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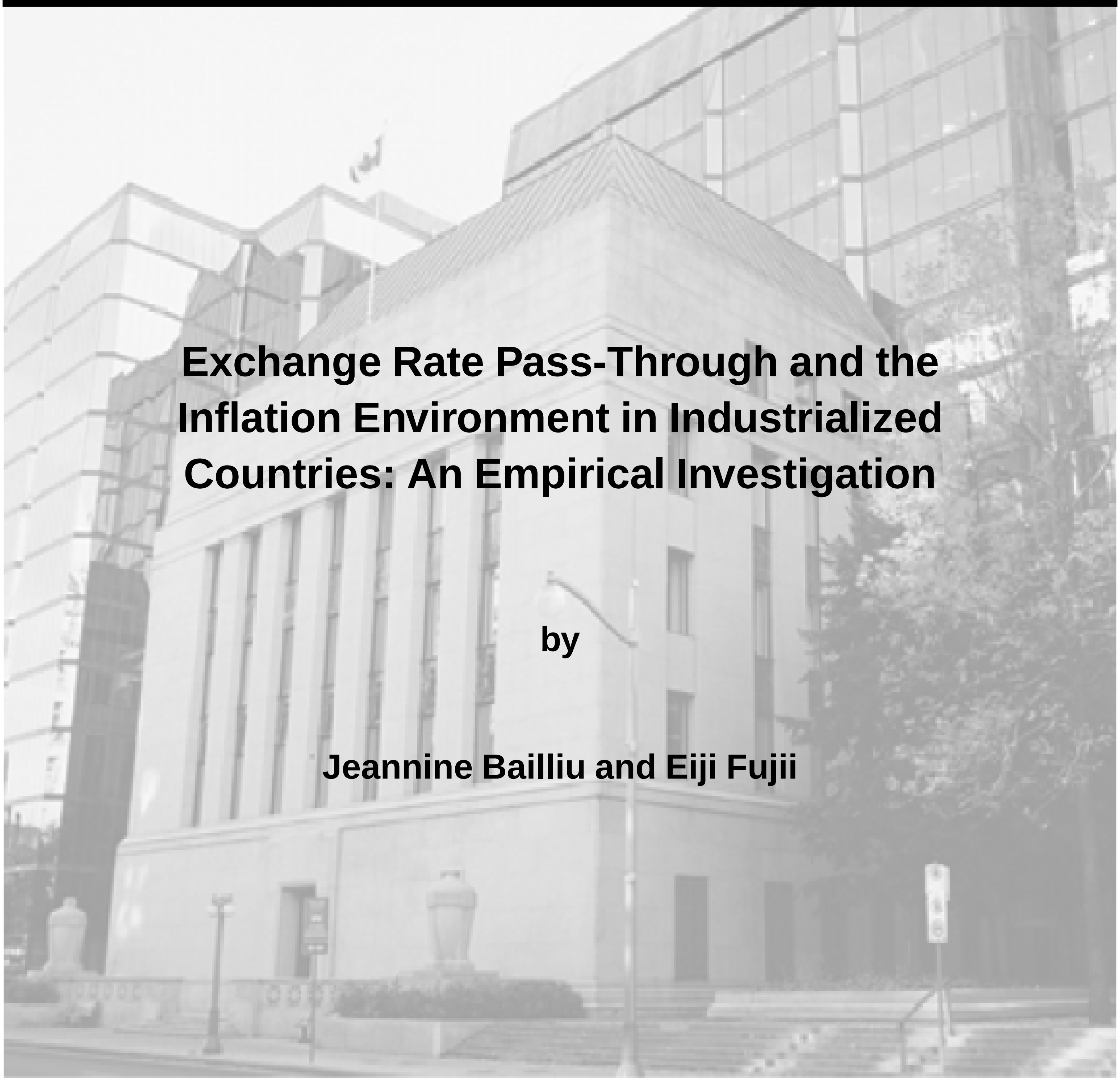

Exchange Rate Pass-Through and the Inflation Environment in Industrialized Countries: An Empirical Investigation

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Jeannine Bailliu and Eiji Fujii

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Jeannine Bailliu

International Department
Bank of Canada
Ottawa, Ontario, Canada K1A 0G9
jbailliu@bankofcanada.ca

and

Eiji Fujii

University of Tsukuba
Japan
efujii@sk.tsukuba.ac.jp

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Abstract

This paper investigates the question of whether a transition to a low-inflation environment, induced by a shift in monetary policy, results in a decline in the degree of pass-through of exchange rate movements to consumer prices. It differs from previous empirical work in its focus on the identification of changes in the inflation environment and its use of a panel-data approach. Evidence from a panel-data set of 11 industrialized countries over the period from 1977 to 2001, supports the hypothesis that exchange rate pass-through declines with a shift to a low-inflation environment brought about by a change in the monetary policy regime. More specifically, the results suggest that pass-through to import, producer, and consumer price inflation declined following the inflation stabilization that occurred in many industrialized countries in the early 1990s but did not decline following a similar episode in the 1980s. Several potential explanations for this finding are discussed, including the possibility that changes in the monetary policy regimes implemented in the 1990s were perceived as more credible than those carried out in the 1980s, and the possibility that the credibility of the new monetary policy regimes was acquired over time.

JEL classification: E31; E42; F31
Bank classification: Inflation and Prices, Exchange Rates, International Topics

Résumé

Dans cet article, les auteurs tentent de répondre à la question de savoir si l'instauration d'un climat de faible inflation, sous l'effet d'une réorientation de la politique monétaire, atténue le degré de transmission des variations du taux de change aux prix à la consommation. Leur étude se démarque des analyses empiriques antérieures car elle s'emploie particulièrement à déceler les changements concernant l'inflation et met à profit une approche reposant sur des données de panel. Les observations recueillies à l'aide d'un ensemble de données de panel se rapportant à onze pays industrialisés et couvrant la période 1997-2001 étayent l'hypothèse selon laquelle le degré de transmission des variations du taux de change s'atténue avec le passage à un climat de faible inflation par suite d'une réorientation de la politique monétaire. Plus précisément, les résultats indiquent que le degré de transmission aux prix à l'importation, à la production et à la consommation aurait diminué après la stabilisation de l'inflation survenue dans bon nombre de pays industrialisés au début des années 1990, mais pas après un épisode similaire qui s'était produit dans les années 1980. Cette constatation génère plusieurs explications potentielles qui sont examinées dans l'article, y compris la possibilité que les changements de politique monétaire opérés dans les années 1990 aient été jugés plus crédibles que ceux mis en place durant les années 1980 ou encore la possibilité que les nouveaux cadres de conduite de la politique monétaire aient acquis leur crédibilité au fil du temps.

Classification JEL : E31; E42; F31
Classification de la Banque : Inflation et prix; Taux de change; Questions internationales

1. Introduction

Starting in the early 1990s, many industrialized countries reduced their inflation rates and entered a period of relative price stability. Although several factors are thought to have contributed to this trend, it is generally agreed that a shift towards more credible monetary policy regimes played an important role.[1] In some countries, such as Australia, Canada, and the United Kingdom, the enhanced credibility was achieved through the adoption of an inflation-targeting framework for monetary policy. In others, such as the United States, monetary policy credibility was boosted through a sustained commitment to maintaining low inflation following a disinflation. Regardless of how monetary policy was improved, however, the outcome was similar across countries. It resulted in an environment in which inflation is lower and more stable.[2]

This low-inflation period in industrialized countries has also coincided with several episodes in which countries have experienced large exchange rate depreciations, which, based on historical experience, had much smaller effects on consumer prices than anticipated. For example, Cunningham and Haldane (1999) examine the experiences of three such countries—the United Kingdom (1992), Sweden (1992), and Brazil (1999)—using an event-study approach. Their study suggests that the pass-through of exchange rate changes to consumer prices in these cases occurred with a lag of several quarters and was incomplete (i.e., less than an amount proportional to the share of imported goods in the consumption basket). Similarly, the response of consumer prices in Canada to the large depreciation in the Canadian dollar in the first half of the 1990s was much smaller than expected.[3]

This common experience has led to the belief, shared by central bankers in many industrialized countries, that the extent of exchange rate pass-through (ERPT) into consumer prices has declined. Furthermore, the fact that this potential decline has coincided with a transition to a low-inflation environment has popularized the view that these two phenomena could be linked. Taylor (2000) was one of the first to formally articulate this view and put forth the hypothesis that the

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1. Other possible factors include favourable shocks, structural change, and increased international competition.
2. See Longworth (2002) for a review of how Canadian monetary policy was able to deliver lower and more stable inflation in the 1990s compared with the previous decade.
3. Laflèche (1996) finds that special factors—such as the restructuring of the retail market, the abolition of customs duties on trade between Canada and the United States, and weakness in the aggregate economy—played an important role in explaining this occurrence. She also suggests that the adoption of inflation targeting in 1991, and the resulting move to a low-inflation environment, may have been a contributing factor. This view is also supported by econometric evidence. Indeed, both Fillion and Léonard (1997) and Kichian (2001) found evidence that, compared to previous decades, the exchange rate pass-through (ERPT) coefficient in a Phillips curve model for Canada fell in the 1990s.

low-inflation environment in many industrialized countries, which was brought about by more credible monetary policies, has successfully reduced the degree of ERPT to domestic prices. He argued that ERPT is primarily a function of the persistence of exchange rate and price shocks, which tend to be reduced in an environment where inflation is low and monetary policy is more credible.

In addition to being intuitively appealing and consistent with anecdotal evidence, Taylor's hypothesis that the move to a low-inflation environment has reduced the rate of ERPT to consumer prices is also theoretically plausible and supported by empirical evidence. Indeed, theoretical models explicitly linking ERPT and the inflation environment have recently emerged as part of the new open-economy macroeconomics (NOEM) literature. The relationship between ERPT and the inflation environment has also been examined empirically in a handful of studies.[4] The majority of these studies are cross-sectional in nature and focus on explaining cross-country variations in pass-through elasticities.[5] Although informative, these studies cannot address the question of whether ERPT has declined in response to a *change* in the inflation environment.

To examine this issue, we opt for a panel-data approach, which enables us to investigate whether ERPT to consumer prices has declined in industrialized countries in response to a change in the inflation environment. More specifically, we estimate the average rate of ERPT, in both the short and long run, in 11 industrialized countries, by using a generalized method of moments (GMM) estimator for dynamic panel-data models. We then examine whether the rate of ERPT exhibits a significant decline as a shift to a low inflation environment occurs. To investigate the question thoroughly, we consider ERPT to consumer, producer, and import prices.

In addition to our panel-data approach, our study also differs from previous empirical work in that we focus on the identification of changes in the inflation environment and we allow for the possibility of multiple breaks. Allowing for the possibility of multiple shifts in the inflation environment seems appropriate in this context, given that many industrialized countries

4. These studies are reviewed in section 2.

5. The one exception is a study by Gagnon and Ihrig (2002). In addition to using a cross-sectional approach, they test whether pass-through declined in each country in their sample following a change in the inflation regime. Our study differs from theirs in that we pay particular attention to the identification of changes in the inflation environment by formally testing for structural breaks in the inflation series in our sample countries, using a test developed by Bai and Perron (1998) that allows for the identification of multiple breaks. We then ensure that these breaks correspond with a change in the monetary policy regime.

experienced two inflation stabilization periods in the post-Bretton Woods era, both of which were achieved by significant shifts in monetary policy.[6]

Using annual data for 11 industrialized countries from 1977 to 2001, we find evidence to support the hypothesis that ERPT declines with a shift to a low-inflation environment brought about by a change in the monetary policy regime. Our results suggest that pass-through to all three price indexes declined following the inflation stabilization period that occurred in many industrialized countries in the early 1990s, but not following a similar episode that occurred in the 1980s.

This paper is organized as follows. Section 2 provides an overview of the literature on ERPT and the inflation environment, and also discusses the analytical framework that underlies our empirical specification. Section 3 presents the specification of the regression model that we use to estimate our cross-country pass-through equation, and reviews the methodology used for estimation. In section 4, we present and discuss estimation results obtained from our cross-country regression model, abstracting away from any effects resulting from a change in the inflation environment. In section 5, we describe our approach to test for the presence of multiple structural breaks in the inflation environment, and then examine the pass-through estimates we obtain when we account for these breaks in inflation. Section 6 concludes.

2. Exchange Rate Pass-Through and the Inflation Environment

2.1 Overview of the literature

Although the degree to which exchange rate movements are reflected in prices has been of interest in international economics for a long time, the question of whether pass-through can be influenced by macroeconomic factors, such as monetary policy, is a more recent occurrence. This is partly because the focus on ERPT in mainstream open-economy macroeconomic models is a relatively new development. Indeed, traditional open-economy macroeconomic models paid little attention to pass-through, given that in such models markets are characterized by perfect competition, prices are assumed to be fully flexible, and purchasing-power parity (PPP) holds at all times, implying that ERPT is complete and immediate. With such a stylized depiction of the pass-through process being a feature of mainstream open-economy macroeconomic models, it is not surprising that, until very recently, most of the research in this area was more microeconomic in nature.

6. Indeed, prior to this most recent episode, inflation was reduced significantly in the early 1980s in many industrialized countries, after rising to double-digit figures as a result of the oil-price shocks of the 1970s and the accommodative policy response to these shocks.

In contrast to how pass-through was being modelled in traditional macro models, the bulk of the pass-through literature approached the question from an industrial-organization perspective and emphasized how pass-through could be incomplete in an environment characterized by imperfect competition and pricing to market.[7] Modelling pass-through as incomplete was thought to be appropriate, given that this approach was suggested by the empirical literature. Indeed, a common finding of earlier pass-through studies—which focused on obtaining empirical estimates of the extent to which the local currency prices of foreign products responded to changes in exchange rates—is that exchange rate changes are passed through to prices only incompletely.[8] Thus, models of pass-through focused on examining industry- or market-specific factors that might influence the pricing behaviour of both producers and consumers. More specifically, they relied on imperfect competition and pricing to market—a situation that arises when markets are segmented and firms with some monopoly power price discriminate across countries.[9] It is assumed in this context that exchange rate movements can be passed through partially into traded goods prices, because producer markups can adjust to compensate.

More recently, pass-through has been examined from a macroeconomic perspective, drawing both on the common finding from the microeconomics literature that ERPT tends to be incomplete and on new developments in the open-economy macroeconomics literature. In the NOEM literature, based mainly on work by Obstfeld and Rogoff (1995), nominal rigidities and market imperfections are introduced into a dynamic general-equilibrium (DGE), open-economy model with well-specified microfoundations. Although PPP holds and pass-through is complete in the framework originally presented by Obstfeld and Rogoff, Betts and Devereux (1996, 2000) extended this model to allow for pricing to market, and therefore incomplete pass-through.

In this type of framework, ERPT will depend on different pricing strategies, such as whether the firm practises producer currency pricing (PCP) or local currency pricing (LCP). As discussed by Betts and Devereux (1996) and Engel (2002), if prices are preset in the currency of the producer, then the home-country price of the foreign good will move one-for-one with changes in the nominal exchange rate; thus there is full pass-through. Consequently, exchange rate movements will lead to a change in the relative price of the goods, and this will lead to a change in consumers' demand for home, relative to foreign, goods. On the other hand, if a firm practises LCP, then prices are preset in the local currency, and changes in the nominal exchange rate will have no short-run effect on prices faced by consumers. Thus, there is no pass-through in the short run.

7. Goldberg and Knetter (1997) provide a comprehensive review of this literature.
8. For example, see Kreinin (1997) and Hooper and Mann (1989).
9. For example, see Marston (1990) and Krugman (1987).

If the economy is best characterized by a combination of firms, some of which practise LCP and some of which follow PCP, then the aggregate degree of pass-through will be partial in the short run. This is consistent with evidence that suggests that the ERPT varies by industry.[10] The assumption that firms in the economy may follow different pricing strategies has also been advanced as an explanation for why ERPT to consumer prices appears to be lower than pass-through to import prices. As discussed in Bacchetta and van Wincoop (2002), this can occur in a model where foreign exporting firms follow PCP, whereas domestic firms—who assemble the imported goods and sell final goods to consumers—prefer to price in the local currency (because they face significant competition from other domestic final goods producers).

The NOEM literature has also examined the extent to which ERPT can depend on a country's inflation performance or monetary policy. As discussed earlier, this work is based on an idea put forth by Taylor (2000), who argued that a shift to a low-inflation environment causes a decline in the expected persistence of cost and price changes, which in turn results in a decline in ERPT. More specifically, several recent papers have developed NOEM-DGE models highlighting the link between pass-through and monetary policy. Emphasizing channels such as a decline in the expected persistence of cost and price changes, a fall in the frequency of price changes, or an increase in the prevalence of LCP, these studies show that a transition to a low-inflation environment—that comes about as a result of a more credible/stable monetary policy—can lead to a lower degree of ERPT.

Choudhri and Hakura (2001) emphasize a channel similar to the one in Taylor (2000) in the context of a DGE model with imperfect competition and staggered contracts. In their model, a low-inflation regime reduces ERPT because the pass-through reflects the expected effect of monetary shocks on current and future costs, which, in turn, are reduced by having a low-inflation regime. Devereux and Yetman (2002) also explore the link between ERPT and monetary policy in the context of a DGE framework. In their model, pass-through is determined by the frequency of price changes of importing firms, and this frequency is a function of the monetary policy regime. Firms in countries where monetary policy is more credible (and hence the mean inflation rate is lower) will tend to change their prices relatively less frequently, leading to a lower degree of pass-through. Finally, Devereux, Engel, and Storgaard (2003) also develop a DGE model linking ERPT to monetary policy. In their framework, the aggregate degree of ERPT is determined by the currency in which the price of imported goods is preset. If prices are sticky in the currency of the exporter, and thus there is a predominance of PCP in the economy, then ERPT will tend to be high. On the other hand, if goods prices are preset in the consumer's currency (consistent with

10. See, for example, Campa and Goldberg (2002).

LCP), then ERPT will tend to be low. Pass-through is linked to monetary policy in that countries with relatively stable monetary policies are assumed to have a prevalence of LCP in the economy.

The relationship between ERPT and the inflation environment has also been examined empirically in a handful of studies. In addition to their theoretical contribution, noted above, Choudhri and Hakura (2001) and Devereux and Yetman (2002) also investigate the role of inflation variables in accounting for cross-country differences in ERPT in a large sample of countries. Their approach involves estimating a first-stage regression for each country in their sample to obtain an estimate of the average pass-through elasticity over a certain time period (usually 25 or 30 years). Then a second-stage specification is estimated where these country-specific average pass-through elasticities are regressed on various explanatory variables, such as inflation performance, exchange rate variability, and openness to trade. Thus, these second-stage regressions do not have a time-series component and focus exclusively on explaining cross-country variations in pass-through. Using this approach on a large sample of countries (both industrialized and developing) over the post-Bretton Woods period, both studies find that cross-country differences in estimated ERPT coefficients can by explained by differences in inflation performance.[11]

Although these studies are informative because they shed light on what might explain cross-country variations in pass-through elasticities, they cannot address the question of whether ERPT has declined in response to a *change* in the inflation environment. A purely cross-sectional analysis cannot tackle this question, given that it uses country-specific measures of pass-through that are averaged over the sample period, and are hence held constant.

Gagnon and Ihrig (2002) address this issue in their study of the link between consumer prices and monetary policy in a sample of 20 industrialized countries over the period from 1971 to 2000. Indeed, in addition to using a cross-sectional approach, as do Choudhri and Hakura (2001) and Devereux and Yetman (2002), they also test whether pass-through declined in each country in the sample following a change in the inflation regime.[12] One regime change was identified for each

11. Campa and Goldberg (2002) use a similar approach in their study of pass-through in Organisation of Economic and Co-operation Development (OECD) countries, although they focus on import rather than on consumer prices. Although they also find a positive association between inflation and ERPT, they conclude that microeconomic factors related to the composition of imports are relatively more important in explaining cross-country differences in pass-through to import prices.

12. In their cross-sectional analysis, Gagnon and Ihrig (2002) also find a systematic relationship between estimated rates of pass-through and inflation. They also examine the link between the pass-through coefficients and parameters estimated from Taylor-type monetary policy rules, but fail to find a robust relationship.

country using a combination of casual inspection of the data and judgment.[13] For each sample country, pass-through equations were then estimated on two subsamples (i.e., pre- and post-regime change). In most cases, the pass-through coefficients were smaller in the second subsample, which the authors interpret as evidence that ERPT has declined in industrialized countries, and that this decline is attributable to the change in the inflation regime.

2.2 Analytical framework

This section presents the analytical framework that underlies the econometric specification that we use to estimate ERPT and to test the hypothesis that aggregate pass-through declines with a shift in the inflation environment. Our approach is to use the standard specification used in the pass-through literature as a starting point. We then adapt it so that it is suitable to estimate pass-through at the aggregate level for all three price indexes considered and to incorporate the influence of the inflation environment on ERPT.

The standard specification used in the pass-through literature is based on the pricing behaviour of exporting firms. This reflects the fact that the earlier literature focused on studying the behaviour of import prices from a microeconomic perspective.[14] It might be useful to consider a simple static profit-maximization problem faced by an exporting firm, as commonly seen in the literature.[15] Let us consider a foreign firm that exports its product to the domestic country. The exporting firm solves the following profit-maximization problem:

$$\max_{p} \ \pi = s^{-1}pq - C(q), \tag{1}$$

where π denotes profits (expressed in the foreign currency), s is the exchange rate measured in units of the domestic currency per unit of the foreign currency, p is the price of the good (denominated in the domestic currency), C(.) is the cost function (in foreign currency units), and q is the quantity demanded for the good.

Solving equation (1) yields the following first-order condition:

13. The identified break dates in the sample countries cover a period starting in 1981 (for countries such as Japan, the United Kingdom, and the United States) and ending in 1993–94 (for Australia and Sweden).
14. This also explains why ERPT was traditionally defined in terms of import prices. Indeed, the traditional definition of ERPT is the percentage change in the local currency price of an imported good resulting from a 1 per cent change in the nominal exchange rate between the exporting and importing countries. This definition has now been expanded to include other types of prices, notably consumer prices.
15. See, for instance, Dornbusch (1987), Knetter (1989), and Marston (1990).

$$p = sC_q\mu, \qquad (2)$$

where C_q is the marginal cost and μ is the markup of price over marginal cost. The markup is further defined as $\mu \equiv \eta/(\eta - 1)$, where η is the price elasticity of demand for the good.[16] The expression for the price level in equation (2) emphasizes that the local currency price of the good can vary as a result of a change in the exchange rate, a change in the firm's marginal cost, and/or a change in the firm's markup. Note that the firm's marginal cost and markup may change independently of the exchange rate. For instance, a change in the cost of a locally provided input (in the foreign country) can shift the marginal cost. Also, demand shocks in the importing country can alter the exporter's markup. It is thus important to take into account movements in these other determinants of the price when estimating pass-through to properly isolate the effects of exchange rate changes on import prices.

Consequently, a simple log-linear, reduced-form equation may be expressed as follows:

$$p_t = \alpha + \lambda s_t + \tau w_t + \eta y_t + \varepsilon_t, \qquad (3)$$

where w_t and y_t are measures of the exporter's marginal cost and the importing country's demand conditions, respectively. The coefficient λ thus measures ERPT. As discussed in Goldberg and Knetter (1997), variants of equation (3) are widely used as empirical specifications in the pass-through literature.

In adapting this specification to be suitable for estimating ERPT at the aggregate level for all three price indexes, there are several issues that need to be considered. First, the aggregate price level and the exchange rate are generally assumed to follow non-stationary processes. Since they are often found to be best described as I(1) series, it is common to use a specification with these two variables in first-difference form when estimating an aggregate pass-through equation—thus one ends up estimating an inflation equation.

Second, the literature on inflation dynamics has emphasized the need to account for the observed inertial behaviour of inflation. However, as pointed out by Galí and Gertler (1999), it has been difficult for theoretical models to capture this persistence in inflation without appealing either to some form of ad hoc stickiness in inflation or to adaptive expectations. The authors appeal to the

16. Note that the expression in equation (2) is applicable to a variety of market structures. In a perfectly competitive industry, η is infinite so that μ is always one. On the other hand, in a monopolistically competitive environment, the exporting firm may have some leverage to raise the price above marginal cost.

latter feature in their structural model of the Phillips curve by extending Calvo's (1983) specification for price stickiness to allow for a backward-looking rule of thumb (which is assumed to be followed by a fraction of firms). Notwithstanding these theoretical challenges, it is nonetheless important to account for this observed inertia in inflation in empirical work—this is typically accomplished by including lags of inflation as explanatory variables.

Third, whereas equation (3) was developed for import prices, we want to use a specification that is also suitable for consumer and producer prices. This is accomplished by using the output gap to proxy for changes in domestic demand conditions in the inflation equations for all three price indexes. Thus, the resulting pass-through equation used for CPI inflation has all the elements of a backward-looking Phillips curve. And finally, as suggested by the NOEM literature, we want to account for the fact that aggregate pass-through may be a function of the inflation environment. We do this by including interaction terms in our pass-through regression model between the rate of change in the exchange rate and dummy variables that capture changes in the inflation environment.

3. Empirical Methodology and Data Description

3.1 Econometric specification and data description

The analytical framework presented above is used to motivate the econometric specification that we use to investigate the link between ERPT and changes in the inflation environment in our sample countries. We modify the standard pass-through specification in equation (3) as discussed above, and also adapt it to account for the fact that we have several countries, to obtain the following specification for our cross-country ERPT regression model:

$$\begin{aligned}\Delta p_{i,t} = {} & \alpha_i + \eta_t + \sum_{j=1}^{2} \phi_j \Delta p_{i,t-j} + \lambda \Delta_{i,t} + \lambda_{reg\_80}(\Delta s_{i,t} * regime\_80_{i,t}) \\ & + \lambda_{reg\_90}(\Delta s_{i,t} * regime\_90 i, t) + \tau \Delta ulc\_row_{i,t} + \delta\, gap_{i,t} + \varepsilon_{i,t}, \end{aligned} \tag{4}$$

where $\Delta p_{i,t}$ is the rate of change in the relevant aggregate price index for country *i* in time period *t*, α_i is a country-specific effect, η_t is a time dummy, $\Delta s_{i,t}$ is the rate of change in the nominal effective exchange rate for country *i* and time period *t*,[17] $regime\_80_{i,t}$ and $regime\_90_{i,t}$ are dummy variables that capture shifts in the inflation environments, $\Delta ulc\_row_{i,t}$ and $gap_{i,t}$ are control

17. The exchange rate is defined in terms of local currency units per unit of the (composite) foreign currency. Therefore, this variable will take on a positive (negative) value in the case of a depreciation (appreciation).

variables that capture changes in foreign producer cost and domestic demand conditions for country *i* and time period *t*, respectively, and $\varepsilon_{i,t}$ is an independent and identically distributed (i.i.d.) error term.[18] Our panel-data set consists of annual observations for the following 11 industrialized countries: Australia, Belgium, Canada, Denmark, Finland, France, Italy, Netherlands, Spain, United Kingdom, and United States.[19]

We provide estimates of ERPT for three aggregate price indexes: the consumer price index (CPI), the producer price index (PPI), and the import price index (IPI). Although our primary interest is in studying the behaviour of ERPT to consumer prices, we also investigate whether changes in the domestic inflation regime that may affect consumer prices are also evident in the behaviour of pass-through to import and producer prices. In the three cases, we include two lags of the dependent variable as explanatory variables to account for price inertia.[20]

One of the main advantages of using panel data in estimating our cross-country pass-through equation is that they allow for the identification of country-specific effects. The country-specific effects, α_i, are designed to account for any unobservable or missing characteristics that vary across countries (but not over time) and that influence inflation rates. For example, they could capture cross-country differences in measurement error in the construction of the price indexes or in institutional preferences for low inflation (as long as the differences between countries are constant over time). The country-specific effects could be either fixed (i.e., a constant that varies for each cross-sectional unit) or random (i.e., a random variable drawn from a common distribution). Although the country-specific effects are probably best modelled as fixed in this case—given that our panel is more accurately described as a sample containing most of the countries of interest (i.e., industrialized countries) rather than a random sample from a larger group of countries—the estimation technique that we use makes it possible to estimate the coefficients of interest without having to restrict the country-specific effects to being either fixed or random. The time dummy, η_t, is intended to capture the effects of global shocks on inflation rates.

To capture movements in the costs of foreign producers that export to the domestic market, we construct a foreign exporters' unit labour cost (ULC) series for each country, using the domestic

18. We checked the stationarity of the individual series in equation (4), using the augmented Dickey-Fuller (ADF) test. According to the ADF test results, these variables are appropriately described as stationary series. We also checked whether the variables in levels were cointegrated, using the Johansen test and found no such evidence.
19. These countries were selected based on data availability. The maximum sample period is from 1977 to 2001. Some countries, however, have shorter samples because of data limitation. Appendix A provides more details on the data.
20. Two lags were necessary to remove autocorrelation in the residuals.

ULC series and the ULC-based real effective exchange rate series. More specifically, the ULC series for foreign producers is defined as $ulc\_row_t \equiv q_t^{ULC} - s_t + ulc\_dom_t$ (where q_t^{ULC} is the ULC-based real effective exchange rate, s_t is the nominal effective exchange rate, and ulc_dom_t is the ULC of the domestic country). Since the nominal and real effective exchange rate series are trade weighted, Δulc_row_t effectively gauges the rate of change in the ULC of the exporters to the domestic country. And as discussed earlier, we use the output gap as a proxy for changes in domestic demand conditions.

To capture the effects of changes in the inflation environment, we construct two dummy variables, $regime\_80_{i,t}$ and $regime\_90_{i,t}$, which capture a shift in the environment in the 1980s and the 1990s, respectively (our methodology for identifying these shifts is discussed in more detail in section 5.1). In each case, the dummy variable takes on the value one starting in the period in which the country experienced a structural break (and for all subsequent years), and zero otherwise.[21] We then interact each dummy variable with the exchange rate term before including them as explanatory variables in equation (4). Thus, the coefficients on these interaction terms capture any change in pass-through that occurs as a result of a transition to one of these new inflation environments.

There are thus three coefficients of interest in equation (4): the coefficient on the rate of change in the exchange rate (i.e., λ) and the two coefficients on the interaction terms described above (i.e., λ_{regime_80} and λ_{regime_90}). The former captures the average rate of short-run exchange rate pass-through in our sample countries (for each relevant price index), whereas the latter two capture any incremental effects due to a change in the inflation environment that starts either in the 1980s or the 1990s.[22]

3.2 Estimation techniques for dynamic panel-data models

To estimate equation (4), we need to use a technique that is suitable for dynamic panel-data models. Complications do arise in estimating such models, stemming from the fact that the lagged dependent variable is correlated with the disturbance term. This renders estimation of both the random- and fixed-effects models using standard techniques problematic. To better illustrate this point, let us consider the following more general form of a dynamic panel-data model:

$$y_{i,t} = \phi y_{i,t-1} + x'_{i,t}\beta + \alpha_i + \varepsilon_{i,t}, \tag{5}$$

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21. If the country did not experience such a break, then the dummy variable in question would take on the value zero for all periods for this country.

22. Given our data frequency, the “short-run” here refers to a one-year period.

where $x_{i,t}$ is a vector of exogenous variables, α_i are individual effects (they could be either fixed or random), and $\varepsilon_{i,t}$ is an i.i.d. error term.

Unlike the case of random effects, estimation of a panel-data model with fixed effects—using either the least squares dummy variable (LSDV) estimator or the within-groups (WG) estimator—does not rely on the assumption that the unobservable individual effects be uncorrelated with the explanatory variables. Thus, the LSDV and WG estimators would be consistent when applied to a dynamic version of the fixed-effects model. However, as a result of the fact that the lagged dependent variable is correlated with the disturbance term, the problem is that these estimators (when applied to dynamic models) are biased in finite samples. Indeed, as shown by Nickell (1981), the standard estimators for a dynamic panel-data model with fixed effects generates estimates that are biased when the time dimension of the panel is small.[23]

To address this issue, we use a dynamic GMM panel-data estimation developed by Arellano and Bond (1991) based on work by Anderson and Hsiao (1981) and Holtz-Eakin, Newey, and Rosen (1988). Their approach involves taking the first difference of equation (5) to remove the individual effects, as follows:

$$y_{i,t} - y_{i,t-1} = \phi(y_{i,t-1} - y_{i,t-2}) + (x_{i,t} - x_{i,t-1})'\beta + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) . \tag{6}$$

Although the model in first differences is still characterized by a correlation between the lagged dependent variable and the disturbance term, Anderson and Hsiao demonstrated that, without the individual effects, there is a simple instrumental variables estimator available. They thus proposed instrumenting for the lagged dependent variable (i.e, $(y_{i,t-1} - y_{i,t-2})$), with either the lag of the level (i.e., $y_{i,t-2}$) or the first difference (i.e., $y_{i,t-2} - y_{i,t-3}$) of the dependant variable; both of these instruments are suitable, given that they are uncorrelated with the disturbance term (i.e., $(\varepsilon_{i,t} - \varepsilon_{i,t-1})$) but correlated with the lagged dependent variable (i.e, $(y_{i,t-1} - y_{i,t-2})$).[24]

Arellano and Bond (1991) build on this approach by taking advantage of the fact that there are many more instruments available that can be used in the context of a GMM estimator. The GMM estimator they develop thus relies on the use of a larger set of moment conditions than the estimator proposed by Anderson and Hsiao (1981), resulting in significant efficiency gains. More specifically, they suggest combining all available lagged values of the dependent variable with

23. And as Judson and Owen (1999) have shown using a Monte Carlo approach, this bias can be sizable even when the number of observations per cross-sectional unit (T) reaches 20 and 30. Therefore, given that our panel-data set has $T = 25$, estimating equation (4) using the standard fixed-effects model would yield biased estimates.

24. Arellano (1989) and Arellano and Bond (1991) subsequently showed that it is better to use the lagged level than the lagged difference as an instrument, given that the latter results in an estimator with a very large variance.

current and lagged values of the differences of the exogenous variables into a large instrument matrix; their GMM estimator then makes use of the moment conditions that these instruments will be orthogonal to the disturbance term. Their methodology also relies on the assumption that there is no second-order correlation in the first-differenced errors. Using this instrument matrix, Arellano and Bond (1991) derive a GMM estimator as well as two specification tests for this estimator that can be used to test the validity of the instruments: a test of second-order autocorrelation in the first-differenced residuals (the *m*2 test for autocorrelation) and a Sargan test of over-identifying restrictions.

Arellano and Bond's dynamic panel-data GMM estimator is also appealing because it can accommodate a situation where one or more of the explanatory variables in the vector $x_{i,t}$ are assumed to be endogenous rather than exogenous.[25] This is useful in the context of estimating equation (4), given that the exchange rate term could be considered an endogenous variable. Indeed, if one believes that PPP holds and thus that relative price levels drive the exchange rate, then there could be a two-way causality between the rate of change of the exchange rate and inflation in our pass-through equation. Given the difficulties in modelling exchange rates, however, it is unclear whether this is the case in practice in our sample countries. Thus, we prefer to take an agnostic approach and consider both cases (i.e., we treat the exchange rate as both exogenous and endogenous).

Despite the fact that the GMM estimator does appear to be the most appropriate choice in this context, it is important to note that there may be an important drawback to using it in practice to estimate a dynamic panel-data model such as equation (4). Indeed, as with any instrumental-variable approach, the dynamic panel-data GMM estimator will suffer from large finite-sample biases if the instruments are weak. Thus, if the lagged values of the endogenous variables are only weak instruments for subsequent first differences, the GMM estimator could be poorly behaved. We acknowledge this potential drawback and address it by reporting estimation results for the pooled OLS and fixed-effects estimators, as well, as a check on the reliability of the GMM estimates. In addition, we report estimation results for two versions of the GMM estimator: one assuming that the exchange rate is exogenous, and a second one where we instrument for the rate of change in the exchange rate.

25. In this case, the endogenous variables are treated similarly to the lagged dependent variable in that lagged levels of the endogenous variables are used as instruments for their respective first differences.

4. Panel Pass-Through Estimates Assuming No Effects from Changes in the Inflation Environment

We begin our empirical exploration by examining the estimation results for equation (4), abstracting away from any effects that changes in the inflation environment may have on the average rate of aggregate pass-through in our sample countries. This is a useful starting point for our analysis, since it will allow us to check that the estimation results for our cross-country pass-through equation appear reasonable and to compare our pass-through estimates with others in the literature. Thus, we modify equation (4) as follows:

$$\Delta p_{i,t} = \alpha_i \eta_t + \sum_{j=1}^{2} \phi_j \Delta p_{i,t-j} + \lambda \Delta s_{i,t} + \tau \Delta ulc\_row_{i,t} + \delta gap_{i,t} + \varepsilon_{i,t}. \tag{7}$$

Table B.1 reports the pass-through estimates, in both the short and long run,[26] for each of the three price indexes that we consider: the import price index (IPI), the producer price index (PPI), and the consumer price index (CPI). The results were obtained by estimating equation (7), using two versions of the dynamic GMM panel-data estimator described above.[27] As discussed, we also present estimation results using the pooled OLS and fixed-effect estimators as a check on the reliability of the GMM estimations. As shown in Table B.1, all of the pass-through estimates are statistically significant and of the expected sign (positive), and the results are fairly robust across estimation techniques. The results are also robust to the presence of outliers. Tables D.1 through D.3 report more complete estimation results for equation (7).[28]

As expected, the size of the pass-through estimates varies substantially across price indexes. Indeed, the point estimates for import prices are much larger, reflecting the fact that the import price index is driven entirely by prices of tradable goods, whereas producer and consumer price indexes are driven by a combination of domestically produced and imported goods.[29] Therefore,

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26. Our measure of long-run pass-through is defined by $\lambda / \left(1 - \left[\sum_{j=1}^{2} \phi_j\right]\right)$. It is intended to capture the feedback effects resulting from the inclusion of the lagged dependent variable terms (i.e., the effects of an exchange rate change in period t will influence inflation over several periods subsequent to this as a result of these feedback effects).
27. GMM1 instruments only for the lagged dependent variable, whereas GMM2 instruments for both the lagged dependent variable and the rate of change in the exchange rate.
28. Tables D.1 through D.3 also report the results of the two specification tests used to check the validity of the instruments for the GMM estimations (i.e., the Sargan test and the *m*2 test for autocorrelation). As shown, the results of these tests suggest that the instruments are indeed orthogonal.
29. And in the case of the CPI, the index also includes the price of services (the majority of which are non-tradable).

the extent of pass-through to producer/consumer prices will depend on the rate of pass-through to import prices, the share of imports in the producer/consumer price indexes, and the response of domestically produced goods to movements in the exchange rate.

Two other reasons may explain why the rate of pass-through to consumer prices is relatively smaller than that to import prices. First, local distribution costs—such as transportation costs, marketing, and services—can drive a wedge between import prices as measured in the import price index and the prices of these goods as reflected in the CPI, and this wedge will fluctuate if distributors adjust their profit margins in response to movements in the exchange rate. Thus, if there is complete pass-through to import prices following a depreciation, pass-through to consumer prices could be lower than an amount proportional to the share of imports in the consumption basket if distributors decide to compress their profit margins to offset (either partially or fully) the increase in the price of the good in the local currency. Second, as discussed in Bacchetta and van Wincoop (2002), differences in the optimal pricing strategies of foreign wholesalers and domestic retailers can also explain why pass-through to consumer prices is lower than an amount proportional to the share of imports in the consumption basket when pass-through to import prices is complete. Indeed, this discrepancy can occur if foreign exporting firms price their goods in the exporter's currency, while domestic retailers resell these goods priced in domestic currency.

Our estimation results indicate that pass-through to import prices in industrialized countries is high in the short run and complete (or near complete) in the long run. Indeed, the point estimates of 0.7493 and 0.9131 reported for short- and long-run pass-through (for GMM2), respectively, suggest that a 1 per cent increase in the annual rate of depreciation of the trade-weighted nominal exchange rate in industrialized countries leads to, on average, a 0.75 per cent increase in the annual rate of inflation of import prices in that same year, and a 0.91 per cent increase in the long run.[30] These results are in line with estimates in the literature of exchange rate pass-through into import prices for industrialized countries.

For instance, Campa and Goldberg (2002) find that the average rate of pass-through into import prices across their sample of 25 OECD countries over the period 1975–1999 is 0.61 in the short

30. As discussed in Bailliu and Bouakez (2004), the import price series for Canada—one of our sample countries—suffer from measurement error in that a number of Canadian import prices are constructed by multiplying the foreign currency price by the nominal exchange rate. Given this, we checked whether our estimates of pass-through to import prices were upwardly biased by the inclusion of Canada in our sample. We conducted robustness checks by excluding Canada from the sample and found the effects on the estimation results to be negligible.

run and 0.77 in the long run.[31] Moreover, they find that partial pass-through is the best description for import price responsiveness in the short run (which, in their case, is one quarter), whereas full pass-through is generally supported as a longer run characterization.[32] And in his study of exchange rate pass-through in euro-area countries, Anderton (2003) finds a pass-through rate of between 0.5 and 0.7 for extra-euro area imports. Our estimates are thus generally consistent with these results. We do find a higher degree of exchange rate pass-through in the short run, but this can be explained by the fact that the short run refers to one quarter in their studies, whereas it spans one year in our analysis.

Our estimation results for producer and consumer prices are also consistent with the literature. For GMM2, the point estimates suggest that the short-run pass-through rates are 8 per cent for consumer prices and 20 per cent for producer prices (increasing to 16 per cent and 30 per cent, respectively, in the long run). Our estimate for long-run pass-through to consumer prices is comparable to that obtained by Gagnon and Ihrig (2002).[33]

5. Exchange Rate Pass-Through in Different Inflation Environments

5.1 Identifying changes in the inflation environment

A formal investigation of Taylor's hypothesis requires a comparison of pass-through estimates under alternative inflation environments, where the shift results from a change in monetary policy. To identify changes in the inflation environment that are the result of a change in the monetary policy regime, we use a two-step approach. First, we use the multiple break test developed by Bai and Perron (1998) to test for the presence of structural breaks in the inflation series in each country in the sample and, if breaks are identified, to determine the timing of these shift(s). This first step thus finds changes in the inflation environment that are significant enough to appear in the data. Second, we check whether these identified breaks line up with changes in the monetary policy regime. This second step ensures that the changes in the inflation environment identified in

31. They calculate the average rate of exchange rate pass-through in their sample countries by taking the unweighted mean of the pass-through coefficients obtained from the individual-country regressions.
32. They conclude that partial pass-through is the best characterization for the short run, given that the estimated short-run pass-through coefficients for the bulk of their sample countries are significantly different from both zero and one. As for the long-run coefficients, the majority are found to be significantly different from zero but not one, thus supporting the hypothesis that pass-through is complete in the long run.
33. Gagnon and Ihrig find an average long-run pass-through rate of 23 per cent in their sample of 20 industrialized countries.

the data are indeed the result of a change in the monetary policy regime and not the result of other factors.

The results of the Bai and Perron test, as well as a description of this methodology, are provided in Appendix C.[34] In addition, graphs depicting the CPI inflation series for each country are shown in Figure C.1 in Appendix C, along with vertical lines representing the dates at which the structural breaks were identified. As shown in these figures, we found evidence of at least one break in all countries, and for most of the countries, two breaks were identified. In the majority of cases, the first break coincides with the Volker-era disinflation in the early 1980s and the second one with the more recent inflation stabilization period that began in the early 1990s.

As outlined in Table 1, most of these identified structural breaks in the inflation series line up with a change in the monetary policy regime in the country in question. The one exception is for Spain, where the Bai-Perron test identified three structural breaks in the 1990s. However, only one of these break dates coincides with a change in the monetary policy regime and therefore we consider only this shift in our analysis.

All of the sample countries experienced a substantial increase in inflation in the 1970s as a result of the oil shocks and the accommodative policy response to these shocks. Consequently, they all took steps to reduce inflation in the first half of the 1980s. Although they took different approaches with varying degrees of success, all brought about a disinflation by making significant changes to their monetary policy regime. In most of the European countries—with the notable exception of the United Kingdom—most of the policy changes focused on using the exchange rate as a nominal anchor, and essentially importing German monetary policy. The most extreme example of this type of regime shift is the Netherlands, where a “hard peg” was adopted versus the Deutsche Mark (DM) in the early 1980s. From that point until the launch of the euro, the Netherlands held the peg. Belgium adopted a similar approach, although the shift was more gradual. These two countries entered a low-inflation environment in the 1980s and stayed there.

The other countries in the sample entered a low-inflation environment in two steps, the first in the 1980s and the second in the 1990s. Whereas the focus of policy changes in the 1980s seemed to be on reducing inflation from the high levels it reached in the 1970s, the emphasis in the 1990s appeared to be on inflation control (i.e., achieving and maintaining low and stable rates of inflation). Many countries—such as Australia, Canada, Spain, and the United Kingdom—adopted inflation-targeting regimes to achieve this goal. Other countries, like the United States, relied on a

34. The structural break tests are conducted on the CPI series, since this is where we would expect a change in the domestic inflation environment to manifest itself. To have enough degrees of freedom to conduct the test, we use quarterly rather than annual data.

Table 1: Identified Structural Breaks in Inflation and Corresponding Policy Change

Country	Date	Policy Change
Australia	1982Q3	Following a high-inflation period in the 1970s, there was a gradual shift in Australian monetary policy towards an approach that ". . . generally articulated a goal of disinflation" (Gruen and Stevens 2000, 43).
Australia	1990Q3	Although the formal announcement of an inflation target occurred in September 1994 in Australia, the shift in monetary policy towards a strategy focused on inflation control started a few years earlier (see Bernanke et al. (1999) for more details).
Belgium	1985Q1	After Belgium joined the European Monetary System (EMS) in 1979, there were frequent downward realignments of the Belgian franc until the mid-1980s, when Belgium started pursuing "a progressively tighter exchange rate policy" (Halikias 1993, 1).
Canada	1982Q3	As was the case in the United States, the Bank of Canada raised interest rates substantially in the early 1980s in order to reduce inflation. See Freedman (1982) for more details. This period also coincided with the end of the practice of targeting monetary aggregates at the Bank of Canada (officially cancelled in November 1982).
Canada	1990Q4	The adoption of inflation targeting in Canada was announced in February 1991.
Denmark	1982Q3	In 1982, a new government took office in Denmark and announced radical measures to tackle the economic crisis the country was experiencing, including a strong commitment to a fixed exchange rate policy. See Dahl and Hansen (2002) for more details.
Denmark	1989Q3	The exchange rate policy in effect since 1982 was further strengthened in the late 1980s when parities against the strongest currencies in the Exchange Rate Mechanism (ERM) were fixed. See Christensen and Topp (1997) for more details.
Spain	1983Q4	Starting in 1978, the Spanish central bank began to take an active role in monetary policy by publicly announcing monetary growth target rates as a means of reducing inflation. Around 1983–84, Spanish monetary policy started de-emphasizing the targeting of monetary aggregates in favour of a focus on the exchange rate (see Ayuso, Kaminsky, and López-Salido (2003) for more details).
Spain	1995Q1	The adoption of inflation targeting in Spain was announced in November 1994 (inflation targets were introduced in January 1995).
Finland	1984Q1	Starting in the early 1980s, the exchange rate was used as a nominal anchor in Finland in an attempt to eliminate the inflation-devaluation cycle that had afflicted the country for most of the post-war period (see Honkapohja and Koskela (1999) for more details).
Finland	1991Q1	Finland abandoned its "hard-currency" exchange rate policy in 1991 following the economic crisis brought on by the collapse of the Soviet Union (see Honkapohja and Koskela (1999) for more details).

(cont.)

Table 1: Identified Structural Breaks in Inflation and Corresponding Policy Change (cont.)

Country	Date	Policy Change
France	1985Q1	Several important changes were made to French monetary policy from 1983 to 1987, including the adoption of a policy of competitive disinflation (which began in 1983 but took several years to complete) and a major reform of French financial markets that profoundly changed the operating procedures of French monetary policy. See Mojon (1999) for more details.
France	1992Q1	France successfully defended its peg during the EMS crisis in 1992, demonstrating its commitment to the EMS and the impending European monetary union.
United Kingdom	1982Q1	Starting in mid-1979, monetary policy shifted significantly in the United Kingdom towards a much more restrictive policy aimed at bringing about a disinflation through higher interest rates. The disinflation occurred gradually over the period from 1980 to 1983. See Nelson and Nikolov (2002) for more details.
United Kingdom	1992Q1	The United Kingdom exited the EMS in the wake of the crisis in September 2002 and announced the adoption of inflation targeting in October 1992.
Italy	1983Q4	Following its decision to join the EMS in 1979, Italy began implementing an inflation stabilization program based on commitment to an exchange rate target. Although the exchange rate anchor was initially rather weak owing to frequent realignments, the system became more stable in the mid-1980s (see Detragiache and Hamann (1997) for more details). Spinelli and Tirelli (1993) identify 1984 as a key date in the transition to a new regime for monetary policy, since this is when the Bank of Italy began announcing targets for M2.
Italy	1996Q1	After being forced out during the crisis in 1992, Italy re-enters the ERM in 1996.
Netherlands	1982Q2	The exchange rate has been a key element in Dutch monetary policy throughout the post-war period. Following the breakdown of the Bretton Woods system, the Dutch authorities decided to stabilize the guilder in terms of the Deutsche Mark. Although there were several devaluations in the 1970s, the peg stabilized in the early 1980s (the last devaluation was in 1983). See Hilbers (1998) for more details.
United States	1981Q2	Paul Volker was appointed Chairman of the Federal Reserve in 1979 and orchestrated a disinflation by raising interest rates (they peaked in early 1981).
United States	1990Q4	A shift in U.S. monetary policy in the 1990s has been identified and characterized as one in which the Federal Reserve responded more aggressively to rising inflation than in previous decades (see Mankiw (2001) for more details).

flexible version of inflation control. And finally, most of the European countries continued to rely on exchange rate pegs as a means of importing the low inflation rate of the core country of the Exchange Rate Mechanism (ERM), Germany.

5.2 Panel pass-through estimates in different inflation environments

Based on these identified structural breaks, we constructed the two dummy variables described in section 3: (i) $regime\_80_{i,t}$ (which captures a shift in the inflation environment in the 1980s); and (ii) $regime\_90_{i,t}$ (which captures a shift in the inflation environment in the 1990s). We then interacted these two dummy variables with the exchange rate term, and included the two interaction terms in the specification, as depicted in equation (4).

Estimation results for equation (4) are reported in Table B.2, focusing on the three coefficients of interest. As shown in the table, the coefficients on the interaction terms are statistically significant in the case of all three price indexes but only for the interaction term with the dummy variable that identifies a change in the inflation environment in the 1990s. This implies that the effects of exchange rate movements on import, producer, and consumer prices were dampened after the shift in the inflation environment that occurred in our sample countries in the 1990s—for those countries that did experience such a shift. For instance, in the case of import prices (for GMM2), the average short-run pass-through rate is equal to roughly 86 per cent prior to the shift, and is reduced to around 71 per cent following a change in the inflation environment in the 1990s. As for producer prices, the average short-run pass-through rate is equal to roughly 18 per cent prior to the shift, and is reduced to around 8 per cent following a change in the inflation environment in the 1990s. Finally, in the case of consumer prices, the change in ERPT from one environment to the next is even more dramatic. Indeed, the short-run pass-through rate falls from around 11 per cent before the shift to around 5 per cent in the low-inflation environment that started in the 1990s.

There are a few potential explanations for why pass-through might have declined in the 1990s but not in the 1980s. First, it is possible that the changes in the monetary policy regimes that were implemented in the 1990s were perceived as being more credible than those that were carried out in the 1980s. This could be due to the fact that many of the sample countries made more substantial reforms to their monetary policy regimes in the latter decade (for example, by adopting inflation targeting). Moreover, as discussed in Paulin (2000), the 1990s were characterized by a period in which central banks acquired greater operational independence to pursue their policy objectives and became more open institutions. This trend most likely contributed to increasing both the effectiveness and credibility of policy actions. Another potential explanation is that credibility is not built overnight, but takes time to acquire. Thus, it is possible that although inflation fell as a result of monetary policy changes implemented in the 1980s, credibility was not enhanced until the 1990s, as a result of the cumulative impact of a range of initiatives and/or time needed for agents in the economy to be convinced of the credibility of the new regime.

6. Conclusion

Using a panel-data set of 11 industrialized countries over the period from 1977 to 2001, we find evidence to support the hypothesis that ERPT declines with a shift to a low-inflation environment brought about by a change in the monetary policy regime. More specifically, our results suggest that pass-through to import, producer, and consumer price inflation declined following the inflation stabilization that occurred in many industrialized countries in the early 1990s, but not following a similar episode that occurred in the 1980s. Several potential explanations for this finding are discussed, including the possibility that changes in the monetary policy regimes that were implemented in the 1990s were perceived as being more credible than those carried out in the 1980s and the possibility that the credibility of the new monetary policy regimes was acquired over time.

References

Anderson, T.W. and C. Hsiao. 1981. "Formulation and Estimation of Dynamic Models Using Panel Data." *Journal of Econometrics* 18: 47–82.

Anderton, B. 2003. "Extra-Euro Area Manufacturing Import Prices and Exchange Rate Pass-Through." European Central Bank Working Paper No. 219.

Arellano, M. 1989. "A Note on the Anderson-Hsiao Estimator for Panel Data." *Economics Letters* 31: 337–41.

Arellano, M. and S. Bond. 1991. "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." *Review of Economic Studies* 58: 277–97.

Ayuso, J., G. Kaminsky, and D. López-Salido. 2003. "Inflation Regimes and Stabilisation Policies: Spain 1962–2001." *Investigaciones Economicas* 28 (3): 615–31.

Bacchetta, P. and E. van Wincoop. 2002. "Why Do Consumer Prices React Less Than Import Prices to Exchange Rates?" NBER Working Paper No. 9352.

Bai, J. and P. Perron. 1998. "Estimating and Testing Linear Models with Multiple Structural Change." *Econometrica* 66: 47–78.

Bailliu, J. and H. Bouakez. 2004. "Exchange Rate Pass-Through in Industrialized Countries." *Bank of Canada Review* (Spring): 19–28.

Bernanke, B.S., T. Laubach, F. Mishkin, and A. Posen. 1999. *Inflation Targeting: Lessons from the International Experience*. Princeton, NJ: Princeton University Press.

Betts, C. and M. Devereux. 1996. "The Exchange Rate in a Model of Pricing-to-Market." *European Economic Review* 40: 1007–21.

_____. 2000. "Exchange Rate Dynamics in a Model of Pricing to Market." *Journal of International Economics* 50 (1): 215–44.

Calvo, G. 1983. "Staggered Prices in a Utility Maximizing Framework." *Journal of Monetary Economics* 12: 383–98.

Campa, J. and L. Goldberg. 2002. "Exchange Rate Pass-Through Into Import Prices: A Macro or Micro Phenomenon?" NBER Working Paper No. 8934.

Christensen, A. and J. Topp. 1997. "Monetary Policy in Denmark Since 1992." In *Monetary Policy in the Nordic Countries: Experiences Since 1992*. BIS Policy Paper No. 2.

Choudhri, E. and D. Hakura. 2001. "Exchange Rate Pass-Through to Domestic Prices: Does the Inflationary Environment Matter?" IMF Working Paper No. WP/01/194.

Cunningham, A. and A. Haldane. 1999. "The Monetary Transmission Mechanism in the United Kingdom: Pass-Through and Policy Rules." In *Monetary Policy: Rules and Transmission Mechanisms*, edited by N. Loayza and K. Schmidt-Hebbel. Santiago, Chile: Banco Central de Chile.

Dahl, C. and N. Hansen. 2002. "The Formation of Inflation Expectations under Changing Inflation Regimes." Danmarks Nationalbank Working Paper No. 2002-4.

Detragiache, E. and A. Hamann. 1997. "Exchange Rate-Based Stabilization in Western Europe: Greece, Ireland, Italy and Portugal." International Monetary Fund Working Paper No. 97/75.

Devereux, M.B. and J. Yetman. 2003. "Price-Setting and Exchange Rate Pass-Through: Theory and Evidence." In *Price Adjustment and Monetary Policy,* 347–71. Proceedings of a conference held at the Bank of Canada, November 2002. Ottawa: Bank of Canada.

Devereux, M., C. Engel, and P. Storgaard. 2003. "Endogenous Exchange Rate Pass-Through when Nominal Prices Are Set in Advance." NBER Working Paper No. 9543.

Dornbusch, R. 1987. "Exchange Rates and Prices." *American Economic Review* 77: 93–106.

Engel, C. 2002. "The Responsiveness of Consumer Prices to Exchange Rates: A Synthesis of Some New Open Economy Macro Models." *The Manchester School* 70: 1–15.

Fillion, J.-F. and A. Léonard. 1997. "La courbe de Phillips au Canada: un examen de quelques hypotheses." Bank of Canada Working Paper No. 1997-3.

Freedman, C. 1982. "The Effect of U.S. Policies on Foreign Countries: The Case of Canada." In *Monetary Policy Issues in the 1980s*. Proceedings of a symposium sponsored by the Federal Reserve Bank of Kansas City, August 1982, Jackson Hole, Wyoming.

Gagnon, J. and J. Ihrig. 2002. "Monetary Policy and Exchange Rate Pass-Through." Board of Governors of the Federal Reserve System, International Finance Discussion Paper No. 704.

Galí, J. and M. Gertler. 1999. "Inflation Dynamics: A Structural Econometric Analysis." *Journal of Monetary Economics* 44: 195–222.

Goldberg, P.K. and M. Knetter. 1997. "Goods Prices and Exchange Rates: What Have We Learned?" *Journal of Economic Literatur*e 35: 1243–72.

Gruen, D. and G. Stevens. 2000. "Australian Macroeconomic Performance and Policies in the 1990s." In *The Australian Economy in the 1990s*. Proceedings of a conference held at the Reserve Bank of Australia, 24–25 July 2000.

Halikias, I. 1993. "Testing the Credibility of Belgium's Exchange Rate Policy." IMF Working Paper No. 93/76.

Hilbers, P. 1998. "Financial Sector Reform and Monetary Policy in the Netherlands." IMF Working Paper No. 98/19.

Holtz-Eakin, D., W. Newey, and H. Rosen. 1988. "Estimating Vector Autoregressions with Panel Data." *Econometrica* 56: 1371–95.

Honkapohja, S. and E. Koskela. 1999. "The Economic Crisis of the 1990s in Finland." *Economic Policy* 29: 400–36.

Hooper, P. and C. Mann. 1989. "Exchange Rate Pass-Through in the 1980s: The Case of U.S. Imports of Manufactures." *Brookings Papers on Economic Activity* 1: 297–337.

Judson, R.A. and A.L. Owen. 1999. “Estimating Dynamic Panel Data Models: A Practical Guide for Macroeconomists.” *Economics Letters* 65 (1): 9–15.

Kichian, M. 2001. “On the Nature and the Stability of the Canadian Phillips Curve.” Bank of Canada Working Paper No. 2001-4.

Knetter, M. 1989. “Price Discrimination by U.S. and German Exporters.” *American Economic Review* 79 (1): 198–210.

Kreinin, M.E. 1977. “The Effect of Exchange Rate Changes on the Prices and Volume of Foreign Trade.” *International Monetary Fund Staff Papers* 24 (2): 297–329.

Krugman, P. 1987. “Pricing to Market when the Exchange Rate Changes.” In *Real-Financial Linkages among Open Economies,* edited by S.W. Arndt and J.D. Richardson. Cambridge, Mass.: MIT Press.

Laflèche, T. 1996. “The Impact of Exchange Rate Movements on Consumer Prices.” *Bank of Canada Review* (Winter): 21–32.

Longworth, D. 2002. “Inflation and the Macroeconomy: Changes from the 1980s to the 1990s.” *Bank of Canada Review* (Spring): 3–18.

Mankiw, N.G. 2001. “U.S. Monetary Policy During the 1990s.” NBER Working Paper No. 8471.

Marston, R. 1990. “Pricing to Market in Japanese Manufacturing.” *Journal of International Economics* 29 (3–4): 217–36.

Mojon, B. 1999. “Monetary Policy under a Quasi-Fixed Exchange Regime. The Case of France between 1987 and 1996." *Banca Nazionale de Lavoro Quarterly Review* 52 (211): 401–30.

Nelson, E. and K. Nikolov. 2002. “Monetary Policy and Stagflation in the U.K.” Bank of England Working Paper No. 155.

Nickell, S. 1981. “Biases in Dynamic Models with Fixed Effects.” *Econometrica* 49 (6): 1417–26.

Obstfeld, M. and K. Rogoff. 1995. “Exchange Rate Dynamics Redux.” *Journal of Political Economy* 103: 624–60.

Paulin, G. 2000. “The Changing Face of Central Banking in the 1990s.” *Bank of Canada Review* (Winter): 3–13.

Spinelli, F. and P. Tirelli. 1993. “Italy.” In *Monetary Policy in Developed Countries*, edited by M. Fratianni and D. Salvatore. Westport, CT: Greenwood Press.

Statistics Canada. 2003. “Changes in the International Merchandise Trade Price Index.” http://www.statcan.ca/english/sdds/document/2203_D1_T9_V1_E.pdf.

Taylor, J. 2000. “Low Inflation, Pass-Through, and Pricing Power of Firms.” *European Economic Review* 44 (7): 1389–408.

Appendix A: Data

Sample Countries

Australia, Belgium, Canada, Denmark, Finland, France, Italy, Netherlands, Spain, United Kingdom, United States

Sources and Definitions of Variables

Dependent variable

1. Rate of change in the relevant annual aggregate price index[1]
   (Source: Organisation of Economic Co-operation and Development's (OECD) *Main Economic Indicators and Monthly Statistics of International Trade*)
   - calculated as the log difference in the level of the average annual price index

Explanatory variables

2. Rate of change in the annual nominal effective exchange rate
   (Source: Bank for International Settlements (BIS))
   - calculated as the log difference in the level of the average annual exchange rate

3. Rate of change in the foreign exporters' unit labour cost (ULC)
   (Source: BIS)
   - calculated as the log difference in the level of the average annual foreign ULC using the domestic ULC and the ULC-based real effective exchange rate
4. Output gap
   (Source: OECD's *Main Economic Outlook*)
   - measured as the deviation of actual output from potential as a percentage of potential output
   - potential output is calculated using the "production function method" (see OECD's *Economic Outlook Sources and Methods* for more details)

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1. We use the following three aggregate price indexes: (i) consumer price index, (ii) producer price index, and the (iii) import price index.

Table A1: Sample Period by Country

	Estimations where dependent variable is rate of change in:[1]		
Country	**Consumer Price Index**	**Producer Price Index**	**Import Price Index**
Australia	1977–2001	1977–2001	1977–2001
Belgium	1981–2001	1981–2001	n/a[2]
Canada	1981–2001	1981–2001	1981–2001
Denmark	1977–2001	1977–2001	1977–2001
Finland	1977–2001	1977–2001	1977–2001
France	1977–1998	1977–1998	1977–1998
Italy	1977–2001	1981–2001	1977–2001
Netherlands	1984–2001	1984–2001	1984–1996[3]
Spain	1980–2001	1980–2001	1980–2001
United Kingdom	1977–2001	1977–2001	1977–2001
United States	1977–2001	1977–2001	1982–2001

Notes:
1. All data are annual.
2. The import price index series for Belgium is only available starting in 1993.
3. The import price index series for the Netherlands was obtained from the BIS.

Appendix B: Estimates of Exchange Rate Pass-Through

Table B1: Panel Pass-Through Estimates for 11-Country Sample over 1977–2001

Estimation technique	GMM1	GMM2	Pooled OLS	Fixed effects
A. IPI inflation				
Short-run	0.7598**	0.7493**	0.7482**	0.7476**
	(0.0624)	(0.0524)	(0.0383)	(0.0431)
Long-run	0.8503**	0.9131**	0.9093**	0.8963**
F-test/chi-square test	128.60	149.91	242.31	195.69
B. PPI inflation				
Short-run	0.2112**	0.2023**	0.2137**	0.2052**
	(0.0287)	(0.0289)	(0.0246)	(0.0259)
Long-run	0.2764**	0.3012**	0.3700**	0.3318**
F-test/chi-square test	32.51	32.51	32.51	44.19
C. CPI inflation				
Short-run	0.0650**	0.0804**	0.0806**	0.0809**
	(0.0238)	(0.0202)	(0.0156)	(0.0166)
Long-run	0.1259*	0.1600**	0.1705**	0.1634**
F-test/chi-square test	5.28	11.53	26.01	21.70

Notes:
1. This table reports estimates of exchange rate pass-through obtained from estimating equation (7). The short-run estimate is $\hat{\lambda}$, whereas the long-run estimate is $\hat{\lambda}/(1-(\hat{\phi}_1+\hat{\phi}_2))$. See Table D.1 in Appendix D for more complete estimation results for equation (7).
2. The figures in parentheses are robust standard errors.
3. The *F* and chi-square test statistics reported for the long-run pass-through estimates correspond to the values of these respective test statistics for the hypothesis that $\hat{\lambda}/(1-(\hat{\phi}_1+\hat{\phi}_2)) = 0$
4. Both GMM1 and GMM2 refer to estimations carried out using the Arellano-Bond one-step dynamic panel-data first-difference robust estimator. GMM1 instruments only for the lagged dependent variable, whereas GMM2 also instruments for the rate of depreciation. In both cases, a restricted version of the estimator is used in that the maximum number of available lagged values of the endogenous variables used as instruments is set to 3. See section 3.2 for more details on these estimators.
5. "**", "*", and "#" indicate statistical significance at the 1, 5, and 10 per cent levels, respectively.

Table B2: Short-Run Panel Pass-Through Estimates for 11-Country Sample over 1977–2001 (using interaction terms to account for inflation regime shifts)

Estimation technique	GMM1	GMM2	Pooled OLS	Fixed effects
A. IPI inflation				
Δs_t	0.8628**	0.8615**	0.8402**	0.8585**
	(0.1617)	(0.1371)	(0.1370)	(0.1456)
$\Delta s_{t} * regime\_80$	–0.0334	–0.0619	–0.0418	–0.0615
	(0.1328)	(0.1065)	(0.1407)	(0.1482)
$\Delta s_{t} * regime\_90$	–0.1845**	–0.1481**	–0.1437*	–0.1465#
	(0.0573)	(0.0530)	(0.0705)	(0.0769)
B. PPI inflation				
Δs_t	0.1486#	0.1844**	0.1819**	0.1969**
	(0.0821)	(0.0603)	(0.0563)	(0.0637)
$\Delta s_{t} * regime\_80$	0.1246	0.0600	0.0775	0.0508
	(0.0955)	(0.0743)	(0.0667)	(0.0745)
$\Delta s_{t} * regime\_90$	–0.1365*	–0.1037#	–0.1091*	–0.1084*
	(0.0618)	(0.0556)	(0.0473)	(0.0493)
C. CPI inflation				
Δs_t	0.0907*	0.1085**	0.1154**	0.1114**
	(0.0443)	(0.0244)	(0.0405)	(0.0391)
$\Delta s_{t} * regime\_80$	–0.0122	–0.0116	–0.0182	–0.0145
	(0.0574)	(0.0329)	(0.0443)	(0.0442)
$\Delta s_{t} * regime\_90$	–0.0427	–0.0544#	–0.0565#	–0.0543#
	(0.0302)	(0.0295)	(0.0305)	(0.0317)

Notes:
1. This table reports the coefficient estimates of the three listed variables obtained from the estimation of equation (4).
2. See notes (2), (4), and (5) from Table B1.

Appendix C: Changes in the Inflation Environment in the Sample Countries

Testing for Multiple Structural Breaks: Methodology

To test for the presence of breaks in the inflation series of our sample countries, we use the endogenously determined multiple break test developed by Bai and Perron (1998). This methodology tests for the presence of breaks in a series when neither the number nor the timing of breaks is known a priori. More specifically, this approach allows us to test for the presence of *m* breaks in the mean inflation rate of each country at unknown times using the following model:

$$\Delta p_t = \mu_j + \eta_t \qquad t = T_{j-1} + 1, \ldots, T_j \text{ and } j = 1, \ldots, (m+1)$$

where $\mu_j (j = 1, \ldots, m+1)$ is the regime-specific mean inflation rate, η_t is an error term, and $T_0 = 0$ and $T_{m+1} = T$. In essence, the testing procedure searches for *m* optimal breaks that achieve a global minimal of the total of the sum of squared residuals in each regime.

We test for breaks in the CPI series, given that this is where we would expect a change in the domestic inflation environment to manifest itself. In conducting the test, we adopt two kinds of test statistics. The first statistic, denoted by $Sup_F(m)$, evaluates the null hypothesis of no structural break against the alternative of *m* structural breaks. The second statistic, $Sup_F(m+1|m)$, tests the null hypothesis of *m* breaks against the alternative of $(m+1)$ breaks.

Table C1: Results of Structural Break Tests on the CPI Inflation Series, by Country

	Australia	**Belgium**	**Canada**	**Denmark**	**Spain**	**Finland**	**France**	**U.K.**	**Italy**	**Nether.**	**U.S.**
A. $Sup_F\,(m)$											
(1)	80.09**	95.54**	56.04**	78.62**	80.25**	48.94**	86.43**	48.23**	91.73**	57.05**	16.59**
(2)	55.22**	51.63**	59.18**	72.54**	61.90**	53.78**	72.82**	39.26**	107.15**	31.22**	13.99**
(3)	30.15**	34.71**	40.50**	50.54**	78.94**	34.55**	175.99**	26.96**	77.23**	24.75**	14.71**
(4)	22.96**	31.75**	31.66**	37.13**	76.62**	24.61**	135.43**	20.09**	74.33**	18.70**	12.69**
(5)	21.51**	27.45**	20.75**	29.83**	61.36**	20.98**	112.65**	14.10**	61.92**	16.75**	5.49**
B. $Sup_F\,(m + 1\|m)$											
(2|1)	12.74*	2.84	39.68**	44.52**	31.35**	25.63**	34.01**	22.01**	46.01**	8.04	9.83*
(3|2)	1.60	3.15	0.82	3.30	36.50**	0.90	5.86	3.18	6.04	0.93	4.14
(4|3)	0.00	0.61	0.57	0.94	14.86**	0.09	8.025	0.63	6.04	0.81	1.48
(5|4)	0.00	0.00	0.00	0.00	0.57	0.00	5.86	0.00	5.80	5.53	0.00
C. Break dates											
	1982Q3	1985Q1	1982Q3	1982Q3	1983Q4	1984Q1	1985Q1	1982Q1	1983Q4	1982Q2	1981Q2
	1990Q3		1990Q4	1989Q3	1991Q4	1991Q1	1992Q1	1992Q1	1996Q1		1990Q4
					1995Q1						
					1996Q1						

Notes:

1. Panel A reports the Sup_F test statistics for the null hypothesis of no structural break against m $(m = 1, \ldots, 5)$ breaks.
2. Panel B presents the Sup_F statistics for the null hypothesis of m $(m = 1, \ldots, 4)$ structural breaks against $(m + 1)$ structural breaks.
3. Panel C provided suggested break dates based on the results of these two tests.

Figure C1: Identified Structural Breaks in the CPI Inflation Series, by Country

(cont.)

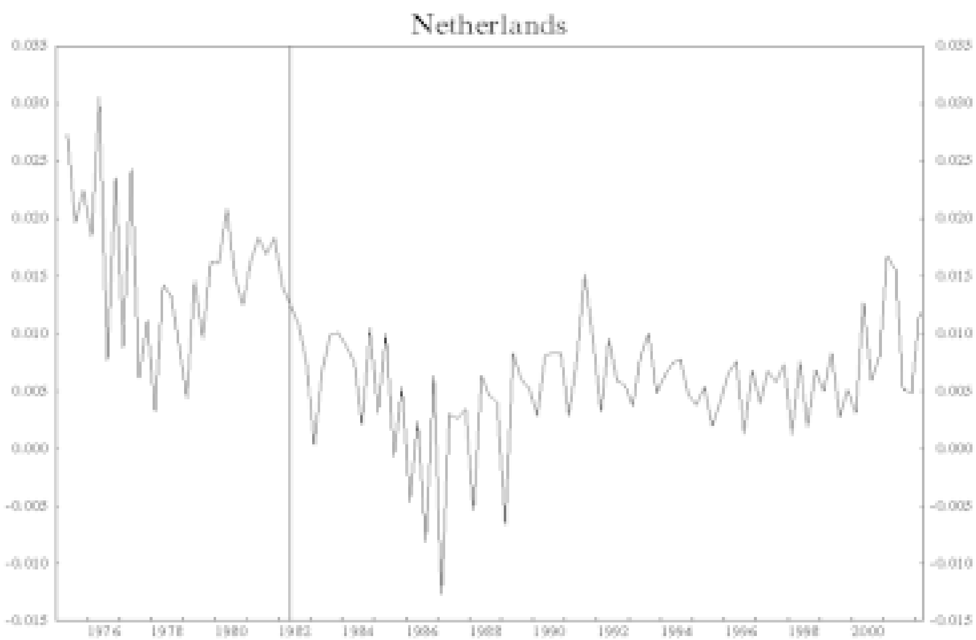
Figure C1 (cont.)
Identified Structural Breaks in the CPI Inflation Series, by Country

(cont.)

Figure C1 (cont.)
Identified Structural Breaks in the CPI Inflation Series, by Country

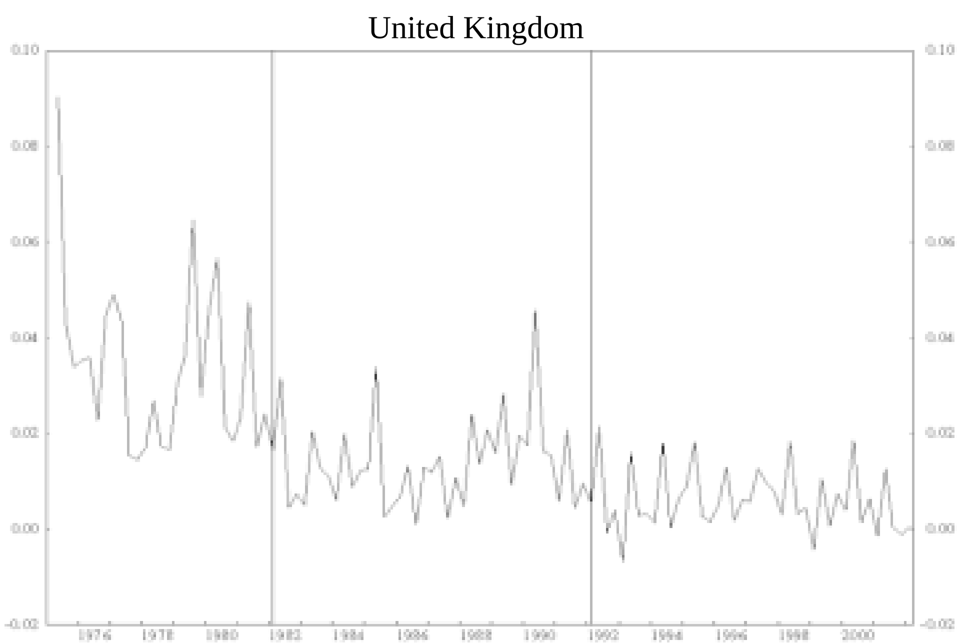
(cont.)

Figure C1 (cont.)
Identified Structural Breaks in the CPI Inflation Series, by Country



(cont.)

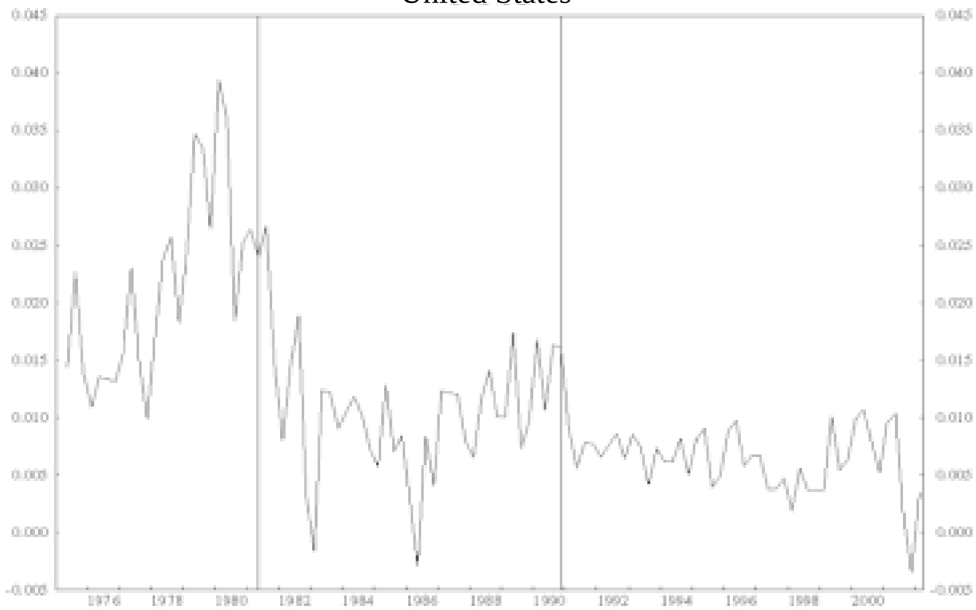
Figure C1 (cont.)
Identified Structural Breaks in the CPI Inflation Series, by Country



(cont.)

Figure C1 (cont.)
Identified Structural Breaks in the CPI Inflation Series, by Country

United States



Appendix D: Estimation Results for Equation (7)

Table D1: Dependent Variable: Rate of Change in Annual Import Price Index
Panel Estimates for 11-Country Sample over 1977–2001

Estimation technique	GMM1	GMM2	Pooled OLS	Fixed effects
$\Delta p_{i,t-1}$	0.1754**	0.2179**	0.2349**	0.2237**
	(0.0478)	(0.0559)	(0.0371)	(0.0378)
$\Delta p_{i,t-2}$	–0.0689**	–0.0385	–0.0577**	–0.0578**
	(0.0204)	(0.0253)	(0.0113)	(0.0109)
$\Delta s_{i,t}$	0.7598**	0.7493**	0.7482**	0.7476**
	(0.0624)	(0.0524)	(0.0383)	(0.0431)
$\Delta ulc\_row_{i,t}$	–0.0429	–0.0203	–0.0257	–0.0146
	(0.0448)	(0.0339)	(0.0392)	(0.0538)
$gap_{i,t}$	0.2509*	0.1547#	0.1432	0.1512
	(0.1241)	(0.0923)	(0.1183)	(0.1225)
No. of observations	207	207	218	218
Sargan test	90.37*	185.61		
m_2 test for autocorrelation	–0.54	–0.67		
Wald test for joint significance of explanatory variables	471.56**	370.76**		
Adjusted R^2			0.9195	0.9225
F-test for joint significance of fixed effects				1.01
Test for joint significance of time effects				
F-test			28.49**	25.49**
Wald test	546.22**	249.81**		

Notes:
1. This table reports estimation results for equation (7).
2. The figures in parentheses are robust standard errors.
3. Both GMM1 and GMM2 refer to estimations carried out using the Arellano-Bond one-step dynamic panel-data first-difference robust estimator. GMM1 instruments only for the lagged dependent variable, whereas GMM2 also instruments for the rate of depreciation. In both cases, a restricted version of the estimator is used in that the maximum number of available lagged values of the endogenous variables used as instruments is set to 3. See section 3.2 for more details on these estimators.
4. "**", "*", and "#" indicate statistical significance at the 1, 5, and 10 per cent levels, respectively.

Table D2: Dependent Variable: Rate of Change in Annual Produce Price Index
Panel Estimates for 11-Country Sample over 1977–2001

Estimation technique	GMM1	GMM2	Pooled OLS	Fixed effects
$\Delta p_{i,t-1}$	0.3434**	0.4206**	0.4538**	0.4138**
	(0.0713)	(0.0621)	(0.0486)	(0.0502)
$\Delta p_{i,t-2}$	–0.1075**	–0.0922*	–0.0312*	–0.0322*
	(0.0312)	(0.0402)	(0.0134)	(0.0128)
$\Delta s_{i,t}$	0.2112**	0.2023**	0.2137**	0.2052**
	(0.0287)	(0.0289)	(0.0246)	(0.0259)
$\Delta ulc\_row_{i,t}$	0.0066	0.0505	0.0759**	0.0413
	(0.0538)	(0.0471)	(0.0278)	(0.0360)
$gap_{i,t}$	0.1251	0.0374	0.0063	0.0513
	(0.0793)	(0.0705)	(0.0514)	(0.0606)
No. of observations	229	229	240	240
Sargan test	117.25**	191.83		
m_2 test for autocorrelation	–1.56	–1.46		
Wald test for joint significance of explanatory variables	204.78**	190.97**		
Adjusted R^2			0.8644	0.8701
F-test for joint significance of fixed effects				0.75
Test for joint significance of time effects				
F-test			19.12**	19.17**
Wald test	1189.62**	936.37**		

Notes: See notes for Table D1.

Table D3: Dependent Variable: Rate of Change in Annual Consumer Price Index Panel Estimates for 11-Country Sample over 1978–2001

Estimation technique	GMM1	GMM2	Pooled OLS	Fixed effects
$\Delta p_{i,t-1}$	0.5061**	0.5228**	0.5426**	0.5201**
	(0.0638)	(0.0468)	(0.0463)	(0.0506)
$\Delta p_{i,t-2}$	–0.0222	–0.0255*	–0.0154**	–0.0153**
	(0.0148)	(0.0102)	(0.0042)	(0.0044)
$\Delta s_{i,t}$	0.0650**	0.0804**	0.0806**	0.0809**
	(0.0238)	(0.0202)	(0.0156)	(0.0166)
$\Delta ulc\_row_{i,t}$	0.1155**	0.1337**	0.1300**	0.1346**
	(0.0317)	(0.0293)	(0.0191)	(0.0227)
$gap_{i,t}$	0.1370*	0.0887#	0.0737#	0.0890*
	(0.0628)	(0.0475)	(0.0375)	(0.0415)
No. of observations	237	237	248	248
Sargan test	78.96	192.13		
m_2 test for autocorrelation	–0.46	–0.25		
Wald test for joint significance of explanatory variables	229.15**	698.87**		
Adjusted R^2			0.9417	0.9445
F-test for joint significance of fixed effects				1.14
Test for joint significance of time effects				
F-test			8.97**	8.49**
Wald test	851.69**	228.62**		

Notes: See notes for Table D1.

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