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PASS-THROUGH OF EXCHANGE RATES AND IMPORT PRICES TO DOMESTIC INFLATION IN SOME INDUSTRIALISED ECONOMIES

by

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Abstract

This paper examines the impact of exchange rates and import prices on domestic PPI and CPI in selected industrialised economies. The empirical model is a VAR incorporating a distribution chain of pricing. Impulse responses and variance decompositions indicate that these external factors have a modest effect on domestic price inflation over the post-Bretton Woods era. The pass-through is somewhat stronger in countries with a larger import share. A historical decomposition over 1996–98 indicates, however, that external factors have had a sizable disinflationary effect in most of the countries during the past couple of years. Estimating the model using post-1982 data has little effect on these conclusions.

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Contents

1. Introduction 1

2. Influences on pass-through 3

3. Model and methodology 4

4. Data 6

5. Results 8

 5.1 Responses to exchange rate shocks 8

 5.2 Responses to import price shocks 13

 5.3 Variance decomposition 16

6. Recent influence of external factors 19

7. Has the influence of external factors changed? 23

8. Conclusion 26

A. Data appendix 28

 A.1 Common variable construction 28

 A.2 Nation-specific variable construction 28

  A.2.1 United States 28

  A.2.2 Japan 29

  A.2.3 Germany 29

  A.2.4 France 29

  A.2.5 United Kingdom 30

  A.2.6 Belgium 30

  A.2.7 Netherlands 31

  A.2.8 Sweden 31

  A.2.9 Switzerland 32

 Tables A1 – A3 33

References 36

1. Introduction

Inflation rates in the industrialised economies have been declining in recent years, even though some of these countries have had lengthy economic expansions. This inflation behaviour thus appears to be quite different from that of the 1970s and 1980s as well as contrary to standard paradigms of inflation and economic activity. For example, the inflation rate in the United States has continued to decline even as the unemployment rate has fallen below levels associated with rising inflation during the previous two decades.

Because the recent relationship between inflation and economic activity has been surprising, pundits have advanced many hypotheses to explain this phenomenon. One hypothesis in particular to explain the US and UK experience has been the disinflationary impact of exchange rate appreciation and import price deflation. In addition, analysts have pointed to the greater openness of the US economy as indicative of increased foreign competitive pressures limiting US domestic inflation.

Recent events have increased interest in the effect of external influences on domestic inflation. Many analysts have pointed to the general decline in import prices in industrialised economies, partly the result of the glut of goods induced by the 1997–98 East Asian crisis, to explain declining inflation in these countries during the past couple of years. Some analysts have even claimed that the greater openness of the industrialised economies, in particular the United States, implies that domestic measures of capacity constraints have become largely passé, and that global capacity measures are more important.[1] In contrast, many analysts have expressed concern that as other countries recover from the crisis, a US dollar depreciation and higher import prices will lead to greater US inflationary pressures.

Because this subject has both policy and theoretical implications, it has spawned many studies through the years. Most of these studies have concentrated on the pass-through of a country's exchange rate fluctuations to its import prices, a literature that has been surveyed comprehensively by Goldberg and Knetter (1997).[2] There have been fewer studies on the pass-through from exchange rate and import price fluctuations to domestic producer and consumer prices, the most prominent being Feinberg (1986, 1989) and Woo (1984).

More recently, several studies have further examined the influences of exchange rates and import prices on domestic inflation. Kim (1998) uses a vector error correction model and finds that in the

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1 For an analysis that refutes some of these claims, see Tootell (1998).

2 In addition, much has been written concerning the related issue of the extent to which exporters adjust their profit margins n response to exchange rate fluctuations. One such recent paper is Klitgaard (1999).

United States, the exchange rate has the expected negative long-run effect on the producer price index (PPI). However, his work does not address the relationship at shorter horizons more relevant for monetary policy.[3] In this regard, Dellmo (1996) finds that the effect of import prices on the consumer price index (CPI) in Swedish data is relatively weak, even though Sweden is a small open economy. In the case of the large, relatively closed US economy, the evidence is mixed concerning the pass-through to domestic CPI inflation. Tootell (1998) finds that measures of foreign capacity do not enter significantly into estimates of the US Phillips curve. In contrast, Koenig (1998) and Boldin (1998) both find that including import prices in a simple CPI inflation forecasting model improves forecasts during the 1990s.

This paper further examines the pass-through of external factors to domestic inflation. Unlike the previously cited papers, it uses a VAR model that permits one to track pass-through from exchange fluctuations to each stage of the distribution chain in a simple integrated framework. In addition, I estimate the model for several industrialised economies and then examine whether the factors affecting pass-through that have been identified in the industry-level studies also explain cross-country differences in pass-through. By estimating the model over different periods of the post-Bretton Woods era, I investigate whether supposedly greater globalisation has affected the pass-through. Finally, I use the model to examine the effect of exchange rates and import prices on domestic inflation in these countries from 1996 to 1998.

To preview the results, the impulse response functions and variance decompositions indicate that exchange rate and import price shocks have modest effects on domestic inflation in most of the countries in the sample, particularly the larger economies. Openness as measured by the import share of domestic demand in a country is correlated across countries with the same measures of the pass-through, but the association is not particularly strong. Concentrating on influences over the last couple of years indicates that external factors have had a sizable disinflationary effect over this period. Finally, estimating the model for different sample periods does not suggest stronger pass-through in the 1980s and 1990s than previously.

The remainder of this paper proceeds as follows. The next section discusses some influences on pass-through that have been identified in previous studies and that may explain cross-country differences in pass-through. Section 3 describes the model and its empirical implementation, and Section 4 the data used in the study. Section 5 provides the results from the impulse responses and variance decompositions. Section 6 discusses the historical decomposition of the 1996–98 period and Section 7 the issue of possible time-varying pass-through. Section 8 concludes.

[3] Furthermore, my attempts at replicating his results indicated that they were sensitive to the specification of the model.

2. Influences on pass-through

There have been many papers that have examined pass-through of exchange rate fluctuations to import prices as well as some that have examined pass-through to domestic producer and consumer prices. In this section, I briefly discuss some factors identified by these studies that may underlie variations in pass-through and how these relate to cross-country differences in pass-through.

Many recent studies have concentrated on the relationship between an industry's characteristics and the pass-through of exchange rate fluctuations in that industry. The theoretical basis for many of these studies has come from papers such as Dornbusch (1987) that applied industrial organisation models to explain the relationship between exchange rate fluctuations and domestic price changes in terms of market concentration, import penetration, and the substitutability of imported and domestic products. Utilising these principles, Feinberg (1986, 1989) finds exchange rate pass-through to domestic producer prices in both the United States and Germany is greater in industries that were less concentrated and faced greater import penetration. More generally, Goldberg and Knetter (1997) find that many studies have concluded that the pass-through to import prices is smaller in more segmented industries – that is, industries where firms are able to engage in third-degree price discrimination.

What do these results imply for differences in pass-through across countries? First, assuming that a country's import share is a good proxy for the import penetration faced by firms, then countries with a larger import share should have a greater pass-through of exchange rate and import price fluctuations to domestic prices. Second, because of both a direct effect and through a greater pass-through, we would expect that exchange rates and import prices should become more important in explaining domestic inflation fluctuations as the import share increases.

Relating the industrial organisation characteristics of concentration and market segmentation to the country level is more difficult. In this study, I will examine how a country's "competitiveness" as measured by the Global Competitiveness Report from the World Economic Forum (1999) correlates with the extent of pass-through and the importance of exchange rates and import prices in explaining domestic inflation fluctuations.

With regard to other influences, Mann (1986) discusses some macroeconomic factors that may affect pass-through. One such factor is exchange rate volatility. Greater exchange rate volatility may make importers more wary of changing prices and more willing to adjust profit margins, thus reducing measured pass-through. Wei and Parsley (1995) and Engel and Rogers (1998) have provided some empirical evidence confirming this hypothesis at the sectoral and product level. Thus we would expect that pass-through should be less in countries where the exchange rate has been more volatile.

Another macroeconomic factor discussed by Mann (1986) is aggregate demand uncertainty. Aggregate demand shifts in conjunction with exchange rate fluctuations will alter the profit margins of importers in an imperfectly competitive environment, thus reducing measured pass-through. If this hypothesis is true, we would expect that pass-through should be less in countries where aggregate demand (which will be proxied by the output gap) is more volatile.

To examine these hypotheses concerning the pass-through of exchange rate and import price fluctuations to domestic inflation, an empirical model to measure pass-through is needed. The model used in this study is presented in the next section.

3. Model and methodology

To examine the pass-through of exchange rate and import price fluctuations to domestic producer and consumer inflation, I use a model of pricing along a distribution chain. In this model, inflation at a particular distribution stage – import, producer, and consumer – in period *t* is assumed to comprise several different components. The first component is the expected inflation at that stage based on the available information at the end of period $t-1$. The second and third components are the effects of period *t* domestic "supply" and "demand" shocks on inflation at that stage. The fourth component is the effect of external exchange rate shocks on inflation at a particular stage. Next are the effects of inflation shocks at the previous stages of the distribution chain. Finally, there is the inflation shock at that particular stage.

The inflation shocks at each stage are simply that portion of that stage's inflation which cannot be explained using information from period $t-1$ plus information about domestic supply and demand variables, exchange rates, and period *t* inflation at previous stages of the distribution cycle. These shocks can thus be thought of as changes in the pricing power and mark-ups of firms at these stages. Two other features of the model are worthy of note. First, the model allows import inflation shocks to affect domestic consumer inflation both directly and indirectly through their effects on producer inflation. Second, there is no contemporaneous feedback in the model: for example, consumer inflation shocks affect inflation at the import and producer stages only through their effect on expected inflation in future periods.

Under these assumptions, the inflation rates of country *i* in period *t* at each of the three stages – import, producer (PPI), and consumer (CPI) – can be written as:[4]

(1) $$\pi_{it}^{m} = E_{t-1}(\pi_{it}^{m}) + \alpha_{1i}\varepsilon_{it}^{s} + \alpha_{2i}\varepsilon_{it}^{d} + \alpha_{3i}\varepsilon_{it}^{e} + \varepsilon_{it}^{m}$$

[4] Note that even though the data in this study have both cross-sectional and time-series aspects, the model will be estimated for each country separately. This is done for two reasons. First, differing institutions in each country are likely to lead to differences in the responses in each country (hence the *i* subscript for each coefficient in the equations). Second, even though there is likely to be cross-country correlation in the equations of the model, it would be unwieldy to take this into account to increase the efficiency of the estimates.

(2) $$\pi_{it}^{w} = E_{t-1}(\pi_{it}^{w}) + \beta_{1i}\varepsilon_{it}^{s} + \beta_{2i}\varepsilon_{it}^{d} + \beta_{3i}\varepsilon_{it}^{e} + \beta_{4i}\varepsilon_{it}^{m} + \varepsilon_{it}^{w}$$

(3) $$\pi_{it}^{c} = E_{t-1}(\pi_{it}^{c}) + \gamma_{1i}\varepsilon_{it}^{s} + \gamma_{2i}\varepsilon_{it}^{d} + \gamma_{3i}\varepsilon_{it}^{e} + \gamma_{4i}\varepsilon_{it}^{m} + \gamma_{5i}\varepsilon_{it}^{w} + \varepsilon_{it}^{c}$$

where π_{it}^{m}, π_{it}^{w}, and π_{it}^{c} are import price, PPI, and CPI inflation respectively; ε_{it}^{s}, ε_{it}^{d}, and ε_{it}^{e} are the supply, demand, and exchange rate shocks respectively; ε_{it}^{m}, ε_{it}^{w}, and ε_{it}^{c} are the import price, PPI, and CPI inflation shocks; and $E_{t-1}(\bullet)$ is the expectation of a variable based on the information set at the end of period $t-1$. The shocks are assumed to be serially uncorrelated as well as uncorrelated with one another within a period.

The structure of the model (1)–(3) suggests it is part of a recursive VAR framework. Thus, to complete the empirical model, I make the following assumptions. (1) "Supply" shocks are identified from the dynamics of oil price inflation denominated in the local currency. (2) "Demand" shocks are identified from the dynamics of the output gap in the country after taking into account the contemporaneous effect of the supply shock. (3) "External" shocks are identified from the dynamics of exchange rate appreciation after taking into account the contemporaneous effects of the supply and demand shocks.

(4) $$\pi_{it}^{oil} = E_{t-1}(\pi_{it}^{oil}) + \varepsilon_{it}^{s}$$

(5) $$\tilde{y}_{it} = E_{t-1}(\tilde{y}_{it}) + a_{1i}\varepsilon_{it}^{s} + \varepsilon_{it}^{d}$$

(6) $$\Delta e_{it} = E_{t-1}(\Delta e_{it}) + b_{1i}\varepsilon_{it}^{s} + b_{2i}\varepsilon_{it}^{d} + \varepsilon_{it}^{e}$$

Finally, I assume that the conditional expectations in equations (1)–(6) can be replaced by linear projections of the lags of the six variables in the system.

Under these assumptions, the model can be estimated as a VAR using a Cholesky decomposition.[5] The impulse responses of PPI and CPI inflation to the orthogonalised shocks of exchange rate appreciation and import price inflation then provide estimates of the effect of these variables on domestic inflation. In addition, variance decompositions of PPI and CPI inflation enable one to determine the importance of these "external" variables for domestic inflation.

---

[5] Although the Cholesky decomposition would identify aggregate supply and demand shocks under the assumptions of this model, one certainly could argue that oil price inflation is affected contemporaneously by both aggregate supply and aggregate demand shocks. If so, each of the shocks in the first two equations of the VAR would then be a combination of aggregate supply and demand shocks (Blanchard and Quah (1989)). However, I believe that this will have little effect on the measurement of exchange rate and import prices shocks and their effect on domestic inflation.

4. Data

Data from nine developed countries – the United States, Japan, Germany, France, the United Kingdom, Belgium, the Netherlands, Sweden, and Switzerland – are used in this study.[6] The data are quarterly and limited to the floating exchange rate period, and come from national sources as compiled by the BIS Data Bank.[7] To account for lags in the construction of some variables and in the model specifications, the estimation period runs from 1976:1 to 1998:4 for most countries.[8]

As far as the variables used in this study are concerned, the exchange rate is the quarterly average of the nominal effective exchange rate as computed by the BIS. Depending upon data availability, import prices are either a general import price index or an index of import unit values. The PPI is the most general producer or wholesale price index that excludes imports. Imports were excluded because the broadest available PPI in some countries – in particular, the United States – does not include imports.[9] The CPI is the overall consumer price index to provide the broadest measure of inflation at the consumer level. The output gap is created by taking the deviations of the log of real GDP from a linear and quadratic trend. The appendix provides country-specific details about the variables.

Annualised percentage changes of the price indices and the average output gaps over five-year periods as well as the last three years are presented in Table 1. This summary provides some insight into the questions and problems of measuring the pass-through of exchange rates and import prices to domestic prices. In particular, the table shows that declines in domestic inflation have usually been associated with exchange rate appreciation and import price disinflation/deflation (and vice versa), and suggests that these external factors may have played a role in the disinflation of the 1980s and 1990s.

However, it also is apparent that these relationships are not particularly tight. Countries have experienced sizable swings in exchange rates and import prices with little or no effect on domestic prices. For example, the exchange rate has depreciated over the past three years in Japan, Germany, and France, but the depreciations were associated with only a moderate increase in inflation (Japan) or continued disinflation (Germany, France). Other factors have obviously been important in the disinflation experienced by these countries, the most prominent probably being the decline in oil prices. Therefore, econometric analysis using the model presented in Section 3 is required to determine the role of exchange rates and import prices in domestic inflation.

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6 The German analysis uses all-German data where possible; using only western German data has little effect on the results.

7 Although a monthly frequency would be desirable in examining these issues and many of the variables are available monthly, key variables in some countries are available only quarterly. For example, a lengthy import price series for the United States is available only quarterly.

8 Because of data availability, the estimation period is 1976:1–1998:3 for France and the United Kingdom, 1981:2–1998:4 for Belgium, and 1978:1–1998:4 for the Netherlands.

9 Using the general PPI irrespective of whether imports were included in the index had little substantive effect on the results outside of the correlation between import share and the pass-through to the PPI.

Table 1

Summary statistics for various periods

Annualised percentage changes over the periods

Country	Oil prices	Output gap[1]	Exchange rate	Import prices	PPI	CPI
United States						
1976 – 80	26.3	1.5	–1.4	13.1	9.3	9.5
1981 – 85	–15.4	–1.7	3.4	–2.1	2.1	4.5
1986 – 90	2.4	2.0	–5.8	3.2	3.2	4.2
1991 – 95	–1.3	–1.7	0.0	–0.4	1.3	2.8
1996 – 98	–13.0	0.6	4.7	–3.9	0.3	2.1
Japan						
1976 – 80	16.9	0.3	8.1	7.2	5.2	6.1
1981 – 85	–16.9	–2.2	5.5	–4.4	–0.6	2.3
1986 – 90	–4.3	0.5	2.9	–4.7	–0.3	1.6
1991 – 95	–5.9	1.6	5.4	–4.2	–1.2	0.9
1996 – 98	–9.0	–0.8	–1.0	–0.8	–0.9	1.1
Germany						
1976 – 80	21.2	1.9	3.7	6.9	4.1	4.2
1981 – 85	–13.4	–1.9	3.1	0.7	2.5	3.2
1986 – 90	–6.0	–1.1	2.5	–1.8	1.2	1.7
1991 – 95	–2.1	2.6	1.7	–0.5	1.1	3.4
1996 – 98	–9.1	–1.5	–1.4	–0.7	0.0	1.3
France						
1976 – 80	28.1	0.9	–2.5	13.7	10.9	10.9
1981 – 85	–8.4	–1.0	–2.9	5.9	7.8	8.4
1986 – 90	–4.0	0.5	0.0	0.4	1.7	3.2
1991 – 95	–2.0	–0.1	1.7	–0.1	0.3	2.2
1996 – 98	–9.7	–0.1	–0.6	–0.7 [2]	0.2 [2]	0.9
United Kingdom						
1976 – 80	22.7	0.9	1.9	9.7	13.6	13.4
1981 – 85	–7.0	–3.4	–5.1	6.6	6.5	6.3
1986 – 90	–3.2	3.7	–0.4	1.5	4.4	6.3
1991 – 95	3.1	–1.3	–4.2	4.7	3.5	2.9
1996 – 98	–15.9	–0.3	7.3	–5.4 [2]	0.7	3.1
Belgium						
1976 – 80	22.6	3.4 [3]	1.6	14.3 [3]	4.4	8.0
1981 – 85	–9.2	–1.2	–2.1	6.0	4.9	6.3
1986 – 90	–5.8	0.3	1.7	–1.0	–0.1	2.2
1991 – 95	–2.2	0.6	1.4	0.4	0.7	2.3
1996 – 98	–8.9	–0.7	–1.4	0.5	–0.7	1.3
Netherlands						
1976 – 80	22.3	1.2 [4]	1.6	8.2	4.0	5.7
1981 – 85	–12.8	–1.8	2.1	–0.8	2.5	3.4
1986 – 90	–5.9	0.6	1.9	–2.4	–1.1	1.0
1991 – 95	–2.4	0.7	1.5	–0.3	0.4	2.7
1996 – 98	–8.6	–0.7	–1.6	–1.9	0.1	2.0
Sweden						
1976 – 80	27.3	–0.4	–2.0	12.8	10.8	10.9
1981 – 85	–6.7	–1.6	–5.0	6.7	7.9	7.9
1986 – 90	–2.8	2.9	–0.8	2.3	4.3	7.0
1991 – 95	2.2	–1.6	–2.9	3.7	2.6	2.8
1996 – 98	–7.7	0.2	–2.6	0.2	0.0	0.2
Switzerland						
1976 – 80	18.8	–2.6	4.8	2.8	1.7	2.8
1981 – 85	–14.7	–0.6	3.7	0.3	2.3	3.7
1986 – 90	–5.7	1.7	1.8	–0.7	1.4	3.1
1991 – 95	–3.2	0.6	2.3	–0.9	0.0	2.5
1996 – 98	–8.7	–1.4	–1.5	–1.5	–1.3	0.3

[1] Average output gap over the period. [2] 1980 only. [3] Through 1998:3. [4] 1977 – 80.

5. Results

As discussed in Section 3, the distribution chain model, equations (1)–(3), can be estimated within a VAR system consisting of six variables: oil price inflation, the output gap, exchange rate change, import price inflation, PPI inflation, and CPI inflation.[10] Under the assumptions of the model, the reduced form residuals from the VAR are orthogonalised using a Cholesky decomposition to identify the "structural" shocks, where the variables are in the order given above.

For each country in the sample, the number of lags in the VAR is set at four (a constant is the only other variable included in the regressions), and the model is estimated over the period 1976:1–1998:4 (92 quarters). Two sets of statistics are used to assess the pass-through from exchange rate fluctuations and import price inflation to domestic inflation. First, impulse responses to the exchange rate and import price shocks for each country are estimated over a two-year (eight-quarter) horizon.[11] These are standardised to correspond to the response to a 1% shock in the exchange rate or import price index to allow a comparison of the sensitivity to these external factors across countries. Second, variance decompositions are used to assess how much of the (forecast) variance in domestic price indices over this period can be attributed to these external factors.

5.1 Responses to exchange rate shocks

Figures 1–3 display the responses of the import price index, the PPI, and the CPI to an exchange rate shock in each of the countries in the sample. In this model, the exchange rate shock is estimated given past values of all the variables plus the current values of oil prices and the output gap. The solid line in each graph is the estimated response while the dashed lines denote a two standard error confidence band around the estimate.[12]

Beginning with the most studied pass-through, the initial impact of an exchange rate appreciation on import prices is negative as expected and remains so for at least a year in all of the countries (Figure 1). By the end of two years, the response is imprecisely estimated in most countries, and there are cases where it is positive. For the United States, the estimated pass-through appears to be similar to previous estimates as well as common perceptions concerning exchange rate pass-through.[13] As far as the other countries are concerned, the pass-through appears to be particularly large in Belgium and the

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[10] By estimating the model in this way, I am ignoring the possibility of cointegration among the log levels of the variables. Cointegration tests do indicate several possible cointegrating vectors. However, the speed of convergence appears to be quite slow (similar to that towards PPP; see Rogoff (1996) and Higgins and Zakrajšek (1999)). Given the short horizons studied in this paper, using this simpler model should have little effect on the results.

[11] Although the model is estimated in first differences, it is then transformed into levels so that cumulative price level responses are examined.

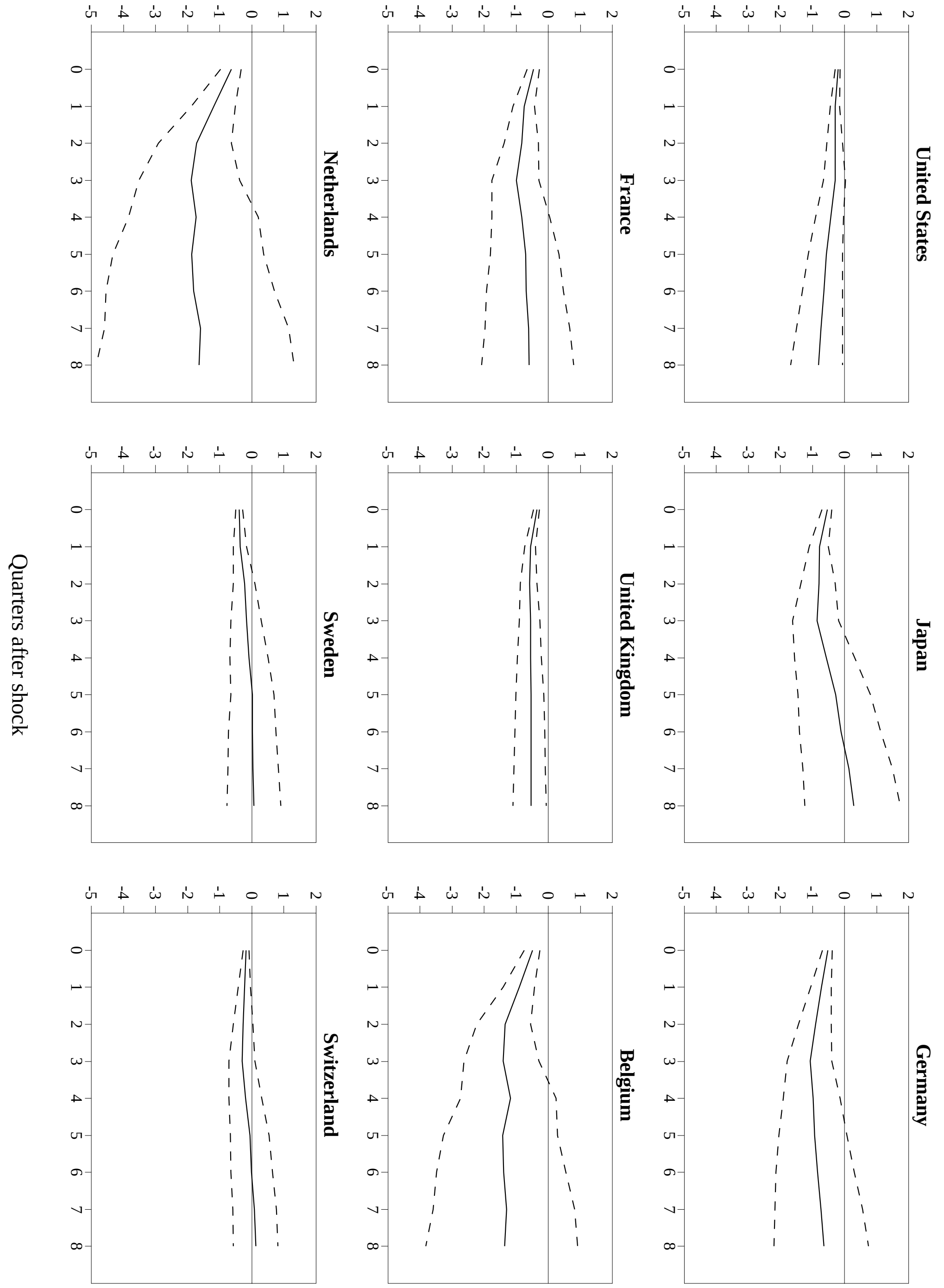
[12] The error bands are estimated using the Bayesian Monte Carlo method employed by RATS with 1,000 draws.

[13] See Kreinin (1977), Woo (1984), Hooper and Mann (1989), and Goldberg and Knetter (1997).

Netherlands, with the eventual change in import prices exceeding 1%. On the other hand, the pass-through appears to be surprisingly small in Sweden and Switzerland.

Figure 1

Response of import prices to 1% increase in exchange rates



The response of the PPI is quite weak in most of the countries, and in some cases it has the wrong sign (Figure 2). The exceptions to this pattern are Belgium and possibly the Netherlands. The point estimates for the United States appear to be somewhat weaker than those in Feinberg (1989), but the estimates for Germany are similar to those in Feinberg (1986). The response of the CPI to the exchange rate shock is even weaker than that of the PPI with even more responses having the wrong sign (Figure 3). Again, the exceptions to this pattern are Belgium and the Netherlands. The weak estimated pass-through to the CPI in the United States is similar to the results in Woo (1984) for the pass-through of exchange rates to the consumption price deflator.

Figure 2

Response of PPI to 1% increase in exchange rates

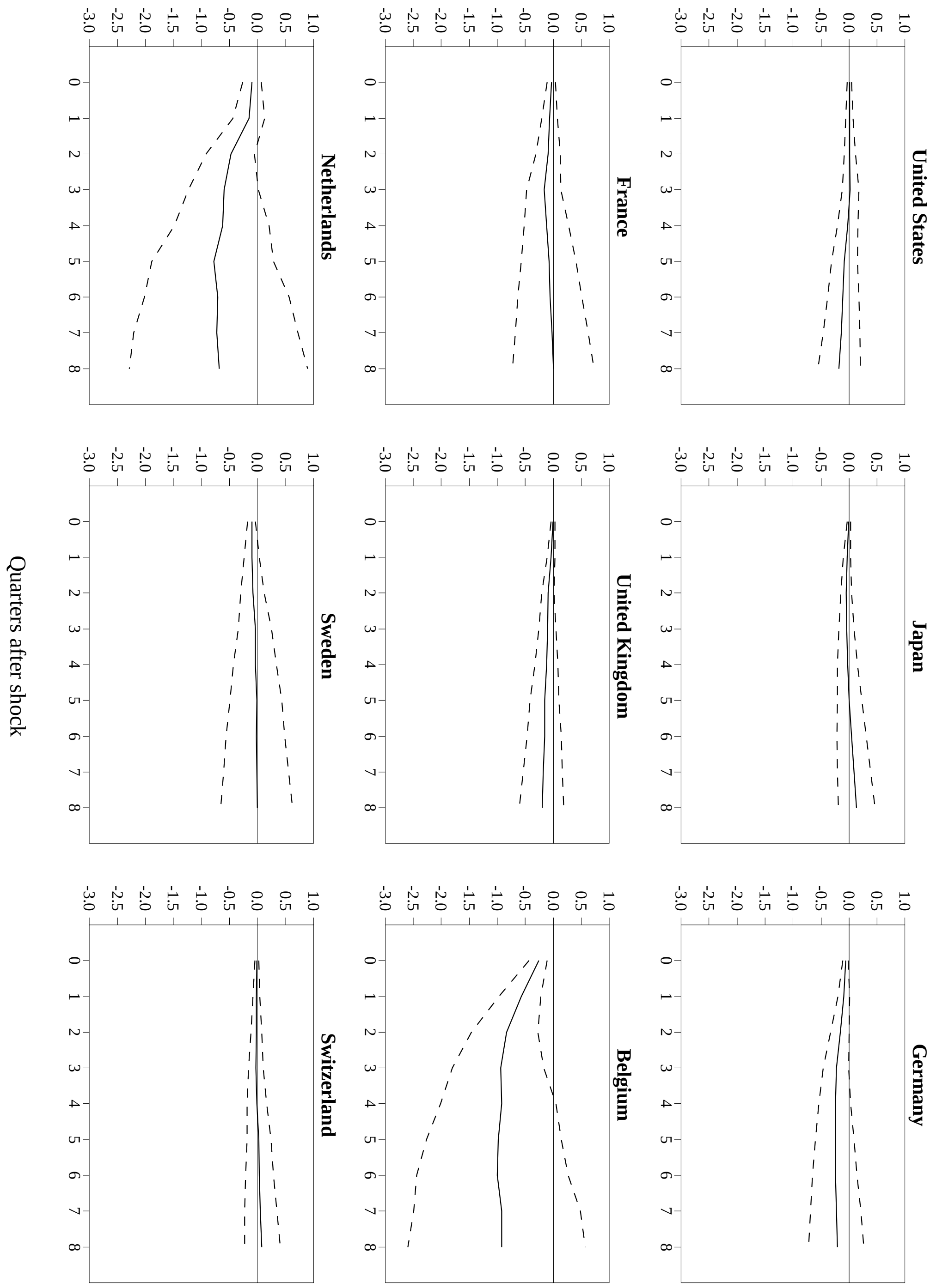
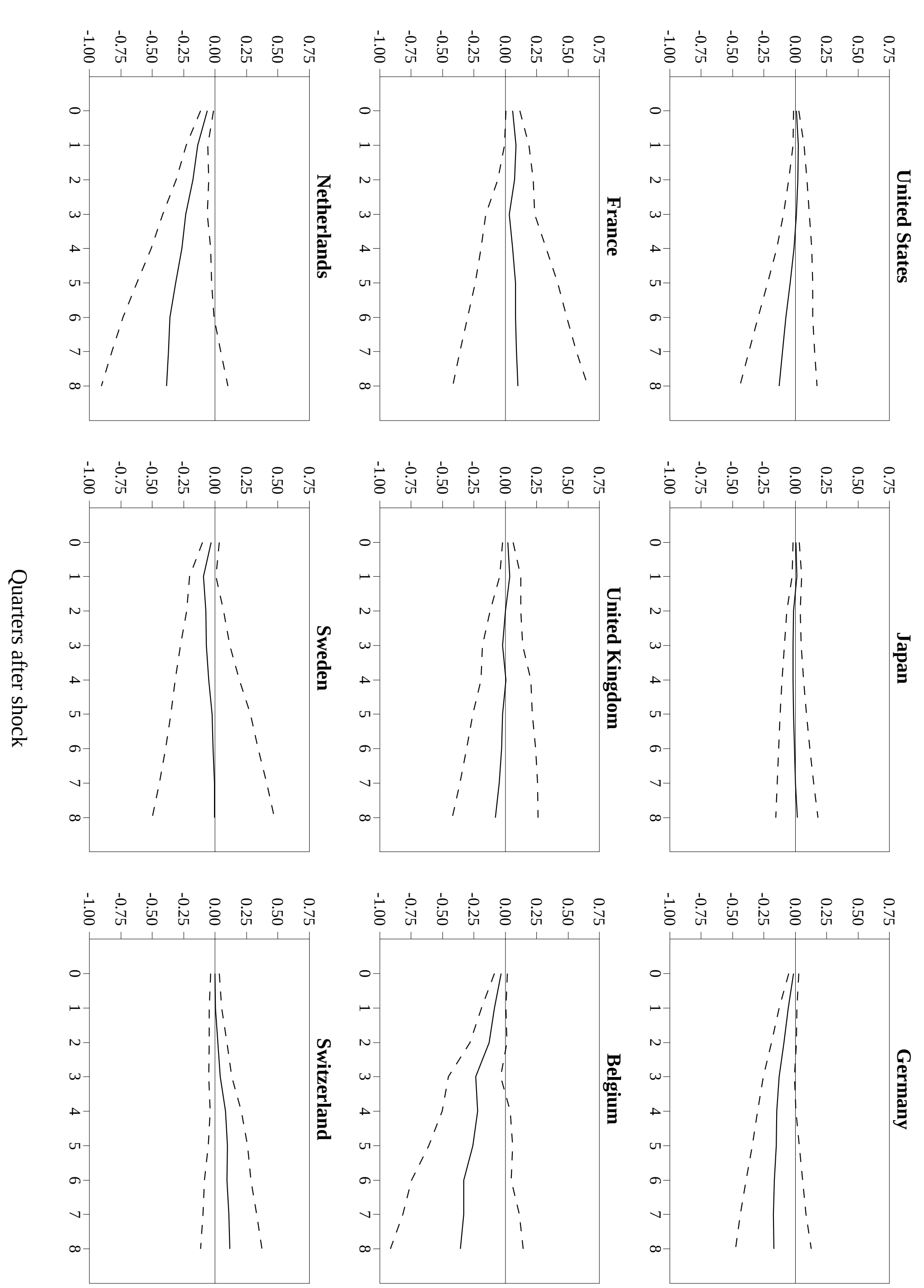


Figure 3

Response of CPI to 1% increase in exchange rates



Although the estimates of exchange rate pass-through are imprecise, there are noticeable differences across countries. To assess possible reasons for these differences, I examine the Spearman rank correlation statistic between the impulse responses at various horizons and some factors expected to influence pass-through. From the discussion in Section 2, the particular factors chosen are: (1) mean import share (imports as a percentage of domestic demand) over 1985–98;[14] (2) exchange rate volatility as proxied by the variance of the residuals from the exchange rate equation of the VAR; (3) GDP (aggregate demand) volatility as proxied by the variance of the residuals from the output gap equation; and (4) "competitiveness" as measured by the average ranking from 1996–99 global competitiveness surveys by the World Economic Forum (1999).

Table 2

Rank correlation between impulse responses to exchange rates and factors influencing pass-through

(a) Impulse response of import prices				
	Response horizon			
Factor	0	1	4	8
Import share	0.033	0.267	0.283	0.417
Exchange rate volatility	–0.317	–0.483*	–0.650**	–0.700**
GDP volatility	–0.133	–0.433	–0.433	–0.350
Competitiveness	–0.550*	–0.567*	–0.517*	–0.200
(b) Impulse response of PPI				
Import share	0.783***	0.667**	0.467*	0.483*
Exchange rate volatility	–0.767***	–0.717**	–0.650**	–0.617**
GDP volatility	0.167	0.033	–0.150	–0.050
Competitiveness	–0.717**	–0.750**	–0.667**	–0.350
(c) Impulse response of CPI				
Import share	0.617**	0.567*	0.300	0.267
Exchange rate volatility	–0.533*	–0.450	–0.450	–0.450
GDP volatility	0.333	0.450	0.083	–0.050
Competitiveness	–0.317	–0.433	–0.483*	–0.250

* Significant at the 10% level (critical value = 0.467). ** Significant at the 5% level (critical value = 0.583). *** Significant at the 1% level (critical value = 0.767).

The rank correlations are mostly in accord with the hypotheses discussed in Section 2 (Table 2). Higher import shares, less volatile exchange rates, and less volatile GDP are correlated with a greater import price response, although the relationship is statistically significant only for exchange rate volatility (panel a). Greater competitiveness is associated with a smaller response, and this association is statistically significant. This suggests that importers to countries identified as more competitive

[14] This is the longest period where there are complete data for each of the countries. Using a particular date or subperiod over this interval does not affect the ranking.

adjust profit margins to a greater extent in order to maintain market share. The results for the PPI response are similar to those for import prices, although the correlations for import share and exchange rate volatility are stronger (panel b). Finally, the associations between these factors and the response of the CPI are weaker than those for the PPI; the import share and exchange rate volatility have statistically significant correlations only at short horizons (panel c).

To summarise, the impulse responses indicate significant but not complete pass-through of exchange rate fluctuations to import prices in most countries in the sample. However, the pass-through to the PPI and CPI is quite modest for the most part. Therefore, "beachhead" behaviour, which has been a focus of many studies of import prices in the United States, appears to be pervasive when examining PPI and CPI pass-through in many industrialised economies.[15] Higher import shares, less volatile exchange rates, less volatile GDP and lesser "competitiveness" are associated with larger pass-through of exchange rates to domestic inflation, although such relationships are short-lived for the CPI.

5.2 Responses to import price shocks

Figures 4 and 5 display the responses of the PPI and the CPI to a shock in import prices. In this model, the import price shock is estimated given past values of all the variables plus the current value of oil prices, the output gap, and the exchange rate. Therefore, the import price shocks are unrelated to exchange rate movements, but are likely to be related to movements in world commodity prices, changes in importers' profit margins, etc. These responses should then be informative about the pass-through from a general import price decline such as that induced by the Asian crisis.

The response of the PPI to import price shocks is positive as expected and statistically significant for the most part (Figure 4). The responses are particularly large in Belgium and Sweden, with the pass-through eventually exceeding 100%. In contrast, the pass-through is rather small in Japan and the Netherlands.

The response of consumer prices to import price shocks is also positive and statistically significant for the most part, although smaller than the PPI response (Figure 5). The pass-through is clearly the largest in Sweden, and is also quite large in the United States and the United Kingdom. As was the case for the PPI, the pass-through is small in Japan and the Netherlands.

I next examine the cross-country rank correlations between these responses and the four factors listed in the previous subsection (Table 3). For the PPI responses, a higher import share is associated with a larger response while greater exchange rate volatility is correlated with a smaller pass-through, although these relationships are strong at shorter horizons only (panel a). Greater GDP volatility is associated with a stronger pass-through, contrary to the hypothesis stated in Section 2, but the

[15] For examples, see Baldwin (1988) and Baldwin and Krugman (1989).

relationship is not statistically significant. Finally, greater competitiveness is associated with a smaller response, a relationship that is statistically significant, suggesting that profit margins at the producer goods level are adjusted more in those countries identified as more “competitive”.

Figure 4

Response of PPI to 1% increase in import prices

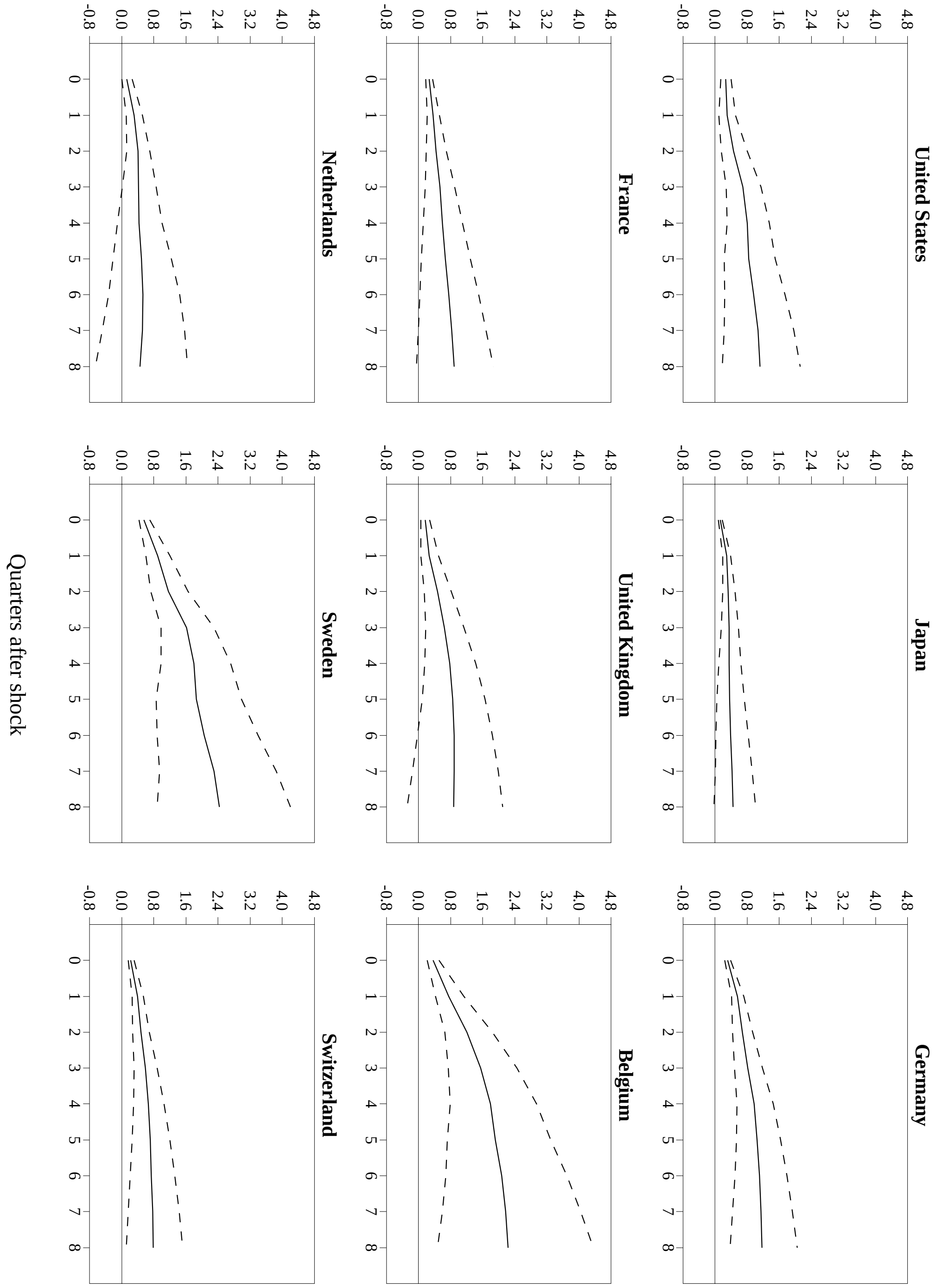
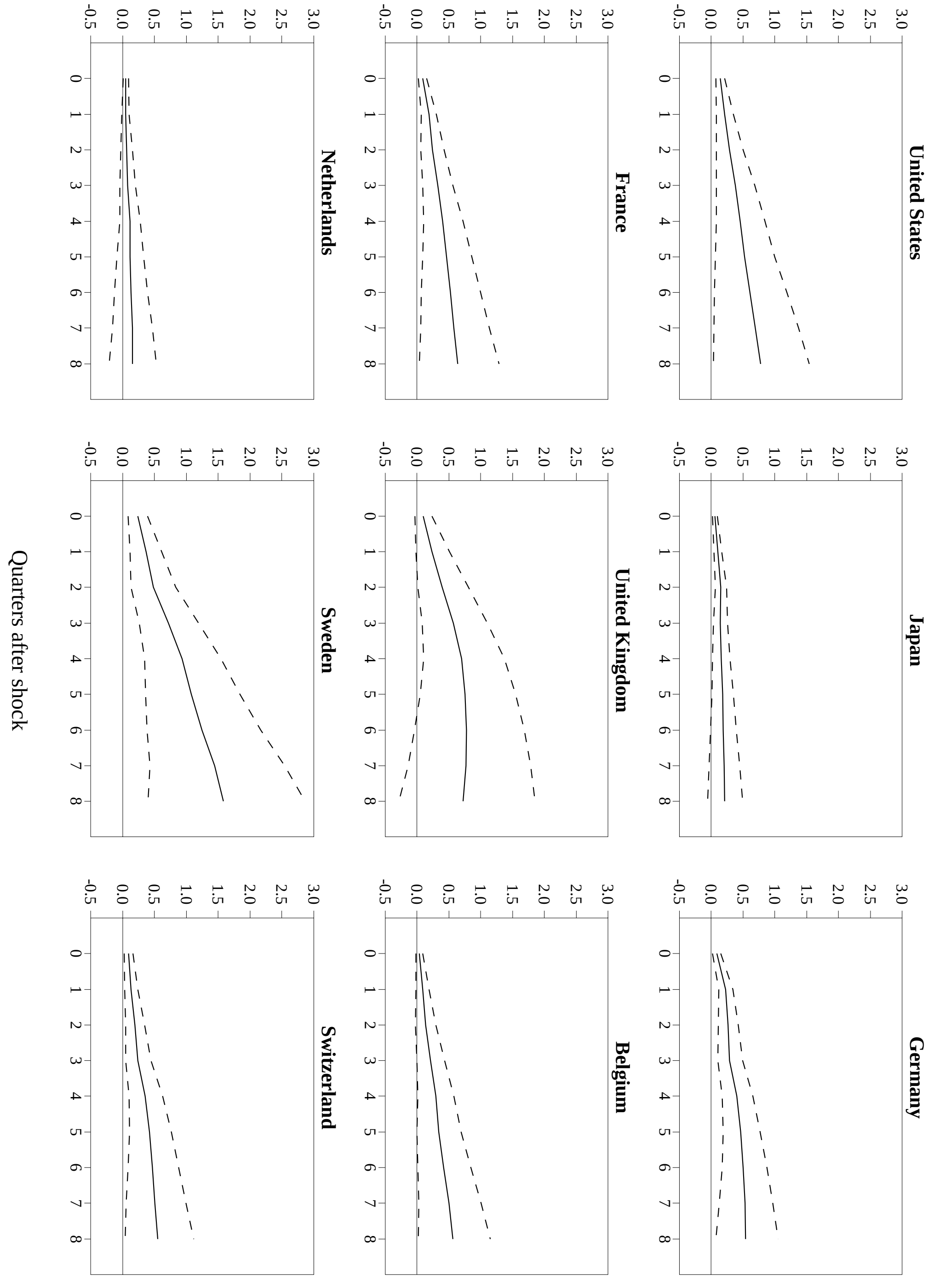


Figure 5

Response of CPI to 1% increase in import prices



For the CPI responses, many of the correlations between the responses and these factors are contrary to the hypotheses posited in Section 2 (panel b). Import share is negatively correlated with these responses, although not significantly so. Both exchange rate and GDP volatility are positively related to this pass-through, but the relationship is strong only at shorter horizons. Finally, greater competitiveness is associated with a larger initial response, but there is little relationship thereafter. These weak correlations suggest that the pass-through of import prices to consumer prices varies across countries in a more idiosyncratic manner than do other pass-throughs, possibly reflecting country-specific market structures not captured by the variables considered in this study.

Table 3

Rank correlation between impulse responses to import prices and factors influencing pass-through

(a) Impulse response of PPI				
	Response horizon			
Factor	0	1	4	8
Import share	0.267	0.550*	0.233	0.217
Exchange rate volatility	–0.350	–0.583**	–0.183	–0.300
GDP volatility	0.183	0.300	0.350	0.167
Competitiveness	–0.467*	–0.600**	–0.333	–0.483*
(b) Impulse response of CPI				
Import share	–0.333	–0.400	–0.250	–0.083
Exchange rate volatility	0.567*	0.483*	0.383	0.267
GDP volatility	0.417	0.533*	0.300	0.050
Competitiveness	0.517*	0.083	0.150	0.150

* Significant at the 10% level (critical value = 0.467). ** Significant at the 5% level (critical value = 0.583). *** Significant at the 1% level (critical value = 0.767).

Overall, the results in this section indicate a somewhat stronger pass-through from import price shocks (not related to exchange rate shocks) to domestic PPIs and CPIs, although the pass-through is far from complete. Also, the pass-through to consumer prices across countries is more idiosyncratic than the other pass-throughs studied, implying that other less easily measured factors are behind these differences.

5.3 Variance decomposition

Although the impulse responses provide information about the size of the pass-through of exchange rate and import price shocks to domestic producer and consumer prices, they do not indicate how important these shocks have been in domestic price fluctuations over the sample period. To provide some information on this, I examine the variance decompositions of the price variables.

I begin by examining the importance of exchange rate pass-through for import price fluctuations (Table 4).[16] Exchange rate shocks are especially important in explaining import price variance for the United Kingdom, where their share ranges from over 30 to 45%. In the other countries, exchange rates explain from 10 to 25% of import price forecast variance initially. This percentage declines in all countries as the forecast horizon increases, so that it ranges from 2 to 15% (with the exception of the United Kingdom) at the two-year horizon.

Table 4

Percentage of import price forecast variance attributed to exchange rate shocks

	Forecast horizon			
Country	0	1	4	8
United States	16.3	12.9	9.2	14.5
Japan	24.3	17.4	9.8	4.6
Germany	26.4	21.0	18.5	12.7
France	16.6	18.7	16.2	9.8
United Kingdom	44.5	45.4	38.6	32.4
Belgium	13.4	16.1	15.0	12.6
Netherlands	6.7	8.9	11.7	10.5
Sweden	27.1	15.8	4.3	1.8
Switzerland	10.8	7.7	5.1	2.7
Spearman rank correlation coefficient with:				
Import share	–0.533*	–0.433	–0.100	–0.250
Exchange rate volatility	0.583**	0.217	–0.183	0.033
GDP volatility	0.383	–0.067	–0.250	–0.250
Competitiveness	–0.167	–0.450	–0.367	0.117

* Significant at the 10% level (critical value = 0.467). ** Significant at the 5% level (critical value = 0.583). *** Significant at the 1% level (critical value = 0.767).

The lower part of Table 4 displays the rank correlations between the percentage of import price variance attributed to exchange rate shocks and the factors listed in Section 5.1. Mean import share is negatively associated with this percentage, although the relationship is strong only at shorter horizons. Exchange rate volatility is positively associated with this percentage at shorter horizons, suggesting the effect of greater exchange rate fluctuations counteracts the smaller import price response documented in Section 5.1. However, there is no apparent relationship at longer horizons. GDP volatility is not correlated with this percentage, while there is a weak indication that exchange rates explain less import price variance in more competitive countries.

[16] The complete variance decomposition of import prices as well as the PPI and the CPI can be found in the Appendix to Tables A1–A3.

For producer prices, the percentage of variance explained by external factors – exchange rates and import prices – is quite high in many countries, which may be surprising since the PPI used here excludes imported goods (Table 5). These factors explain one-third or more of variance of PPI (at least for some horizons) in five countries – Germany, France, Belgium, Sweden and Switzerland. Their contribution in the other countries is more modest. The differences across countries appear to be positively related with GDP volatility at shorter horizons and negatively related with the competitiveness measure at longer horizons.

Table 5

Percentage of PPI forecast variance attributed to exchange rate and import price shocks

	Forecast horizon			
Country	0	1	4	8
United States	12.3	8.2	13.4	14.6
Japan	21.1	29.9	17.3	13.9
Germany	48.8	44.4	45.7	45.3
France	33.4	29.6	21.2	18.4
United Kingdom	8.8	8.7	16.3	15.8
Belgium	20.9	29.8	46.9	51.8
Netherlands	5.3	10.1	11.4	11.4
Sweden	41.6	39.7	44.6	46.1
Switzerland	33.9	37.9	33.0	26.9
Spearman rank correlation coefficient with:				
Import share	–0.133	0.067	0.283	0.400
Exchange rate volatility	0.000	–0.100	–0.350	–0.367
GDP volatility	0.467*	0.600**	0.200	0.233
Competitiveness	–0.417	–0.517*	–0.733**	–0.600**

* Significant at the 10% level (critical value = 0.467). ** Significant at the 5% level (critical value = 0.583). *** Significant at the 1% level (critical value = 0.767).

The influence of external factors on CPI variance is less than it is for the PPI, even though imported goods are included in the CPI (Table 6). In most of the countries, these factors explain less than 20% of the variance of the CPI, although this percentage tends to increase as the forecast horizon increases. At shorter horizons, none of the factors I have considered have a strong relationship with the percentage of CPI variance attributed to external factors. However, at longer horizons this percentage tends to be higher for countries with a larger import share, lower exchange rate volatility, and a lower competitiveness ranking.

In summary, the variance decompositions indicate that external factors explain only a modest proportion of the forecast variance of domestic consumer prices over the post-Bretton Woods era. As

Table 6

Percentage of CPI forecast variance attributed to exchange rate and import price shocks

	Forecast horizon			
Country	0	1	4	8
United States	10.3	8.8	8.9	10.5
Japan	8.2	14.5	15.6	11.1
Germany	7.0	17.6	27.2	25.3
France	13.2	17.9	17.7	16.7
United Kingdom	3.2	5.4	10.8	10.4
Belgium	3.4	7.1	18.8	26.5
Netherlands	12.9	16.7	17.2	15.1
Sweden	10.6	16.6	22.8	27.5
Switzerland	6.2	7.3	13.6	16.9
Spearman rank correlation coefficient with:				
Import share	–0.033	–0.133	0.300	0.533*
Exchange rate volatility	–0.200	–0.300	–0.533*	–0.550*
GDP volatility	–0.200	0.000	0.267	0.317
Competitiveness	–0.033	–0.367	–0.883***	–0.667**

* Significant at the 10% level (critical value = 0.467). ** Significant at the 5% level (critical value = 0.583). *** Significant at the 1% level (critical value = 0.767).

expected, the influence of these factors appears to be somewhat greater in the more open economies, although the relationship is strong only at longer horizons. Again at longer horizons, the influence of external factors is less in countries with less volatile exchange rates as well as those countries identified as more "competitive". With regard to the latter correlation, it appears that importers are willing (or feel compelled) to adjust profit margins to maintain market share in those countries whose business climate is considered competitive.

6. Recent influence of external factors

The analysis in the previous section suggests that external factors have had only a modest effect on domestic price fluctuations during the post-Bretton Woods era. Nonetheless, these factors could still have been a significant contributor to the recent disinflation in the United States and the United Kingdom (as well as domestic price fluctuations in the other countries) if the shocks to these factors have been large and/or persistent.

To investigate the recent influence of external factors, I use a historical decomposition of the VAR model for the period 1996:1–1998:4.[17] In this decomposition, a base projection is made using the

[17] Because of data availability, the historical decompositions for France and the United Kingdom are from 1996:1–1998:3.

actual data up to 1995:4 and assuming no subsequent shocks occur in any of the variables of the model. Then, using the estimated shocks to each of the variables, the projection error can be decomposed into the contributions from the shocks to each variable.

I begin with the decomposition of import price inflation to investigate how unusual recent import price behaviour has been in these countries. The results are presented in Table 7. The first column of the table display the actual annualised percentage change of import prices over 1995:4–1998:4. The second column has the base projection, and the third has the projection error (projection – actual). The last three columns display the contributions of the shocks combined into three groups: demand and supply shocks (oil price and output gap), external factors (exchange rate and import price shocks), and domestic price shocks (PPI and CPI). The contribution is defined as the difference between the base projection and the projection that includes the associated shocks.[18]

Table 7

Historical decomposition of import prices: 1995:4–1998:4

Annualised percentage changes

		No subsequent shocks:		Contribution of shocks (percentage points):[1]		
Country	Actual	Projection	Projection error	Oil price and output gap	Ex. rate and import price	PPI and CPI
United States	–3.8	0.7	–4.4	–1.2	–2.5	–0.7
Japan	0.2	–3.5	3.7	4.8	1.2	–2.2
Germany	–0.6	0.0	–0.6	1.4	–2.7	0.8
France[2]	0.7	–1.5	2.2	3.5	–0.8	–0.5
United Kingdom[2]	–4.7	1.7	–6.4	0.5	–5.7	–1.3
Belgium	1.2	0.5	0.6	2.5	–0.4	–1.4
Netherlands	–1.0	–2.6	1.6	1.0	0.9	–0.3
Sweden	0.0	3.6	–3.5	0.5	–2.0	–2.0
Switzerland	–1.8	–0.6	–1.2	0.9	–1.9	–0.2

[1] Because the model is estimated in log differences while import price inflation in this table is expressed as an annualised percentage rate, the contributions of the shocks do not add up exactly to the projection error. [2] Because of data availability, the decomposition is until 1998:3 for France and the United Kingdom.

According to the model, import price inflation was below its projection in just over one-half of the countries in the sample – the United States, Germany, the United Kingdom, Sweden and Switzerland.

[18] Because the table displays the more familiar annualised percentage changes rather than the log differences in which the model was estimated, the contributions do not add up exactly to the projection error.

Shocks to external factors contributed to the lower import price inflation in these countries as well as France and Belgium. In countries other than the United States and the United Kingdom, the disinflationary effects of negative shocks to import prices stemming from the Asian crisis overwhelmed the inflationary effects of exchange rate depreciation. As far as the other variables are concerned, supply and demand shocks contributed to higher import price inflation in all countries except the United States. In contrast, domestic price shocks lowered import price inflation except in Germany.

Moving to domestic price behaviour, actual PPI inflation was less than projected except in Japan and the Netherlands (Table 8). Shocks to the external factors reduced PPI inflation in this period in all countries except the Netherlands. Therefore, these factors contributed to lower PPI inflation not only in the United States and the United Kingdom (whose currencies appreciated), but also in depreciating currency countries like Germany and Japan. As was the case for import price inflation, supply and demand shocks in this period tended to increase PPI inflation except in the United States. Finally, price shocks reduced PPI inflation in all of the countries, suggesting that the recent disinflation has been influenced by factors outside the model, which may include a greater policy emphasis on reducing inflation.

Table 8

Historical decomposition of PPI: 1995:4–1998:4

Annualised percentage changes

		No subsequent shocks:		Contribution of shocks (percentage points):[1]		
Country	Actual	Projection	Projection error	Oil price and output gap	Ex. rate and import price	PPI and CPI
United States	0.6	2.1	–1.5	–0.5	–0.4	–0.5
Japan	–0.9	–1.1	0.2	1.6	–0.5	–1.0
Germany	–0.1	1.3	–1.3	0.2	–1.2	–0.4
France[2]	–0.8	–0.5	–0.3	1.5	–1.0	–0.8
United Kingdom[2]	1.1	3.5	–2.4	0.7	–1.6	–1.4
Belgium	–0.4	0.4	–0.8	1.5	–0.3	–2.0
Netherlands	0.5	–0.8	1.3	0.8	0.6	–0.2
Sweden	–0.4	3.2	–3.6	0.2	–2.2	–1.5
Switzerland	–1.4	–0.1	–1.3	0.3	–1.1	–0.6

[1] Because the model is estimated in log differences while import price inflation in this table is expressed as an annualised percentage rate, the contributions of the shocks do not add up exactly to the projection error. [2] Because of data availability, the decomposition is until 1998:3 for France and the United Kingdom.

The story for consumer price inflation is similar to that of producer price inflation (Table 9). Except for Japan and the Netherlands, actual CPI inflation was below the model's base projection. Shocks to the external factors were negative contributors except for Belgium and the Netherlands. So these factors reduced inflation not only in countries where the currency had appreciated, but also in a number of countries where the currency had depreciated. Except for the United States and Sweden, supply and demand shocks contributed to higher consumer price inflation during this period. Domestic price shocks reduced CPI inflation in all countries during this period, suggesting that some factors outside the model have contributed to the disinflation. In particular, this may reflect a greater policy emphasis on reducing inflation during this period.[19]

Table 9

Historical decomposition of CPI: 1995:4–1998:4

Annualised percentage changes

Country	Actual	No subsequent shocks: Projection	Projection error	Contribution of shocks (percentage points):[1] Oil price and output gap	Ex. rate and import price	PPI and CPI
United States	2.2	3.5	–1.3	–0.3	–0.3	–0.6
Japan	1.1	1.0	0.1	0.9	–0.3	–0.5
Germany	1.3	2.3	–1.0	0.0	–0.5	–0.5
France[2]	1.1	1.4	–0.3	0.8	–1.0	0.0
United Kingdom[2]	3.1	4.2	–1.1	0.6	–0.6	–1.1
Belgium	1.5	2.1	–0.6	0.6	0.0	–1.1
Netherlands	2.2	1.4	0.8	0.1	0.6	0.1
Sweden	0.0	4.3	–4.3	–0.2	–1.7	–2.4
Switzerland	0.3	1.5	–1.1	0.4	–1.1	–0.5

[1] Because the model is estimated in log differences while import price inflation in this table is expressed as an annualised percentage rate, the contributions of the shocks do not add up exactly to the projection error. [2] Because of data availability, the decomposition is until 1998:3 for France and the United Kingdom.

Overall, the historical decompositions of the last three years suggest that exchange rates and import prices have been a larger factor in the disinflation of the period than would be suggested from their modest contributions to inflation over the post-Bretton Woods era. A major reason for the larger

[19] In the case of the United States, another factor that may have contributed to negative CPI shocks was the implementation of methodological changes in the CPI during this period. It would be desirable to use a methodologically consistent series, but the historical data have not yet been updated with the new methodology. So, for now, I am using the published historical series.

contribution during this period is probably the global overcapacity in many goods induced by the Asian crisis, which contributed to a decline in the world prices of many goods imported by the industrialised economies. Nevertheless, it appears that tighter monetary policy in these countries during this period also contributed to the disinflation.

7. Has the influence of external factors changed?

When discussing the influence of exchange rates and import prices on domestic inflation, pundits frequently point to greater global integration and competition as reasons for a greater pass-through of these factors. On the other hand, central banks have been more concerned with price stability during the last two decades. This would imply that monetary authorities may have counteracted the inflationary impact of these external shocks, reducing the measured pass-through over time.[20]

Therefore, the pass-through of external factors to domestic inflation may have changed over the period of estimation. To investigate this, I use a simple strategy of estimating the model over a shorter sample period that does not include the 1970s.[21] Balancing the concerns of using data from as late in the sample period as possible and of having sufficient observations for estimation, I decided to estimate the model from 1983:1 to 1998:4. I then examine some of the statistics discussed previously, concentrating solely on the CPI for brevity.[22]

First, examining the impulse response of the CPI to an import price shock, the differences between the responses estimated over the whole sample and those estimated over the shorter sample are small and probably statistically insignificant (Figure 6). Nevertheless, an import price shock appears to have a less inflationary effect during the later sample period in the United States, Japan, France, the United Kingdom and Sweden. Therefore, the impulse response functions do not indicate a greater pass-through from import prices to consumer prices during the 1980s and 1990s. In addition, the cross-country rank correlations between the responses and the factors listed in Section 5.1 retain the same signs, although they are somewhat weaker than they are in the full sample.

From the variance decomposition of the CPI in the later sample, external factors continue to contribute modestly to CPI fluctuations (Table 10). The proportion of the CPI forecast variance explained by

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[20] Some small open economies, most prominently Canada and New Zealand, began to use a monetary conditions index as a guide to monetary policy during this period. Such indices include the country's exchange rate as a component. The countries in my sample did not formally incorporate such an index in their monetary policy deliberations, but they certainly may have informally incorporated exchange rates and import prices into their policy calculations.

[21] Alternatively, one may wish to estimate a time-varying parameter model to address this issue. However, incorporating such variation in an identified VAR is a difficult exercise (see, for example, Boivin (1998)) and is beyond the scope of this paper.

[22] The conclusions in examining the effects on the PPI are substantially the same.

these factors in the shorter sample period is similar to that in the full sample for most of the countries (upper panel). Thus, by this metric, the external factors do not appear to have become more important in explaining CPI fluctuations. In addition, the relationship between the external factor contribution and the various factors listed in Section 5.1 across countries is similar in the two samples (lower panel).

Figure 6

Response of CPI to 1% increase in import prices

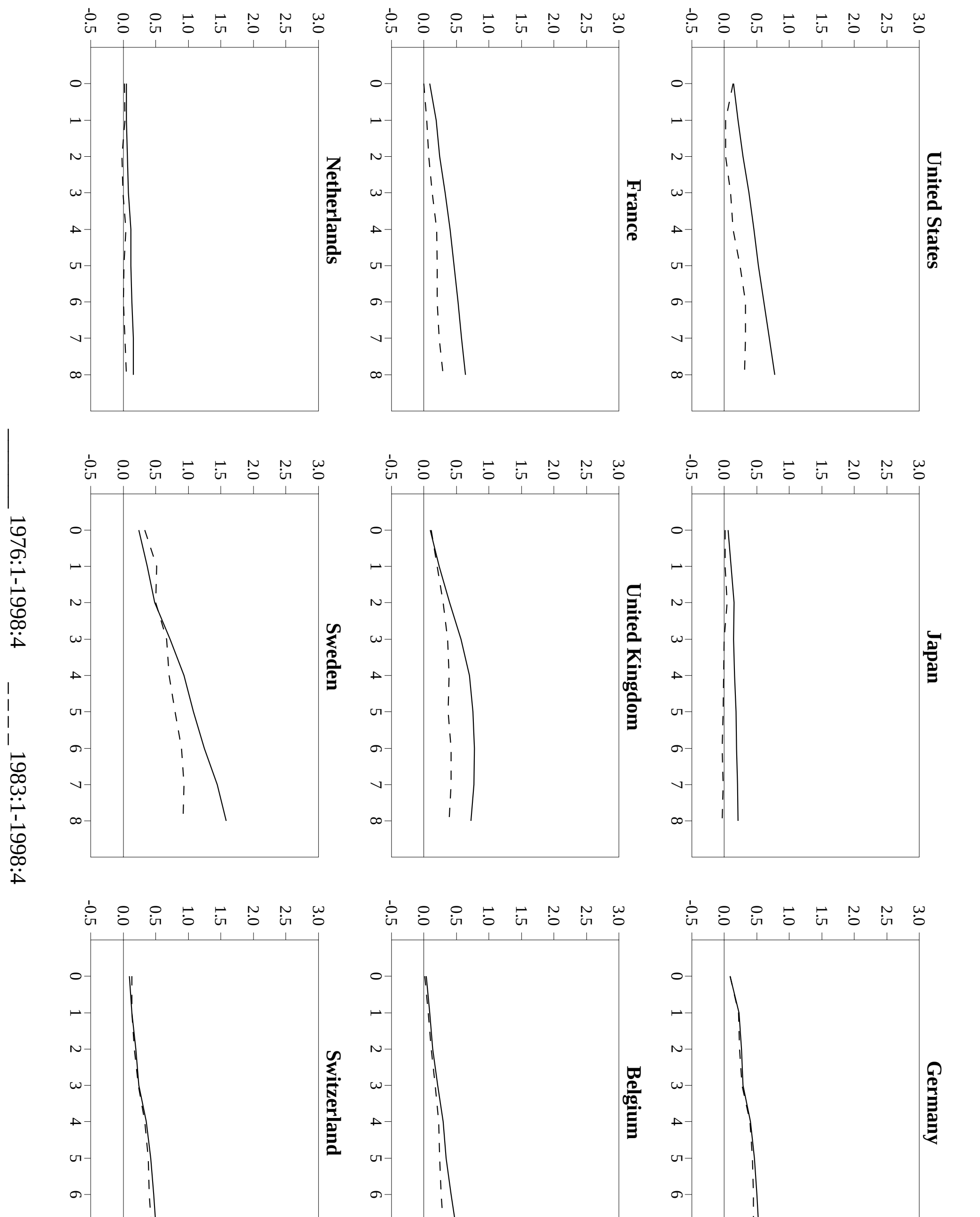

Table 10

Percentage of CPI forecast variance attributed to exchange rate and import price shocks

Model estimated over 1983:1–1998:1

	Forecast horizon			
Country	0	1	4	8
United States	11.5	4.1	1.8	5.3
Japan	5.3	7.0	3.4	1.7
Germany	3.4	8.2	15.2	11.4
France	1.6	4.9	24.5	32.7
United Kingdom	6.2	9.1	17.3	17.4
Belgium	1.8	4.7	17.9	24.3
Netherlands	7.6	16.5	18.6	15.5
Sweden	26.7	34.4	27.5	20.9
Switzerland	14.2	12.5	14.8	14.0
Spearman rank correlation coefficient with:				
Import share	0.050	0.333	0.600**	0.667**
Exchange rate volatility	0.383	0.033	–0.517*	–0.583**
GDP volatility	–0.067	0.400	0.400	0.050
Competitiveness	0.667**	0.117	–0.517*	–0.483*

* Significant at the 10% level (critical value=0.467). ** Significant at the 5% level (critical value = 0.583). *** Significant at the 1% level (critical value = 0.767).

Concentrating on the last three years' disinflation, the historical decomposition suggests a smaller contribution of external factors to the disinflation (Table 11). Except for the United Kingdom, external factors have a lesser disinflationary effect in the model estimated over the later period than in the model estimated over the full sample. The disinflationary contributions in most countries except the United Kingdom come from the price shocks, suggesting again that there have been influences outside the model that have contributed to the disinflation. Among such influences may be a greater policy emphasis on reducing inflation, a factor particularly relevant in the European economies during the run-up to the introduction of the euro.

Overall, these results suggest that the exchange rate and import prices have not assumed a bigger role in domestic consumer price inflation in recent years. There is even some suggestion that they may have had a smaller role. In any case, the conclusion that the pass-through is modest still appears to hold in this later period.

Table 11

Historical decomposition of CPI: 1995:4–1998:4

Annualised percentage changes (model estimated over 1983:1–1998:1)

		No subsequent shocks:		Contribution of shocks (percentage points):[1]		
Country	Actual	Projection	Projection error	Oil price and output gap	Ex. rate and import price	PPI and CPI
United States	2.2	3.1	–0.9	–0.2	–0.1	–0.6
Japan	1.1	1.5	–0.5	0.0	–0.1	–0.4
Germany	1.3	1.9	–0.6	0.1	0.0	–0.7
France[2]	1.1	1.8	–0.7	0.1	0.1	–0.8
United Kingdom[2]	3.1	3.9	–0.8	–0.6	–0.7	0.5
Belgium	1.5	1.7	–0.3	0.5	0.1	–0.8
Netherlands	2.2	1.8	0.4	0.1	0.2	0.0
Sweden	0.0	2.1	–2.1	–0.2	–1.2	–0.8
Switzerland	0.3	0.8	–0.5	0.5	–0.5	–0.5

[1] Because the model is estimated in log differences while import price inflation in this table is expressed as an annualised percentage rate, the contributions of the shocks do not add up exactly to the projection error. [2] Because of data availability, the decomposition is until 1998:3 for France and the United Kingdom.

8. Conclusion

This paper has examined the pass-through of external factors – the exchange rate and import prices – to domestic inflation for several industrialised economies. Using a VAR model of a distribution chain, my results can potentially reconcile some of the recent findings concerning the effect of globalisation on the US inflation process. First, the impulse responses and variance decompositions estimated over the post-Bretton Woods period show that the effect of external factors on domestic inflation is quite modest in most of these countries, including the United States. This would suggest that when looking over this whole period, external variables like global capacity have had little effect on domestic inflation, consistent with Tootell's (1998) results for the United States.

However, when I examine the recent disinflation episode, I find that external factors have a sizable disinflationary effect in all of the countries, in particular the United States and the United Kingdom. Although the pass-through is generally modest, the shocks to these factors during 1996–98 were sufficiently large and/or frequent to have a significant disinflationary effect. Therefore, concentrating on the mid to late 1990s, as do Boldin (1998) and Koenig (1998), external factors appear to improve the forecast of US consumer price inflation.

These results also have several implications for monetary policy in the industrialised countries. One is that although external factors have contributed to the disinflation of the 1990s, their contribution has mostly been modest. Thus much of the decline in inflation during this decade has come from other, presumably more permanent factors, indicating that central banks have been successful in reducing inflation trends and expectations. Another implication is that recent fluctuations in exchange rates and import prices resulting from the recent economic turmoil and the nascent recovery from it will probably have modest effects on domestic PPI and CPI inflation in the industrialised world unless domestic policy mistakes are made.

Nevertheless, because of the recent financial and economic crises in several emerging markets and their effects on the global prices of some goods as well as increasing globalisation, more research on the extent to which pass-through may have changed in recent years is necessary. A model that incorporates time variation in some of its parameters may be desirable for such an investigation. Furthermore, additional investigation into the sources of the 1990s disinflation is needed; in particular, the role and sources of the domestic “price shocks” in the historical decomposition. Such an investigation may also provide more insight into the mechanisms behind the pass-through of exchange rates and import prices to domestic prices.

A. Data appendix

This appendix describes some of the details in the construction of the variables used in this study. As mentioned in the text, the data come from the BIS Data Bank. I first discuss variables whose construction is common for all the countries. I then discuss the construction of GDP, the import price index, the PPI, and the CPI for each country separately, as the details in their construction differ across countries.

A.1 Common variable construction

Local currency oil price index: This is constructed for each country using a US dollar-based crude oil price index from the BIS Data Dank (1990=100, quarterly average of monthly data). This is converted into a local currency index using an index of the currency's exchange rate versus the US dollar (1990=1.00, quarterly average of monthly data).

Output gap: As discussed in the text of the paper, the output gap is calculated as the residual from a regression of the logarithm of GDP (details for each country are given below) on a constant plus linear and quadratic time trends.

Exchange rate: This is taken as the quarterly average of the BIS-calculated nominal effective exchange rate index versus 25 countries (1990=100).

Import share: This is imports as a percentage of domestic demand (GDP + imports – exports), where all variables are in the same units as GDP (see below for each country).

Competitiveness: This is the average ranking of global competitiveness from 1996–99 as compiled by the World Economic Forum (1999).

A.2 Nation-specific variable construction

A.2.1 United States

GDP: This is gross domestic product valued using billions of 1992 chain-weighted US dollars, seasonally adjusted at an annual rate.

Import price index: This is the national income and product account (NIPA) total import price index (1992=100), seasonally adjusted.

PPI: This is the quarterly average of the monthly finished goods index of the US PPI (1982=100), seasonally adjusted.

CPI: This is the quarterly average of the monthly all-items index of the US CPI (all urban consumers, 1982–84=100), seasonally adjusted.

A.2.2 Japan

GDP: This is gross domestic product in billions of yen valued using 1990 prices, seasonally adjusted at an annual rate.

Import price index: This is the quarterly average of the monthly general index of import prices in Japan (1995=100), not seasonally adjusted. The series is seasonally adjusted by regressing the log difference of the series on quarterly dummy variables.

PPI: This is the quarterly average of the monthly general wholesale price index for domestic products for domestic use (1995=100), not seasonally adjusted. The series is seasonally adjusted in the same manner as the import price series.

CPI: This is the quarterly average of the monthly all-Japan general CPI (1995=100), not seasonally adjusted. The series is seasonally adjusted in the same manner as the import price series.

A.2.3 Germany

GDP: This is constructed by splicing two series. The first is all-German gross domestic product in billions of marks using 1991 prices, seasonally adjusted, which begins in 1991:1. Prior to that, I use western German gross domestic product in billions of marks at 1991 prices, seasonally adjusted. The latter series is reindexed so that the 1991:1 values of the two series are equal.

Import price index: This is the quarterly average of the monthly general import price index (1991=100), seasonally adjusted, which is available for western and eastern Germany combined over the entire sample period.

PPI: This is constructed by splicing two series. The first is the all-German PPI excluding the VAT for domestic sales of manufactures (1991=100), not seasonally adjusted, which begins in 1991:1. Prior to that, I use the western German version of the same series. The latter series is reindexed so that the 1991:1 values of the two series are equal. The spliced series is seasonally adjusted by regressing the log difference of the series on quarterly dummy variables.

CPI: This is constructed in the same manner as the PPI. The two series that are spliced are the all-German all-items cost of living index (1991=100), seasonally adjusted, which begins in 1991:1 and the western German version of the same.

A.2.4 France

GDP: This is gross domestic product in millions of French francs valued using 1980 prices, seasonally adjusted.

Import price index: This is the implicit price deflator for imports of goods and services in the GDP accounts (1980=100), seasonally adjusted.

PPI: This is the quarterly producer price index for industrial products (1980=100), seasonally adjusted.

CPI: This is constructed by splicing two series. The first is the quarterly average of the monthly retail consumer price index, all items (1990=100), not seasonally adjusted, which begins in 1990:1. Prior to that, I use the retail price index, total (1980=100), not seasonally adjusted. The latter series is reindexed so that the 1990:1 values of the two series are equal. The spliced series is seasonally adjusted by regressing the log difference of the series on quarterly dummy variables.

A.2.5 United Kingdom

GDP: This is gross domestic product (expenditure-based) in millions of pounds sterling using 1990 prices, seasonally adjusted.

Import price index: This is the quarterly general index of import prices (1990=100), not seasonally adjusted. It is seasonally adjusted by regressing the log difference of the series on quarterly dummy variables.

PPI: This is the quarterly average of the monthly producer price index of home market sales of all manufactured products based on the 1992 SIC classification (1990=100), not seasonally adjusted. It is seasonally adjusted in the same manner as the import price index.

CPI: This is the quarterly average of the monthly retail price index, all items (January 1987=100), not seasonally adjusted. It is seasonally adjusted in the same manner as the import price index.

A.2.6 Belgium

GDP: This is constructed by splicing two series. The first is gross domestic product in billions of Belgian francs using 1990 prices, seasonally adjusted, which begins in 1984:1. For 1980:1–1983:4, I use a discontinued gross domestic product series in billions of Belgian francs using 1985 prices, seasonally adjusted. The latter series is reindexed so that the 1984:1 values of the two series are equal.

Import price index: This is the quarterly average of the monthly imported goods producer price index (1990=100), not seasonally adjusted. It is available beginning in 1980, which matches the period for which GDP is available. The series is seasonally adjusted by regressing the log difference of the series on quarterly dummy variables.

PPI: This is constructed by splicing two series. The first is the quarterly average of the monthly index of producer prices for domestic sales of finished manufactures (1990=100), not seasonally adjusted, which begins in 1980:1. Prior to that, I use a discontinued quarterly average of the monthly index of producer prices for finished manufactures (1980=100), not seasonally adjusted. The latter series is reindexed so that the 1980:1 values of the two series are equal. The spliced series is seasonally adjusted in the same manner as the import price index series.

CPI: This is constructed by splicing three series. The first is the quarterly average of the monthly general consumer price index (1996=100), seasonally adjusted, which begins in 1991:1. The second is the quarterly average of a discontinued monthly general consumer price index (1980=100), seasonally adjusted, which begins in 1980:1. The second series is reindexed to the 1991:1 value of the first series. The third series is the quarterly average of another discontinued monthly general consumer price index (1980=100), seasonally adjusted, which begins in 1970:1. The third series is reindexed to the 1980:1 value of the reindexed second series.

A.2.7 Netherlands

GDP: This is gross domestic product in millions of Dutch guilders using 1990 prices at purchasers' values, seasonally adjusted.

Import price index: This is constructed by splicing two series. The first is the quarterly average of the monthly general import price index (1990=100), not seasonally adjusted, which begins in 1981:1. Prior to that, I use the unit value of total imports (1990=100), not seasonally adjusted. The latter series is reindexed so that the 1981:1 values of the two series are equal. The spliced series is seasonally adjusted by regressing the log difference of the series on quarterly dummy variables.

PPI: This is the quarterly average of the monthly producer price index excluding exports and imports (1990=100), not seasonally adjusted. The series is seasonally adjusted in the same manner as the import price series.

CPI: This is the quarterly average of the monthly all-items consumer price index for all households (1995=100), seasonally adjusted.

A.2.8 Sweden

GDP: This is constructed by splicing two series. The first is gross domestic product in millions of Swedish kronor using 1991 prices, not seasonally adjusted, which begins in 1980:1. Prior to that, I use a discontinued gross domestic product series in millions of Swedish kronor using 1980 prices, not seasonally adjusted. The latter series is reindexed so that the 1980:1 values of the two series are equal to the 1980:1 value of the 1991-price series. The resulting series is seasonally adjusted using the US Census X-11 program.[23]

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[23] Seasonally adjusting by regressing the log difference of the not seasonally adjusted series on quarterly dummy variables had no substantive effect on the results.

Import price index: This is constructed by splicing two series. The first is the quarterly average of the monthly general import price index (1990=100), not seasonally adjusted, which begins in 1990:1. Prior to that, I use the quarterly average of a discontinued monthly index of import prices (ISIC 1–3, 1968=100), not seasonally adjusted. The latter series is reindexed so that the 1990:1 values of the two series are equal. The spliced series is seasonally adjusted by regressing the log difference of the series on quarterly dummy variables.

PPI: This is constructed by splicing two series. The first is the quarterly average of the monthly producer price index for home sales (1990=100), not seasonally adjusted, which begins in 1990:1. Prior to that, I use the quarterly average of the monthly general domestic supply price index (1968=100), not seasonally adjusted. The latter series is reindexed so that the 1990:1 values of the two series are equal. The spliced series is seasonally adjusted in the same manner as the import price series.

CPI: This is the quarterly average of the monthly all-items consumer price index (1980=100), not seasonally adjusted. The series is seasonally adjusted in the same manner as the import price series.

A.2.9 Switzerland

GDP: The construction of this series is similar to that of the Swedish GDP series. The primary series is gross domestic product in millions of Swiss francs using 1990 prices, not seasonally adjusted, which begins in 1980:1. Prior to that, I use a discontinued gross domestic product series in millions of Swiss francs using 1980 prices, not seasonally adjusted. The series are spliced in the same manner as the Swedish GDP series were spliced, and the resulting series is seasonally adjusted using the US Census X-11 program.[24]

Import price index: This is the quarterly average of the monthly general import price index (May 1993=100), not seasonally adjusted. The series is seasonally adjusted by regressing the log difference of the series on quarterly dummy variables.

PPI: This is the quarterly average of the monthly producer price index excluding imports (May 1993=100), not seasonally adjusted. The series is seasonally adjusted in the same manner as the import price series.

CPI: This is the quarterly average of the monthly all-items consumer price index (May 1993=100), not seasonally adjusted. The series is seasonally adjusted in the same manner as the import price series.

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[24] Again, seasonally adjusting by regressing the log difference of the series on quarterly dummy variables had little impact on the results.

Table A1

Variance decomposition of import prices

Country	Forecast horizon	Oil prices	Output gap	Exchange rate	Import prices	PPI	CPI
		Percentage of forecast variance attributed to:					
United States	0	40.7	7.1	16.3	35.9	0.0	0.0
	1	55.5	9.5	12.9	21.3	0.3	0.6
	4	54.2	19.6	9.2	13.7	0.2	3.1
	8	41.5	29.4	14.5	9.7	0.7	4.2
Japan	0	46.3	2.1	24.3	27.3	0.0	0.0
	1	70.4	1.0	17.4	10.8	0.1	0.3
	4	81.2	0.4	9.8	4.2	1.9	2.6
	8	78.1	3.7	4.6	5.6	4.9	3.1
Germany	0	42.2	0.0	26.4	31.3	0.0	0.0
	1	49.2	0.8	21.0	28.7	0.1	0.1
	4	50.2	2.8	18.5	26.7	0.7	1.2
	8	49.8	5.3	12.7	29.1	2.1	1.0
France	0	29.0	1.2	16.6	53.2	0.0	0.0
	1	37.7	0.5	18.7	41.8	1.1	0.3
	4	38.1	0.8	16.2	32.8	10.3	1.8
	8	33.9	3.3	9.8	30.9	16.2	6.0
United Kingdom	0	19.9	0.2	44.5	35.3	0.0	0.0
	1	24.6	0.1	45.4	25.4	3.8	0.7
	4	22.8	0.3	38.6	27.2	10.5	0.7
	8	22.3	0.6	32.4	24.8	17.5	2.4
Belgium	0	40.4	0.4	13.4	45.9	0.0	0.0
	1	46.4	0.1	16.1	32.6	2.7	2.0
	4	38.8	0.1	15.0	40.8	4.9	0.3
	8	36.3	0.1	12.6	46.4	4.5	0.1
Netherlands	0	65.0	0.5	6.7	27.8	0.0	0.0
	1	71.7	1.2	8.9	18.0	0.1	0.0
	4	66.6	3.5	11.7	17.3	0.8	0.2
	8	66.2	5.9	10.5	15.6	0.9	1.0
Sweden	0	43.3	0.1	27.1	29.5	0.0	0.0
	1	54.2	0.2	15.8	28.3	1.1	0.4
	4	48.7	2.3	4.3	38.5	3.1	3.2
	8	44.5	2.8	1.8	41.5	4.4	5.1
Switzerland	0	25.0	0.4	10.8	63.9	0.0	0.0
	1	28.3	1.8	7.7	58.1	0.9	3.2
	4	28.5	1.8	5.1	52.6	4.6	7.3
	8	26.6	1.5	2.7	50.2	12.1	6.8

Table A2

Variance decomposition of PPI

Country	Forecast horizon	Percentage of forecast variance attributed to: Oil prices	Output gap	Exchange rate	Import prices	PPI	CPI
United States	0	38.9	0.8	0.2	12.1	48.0	0.0
	1	54.4	4.2	0.1	8.1	31.4	1.8
	4	50.5	12.4	0.1	13.2	21.9	1.9
	8	44.0	22.5	1.8	12.8	16.4	2.5
Japan	0	3.3	11.6	0.0	21.1	63.9	0.0
	1	20.3	5.4	1.2	28.7	44.3	0.1
	4	53.2	1.3	0.7	16.6	27.4	0.7
	8	53.8	2.6	1.1	12.8	29.3	0.4
Germany	0	22.6	2.0	5.5	43.3	26.6	0.0
	1	30.8	7.7	3.7	40.6	17.1	0.0
	4	34.1	13.6	7.2	38.5	6.5	0.0
	8	35.1	16.3	5.9	39.4	3.2	0.0
France	0	12.3	1.3	0.7	32.7	52.9	0.0
	1	19.9	2.7	1.0	28.6	47.6	0.3
	4	20.9	3.3	1.5	19.7	49.4	5.2
	8	15.6	5.3	0.5	17.9	48.6	12.2
United Kingdom	0	15.9	1.1	0.1	8.7	74.2	0.0
	1	22.4	0.4	1.1	7.6	68.5	0.1
	4	28.2	2.3	3.3	13.0	51.8	1.4
	8	27.4	6.9	4.0	11.7	47.8	2.2
Belgium	0	50.8	0.0	8.0	12.9	28.3	0.0
	1	43.8	0.1	12.0	17.8	25.5	0.8
	4	32.9	0.3	14.1	32.8	19.7	0.2
	8	32.2	0.5	12.0	39.8	15.2	0.3
Netherlands	0	23.7	0.7	1.3	4.0	70.3	0.0
	1	42.5	0.5	1.4	8.7	46.4	0.5
	4	67.8	4.8	5.4	5.9	14.8	1.2
	8	68.3	5.9	6.0	5.4	12.0	2.4
Sweden	0	24.9	9.0	7.0	34.7	24.5	0.0
	1	31.8	6.5	3.8	35.8	22.1	0.0
	4	31.6	4.7	0.9	43.7	17.6	1.5
	8	28.7	2.8	0.3	45.8	18.6	3.8
Switzerland	0	1.2	2.6	0.6	33.3	62.3	0.0
	1	5.9	5.0	0.5	37.4	51.1	0.1
	4	10.2	5.9	0.3	32.7	49.1	1.8
	8	9.8	5.2	0.5	26.5	56.4	1.7

Table A3

Variance decomposition of CPI

		Percentage of forecast variance attributed to:					
Country	Forecast horizon	Oil prices	Output gap	Exchange rate	Import prices	PPI	CPI
United States	0	32.1	8.5	0.2	10.1	7.1	42.0
	1	44.4	13.3	0.8	8.1	9.6	23.9
	4	43.1	24.3	0.2	8.7	9.0	14.9
	8	35.9	32.5	1.6	8.9	10.2	10.9
Japan	0	1.9	7.7	0.2	8.0	15.5	66.7
	1	4.1	4.1	0.6	13.9	17.2	60.0
	4	22.0	1.0	0.6	15.0	29.0	32.3
	8	31.3	1.8	0.2	10.9	33.7	22.1
Germany	0	7.6	2.4	0.5	6.4	2.1	80.9
	1	18.4	1.3	2.8	14.9	3.6	59.0
	4	25.3	9.5	8.0	19.2	2.2	35.9
	8	26.0	24.4	6.6	18.6	1.1	23.3
France	0	1.3	0.3	5.3	7.8	34.5	50.7
	1	3.5	0.5	5.0	12.8	38.0	40.1
	4	4.3	2.4	1.4	16.3	42.6	32.9
	8	4.6	6.0	0.8	16.0	40.8	32.0
United Kingdom	0	3.2	2.5	0.9	2.3	45.3	45.7
	1	6.3	2.6	1.1	4.3	52.0	33.8
	4	14.5	5.7	0.2	10.6	42.7	26.2
	8	18.2	15.4	0.4	10.0	39.5	16.7
Belgium	0	40.7	3.1	1.5	1.8	4.8	48.1
	1	42.6	3.4	3.8	3.4	19.8	27.1
	4	24.4	3.7	9.2	9.6	29.2	23.9
	8	19.6	1.3	10.2	16.3	30.4	22.2
Netherlands	0	5.4	6.3	6.2	6.7	4.4	71.1
	1	14.7	10.1	12.8	4.0	2.0	56.5
	4	32.4	14.3	13.7	3.5	0.3	35.8
	8	40.7	19.7	12.1	3.0	0.5	23.9
Sweden	0	1.3	7.7	1.1	9.6	3.8	76.6
	1	3.7	7.0	4.0	12.7	4.4	68.2
	4	15.6	4.0	1.6	21.2	6.9	50.6
	8	21.5	8.3	0.4	27.0	9.8	32.9
Switzerland	0	19.8	0.1	0.0	6.2	3.6	70.3
	1	36.8	1.0	0.0	7.2	6.7	48.2
	4	35.0	8.1	2.1	11.5	31.2	12.2
	8	24.3	13.0	3.2	13.7	41.8	4.1

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