Business Cycles: Theories, Evidence and Analysis

Proceedings of a conference held by the International Economic Association, Copenhagen, Denmark

Edited by
Niels Thygesen
Kumaraswamy Velupillai
and
Stefano Zambelli

MACMILLAN in association with the INTERNATIONAL ECONOMIC ASSOCIATION

12 A War-Economy Theory of the Long Wave

Joshua S. Goldstein
SCHOOL OF INTERNATIONAL RELATIONS
UNIVERSITY OF SOUTHERN CALIFORNIA

INTRODUCTION

Long waves of roughly fifty years in economic and social life have intrigued many scholars because they offer an alternative perspective from which to view history and the present situation – an alternative to either static or linear projections of the future. Past empirical studies of long waves have agreed on the dating of long waves historically but not on the scope of those waves in terms of variables encompassed, relevant time-periods, or causal mechanisms (see review in Goldstein, 1988: ch. 3). I have sought to advance the empirical evidence relevant to long waves by sorting and testing conflicting hypotheses in the long-wave debate against about fifty historical time-series (Goldstein, 1988). Based on the most salient lagged correlations among variables found in my empirical analysis, I adduced a set of causal dynamics among variables that could account for the sequence of phenomena making up the long wave – as best that sequence could be inferred from spotty empirical data. The adduced theory is a tentative one, with many remaining loose ends and anomalies. But it is better-grounded empirically than past long-wave theories.

My theory of long waves centres on the relationship between war and economic growth in the world system. Periods of severe war follow phases of robust economic growth and lead to phases of stagnant growth. The empirical evidence that war plays a central role in long waves is quite strong. Long waves in prices can be explained largely by the inflationary effects of recurrent wars. Economic innovations, capital investment, and real wages also play reinforcing roles in generating long waves, in my view – and all are also affected by major wars. The theory thus builds on, rather than contradicts, other long-wave theories stressing innovation, over-investment, and class struggle.

In this paper, I investigate the adduced causal dynamics among war and economic variables directly, setting aside the idea of long waves (as the expression of those underlying dynamics in the historical behaviour of the system). That is, I begin from the micro level of shorter-term relations among the variables in a system, rather than the macro level of how that system behaves over the long term. First I will summarise these causal dynamics, posited in my long wave theory. Then I will present evidence from a new analysis of several of the longest and highest-quality historical time-series in the period 1750–1935, using VAR modelling.

Finally, I will discuss the question of whether the underlying causal dynamics continue to operate in the present-day world system, despite the unusual nature of the most recent long wave. In terms of a four-phase dating scheme of long waves, I argue that the 1940–68 'expansion' phase was distorted by the extension of the core of the world system to America, which poured huge new economic resources into the European war system at the time of the Second World War. Despite this disruption, there is some evidence that long-wave dynamics continue in the present.

1 GOLDSTEIN'S LONG-WAVE THEORY

My theory posits causal dynamics among war, production, prices, real wages, technical innovation, and capital investment. These variables are all conceived at a global level of analysis – i.e. in the core of the world system, roughly equivalent to the 'Great Power system' in politics or the 'leading industrial countries' in economics.

1.1 War and Prices

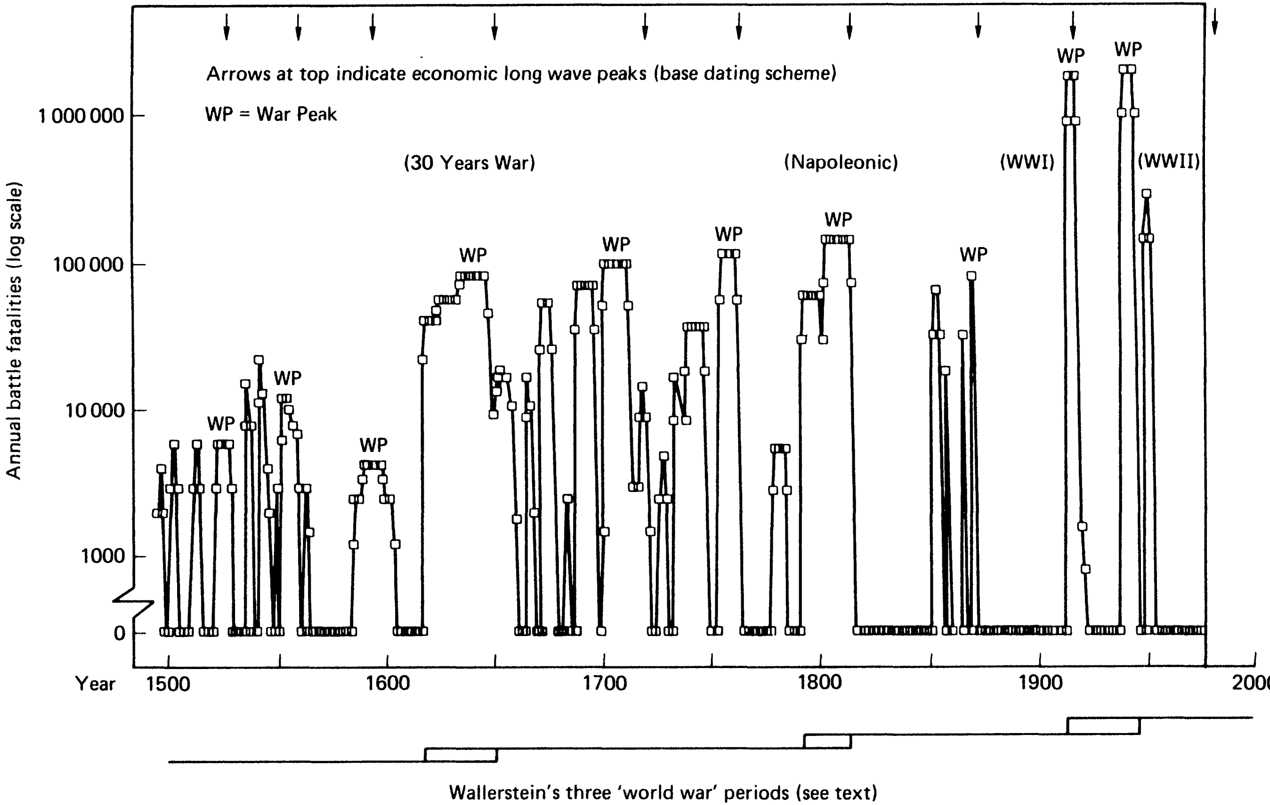
Long waves in prices, more than in any other economic or political phenomenon, have attracted attention to the phenomenon of long cycles. Price waves are clearly visible in many untransformed historical price-series (including that of Kondratieff in the 1920s), whereas long waves in production, innovation, and other aspects of economic or social life have been sharply debated and require more controversial methodologies. As for the price waves, some critics of long waves argue that the price peaks about every fifty years are merely the by-product of severe wars, and hence are not 'endogenous' economic cycles.

The bulk of evidence supports the idea that wars cause the long waves in prices. Figure 12.1 is a graph of Levy's (1985) data on Great Power war fatalities, which I transformed into a 500-year time-series. The long-wave dating for prices – my 'base dating scheme' – is a composite of the dates given by Braudel (1972), Frank (1978), Kondratieff (1935), and Mandel (1980), with a minor modification (Goldstein, 1988). The price peaks in this scheme are shown at the top of Figure 12.1 as vertical arrows. On the graph of Great Power war battle fatalities, I have marked the recurrent, particularly severe and prolonged wars as 'war peaks' (WP). The dates and peak wars are listed in Table 12.1. Clearly each spurt of inflation ending a long-wave price upswing corresponds with a high severity of war in the Great Power system. The only exception is the Second World War which I will discuss later.

Wallerstein's three periods of 'world war' are shown at the bottom of Figure 12.1: the Thirty Years' War, Napoleonic Wars, and the First and Second World Wars. I call these 'hegemonic wars' because they are struggles for the dominant position in the world system. Out of each war has emerged a new hegemon – the leading country on the winning side that survives with its economy intact and reorganises the world system around itself, while its adversaries and allies are drained by war. The three hegemons were the Netherlands, Britain, and the USA.

It is tempting to assign the struggle for hegemony – including the great hegemonic wars ('world wars', 'global wars', 'systemic wars', etc.) – a place in the long wave. Several past schemes have tied *pairs* of long waves to hundred-year cycles of war. However, in my view the relationship is more irregular. There is no fixed number of long waves that makes up a cycle of hegemony. Rather, there is a longer-term cycle, the rise and fall of hegemony, which does not appear strongly linked to long waves in a causal sense. The two cycles, of course, overlap in that hegemonic wars are also war peaks in the long wave (again, except the Second World War). But other long-wave war peaks occur at times of intermediate hegemony, adjusting but not rewriting the political arrangements in the world system.

What accounts for the regularity of war recurrence? I find explanations based on endogenous 'war cycle' mechanisms, such as the 'social memory of war' or the 'alternation of generations', incom-



Source: Goldstein (1988) p. 290

Figure 12.1 Great Power war severity, 1495–1975

Table 12.1 Dating of long war cycles, 1495–1975

Cycle	*Starting date of war cycle*	*Peak war years*	*Length (years)*	*Ending date of corresponding long wave phase period*
1	(1495)	1521–1529	(35)	1528
2	1530	1552–1556	28	1558
3	1558	1593–1604	47	1594
4	1605	1635–1648	44	1649
5	1649	1701–1713	65	1719
6	1714	1755–1763	50	1761
7	1764	1803–1815	52	1813
8	1816	1870–1871	56	1871
9	1872	1914–1918	47	1917
10	1919	1939–1945?	(27)	(1968/80?)

Cycle	*Peak wars*	*Annual fatality rate at peak (thousands)*
1	First and Second Wars of Charles V (Ottoman War v. Hapsburgs)[a]	13
2	Fifth War of Charles V (Ottoman War v. Hapsburgs)[a]	22
3	War of the Armada (Austro-Turkish War)[a]	11
4	Thirty Years' War: Swedish/French Phase	88
5	War of the Spanish Succession	107
6	Seven Years' War	124
7	Napoleonic Wars	156
8	Franco–Prussian War	90
9	First World War	1934
10	Second World War	2158

[a] Dating of war peaks in cycles 1–3 based primarily on intra-European wars rather than those against Turkey. Wars against Turkey are included in the statistics, however, and are shown above in parentheses.

Source: Goldstein (1988) p. 241.

plete. These contributing factors notwithstanding, I have proposed that the war cycle cannot be explained independently of economics. While prices merely respond to war, trends in economic production both affect and respond to the severity of Great Power wars. Prosperity gives the Great Powers the wherewithal to fight bigger wars.

Big wars, however, drain the world economy, which must be slowly rebuilt over decades. Periodic big wars also serve as regulating 'shocks' to cycles of capital investment and technical innovation, and they drive down real wages.

1.2 War and Production

The growth of world production appears to vary in a manner consistent with this war-growth theory of the long wave, although the changes in growth rates are generally not dramatic. Upswings of faster and more robust growth in production *precede* upswings in war and prices, which in turn precede production downswings marked by slower and less stable growth. The production waves appear to lead war/price waves by about a quarter of a cycle (ten to fifteen years) on average. These production waves are less sharply defined than the price waves, resembling 'swells' rather than the more extreme peaks and troughs in prices. Wojtyla (1988) illustrates one possible dating scheme (see Table 12.2) which leads my price dating by ten to fifteen years on average, and which seems to show alternating phases of economic growth in leading industrial countries (based on Maddison's data).

Production upswings, then, provide the economic surplus in the world system to fill the 'war chests' of the Great Powers. Severe wars drain those war chests and end the robust growth of the world economy (through the obvious disruption and destruction wrought by war, which is not fully compensated by the full mobilisation of economic resources for the fight). Toward the end of the war upswing, as production has already begun stagnating, sharp world-wide inflation often results from the severity of war (which increases demand and reduces supply); this phase of 'stagflation' has historical precedents before the 1970s (around 1920, 1872, 1815). Finally, as wars give way to peace (often in a flurry of bankruptcies), the world economy recovers and eventually a new period of robust economic growth gets under way.

The central dynamic of the long wave, then, is the long-term 'lagged negative feedback loop' of world economic growth and Great Power wars. I posit that this central dynamic is reinforced by three other such feedback loops involving variables that affect production and are affected by war – real wages, innovation, and capital investment.

Table 12.2 Growth rates by production phase periods

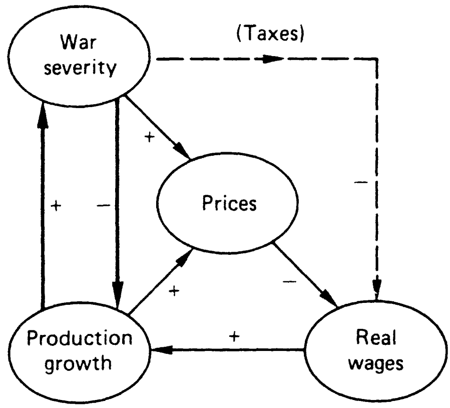
*Kondratieff phase**	*Average growth rate for contending Great Powers*	*Germany*	*France*	*UK*		
Downswing 1790–1830	1.5%	1.3%	0.8%	2.4%+		
Upswing 1830–1860	2.0	1.9	1.8	2.2+		
Downswing 1860–1890	1.8	2.3+	1.1	2.0		
Upswing 1890–1910	2.1	3.1+	1.5	1.6		
					USA	
Downswing 1910–1950	1.7	1.5	1.2	1.4	2.8+	
		Western Europe				*USSR*
Upswing 1950–1970	4.6	5.0			3.5	5.2+
Downswing 1970–Date	2.3	2.4			2.5+	2.0

* This dating for production phases leads price phases by 10 to 15 years.
+ Leader
Source: Based on data in Angus Maddison *Phases of Capitalist Development* (Oxford University Press, 1982); Angus Maddison 'A Comparison of Levels of GDP Per Capita in Developed and Developing Countries, 1700–1980: *Journal of Economic History*, vol. XLIII, no 1, March 1983.
Source: Wojtyla (1988:5)

1.3 War, Production, Prices and Real Wages

Although my empirical analysis for real wages extends only to two British series, it shows evidence of an inverse correlation of real wages with the price phases of the long wave. When prices rise, real wages fall. This timing makes particular sense in relation to the timing of Great Power wars – during the biggest wars, with high taxation and inflation, real wages fall way behind prices; during peacetime, economic resources are channelled back to the civilian economy and workers end up better off in real terms. In short, workers suffer in wartime.

The long waves in real wages should, in principle, bear some



Source: Goldstein (1988) p. 260.

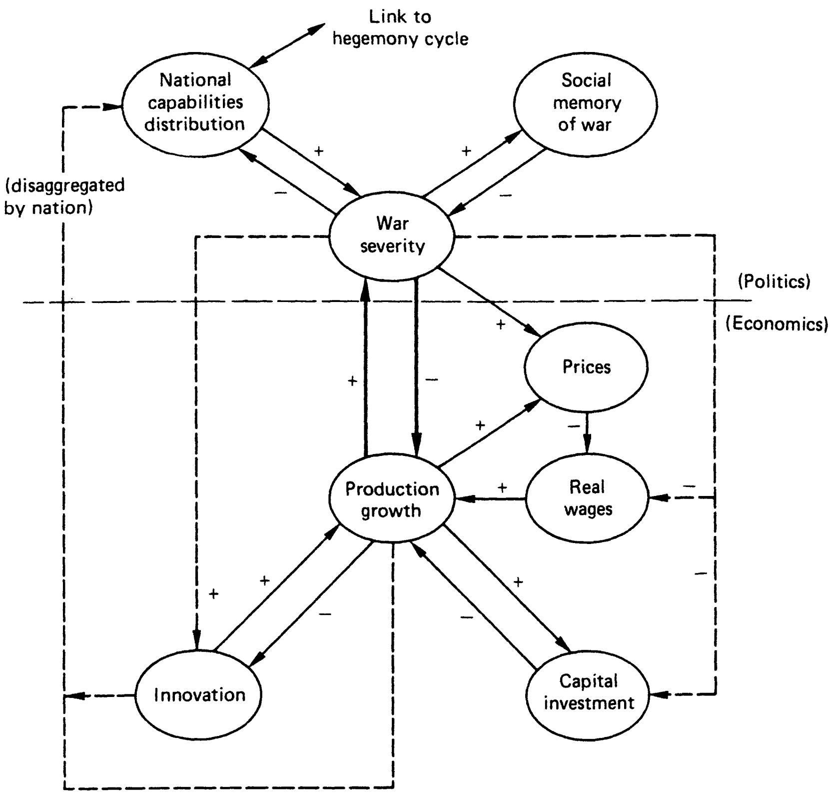
Figure 12.2 Adduced causality, production/war/prices/wages

relation to long waves of 'class struggle' described by some researchers (e.g. Mandel, 1980). However, I have not been able to identify that relationship to date.

Figure 12.2 maps out the adduced causal dynamics at the core of the long wave. Most important is the cycle in which production growth stimulates war severity, but war severity dampens production growth in the world system. War severity also affects prices (positively) and real wages (negatively, both directly and by way of prices). Real wages appear, from the lagged timing, to have a positive effect on production – a plausible connection since better-paid workers would be more productive. Finally, I adduce a direct, positive effect of production on prices (as well as the indirect effect through war). This connection rests on the idea that as a production upswing proceeds, demand increases while supply at some point begins to experience limits.

1.4 Innovation and Capital Investment

Two other economic phenomena come into play in this account of long-wave dynamics. First, an innovation cycle reinforces the long wave in that a higher rate of innovation stimulates (with some lag) stronger economic growth, but strong economic growth in turn dampens the innovation rate. This is the majority view among long-wave scholars (e.g. Mensch, C. Freeman, Van Duijn) focusing on



Source: Goldstein (1988) p. 275

Figure 12.3 Theoretical model of long-wave dynamics

innovation. My empirical evidence on the timing of innovations, although sketchy, is consistent with this interpretation. The timing suggests that innovations are highest in the rebuilding phase after post-war stagnation. I tried to test whether inventions lead innovations, as some researchers believe; but the data on patents gave anomalous results (British long waves of invention being half a cycle out of phase with American ones).

Second, a capital-investment cycle also reinforces the long wave. Production upswings lead to upswings of capital investment, ultimately leading to overinvestment and retrenchment, dampening production growth. The Massachusetts Institute of Technology (MIT) group suggests that this cycle of over- and under-investment (their 'self-ordering of capital') may extend the wavelength of the long wave (Sterman, 1983).

Figure 12.3 illustrates my causal model of long waves with the inclusion of innovation and capital investment. Also shown in the figure are two possible influences on war that may also help regulate the timing of the long wave. The first, social memory of war, has been mentioned above. The second is the possible effect of 'national capabilities distribution' (in the Great Power system) in perpetuating the war-cycle component of the long wave. Immediately after a severe war, the capabilities of winners usually far overshadow those of losers. Under these conditions a severe war is unlikely (Organski's power transition theory); rather, war is likely to occur after the low-capability countries have recovered and embarked on long-term growth that brings their capabilities within striking distance of adversaries. Thus war severity disequalises national capabilities distribution, which in turn dampens war severity (which allows capabilities to equalise, thus increasing war severity). National capabilities are affected by relative national rates of innovation and production growth, in addition to the effects of war. The national capabilities distribution also connects with the hegemony cycle, but (as mentioned above) I consider this only a weak causal connection. The most important point of Figure 12.3 is that an adequate model of the long wave must bridge economics and politics.

2 A NEW STATISTICAL ANALYSIS

In order to explore further the causal connections among the key variables of the long wave, I have conducted a new analysis using VAR modelling. The VAR model is essentially a multivariate, multi-equation reduced-form statistical model in which each variable is regressed on its own past behaviour and the past behaviour of every other variable in the system. This method was developed by economist Christopher Sims (1980), and its applications to political science are discussed by Freeman, Lin, and Williams (forthcoming).

The data I used in this exploratory exercise consisted of several of the best time-series (highest quality and longest duration) from my earlier analysis (described and listed in Goldstein, 1988, Appendices A, B). For each of six variables of interest, I chose one time-series. In one case (world industrial production) I spliced together two series

(1740–1850 and 1850–1975) by multiplying the second series by the ratio of the two in 1850. The six series were:

War	Logged war severity (from Levy)	1495–1975
Production	World industrial production (spliced)	1740–1975
Prices	British wholesale price index	1750–1975
Innovation	Haustein's list of innovations	1764–1975
Real wages	S. English real wage index	1736–1954
Investment	US private building volume	1830–1957

The use of US private building volume as a measure of world investment was particularly questionable, and the time-frame covered by that series is considerably less than the other series. Therefore, I dropped capital investment from this analysis, pending better data. This left five variables, spanning the years 1764–1954.

In specifying the time-frame and number of included lags in the model, I used a Bayesian approach of imposing prior theoretical expectations. One must decide how many lags of the independent variables should be included on the right-hand side of each equation. There are statistical tests to induce this from the data, but since my theory calls for up to 10–15 lags I began by simply using 15 lags. That is, the lagged effects of one variable's past behaviour in influencing another variable's current behaviour may extend up to fifteen years (just over one quarter of a cycle). My theory has no lagged effects longer than this.

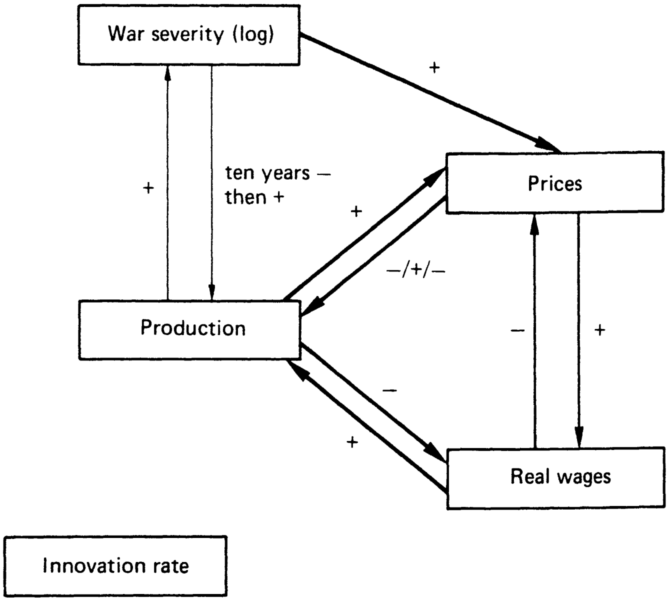
Since in my theory, the Second World War is considered unusual and because the war years have many extremes in the time series that would have a heavy influence on the statistical results, I decided not to include the years after 1935 in the analysis. The years 1936–54 would add few degrees of freedom and might well introduce an instability that would mask earlier patterns. The Second World War in any case cannot be fully included with 15 lags in the model and data up through only 1954. This left a time-frame for the five-variable VAR model of 1764–1935. While VAR analysis allows the testing of time-stability within the time-frame covered (to see whether the coefficients change significantly at a certain candidate break-point), preliminary tests merely show that the great wars (Napoleonic, and the First and Second World Wars) are unstable relative to the peaceful years. Of course I could not use only peaceful times in this analysis, so I relied on my prior analysis which suggested omitting the Second World War but assuming that the prior 150 years could be modelled as one system (even though the sudden changes in the system induced by war and peace do no make for 'stability' in the coefficients). Allowing for the fifteen years of lags in variables, the actual analysis at this point covered the period 1779–1935, or 157 years.

The VAR model is estimated for all five equations using ordinary least squares (OLS) (which works when the same lagged variables make up the right-hand side of each equation). For each variable taken as the dependent variable (one equation), the significance of each other variable (as an independent variable) is assessed in the form of an F-fest for the joint significance of the coefficients on all fifteen lagged terms on that variable. These F-tests, then, are statistically significant if the behaviour of a given variable over the past fifteen years is correlated with the present behaviour of another variable (taking into account the independent effects of the second variable's own past behaviour and that of all other variables in the model).

The statistically significant correlations in the five-variable VAR model are diagrammed in Figure 12.4. Each causal arrow points from an independent variable (past fifteen years) toward the dependent variable (present) it affects. The significance level of the F-statistic is indicated by the width of the arrow. Each of the five variables was also significantly affected by its *own* recent past behaviour (autoregressive), and this is not shown on the figure.

These causal arrows are supplemented by a simulation of the VAR model to identify the *kind* of response which one variable has to another. In this simulation, a hypothetical positive shock is induced in one variable at a time, and its subsequent effect on all the variables is traced in the moving average responses of those variables when the estimated model is simulated. The shock is ahistorical, but based in magnitude on the standard deviation of the residuals from historical data. The simulation requires an 'ordering' of variables specifying how the shock will propagate through the system; to check for robustness I used one ordering based on 'forward timing' along the long wave, and a second reversed ordering (the effects of shocks were robust against both orderings). Based on the response to the hypothetical shock, I have put a plus or minus sign (or in some cases a notation) by each causal arrow in Figure 12.4 (below I will show graphs of the moving average responses to the shocks).

Turning now to the actual relationships found significant in Figure



Note: Arrows indicate direction of causality (forward through time) suggested by lagged correlations. Statistical significance shown by size of arrow is given by the F-test on the joint (1–15) lagged coefficients for each variable in each equation.

Statistical significance:

Less than 0.01
Less than 0.05
Less than 0.10

Notations by arrows indicate direction of (moving average) response in the second variable, to a hypothetical shock in the first variable, in a VAR simulation. (+ indicates response in kind; – indicates opposite response).

Figure 12.4 Significant lagged correlations (over 1–15 lags taken jointly) in VAR model of five long-wave variables, 1779–1935.

12.4, there was good support for the relationships postulated in my theory (Figure 12.2 above):

1. The two-way relationship of war and production was significant – although the direction of response of war to production was

unclear and the postulated negative response of production to war lasted only about ten years.
2. The one-way causation from war to prices was highly significant and positive as postulated in the theory.
3. The positive effects of production on prices, and of real wages on production, were significant in the VAR model, although there were also significant reverse linkages not postulated in the theory.
4. Prices did exert a significant influence on real wages, but a positive one; this is because the negative effect of prices on real wages is instantaneous, while the effect seen here, over 1–15 years, is the partial return of real wages toward where they were before the price shock (instantaneously) changed them.

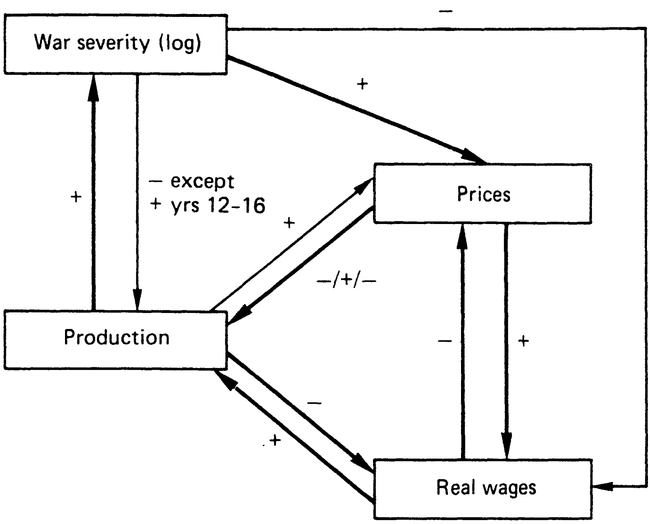
In the model wages also had a significant reverse effect on prices. Surprisingly, no significant relationships involving innovation were found in the model (perhaps just because of data quality).

Since innovation did not appear significant in the five-variable model, I dropped it from the analysis and created a four-variable VAR model. This allowed the time-frame to be extended to 1750–1935, which after allowing for 15 lags left an analysis of 1765–1935, or 171 years. In this four-variable model, with a slightly longer time-frame, the degrees of freedom are increased.

Using this four-variable model, I then checked whether the 15 lags could be shaved down somewhat to increase degrees of freedom. Using Sims's modified likelihood test to check whether additional lags significantly change the estimated model, I tested 10, 12, and 15 lags, staying within the general confines of my theory (roughly a quarter of a cycle maximum for lagged effects). 12 lags turned out to be significantly different (at .01) from 10 lags, but 15 was not significantly different from 12. Thus I reduced the specification of 15 lagged terms to 12 for each independent variable.

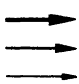
The results of this four-variable analysis are shown in Figure 12.5 (the graphs of moving average response curves are included on Figure 12.6):

1. Both the positive link from production to war and the negative link from war to production are still significant.
2. The positive effect of recent war on present prices is still extremely significant.
3. Unlike the five-variable model, here war exerts a significant, negative effect on real wages, as in the theory.



Note: Arrows indicate direction of causality (forward through time) suggested by lagged correlations. Statistical significance shown by size of arrow is given by the F-test on the joint (1–12) lagged coefficients for each variable in each equation.

Statistical significance:

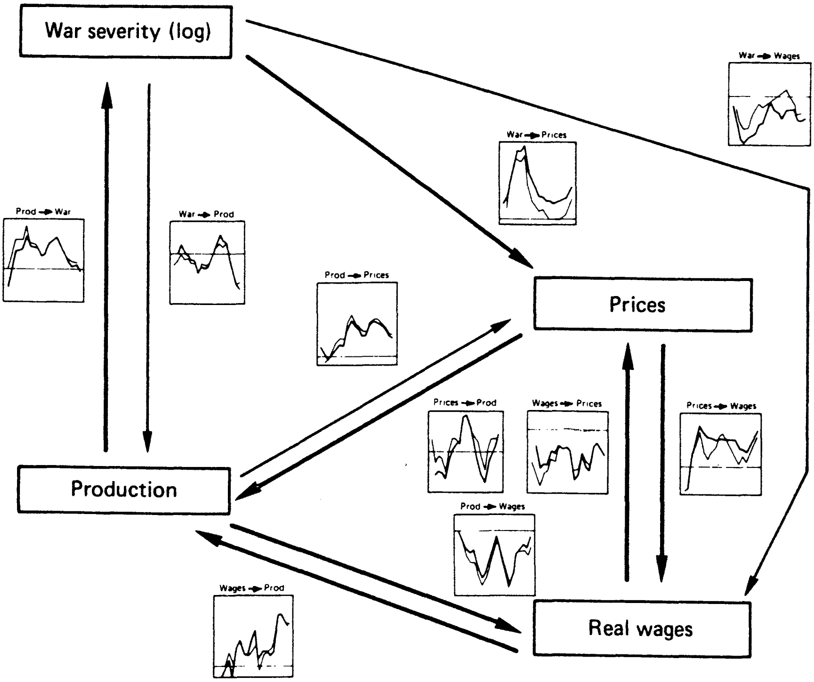


Notations by arrows indicate direction of (moving average) response in the second variable, to a hypothetical shock in the first variable, in a VAR simulation. (+ indicates response in kind; – indicates opposite response).

Figure 12.5 Significant lagged correlations (over 1–12 lags taken jointly) in VAR model of four long-wave variables, 1762–1935.

4. The two-way interaction of production with prices and production with real wages resembles the five-variable model (the effects of production on prices, and wages on production, are still positive as theorised.
5. The price-wage interaction is also similar to the five-variable model.

As a further test, I ran a VAR model identical to the four-variable model just discussed except that only 5 annual lags, rather than 12,



Note: Arrows indicate direction of causality (forward through time) suggested by lagged correlations. Statistical significance shown by size of arrow is given by the F-test on the joint (1–12) lagged coefficients for each variable in each equation.

Statistical significance:

→ Less than 0.01
→ Less than 0.05
→ Less than 0.10

Graphs by each arrow indicates moving average response in the second variable, to an orthogonalised shock in the first variable, in a VAR simulation. Solid lines represent main ordering of variables; dashed lines represent reverse ordering.

Figure 12.6 Significant lagged correlations (over 1–12 lags taken jointly) in VAR model of four long-wave variables, 1762–1935, with MAR responses are included for each variable. Although this model is presumably mis-specified, it opens, in a sense, a window on shorter-term causal connections while becoming blind to longer-term effects beyond five years.

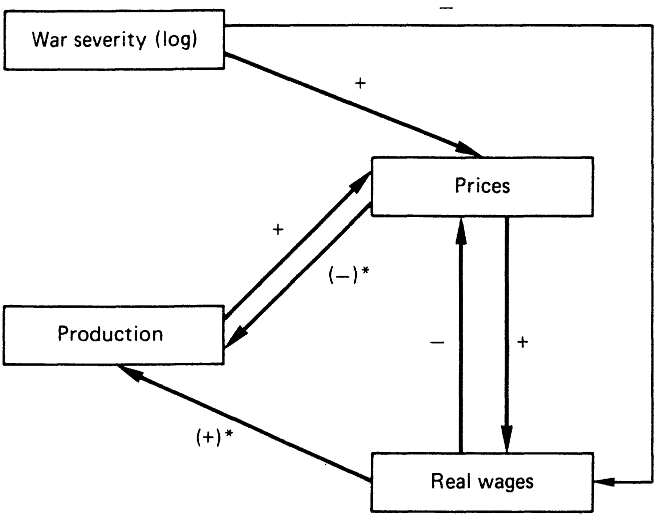
According to my theory, the lagged correlations between war and production, postulated as operating over a ten-to-fifteen year period, should disappear in the 5-lag model. This is exactly the case in the results of the 5-lag VAR analysis, shown in Figure 12.7. The production-war connection is no longer significant, and war becomes the only 'exogenous' variable in the system if we consider just the short-term interactions (one-to-five years). Only in considering longer-term effects (one to twelve years, Figure 12.5 & 12.6) do we see that war is endogenous, responding to changes in production. All this fits my long-wave theory well, and calls in question models of the economic long wave which leave out war.

Finally, the contemporaneous correlations of residuals in the VAR model reflect very short-term causal effects on a time-frame of less than one year (thus appearing contemporaneous in annual data). The correlations are:

Prices – real wages	−0.32
War – prices	+0.12
War – real wages	−0.10
War – production	−0.23
Prices – production	+0.24
Production – real wages	0.00

Here the statistics say nothing about the directions of causality which I will instead draw from those adduced in my theory. The price–wage correlation confirms that the *immediate* effect (not the delayed effects after one-to-fifteen years) of prices on wages is negative, as one would expect. The residual correlations also suggest same-year effects of war on prices (positive), on production (negative), and on real wages (negative). There is also a same-year positive correlation of production and prices, the causal direction of which is unclear.

These new analyses were undertaken for exploratory purposes. I consider the results a success in largely supporting my long-wave theory. The causal diagrams that emerge from a VAR analysis of selected time-series contain almost all the relationships postulated in my long-wave theory. The main exceptions were the failure to establish any relationships using Haustein's list of innovations, and



* In reverse ordering simulation, response is − then +.

Note: Arrows indicate direction of causality (forward through time) suggested by lagged correlations. Statistical significance shown by size of arrow is given by the F-test on the joint (1–5) lagged coefficients for each variable in each equation.

Statistical significance:

Less than 0.01
Less than 0.05
Less than 0.10

Notations by arrows indicate direction of (moving average) response in the second variable, to a hypothetical shock in the first variable, in a VAR simulation. (+ indicates response in kind; – indicates opposite response).

Figure 12.7 Significant lagged correlations (over 1–5 lags taken jointly) in VAR model of four long-wave variables, 1755–1935.

the unexpected reverse feedbacks among production, prices, and wages.

The elements of the theory concerning war are supported, overall, by the VAR analysis. War is affected by, and in turn affects, production. War exerts a one-way influence on prices (positive), and on real wages (negative). In the short time-frame, war seems to be exogenous, driving prices and real wages; but in fact war is endogenous and responds to production on a time frame of up to twelve years.

3 A FOUR-PHASE DATING SCHEME

Given the important time-lags among variables in this theory, we must abandon the simple two-phase dating scheme for long waves. Figure 12.8 illustrates the timing sequence of the variables in my long-wave theory. There is not simply an '*A*' phase and a '*B*' phase, but a series of lagged phases.

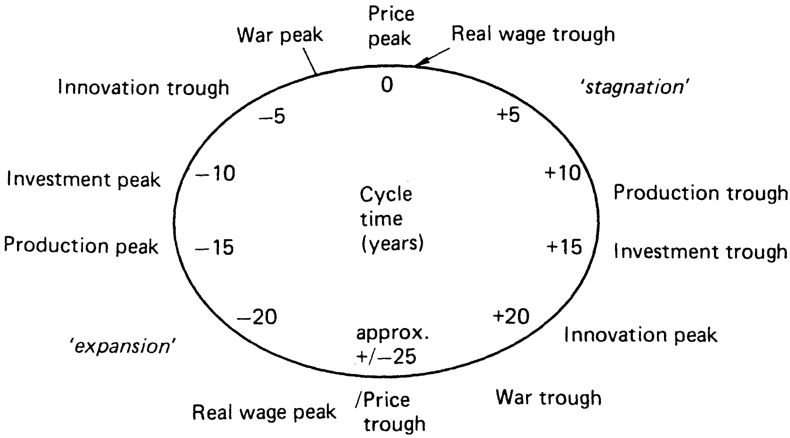
Concentrating on the crucial production and war variables, which lag each other by about a quarter of a cycle, we can define a four-phase scheme of the long wave:

1. *Expansion* – production, investment, war severity, and prices all rise; innovation is stagnant; real wages flatten out.
2. *Stagflation* – war severity is high, prices rise rapidly, and production and investment stagnate (stagflation); innovation is low; real wages fall.
3. *Stagnation* – production growth is low and uneven; investment is low; war severity declines; inflation is low (or prices even decline); innovations begin rising; real wages recover.
4. *Rebirth* – production growth picks up again, investment follows; prices are low, war severity is low; innovation is high; real wages are high.

The traditional conception of long waves in terms of synchrony of prices and production gives rise to an *A*-phase, *B*-phase rendition of all-round economic expansion or stagnation. These phases do occur – they are phases 1 and 3 above – but account for only half of the story. The other half is in certain ways even more interesting. The war phase and the rebirth phase seem to represent extremes of the undesirable and desirable points in the long wave.

This four-phase timing may be tentatively matched with historical dates. The beginning dates of 'expansion' and 'stagnation' would come from the price troughs and peaks listed in my base dating scheme (Goldstein, 1988) – except that I would change 1917 to 1920, which seems a better date for the *price* peak. The following dating is put forward as a starting-point, and may need adjustment:

Expansion	1790–1803?	1848–60?	1893–1910	1940–68
War	1803?–14	1860?–72	1910–20	1968–80
Stagnation	1814–30	1872–(?)	1920–33	1980–95?
Rebirth	1830–48	(?)–1893	1933–40	?1995–2010?



Source: Goldstein (1988) p. 259.

Figure 12.8 Sequence and timing of idealised long wave

In this scheme, as I have mentioned, the Second World War does not fit into the normal long-wave timing. It comes at the beginning, rather than the end, of an expansion phase, and hence follows too closely on the First World War. Or, put more accurately, it is too big a war for coming so soon after the First World War. How was the world system able to afford such a big war at this point in time? And how, following that monstrously large war, could the world system resume robust growth to finish out the expansion phase, rather than skipping to stagnation? The answer has to be a great and relatively sudden influx of economic surplus, of the 'nerves of war', into the Great Power system. This is what happened as the core of the world system expanded to incorporate the USA (and to a lesser extent Russia and Japan) in the early twentieth century. The USA paid for much of the Second World War and for most of the post-war economic aid which put Europe and Japan back on track to sustained growth.

Given the disruption to the long wave around the Second World War, it is not clear that the world has returned to 'normal' dynamics since then. Perhaps the events of the twentieth century have broken the long-wave dynamic once and for all. If so, any insights into the present or projections into the future would be of little use. Nonetheless, there are ways in which the long-wave dynamic seems to continue – the Vietnam War (on top of the Cold War) in the late

1960s, the 'stagflation' on schedule in the 1970s, the end of robust world economic growth in the 1970s and 1980s, and the downturn of inflation in at least some key economies in the 1980s.

If this timing sequence is correct, we are now in the 'stagnation' phase of stagnant production, low inflation, and reductions in Great Power war (or in the cold war, which has been the economic equivalent of a low-intensity, drawn-out Great Power war). The historical analogies to our present phase are in 1920–33, or perhaps more appropriately (as I argue in Goldstein, 1988) in the 1870s and 1880s.

In such a sequence, the Reagan military build-up of the 1980s is counter-cyclical. That build-up could not last and, after less than a decade, came to a halt under a cloud of national debt. The Reagan policy of priming economic growth by cutting taxes and increasing military spending led to massive deficits in part because the underlying production-downswing phase could not respond strongly enough to such stimulation. On the other hand, the policy did not trigger high inflation because the underlying price-downswing phase (notable in decreasing oil prices in the late 1980s) kept inflation under control and production creeping forward despite the drain of increased military spending.

The US military build-up of the 1980s appears as a delayed 'last gasp' of the war-stagflation phase. It has, at best, applied counter-cyclical pressure to smooth out the transition to out-and-out stagnation. At worst, it has delayed true stagnation by a few years but increased its potential severity. The policy has also thwarted the real wage increases that should be the due of workers in this phase, as the economy readjusts away from war.

The debt for those years must still be paid off or written off, and this may hold back the coming of 'rebirth' and perhaps bring financial instability, even crashes. But the long-term picture, which even the US frenzy of spending did not change, is that the world economy and the world military system are moving toward a truly 'peacetime' economy for the first time since before the Second World War. That is, the world may finally demobilise from the last great war in a way that was done quickly after most wars in centuries past. The 'permanent' war economy may be long-lived but not immortal after all. Thus, the peaceful character of these years offers one consolation for continuing stagnation and possible financial collapses in the early 1990s. By 1989 these trends have clearly emerged, and it is 'no accident' (as the Soviets like to say) that the trends have moved furthest and fastest in that greatest of military economies, the Soviet Union.

A second consolation in this late stagnation period is the high rate of innovation as new sectors are arising to carry the next wave of prosperity. The most interesting of these innovations may be occurring in the biotechnology, electronics, telecommunications, and space industries (the latter and much of the rest depending on the ability of political leaders to resist militarising space).

If this difficult transition through 'stagnation' can be navigated successfully, we may look forward to the 'best of times' in the rebirth phase around the turn of the century. This all-important time of peace *and* prosperity for the great powers may offer the best hope for restructuring the war system in fundamental ways. Those years may offer a 'window of opportunity', toward which we should now be aiming, to get off the merry-go-round of Great Power war once and for all.

Note

* Acknowledgements: For their comments on and criticisms of an earlier draft of this paper, I thank John Freeman, David Gordon, Giovanni Arrighi, Richard Goodwin, Dina Zinnes, Paul Pudiate, Andra Rose, André Gunder Frank, Alfred Kleinknecht, Thomas Kuczynski, Beverly Silver, Andrey Poletayev, Stanislav Menshikov, Ernest Mandel, and Immanuel Wallerstein. A previous version of this paper was presented at the 'Long Wave Debate' conference, Vrije Universiteit Brussels, 12–14 January 1989.

References

Braudel, Fernand (1972) *The Mediterranean and the Mediterranean World in the Age of Philip II* (London: Collins).

Frank, André Gunder (1978) *World Accumulation, 1492–1789* (New York: Monthly Review Press).

Freeman, Christopher, Clark, John and Soete, Luc (1982) *Unemployment and Technical Innovation* (London: Frances Pinter).

Freeman, John R., Lin, Tse-min and Williams, John (forthcoming) 'Vector Autoregression and the Study of Politics', *American Journal of Political Science*.

Goldstein, Joshua S. (1988) *Long Cycles: Prosperity and War in the Modern Age*. (New Haven: Yale University Press).

Haustein, Heinz-Dieter and Neuwirth, Erich (1982) 'Long Waves in World Industrial Production, Energy Consumption, Innovations, Inventions, and Patents and Their Identification by Spectral Analysis', *Technological Forecasting and Social Change*, no 22, pp. 53–89.

Kondratieff, Nikolai D. (1935) 'The Long Waves in Economic Life', *Review of Economic Statistics*, vol. 17 no 6 (November) pp. 105–15.

Levy, Jack S. (1983) *War in the Modern Great Power System, 1495–1975* (Lexington, Kentucky: University Press of Kentucky).

Mandel, Ernest (1980) *Long Waves of Capitalist Development* (Cambridge: Cambridge University Press).

Mensch, Gerhard (1979) *Stalemate in Technology: Innovations Overcome the Depression* (Cambridge, Massachusetts: Ballinger).

Sims, Christopher (1980) 'Macroeconomics and Reality', *Econometrica*, vol. 48, no 1, pp. 1–48.

Sterman, John D. (1983) 'A Simple Model of the Economic Long Wave', MIT System Dynamics Group, working paper D–3410, March.

Van Duijn, J. J. (1983) *The Long Wave in Economic Life* (Boston: Allen & Unwin). (From the Dutch version of 1979.)

Wojtyla, Henry L. (1988) 'Going for Growth and Global Diversification: An Investment Strategy for the Post-Reagan Era', Investment Strategy Special Report (New York: Rosenkrantz, Lyon, and Ross) 17 August 1988.