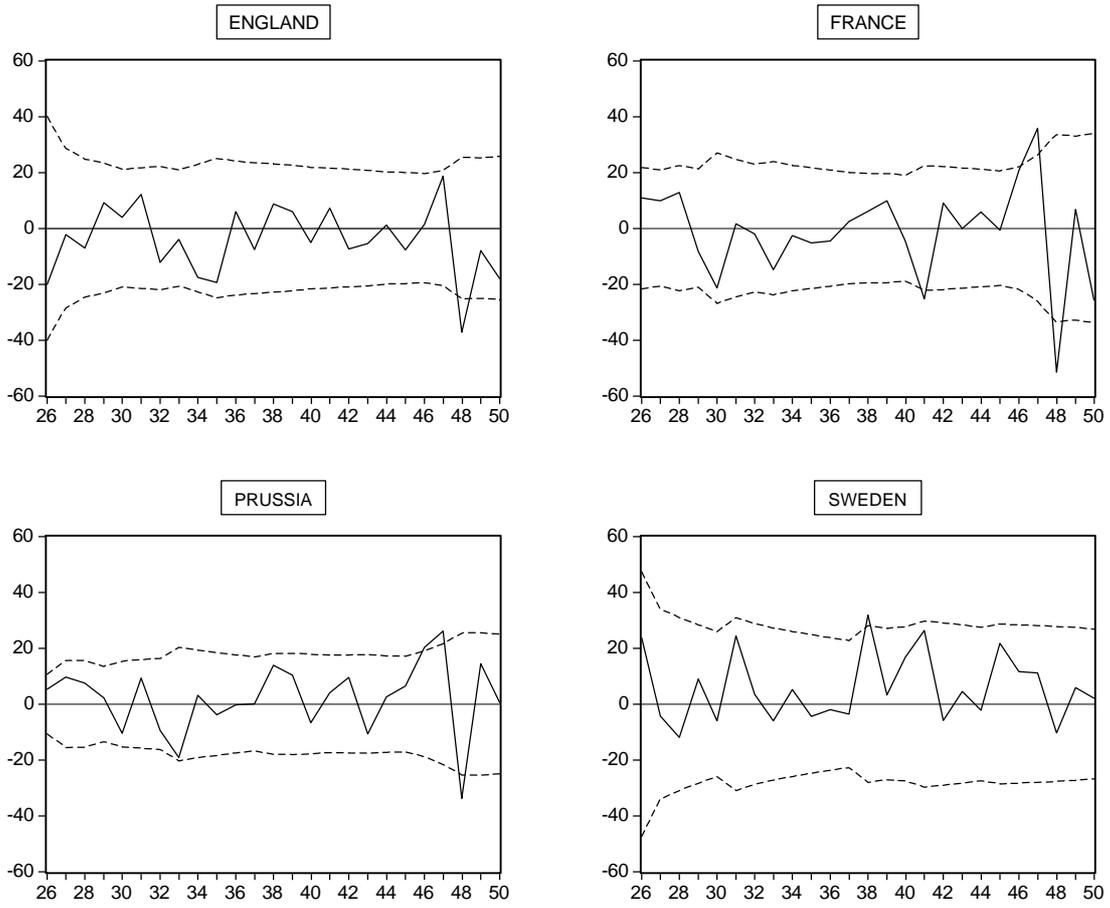
Figure 3: Convergence of European and Prussian Wheat Prices



Notes: What are reported are the coefficients of variation for the price of wheat among the eight provinces of Prussia on the one hand and among five groups of continental European countries on the other. The groups are: Southeast (Switzerland, Lombardy, Papal States, Austria, Hungary), West (France, Belgium), Center (Germany [aggregated], the Netherlands), and North (Finland, Norway, Sweden).

Sources: see Appendix; for Germany (aggregated) see Jacobs and Richter, *Großhandelspreise*, p. 74.

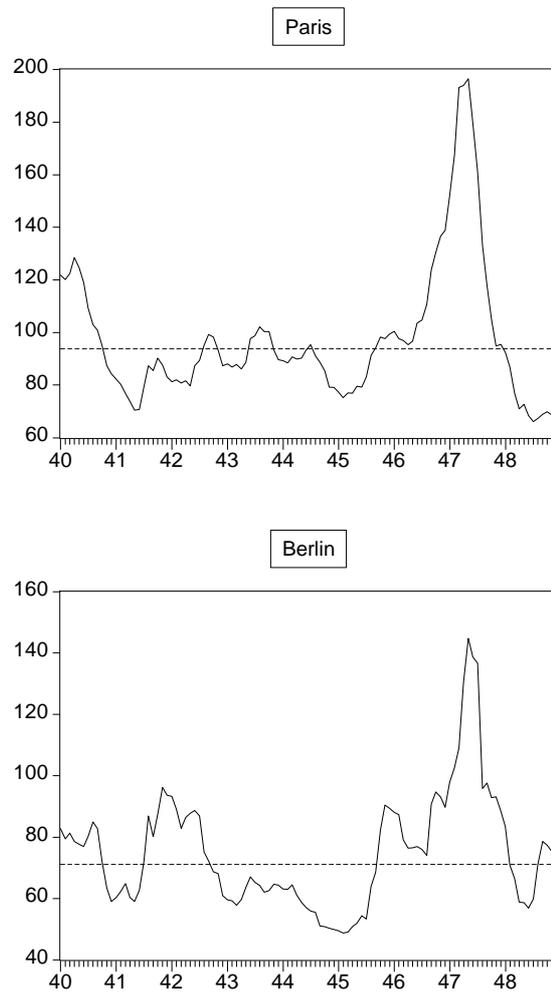
Figure 4: Forecast Errors in Grain Prices



Notes: See text and Figure 2.

Sources: see Appendix.

Figure 5: Monthly Wheat Prices, 1840-48

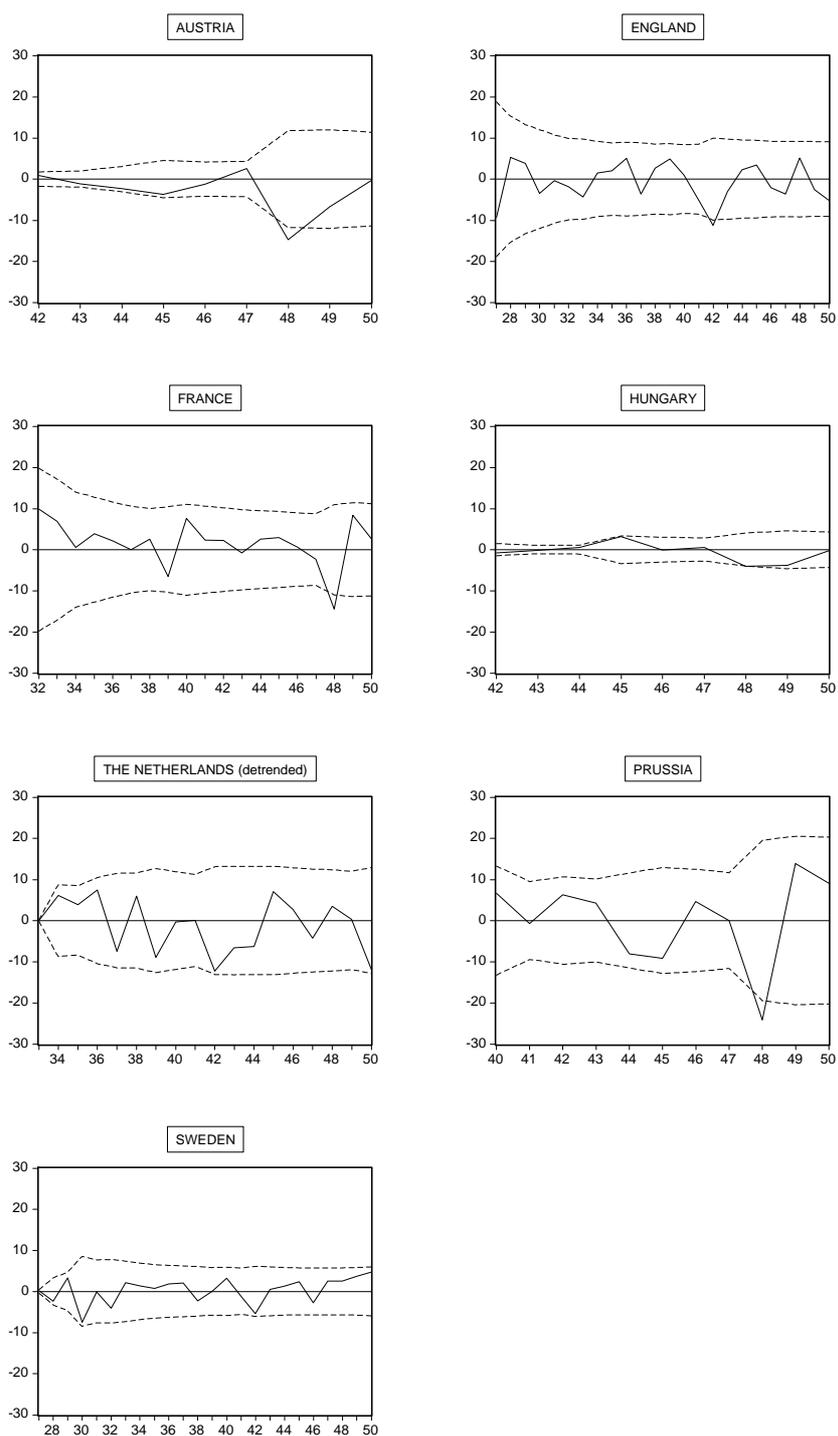


Notes: The dotted lines mark the average wheat price 1838-45.

Sources: *Amtsblatt* 1840-1849, Labrousse, Romano, and

Dreyfus, *Prix*, p. 196f.

Figure 6: Shocks to Manufacturing, 1820-50



Notes: See text. All growth rates in percent. Prussia: textile production only. The Netherlands: model includes trend.

Sources: see Appendix.

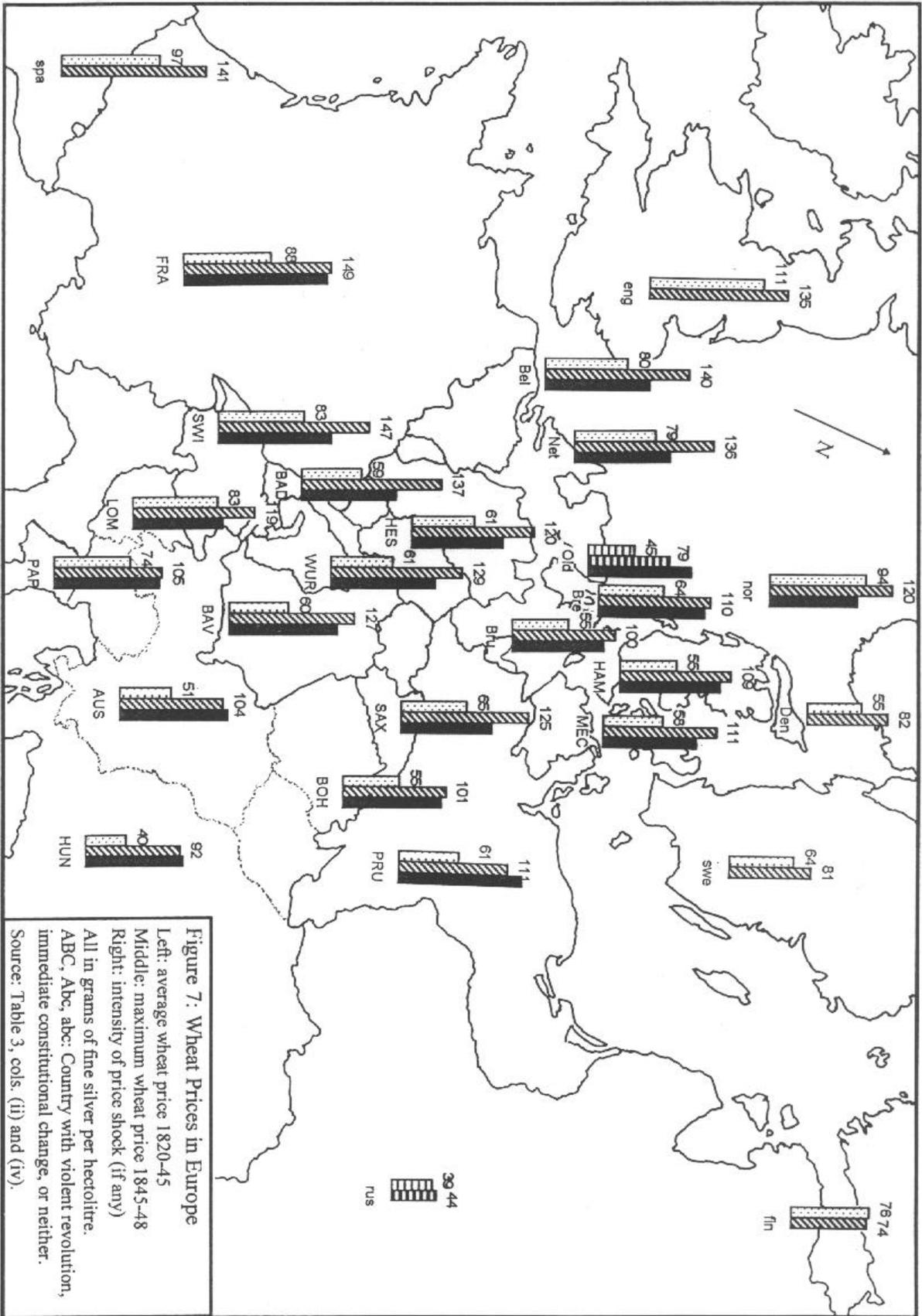


Table 1: Granger Tests

Country	Direction	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5
Austria	Grain Prices → Manufacturing	0.05	0.07	0.12	0.08	0.14
	Manufacturing → Grain prices	0.70	0.45	0.70	0.89	0.86
England	Grain Prices → Manufacturing	0.13	0.07	0.09	0.05*	0.10
	Manufacturing → Grain prices	0.55	0.89	0.12	0.20	0.36
France	Grain Prices → Manufacturing	0.06	0.01*	0.01*	0.06	0.17
	Manufacturing → Grain prices	0.28	0.50	0.61	0.89	0.66
Hungary	Grain Prices → Manufacturing	0.01*	0.00*	0.03*	0.02*	0.15
	Manufacturing → Grain prices	0.17	0.06	0.08	0.08	0.13
Netherlands	Grain Prices → Manufacturing	0.14	0.24	0.18	0.16	0.20
	Manufacturing → Grain prices	0.40	0.74	0.40	0.34	0.37
Prussia	Grain Prices → Manufacturing	0.03*	0.00*	0.01*	0.06	0.03*
	Manufacturing → Grain prices	0.77	0.43	0.44	0.15	0.23
Sweden	Grain Prices → Manufacturing	0.00*	0.00*	0.00*	0.01*	0.02*
	Manufacturing → Grain prices	0.20	0.44	0.61	0.46	0.13

Notes: P(F-Stat) for Granger tests at different lag lengths. All data are annual.

Numbers marked “*” allow rejection of the H0: “no causality” at conventional levels. Granger causality is commonly interpreted as meaning that the series that is “causal” precedes the other series and contains information useful in predicting it.

Grain prices are in levels, production data are in growth rates computed as first differences of the raw data in logs. Prussia: textile production only.

Sources: see Appendix.

Table 2: Equation (4) $\hat{y}_t = \alpha + \sum_{i=1}^m \beta_i \hat{y}_{t-i} + \delta p_{t-1} + \lambda REV_t + \varepsilon_t$

	<i>Austria</i>		<i>England</i>		<i>France</i>		<i>Hungary</i>		<i>Netherlands</i>		<i>Prussia</i>		<i>Sweden</i>	
	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
α	21.19*** (6.33)	13.99* (2.25)	13.54** (2.31)	15.42** (2.65)	9.58 (1.52)	5.54 (0.83)	4.20*** (3.79)	0.66 (0.24)	7.74 (1.07)	8.81 (1.10)	31.78*** (3.91)	23.18** (2.49)	10.87*** (3.70)	11.05*** (3.48)
\hat{y}_{t-1}	-0.94	-0.92	-0.61	-0.54	-0.51	-0.45	-0.18	-0.11	-0.39	-0.38	-0.70	-0.65	-0.68	-0.71
\hat{y}_{t-2}	-0.80	-0.56	-0.62	-0.59	-0.68	-0.48	0.58	-0.58	-0.14	-0.15	-0.76	-0.64	-0.34	-0.31
\hat{y}_{t-3}	-0.63	-0.53	-0.27	-0.31	-0.18	-0.05	0.54	1.26	-0.18	-0.20	-0.09	-0.13	-0.37	-0.39
\hat{y}_{t-4}	-0.33	-0.28	-0.32	-0.43	-0.39	-0.33	-0.21	0.20	-0.20	0.18	0.18	0.09	-0.16	-0.19
P_{t-1}	-0.22*** (4.81)	-0.11 (1.10)	-0.07 (1.65)	-0.09** (2.18)	-0.16*** (3.59)	-0.08* (1.80)	-0.09*** (3.37)	-0.04 (1.11)	-0.06 (0.95)	-0.07 (0.92)	-0.42*** (4.11)	-0.29** (2.49)	-0.14*** (3.07)	-0.15*** (2.86)
REV_t		-9.82 (1.63)		10.49*** (3.17)		-12.38*** (3.71)		-6.55* (1.88)		4.01 (0.58)		-13.08** (2.77)		2.22 (1.29)
Period	1835- 1850	1835- 1850	1820- 1850	1820- 1850	1825- 1850	1825- 1850	1835- 1850	1835- 1850	1820- 1850	1820- 1850	1833- 1850	1833- 1850	1820- 1850	1820- 1850
\bar{R}^2	0.64	0.66	0.28	0.36	0.39	0.64	0.46	0.53	0.18	0.15	0.57	0.59	0.49	0.48

Notes: HAC t-statistics (absolute) in brackets below coefficients. ***/**/* indicates significance at the 1/5/10 per cent level. In all cases the AR(m=4) elements of the models are jointly significant at conventional levels (Wald-F-test). Q-tests (at lag 1 and larger) suggest no autocorrelation of the residuals. In the case of Prussia we have used textile production only. The models for England, France, the Netherlands, and Sweden include a linear and a quadratic trend term (not reported).

Sources: see Appendix.

Table 3: Agrarian, Industrial, and Political Shocks in Europe, 1845-48

Country	Average wheat price 1838-45 grams fine silver per hectolitre (i)	Wheat price max(1845-48) grams fine silver per hectolitre (ii)	No. of years 1845-47 wheat price > average 1838-45 (iii)	Wheat price forecast error max(1845-48) over SE (iv)	Price shock 1845-48? (v)	Industrial growth 1848 (in per cent) (vi)	Production forecast error 1848 over SE (vii)	Production shock 1848? (viii)	Repression before 1848? (ix)	Revolution 1848? (x)
Austria	52.89	103.96 (47)	3	2.62 (47)	yes	-8.04	-2.49	yes	yes	yes
Baden	76.96	136.57 (47)	3	2.31 (46)	yes	-	-	-	no	yes
Bavaria	70.02	127.28 (47)	3	2.74 (47)	yes	-	-	-	yes	yes
Bohemia	61.48	101.23 (47)	2	2.41 (46)	yes	-	-	-	yes	yes
France	93.82	149.18 (47)	2	2.71 (47)	yes	-10.64	-2.63	yes	no	yes
Hamburg	67.11	108.72 (47)	2	2.45 (46)	yes	-	-	-	no	yes
Hesse-Darmstadt	76.68	119.69 (47)	3	2.24 (45)	yes	-	-	-	no	yes
Hungary	39.01	92.34 (47)	3	2.38 (47)	yes	-4.93	-2.02	yes	yes	yes
Lombardy	88.32	119.13 (47)	2	2.19 (47)	yes	-	-	-	yes	yes
Mecklenburg-Schw.	72.91	110.89 (47)	2	2.27 (46)	yes	-	-	-	yes	yes
Papal States	73.99	105.12 (47)	2	2.56 (47)	yes	-	-	-	no	yes
Prussia	71.20	110.68 (47)	2	2.41 (47)	yes	-24.02	-2.48	yes	yes	yes
Saxony	73.30	125.21 (47)	2	2.23 (47)	yes	-	-	-	yes	yes
Switzerland	87.88	146.72 (47)	2	2.76 (47)	yes	-	-	-	no	yes
Württemberg	75.90	128.70 (47)	3	2.57 (46)	yes	-	-	-	no	yes
(...)										

Table 3 to be continued on following page!

(...) *Table 3 continued from previous page!*

Country	Average wheat price 1838-45 grams fine silver per hectolitre (i)	Wheat price max(1845-48) grams fine silver per hectolitre (ii)	No. of years 1845-47 wheat price > average 1838-45 (iii)	Wheat price forecast error max(1845-48) over SE ^b (iv)	Price shock 1845-48? (v)	Industrial growth 1848 (in per cent) (vi)	Production forecast error 1848 over SE (vii)	Production shock 1848? (viii)	Repression before 1848? (ix)	Revolution 1848? (x)
Belgium	93.80	140.13 (47)	2	2.54 (47)	Yes	-	-	-	no	(yes)
Bremen	76.12	109.51 (47)	2	2.59 (47)	Yes	-	-	-	no	(yes)
Brunswick	62.33	100.29 (47)	2	2.23 (47)	Yes	-	-	-	no	(yes)
Denmark	66.32	81.51 (47)	2	1.16 (46)	no	-	-	-	no	(yes)
Netherlands	82.58	135.99 (47)	2	2.33 (47)	yes	-4.06	0.57	no	no	(yes)
Oldenburg ^a	52.13	79.34 (47)	3	2.51 (45)	yes	-	-	-	no	(yes)
England	115.31	134.68 (47)	1	1.81 (47)	no	3.94	1.09	no	no	No
Finland	73.57	73.69 (45)	1	-0.34 (46)	no	-	-	-	yes	No
Norway	89.28	119.74 (47)	2	2.13 (47)	yes	-	-	-	no	No
Russia ^a	50.72	44.12 (48)	0	-0.10 (46)	no	-	-	-	yes	No
Spain	105.34	141.27 (47)	2	1.75 (47)	no	-	-	-	yes	no
Sweden	75.76	81.44 (45)	1	1.52 (45)	no	1.69	1.08	no	no	no

Notes: ^a Rye. ^b SE – standard error of forecast in selected year.

Sources: see Appendix