

Global Disinflation

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Summary

A long-term disinflationary trend is widely observed all over the world. Since the mid-1990s, this trend has been more pronounced in industrial countries and many emerging economies in Asia. Japan is faced with a deflation problem. Emerging economies in Asia and several industrial countries, arguably including the United States, have also shown clear disinflationary trends. Hong Kong SAR has been experiencing much deeper and prolonged deflation than Japan.

This paper discusses factors contributing to “global disinflation” to reexamine Japan’s deflation in a broader context and shed some light on the prospect of the global economy. For this purpose, we try to empirically answer the following questions in the paper. Namely, 1) does the expansion of supply capacity in emerging economies play a significant role in slowing down global inflation, especially in industrial countries? And, if that is the case, 2) why does economic performance differ among countries?

There are five major possible sources of the recent global disinflation: 1) anti-inflationary monetary policy and restrictive fiscal policy, 2) output gaps coincidentally observed in many countries under a synchronized international business cycle, 3) productivity increase in the information technology-related sector, 4) global supply shocks caused by the expansion of supply capacity in emerging economies, and 5) the collapse of asset price bubbles. With regard to 4) above, it is noteworthy that in the tradable goods sector global competition has intensified since the beginning of the 1990s, as more emerging economies in Latin America and eastern Europe, and China have entered the world market.

There can be counter-arguments about the fourth factor, i.e. the global supply shock caused by the expansion of supply capacity in emerging economies. First, it does not take account of economic adjustments through exchange rates. Second, declines in prices of tradable goods may change *relative* prices, but not necessarily *aggregate* prices. Regarding the first argument, if foreign exchange rates move so that the purchasing power parity holds, or if they move quickly enough to adjust current account imbalances between countries, emerging economies will face appreciation of

their currencies and subsequent declines in their price competitiveness. However, in reality, this does not always hold true at least in the short run. Regarding the second argument, if a domestic economy adjusts itself to a supply shock without major costs, there would not necessarily be a decline in *aggregate* price levels or a downturn of the economy. However, in reality, there are certain rigidities particularly those regarding the reallocation of labor that impede adjustments in the short run. Therefore, an external shock on tradable goods prices *can* put downward pressures on *aggregate* price levels and economic activities.

In fact, our empirical analysis shows that there were certain shocks, which cannot be attributed to output gaps or inflationary expectations behind global disinflation since the mid-1990s. We also find a certain degree of positive correlation between this shock and the expansion of supply capacity in emerging economies.

Based on our findings and applying the structural VAR model proposed in Kamada and Hirakata [2002], this paper analyzes how each of those factors we discussed in this paper affects inflation rates of major industrial countries. Specifically, we breakdown historical inflation rates into three kinds of structural shocks: 1) a cyclical demand shock, 2) a productivity shock, and 3) a supply shock caused by the expansion of supply capacity in emerging economies. We find that the supply shocks caused by the expansion of supply capacity in emerging economies have put significant downward pressures on prices in major industrial countries since the mid-1990s.

This result also poses a different question: why does economic performance differ among countries under such global supply shocks? Based on the findings in this paper, it seems that how such shocks affect each economy depends on the magnitude of the shocks and the degree of structural flexibility of each economy in response to various shocks. From this perspective, Japan's poorer economic performance as compared with that of the United States in recent years can be largely attributed to Japan's structural rigidities. This is consistent with the results of our empirical analysis. On the other hand, in the case of relatively advanced economies in emerging Asia, notably Hong Kong, the issue is not as much as their structural rigidities as the magnitude of the supply shocks. In those economies, the supply shocks seem

extremely large partly due to the absence of adjustments of exchange rates vis-à-vis their trading partners including China.

Our findings have the following implications for economic policy. First, since the expansion of supply capacity in emerging economies is considered to be a permanent structural change in the global economy, reform to enhance the structural flexibility of the economy is essential for sustainable economic growth. Second, a sound financial sector is essential to achieve and maintain structural flexibility. In fact, those countries that have a sound financial sector such as the United States and South Korea have managed to deal with adjustment pressures and shown, at least so far, relatively good economic performance. In contrast, Japan does not seem to be successful in dealing with pressures for structural changes. Japan seems to be trapped in a vicious circle of its financial sector problem dampening growth of its real economy. Policymakers must tackle with both the financial sector problem and the real economic problem simultaneously.

1. Introduction

It has already been several years since Japan fell into deflationary slump, and during this period there have been a large number of debates on its possible sources and policy prescriptions. Meanwhile, if one looks at price developments abroad, one will notice that Japan is not an extreme exception. Emerging economies in Asia and several industrial countries, arguably including the United States, have also shown clear disinflationary trends. In particular, Hong Kong SAR has been experiencing much deeper and prolonged deflation than Japan. Against this background, there are even some commentators who refer to the current situation as “global deflation.” Moreover, monetary policymakers around the world have turned their attention to deflation.¹

There are a large number of studies on Japanese deflation, including some by staff members at the Bank of Japan.² This paper investigates the factors contributing to “global disinflation” to reexamine Japan’s deflation in a broader context and shed some light on the prospect of the global economy. For this purpose, we empirically investigate the following questions in the paper. Namely, 1) does the expansion of supply capacity in emerging economies play a significant role in slowing down global inflation, especially in industrial countries? And, if that is the case, 2) why does economic performance differ among countries?

The structure of this paper is as follows. Section 2 lays out a cross-country overview of price developments. Here a close attention is paid to distinguish changes in *relative* prices from those in *aggregate* price levels. Section 3 examines possible sources of the recent global disinflation. Section 4 focuses on one of the possible sources, i.e. a global supply shock caused by the expansion of supply capacity in emerging economies. Given its debatable validity, we attempt to show statistical

1 For example, some economists (Ahearne, et al.) at the FRB wrote the paper entitled, “Preventing deflation: Lessons from Japan's experience in the 1990s” in 2002. In addition, Bean C., the Chief Economist at the Bank of England gave a speech in November 2002 on “The MPC and the U.K. economy: Should we fear the D-words?” in which he referred to the risk of the U.K. falling into deflation.

2 Numerous studies have focused on the Japan’s sustained deflationary slump. See, *inter alia*, Research and Statistics Department, Bank of Japan [2000].

evidence of it and discuss how it affects not only *relative* prices but also *aggregate* price levels. Section 5 shows empirical analysis on how each of possible factors has affected the recent disinflation in major industrial countries. Finally, Section 6 summarizes the major findings in this paper and discusses their implications for economic policy.

2. Stylized facts of cross-country price trends

We start with a cross-country overview of developments of consumer price indices (CPI hereafter). There are three remarkable common characteristics.

(1) A long-term disinflationary trend is widely observed all over the world

First, with regard to long-term developments of CPI, inflation shows a downward trend around the world (Figure 1, Figure 4). Virtually without exception, average CPI inflation in each decade has declined. In Latin America as well, following “hyper inflation” era until the late 1980s, inflation has moderated significantly, although, in some countries, interrupted recently by sharp depreciation of their currencies.

(2) Disinflationary trend has recently been pronounced

Second, disinflationary trend has recently been pronounced in industrial countries and many emerging economies in Asia, although interrupted in early spring 2003 by sharp increases in crude oil price under heightened geopolitical concerns.

Looking at industrial countries (Figure 1-1), Japan has faced sustained deflation for more than three years. Switzerland’s inflation is also close to zero, and German inflation has declined to about 1 percent. As for the United States and the United Kingdom, inflation is still clearly in positive territory, but from a historical perspective, it is very low. On the other hand, in some countries in the euro area (e.g. Netherlands, Spain), inflation remains relatively high levels.

Turning to emerging economies (Figure 1-2), Hong Kong SAR has experienced

much deeper and prolonged deflation than Japan, while Taiwan's inflation hovers around zero. Thailand's inflation has also declined to around 1 percent. China shows mild deflationary trend, although it continues to post high economic growth at least compared with industrial countries. Outside Asia, some Latin American countries recently showed clear upward trends due to sharp depreciation of their currencies.

(3) Disinflationary trend is prominent in goods prices

Third, disinflationary trend is prominent in goods prices around the world. In fact, on a core goods inflation basis (Figure 2), Japan, the United States and the United Kingdom have been posting year-on-year declines. In addition, in Germany and France goods price inflation has declined to close to zero. It should be noted that given possible upward biases regarding "measured CPI," "true inflation" could be significantly lower for some countries.

On the other hand, service price inflation (Figure 3) is higher in all countries than goods price inflation and its trend seems to differ among countries. For example, service price inflation declines at roughly the same pace and timing as goods price inflation in Japan, Taiwan Province of China and Hong Kong SAR. Among them, Hong Kong SAR is currently recording large minuses, while Japan and Taiwan Province of China are around zero. As for the United States, service price inflation is still clearly positive, although there seems to be increasing downward pressures. Meanwhile, in the United Kingdom and France, service price inflation seems to be on an upward trend.

(4) Some remarks

To sum up, based on our findings, there are three remarkable common characteristics: 1) a long-term disinflationary trend is widely observed all over the world, 2) disinflationary trend has recently been pronounced, and 3) disinflationary trend is prominent in goods prices.

It is noteworthy that although as long as goods price inflation is concerned, many countries have been posting year-on-year declines, "deflation" — a persistent decline in

aggregate price level — has been, at least so far, the exception rather than the rule. Against this background, such expressions as “global deflation” seem to overstate the current situation and “global disinflation” is more appropriate to describe the current situation.

3. Possible sources of the recent global disinflation

(1) Standard views on inflation: some notes

In this section, we examine possible sources of the recent global disinflation. To do that, we start with a brief review of standard view on inflation.

According to the standard theory, inflation is affected by output gaps, inflationary expectations, money supply, or supply shocks (e.g. changes in import prices). Roughly speaking, in the long run, inflationary expectations and money supply are considered to be the primary determinants of inflation, while, in the short run, output gaps are considered to play a prominent role.

What should be noted here is that, in reality, changes in inflation tend to be caused by a combination of several of these factors. A good example of this is the oil crisis in 1970s. For an oil-importing country, the crisis was primarily a supply shock, but it also induced output gap through a decline in real income due to income transfers to oil-producing countries. Similarly, an influx of cheap imports from China in recent years is primarily a supply shock, but it also seems to induce output gap, as domestic demand shifts towards imports and domestic competitors shift their production to China in addition to the streamlining of their distribution channels. These viewpoints will turn out to be extremely important later on in this paper when we empirically investigate how an influx of cheap imports from emerging economies affects industrial countries.

(2) Possible sources of the recent global disinflation

Based on the framework described above, this subsection presents possible sources of the recent global disinflation.

(a) Anti-inflationary monetary policy and restrictive fiscal policy

First, with regard to the long-term disinflationary trend, there is widespread consensus that anti-inflationary monetary policy³ and restrictive fiscal policy have played an important role. Since the late 1970s, there was a widespread shift of central banks in industrial countries toward a more focused attitude on inflation. In addition, many central banks in Asia moved their focus to anti-inflation and transparency of policy after the crisis of 1997-1998. In fact, some countries such as South Korea have introduced inflation targets. Moreover, many Latin American and eastern European countries have introduced currency board systems.

With regard to fiscal policy, much attention has been paid to improve fiscal balance in many industrial countries, with the United States focusing on reducing its fiscal deficits and EU countries on achieving the standards required for EMU membership ("convergence criteria"). In fact, there have been significant improvements in structural fiscal balance in most industrial countries, with notable exception of Japan.

(b) Output gaps coincidentally observed in many countries under synchronized international business cycles

Second, with regard to the strengthening of global disinflationary trends over the past few years, cyclical output gaps seem to have played an important role. At the end of 2000, many countries coincidentally faced output gaps under global economic downturn (Figure 5). Although output gaps seem to have shrunk to some extent since then, they remain high levels in many countries. Under these circumstances, unemployment rates (Figure 6) are either rising or remain high levels in most countries and wage growth rates have weakened, with notable exceptions of some countries in the euro area which are known for their rigid labor markets (Figure 7).

³ On this point, IMF [2000] provides a comprehensive survey of relevant prior research and concludes that anti-inflationary monetary policy has contributed substantially to a long-term disinflationary trend.

(c) Productivity increase in the information technology-related sector

Third, productivity increase seems to have affected global disinflationary trend. Within the framework of the demand and supply curves, this can be interpreted as an outward shift in the supply curve, which can lead to both disinflation and economic expansion.

Intuitively, productivity increase seems to have been driven by the information technology-related manufacturing sectors. In fact, there are a number of empirical studies that confirmed that the pace of technology advances has accelerated in these sectors since the mid-1990s.⁴ In addition, in the United States, the use of IT has been demonstrated to be a major factor for the growing productivity of the finance, insurance, retail and wholesale sectors.⁵

(d) Global supply shock caused by the expansion of supply capacity in emerging economies

Fourth, the expansion of supply capacity in emerging economies, in particular China, seems to have put downward pressures on goods prices around the world and, in a certain way, on aggregate price levels as well. Admittedly, this hypothesis may sound quite intuitive, and there can be a host of questions regarding its theoretical validity. We will discuss this point in further detail and show statistical evidence for this hypothesis. Before that, in the following, we see how emerging economies have expanded their supply capacity.

In retrospect, in the 1990s more emerging economies in Latin America and eastern Europe, and China have entered the world market partly prompted by the end of the Cold War and the signing of FTA such as NAFTA, following Asian NIEs and ASEAN4 that made a great progress in 1980s. Under these circumstances, in the tradable goods sector global competition has intensified, putting downward pressures on the prices of the tradable. This, in turn, prompts firms in each country to enhance

4 For example, Basu et al. [2001] and Kato [2003] clearly demonstrate that the productivity (total factor productivity) growth rate rose for durable goods manufacturing and some part of non-manufacturing sector in the U.S. in the late 1990s.

5 For more on this point see Saito [2002] and Kato [2003].

productivity and seek for more cheap production factors (in particular, labor) through foreign direct investment in emerging economies and fragmentation.⁶ However, ironically enough, under intensified global competition, these efforts by firms have tended to result in further reductions in prices.

Consistent with this view, the share of emerging economies in global export market and import penetration ratios of industrial countries show clear upward trend, with marked acceleration in the late 1990s. Figure 8 shows the share of emerging economies in global export market. The right-hand chart shows the share based on each country's export value converted into the US dollar term by spot exchange rates. This is based on the assumption that "the law of one price" holds for tradable goods. In contrast to this "nominal share," the left-hand chart shows the share based on each country's export value converted into the US dollar term by the exchange rates consistent with PPPs, assuming that there is significant price dispersion of export goods between emerging and industrial economies (the "adjusted share"). In either case, emerging economies, in particular China, show a marked increase in their share in world export market.

In accordance with this, import penetration ratios of industrial countries show clear upward trend, with marked acceleration in the late 1990s (Figure 9). A look at the import sources of developed countries (Figure 10) shows that they tend to be "hinterlands" for each country: the major source for Japan is Asia; for United States, Latin America; for Germany, central and eastern Europe. It is noteworthy, however, that the penetration from China is growing rapidly in all cases.

With regard to the declines in goods prices, one may consider that they were merely the results of faster productivity growth in goods sector under the recent disinflationary trend in terms of aggregate price levels. However, given 1) the rising import penetration ratios in industrial countries, 2) the loss of firms' monopolistic

⁶ "Fragmentation" means unbundling the whole production process into many small unit and reallocating each of them among countries so that lower production cost can be achieved. A good example of this is personal computer industry, which has easily-modularized products. See Jones [2002] for the leading study on this topic. For a variety of examples of fragmentation in the real world, see Kozu, Nakayama, Mineshima, and Saita [2002].

powers that is frequently pointed out,⁷ and 3) too large inflation gap between goods and services to be purely the result of sectoral productivity differences in some countries,⁸ it is reasonable to think that the expansion of supply capacity in emerging economies has put downward pressures on goods prices in industrial countries.

(e) Collapse of asset price bubbles

Fifth, it is also likely that the deflation or disinflation of Japan and some countries in Asia partly stems from the collapse of asset price bubbles. Within the standard framework for inflation presented above, the outcome of a collapse of asset price bubble emerges as output gaps. However, output gaps caused by the collapse of bubbles tend to differ significantly from those caused under usual business cycles in their magnitude and persistence. This is why the collapse of bubbles tends to put unusually strong and sustained forces to hold down growth and prices. To illustrate this, suppose what will happen if asset price bubble collapses. In that case, a “vicious circle” tends to be triggered: 1) the collapse of asset price bubble damages balance sheets of firms and financial institutions; 2) the deterioration of balance sheets makes firms and financial institutions cautious in their investment and lending activities and prompt them to deleveraging;⁹ 3) such a balance sheet problem, combined with a extremely large output gap that is caused by a marked swing in growth expectations, continues to exert downward pressures on firms’ investment activities; 4) deleverage by firms causes money supply growth to wane; 5) slowdowns in money supply growth cause downward revisions to nominal growth expectations, which, in turn, makes firms more cautious.

⁷ For example, Greenspan, A. often refers to this point.

⁸ For example, in the U.K., inflation gap between goods and service prices used to be well explained by sectoral productivity difference. However, since 2001 goods prices (particularly those of clothing and consumer electronics) began to fall so sharply that this factor alone could not explain the inflation gap well. Referring to this point, Bean, C., the Chief Economist at the BOE, said in his speech in 2002 (see footnote 1) that one important factor was intensified global competition caused by the expansion of supply capacity in low-wage emerging economies.

⁹ See Policy Planning Office, Bank of Japan [2003] for a detailed discussion on how Japanese firms became cautious in investment activities after the collapse of the bubble and how it has affected money supply trends.

Admittedly, there seems to be many other factors contributing to the prolonged stagnation of the Japanese economy, but it is likely that the vicious cycle described above has played a significant role. Looking at abroad, a similar process can be seen in Thailand after the crisis of 1997-1998. Supported by the recovery of the overseas economy and historically low interest rates, its economy is gradually recovering. However, with corporate sector still lacking momentum, full-fledged recovery is yet to be seen. Under these circumstances, money supply growth remains weak and inflation has declined to very low level, as already discussed. In this regard, Germany is arguably another example. It is often pointed out that the backlash from the “reunification boom” continues to depress the economy in particular its construction sector.

The United States after the collapse of “IT-bubble” is also sometimes cited as having exhibited some deflation-like tendencies. Given that the Fed has aggressively cut interest rates¹⁰ (Figure 11 (1)) and that it maintains soundness of financial sector unlike Japan in the early 1990s, there is a good chance that it avoids falling into deflation. However, paradoxically, it is also true that, in spite of the strongly expansionary monetary policy, the recovery of capital expenditures and thus full-fledged recovery are yet to be seen. In addition, downward revisions in medium-term growth expectations for corporate earnings have not come to a halt yet (Figure 11 (2)). Admittedly, recent economic data seem to be affected to some extent by heightened geopolitical concern. Therefore, one should closely monitor the economic developments after the war in Iraq to evaluate the risk of the United States falling into deflation.

4. Global supply shock caused by the expansion of supply capacity in emerging economies: Empirical evidence

(1) The issue

As we noted in Section 3, there can be counter-arguments about the fourth factor,

10 Figure 11 (1) compares the actual FF rate with the fitted Taylor-rule interest rate.

i.e. the global supply shock caused by the expansion of supply capacity in emerging economies: 1) it does not take account of economic adjustments through exchange rates; 2) declines in prices of tradable goods may change *relative* prices, but not necessarily *aggregate* prices. In this section, we first show statistical evidence of that factor, and then discuss how it affects *aggregate* price levels in industrial countries.

(2) Empirical analysis on a global supply shock

(a) Identifying a global supply shock

To identify a global supply shock, we start with estimating the New Keynesian Phillips curves without proxies of supply shocks for selected major countries¹¹ using SUR (seemingly unrelated regressions) technique. Then, we focus on the estimation residuals which are considered to consist of supply shocks (e.g. influx of cheap imports, productivity increase¹²) and error terms. Specifically, we attempt to extract common components from each country's estimation residuals using principal component analysis technique.

Figure 12 shows the first principal component extracted from each country's estimation residuals. As can be seen, it fluctuated around zero until the mid-1990s, while since the mid-1990s it has moved into negative territory, implying that there have been common shocks that worked to depress prices.

(b) Interpretation of the identified global supply shock

The question is what governs the fluctuations of this first principal component. So far, the principal component is nothing more than a “statistically identified” supply shock extracted from the estimation of the New Keynesian Phillips curve. It is, however, not yet *fully* identified in the sense that it is possible that these supply shocks

11 This analysis covers seven countries: Japan, the United States, France, Italy, the United Kingdom, South Korea, and Taiwan Province of China. It would have been better to increase the number of countries in order to avoid sample bias, but this would have run into data constraints, and so only these seven countries were chosen.

12 More accurately, an increase in productivity under sticky nominal wage induces a supply shock. For a detailed discussion on this point, see Erceg, Henderson and Levine [2000] and Kimura, Kurozumi, and Monma [2001].

include both the “global supply shock caused by the expansion of supply capacity in emerging economies” (Factor (d) above) and also “productivity increase mainly driven by the IT-related sectors.” (Factor (c) above). We cannot yet say that a “global supply shock caused by the expansion of supply capacity in emerging economies” (Factor (d) above) has been confirmed.

The next step, therefore, is to examine correlation between the identified global supply shock and a proxy for the expansion of supply capacity in emerging economies. If indeed the latter is a common factor behind recent global disinflation, there should be a highly positive correlation between the two. Figure 13 shows the identified supply shock and the share of emerging economies in the global export market, a proxy for the expansion of supply capacity in emerging economies. The left-hand chart (Figure 13 (1)) shows the “nominal” share, while the right-hand chart (Figure 13 (2)) shows the “adjusted” share. Note that, in both cases, the share of emerging economies in the global export market and the identified supply shock show similar movements. In fact, the correlation between the two based on the samples since 1990/Q1 turns out to be a bit higher than 0.5 in absolute terms, which indicates that they correlate to some extent. This result implies that the expansion of supply capacity in emerging economies has indeed played a role in the global disinflation. The remaining question is what mechanism is working behind the correlation. We discuss this point in further detail in the following subsection.

(3) How does the expansion of supply capacity depress aggregate price levels of industrial countries?

(a) Why adjustments through exchange rates don't fully work

If foreign exchange rates move so that the purchasing power parity holds, or if they move quickly enough to adjust current account imbalances between countries, emerging economies will face appreciation of their currencies and subsequent declines in their price competitiveness. However, in reality, this does not always hold true at least in the short run partly due to speculative movements.

Then, what happens over the longer term? If emerging economies had floating

exchange rate regimes, foreign exchange rates would move for the purchasing power parity to hold, or they would move to adjust current account imbalances between countries. However, in reality, many emerging economies including China peg — either formally or de facto — their currencies at fixed rates to those of major industrial countries that they are economically closely related to (in particular, the U.S. dollar and euro). Therefore, it is possible that industrial countries see a significantly prolonged period of influx of cheap imports from emerging economies, and indeed this seems to be exactly what we are seeing. Moreover, relatively advanced emerging economies in Asia such as Hong Kong seem to have faced the similar shocks from less advanced economies, in particular China. In this regard, it is noteworthy that nominal hourly wage in China is not only far less than those of the developed countries, but also it is significantly lower than those of the relatively advanced emerging economies in Asia such as Asian NIEs (Figure 14).

Meanwhile, generally speaking, with the foreign exchange rates fixed at lower level than consistent with the PPP, rising export demand will cause an increase in the prices of production factors such as nominal wage and subsequently an increase in prices. Therefore, even under the fixed exchange regimes, adjustment mechanism is expected to work to some extent. However, in the case of China, such adjustment mechanism seems to be hardly working due to a large slack in the labor market.

(b) Why an influx of cheap imports depresses aggregate domestic price levels

Even if adjustment mechanism through foreign exchange rates does not fully work, there still is no straightforward reason for *aggregate* domestic price level to decline in the face of an influx of cheap imports. That is, were there no frictions in domestic adjustment process in response to a supply shock, there would not necessarily be a decline in *aggregate* price levels or a downturn of the economy. However, in reality, there are certain rigidities particularly those regarding the reallocation of labor that impede adjustments in the short run.

To illustrate this, suppose that the prices of the tradable decline in the face of an influx of cheap imports. In this case, if there were no frictions in adjustment process,

the decline in the prices of the tradable would increase demand for non-tradable (typically services) through income effect, which would result in increase in their prices. However, in reality, an increase in uncertainty during this adjustment process and subsequent loss of consumer confidence might offset the income effect. In this case, *aggregate* price level *can* fall. In addition, if the reallocation of labor from the tradable to non-tradable sector were achieved perfectly smoothly, a fall in wage of the tradable sector would not necessarily result in a fall in wage in the whole economy. However, in reality, there are certain rigidities regarding the reallocation of labor, a fall in wages in the whole economy *can* occur. Therefore, an external shock on tradable prices *can* put downward pressures on *aggregate* price levels and economic activities.

(c) Why economic performance differs among countries

Based on the framework described so far in this paper, it can be said that how each country's prices and economic activity are affected by the global supply shock depends largely on the following factors.

1) Magnitude of the supply shock

First, our discussions so far suggest that the magnitude of the supply shock caused by the expansion of supply capacity in emerging economies depends largely on the flexibility of foreign exchange regime and the degree of exposure to emerging economies. A good illustration of this is Hong Kong SAR. It is noteworthy that, under its currency board system, there is virtually no adjustment through exchange rate between China. Consequently, cheap imports continue to flood in from China, depressing domestic prices. In addition, being in close geographical and cultural proximity to China seems to cause direct arbitrage of the prices of production factors between the two economies. Under these circumstances, even some services that are conventionally considered to be the non-tradable seem to be turning into the tradable. Similar situations can be seen in other relatively advanced Asian economies, although less prominent than in Hong Kong SAR.

2) Degree of structural flexibility

Second, economic consequences in response to the supply shock largely depend upon how flexibly each economy adjusts itself. A good illustration of this is the contrast between the United States and Japan. In the United States, there has been hardly any evidence that the economy deteriorated due to increases in import penetration ratio since the early 1990s¹³, and this can be largely attributed to its structural flexibility. In fact, statistics suggest that the shift in demand and the reallocation of labor from the tradable to non-tradable sector have been achieved smoothly and, under these circumstances, service prices have risen, at least so far, to offset the decline in goods prices. On the other hand, Japan has been struggling facing the challenge by emerging economies in Asia due to its structural rigidity, which partly stems from its successful model (“Japanese-style management”) ¹⁴ in the past. ¹⁵

3) Developments of terms of trade

In the former discussion, we assumed implicitly that a country’s terms of trade tend to improve facing an influx of cheap import. However, in reality, this is not always the case. If a country faces a deterioration of terms of trade in addition to an influx of cheap import, it will suffer from more deflationary pressures than otherwise, through the shift of domestic demand to imports and adverse income transfer.

Looking at recent developments of term of trade for each country (Figure 15), South Korea, Japan, Taiwan Province of China and Thailand have experienced deterioration of terms of trade over the past few years partly due to increases in crude oil price, while Germany’s terms of trade have been improving. Regarding the long-term trend of terms of trade, Japan and many other Asian countries have experienced deterioration since the mid-1990s, while Germany saw substantial improvement since the 1980s and the United States has experienced improvement since the late 1990s.

13 Figure 9 shows that in the United States the import penetration ratio rose much more than in Japan through the 1990s.

14 For more on this point see Maeda, Higo, and Nishizaki [2001].

15 After interest rates dropped to nearly zero, Japanese monetary policy has been unable to respond to shocks by lowering interest rates, which may also be a contributing factor.

Although it is difficult to fully explain the factors behind the developments of each country's terms of trade, it is possible to say that the high share of IT-related products¹⁶ in net export is partly attributable to the downtrend for Japan and many other Asian countries.

5. Empirical analysis of disinflationary factors in major developed countries

(1) Purposes and methodology

In this Section, we empirically investigate how each of those factors we examined so far has affected the recent global disinflation. In particular, we are interested in how supply shocks caused by the expansion of supply capacity in emerging economies have affected inflation of major industrial countries. To show this, we breakdown historical inflation rates of selected major industrial countries into three kinds of structural shocks: 1) a cyclical demand shock, 2) a productivity shock, and 3) a supply shock caused by the expansion of supply capacity in emerging economies. In addition, we attempt to empirically demonstrate the differences across countries as to how to adjust to a supply shock caused by the expansion of supply capacity in emerging economies and discuss what makes such differences.

We employ, following Kamada and Hirakata [2002], one of the preceding empirical studies on Japan, structural VAR model¹⁷ for our study. As we have already discussed, an influx of cheap imports from China is primarily a supply shock, but it also involves output gaps, as domestic demand shifts towards imports and domestic competitors shift their production to China in addition to the streamlining of their distribution channels. To capture this propagation process properly, structural VAR model is considered to be most appropriate.

In light of our purpose, the model should include, in addition to inflation rate, those variables that capture supply shocks caused by the expansion of supply capacity in

¹⁶ Note that prices of IT-related products such as semiconductors have declined much higher than other tradable goods, reflecting their relatively high productivity growth rates.

¹⁷ See the Appendix for an overview of the structural VAR model proposed in Kamada and Hirakata [2002].

emerging economies. In this regard, we follow Kamada and Hirakata [2002] and choose three variables:¹⁸ prices (CPI core¹⁹), real GDP and import penetration ratio. We confirm theoretically that by using these three variables supply shocks caused by the expansion of supply capacity in emerging economies can be identified. In addition, with this model, we can quantitatively capture the impact of three kinds of structural shocks mentioned above on inflation, output growth and import penetration ratio.

(2) Empirical results and their interpretation

(a) Decomposing disinflation since the mid-1990s in major industrial countries

Using the structural VAR model described above, we decompose the historical inflation rates of selected major industrial countries (Japan, the United States, the United Kingdom and Germany) into three kinds of structural shocks.

Figure 16 shows the estimation results. Obviously, for all the selected countries, supply shocks caused by the expansion of supply capacity in emerging economies have exerted significant downward pressures on prices since the mid-1990s. In particular, in the United States (Figure 16 (2)), it can clearly be seen that while the demand shocks have worked to increase the inflation rate, the supply shocks caused by the expansion of supply capacity in emerging economies have worked to offset it in the late 1990s. The productivity shocks also worked to reduce inflation rates, but the contribution of them to inflation rate has been relatively minor. Supposedly, a productivity gain tends to induce not only an outward shift in supply curve, but also that in demand curve.

(b) Impulse responses of aggregate prices and output gaps to the supply shocks caused by the expansion of supply capacity in emerging

Finally, we attempt to empirically demonstrate the differences across countries as to how to adjust to a supply shock caused by the expansion of supply capacity in

18 All variables are defined in first difference of logarithms. Therefore, they are approximately equal to the rate of change from the previous quarter.

19 For the U.K., the RPIX (retail price index minus mortgage interest payments).

emerging economies and discuss what makes such differences. To do this, we examine the impulse response functions implied in the estimated structural VAR system. Figure 17 shows the cumulative impulse response function for each country. Major results are as follows.

First, the results indicate that when a supply shock occurs, CPI declines from the initial level permanently for all the selected countries.

Second, for all the selected countries except Germany, the supply shock initially reduces real GDP, while the persistence of the negative effects differs among countries. For example, in the United States and the United Kingdom, real GDP recovers the initial level in a few quarters. In contrast, in Japan, real GDP does not return to the initial level even after 5 years.²⁰ This seems to imply the structural rigidity of the Japanese economy in the face of a supply shock caused by the expansion of supply capacity in emerging economies. On the other hand, in Germany alone, real GDP increases immediately after a shock. Given the fact that the rigidity in its labor market is often pointed out, this was a somewhat unexpected result. One possible interpretation of this is, although very tentative, that substantial improvements in the terms of trade during the sample period (Figure 15-1) have offset the negative impact from the shocks.

6. Conclusions

In this paper we investigate the factors contributing to “global disinflation” to reexamine Japan’s deflation in a broader context and shed some light on the prospect of the global economy. For this purpose, we empirically investigate the following questions in the paper. Namely, 1) does the expansion of supply capacity in emerging economies play a significant role in reducing global inflation, especially in industrial countries? And, if that is the case, 2) why does economic performance differ among countries? Below is a summary of the main results from our empirical analysis and

²⁰ The “quantitative results” may change depending on the lags in the VAR model. However, there is no change in the “qualitative results” of Japan being slower to adjust than the United States and the U.K.

some remarks on them.

First, it is noteworthy that in the tradable goods sector global competition has intensified since the beginning of the 1990s, as more emerging economies in Latin America and eastern Europe, and China have entered the world market.

Second, according to our empirical study, such structural change in the global economy has caused common supply shocks on prices in industrial countries and relatively advanced emerging economies in Asia. Moreover, we find that such supply shocks have put significant downward pressures on prices in industrial countries since the mid-1990s.

Third, it seems likely that how global supply shocks affect each economy differs according to the magnitude of the shocks and the degree of structural flexibility of each economy in response to such shocks. From this perspective, Japan's poorer economic performance as compared with the United States can be largely attributed to its structural rigidities. Essentially, the results of our empirical analysis seem to be consistent with this view. On the other hand, in relatively advanced economies in emerging Asia, notably Hong Kong SAR, the magnitude of the supply shocks seems extremely large partly due to the absence of adjustments by foreign exchange rates between China.

Our study has the following implications for policymakers.

First, since the expansion of supply capacity in emerging economies is considered to be a permanent structural change in the global economy, policymakers in each country are expected to implement structural reforms to enhance the structural flexibility of the economy for sustainable economic growth.

Second, a sound financial sector is essential to achieve and maintain structural flexibility. In fact, those countries that have a sound financial sector such as the United States and South Korea have managed to deal with adjustment pressures and shown, at least so far, relatively good economic performance. In contrast, Japan does not seem to be successful in dealing with pressures for structural changes. Japan seems to be trapped in a vicious circle of its financial sector problem dampening growth of its real economy. Policymakers must tackle with both the financial sector problem

and the real economic problem.

A note on the structural VAR Model proposed in Kamada and Hirakata [2002]

1. Rationale for applying a structural VAR in this analysis

The purpose of this analysis is to quantitatively measure the impact on domestic prices of a supply shock caused by the expansion of supply capacity in emerging economies. As we have already discussed, an influx of cheap imports from China is primarily a supply shock, but it also involves output gaps, as domestic demand shifts towards imports and domestic competitors shift their production to China in addition to the streamlining of their distribution channels. To capture this propagation process properly, structural VAR model is considered to be most appropriate. Moreover, the model should include, in addition to inflation rate, those variables that capture supply shocks caused by the expansion of supply capacity in emerging economies.

2. Outline of the trivariate structural VAR proposed in Kamada and Hirakata [2002]

Kamada and Hirakata [2002] uses in their structural VAR model three economic variables:²¹ prices (CPI core²²), real GDP and import penetration ratio. They show theoretically that, by using these three variables, they can identify and quantitatively capture three kinds of structural shocks including supply shocks caused by the expansion of supply capacity in emerging economies:

21 All variables are defined in first difference of logarithms. Therefore, they are approximately equal to the rate of change from the previous quarter.

22 For the U.K., the RPIX (retail price index minus mortgage interest payments).

- 1) A cyclical demand shock
- 2) A productivity shock
- 3) A supply shock caused by the expansion of supply capacity in emerging economies

It should be noted that econometricians cannot observe these structural shocks *directly*. Rather, they are *statistically identified* from the fluctuations in the three economic variables in the model. Below is a description of how this identification works:

- 1) Shocks that do not affect real GDP and import penetration in the long-run are considered "cyclical demand shocks."
- 2) Shocks that do not affect import penetration ratios in the long-run are considered "productivity shocks." In other words, these are shocks that may have a long-run effect on real GDP and prices.
- 3) All other shocks are identified as "supply shocks caused by the expansion of supply capacity in emerging economies." These are primarily the shocks that appear as rises in import penetration ratios and may affect real GDP and prices in the long-run.

This paper applies the structural VAR model described above to Japan, the United States, the United Kingdom and Germany to quantitatively capture how each shock, in particular a supply shock caused by the expansion of supply capacity in emerging economies, has affected the inflation rate and GDP of each country.

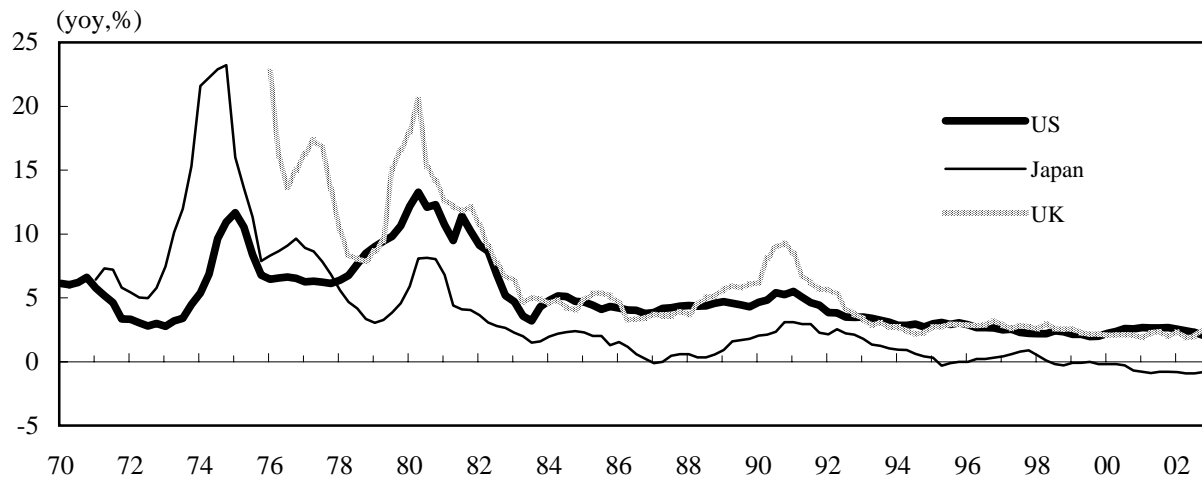
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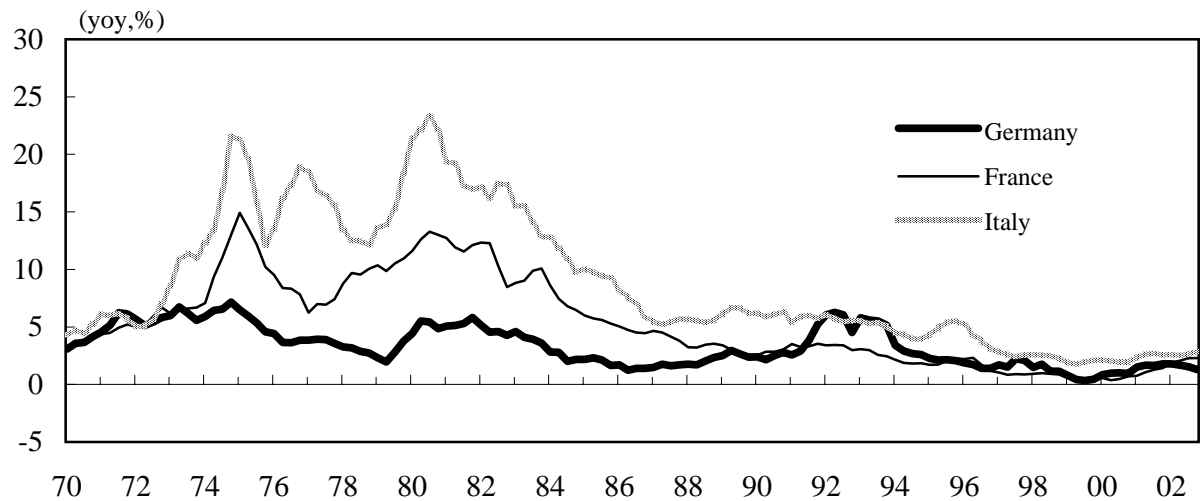
Consumer Price Index (Core)



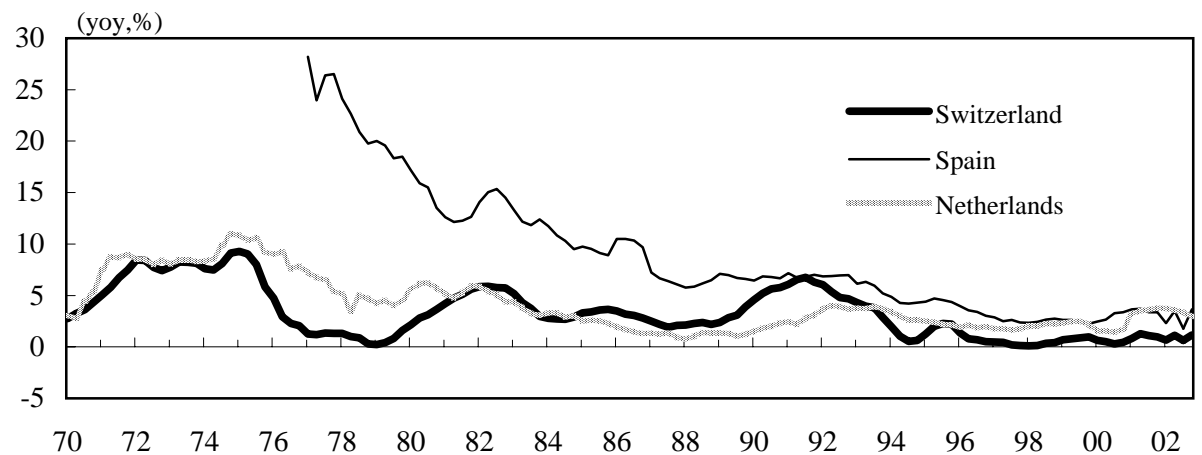
Note 1: U.S. figures exclude food and energy.

Note 2: Japanese figures exclude agricultural, fishery and livestock products and are adjusted for the impact of the consumption tax hike.

Note 3: U.K. figures exclude mortgage interest payments.



Note 4: German, French and Italian figures exclude food and energy.

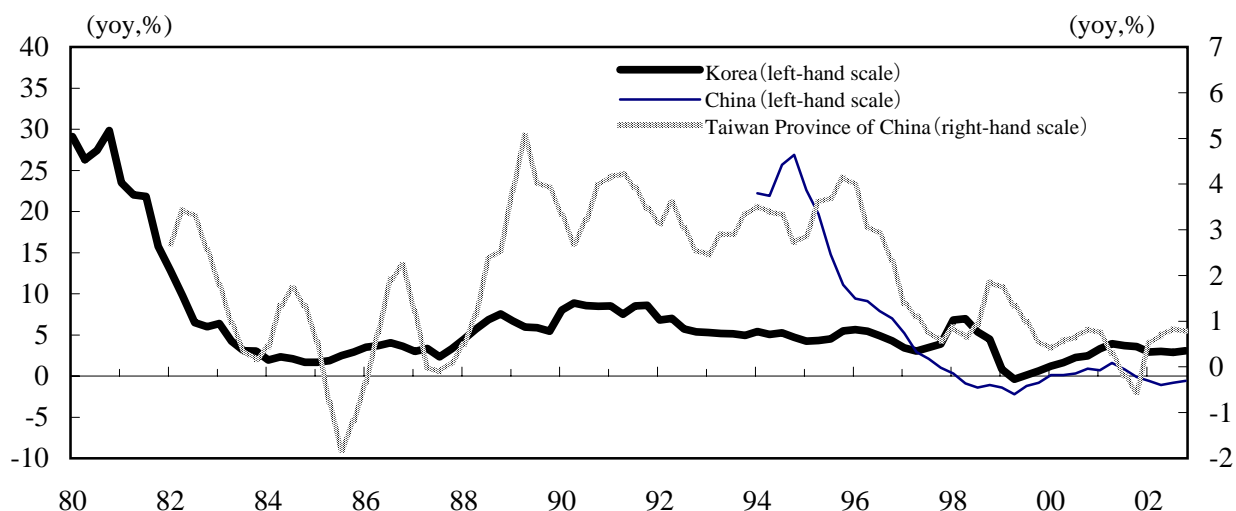


Note 5: Swiss, Spanish and Dutch figures exclude food and energy.

Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, WEFA, Datastream.

(Figure 1-2)

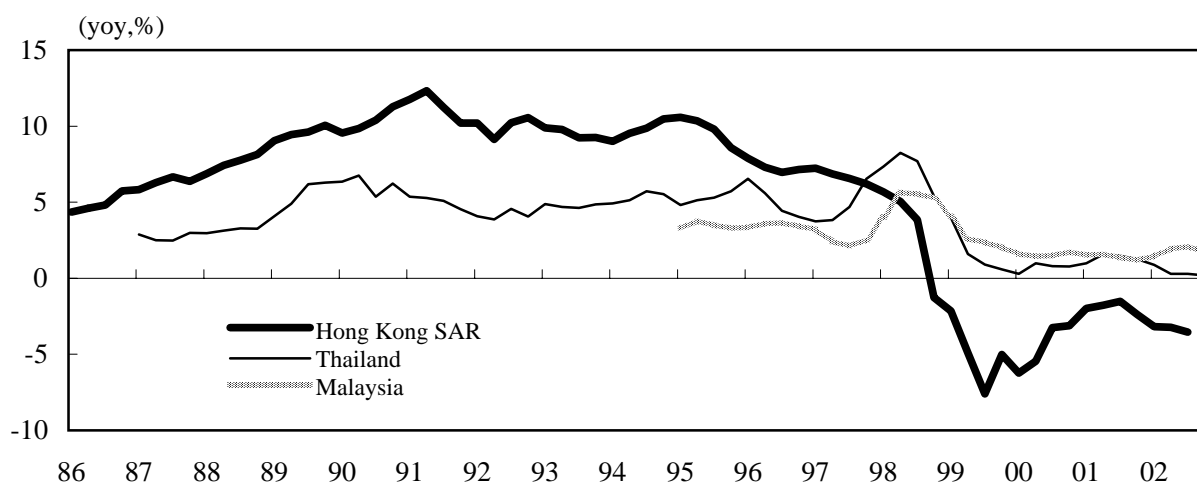
Consumer Price Index (Core)



Note 1: South Korean figures exclude agricultural products and refined oil.

Note 2: Chinese figures are aggregate.

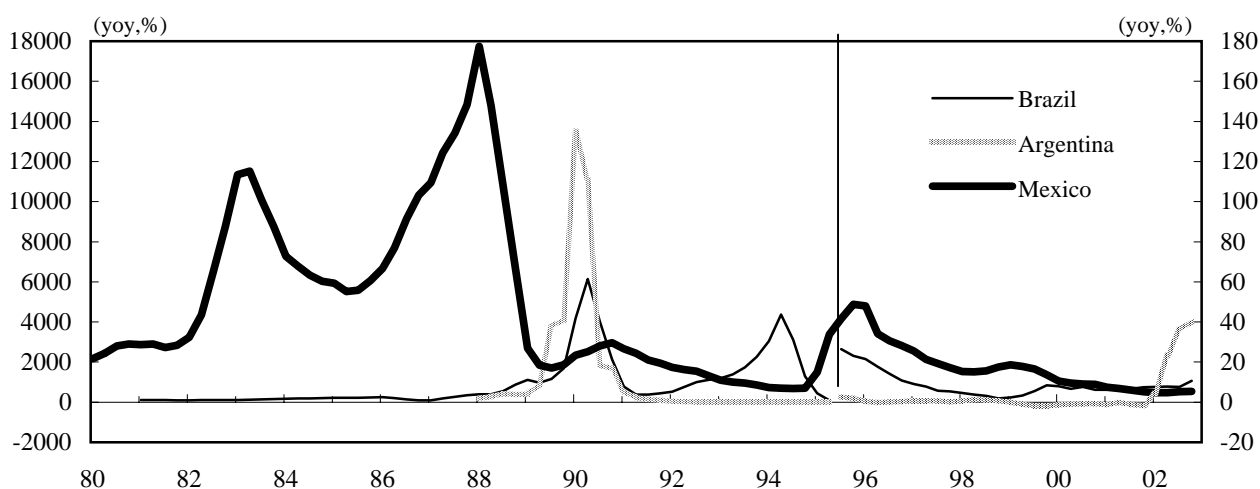
Note 3: Taiwanese figures exclude perishable food and energy.



Note 4: Hong Kong figures exclude food, electric power and gas. Estimates from the Bank of Japan International Department are used.

Note 5: Thai figures exclude perishable food and energy.

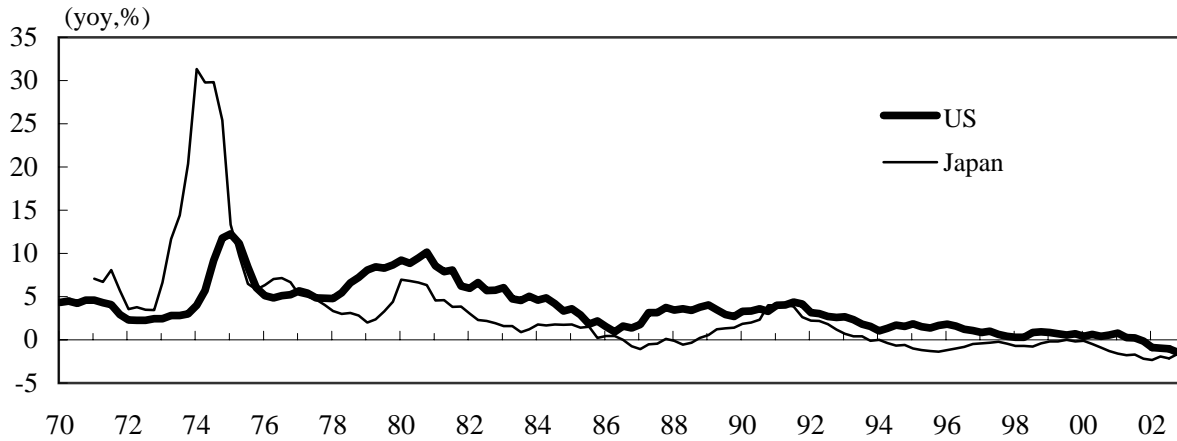
Note 6: Malaysian figures are aggregate.



Note 7: For Argentina and Brazil prior to 1995/Q3, left-hand scale is applied. Otherwise, Right-hand scale is applied.

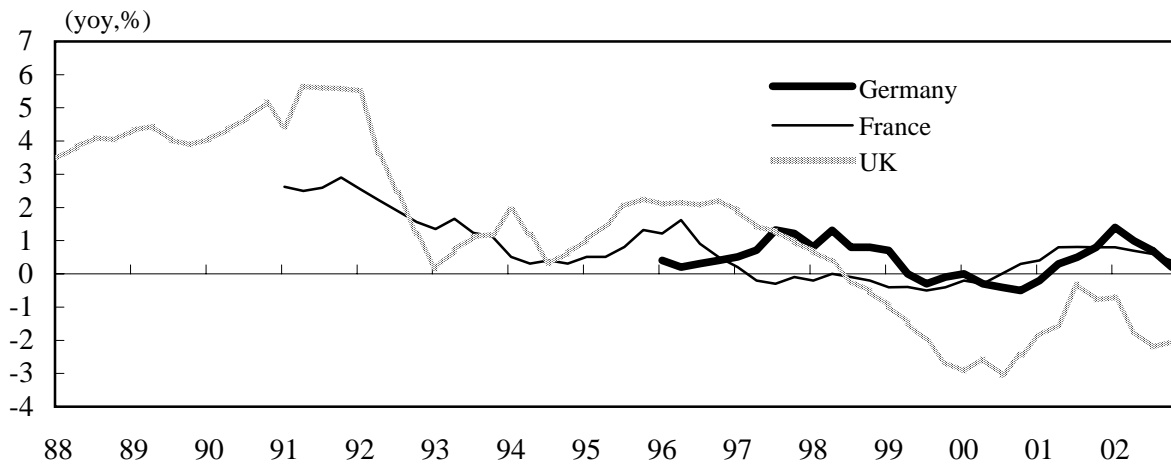
Source: CEIC, Bloomberg.

Consumer Price Index (Core goods)



Note 1: Japanese figures were calculated by the Bank of Japan based on data from the Ministry of Public Management, Home Affairs, Posts and Telecommunications. Figures exclude agricultural, fishery and livestock products and are adjusted for the impact of the consumption tax hike.

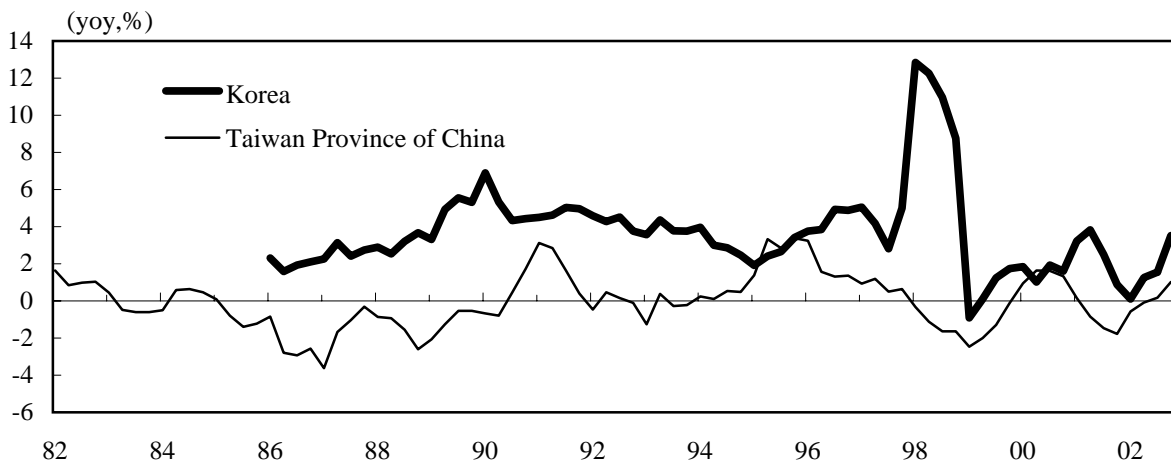
Note 2: U.S. figures exclude food and energy prices.



Note 3: German figures exclude food energy.

Note 4: French figures are for manufactured goods.

Note 5: U.K. figures exclude food, alcoholic beverages, tobacco products and gasoline.



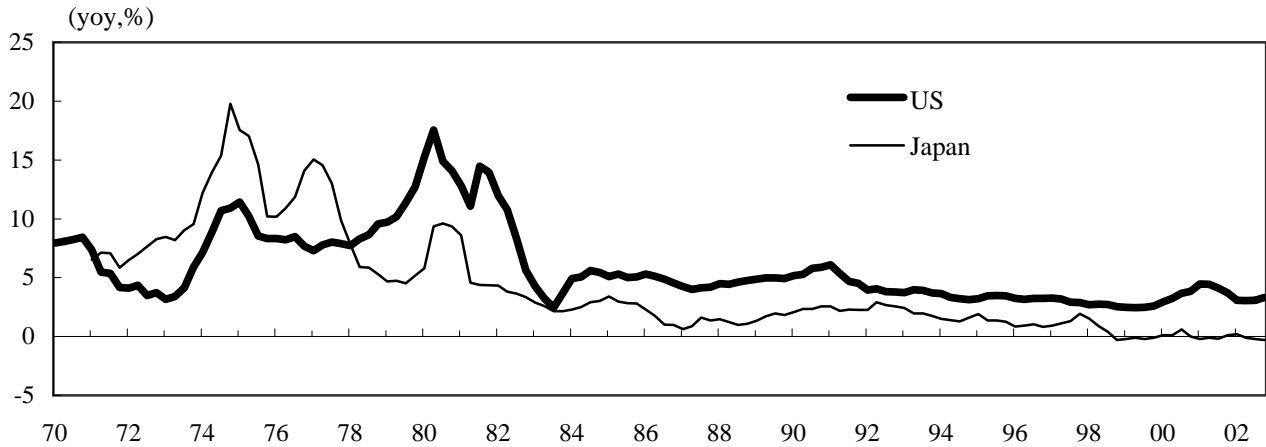
Note 6: South Korean figures are for manufactured goods.

Note 7: Taiwanese figures exclude food.

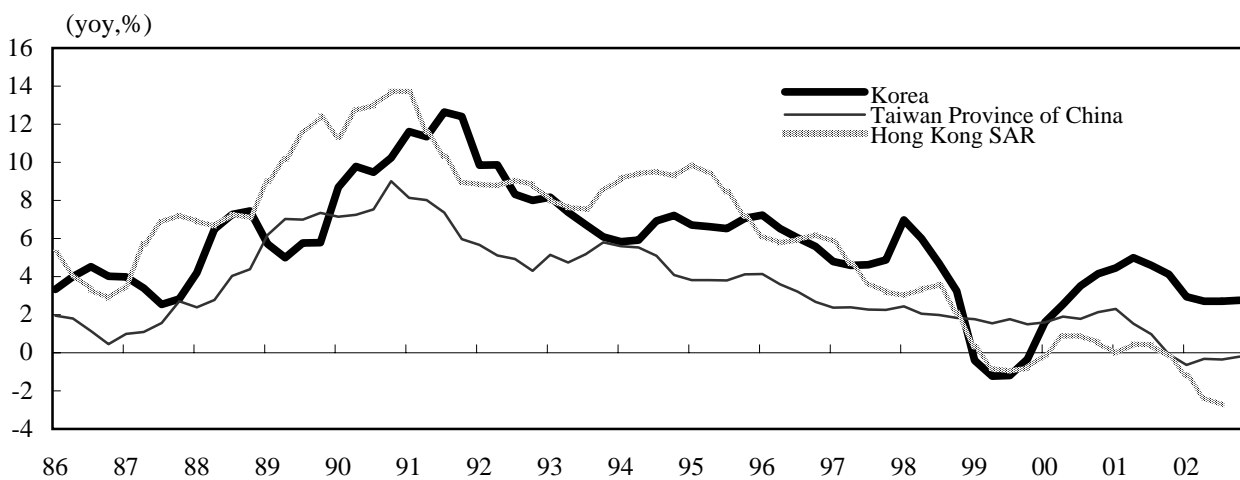
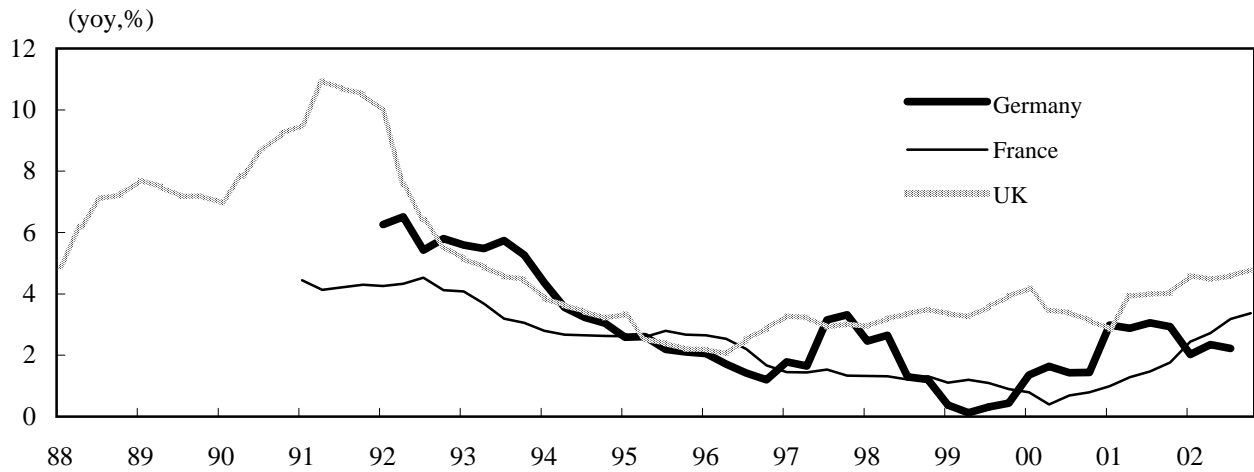
Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, WEFA, Datastream, CEIC.

(Figure 3)

Consumer Price Index (Services)



Note 1: Japanese figures were calculated by the Bank of Japan based on data from the Ministry of Public Management, Home Affairs, Posts and Telecommunications, and are adjusted for the impact of the consumption tax hike.



Note 2: The Hong Kong service price index was estimated by the Bank of Japan International Department.

Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, WEFA, Datastream, CEIC.

**Trend of inflation for selected countries
(Average inflation rate for each decade)**

	1970s	1980s	1990s-	1990s-	
				1990-1995	1996-2002
Japan	9.3	2.5	0.8	1.7	▲ 0.0
U.S.	7.1	5.6	2.9	3.5	2.4
Germany	5.0	2.9	2.4	3.5	1.4
France	10.3	7.4	1.9	2.4	1.4
U.K.	13.5	7.0	3.5	4.6	2.4
Switzerland	5.0	3.3	2.0	3.5	0.8
South Korea	15.2	8.4	5.1	6.6	3.8
Taiwan Province of China	9.6	4.7	2.3	3.8	1.0
Hong Kong SAR	N.A	6.4	4.5	9.5	0.2
Thailand	N.A	3.9	4.1	5.0	3.4
Mexico	N.A	80.6	17.3	19.2	15.6
Brazil	N.A	324.2	788.8	1700.3	7.6

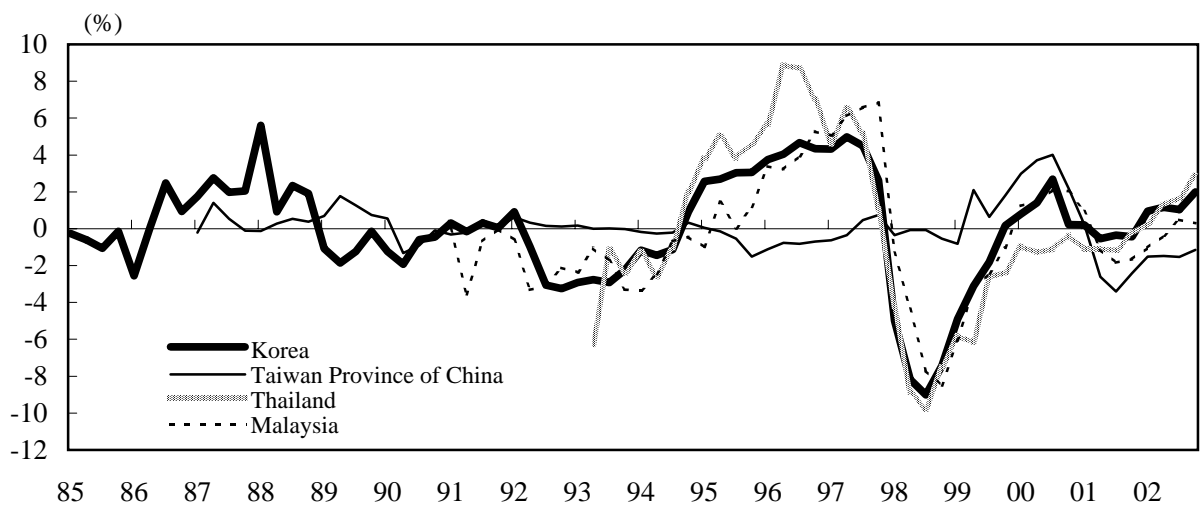
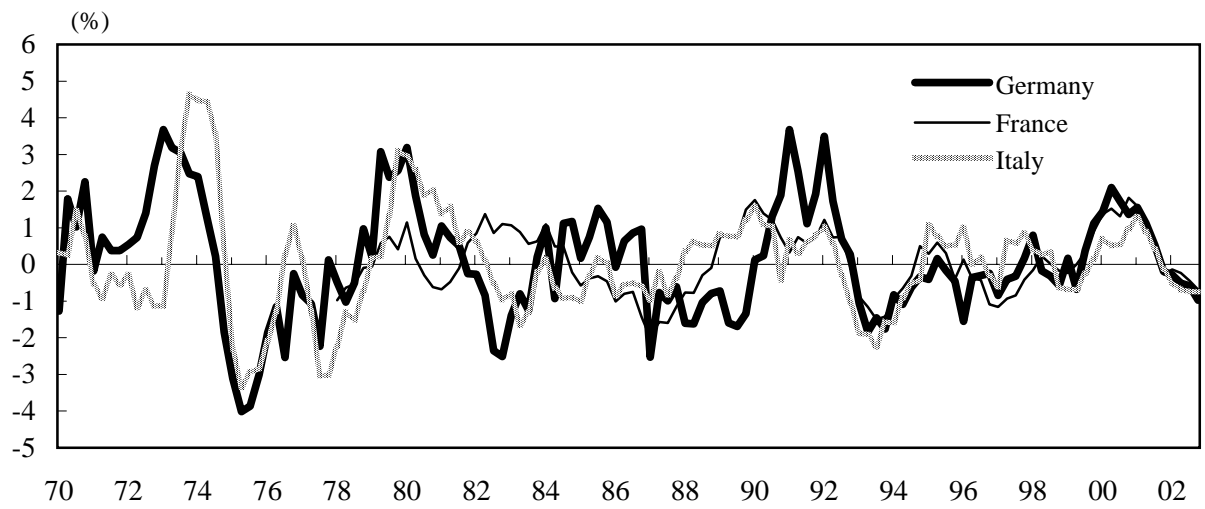
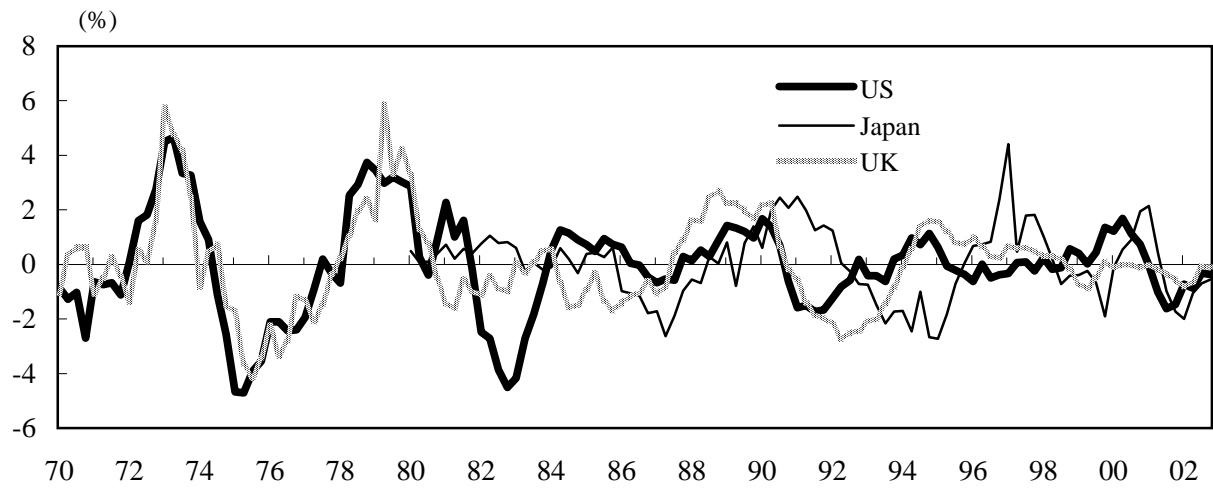
Note 1: Based on data beginning 1971 for Japan and Germany, 1973 for France, 1976 for U.K., 1986 for Hong Kong SAR, 1987 for Thailand, 1982 for Mexico, and 1981 for Brazil.

Note 2: Based on quarterly data.

Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, WEFA, Datastream, CEIC.

(Figure 5)

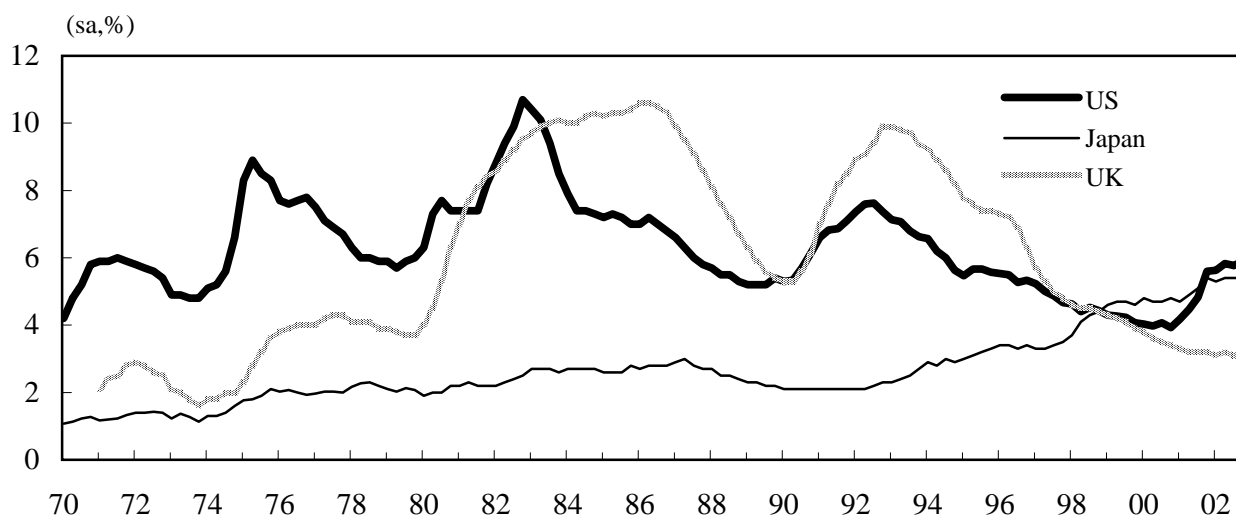
Output Gaps



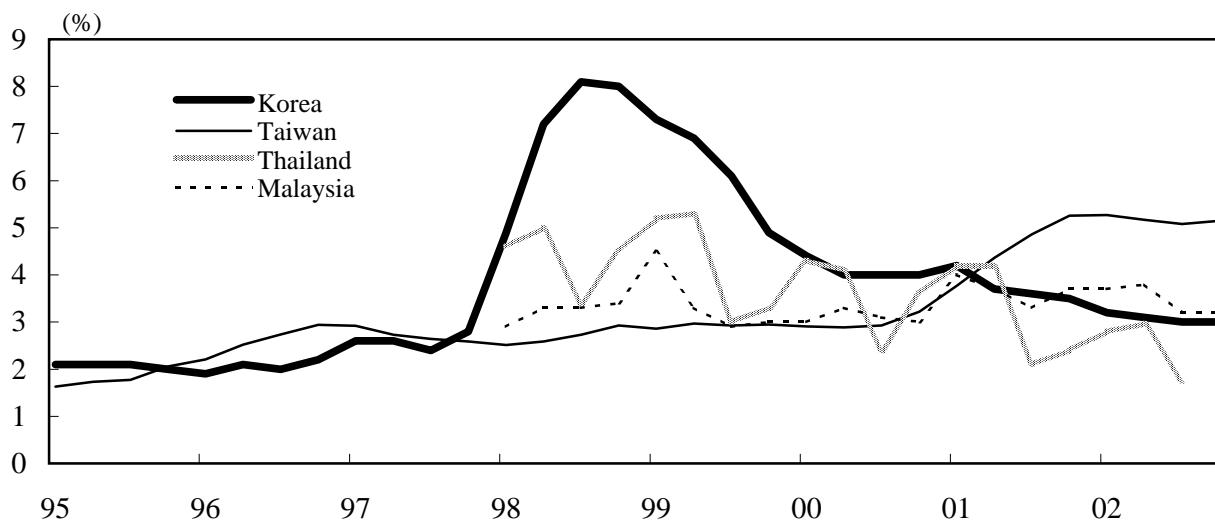
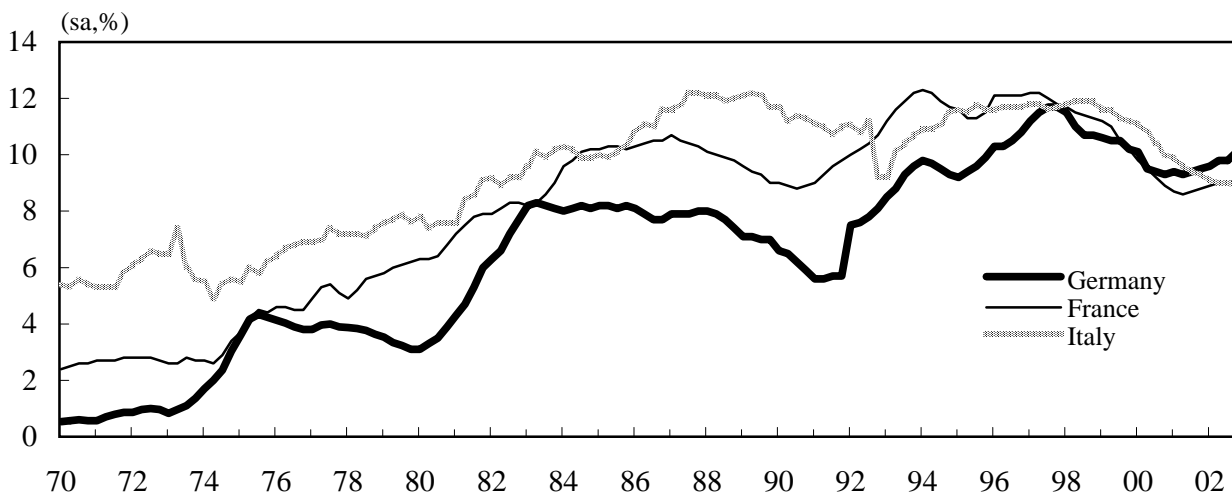
Note: Estimated by the authors using a band-pass filter.

Source: Cabinet Office, WEFA, Datastream, CEIC.

Unemployment rate



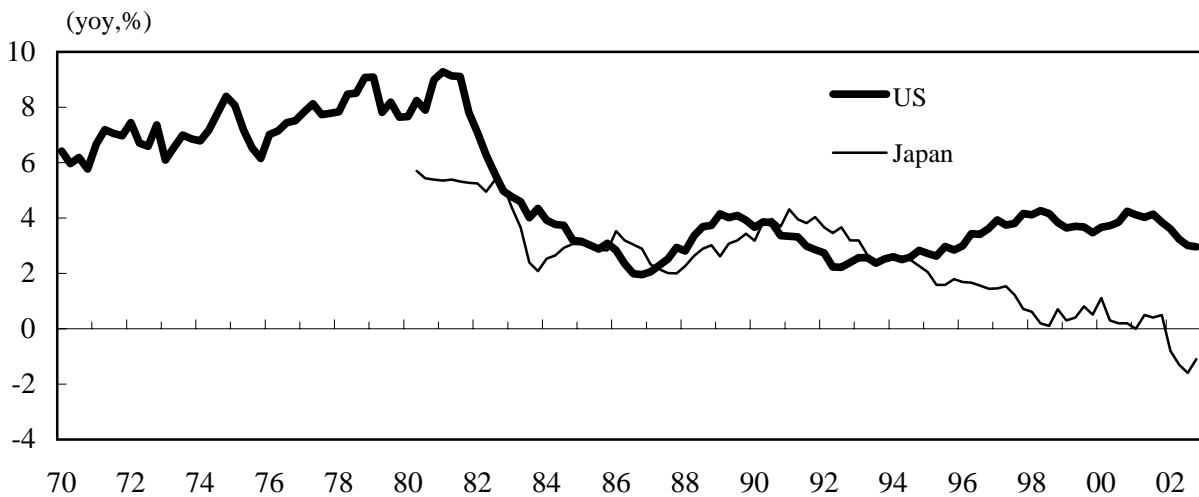
Note: From 1971 to 1990, the figures are based on statistics for the former West Germany.



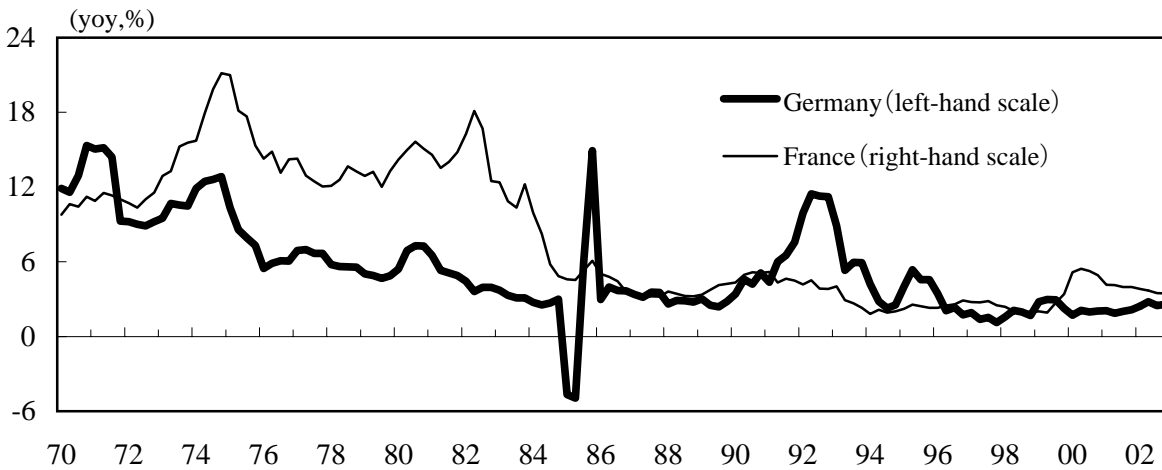
Note 2: The data for South Korea and Taiwan are seasonally adjusted, while the data for Thailand and Malaysia are not seasonally adjusted.

Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, WEFA, Datastream, CEIC.

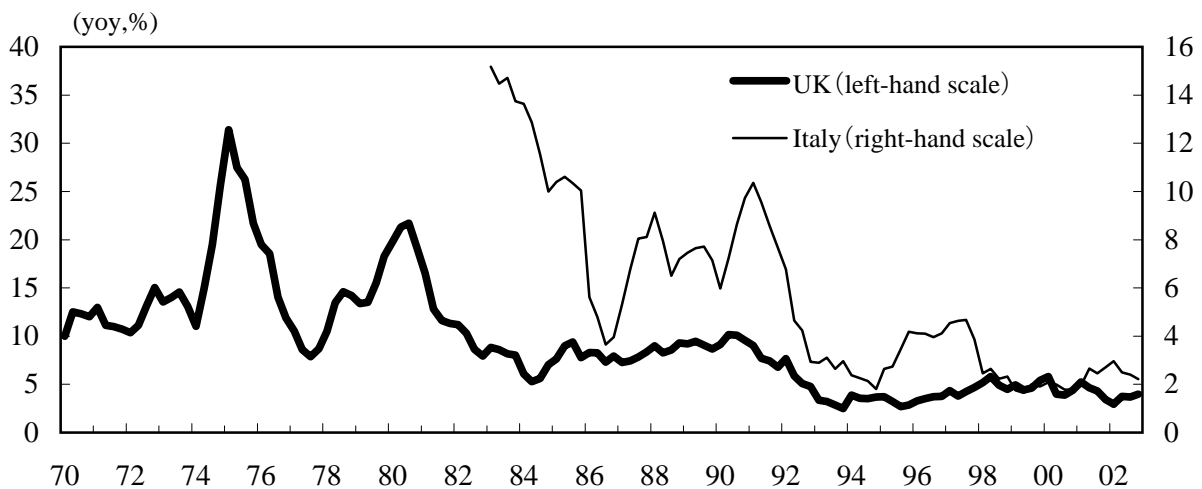
Nominal wage



Note 1: Japanese figures represent the scheduled cash earnings for places of business with 30 or more employees.
Note 2: U.S. figures are average hourly earnings for the non-agricultural private sector.



Note 3: German figures represent the average monthly wage index.
Note 4: French figures represent the hourly wage index.

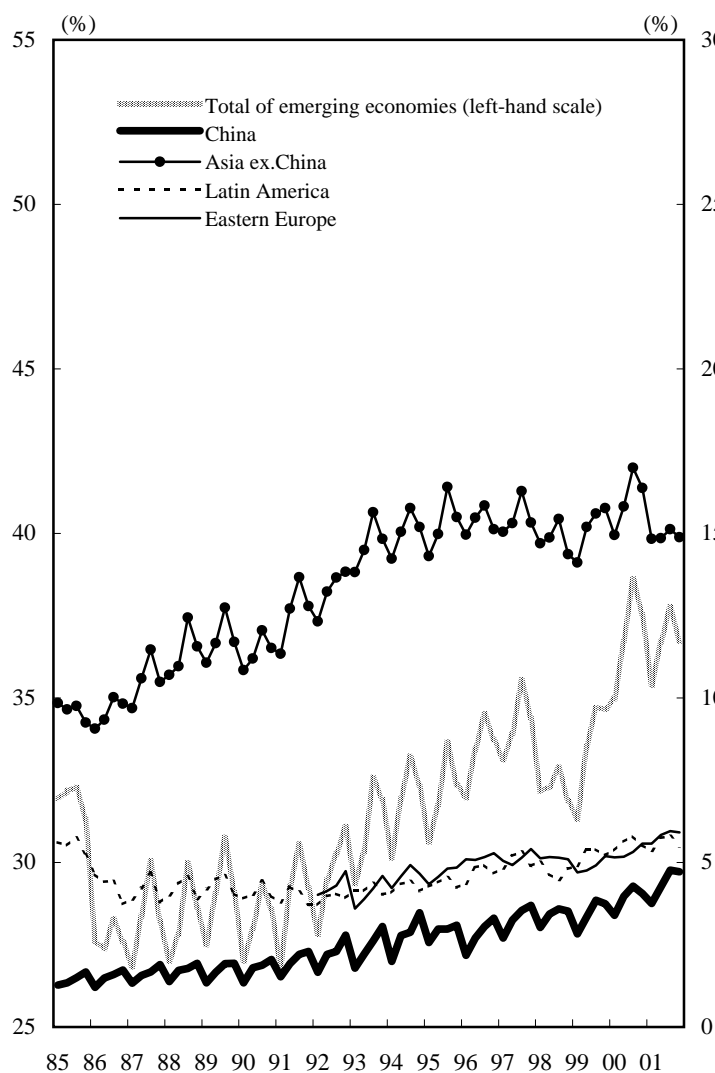


Note 5: U.K. figures represent the average weekly earning index.
Note 6: Italian figures represent the hourly earning index.

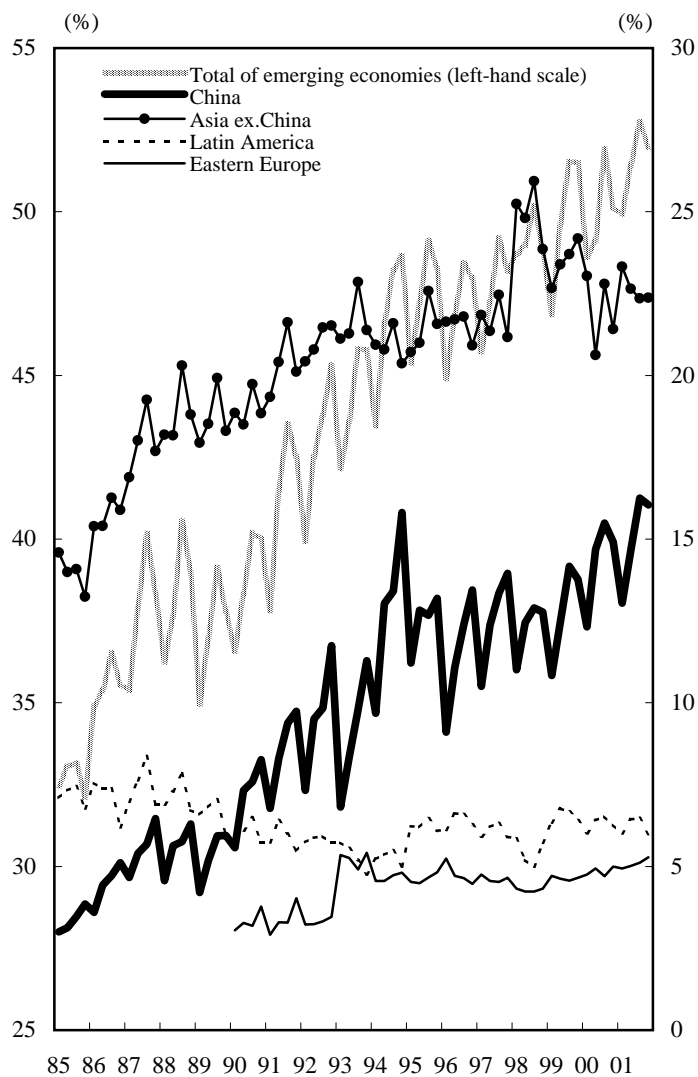
Source: Ministry of Health, Labour and Welfare, WEFA, Datastream.

Share of emerging economies in world exports

(1) Share based on each country's export value converted into the US dollar by spot exchange rates

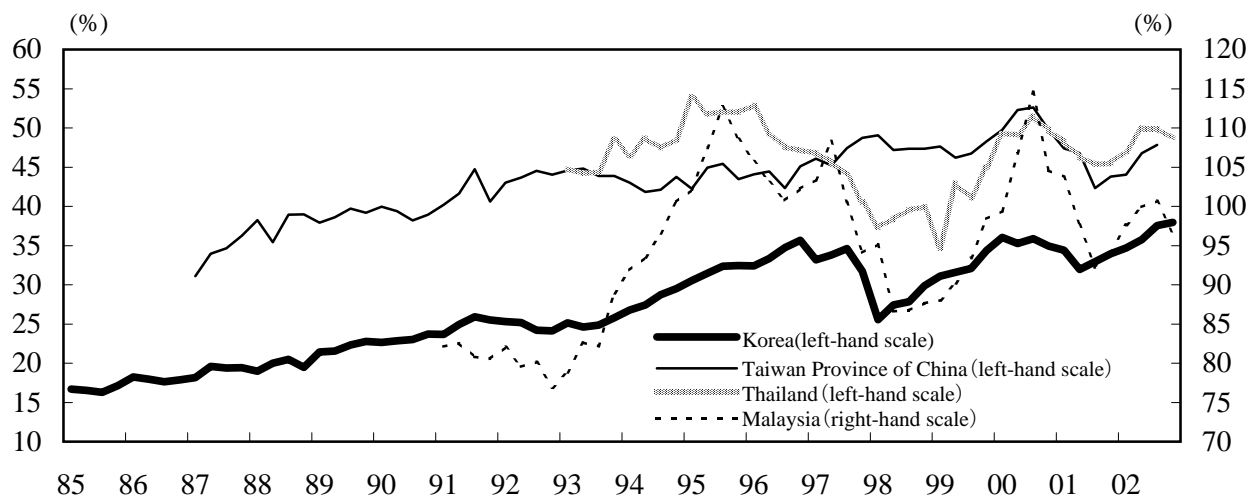
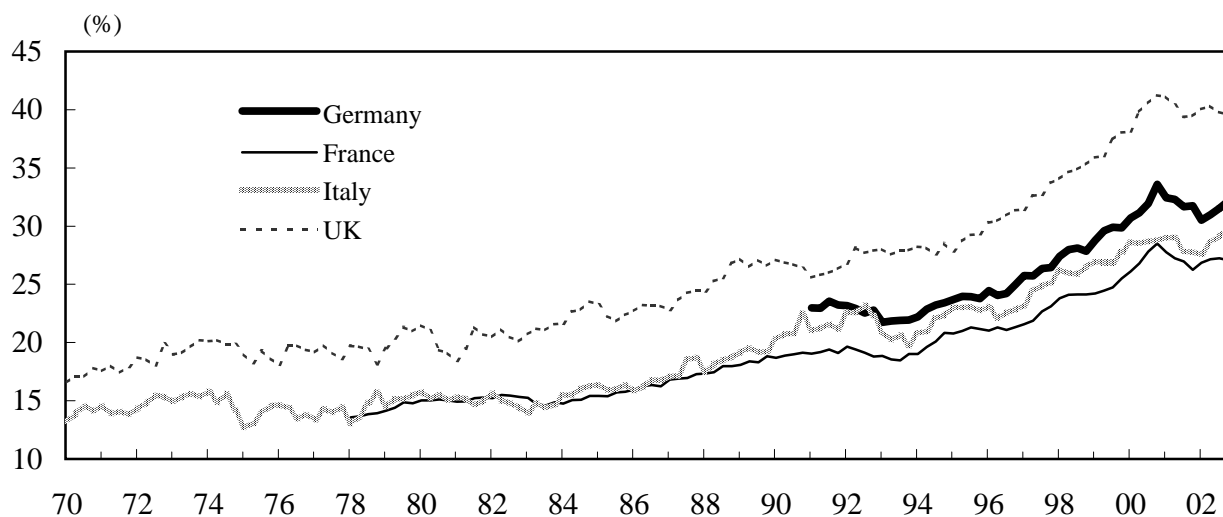
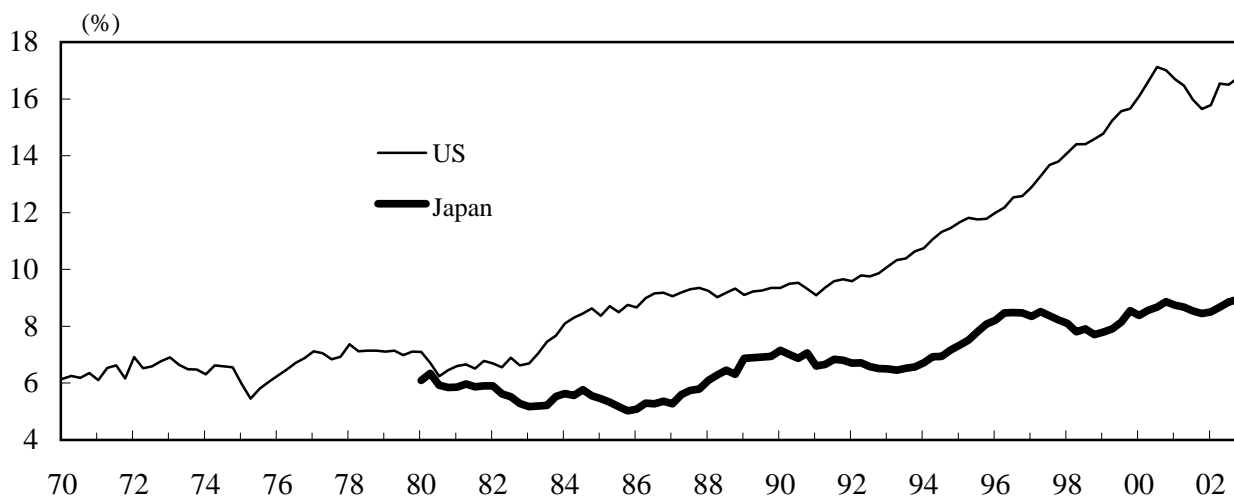


(2) "Adjusted" share based on each country's export value converted into the US dollar by the PPP



(Figure 9)

Import penetration ratio

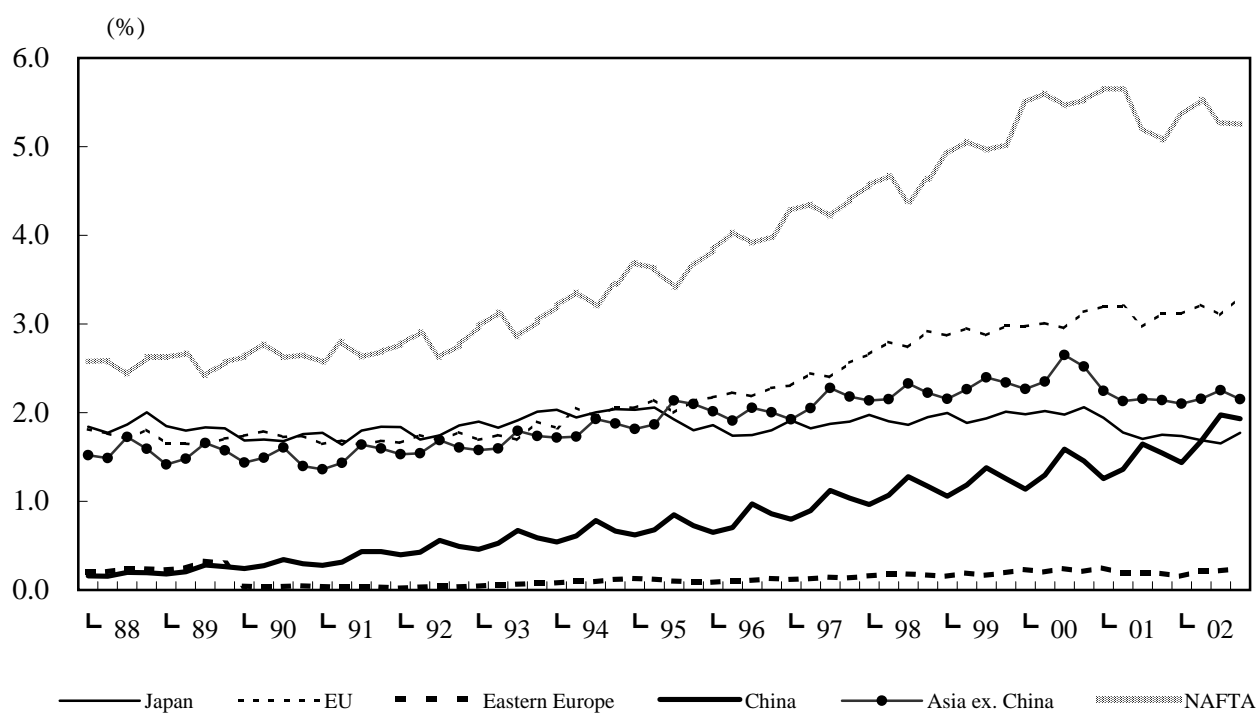


Note: Import penetration ratio = (real imports / real GDP) × 100 (%)

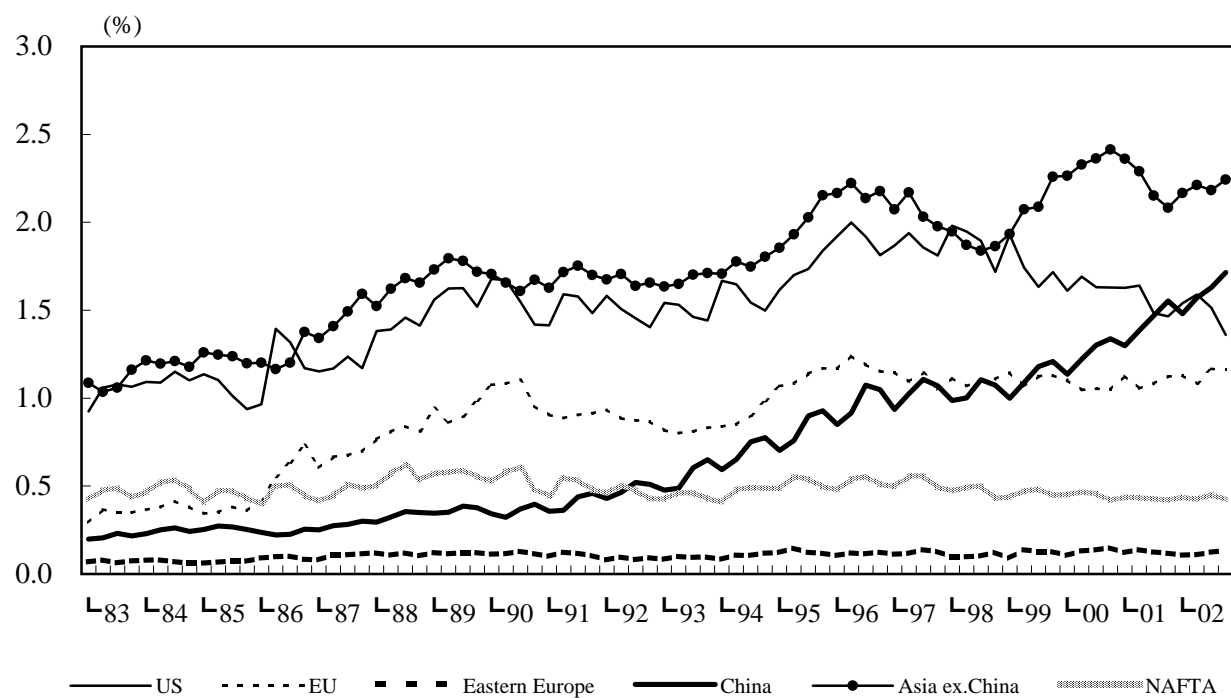
Source: Cabinet Office, WEFA, Datastream, CEIC.

Breakdown of import penetration by trading partner

(1) US

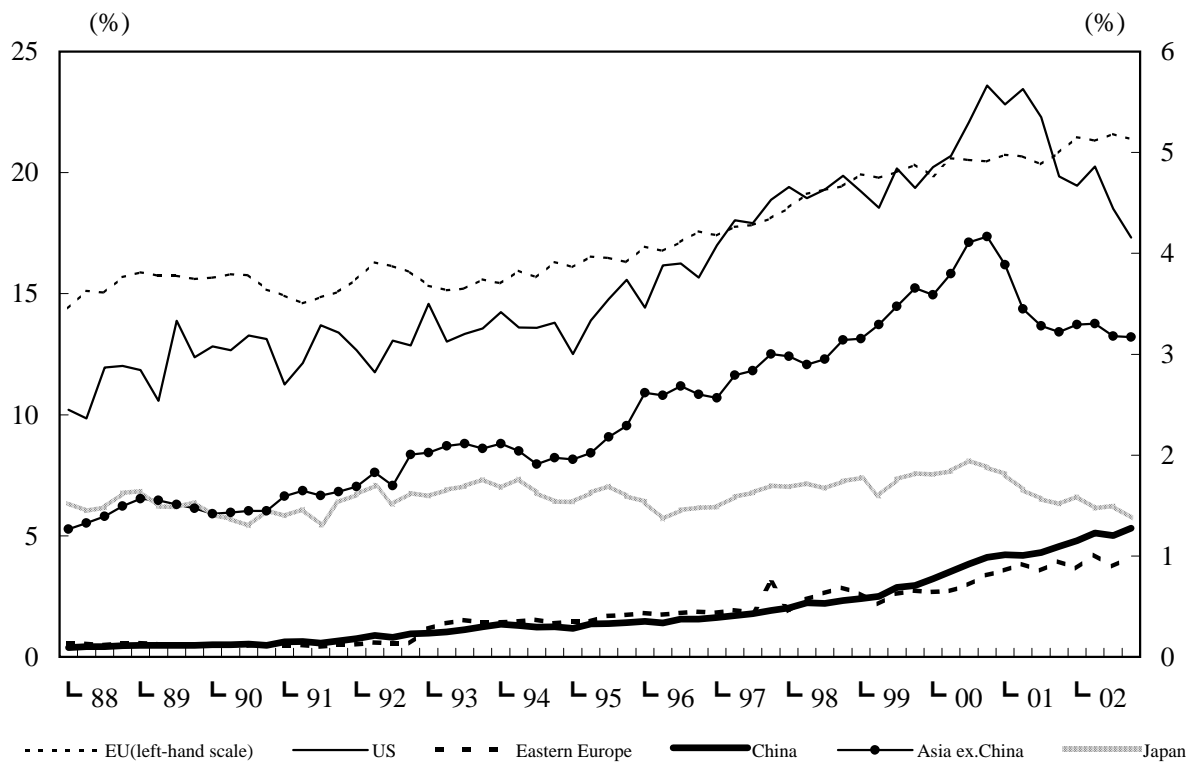


(2) Japan



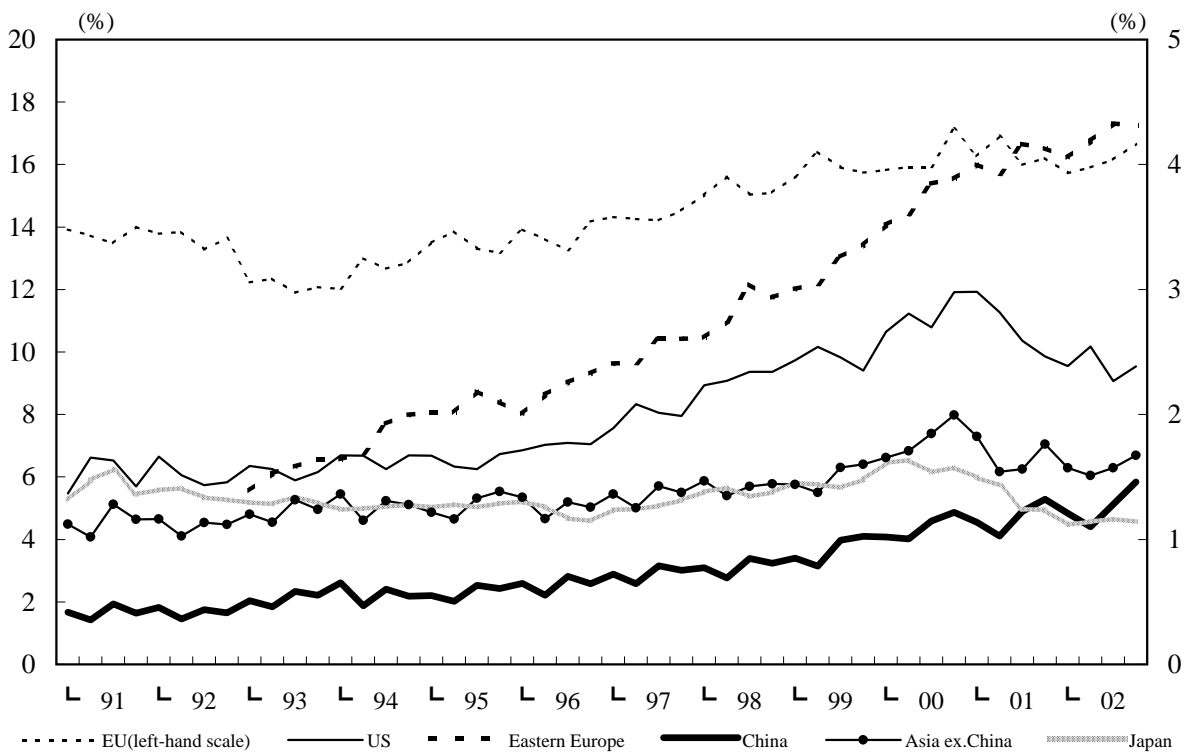
Breakdown of import penetration by trading partner

(3) UK



Note:For all areas except EU, right-hand scale.

(4) Germany

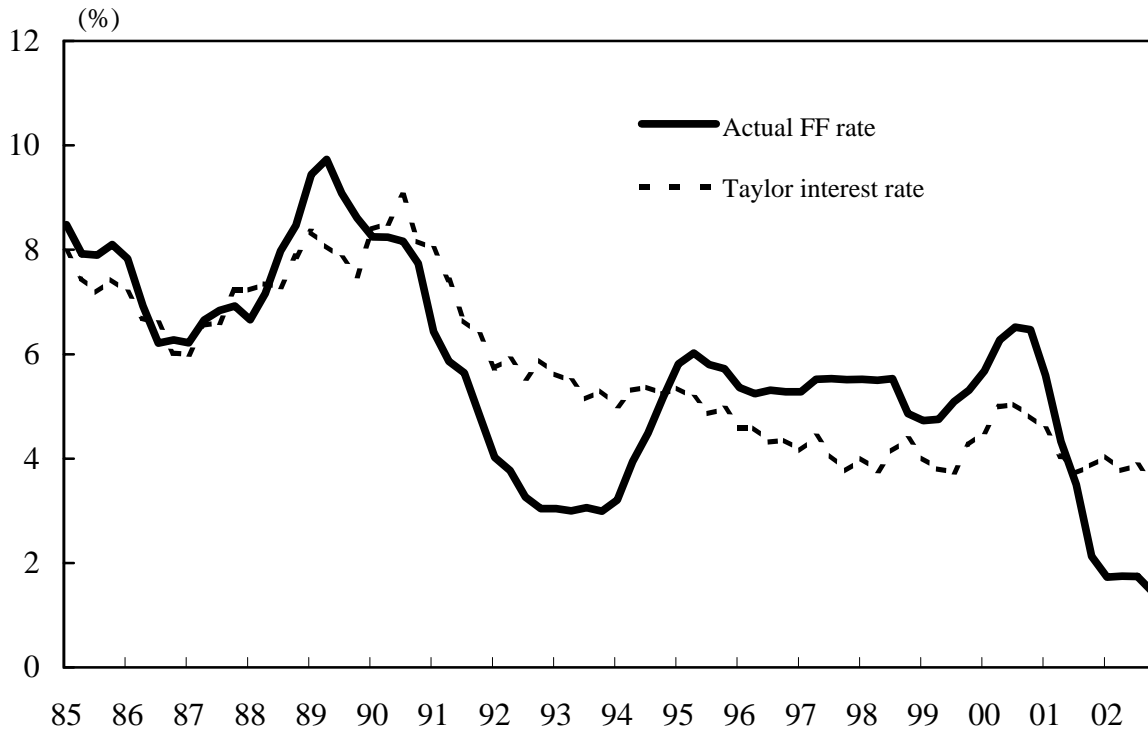


Note:For all areas except EU, right-hand scale.

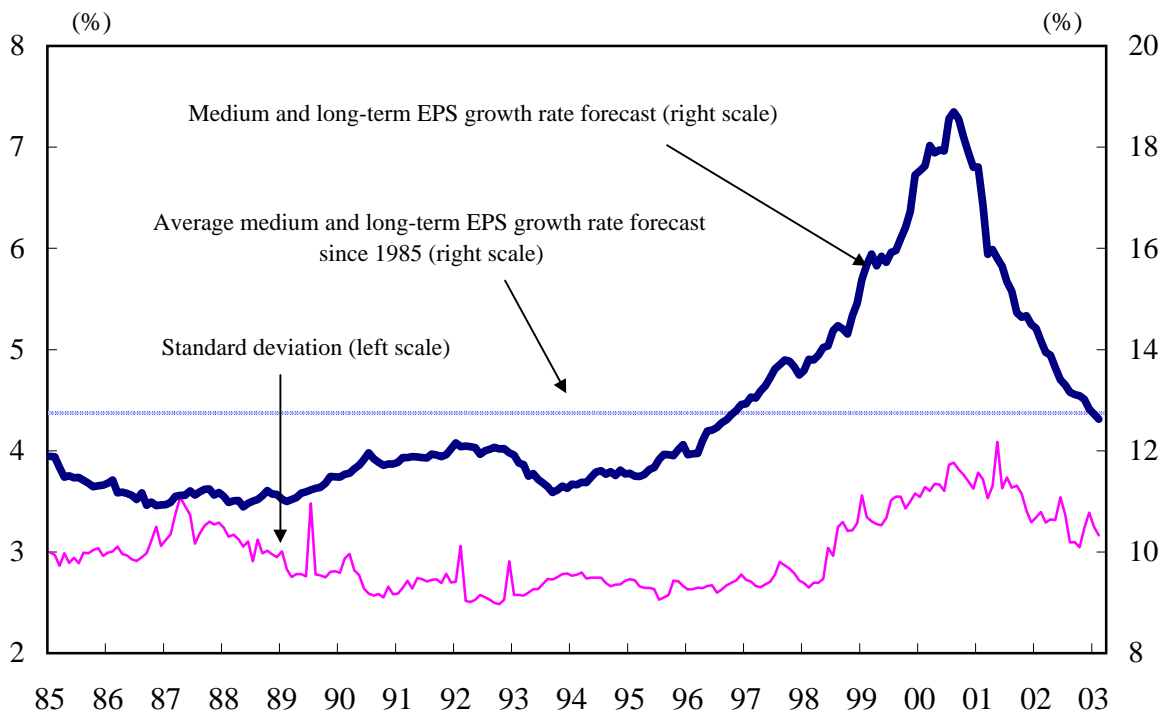
Source:Datastream

U.S. economy after the collapse of "IT bubble"

(1) Monetary condition (Taylor interest rate and actual FF rate)



(2) Downward revision in stock market expectation for medium and long-term corporate earnings growth



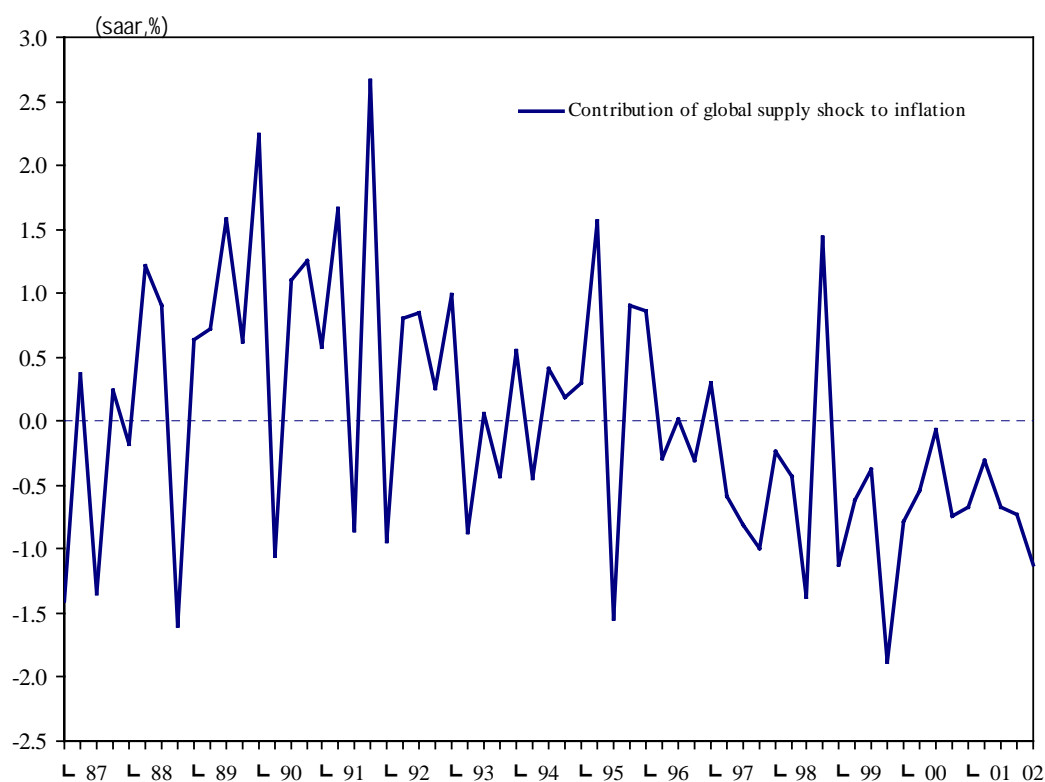
Identification of global supply shock

(1) SUR estimation results (sample period: 87/Q1--2002/Q1)

Dependent variable: inflation rate (CPI)							
	Japan	US	France	Italy	UK	Korea	Taiwan
π_{t+1}	0.18 (1.60)	0.44 (3.90)	0.19 (1.66)	0.41 (4.96)	0.24 (0.11)	0.38 (1.47)	-0.23 (0.57)
π_{t-1}	0.29 (2.69)	0.26 (2.25)	0.34 (2.78)	0.42 (5.13)	0.44 (5.39)	0.20 (1.86)	-0.10 (0.85)
y_t	-	0.03 (0.39)	-0.28 (1.07)	-0.17 (1.03)	0.11 (1.06)	0.19 (1.52)	-0.40 (1.06)
y_{t-1}	0.33 (3.36)	-	0.38 (1.47)	0.23 (1.48)	-	-	-0.23 (0.57)

Note: π :inflation rate (saar); y :output gap
t-values in parentheses.

(2) Identified global supply shock

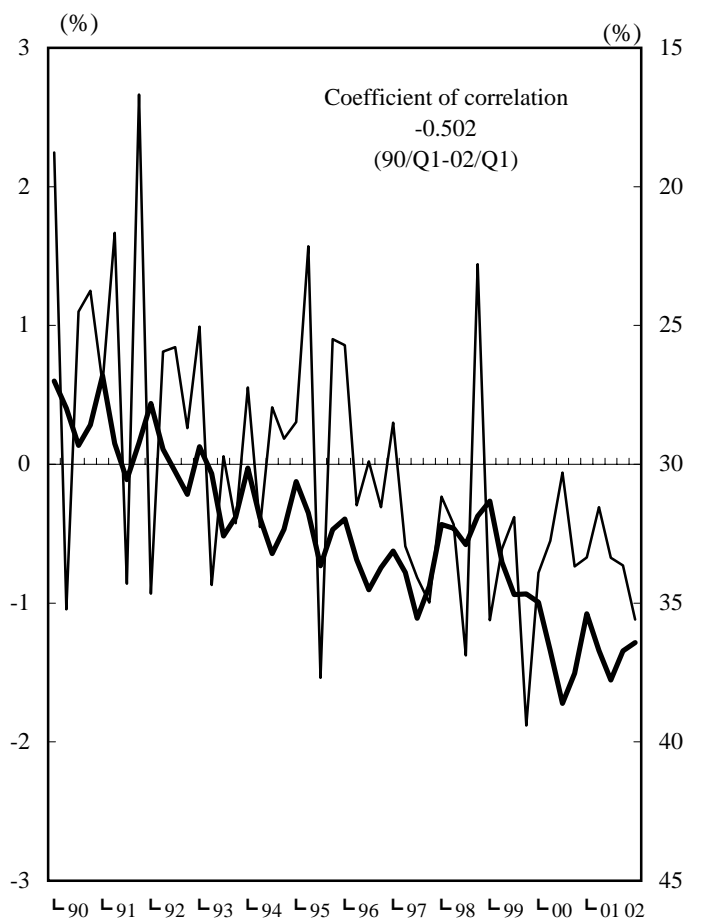


Source: Cabinet Office, Ministry of Public Management, Home Affairs, Posts and Telecommunications, WEFA, Datastream, CEIC

"Global supply shock" and share of emerging economies in world exports

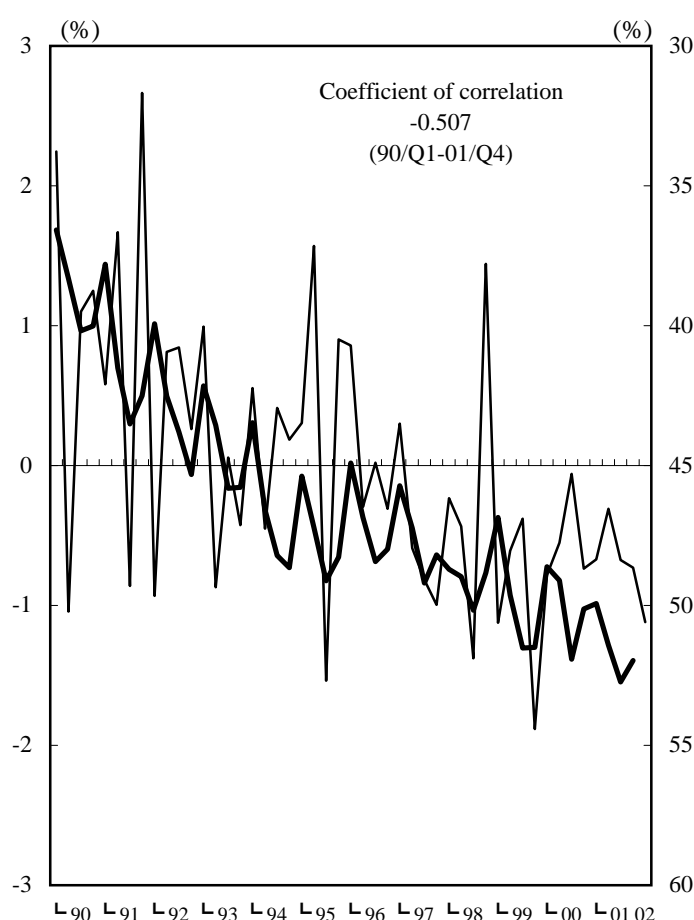
(1) "Global supply shock" and "nominal" emerging-economy share of world exports

(2) "Global supply shock" and "adjusted" emerging-economy share of world exports



— Contribution of "common global supply shock" to inflation rate (left-hand scale)

— Emerging economy share of world exports (right-hand scale [inverted])

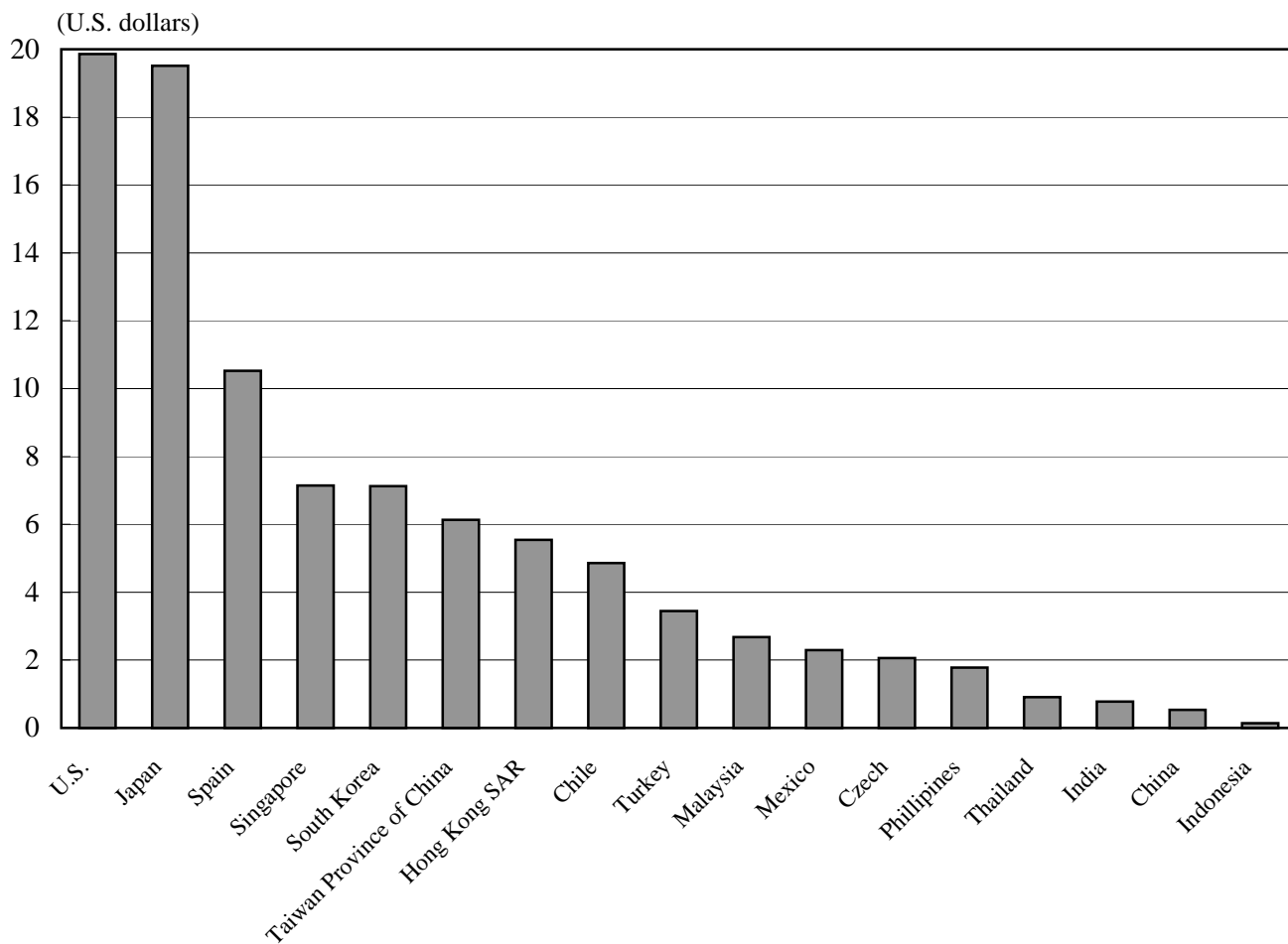


— Contribution of "common global supply shock" to inflation rate (left-hand scale)

— Emerging economy share of world exports (right-hand scale [inverted])

Source: Cabinet Office, Ministry of Public Management, Home Affairs, Posts and Telecommunications, WEFA, Datastream, CEIC, IMF, "International Financial Statistics," "World Economic Outlook."

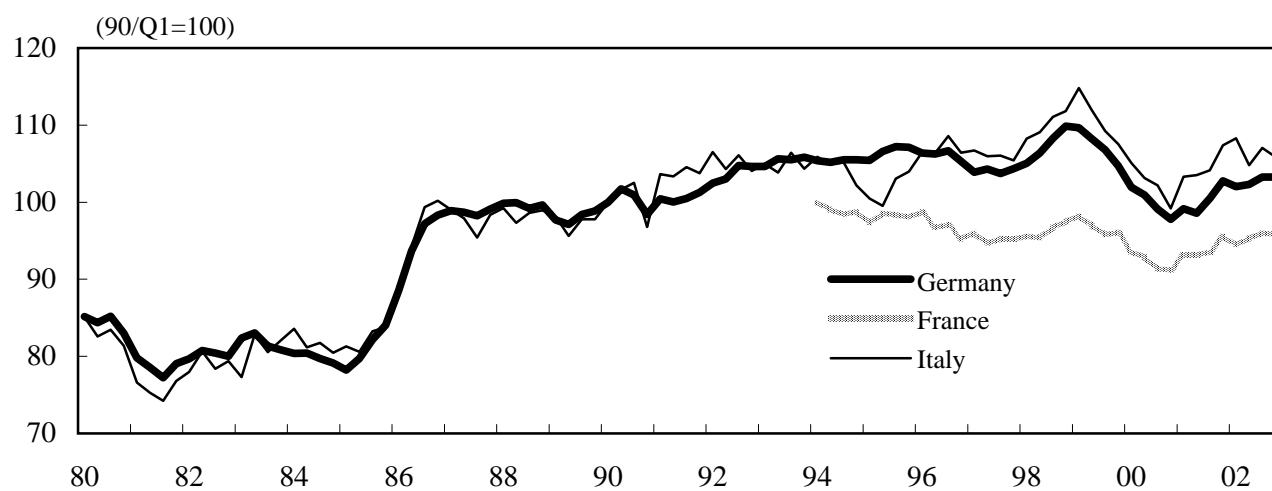
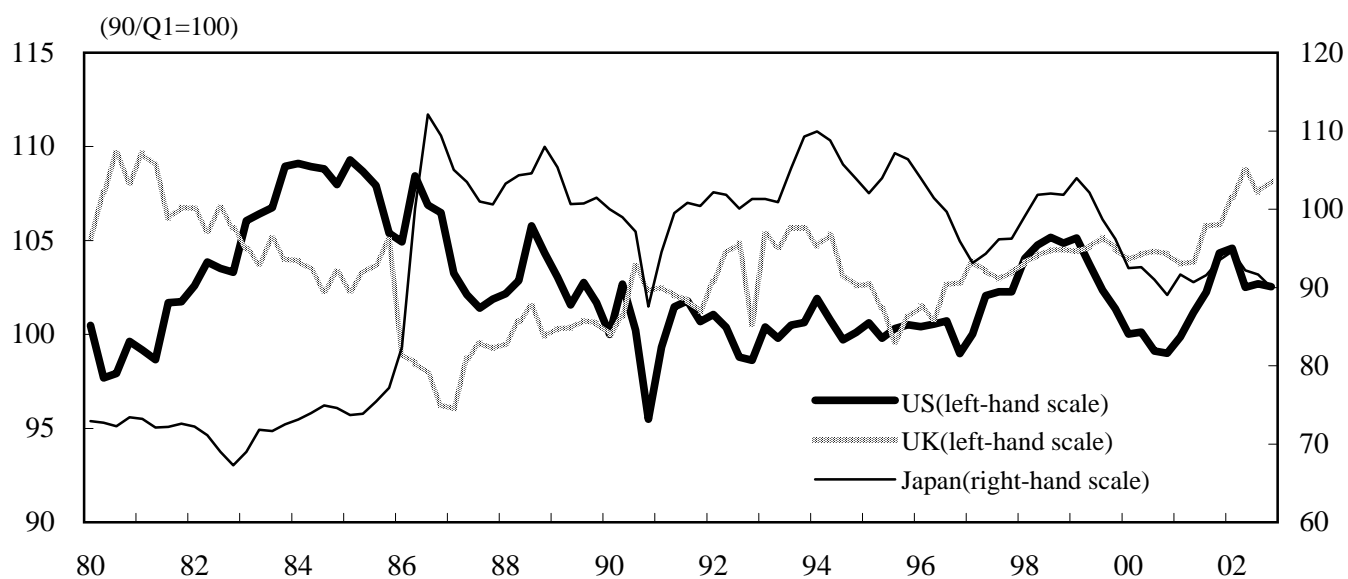
Hourly labor cost in manufacturing industry (2001)



Source: IMD, "Competitiveness Yearbook (2002)."

(Figure 15-1)

Terms of trade



Reference: Trend of terms of trade for each country

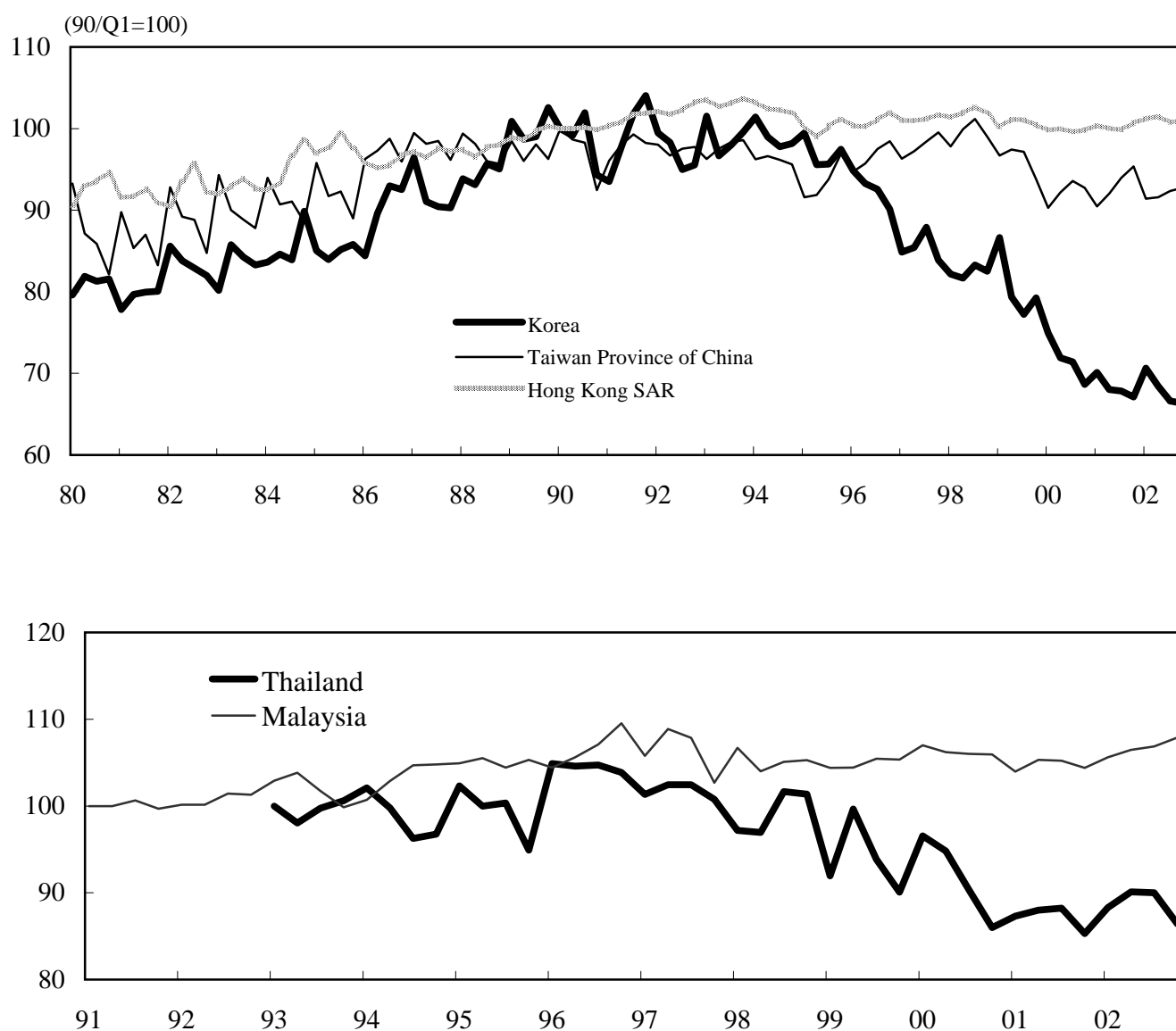
	80-85	86-90	91-95	96-00	01-
Japan	72.6	101.3	103.3	97.6	92.3
U.S.	104.4	102.9	100.4	101.8	102.5
U.K.	105.5	99.8	103.1	103.7	106.4
Germany	81.0	98.2	104.3	105.0	101.2
France	n.a.	n.a.	98.6	95.5	94.6
Italy	80.4	97.9	104.1	107.3	105.5

*Shaded areas indicate worsening from the previous period.

Note : Terms of trade indexed to 90/Q1= 100 for all except France. France indexed to 94/Q1 = 100.

Source: Bank of Japan, WEFA, Datastream.

Terms of trade



Reference: Trend of terms of trade for each country

	80-85	86-90	91-95	96-00	01-
South Korea	82.7	94.8	97.8	82.1	68.3
Taiwan Province of China	89.3	97.4	96.6	96.5	92.5
Hong Kong SAR	94.0	98.0	101.9	100.7	100.6
Thailand	n.a.	n.a.	99.2	98.3	88.2
Malaysia	n.a.	n.a.	102.2	105.9	105.4

*Shaded areas indicate worsening from the previous period.

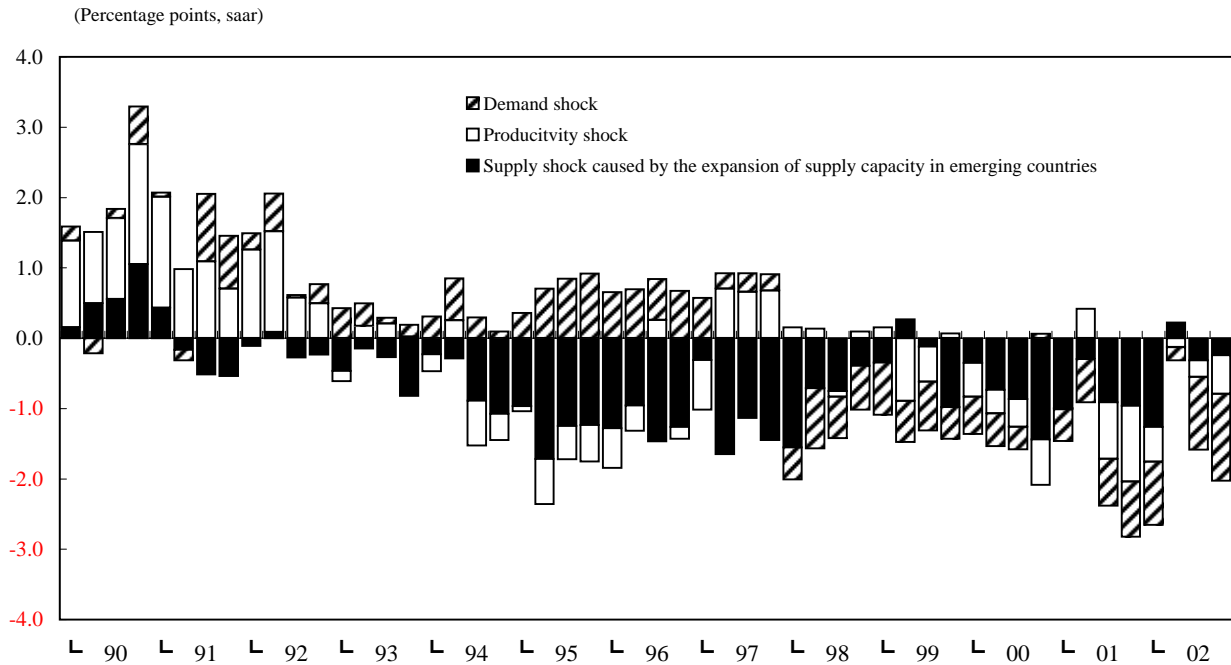
Note 1: Thailand indexed to 93/Q1 = 100; Malaysia to 91/Q1 = 100.

Note 2: Calculated from the export/import deflator for all countries.

Source: CEIC.

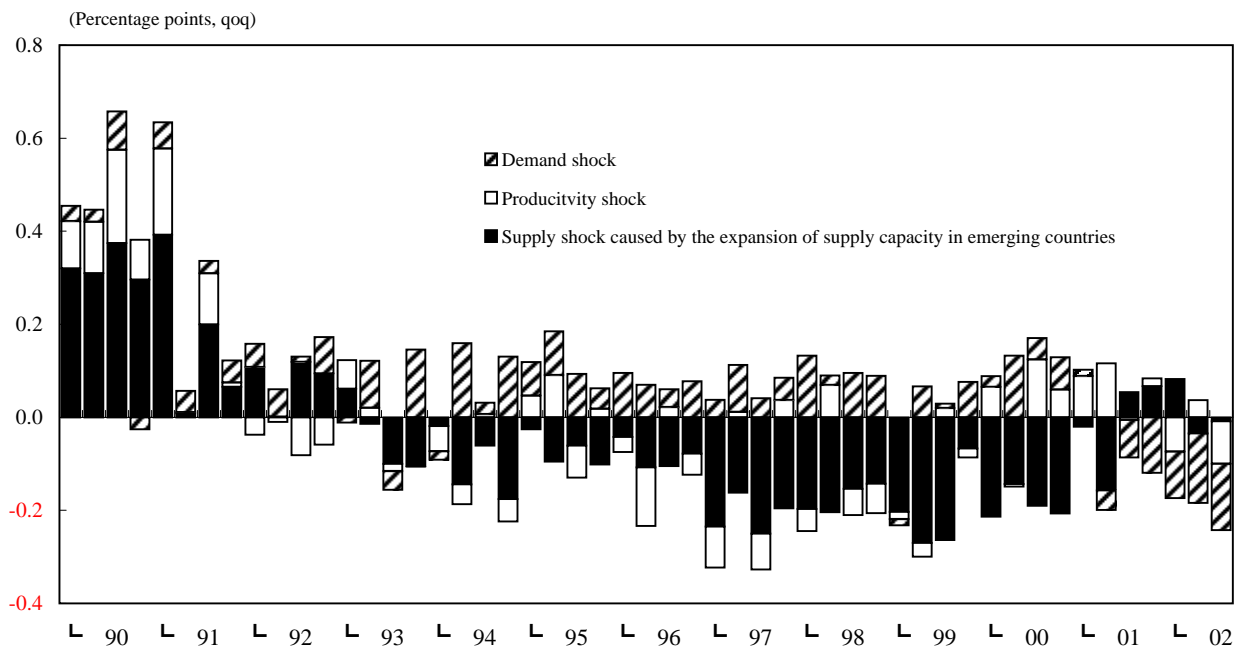
Decomposing CPI inflation rates

(1) Japan



Source: Kamada and Hirakata (2002)

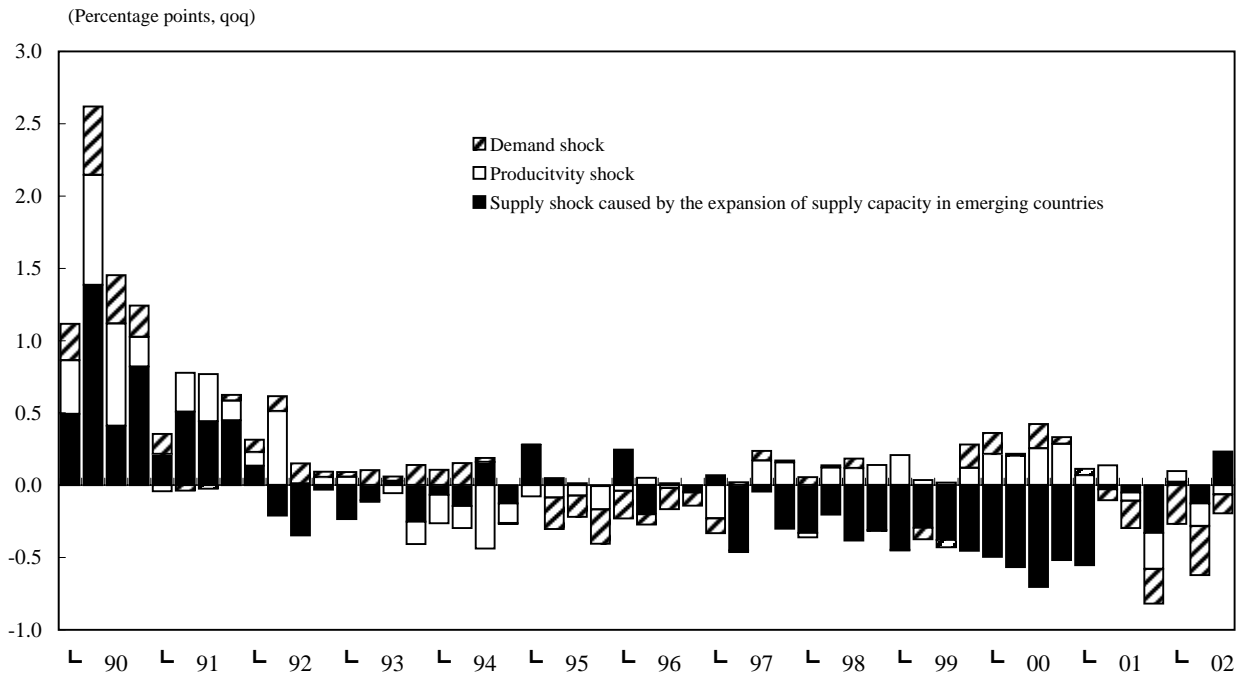
(2) U.S.



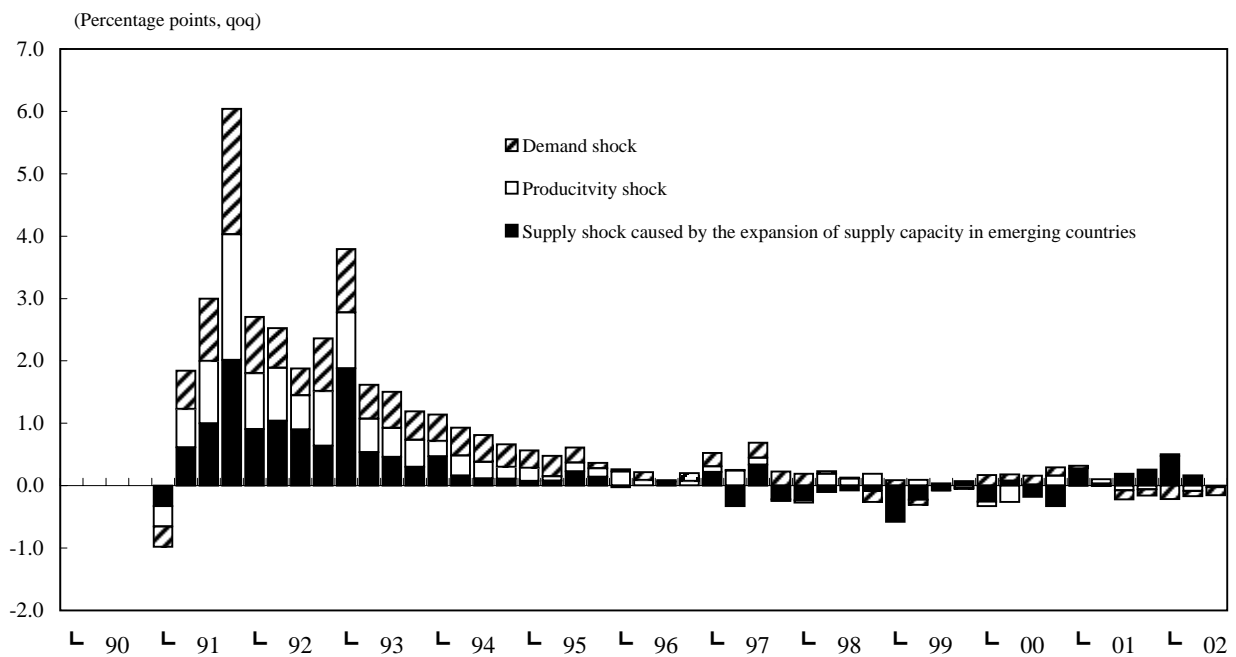
(Figure 16-2)

Decomposing CPI inflation rates

(3) UK



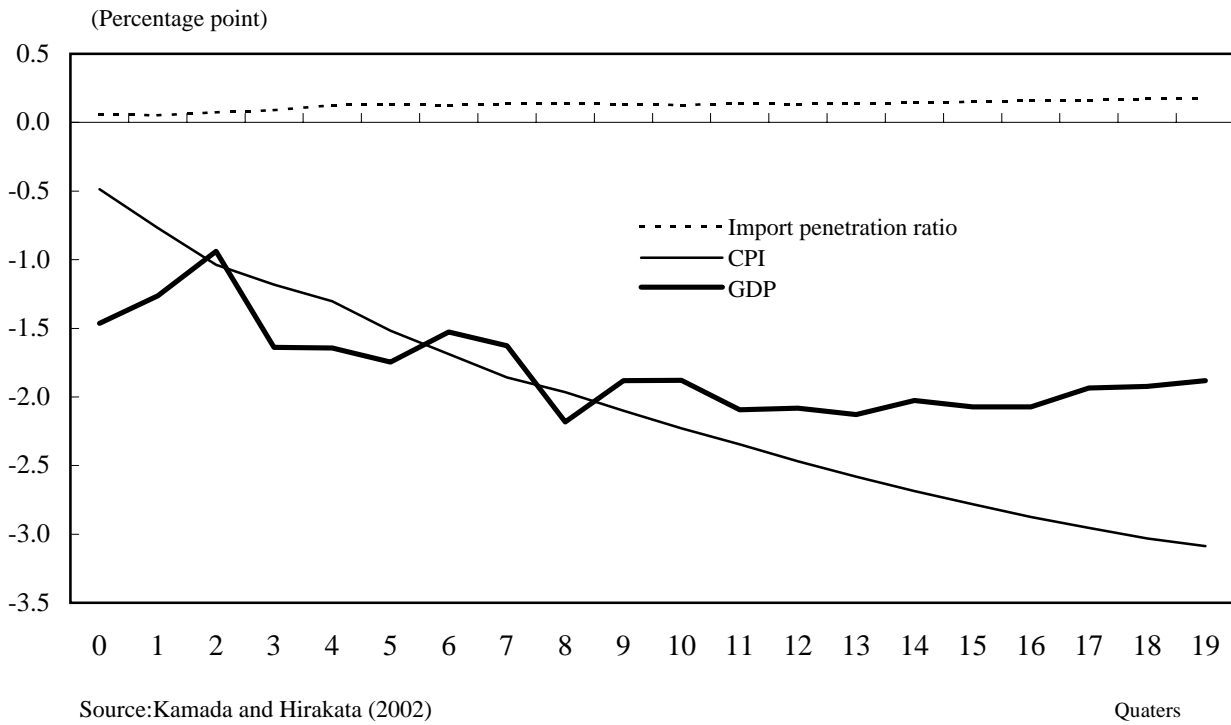
(4) Germany



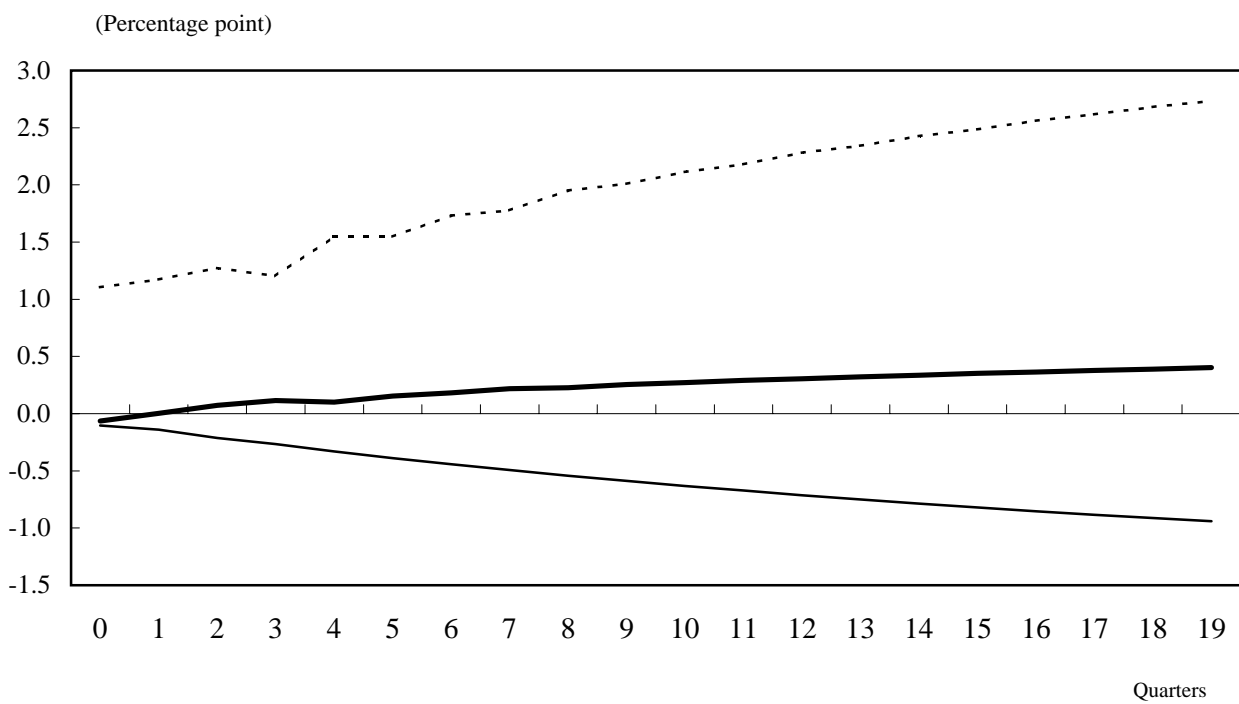
Source:WEFA

Cumulative effects of a supply shock caused by the expansion of supply capacity in emerging economies

(1) Japan (results of preceding study by Kamada and Hirakata [2002])

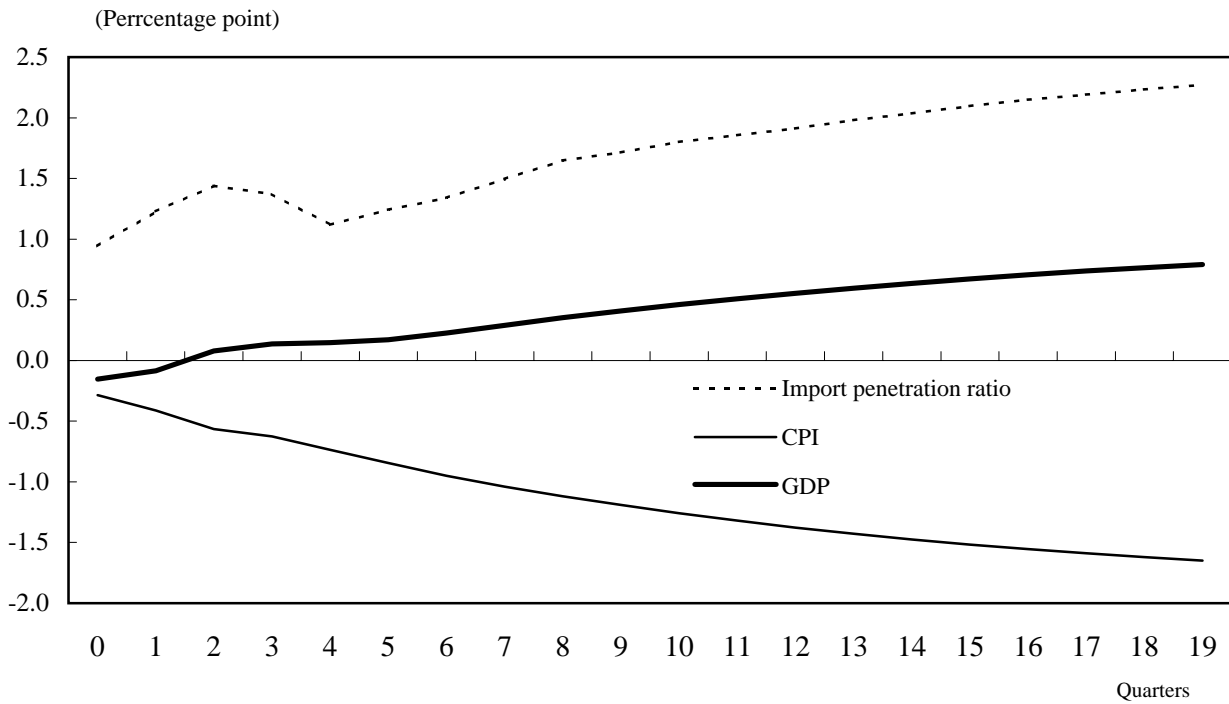


(2) US

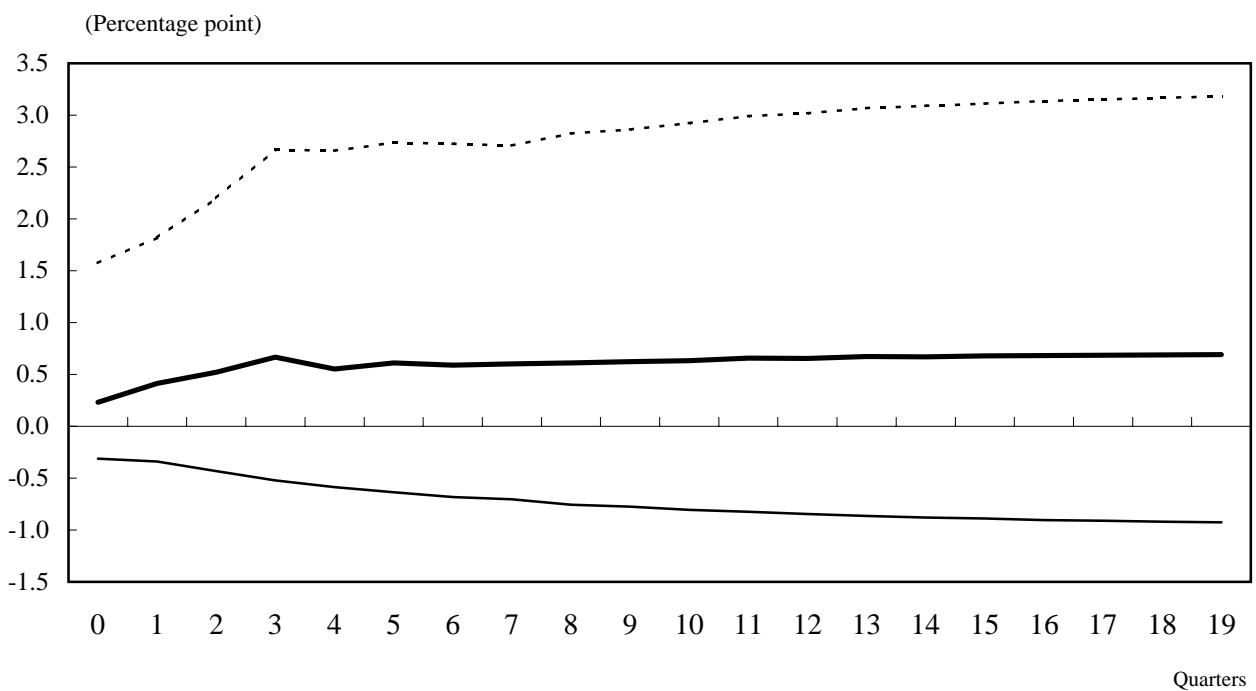


Cumulative effects of a supply shock caused by the expansion of supply capacity in emerging economies

(3) UK



(4) Germany



Source: Datastream.