HICKSIAN INSTABILITY IN ASSET MARKETS AND FINANCIAL FRAGILITY

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In the course of developing his general equilibrium model, Hicks addressed the possibility of instability in a market for goods which were produced and consumed, i.e. a flow market (Hicks, 1946, 62-7). This is his famous “snake diagram” in which excess supply increases as price decreases over a range of values of the price of the good but the instability is bounded by stable equilibria above and below the unstable equilibrium. Analysis of the possibility of systemic financial instability leading to financial crisis will benefit from an equivalent construct based on markets for financial assets. The purpose of this short paper is to develop such a construct and to apply it to the problem of assessing the fragility of and the potential for serious downside instability in a financial system. While the process of serious systemic instability necessarily involves the interaction of markets for different financial (and other capital) assets, the instability will be triggered by a major fall in prices in at least one individual market. Since a financial (systemic) crisis is a necessary (but not sufficient) condition for economic depression, a better conceptual approach to serious downward instability in a financial system will permit more efficient analysis of the antecedents of depression.

The first section derives the emendation of the Hicksian concept for a single market dealing in a single (specific kind of) financial asset. The analysis is set in a closed economy for ease of exposition, and this assumption is relaxed in the third section. The second section applies the Hicksian approach to the potential instability of a financial system (of interdependent markets). The third section examines how financial crisis ties into the analysis of depression and macro-economic policy in an international world (Gray, 1996).

1. HICKSIAN INSTABILITY IN AN INDIVIDUAL ASSET MARKET

Instability in a market is a subject which economic theory does not handle with great insight because of the wide range of operational idiosyncrasies which exists and because of theory’s predisposition to emphasize equilibrium solutions. The basic device is Hicks’s diagram of market instability (Hicks, 1946, 65) a unstable equilibrium in which an increase in price calls forth an increase in excess demand over a range of values of price and which is bounded by two stable equilibria (above and below) so that the market is unstable over a range of prices. Hicks does not offer any suggestion as to what determines the distance between the two stable equilibria (the range of instability). This framework, rudimentary as it is, applies to markets dealing with flows of production and demand rather than to a market dealing with a stock of assets. The cobweb theorem (Eckstein, 1968), which is also capable of generating instability in flow markets, deals with the problem of a good in which supply decisions require very long lead times. This could be applicable to markets for durables (investment goods) with long production times such as commercial real estate. Fluctuations in demand in flow markets for goods with short lead times in production are characterized by quick

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responses in supply schedules which are inherently stabilizing. For goods of this kind, HICKSIAN INSTABILITY IN ASSET MARKETS
Hicksian instability will have a small range.

Asset markets are different from flow markets for several reasons.

1. The existing stock of assets must find satisfied holders if equilibrium is to be regained. Bankruptcies apart, changes in the quantity available are so small relative to the existing stock that they can be ignored.

2. Changes in asset values affect net wealth positions, entrepreneurs' "degree of confidence" (Kregel, 1977), and the willingness of "secured executives" of financial institutions to lend. In this way, they contribute directly to depression and to the difficulty of rebounding from a depression to normalcy (Gray, 1990).

3. Markets for financial assets are likely to have a limited range of stability before encountering instability, i.e. the Hicksian diagram depicting instability in the face of the smallest shock is not a good representation.

4. Market instability is likely to be asymmetric in that expectations based on (recent) experience are unlikely to view the probabilities of significant downward or upward movements in price levels as identical.

5. Once within the unstable range, the instability feeds on itself (a crisis) so that the range of instability can be substantial.

These features are summarized in Figure 1, in which $p$ is the going equilibrium price and which depicts downward instability. Reasone and 5 are developed in terms of an individual market under the assumption that other financial markets are not the source of the perturbation.

The excess demand curve in Figure 1 is capable of shifting because of internal changes in expectations or perceptions (possibly by recognition of a temporary excess) or because of external changes in the environment (including behavior in other financial markets). External changes imply turbulence in the economic system. To generate instability in a market, the shift in the excess demand schedule must be large enough to overcome "stabilizing behavior" by the actors in the market. A minor leftward shift in the curve will simply lower the equilibrium set of prices and the market will continue to clear. Only if the perturbation is big enough to shift the excess demand curve into a range at which downward momentum feeds on itself will the market become unstable.

The behavior of an asset market can be described in terms of the two measurements, $a$ and $b$: $a$ measures the robustness of the market (its lack of fragility) and $b$ measures the range of instability of prices or the severity of the crisis. The horizontal measure, $a$, effectively shows the size of the shock (shift in the excess demand curve) which must take place before the market becomes unstable. The greater is $a$, the more robust (the less fragile) is the market under conditions of turbulence. The vertical measure, $b$, shows the amount by which the price level must sink after a crisis before the market becomes stable again. The process is not reversible, i.e. there is no reason to suppose that the market will rebound upwards with the same instability after a crisis because of a downward shift of the ED curve. Bankruptcies of some asset holders and the change in

the degree of confidence of the surviving actors in the market will reduce any upward instability.

The robustness of a financial market, the size of $a$, depends upon the expectations of the actors in the market and the degree to which they can finance their positions in the event of some adverse shock. It will be influenced by several factors. Following Tversky and Kahneman (1981), recent experience will be important to determine the degree of confidence the actors have in the ability of the market to return to some price level in harmony with fundamentals. Thus, any market which has recently experienced adverse shocks will have a smaller $a$. Equally, confidence in the potential successful intervention of a lender of last resort will increase as will the existence of hedging devices such as forward and futures markets and options. The degree to which asset holders can maintain their positions in the face of adverse shocks is directly dependent upon the financial leverage ( gearing) of their position as well as upon the ability of the holders of hedging instruments to meet their contracts without bankruptcy. In addition, if contracts expire during a period of lower prices, hedge protection must continue to be available. Thus, $a$ will be smaller and the market will be more prone to significant downward movement when (1) the leverage of some asset (and liability) holder is greater, (2) the shock is expected to last longer, (3) the ability of the lender of last resort to function to the degree needed is weaker, and (4) the vulnerability of the existing hedging devices is greater.

The "backlash" constitutes the range of instability ($b$). In this range, people's actions become mutually-reinforcing as one person’s sales becomes additional information for and influences the expectations of other actors in the market. Net sales will be induced by a revision of expectations caused by the size of the original shock and the amount of
net selling (or price fall) as well as by the inevitable increase in leverage as asset values decline (induced leverage). Induced leverage increases asset sales and as asset holders try to avoid such an occurrence. Asset holders who experience increased leverage can inject more equity into their position. In some markets, lenders may have the option of calling their loans at their discretion but most loans are callable only when the equity component of the borrower is threatened or disappears. The range of instability will also depend upon the size of the shock and the degree of erosion of confidence that the market will revert reasonably quickly to a price level in line with previously perceived underlying values. Speculators can take short positions and in this way intensify the rate of fall of prices and add to pressures from induced leverage as well as to the gloom of short-run expectations. All of these effects are mutually reinforcing.

Thus, if there is a degree of leverage on the part of asset holders greater, (2) change in expectations is more drastic (and the unanimity about the new adverse expectations is greater), and (3) the amount of credit extended by the lender of last resort, financial institutions and people willing to offer hedge protection against a fall in prices, is smaller. The larger is b, (1) the larger is the loss of net wealth of the community, (2) the greater is the danger that asset holders in the damaged market reduce positions in the other markets (contagion), and (3) the greater is the danger that the economy will be catapulted into depression. Note that the lender of last resort can still ease the collapse of prices once instability has started but it seems reasonable to suggest that the task will be much more difficult and will call for an extension of much larger amounts of credit than in the stable part of the excess-demand curve.

II. SYSTEMIC INSTABILITY

The above analytical device can be used to diagnose systemic fragility and instability. Here we postulate an adverse shock impinging on one (impact) market and examine the implications of contagion from the impact market to other markets and for the system. An external shock or an internal revision of expectations could affect several financial markets simultaneously so that any contagion would be merely a reaction to unequal damage in the group of markets. The two events will be similar only if there is substantial contagion in the case of a shock on a single market. The single-market shock case requires a study of the contagion linkages and is, therefore, analytically more important. Recognition that contagion linkages can be broken identifies the fact that all financial markets are equally fragile at any one time. A mass shock would seek out the weakest market and strike the system most telling through that market.

The effect of a single-market shock will depend on the fragility of the market hit by the shock. It is necessary then to recognize that the character of shocks may vary. For example, Eichengreen and Portes report that British banks were not seriously threatened by a withdrawal of foreign credits from sterling.

(Since the run took the form mainly of sales of foreign-owned Treasury bills and withdrawals of credits previously granted to the discount market, it posed little threat to the banking system [1987, 29].)

The resilience of the system will be greater than that of the impact market if the shock induces an inflow of funds to the impact market from other markets. In this way, the shock will be dispersed among a series of markets and instability (crisis) will be avoided. Put another way, the system will be as or more fragile than the impact market if the impact market becomes unstable (the shock exceeds the value of a) and the repercussions trigger defaults and bankruptcies in other (fragile) markets. A full-scale systemic crisis emerges if all of the financial markets are precipitated into their B domain. The crucial elements in such a scenario are the magnitude of the shock, the robustness of the impact market, and the network of linkages to other financial markets together with the inherent robustness of those markets.

Financial markets are seldom independent of each other because asset holders will have diversified their risk by holding assets traded in different markets. Thus, an adverse shock in the impact market will automatically affect the solvency of asset holders in other markets. If the asset holders have enough reserves to be able to support their position in the impact market, then funds will flow into the impact market and crisis will be avoided.) albeit at the cost of a weakening of the robustness of the other markets where asset holders will have suffered induced leverage. The same logic applies to the solvency of financial institutions. If the shock is large and the institutions are heavily invested in the impact market, then they may be threatened with insolvency unless rescued by actions of the lender of last resort. Similarly, if there exist potential private purchasers of assets at "bargain basement prices," funds will flow into the market.

Under this optimistic set of circumstances, the system will be stable and the impact market will teeter on the brink of its B domain without actually entering it. Given time, the asset holders will rebuild their positions (reduce their leverage) and the markets will gain or regain robustness. In this scenario the role of linkage is positive.

If, on the other hand, the asset holders in the impact market are leveraged as highly as the availability of credit permits, an adverse shock in the impact market will result in their assets in the impact market being sold out from under them and the impact market will enter its B domain. Once the impact market becomes unstable, a revision of expectations will likely take place in the other financial markets, and fully leveraged asset holders in those markets will also have their assets sold out from under them. The role of linkages is clearly vital. If the impact market is mainly linked to a robust market in which asset holders have strong reserves of liquid assets and net worths, the impact will not generate a crisis. The weaker are the related markets and the less robust are financial intermediaries, the greater is the likelihood of a full-scale systemic crisis.

The more fragile is the system, the greater is the need for prompt and strong action by the lender of last resort. The more highly leveraged are the asset holders and the financial institutions, the less is their capital adequacy, the greater is the probability of a crisis, and the deeper is that crisis likely to be. The greater the system's value of a is, the greater is the reduction in community net wealth and the less likely is the economy to avoid depression. Once in a depressed state, the first priority of asset holders and of financial institutions will be to rebuild their liquid assets and their net worth. This process and the critical experience will lead to pronounced risk aversion toward investment projects by lenders and entrepreneurs.

It is necessary to confront explicitly the distinction between perceived robustness and actual robustness. It is quite possible that the actors in a market or a system overestimate the robustness of the market or system. The size of a depends upon actual robustness. The implications of any excess in perceptions over actuality can be seen best in an example. Assuming what are excessively aggressive positions (excessive leverage) in the light of an inadequate response or response capability by the lender of last
resort and any other sources of support. If actors believe that there is a support system for the market in the face of some particular shock, they dare to incur greater leverage than they would in the absence of this belief. In other words, an excess of perceived over actual robustness contributes to the size of the shock. When such a shock of sufficient magnitude occurs, rendering the market unstable (pushing it into its b domain), the overestimation of the actors' positions will make b bigger so that the fall in prices will be proportionately larger. It is possible for actors to perceive their excessive optimism very gradually in which event they will slowly readjust their positions and no crisis will occur. Given the herd instinct which characterizes financial markets, this outcome seems less probable than one of a sudden awareness that the perception of robustness is excessive. This will communicate itself throughout the market or system very quickly. This is what Kindleberger and Minsky refer to as a "pall of mull over liquidity" (Gray, 1990, 279). An excess of perception over actual robustness will provide greater stability as long as the confidence holds but it also increases the probability of an internal shock in which expectations of the future are revised – sometimes suddenly. At such a time, it is also likely that an excess of perceived over actual robustness will result in a larger value of b for the system.

III. FRAGILITY IN INTERNATIONAL MARKETS

Financial crises can trigger depression through three causal mechanisms: reduced spending by households and other micro-units; severely damaged business confidence; and sharply reduced confidence on the part of financial institutions. Households and other micro-units will have been subjected to substantial reductions in net wealth (including losses in the value of residential housing). Their immediate need is to rebuild their liquidity and wealth which will require high rates of saving by those whose incomes permit such saving. Business confidence is reduced and the rate of investment in plant and equipment is likely to fall with the traditional multiplier effects on employment and spending. Business confidence must be rebuilt so that entrepreneurs will have the necessary degree of confidence to invest in the face of substantial Keynesian uncertainty. Finally, lenders are likely to have suffered heavy losses so that any financial institutions which have survived the crisis will need to rebuild their capital and will be risk averse in extending credit.

The effects of depression in one country can be transmitted to other economies through linkages among financial and non-financial markets. In the modern world, with greater international inter-dependence, these linkages are likely to be much stronger and will transmit and aggravate or dissipate shocks more effectively. The mechanism would be very similar to that considered in Section II above with the possible exception that a nation which did not capitulate to depression in the face of the shock might not have the political courage or social awareness of the need for it to maintain open markets for exports from economies which did not escape depression.7 The correct policy to counter depression in other countries would be for the prosperous economy to act as the locomotive by running temporary deficits on current account and, in the process, reducing its international net worth (Gray, 1992). Acts to counter both financial crises and depression could be marred by a nationalist position on the part of the central banks and the treasuries of nations with strong currencies and economies respectively.

The international interdependence of financial markets is currently of greatest concern because it is in the foreign exchange markets that the highest probability of crisis exists and because the linkages to other major financial markets are so direct as virtually to ensure that, in the event of the foreign exchange market entering its b domain, other major markets would, almost inevitably, do the same. The main problem seems to lie in the possibility of a substantial shift in perceptions of holders of assets denominated in a national currency other than their own. International investment in assets denominated in a currency different from that of the asset holder's liabilities or ultimate expenditures, is now commonplace. As of the end of 1990, claims on the U.S. financial system by private foreign asset holders exceeded $1.3 trillion and roughly half of those claims ($687 billion) were on the U.S. banking system [Scholl, 1991]. If the dollar were perceived to be likely to weaken in the foreign exchange markets, a strong motivation for asset holders to liquidate dollar-denominated assets would exist. Such a move could easily trigger a run on the dollar. Existing technologies allow for massive movements of funds to be made quickly. A sudden run on or rush out of a single currency would also involve linkages with the markets in which the funds were invested. A rush out of, say, the U.S. dollar would involve major sale of equities, corporate and Treasury securities, commercial paper, and bank certificates of deposit, possibly triggering a crisis in those markets as well. There is also a greater danger of external shock in international markets since intergovernmental political tension, particularly over economic disputes, or even the slightest hint of some impediment to the free movement of funds would cause a flight from the dollar. The existence of hedging investments would not be a strong counterforce since forward markets and their equivalents dry up when there is unanimity over the direction of change of prices.

Investors always have the option of seeking a safe haven in cash which will carry a non-negative nominal rate of return. The cash in question is their own functional currency. It is this possibility of seeking cash that has the potential, in a highly integrated global economic and financial system, to trigger a disruptive flight from an important currency.

Under such circumstances, there is a great danger that the lender of last resort mechanism would be ineffectual. Lender of last resort activities were conceived in a national, single-currency setting or, internationally, in a hegemonic system in which the hegemon was a financial power of great strength. Under either circumstance, the lender of last resort was a central bank which supplied liquidity to the system by issuing its own national currency. The fragility of the international financial system is much greater than the covered lender of last resort (the U.S. financial authorities) can only issue the weak currency. This may be a very clear example of an excess of perceived robustness over actual robustness. In the event of a rush from the dollar, it would be necessary for the central banks of the creditor countries to assume lender of last resort responsibilities by lending their currency freely to the U.S. government. Such arrangements would need to exist prior to the crisis, partly because speed of reaction is essential if the crisis is to be nipped in the bud and partly because there always exists the possibility of a breakdown of co-operation among central banks when political tensions exist and/or when politicians are interested in playing to their own electorate.
IV. CONCLUSION

There is an inevitable tendency for analysts, raised in periods free of financial crisis, to neglect the possibility of such an occurrence and to assume stability more or less as an act of faith. Such an act may no longer be justifiable. The Hirschmanian�on of asset markets presented here, then, is a useful device in that it may serve to stimulate consideration of potential instability in financial analyses. It permits separation of the fragility of a market from the magnitude of any ensuing crisis and helps to identify the causal linkages which can generate contagion among financial markets. The factors which contribute to and mitigate fragility are more easily recognized. In addition, the analysis allows the interdependence between fragility and magnitude of crisis to be identified. It would seem that major financial crises of the kind to precipitate depression will necessarily involve strong linkages and contagion among financial markets and a general change in expectations leading to a simultaneous adverse shock impinging on all markets simultaneously.

In the analysis up into an integrated financial world operating with national currencies and in the absence of a strong hegemon shows the danger that exists if a serious change of expectations triggers a self-reinforcing series of actions and precipitates the foreign-exchange market into its b domain. The analytic framework reinforces recognition by Kindleberger [1978] and others of the need for preventive measures designed to ensure the stability of the international financial system.

NOTES

The author is indebted to Charles P. Kindleberger for comments on an earlier draft and to his assistant, Raymond P. Minsky for discussions on the subject of financial instability. The usual disclaimers apply.

1. Figure 1 is effectively the Hicks diagram when p is the equilibrium price.
2. The concept of severe instability in financial markets is developed in Kindleberger [1978, Ch. 2] and Minsky [1972, 1977]. It is probably true to say that Minsky has concerned himself primarily with the irreversibility of a long-term trend increases in fragility over time (i.e. vulnerability to crisis) and Kindleberger has put greater emphasis on sudden crises. In terms of Figure 1, Minsky’s hypothesis argues that the value of a market will tend to decline with time (see below).
3. In the light of recent events, there has been some work on bubbles in asset markets—particularly in equity markets. Hints in Chapter 1 provide a substantial fall in values. This paper is concerned more with downturns in stability of market and, therefore, would be relevant to the potential instability in a market after the bubble has expanded. A bubble implies a short-term euphoria, and this need not apply when the conditions contributing to excessive optimism have built up over a long period. A long accumulation of liabilities has made instability in the foreign exchange market possible [Gray, 1992, Tables 1 and 2].

4. The cocked theorem can help to explain severe overbuilding of commercial real estate and dwellings and, in this way, explains why banks and other financial intermediaries have to be extremely cautious when extending loans to homeowners which are likely to be victims of unstable bubbles. Bad debts following from a failure to perceive dangers of the kind faced by住宅 is obviously contributed to a weakening of deposit intermediaries and other lenders.

5. In financial markets, there is always a "easy money" available to asset holders 1 cash. Also note that a "suck" can comprise any number of adverse shocks which are self-reinforcing and that it is the total shock which is the trigger of any instability. The shock of cash is less divisive in a world of internationally integrated asset markets and multiple national currencies (see Section III below).
6. After a negative shift in the crisis demand schedule, the system will "get used" to the new price level. Analysts will reduce their financial leverage and will incorporate the new price level into their expectations.

REFERENCES


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Thus, the temporarily-space small changes in price levels do not necessarily reinforce each other to enhance the likelihood of downward price instability.

7. As drawn, the measure 0 represents the vertical distance between the vertical part of the curve (the point at which the market reaches a maximum and marks the onset of instability) and the point in the D curve directly below that point. One measure of the curve shifts equally throughout its length.

8. The possibility of a discrepancy between perceived and actual market behavior is considered at the end of Section III below.

9. An excess demand schedule with no "noncrash" is stable.

10. This represents a balance between liquidity into the system by the central bank and what holds only for potential instability in a single market because the resources are necessarily withdrawn from another market.

11. The 1987 sell-off, an example of a quick recognition of turbulence between two markets, was triggered by a large movement of funds from equities to fixed-interest instruments and was precipitated by non-American (Murphy, 1989). It was therefore an internal shock brought about by a sudden recognition of an imbalance. Fortunately, the instability did not encompass the foreign exchange market (see Section III below).

12. An interesting table produced by Eichengreen and Fortes [1992, 28] shows that the values of bank equities remained high in Britain from June 1930 through December 1933, relative to the indus and relative to the banks' equity values in 1928. This was true for Canada and several other countries until December 1932. For the United States, the opposite occurred. Banks stocks fell in price more than bank equities from the end of 1930 onward.

13. The present diligence of American banks and commercial banks can be attributed to their ever-investment in the commercial real estate market and the magnitude of the decline in the prices of commercial real estate.

14. "Bajinon basment prices" must be identified as a price level in excess of that at which the market equally holds to the demand market or the financial markets in general.

15. The reader will recognize the similarity between excessive perceptions here and the state of euphoria in the Kindleberger-Minsky model of financial crisis [Gray, 1990, 270].

The relevance of a well-designed hedging operations would be an example of an alternative source of support.

16. This ability to transmit shocks is what Gray and Gray [1981] identified as a reduction in stability-efficiency in face of greater international financial interdependence. From a policy viewpoint, it may be desirable to increase the stability-efficiency to a point at which contagion is substantially reduced.

17. Compare Kindleberger [1986].

18. Accountee refer to the currency of expenditure and financial reports as the "functional currency".

19. Foreign holders of dollar assets have a stronger motivation to flee than do US residents who might take a long position in foreign currencies to speculators capital gain. Foreigners would be less likely opposed by restrictions on their financial currencies, while the US residents would be seeking an uncertain trading profit.

20. In addition, a lack of full ownership of conditions and the markets or an error in translation could precipitate a crisis [Morphy, 1980].

21. Note that this process has the very desirable side-effect of changing the currency of denomination of international from the debtor to the creditor's currency. The process would also make the debt publicly rather than private-owned. Public bodies may be expected to have greater awareness of the need for stability in international financial situations than the individual private asset holder.

22. See the references cited in Lieutenant and Herring [1986].

23. REFERENCES:
BUSINESS CYCLE VOLATILITY IN DEVELOPED MARKET ECONOMIES, 1870-1986: REVISIONS AND CONJECTURES

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INTRODUCTION

The conventional wisdom concerning the volatility of American business cycles has been, until very recently, that the post-World War II period was actually subject to much milder business cycles than the pre-Great Depression period. This view was largely based on the empirical work of Simon Kuznets and was seen to support the belief that Keynesian macroeconomic policies contributed considerably to increasing the stability of business cycles in the United States after World War II.¹ Christina Romer [1986a, 1986b, 1988], however, revised Kuznets's real GNP estimates for the pre-Depression period (most significantly for the 1899-1908 period) and challenged the view that the pre-Depression period (1899-1929) was, in any meaningful way, more volatile than the post-World War II period (1947-1955).² Romer's revised estimates speak in favor of the argument that increased government intervention did little, if anything, to affect increased macroeconomic stability in the United States. This point has been reiterated by Sheffrin [1991, 36, 17, 40, 42, Ch. 2] who, using real GNP and GDP estimates for six other countries — the United Kingdom, Norway, Italy, Denmark, Sweden, and Canada — concludes that there is little difference in cyclical volatility between the 1871-1914 and 1914-1938 periods with the exception of Canada and Sweden.³ It should be noted here that Sheffrin excludes the 1915-28 period from his analysis, and thus his volatility estimates are not directly comparable to Romer's. This is also the case with a more recent study by Boccaz and Kohoe [1994] which adds Australia, Germany, and Japan to Sheffrin's list of countries and largely retests some of the empirical results and interpretation of the results found in Sheffrin [1988, 1991].⁴

Nathan Balke and Robert Gordon [1989] have recently revised Romer's real U.S. GNP for the 1869-1928 period and thereby Romer's volatility estimates. Their new estimates support the traditional view that the post-World War II period's business cycles, in fact, were characterized by much less volatility than were business cycles of the pre-Depression period. It seems that we have now come full circle. The Balke and Gordon estimates are the most comprehensive revisions of U.S. real GNP available to date. Unlike the Kuznets and Romer GNP estimates, both of which only incorporate direct measures for commodity output, Balke and Gordon [1989, 40, 51-58] also use direct measures for non-commodity transportation, communications, and construction outputs.⁵

On a more general level, Angus Maddison [1984, 1985; 1987, 57-88, 88-199], using the most recent real GDP estimates available for sixteen developed market economies (including Canada and the U.S.), finds that in all of these economies with few exceptions, there was much more cyclical volatility during the 1870-1913 period as compared to the post-World War II period. Finally, Andrea Bolth [1989, 1714-17] applies four volatility measures to real GDP estimates for fifteen countries which are also examined at:


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