

# Deflation\*

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## Introduction

### A. Deflation under a Commodity Base Money

Deflation ought not to be a serious monetary problem; yet it has apparently become so (Bernanke 2003). Deflation should be most likely to occur under a commodity money regime, e.g. the Gold Standard, when it will reflect the relative shortage of the monetary base commodity, vis a vis all other commodities. Ceteris paribus, one might expect a roughly equal probability of comparative surpluses and deficits in the monetary base commodity, and during the gold standard century before 1914 there were roughly an equal number of years of price declines and increases. In the UK, for example, between 1815 and 1913, (using the Overall Index from the Rousseaux Price Indices, Mitchell (1962), pp 471-473), there were 41 years in which prices rose, 45 years of price declines and 13 years of no change; and from

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1873 to 1913 16 years of rising prices, 17 years of falling prices and 8 years of no significant change.

#### **A.(i) Auto-correlation of Inflation under a Commodity Money**

But prices should not follow a random walk path under a commodity money standard. A rise in the general price level is the equivalent of a decline in the relative value of the commodity money, so less of it will be produced. So, over the longer run, depending on the speed of reaction of the supply of the monetary base commodity to changes in its relative value, one would expect the price level to be mean reverting, unless there was some technological or institutional reason for a differing trend in the supply of the commodity monetary base, relative to all other goods and services.

Such mean reversion will, however, probably be relatively sluggish, since the effect of changes in the relative price of the commodity base (e.g. gold) will be slow acting, and also much affected by idiosyncratic supply side shocks. It may take a century for such mean reversion to become apparent. In fact, the same index, annually from 1816 to 1913, is marginally stationary. The Dickey-Fuller test statistic was -3.128, compared with a 5% critical value of -2.892 and a 1% critical value of -3.513. In the meantime there may well be, perhaps gentle, trends in price levels, depending on underlying shifts in the demand, or supply, of the monetary base, (relative to changes in the supply of all other goods and services). Such trends will be overlain with short-term seasonal, annual or cyclical fluctuations in the economy.

This is, indeed, what we observe. In the years 1873-1913, which is one of the periods on

which we focus, and which was the hey-day of the Gold Standard, Dickey-Fuller tests show that the CPI was mildly trended (I1) in the UK, France and Germany, but mean reverting in the USA. The test statistics were respectively -1.93, -1.59, -0.162 and -3.87 against a 10% critical value of -2.61.

Against this background what is, perhaps, surprising about the gold standard era is how low the short-run first-order auto-correlation of inflation, e.g. from year to year, actually was. One might have expected longer term changes in the supply of gold, relative to all other commodities, to have imparted some shorter-run persistence in price levels.

**Table 1: Inflation autoregressions, 1873-1913**

	USA	UK	Germany	France
AR(1) coefficient	0.25 (0.16)	0.21 (0.16)	0.15 (0.16)	-0.12 (0.16)
Standard error of equation	2.75	2.69	3.88	1.33

*Note: Standard errors of the AR(1) coefficients are in parentheses*

One possible reason for the low first-order auto-correlation of inflation in these years was that, at this stage of development, a large proportion of production and consumption was agricultural. The harvest is dependent on the weather; there is considerable (random?) fluctuation in the weather from year to year and place to place, and hence in the volume of

non-monetary goods. In addition there were a variety of other idiosyncratic shocks, which had varying degrees of commonality between countries (see Section 3 below and Morgenstern, 1959). For all such reasons there was no significant auto-correlation between inflation in the previous year and in the current year. Although the shocks to the inflation rate, as measured by the standard error of the error term in the auto-regressions reported in Table 1, were large, a rational forecaster would have assumed, on this basis, that inflation in the year ahead would be zero.

#### **A.(ii) Expectations and Real Interest Rates under a Commodity Money System**

One of the main concerns about deflation, at least currently, is that it may force real interest rates above their equilibrium level, given the lower bound to nominal interest rates, (abstracting from Gesell type policies, see Buiter and Panigirtzoglou (1999 and 2003). See for example Coenen (2003) and Klaeffing and Perez (2003) and the many references on this subject cited by them. This syndrome is worsened when deflation is auto-correlated, since then expectations of past deflation lead to expectations of future deflation.

Under the Gold Standard, and indeed probably until 1939, there is a great problem with assessing expectations. Over the very long run, perhaps a century, a commodity base money should deliver price stability, i.e. a mean-reverting IO series; over medium-run periods there will normally be some trending, an I1 series, as shocks and readjustments occur; over short-run periodicities, quarterly and annual there was much (largely random) fluctuation. In such circumstances, deflating nominal variables by ex post (annual) inflation will give a poor

estimate of ex ante real interest rates, though this remains commonly done (e.g. Meltzer 2003); this is not to state that a measure of ex post real interest rates may not be of some considerable relevance, e.g. to existing debtors and creditors; but it is worthwhile to distinguish between the concepts, and effects, of ex ante and ex post real interest rates, especially under a commodity base system.

To try to get some handle on ex ante real interest rates under the Gold Standard, we turn to a brief study of short and long interest rates.

According to the expectations theory of the term structure, the yield of an n-period bond is equal to the average of one-period bonds over the n-periods plus a term premium:

$$i_t^n = \frac{1}{n} \sum_{i=0}^{n-1} E_t i_{t+i}^1 + \theta_t.$$

The Fisher equation decomposes the short-term interest rate into an ex-ante real interest rate and an inflation expectations term:

$$i_t^1 = r_t + E_t \pi_{t+1}$$

Combining the expectations hypothesis and the Fisher equation yields the n-period Fisher equation:

$$i_t^n = \frac{1}{n} \sum_{i=0}^{n-1} E_t r_{t+i} + \frac{1}{n} \sum_{i=0}^{n-1} E_t \pi_{t+i+1} + \theta_t$$

or

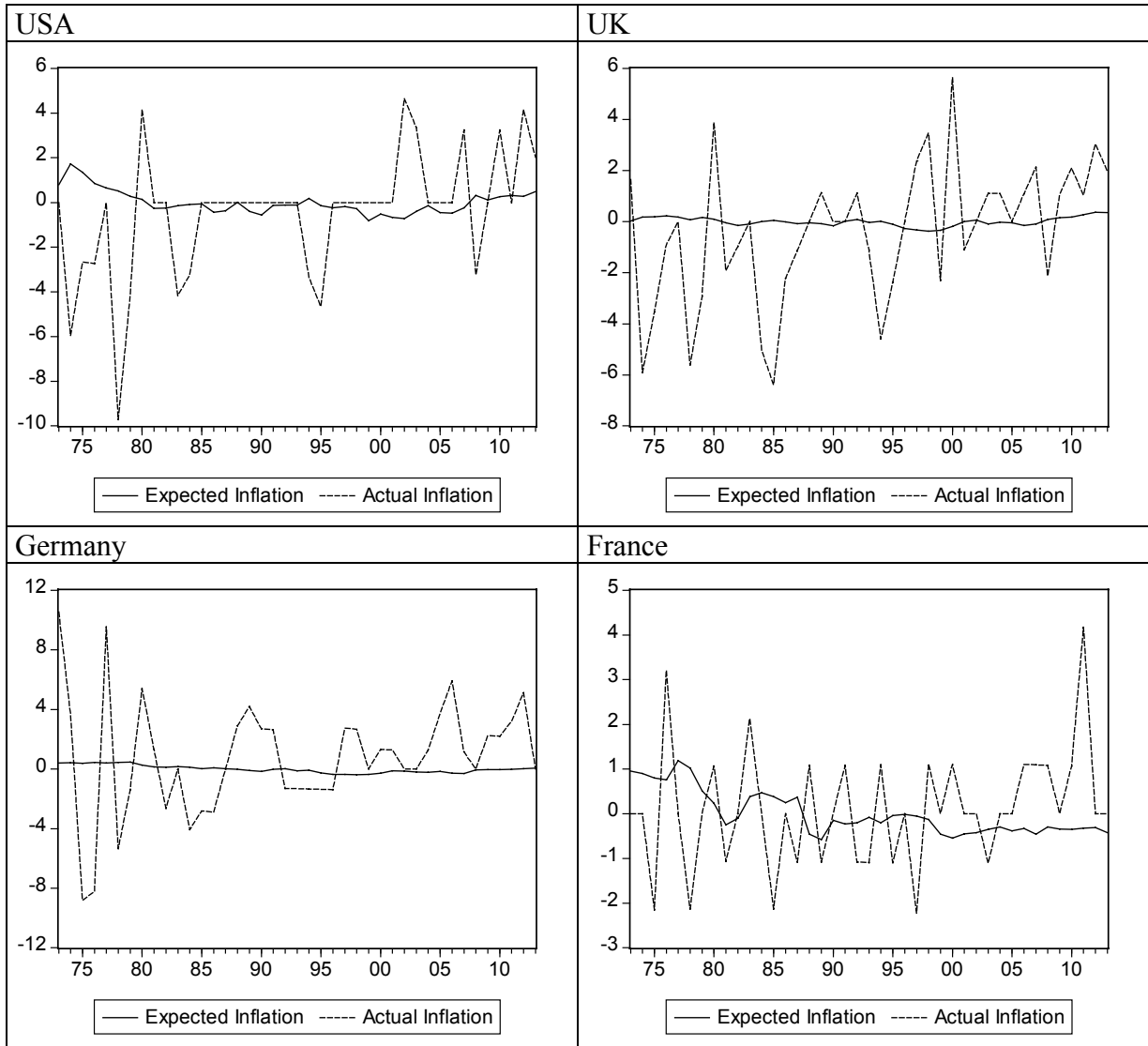
$$i_t^n = \frac{1}{n} i_t^1 + \frac{1}{n} \sum_{i=1}^{n-1} E_t r_{t+i} + \frac{1}{n} \sum_{i=1}^{n-1} E_t \pi_{t+i+1} + \theta_t$$

If we follow Fama (1975), and assume that the equilibrium real interest rate is constant in the long-run and that also the risk premium is constant in the long-run, then we should be able to back out movements in inflation expectations from the residuals of the regression:

$$i_t^n = \alpha + \beta i_t^1 .$$

We ran this regression for the US, the UK, Germany and France . In Figure 1 we plot actual CPI and expected CPI inflation given by the residuals of these regressions. The graphs suggest that inflation expectations were in fact rather flat over the sample period, except maybe for France. Given that really long-run price inflation was zero, we can then assume that during these decades ex ante real interest rates were roughly the same as nominal interest rates. Since nominal interest rates never came close (for long) to the zero bound, we can be reasonably confident that real interest rates also remained clearly positive during these years.

**Figure 1: Actual inflation and expected inflation, 1873-1913**



## B. A Fiat Monetary System

The main alternative to a commodity money system has been a fiat money system, in which the growth of the monetary base is the (usually indirect) outcome of a series of policy decisions on interest rates, the financing of the government deficit, etc. The tendency for such a fiat system to be inflationary is well-documented (Bernholz, 2003); this tendency arises largely from the fact that government expenditures are popular and taxation unpopular. So the government is usually a debtor, like other well-organised pressure groups, e.g. business, home owners with mortgages, and easy money is beneficial to debtors.

### B.(i) **Auto-correlation of Inflation under a Fiat System**

In such circumstances the persistence and severity of deflation will be accentuated by the greater auto-correlation of inflation under fiat money regimes. This increased persistence between the late 1960s and the 1990s is shown in Table 2 below.

Just as we might have expected more such auto-correlation under the gold standard, quite why such first-order auto-correlation was allowed to rise so high under a fiat money regime is, perhaps, something of a puzzle but we do not have time to pursue that now. It does not seem to us to be a necessary feature of a fiat money system. Indeed, since inflation targetry has been adopted in the UK, from 1993 onwards, such auto-correlation has once again become insignificant. See Chart 1, taken from Benati, (2003), Figure 3, p. 41.



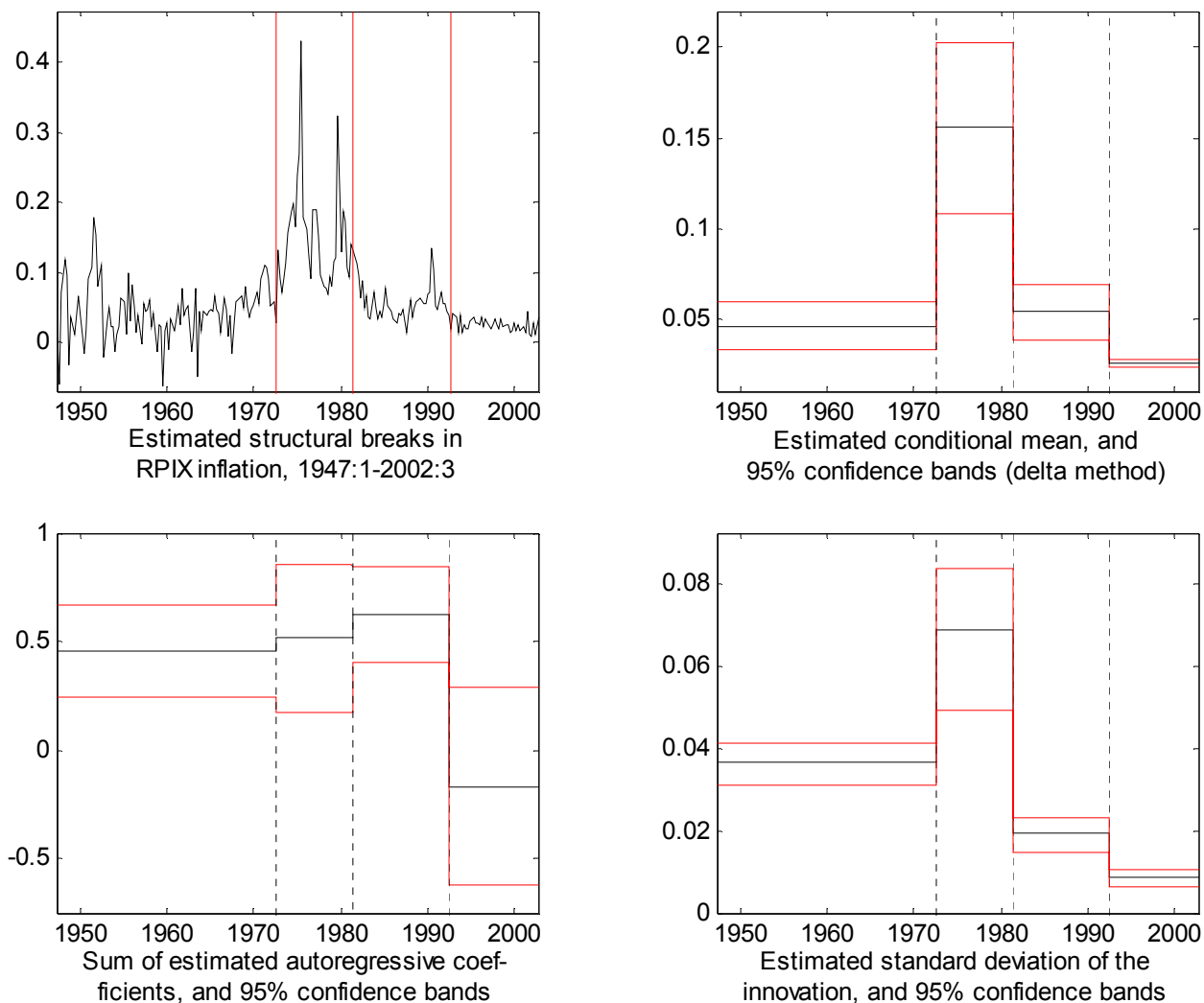
**Table 2: Time varying inflation persistence**

	US	UK	Germany	France	Japan
1870-1890	0.08 (0.23)	0.13 (0.23)	0.13 (0.23)	-0.16 (0.22)	0.11 (0.24)
1891-1913	0.23 (0.21)	-0.01 (0.22)	0.40 (0.20)	0.01 (0.22)	-0.11 (0.22)
1920-1939	0.30 (0.19)	0.32 (0.22)	-	0.25 (0.22)	-
1925-1939	0.59 (0.22)	0.63 (0.21)	0.50 (0.20)	0.40 (0.25)	0.73 (0.26)
1950-1965	-0.21 (0.26)	0.22 (0.27)	-0.30 (0.17)	0.19 (0.27)	-0.34 (0.13)
1966-1979	0.70 (0.23)	0.71 (0.20)	0.77 (0.18)	0.80 (0.16)	0.50 (0.26)
1980-1989	0.75 (0.18)	0.69 (0.21)	0.80 (0.21)	0.94 (0.15)	0.62 (0.27)
1990-2002	0.70 (0.20)	0.68 (0.18)	0.47 (0.27)	0.73 (0.15)	0.84 (0.18)

*Notes: The table reports the AR1 coefficient with standard errors in parentheses (estimate of AR(1) model for the inflation rate:  $\pi_t = \alpha + \beta\pi_{t-1}$ ). Estimation for 1920-1939 was not possible for Germany and Japan because of the German hyperinflation in the early 20s and data-unavailability for Japan so that the sample was reduced to 1925-1939; it appeared that dropping the observations for the first half of the 1920s produced significant larger AR-coefficients for the other three countries.*

So, if deflation takes hold, under our current monetary regime, with our standard operating procedures, it will normally be expected to continue. That, of course, means that real interest rates will be above nominal interest rates.

**Figure 2: Time varying inflation persistence in the UK**



*Notes: RPIX inflation, estimated structural breaks in the mean, innovation standard deviation, and AR coefficients. Taken from Benati, (2003), Figure 3, p. 41.*

C. Why do we have occasional Deflation under a Fiat Money System?

It is remarkable that, under a fiat money system, there should be any worry about deflation at all. Under this system the authorities can, in principle, create an unlimited amount of (base) money by buying anything that they choose. So, unwanted deflation should be inconceivable under such a system, (n.b. countries which have chosen to fix their exchange rate to that of another country are in a monetary regime more akin to a commodity monetary system than to a fiat monetary system).

Nevertheless such deflation has occurred. Much of the deflation outside the USA in the inter-war years was due to the attempt of countries to attempt to cling to the restored gold standard (Eichengreen, 1992). While there is some debate about how far, and on what occasions, the availability of gold reserves limited the freedom of action of the US authorities, (Meltzer, 2003; Friedman and Schwartz, 1963), the general consensus was that such constraint was slight, and could have been overcome, given sufficient willingness to do so. So the US experience, 1929-33, counts as an example of unwanted deflation in a fiat monetary system. An even more obvious case is that of Japan since 1992. There were no constraints on its actions from limited foreign exchange reserves, or from trying to prop up a devaluing currency, rather the reverse. Admittedly the extent of deflation in Japan has been mild, but how could it have happened?

**C.(i) A Partial Explanation?**

There are, perhaps, at least four elements in the attempt to explain a set of events, i.e.

deflation in the USA and in Japan, that should never have happened. These are:-

- (1) The deflation was not entirely, certainly initially, unwanted;
- (2) The authorities imposed on themselves strict limits on the set of assets that the Central Bank was allowed to buy;
- (3) When nominal interest rates on the assets in this limited set had been driven to zero (ZIRP in Japan), this was regarded as representing the furthest possible extent of the conduct of monetary policy;
- (4) Prior to the deflation, monetary policy had been run in a manner that raised the auto-correlation between inflation in the past year and current inflation. So now, unlike before 1914, a rational forecaster, having experienced deflation, would forecast future deflation.

We will discuss each of these elements in turn, starting with the possibility that such deflation was not entirely unwanted.

#### **C.(ii) (Asset) Price Deflation is Desirable?**

Both in the USA, after 1929, and in Japan, after the 'bubble' around 1990, there was some feeling that the asset price bubble had been so excessive as to be somewhat immoral.

Moreover, the Austrian theory of the trade cycle, and Schumpeter's 'creative destruction' implied that some 'cleansing of the Augean stable' would lead to needed structural reforms, and was indeed inevitable and essential to rid the economy of mis-allocated capital.

Governor Hayami and other BoJ staff have repeatedly referred to a distinction between 'bad deflation' and 'good deflation' and argued that Japan's was a 'good' type. For instance, Hayami (2001) said that "at a time when prices decline on account of productivity gains based on rapid technological innovation, a forceful reduction in interest rates with a view to raising prices may amplify economic swings." Governor Hayami regularly raised concerns that low interest rates were creating a "moral hazard" problem as they would delay reforms by the corporate sector. See Kyodo News (2000). According to financial newswires, BoJ Governor Matsushita said that "prolonged easy monetary policy contributed to the creation of Japan's 'bubble economy' of inflated stock and land prices in the late 1980s. Traders said this was interpreted as implying that the bank would raise interest rates to avoid creating another bubble." (Reuters News Service, 1996).

The Bank of Japan did not seem much concerned about deflation even as late as 1999, when it claimed that its policies had averted deflation, while at the same time worrying that these 'stimulatory' policies may have slowed 'structural change': Deputy Governor Yamaguchi said in 1999 that "the decisive monetary easing and active interventions to support the financial system by the Bank of Japan no doubt averted deflation or financial panic in Japan. On the other hand, those policy decisions might have dampened the restructuring efforts at Japanese financial institutions." (Yamaguchi, 1999).

The argument that the Bank of Japan consciously accepted deflation as a spur to structural reform has been most forcefully stated by Richard Werner in Princes of the Yen (2003). He writes, (p. 165, but also see pp 162, 163), that:-

‘The media have been frequently reporting that “Hayami is convinced that Japan needs to undergo radical corporate restructuring and banking reforms before it can recover - and that he has a duty to promote this. .... Mr. Hayami’s passion for reform also has a flavour of austerity. On paper, most economists - and politicians - think it would be sensible to offset the pain of restructuring with ultra-loose monetary policy. But Mr. Hayami fears that if he loosens policy too quickly, it would remove the pressure for reform”, (Tett 2001). In other words, it must be concluded that the central bank is aware that serious monetary stimulation *would* create a recovery, but it has chosen for a decade to avoid this because it would delay its structural reform agenda. Also see Werner (1996, 2002). Adam Posen, an economist at the Institute for International Economics in Washington, D.C., agrees with this conclusion: “Between a process of elimination, and careful reading of the statements of BoJ policy board members, I am led to the conclusion that a desire by the BoJ to promote structural change in the Japanese economy is a primary motivation for the Bank’s passive-aggressive acceptance of deflation”, Posen (2000), p. 22.’

Mutatis mutandis there was originally much the same cast of mind at the Fed. Let us start with a few quotes from Friedman and Schwartz (1960):-

(1), p. 290:-

‘Nonetheless, there is no doubt that the desire to curb the stock market boom was a major if not dominating factor in Reserve actions during 1928 and 1929.

Those actions clearly failed to stop the stock market boom. But they did exert steady deflationary pressure on the economy.’

(2), p. 358:-

‘They [i.e. most of the governors of the Banks, members of the Board, and other administrative officials of the System], tended to regard bank failures as regrettable consequences of bad management and bad banking practices, or as inevitable reactions to prior speculative excesses, or as a consequence but hardly a cause of the financial and economic collapse in process.’

(3), p. 371:-

‘James McDougal of Chicago wrote that it seemed to him there was “an abundance of funds in the market, and under these circumstances, as a matter of prudence.... it should be the policy of the Federal Reserve System to maintain a position of strength, in readiness to meet future demands, as and when they arise, rather than to put reserve funds into the market when not needed.” He went on to stress the danger that “speculation might easily arise in some other direction” than in the stock market.’

(4), p. 372:-

‘Lynn P. Talley of Dallas wrote that his directors were not “inclined to countenance much interference with economic trends through artificial methods to compose situations that in themselves grow out of events recognized at the time as being fallacious” – a reference to the stock market

speculation of 1928-29. Talley's letter, like some others, reveals resentment at New York's failure to carry the day in 1929 and the feeling that existing difficulties were the proper punishment for the System's past misdeeds in not checking the bull market. "If a physician," wrote Talley, "either neglects a patient, or even though he does all he can for the patient within the limits of his professional skill according to his best judgment, and the patient dies, it is concluded to be quite impossible to bring the patient back to life through the use of artificial respiration or injections of adrenalin."

W.B. Geery of Minneapolis wrote that "there is danger of stimulating financing which will lead to still more overproduction while attempting to make it easy to do financing which will increase consumption."

Similarly, Meltzer (2003) writes:-

(1), p. 248:-

'Carter, Glass and Miller blamed Strong's 1927 policy for the speculative boom and the 1929 collapse. Using a phrase that was repeated many times in the next few years, they described the collapse as an *inevitable* consequence of the preceding expansion. For them, the problem was the violation of real bills by financing speculation.'

(2), p. 290:-

'They ["a substantial body of opinion within and outside the Federal Reserve



System”] believed that crises and recessions were inevitable after speculative lending; they had to be endured to re-establish a sound basis for expansion.’

### C.(iii) **Self-imposed Limits on Asset Purchases**

As the first quote from Meltzer (2003) indicates, the belief about the inevitability (in some cases the desirability) of the deflation following on after the excesses of the Stock Market bubble in 1928/29 was intimately inter-twined with the Real Bills doctrine. This had two main elements. The first was a belief that the real economy was essentially self-equilibrating. The second was that the quantum of commercial (real) bills extant was closely correlated with the (sustainable) level of real output at current prices.

Consequently purchases of assets (expansionary open market operations) other than commercial bills would not lead to an expansion of real output, but only fuel inflation. This was, indeed, even the case with purchases of government bonds; so we get the (extraordinary as it now seems) occasions of such purchases being criticised by several Board members and Bank Presidents as inflationary even in the depths of the worst deflationary crisis in modern history.

This was one of the main themes of Meltzer’s recent volume 1 (2003), History of the Federal Reserve; he argues that this theory, which led to a self-imposed constraint on expansionary open market purchases, was one of the main causes of the depth and persistence of the US deflation.

The real bills doctrine was, most certainly, erroneous, and has been abandoned. Nevertheless the view that a Central Bank should only purchase self-liquidating, riskless, short-dated assets has continued. It was only after deflationary pressures persisted, despite short-term interest rates being brought down close to zero, that the Bank of Japan began to buy sizeable quantities of somewhat longer dated JGBs.

If the authorities limit themselves to buying very short dated assets, especially when their interest yield is determined by the initial discount at which they are issued, then their yield can be brought down to zero without necessarily having a significant effect on private sector wealth or expenditures. Indeed, it is perhaps partly this absence of direct wealth effect that makes the asset appear suitable for Central Bank operations in the first place, see Goodhart (2003). Especially when such a short-dated asset is perceived as safe against default, there may be a quasi liquidity trap with investors indifferent between holding this safe asset and money.

Given, however, the existence of longer dated assets offering a prospective yield, e.g. Consols with a coupon, houses with a rental, or a convenience, yield, equities with an expected dividend yield, it is impossible to have a general liquidity trap. As the authorities buy up the existing stock of such assets, their price will rise, without any necessary limit, toward infinity. If the authorities make the private sector infinitely wealthy, they are likely to start spending more at some stage!

Of course, as the prices of long-dated government debt, foreign exchange, houses or equities, or whatever else the authorities (dare to) buy rises, so Keynes' speculative motive will increasingly kick-in. Private sector holders of such assets will sell, since they cannot believe that such high prices would be maintained. It is, at least, imaginable that the authorities could buy up the entire stock of private sector holdings of government bonds, or houses, or equities at some finite price. But the magnitudes are such that the monetisation of the entire stock of JGBs, or Tokyo property, could be confidently expected to end deflation.

The two assets, beyond safe short-dated assets, e.g. T bills, that most commentators have advocated that the Bank of Japan purchase are foreign exchange (e.g. Svensson, 2000; McCallum (1999) and Meltzer (1999a, b and c) and longer-dated government bonds (JGBs). This is remarkable first because in the case of fx purchases this will have potentially adverse effects on other countries' economies, and hence will have constraining political economy repercussions, and second because JGBs are exactly those assets most likely to fall in value should the policy of moving from deflation to (low) inflation succeed. Also, should the (Japanese) economy be kick-started by an initial large devaluation, there could be some subsequent appreciation (and hence loss on fx holdings). Indeed such appreciation is in some proposals to be desired in order to encourage interest rates in Japan to remain below foreign interest rates (under UIP). Of course, the counterpart to the capital loss on government bond holdings will be a capital gain to the Treasury, so the Central Bank could be effectively indemnified by a variety of (accounting) procedures. But perhaps this is too unconventional for the authorities, who would rather deflate conventionally than reflate unconventionally.

One argument sometimes raised against any such 'unconventional' policies is that they would

be so powerful that the merest attempt to introduce them would turn present deflation into uncontrollable (hyper-) inflation. Indeed, Japan probably does now stand at great risk of such serious inflation, but this is rather because the ‘conventional’ policies of fiscal expansion have led to such a large deficit and outstanding debt stock that it is hard to see this financed, once nominal interest rates have returned to ‘normal’ levels, without resort to ‘unanticipated’ inflation. The longer the authorities in Japan refrain from sufficiently expansionary monetary policy, the worse the ultimate danger of hyperinflation succeeding deflation becomes.

#### D. Asset Prices and Deflation

One of the reasons for, at least, considering expansionary (open market) purchases of other domestic assets, e.g. property via Real Estate Investment Trusts (REITs), is that the link between deflation and such other domestic asset prices has been strong, as we shall document later in this paper. This is partly because of the inter-relationships between such asset price fluctuations and bank credit expansion.

In the past, severe, adverse and persistent deflations have been accompanied by major asset price reversals, fragile banking systems and depressed economic activity (US 1929-39, Japan 1991-2003). In these episodes, the scale of the fall in nominal asset prices greatly exceeded the falls in the CPI, so that there was also a severe contraction in real asset prices.

Housing and equity prices may affect household consumption via their effect on household consumption. Asset prices affect consumers’ perceived lifetime wealth, which in turn determines

their spending and borrowing plans as they wish to smooth consumption over the life cycle<sup>1</sup>. Data on the composition of household wealth have become available only recently. Table 2 shows the composition of household wealth in the G7 countries in 1998. In all countries, maybe except for Japan, housing assets account for a substantial share in household wealth. Equity accounts for a lower share than housing assets throughout, but there are significant differences across countries. The share of equity in household wealth is considerable in the US, Italy, the UK and Canada, but negligible in Japan, Germany and France.

**Table 3: Composition of household total assets (in percent)**

	Housing assets	Equity	Other financial assets	Other tangible assets
United States	21	20	50	8
Japan	10	3	44	43
Germany	32	3	35	30
France	40	3	47	9
Italy	31	17	39	13
United Kingdom	34	12	47	7
Canada	21	17	39	23

*Note: Data refer to 1998 (1997 for France)*

*Source: OECD Economic Outlook, December 2000, Table VI.1*

The figures suggest that a major reversal of asset prices, especially of house prices, which is perceived to drive asset prices to a new and permanently lower level, will have a substantial negative effect on consumers' perceived lifetime wealth. As a reaction consumers will reduce their consumption in an attempt to smooth the adverse effect of the drop in lifetime wealth on consumption over the lifecycle. In a recent paper, Case, Quigley and Shiller (2001) find that both property and equity prices have a significant effect household consumption both for a panel of

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<sup>1</sup> The lifecycle model of household consumption was originally developed by Ando and Modigliani (1963). A

14 industrialised countries and for a panel of U.S. states. Quantitatively they find the effect of property prices to be substantially larger than that of equity prices, a finding that is consistent with a larger share of housing wealth in private sector wealth.

Asset prices may also affect economic activity via their effect on balance-sheet of households and firms and of the banking sector. New theoretical insights about the implications of asymmetric information in credit markets have motivated the development of business cycle models where the effect of asset valuation on credit availability plays an important role in shaping business cycles by propagating and amplifying productivity and monetary policy shocks<sup>2</sup>. In the standard real business cycle model and the standard Keynesian textbook IS-LM model, credit market conditions do not have any effect on macroeconomic outcomes. This result hinges on the assumption of frictionless credit markets. Following Brunner and Meltzer (1972), Bernanke and Blinder (1988) show that relaxing the assumption of perfect substitutability of loans and other debt instruments, such as bonds, gives rise to a separate macroeconomic role of credit in an otherwise standard textbook IS-LM model. Bernanke and Gertler (1989) and Kiyotaki and Moore (1997) develop modified real business cycle models with informational asymmetries in credit markets. Because of these information asymmetries, firms and households are borrowing constrained and can only borrow when they offer collateral, which is provided in the form of tangible assets. The credit worthiness of the private sector is therefore determined by the price of collateralisable assets. Table 4 shows the share of real estate secured borrowing in the G7 countries. The share of property secured borrowing lies around 60% in the Anglo-Saxon countries and around 40% in the Continental European countries. For Japan no estimate

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formal exposition of the lifecycle model can be found in Deaton (1992) and Muellbauer (1994).

is available, but there are indications suggesting that the share might be quite high (Borio, 1996). Unfortunately there are no cross country data available for the share of equity secured borrowing. Asset prices also affect the value of bank capital, both directly to the extent that banks own assets, and indirectly by affecting the value of loans secured by assets<sup>3</sup>. Via their effect on banks' balance sheets, asset prices influence the risk taking capacity of banks and thus their willingness to extend loans.

This implies that a major reversal in asset prices will lead to a substantial reduction in the availability of credit. A decrease in credit availability depresses economic activity, which in turn feeds back into borrower's net worth, so that a self-reinforcing process evolves. This mutually reinforcing interaction between credit and economic activity is in the literature referred to as the "financial accelerator". A major asset price reversal which leads to a protracted weakness in economic activity is more likely to lead to deflation and depression when inflation persistence is high. With inflation persistence being reflected in inflation expectations, the incidence of a deflation may become more easily entrenched in expectations. With persistent expectations of a deflation, monetary policy will not be able to reduce real interest rates sufficiently to kick start the economy again. Even when nominal interest rates are reduced to zero, expectations of a persistent deflation will keep ex ante real interest rates positive. This will on the one hand have a direct negative effect on aggregate demand, on the other hand it will further weaken asset prices. As a result, demand will continue to be restrained and a depression may evolve.

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2 Early works focusing on the macroeconomic role of credit are Fisher (1933), Kindleberger (1973, 1978), Minsky (1964) and Brunner and Meltzer (1972). For a survey of this early literature see Gertler (1988).

3 Chen (2001) develops an extension of the Kiyotaki and Moore (1997) model where an additional amplification of business cycles results from the effect of asset price movements on banks' balance sheets.

**Table 4: Share of loans secured by real estate collateral (in percent)**

	Share		Share
Australia	34	Netherlands	36
Belgium	34	Spain	33
Canada	56	Sweden	>61
France	41	UK	59
Germany	36	USA	66
Italy	40		

*Source: Borio(1996), Table 12, p.101.*

*Note: Data refer to 1993 (Sweden 1992).*

#### E. The Structure of the Remainder of this Paper

The main thesis of our paper is that deflation per se is not a serious problem. It is the combination of asset price deflation, together with general (goods and services) deflation, that is so deadly. In the rest of this paper we shall examine some historical episodes to throw some light on this.

In Section II we discuss the role of asset prices for the stability of the financial system and the availability of credit to the economy. Based on a simple impulse response analysis we investigate how innovations to property prices and share prices affected bank lending in a sample of twelve countries over the period 1985-2001.

In Section III, we shall focus on three particular episodes of deflation. The first is between



1873 and 1896 in the main Western developed countries, US, UK, France and Germany. The second relates to the USA in the interwar period. The third is in East Asia in the last decade, covering China, Japan, Singapore and Hong Kong. In the first and third cases we compared the deflationary period with an adjacent, roughly equal length, period of rising prices, subsequently in the first case, 1897-1913, and previously in the latter case. We also used econometric techniques in all three instances to examine whether either goods and services deflation, and/or asset price deflation had an adverse effect on real growth.

Section IV concludes.

## **II. Asset Prices and the Financial System**

The recurrence of boom and bust cycles in asset and credit markets, followed by financial sector distress and deflationary pressures on goods prices, has led to a resurgence of both academic and policy interest in the interlinkages between asset, credit and goods markets. As a result, Irving Fisher's (1933) theory of debt deflation, which was motivated by the deflationary spirals evolving in the US and other countries during the Great Depression 1929-1932, has gained new topicality. Fisher developed a chain of interlinkages between asset prices, goods prices, economic activity and the financial sector, which may set in motion a deflationary spiral once a negative shock occurs<sup>4</sup>, as already described in the Introduction.

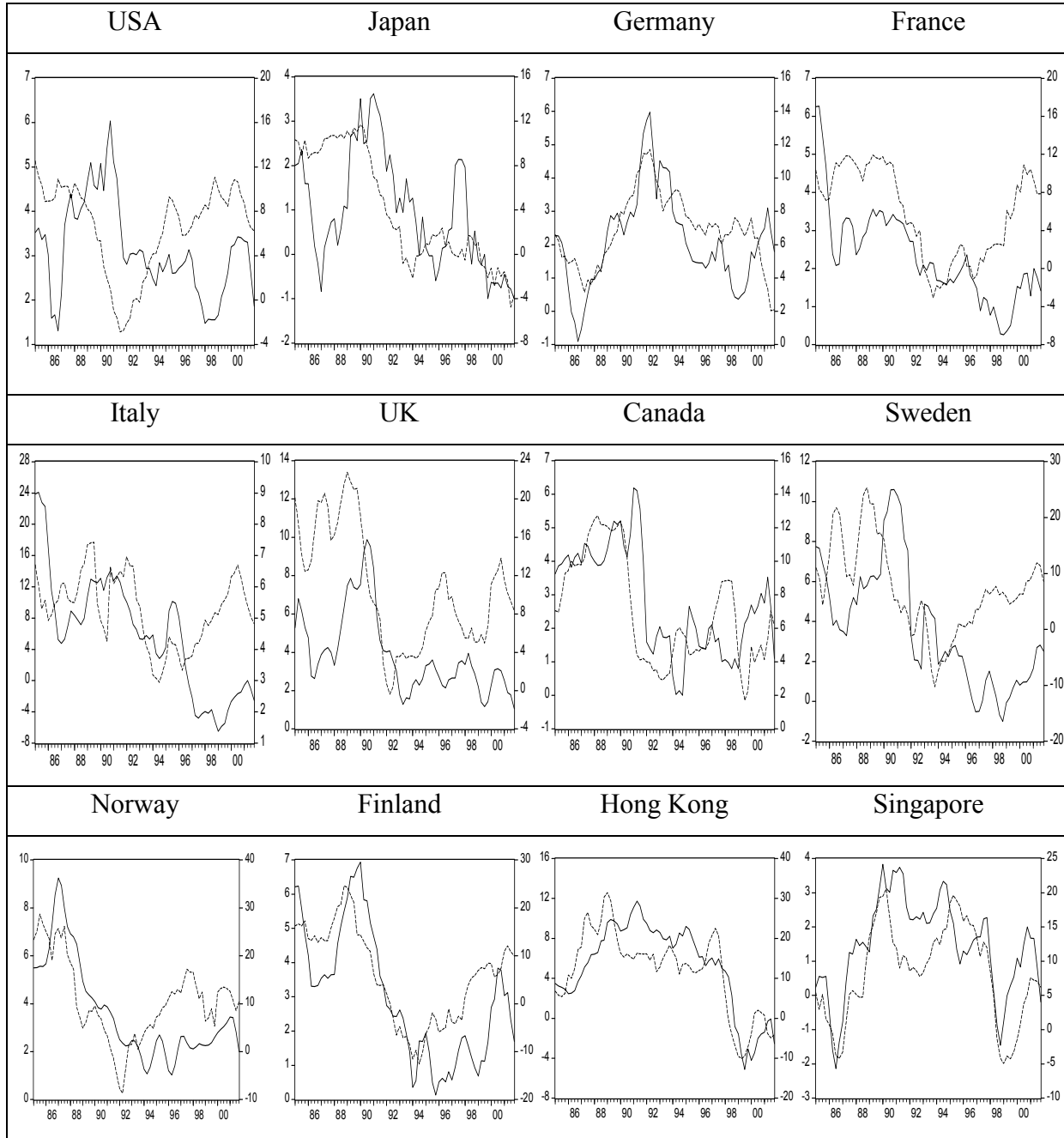
The existence of a financial accelerator or debt deflation mechanism implies a close empirical correlation between bank lending and asset prices. Such a close correlation, especially between bank lending and property prices, has in fact been widely documented in the policy-oriented literature (e.g. IMF, 2000, BIS, 2001). Figures II.1-3 display the co-movement of credit growth (dotted line, right hand scale), defined as the year-on-year percent change in bank lending to the private non-bank sector, and respectively the year-on-year percent change in the consumer price index, the equity price index and the residential property price index (solid line, left hand scale). The sample of countries comprises the G7, three Nordic countries (Sweden, Norway and Finland) and two South East Asian countries (Hong Kong and Singapore). The sample period is first quarter 1985 to fourth quarter 2001.

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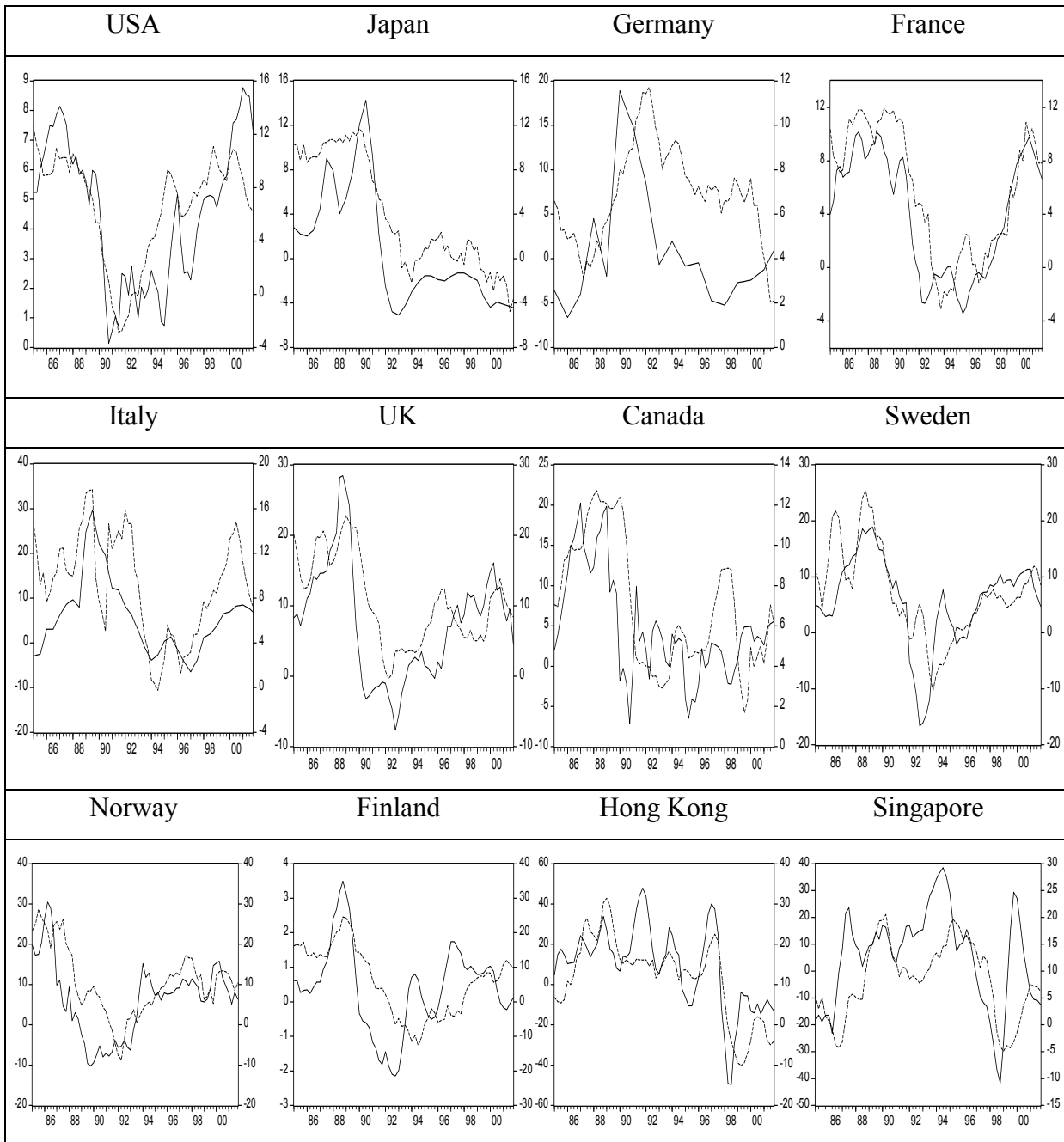
<sup>4</sup> King (1994) provides an overview and a contemporaneous interpretation of Fisher's debt deflation theory. See also Bernanke (1983).

Figure II.1 suggests that credit growth generally leads consumer price inflation. The credit boom experienced by most industrialised countries in the late 1980s was often accompanied by low or falling rates of consumer price inflation. When the boom turned into a bust in the early 1990s, consumer prices often continued to rise and peaked several quarters after credit growth. In the late 1990s, again many countries experienced high rates of credit growth together with low or falling rates of rates of CPI inflation. In Hong Kong, credit growth also leads CPI inflation by several quarters, while in Singapore the correlation appears to be rather coincident. Figures II.2 and II.3 show that credit and property prices follow the same cycle swings, with house price inflation rather leading credit growth, than conversely. On the other hand, the movements in credit and share prices appear to be largely uncorrelated due to the high volatility of share price movements.

Figure II.1: Credit growth and CPI inflation 1985-2001

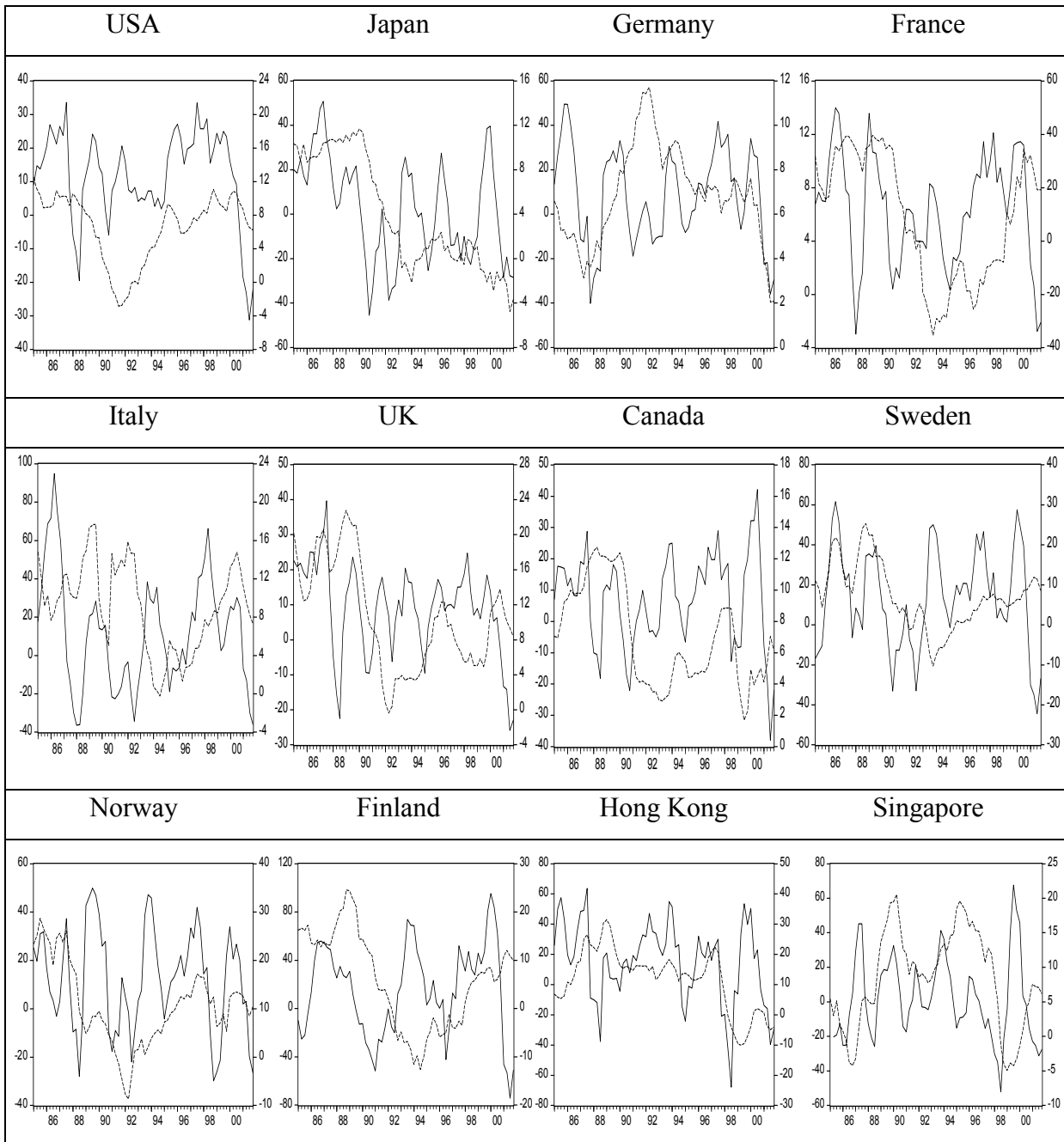


**Figure II.2: Credit growth and house price inflation**



*Sources: BIS, IMF, CEIC. The dotted line represents credit growth (right hand scale) and the solid line represents the rate of change in the residential house price index (left hand scale).*

**Figure II.3: Credit growth and equity price inflation**



*Sources: BIS, IMF, CEIC. The dotted line represents credit growth (right hand scale) and the solid line represents the rate of change in the share price index (left hand scale).*

*A simple impulse response exercise*

In the following exercise we use a multivariate modelling approach in order to analyse the relationship between bank lending and equity and property prices. We estimate a VAR comprising real bank lending, real GDP, real equity prices, real property prices and a short-term real interest rate. The analysis covers twelve countries, the G7, Sweden, Norway, Finland, Hong Kong and Singapore. The sample period is first quarter 1985 to fourth quarter 2001. We do not perform an explicit analysis of any potential long run relationships because of the relatively short sample period and large number of endogenous variables. By doing the analysis in levels, we allow for implicit cointegrating relationships in the data.

Nominal bank lending, share prices and property prices were transformed into real terms by deflation with the consumer prices index. The (ex-post) short-term real interest rate is measured as the three months interbank money market rate less annual CPI inflation. All data except for the share price index and the money market rate are seasonally adjusted. With the exception of the real interest rate, all data were transformed into natural logs. All data were taken from the BIS or the IMF database. Detailed information about the original source of the residential property price series can be obtained from the authors.

The VAR model estimated for each of the twelve countries under investigation is given by:

$$x_t = A_1 x_{t-1} + \dots + A_n x_{t-n} + \mu + \delta t + \varepsilon_t.$$

$x$  is a vector containing the log of the real GDP, the log of real domestic credit, the log of real property prices, the log of real equity prices and the short-term real interest rate.  $t$  is a

deterministic time trend. The lag order  $n$  was in each case determined based on sequential Likelihood Ratio tests.

In order to recover the structural shocks from the reduced form system, we use a standard Cholesky decomposition. The ordering adopted here is the following: real GDP, real property prices, real bank lending, the real interest rate and real share prices. We therefore assume that real GDP does not respond contemporaneously to innovations to any of the other variables, but may affect all other variables within quarter. This assumption is fairly standard in the monetary policy transmission literature. We further assume that real property prices are rather sticky, so that they are not affected contemporaneously by credit, interest rates and share prices. Share prices are rather flexible and are allowed to respond within the quarter to innovations in all other variables. Money market interest rates are also rather flexible, so that they are allowed to respond within the quarter to innovations to economic activity, property prices and credit. The chosen ordering also reflects the common assumption that interest rate changes are transmitted to the economy with a lag. The chosen ordering of the variables has, in our view, the most intuitive appeal and also yields plausible impulse responses. The results are generally not sensitive to a re-ordering of the variables. The exception is the ordering of the real interest rate and bank lending. Allowing for an immediate effect of interest rates on lending often yields an implausible positive response of bank lending to a positive interest rate shock.

Figure II.4 displays standardised impulse responses of credit to asset price shocks and of asset prices to credit shocks in a two standard error confidence band. The results of the impulse response analysis are summarised in Table II.1, where we report the number of significant



impulse responses of each variable<sup>5</sup>. The findings suggest that property prices have a significant effect on bank lending, while the evidence of significant dynamic effects of credit shocks on asset prices or of equity price shocks on credit is rather weak. In ten out of twelve countries bank lending responds significantly positive to a property price shock. Only in Italy and in the UK is the dynamic effect of a property price shocks on lending not significantly larger than zero. Credit shocks have a significant effect on equity prices only in one third of the countries, and on property prices only in two countries. Share prices shocks are found to affect bank lending significantly only in four out of twelve countries.

**Table II.1: Summary of impulse response analysis**

Significant effect of equity on credit	Significant effect of property on credit	Significant effect of credit on equity	Significant effect of credit on property
4	10	4	2

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<sup>5</sup> Here we do not count the significantly negative response of property prices to credit shocks in Germany and the significantly negative response of share prices to credit shocks in Canada.

**Figure 6: Dynamic interaction between credit and asset prices**

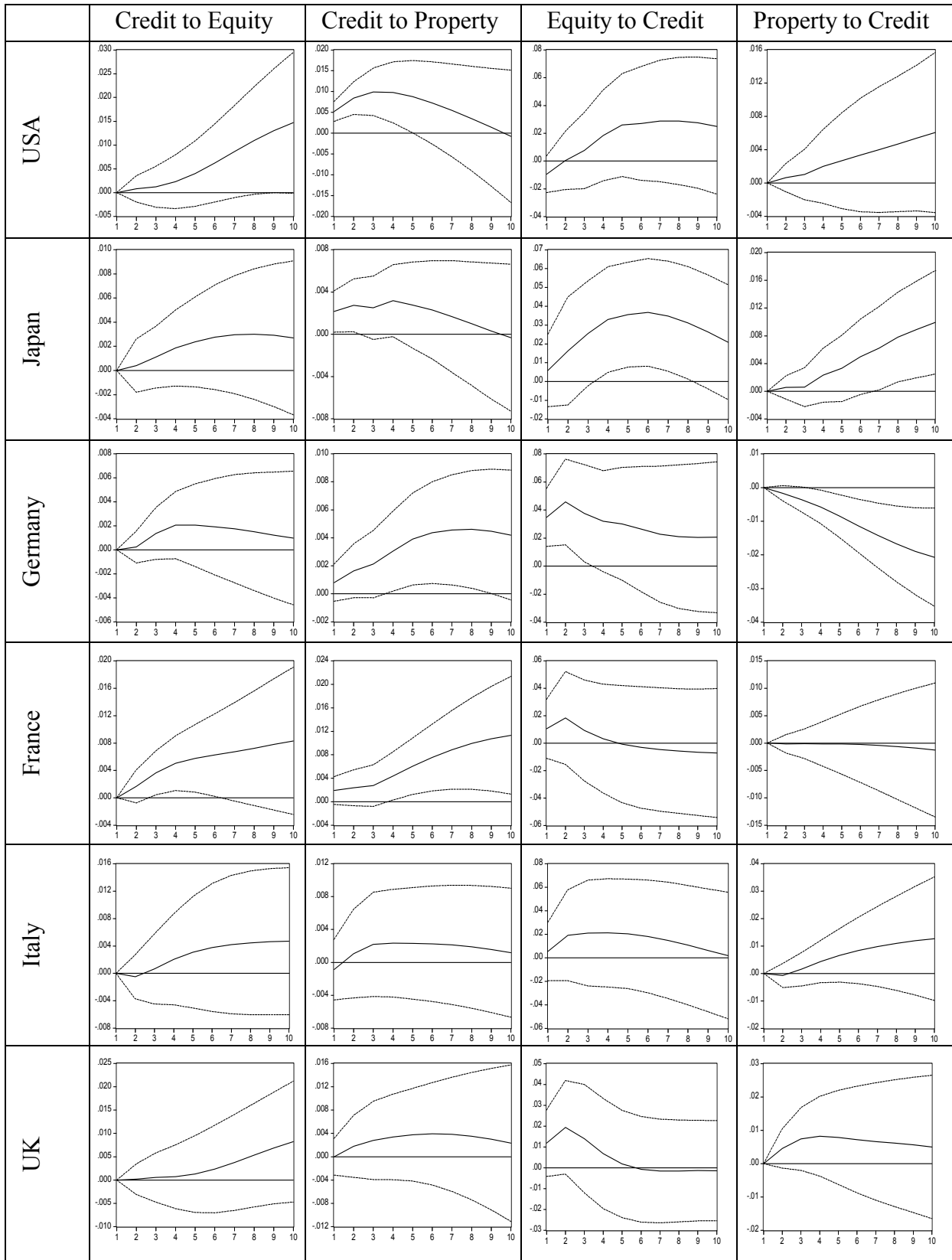
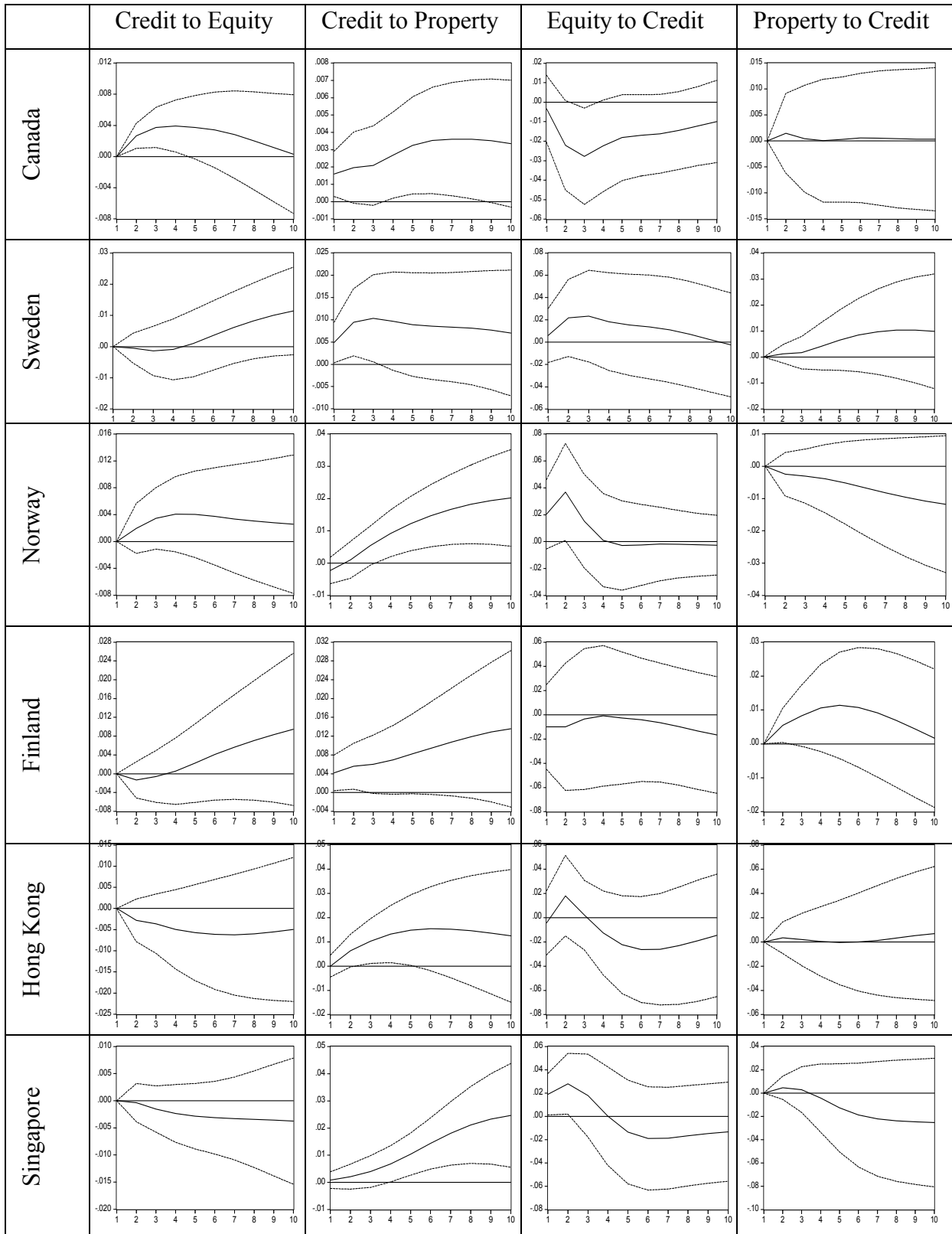


Figure 6, continued



Note: The figures display impulse responses to a one standard deviation shock in a two standard error confidence band.

### III. Deflations: Good or Bad

#### a) Prologue

Prices go down when supply exceeds demand. A rise in supply is intrinsically beneficial. A fall in demand can, however, be bad if there are, as is generally found, price/wage rigidities in the short run. Such a fall in demand may be particularly bad if it causes deflation for two main reasons, the zero lower nominal bound to interest rates and the possibility of greater intransigence against wage/price nominal cuts, (though this latter is contentious, e.g. see for example Yates (1998); recent papers on this subject are Nickell and Quintini (2003), Christofides and Leung (2003), Kuroda and Yamamoto (2003). But there is no general reason to be necessarily concerned about wage/price deflation, especially since under the present fiat money system a Central Bank can always expand the money stock sufficiently to prevent deflation by buying additional assets, whose yield has not already been driven to zero.

This latter is not possible under a commodity, or pegged, exchange rate system, where monetary growth is restricted by the convertibility objective. In such cases a decline in the growth rate of the money stock can be forced onto the system. One might then, at first glance, expect deflations to have been more troublesome under such fixed rate systems. In fact, however, this has not been so.

b) 1873-1913

The longest lasting trend deflation of prices known in history took place in the developed world between the early 1870s and the late 1890s. How far this was due to demand-side factors, (e.g. a slowing in the rate of gold production relative to a rise in the demand for monetary gold reserves), as compared with supply side factors, (e.g. a rise in agricultural production (in the New World) combined with improved transport and communication technology (steamships and telegraph)), is both debatable and beyond the scope of this paper.

What we do want to show is that this period of the ‘great depression’ was, in aggregate, quite beneficent. We do so by comparing this period with the subsequent pre-war period of the late 1890s till 1913. The ‘great depression’ is commonly dated from 1873 till 1896 (Morgenstern 1959). In order to assess whether there was a significant difference in the economic performance of countries between the ‘great depression’ (1873-1896) and the following pre-war period (1897-1913) we compare the average growth rates of GDP and average inflation rates, shown in in Table III.1 below.

**Table III.1: Average CPI inflation and GDP growth in the pre-WW1 period**

	CPI Inflation			GDP Growth		
	Average 1873-1896	Average 1897-1913	Difference	Average 1873-1896	Average 1897-1913	Difference
USA	-1.52 (0.57)	1.03 (0.50)	2.55 (0.76)	4.52 (1.07)	4.49 (1.35)	-0.03 (1.72)
UK	-1.53 (0.53)	1.21 (0.48)	2.74 (0.72)	1.81 (0.74)	1.74 (0.84)	-0.05 (1.12)
Germany	0.0 (0.96)	1.93 (0.44)	1.93 (1.06)	2.32 (0.76)	2.66 (0.63)	0.34 (0.99)
France	-0.14 (0.27)	0.43 (0.32)	0.57 (0.42)	1.33 (0.94)	1.72 (0.95)	0.39 (1.34)

Note: Standard errors are in parentheses.

The obvious feature from this is that trend growth rates of real output were not greatly different; growth in the US and UK was slightly lower in the second period, whereas growth was a bit faster in France and Germany. In all four countries the difference in growth rates is, however, not significantly different from zero. In contrast there was deflation in all four countries in the first period, and inflation in the second. The difference between the average rate of price change in the two periods was over 2% for US and UK and about 2% in Germany, but was less significant at 0.57% in France.

In accord with our econometric exercises in Section II, we next assess the effect of deflation on output growth in USA, UK, Germany and France based on simple output growth regressions over the period 1873-1913, regressing output growth on lagged output growth, a proxy for the potentially adverse effect of deflation; and once-lagged interest rates, equity and housing prices. These latter were entered both in nominal and ex-post real terms in different runs of the equations. We report on the best runs using real ex-post asset prices below, but all are available from the authors. As it is not clear how best to assess the growth effects of deflation, we tried three different specifications to test for this. In the first specification we include a dummy taking on the value 1 from 1897 onwards ( $DI897$ ). This specification essentially tests whether there was a significant change in the average output growth rate between the deflationary period 1873-1896 and the inflationary period 1897-1913. If growth was significantly higher in the latter period the dummy coefficient would be significantly positive. In the second specification we include a dummy variable which takes on the value one in years when there was a deflation in the previous year ( $DEF_{t-1}$ ). If deflation had a

negative effect on next period's output growth this dummy variable would come out significantly negative. Finally, we add the lagged change in the CPI ( $\Delta CPI_{t-1}$ ) and lagged CPI deflation ( $\Delta CPI_{t-1}^{DEF}$ ) to the equation.  $\Delta CPI_{t-1}^{DEF}$  equals the change in the CPI in years of deflation and is zero otherwise. If deflation had an adverse effect on growth the deflation variable would come out significantly positive.

We present estimates of the following three output growth regressions (n.b. long rates and housing prices never appeared significant and were therefore omitted):

$$1. \Delta GDP_t = a1 * \Delta GDP_{t-1} + a2 * RIRS_{t-1} + a3 * \Delta RSP_{t-1} + a4 * D1897$$

$$2. \Delta GDP_t = a1 * \Delta GDP_{t-1} + a2 * RIRS_{t-1} + a4 * \Delta RSP_{t-1} + a4 * DEF_{t-1}$$

$$3. \Delta GDP_t = a1 * \Delta GDP_{t-1} + a2 * RIRS_{t-1} + a3 * \Delta RSP_{t-1} + a4 * \Delta CPI_{t-1} + a5 * \Delta CPI_{t-1}^{DEF}$$

The regressions were estimated by Seemingly Unrelated Regressions (SUR) both allowing all coefficients to vary across countries and by pooling the observations across countries allowing only the regression intercepts to vary across equations. The results are reported in Table III.2. One common feature is that there appeared to be some short-run negative auto-correlation in changes in GDP (not reported). Good years tend to be followed by bad, and vice versa. Why this was so, is not clear to us. Of more importance is the negative result that in all three specification we find no evidence of a negative effect of deflation on growth. In the second and third specification there is even some slight evidence that years of deflation were followed by higher growth in the UK and Germany respectively. The sole important determinant of output growth appears to be the short-term real interest rate, which is

significant at the 5% level for Germany, France and the UK. The real interest rate elasticity is also significant at the 1% or 5% level, depending on the specification, in the pooled regressions. Except for France, where the change in real share prices is significant at the 5% level, we were not able to find clear, significant effects of equity price changes on real output in this data set, a somewhat disappointing conclusion.

**Table III.2: Output growth and deflation**

	Specification 1			Specification 2			Specification 3			
	$RIRS_{t-1}$	$\Delta RSP_{t-1}$	$DI897$	$RIRS_{t-1}$	$\Delta RSP_{t-1}$	$DEF_{t-1}$	$RIRS_{t-1}$	$\Delta RSP_{t-1}$	$\Delta CPI_{t-1}$	$\Delta CPI_{t-1}^{DEF}$
US	0.184 (0.72)	-0.055 (-0.88)	0.54 (0.31)	0.207 (0.79)	-0.046 (-0.71)	-0.956 (-0.47)	-0.236 (-0.70)	-0.034 (-0.51)	-0.869 (-1.42)	0.514 (0.78)
UK	<b>-0.475</b> <b>(-2.7)</b>	-0.063 (-0.93)	-1.254 (-1.25)	<b>-0.751</b> <b>(-3.27)</b>	-0.05 (-0.77)	<b>2.419</b> <b>(2.03)</b>	-1.00 (-1.47)	-0.08 (-1.12)	-0.349 (-0.48)	-0.412 (-0.88)
Germany	<b>-0.284</b> <b>(-2.29)</b>	0.017 (0.40)	0.062 (0.06)	<b>-0.511</b> <b>(-2.99)</b>	0.002 (0.04)	2.103 (1.50)	<b>-2.157</b> <b>(-2.74)</b>	-0.03 (-0.66)	<b>-1.831</b> <b>(-2.39)</b>	0.018 (0.05)
France	<b>-1.38</b> <b>(-3.59)</b>	<b>0.223</b> <b>(2.50)</b>	-1.176 (-0.94)	<b>-1.246</b> <b>(-2.69)</b>	<b>0.195</b> <b>(2.25)</b>	-0.40 (-0.27)	-0.166 (-0.24)	<b>0.214</b> <b>(2.51)</b>	1.422 (1.60)	0.10 (0.09)
Pool	<b>-0.319</b> <b>(-3.40)</b>	0.001 (0.01)	-0.375 (-0.64)	<b>-0.414</b> <b>(-3.35)</b>	-0.001 (-0.05)	0.99 (1.30)	<b>-0.567</b> <b>(-2.08)</b>	-0.001 (-0.05)	-0.269 (-0.91)	-0.043 (-0.16)

*Note: Equations estimated by SUR. Significant coefficients (10% level) are in bold.*

### c) The Interwar Period

In the interwar period many countries experienced deflations in 1920/21 and then again in the great depression of 1929-33. In view of the deflationary spirals evolving in the US and other countries during the Great Depression 1929-1932, Irving Fisher (1933) developed his famous theory of debt deflation, as already noted in Section II.



In order to test whether the great depression in the USA was driven by goods price deflation, or rather asset price deflation, we estimate regression specification 2 and 3 of the previous section, now also including the lagged change in real property prices on the right hand side of the equation. The results are reported in Table 2 and suggest that even in the interwar period goods price deflation did not appear to have had an adverse effect on output growth. In both specifications the measures of deflation are insignificant. Also the real ex post interest rate was insignificant. Perhaps more surprising, the change in share prices does not appear to have affected output growth significantly. The main driving force of output growth in the USA in the interwar period appears to have been the change in real property prices, with an elasticity significant at the 1% level.

**Table III.3: Output growth regressions for the US, 1919-1934**

Specification 2				Specification 3				
$RIRS_{t-1}$	$\Delta RSP_{t-1}$	$\Delta RHP_{t-1}$	$DEF_{t-1}$	$RIRS_{t-1}$	$\Delta RSP_{t-1}$	$\Delta RHP_{t-1}$	$\Delta CPI_{t-1}$	$\Delta CPI_{t-1}^{DEF}$
-0.445 (-1.09)	-0.05 (-0.61)	<b>1.886</b> <b>(3.19)</b>	-0.54 (-0.11)	-0.753 (-0.79)	-0.121 (-0.855)	<b>2.149</b> <b>(3.00)</b>	-0.486 (-0.61)	0.92 (0.77)

Note: Equations were estimated by OLS. Significant variables (10% level) are in bold.

d) East Asia (Currently)

By comparison with the ‘great depression’ of 1873-1896, or the collapse in prices in many countries in the inter-war years of 1920/21 and again in 1929-33, the recent deflations in East Asia have, in terms of the movements in CPI, been brief and mild. Japan is regarded as the

archetype of current deflationary experience, but in practice the CPI has only fallen by 3.3% from its peak in 1998 Q4. In contrast, asset price deflation has been much more pronounced. The Nikkei stock price index has fallen from its peak in 1989 Q4 by 64% and residential property prices have been falling since 1991 Q1 by 32%.

So much attention has been paid to Japan that there has been little realisation that China, since 1998 Q1, experienced, prior to 2003, greater deflation than Japan, and a much steeper earlier fall in inflation; in 1994 China's rate of inflation was over 20%, compared with around 1% in inflation in Japan in that same year. Since 1998 Q1 the cumulative fall in the Chinese CPI was 6%, almost double that of Japan. China, of course, has had no asset price deflation to accompany the recent period of CPI deflation. Housing prices rose slightly over these years by 3.6% since the start of the deflationary period in 1998 Q1; such prices rose strongly in Shanghai and remained broadly stable in the other main cities sampled, which were Beijing, Guangzhou and Shenzhen. Equity prices were volatile, but rose by 27.5%.

The other Asian countries which are frequently described as subject to deflationary pressures are Hong Kong and Singapore. Hong Kong experienced the sharpest fall in consumer prices of all the Asian countries, with a fall from peak since 1998 Q4 of more than 16%. Still more pronounced has been the drop in property prices. From their peak in 1997 Q2 property prices came down by 66%. Over the same period, share prices were volatile and fell by 26%.

Singapore, on the other hand, experienced only two brief episodes of deflation in 1998/99 and in 2002/3. However, like Hong Kong, Singapore experienced a rather pronounced asset price deflation. Residential property price fell since 1996 Q2 by 38 % and share prices fell

since 1996 Q1 by 24%.

In accordance with our exercise for the pre-WW1 period, we compared the GDP growth performance of the Asian countries in the deflationary years with the preceding period of similar length. GDP data were available up to 2003 Q2. For Hong Kong we used only GDP data up to 2003 Q1 as the second quarter of 2003 was strongly affected by the SARS blip. In order to see whether it is CPI or asset price deflation that matters this was done both for the period of CPI deflation and for the period of asset price deflation. Exceptions are Singapore, where there is no clear peak in the CPI so that we analysed only the period of asset price deflation, and China, where there was no asset price deflation so that we analysed only the period of CPI deflation. The results are reported in Table III.4.

**Table III.4: Average GDP growth in the Asian countries**

	CPI Deflation			Asset price deflation		
	Deflation period	Preceding period	Difference	Deflation period	Preceding period	Difference
Japan	1.41 (0.84)	1.25 (1.06)	-0.16 (1.35)	1.23 (0.54)	3.94 (0.43)	2.77 (0.69)
Hong Kong	3.15 (1.40)	2.76 (0.48)	-0.39 (1.99)	2.17 (1.38)	4.97 (0.74)	2.8 (1.56)
Singapore	-	-	-	3.81 (1.54)	8.85 (0.91)	5.04 (1.79)
China	7.84 (0.13)	10.10 (0.34)	2.26 (0.36)	-	-	-

*Note: Standard errors are in parentheses.*

What is patent from the data is that both the deflationary pressure, and the adverse economic implications for the economies, has come from asset price deflation, not from CPI deflation. Both for Japan and Hong Kong the growth performance of the economy is not significantly

worse in the period of CPI deflation compared to the preceding period of no deflation, while growth appears to have been significantly slower in the period of asset price deflation. In Singapore there is also clear evidence that growth has been slower in the period of asset price deflation, while China appears to be the only case where the period of CPI deflation has been associated with a significant slow down in GDP growth.

Again we have run the same regressions as in Subsection (b) above, using as long data sets as we can find. The only addition is that, in a world characterised generally by fiat money and floating exchange rates, we have also included the real effective exchange rate as an additional variable, (though note that China and Hong Kong both had pegged rates, while that of Japan and Singapore were heavily managed). The results of the regression are reported in Table III.5.

The sample period covers 1982:1-2003:2 for Japan, 1985:1-2003:2 for Hong Kong, 1986:1-2003:3 for Singapore and 1999:2-2003:2 for Mainland China. As it was not entirely clear when to date the start of the deflation regime for each country, we restricted the analysis to specifications 2 and 3. For China we estimated only one regression including the lagged change in the CPI as there were only negative changes in the CPI over the available sample period. As we were using quarterly data instead of annual data we estimated specification 2 and 3 with a richer lag structure, allowing up to five lags of each variable to enter the regression equation. A preferred regression specification was derived by eliminating all insignificant lags, retaining at least one lag for each variable. As for the pre-WWI and the interwar period, we find that

measures of CPI deflation do not have a significant effect on output growth. The change in real property prices has a strong and highly significant effect on output growth in all four countries. The change in real share prices comes out significantly in Japan and Hong Kong, the real effective exchange rate in Hong Kong and China. The ex-post real interest rate is found to have a significant effect on output growth in Japan for specification 2 and in China.

**Table III.5: Output growth regressions for the Asian countries**

	Specification 2					Specification 3					
	<i>RIRS</i>	$\Delta RSP$	$\Delta RHP$	<i>REX</i>	<i>DEF</i>	<i>RIRS</i>	$\Delta RSP$	$\Delta RHP$	<i>REX</i>	$\Delta CPI$	$\Delta CPI^{DEF}$
Japan (1,5,1,1,1) (1,5,1,1,1,1)	<b>-0.36</b> (-1.72)	<b>0.021</b> (1.93)	<b>0.295</b> (3.37)	0.011 (0.67)	-0.513 (-0.66)	-0.266 (-1.13)	<b>0.021</b> (1.95)	<b>0.278</b> (3.09)	0.006 (0.32)	0.322 (1.17)	-0.059 (-0.71)
Hong Kong (1,4,1,1,1) (1,4,1,1,1,1)	0.122 (0.52)	<b>0.024</b> (1.86)	<b>0.098</b> (2.76)	<b>0.126</b> (1.78)	1.625 (0.58)	-0.19 (-0.50)	0.021 (1.55)	<b>0.089</b> (2.47)	<b>0.147</b> (2.00)	-0.425 (-1.01)	-0.108 (-0.16)
Singapore (1,3,4,2,1) (1,3,4,2,1,1)	0.30 (0.68)	<b>0.032</b> (2.09)	<b>0.134</b> (3.21)	<b>0.163</b> (1.67)	-1.493 (-0.48)	0.299 (0.53)	<b>0.032</b> (2.10)	<b>0.137</b> (3.23)	0.16 (1.59)	-0.351 (-0.47)	1.23 (0.69)
China (3,3,4,1,1)	-	-	-	-	-	<b>-0.438</b> (-2.17)	-0.001 (-0.04)	<b>0.107</b> (3.09)	<b>0.235</b> (2.43)	-0.088 (-0.47)	-

*Notes: The Table reports estimation results for two output growth regression specifications. For China only one specification was estimated as the sample period covered only periods of deflation. The sample period was 1982:1-2003:2 for Japan, 1985:1-2003:2 for Hong Kong, 1986:1-2003:3 for Singapore and 1999:2-2003:2 for China. RIRS is the ex-post short-term real interest rate,  $\Delta RSP$  is the change in real equity prices,  $\Delta RHP$  is the change in real property prices, *REX* is the effective real exchange rate, *DEF* is a dummy which takes on the value one if there was consumer price deflation and zero otherwise,  $\Delta CPI$  is the change in the CPI and  $\Delta CPI^{DEF}$  is the change in the CPI if there was consumer price deflation and 0 otherwise. In the first column we report the chosen lag structure in parentheses. The numbers refer to the retained lags of each variable in each of the estimated specifications. The other columns report estimated coefficients with *t*-statistics in parentheses. Coefficients which are significant at least at the 10% level are in bold.*

#### IV. Conclusions

The empirical results of our paper are starkly simple. There is no innate disadvantage in goods and services price deflation as such; indeed this can often be consistent with continuing strong growth. It is rather when (demand) deflation is accompanied by, or exhibits itself in the guise of, property price deflation that trouble brews. The strength of this relationship (except in 1873-1913, when the data for the US and UK are somewhat dodgy) surprised even us. But property is not only the main component of wealth, (in most cases far outdistancing equities, or which exaggerated attention has been devoted), but is also closely associated with bank credit (and hence monetary) expansion. Bank lending is collateralised on, and commonly for purchases of, property, much more so than for equities, or other goods and services.

The practical conclusions are also clear. Japan will experience a sustainable recovery when property prices there stop falling, and not before, (n.b. this is a testable hypothesis. Time will tell). In the US and UK, the IT, dot.com, equity collapse did not lead to a sharp drop in output because easy money led to a housing price boom. If, and when, housing prices subsequently tumble, there may be a much more searching examination of the efficacy of monetary policy.

Our claim that the course of property prices has been of greater importance for output growth than that of goods and services inflation does not, of itself, imply that Central Banks should target housing prices, instead of, or even as well as, general goods and services prices. But it

does suggest that Central Banks, and others, should be aware of the nexus of relationships tying property prices, credit and monetary expansion, output and general goods and services inflation together. Moreover, a Central Bank has not exhausted its armoury when interest rates on short term (or even longer term) government debt go to zero. Even when international political economy (a.k.a. US Treasury) concerns prevent a Central Bank from buying foreign exchange (US T bonds), it can always purchase domestic property (via REITs). Unconventional indeed, but then purchases of government debt were unconventional to the true believers in the real bills doctrine.

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