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Exchange Rate Risk Premium Estimation and an Analysis of Exchange Rate Pass-through into Import Prices

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Declaration of Authorship

I, Sirui Wu, declare that this thesis titled, "Exchange Rate Risk Premium Estimation and an Analysis of Exchange Rate Pass-through into Import Prices" and the work presented in it are my own. I confirm that:

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Abstract

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by Sirui Wu

This thesis investigates the topics related to the exchange rate as it plays a key role in the financial market and international trading. Moreover, it has essential impacts on the effectiveness of monetary policy. Chapter 1 discusses the initial motivations of this thesis, introduces the content of chapters, and briefly positions each essay. In Chapter 2, an innovative model with high predictive power is developed to estimate the currency risk premium based on the Taylor Rule fundamentals, which builds a bridge between exchange rates risk premium and the macroeconomic variables. After that, the focus is switched to the exchange rate pass-through into import prices that measures the response of import prices to the fluctuations in exchange rates. Chapter 3 studies the exchange rate pass-through into aggregated import prices for five developed economies while chapter 4 studies it on a disaggregated import price level for the UK. The findings reveal that exchange rate pass-through differentiate across countries and empirical evidences on the impacts of macroeconomic determinants of exchange rate pass-thorough are provided. Finally, Chapter 5 provides concluding comments and suggestions for the future research. An appendix of all the equations introduced in this thesis is included at the very end.

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Chapter 1: Introduction

This thesis explores the area of international economics and finance through a study of exchange rates. The motivation for focusing on the exchange rate is that the foreign exchange market is the largest trading market; it is 36 times larger than the combined imports and exports for the world's 35 largest economies, 16 times greater than their combined GDP, and approximately 10 times greater than exchange-traded equity turnover (BIS, 2010). In addition to that, a boosting turnover in the foreign exchange markets can be seen, with daily turnover generated from the trading activity in foreign exchange markets rising from \$2.1 trillion in 2010 (BIS, 2010) to \$5.1 trillion in 2016 (BIS, 2016), and to \$12.6 trillion in exchange-traded futures and options in February 2018 (BIS, 2018). Moreover, output and employment are impacted through real exchange rates; inflation is impacted through the cost of imports and product prices, and international capital flows are impacted through the risks and returns of different assets (James, Marsh and Sarno, 2012). Thus, exchange rates are a fairly essential focus for policymakers and the general public.

This thesis deals with three topics; the first topic introduced in Chapter 2 considers the estimation of exchange rate risk premium based on Taylor rule fundamentals. The second and third topics switch the focus from exchange rate risk premium to exchange rate pass-through into import prices, and they are introduced in Chapter 3 and Chapter 4 respectively. Exchange rate pass-through into import prices measures the degree to which import prices will respond to the changes and fluctuations of exchange rates in international trading activities, versus the absorption in producer profit margins or markups. Chapter 3 provides an empirical study of exchange rate pass-through into aggregated import prices while Chapter 4 considers the topic on a disaggregated import price level.

Chapter 2 explores the forecasting of exchange rate risk premium based on Taylor rule fundamentals and this contributes to a new perspective in explaining exchange rates under the category of portfolio balance model of exchange rate. The model builds a bridge between the exchange rate risk premium and macroeconomic variables through Taylor rule fundamentals.

The portfolio balance model of exchange rate assumes that assets denominated in different currencies are not perfectly substitutable. This means that returns on bonds may differ due to a risk premium when expressed in a common currency, and this is what other classical models, such as Purchasing Power Parity (PPP), fail to integrate. Chapter 2 also includes a review and discussion of PPP, Uncovered Interest Parity (UIP) and Taylor-rule fundamentals in the literature review section.

Chapter 2 aims to investigate the excess return on a foreign interest-bearing asset, relative to home currency, and on the basis of quarterly data for developed economies. Hence, US dollar is considered as the home currency while UK pound and Japanese Yen are treated as foreign currencies. This chapter explores the strength of the US dollar against the UK pound and the Japanese yen by examining the excess return on a foreign interest-bearing asset, or risk premium, which can be regarded as the incongruity of Purchasing Power Parity (PPP) theory from the empirical data. A Taylor rule-based two-country interest rate model will then be adopted to estimate the excess return of US dollar against UK pound and Japanese Yen. The excess return on foreign currency is estimated and modelled as a log-linear function of the nominal dollar depreciation and the spread differential between two countries' nominal interest rate. Nominal interest rates are decomposed into five components in the stage of interest rate estimation: lagged interest rate, equilibrium interest rate, inflation gap, output gap and financial stress index (FSI) through a smoothed Taylor rule both in an OLS and GMM framework.

When estimating the policy rates by Taylor rule-based interest rate regressions, in addition to the output gap and inflation gap, another regressor will be introduced into the traditional Taylor rule as a financial stress variable (FSI). The adoption of the FSI variable is an extension of the work of Martin and Milas (2013). The models without FSI will be compared with the corresponding models with FSI to test whether FSI plays a significant role in interest rate setting. There are two different sets of FSI data from different sources: one data set is provided by International Monetary Fund (IMF) from 1980 Q4 to 2018 Q3, and another data set is from Federal Reserve Bank of Kansas City and is used for the robustness check. The full sample is divided at the break point 2007 Q2, so the sample prior to 2007 Q2 is recognised as a pre-crisis sample and the sample after 2007 Q2 is recognised as a crisis & post-crisis sample. Moreover, the regression of the nominal interest rate for the US, UK and Japan will be run over three different sample periods: full sample, pre-crisis sample and crisis & post-crisis sample. After obtaining the estimation of policy rates, three different rates will be adopted as the expected exchange rate respectively, in order to calculate and compare the estimated exchange rate risk premium: the actual exchange rate, the 3-month spot rate and the 3-month forward rate.

The initial results in Chapter 2 show that the Taylor rule-based model is adequate in estimating the excess return on a foreign interest-bearing asset in pairs of US/UK and US/Japan. In addition, GMM estimation gives more significant estimations than those of OLS estimation for all three countries' interest rate setting behaviour. The Taylor-rule base regression does not seem to fit the model for Japan. This may be due to Japan's unique monetary condition of deflation and low inflation following the financial crisis of 1998. In addition, the empirical results reveal significant differences in the estimated coefficients between the pre-crisis sample and the crisis & post-crisis sample, which indicates a regime-switch in the monetary policy. Moreover, the inflation gap seems to be insignificant but the inflation gap with one lead is significant. This could be explained by price stickiness.

The responsiveness of prices to movements in the nominal exchange rate plays an important role in the transmission of optimal monetary policy and shocks in open economies. For example, dating back to Friedman (1953), a traditional argument for flexible exchange rates states that exchange rate flexibility facilitates relative price adjustment in face of country-specific real shocks. The adjustment of relative prices results in an expenditure-switching effect between foreign and home goods that partly counteracts the initial shock's effects. This argument is based on the premise that prices of imported goods in domestic currency respond to movements in nominal exchange rates. If the degree of exchange rate pass-through is low, that is, if import prices only reflect small fluctuations in the exchange rate, the expenditure-switching effects will be small. Therefore, this will reduce the impact of the short run adjustment of nominal exchange rates and enlarge the monetary effectiveness due to the insulation. Thus, the degree of aggregate exchange rate pass-through and its determinants are crucial to the effectiveness of macroeconomic policy.

Chapter 3 assesses the exchange rate pass-through into import prices for five countries: France, Germany, Japan, the UK and the US. The exchange rate pass-through is said to be complete if the changes in the exchange rates are fully transmitted to import prices, if this does not occur, the exchange rate is said to be incomplete. Firstly, the short run and long run exchange rate pass-through elasticity of import prices is derived to provide an across-country empirical evidence of the degree of the exchange rate pass-through. By using quarterly time series data, the level of exchange rate pass-through is examined over the period of 1980-2016.

The second goal of Chapter 3 is to try to examine the determinants of exchange rate pass-through for each country by assessing the money growth rate, annualised money growth rate, inflation, annualized inflation, exchange rate volatility and real GDP. Both quarterly first-order difference equation and annualized first-order difference equation have been adopted to assess the difference between quarterly effects and annual effects where one unit of time lag is a quarter. In addition, two methods are used to test the determination of tested factors. The first method considers factors as endogenous variables and the second method employs the cross-section product to examine whether a variable is significant in affecting the dependent variable.

The results show that France and the US have higher exchange rate pass-through both at the short run and the long run. Real GDP has significant effects only on France according to the data. Exchange rate volatility is significant across all five countries, which is consistent with the findings of previous studies. However, for those countries whose money growth rate is significantly effective in determining exchange rate pass-through, their inflation rate is insignificant at the same time according the estimation results. There is no situation where both of them are significant at the same time for any country on a quarterly basis. German exchange rate pass-through is influenced by money growth rate only at annualized level, while inflation rate is positively effective only at annualized level in the case of France and US. In general, the results imply that the adoption of the annualized rate and annualized first-order difference regression do improve the response of exchange rate pass-through to those determinants. This can be explained by the price stickiness, this is, the changes in price is normally considered to be sluggish in the response of monetary policy changes or other market shocks.

Chapter 4 extends the exchange rate pass-through analysis by focusing on the UK at a disaggregated import prices level. The research provides important insights for the decision making in international trade strategy in the context of the UK considering the challenges of BREXIT. This chapter will show the empirical evidence of impacts of exchange rate pass-through on the UK in its import prices. Firstly, the degree of exchange rate pass-through of the UK will be examined at six industries: manufacture (MAN), semi-manufacture (SMAN), finished-manufacture (FMAN), Food & Beverage & Tobacco (FBT), basic material (BM) and fuels. Meanwhile, five different measures will be explored to describe the domestic market demand condition as part of the robustness check, and consideration will also be given to the impact of a positive and negative business climate index on the UK's exchange rate pass-through in the chapter. Then, Chapter 4 will explore the determinants of the exchange rate pass-through on five factors: money growth, inflation, exchange rate volatility, real GDP and central bank credibility. Lastly, the bilateral exchange rate pass-through at a two-country level will be examined for five countries: Australia, Canada, China, Eurozone, Japan, and the US.

The results show that semi-manufacture has the highest exchange rate pass-through while Food & Beverage & Tobacco has the lowest value, and exchange rate pass-through for fuels' import price is not linearly significant. The exploration of domestic demand conditions by six different indices has shown that the IMP and BCI indexes perform better than GDP, GDP growth rate, IMP growth rate and BCI UK in describing domestic market demand conditions. In addition, the determinants of exchange rate pass-through have been investigated for the UK's disaggregated import prices in six different import sectors. Negative BCI has significantly positive effects on the exchange rate. The results show that all the factors are significant in determining the changes of import prices, however at different timing lags. Inflation tends to have more immediate effects on the import prices than other factors while real GDP and central bank credibility seem to have a lagged influence on the import prices (about two to three quarters lagged). Exchange rate volatility also has an impact on the import prices up to three lagged quarters, implying that exchange rate volatility has longer and more consistent impacts on the import prices than other factors. This could be used as an indicator when predicting the changes of import prices at a qualitative or quantitative level.

Chapter 2: Exchange Rate Risk Premium Estimation: An Approach of Taylor Rule Fundamentals

2.1 Introduction

A number of exchange rate models have been built, and investigated, by economists in existing literature, among which the Purchasing Power Parity (PPP) and Uncovered Interest Parity (UIP) are two of the traditional exchange rate models, based on international trading behaviour and assumptions. In addition, modern macroeconomic models, based on the portfolio balance model and Taylor rule fundamentals are becoming popular in recent years. The portfolio balance model captures international capital movements by portfolio managers, which the previous two models fail to observe. Models, based on the Taylor rule fundamentals, build the link between exchange rate behaviours and interest rate rules, reflecting monetary policy's influence on corresponding exchange rate behaviours. This section will give an introduction to exchange rate models discussed in previous literature. Moreover, a variable presenting the financial stress index and its adoption in the Taylor rule fundamentals, will also be discussed.

2.1.1. A review of classical exchange rate models

This section will provide a brief introduction of three classical exchange rates models and their practice in the real market. The three models are: PPP, UIP and portfolio balance model.

Purchasing Power Parity (PPP)

The underlying principle of PPP theory is that the equalization of goods' prices will be achieved internationally by arbitrage forces once the goods' prices are expressed in terms of the same currency. The theory applies the 'law of one price', which claims that identical products sold in different markets will remain at the same price when measured in the same currency and in the absence of trade barriers and limited transport costs within a competitive market structure. PPP was first introduced by Cassel (1928) and emphasised that the price level is the most important determinant in exchange rates among other explanatory variables. Absolute PPP can be stated as just the ratio of two countries' price levels, $S = \frac{P}{P^*}$, where S is defined as the exchange rate domestic currency per unit of foreign currency, P is the domestic price of a specific bundle of goods, and $P^*$is the foreign price of a specific bundle of goods. Relative PPP states that exchange rates will change in line with the inflation differential between two economies. It is known as a weak form of absolute PPP, since absolute PPP is implausible, due to its theoretically weak assumptions of no barriers to trade, transport costs and a competitive market structure. It can be expressed algebraically by $\%\Delta S=\%\Delta P-\%\Delta P^*$, where the left-hand side is the percentage change in exchange rate, and right-hand side is the percentage change of differences between domestic price levels and foreign price levels.

The PPP hypothesis does not always hold in line with actual exchange rates. Empirical evidence has shown that exchange rates' behaviour is much more volatile than the corresponding price levels (Frenkel and Mussa 1980). The first reason for its failure lies in its theoretical assumptions. Frenkel (1981) found that PPP holds better for geographically-close countries where trade linkages are strong and transport costs are low. Eurozone currencies are quite accurately followed by PPP but there are discrepancies in actual exchange rates between Deutschmark, Yen and Pound Sterling against the US dollar compared to their PPP exchange rates. This indicates that PPP only holds if trade barriers are low, which is not the case within the global context, as tariffs and transport costs can be high. For the same underlying reason, Officer (1986) proposed that PPP holds better for tradeable goods over non-tradeable goods. In addition, statistical problems exist for researchers when selecting the identical price level to which compare goods, since weights are attached differently in various categories of goods by different countries. Moreover, theoretically, the concept that PPP is based upon the arbitrage power in the commodity market which does not account for the impacts on exchange rates by international capital movements, which are instead growing substantially.

Despite the fact that PPP does not hold well with time series data, PPP still plays a role in exchange rate determination in the short to medium term. Large deviations of currencies from PPP will cause the commodity market arbitrage power to reverse the exchange rate. The empirical evidence that PPP performs better in the long run rather than short run (Lothian, 1998), whilst considering its reversion property, indicates that PPP may be a useful index for the long run exchange rate. It is also argued that the PPP model dominates the random walk (RW) forecasts for long-horizons, while RW outperforms the PPP model at short horizons (Cheung, Chinn and Pascual, 2005).

Uncovered Interest Parity (UIP)

Uncovered interest parity can be dated back to Fisher (1896); the theory of interest parity came into the public realm through the work of Keynes (1923). It can be expressed as $E\dot{S} = r - r^{*}$, where $E\dot{S}$ represents the expected rate of depreciation of the home currency, r is the home currency's interest rate, and r^{*} is the foreign interest rate. A wide-range of previous literature has claimed a strong linkage between real exchange rates and the real interest rate differentials of corresponding parity countries. For example, Frankel (1979) posited a theory that the floating exchange rate is based on real interest rate differentials and gave an explanation of how an increase in the short-run real interest rate would lead to a currency's real appreciation. Dumas (1992) also suggested this by examining the derivation of the interest-rate differential, which is further corroborated by the recent empirical work by Mark (2009). Moreover, Cheung, Chinn and Pascual (2005), and Alquist and Chinn (2008), also highlights that in the long-term UIP forecasts are better than RW.

Portfolio Balance Model

The above classical models do not capture the economic shocks in their explanations of exchange rates, thus, they fail to explain exchange rate volatility within the context of the real-world environment. Smith (1987) has pointed out that exchange rate volatility can be influenced by real and nominal shocks. Portfolio balance model includes a risk element, which allows for the impacts of shocks with greater accuracy (in relation to exchange rate fluctuations) compared to the above-mentioned models. One underlying assumption of the portfolio balance model is that domestic and foreign bonds are not perfect substitutes, and this will influence investor's perspectives and investments, which is the main distinguishing feature of the portfolio balance model from PPP and UIP. Besides, investors will require a higher expected return, to compensate the extra risk they bear if they are risk-averse and rational. This risk premium could be an exposure of various risks in an economy, such as: inflation risk, exchange control risk, default risk and political risk. Those exchange rate models, coupled with the portfolio balance concept, were innovated by William Branson (1980, 1981, 1983 and 1984), Branson, Halttunen and Masson (1977) and Kouri (1976). Subsequent models have been developed and extended in different directions by Maurice Obstfeld (1980). The basic fundamental of this method can be expressed by $r - r^* = E\dot{S} + RP$, where RP represents currency risk premium.

2.1.2. Taylor-rule fundamentals

This section will first introduce the Taylor rule, its appeal to the monetary authorities, and its significant impact on policy-makers across countries. Secondly, critiques of Taylor rule measurements will be discussed, such as the output gap and the inflation gap. Lastly, the adoption of Taylor rule fundamentals for exchange rate forecasting in modern macroeconomic models will be presented and discussed, along with its predictability.

The Taylor rule was first discussed by John Taylor in November 1992, at the Carnegie Rochester Conference, and was implemented by monetary authorities. It has become the standard framework that introduces monetary policy in many macroeconomic models. It revolutionized the way many central banks' policy-makers think and act and provided a new perspective for policy-makers to think about monetary policy. It models the policy rate as a systematic response to economic conditions, rather than optimizing on short-term issues. The Taylor rule suggests to policy-makers to set the nominal interest rate, as per the function of the inflation gap (the difference between the actual inflation and its target) and the output gap (the difference between the real GDP level and potential GDP). The Taylor rule is based upon three assumptions: a two percent inflation target rate, a two percent equilibrium of the real interest rate, and equal weights on inflation gap and output gap at 0.5. The rule is in the following form:

$$i = 2 + \pi + 0.5(\pi - 2) + 0.5(y - y^*)$$

where π is the rate of inflation, measured by the GDP deflator of the preceding four quarters, and (y-y*) is the percent output gap. Taylor said that he derived the simple form function from the foundation of studies of different rules, in the various types of stochastic simulations for monetary modelling, and it was a prescriptive rule rather than a descriptive rule (Koeing et al, 2012). The rule is used to explain policy-makers' behaviour in the past, and to provide a view of policy in the future. It performs as a benchmark for monetary authorities in assessing the current situation of monetary policy and in deciding the future policy direction.

The Taylor rule attracted the attention of central bank policy-makers because of its simplicity, intuitiveness and efficiency, as an instrument in exploring monetary policy. This rule is simple since it only requires the inflation gap and output gap to predict the next period's monetary goal. The rule is intuitive, since it requires policy-makers to adjust the policy rate along with the market shocks in aggregate demand and price level; the deviations of inflation from its target, and deviation of output from its potential, intuitively relate to the policy rate-setting. It can be seen that the rule requires central banks to increase the policy rate in order to respond to a rise in the inflation gap. Before 1993, most literature presented the way to explore monetary policy by an exogenous autoregressive process on money supply. However, this was not how policy-makers determined the target rate by themselves, perhaps except in the period from 1979-1983, the main instrument to decide the policy rate for Federal Reserve is a short-term interest rate, following the Treasury Federal Reserve Accord (Meulendyke, 1998). Taylor (1993) has showed in his paper that its rule tracked the actual path of policy rate for the Federal Reserve from 1987 to 1992. This implies the fitness and efficiency of the Taylor rule in describing the past policy rate and providing a benchmark for the future. However, Taylor (1993) did not support the monetary authorities in following a rule, mechanically, in setting the policy rate. He also stated the reason - that there should be adjustments for different policy rate regimes from period to period.

Whilst the Taylor rule was formally recognised in 1993, the Federal Open Market Committee (FOMC), however, appeared to have been utilizing similar principles from 1987 to 1992, which further emphasises the analytical capabilities of the rule. Once the Taylor rule became public knowledge, they included it within their information set, which was reviewed regularly by them. FOMC staff have been regularly using the Taylor rule for guidance in deciding the policy rate from at least 1995 (Koeing et al, 2012). The documents of FOMC meeting transcripts from 1993 to 2003 can provide evidence that the Taylor rule was used by FOMC, in a way similar to what Taylor had recommended in 1993. FOMC members regularly applied rules in their deliberations. Not only did the Federal Reserve use Taylor as a central instrument to analyse policy rate-setting, but also other central banks have incorporated the rule to various degrees in their monetary policy analysis and decision-making, such as the European Central Bank, Bank of England and Bank of Japan.

However, this monetary policy rule was criticised by sceptics. Fed Chairman, Alan Greenspan (1997), thought that the Taylor rule was not always preferable, since the policy needed to respond to the shocks or changes that were outside of its previous experience. He also argued that the Taylor rule seemed to assume that future situations would be similar to the past, which was not the case in reality since what happened in the past is not a reliable guide to the future. Bernanke and Mishkin (1992) claimed that the monetary authorities were not allowed to respond to unforeseen economics shocks by monetary policy rules, a view with which Taylor (1992) disagreed. Taylor (1993) also indicated that the specific policy rule could be added to the factor lists, such as structural model and leading market indicators.

The first problem with the Taylor rule is the sensitivity of Taylor-rule implied policy rates to the different measurements. Firstly, there are many ways of plotting the measurement of the inflation rate, or the output gap, such as the current GDP deflator inflation, the current CPI inflation, the consensus forecast of CPI inflation for one period afterwards, and the current core CPI inflation, whilst the output gap can be calculated based on HP trend, production function, or multi-variate Kalman trend, among others. At the meeting of the FOMC in May 1995, the question of which measure of inflation should be used, in estimating the Taylor's benchmark for the policy, was discussed. Chairman Greenspan noticed that the policy prescription, estimated by the Taylor rule, would change if the GDP data were revised. Donald Kohn also claimed that the normative prescription for the policy rate was at 4.5 percent if the implicit price deflator was used, while the normative prescription for the policy rate is 5.75 percent if the consumer price index was used. Besides, the Taylor rule did not track the actions of FOMC in the earlier years, if the CPI inflation rate was used. The Vice Chairman, Alan Blinder, stated that the parameters of the Taylor rule should be changed, if the variables were changed (FOMC, 1995). Secondly, the forward or backward-looking method would also result in different target rates (FOMC, 1997; 2003).

The second problem concerns the uncertainty of the output gap. To deal with the uncertainty of the inflation rate of unemployment, which is measured by the output gap and cannot be detected directly in time, Meyer suggested a policy rate to respond to the increase of the core inflation rate by the Taylor rule, but to respond negatively to a decrease of inflation (FOMC, 1999a). Some other approaches have also been offered by other members. A speed limit rule was recommended by Gramlich (FOMC, 1999b), which targets the aggregate growth demand at about 3 percent, and to remain with a policy if there is no sign of inflation acceleration. Gramlich advocated two additional solutions, in the later meeting: replacing the output gap term by an inflation-targeting rule (FOMC, 1999c), or adding a term relating to the nominal GDP directly (FOMC, 1999d).

The linkage between interest rates and exchange rate has been studied by various researchers. Interest rate-setting behaviours in an open economy, has been investigated quantitatively by Clarida, Gali and Gertler (1998). It has also been studied in the perspective of welfare properties (Ball, 1999; Clarida, Gali and Gertler, 2001; Svensson, 2000). The study of Ghosh, Ostry and Chamon (2016) also indicates that the foreign exchange rate intervention is an effective second monetary policy instrument to improve welfare. Previous literature has indicated a connection between interest rate rules of monetary policy and exchange rates behaviour, while the Taylor rule is a monetary rule that central banks will respect and follow when setting the interest rates. It is plausible to set a model with the linkage between exchange rate behaviour and Taylor rule fundamentals, such as the inflation gap, output gap and inflation. In general, this model tends to combine the macroeconomic fundamentals of PPP and UIP into one model.

Engel and West (2006) investigated the Deutschmark-Dollar real exchange rate with the Taylor rule fundamentals that demonstrated the exchange rate as a present value, and the present value is estimated by theoretical forecasting equations. A similar approach has been studied by Frankel and Meese (1987) and West (1987). The discount factor relies on weights that the real exchange rate obtains in the Taylor rule.

Aside from the method that treats the exchange rate as a present value concept, there are three other strands of literature that analyse exchange rates in the framework of the interaction between interest rates and exchange rates. One of the methods is to identify vector autoregressions (VARs). Kim (2002) devised an exchange rate into interest rate equation. The second method is the examination of interest parity, which decomposes the real exchange rates into two parts, those that can be connected to interest rates and those that cannot, such as the work demonstrated by Campbell and Claria (1987), Edison and Pauls (1993) and Baxter (1994). The third method is to build an equilibrium exchange rate model. One of the examples is the general equilibrium sticky-price models with calibration, such as the work of Benigno (2004) and Benigono and Benigno (2001). Another example is the fundamental equilibrium exchange rate, where equilibrium exchange rate is characterized as the real exchange rate that is consistent with macroeconomic variables, shown by the work of Clark and MacDonald (1999). In this chapter, the second method's structure will be followed.

Some studies (i.e. Molodtsova, Nikolsko-Rzhevskyy and Papell, 2008; Molodtsova and Papell, 2009) have shown that exchange rate models, based on the Taylor rule fundamentals, perform better than others, while other studies (i.e. Rogoff and Stavrakeva, 2008) disagree with these findings. Molodtsova (2008) found positive evidence among 8 of 10 currencies, when she investigated the predictability of short term and real-time exchange rates with Taylor rule fundamentals, for 9 OECD currencies and the Euro against US dollar. In addition, in the work of Molodtsova and Papell (2009), out-of-sample predictability of exchange rates - with Taylor rule fundamentals - has also been explored for 12 OECD currencies, and evidence of predictability - for 11 out of 12 currencies - was identified for the post-Bretton Woods period. On the other hand, Rogoff and Stavrakeva (2008) stated that evidence in favour of the Taylor rule fundamentals is not robust.

2.2. Methodology

This chapter aims to investigate the excess return, on a foreign interest-bearing asset, relative to home currency, on the basis of quarterly data. Hence, the US dollar is considered as a home currency, while the UK pound and Japanese Yen are treated as foreign currencies. The excess return, also called 'risk premium on foreign currency', is calculated based on two variables: expected home currency depreciation and nominal interest rate differentials. The Taylor rule-based two-country interest rate model will be adopted to estimate the excess return of the UK pound and Japanese Yen against the US dollar.

Nominal expected home currency depreciation will be computed by quarterly exchange rate data directly. Nominal interest rates for each country will be forecasted by a modified Taylor rule regression, and then the nominal interest rate differentials could be obtained by the fitted values of home country and foreign country interest rates.

In the modified Taylor rule-based interest rate regressions, apart from the output gap and inflation gap, another regressor will be introduced into the original Taylor rule as a financial stress variable (FSI). The models (without FSI) will be compared with the corresponding models (with FSI) to test whether FSI plays a significant role in interest rate-setting. There are two different sets of FSI data: one data set is provided by the International Monetary Fund (IMF) from 1980 Q4 to 2018 Q3, and the other data set is from the Federal Reserve Bank of Kansas City, employed for a robustness test. The full sample will be divided into two time periods: a pre-crisis period and crisis & post-crisis sample at break point 2007 Q2, by following the work of Martin and Milas (2013). Moreover, the estimation regression of the nominal interest rate for the US, UK and Japan, will be run on three different sample periods separately; they are: full sample 1980 Q4-2018 Q3, pre-crisis sample 1980 Q4-2007 Q1 and crisis & post-crisis sample 2007 Q2-2018 Q3.

Furthermore, both OLS and GMM estimation methods will be applied. Three different measurements of inflation gap in the regression estimation will also be tested.

2.3. Model

2.3.1. Model Specification

Table 1: Variable Definitions

Variable	Definition
$\mathbf{e_t}$	Log of the nominal exchange rate quoted as domestic currency units per unit of foreign currency
$\mathbf{i_t}$	Nominal interest rate per annum (%)
$\hat{\mathbf{i}}_\mathbf{t}$	Desired steady-state nominal policy rate
$\bar{\mathbf{i}}$	Equilibrium nominal policy rate
$\mathbf{y_t}$	Output gap
$\mathbf{cpi_t}$	Consumer price index
$\boldsymbol{\pi}^\mathbf{T}$	Inflation target (%)
$\boldsymbol{\pi}_\mathbf{t}$	Inflation rate (%)
$\boldsymbol{\pi}_\mathbf{t} - \boldsymbol{\pi}^\mathbf{T}$	Inflation gap
$\mu_\mathbf{t}$	Financial stress index
$\boldsymbol{\lambda}_\mathbf{t}$	Nominal excess return on foreign interest-bearing assets/nominal currency premium
$\mathbf{sp}_t$	3-month average spot exchange rate in logarithm
$\mathbf{f}_t$	3-month forward exchange rate in logarithm
$\boldsymbol{\rho}_\mathbf{i}$	Parameter corresponds to variable i
$\boldsymbol{\rho}_{\boldsymbol{\pi}}$	Parameter corresponds to variable π
$\boldsymbol{\rho}_\mathbf{y}$	Parameter corresponds to variable y
$\boldsymbol{\rho}_\mu$	Parameter corresponds to variable μ

Superscript * refers to foreign country. $\varepsilon_t \sim \mathrm{iid}(0, \sigma^2)$ (Homoscedasticity)

The nominal excess return on foreign interest-bearing assets equals the differential between foreign and the US nominal interest rates, plus the expected nominal depreciation of the domestic currency. This excess return can also be considered as a relative foreign to US risk premium, for investing in foreign-interest based assets against the US-interest based assets, also known as the excess foreign currency return.

In the Engel and West (2010) paper, nominal excess return on foreign interest-bearing assets is defined by:

$$\lambda_t \equiv i_t^* - i_t^h + E_t e_{t+1} - e_t \tag{2.1}$$

where λ_t is regarded as a deviation form uncovered interest parity.

The nominal interest rate i_t in equation (2.2) can be modelled by a smoothed Taylor rule (Hofmann and Bogdanova, 2012).

$$i_t = \rho_i i_{t-1} + (1 - \rho_i)\hat{i}_t \tag{2.2}$$

Desired steady-state nominal policy rate $\hat{i}_t$ is modelled as

$$\hat{i}_t = \{\bar{i} + \rho_\pi(\pi_t - \pi^T) + \rho_y y_t\} + \varepsilon_t \tag{2.3}$$

where ρ_i is considered as a smooth parameter and $\bar{i}$ is the equilibrium nominal interest rate, assumed constant.

Substituting (2.3) to (3.2) to get

$$i_t = \rho_i i_{t-1} + (1 - \rho_i)\{\bar{i} + \rho_\pi(\pi_t - \pi^T) + \rho_y y_t\} + \varepsilon_t \tag{2.4}$$

Substituting (2.4) to (2.1), the estimated excess return is obtained:

$$\begin{aligned}\lambda_{1t} = (E_t e_{t+1} - e_t) + \frac{1}{4}\{(\rho_i^* i_{t-1} + (1 - \rho_i^*)(\bar{i}^* + \rho_\pi^*(\pi_t - \pi^T)^* + \rho_y^* y_t^*)\} \\ - \frac{1}{4}\{\rho_i^h i_{t-1} + (1 - \rho_i^h)(\bar{i}^h + \rho_\pi^h(\pi_t - \pi^T)^h + \rho_y^h y_t^h)\}\end{aligned} \tag{2.5}$$

In this chapter, the nominal interest rate i_t will be regressed on Equation (2.4) first and then the excess return on a foreign interest-bearing asset will be estimated, by fitted interest rates from Equation (2.5), where interest rate estimations are divided by four to fit quarterly basis data.

Now, introducing the financial stress index μ to the regression for the nominal interest rate, then the desired steady-state nominal rate is structured by

$$\hat{i}_t = \{\bar{i} + \rho_\pi(\pi_t - \pi^T) + \rho_y y_t + \rho_\mu \mu_t\} + \varepsilon_t \tag{2.6}$$

Substituting (2.6) to (2.2), the following equation is obtained:

$$i_t = \rho_i i_{t-1} + (1 - \rho_i)\{\bar{i} + \rho_\pi(\pi_t - \pi^T) + \rho_y y_t + \rho_\mu \mu_t\} + \varepsilon_t \tag{2.7}$$

Substituting (2.7) to (2.1), the estimated excess return is expressed as follows:

$$\lambda_{2t} = (E_t e_{t+1} - e_t) + \frac{1}{4}\{(\rho_i^* i_{t-1} + (1-\rho_i^*)(\bar{\imath}^* + \rho_\pi^*(\pi_t - \pi^T)^* + \rho_y^* y_t^* + \rho_\mu^* \mu_t{}^*)\}$$
$$- \frac{1}{4}\{\rho_i^h i_{t-1} + (1-\rho_i^h)(\bar{\imath}^h + \rho_\pi^h(\pi_t - \pi^T)^h + \rho_y^h y_t^h + \rho_\mu^h \mu_t)\} \quad (2.8)$$

The nominal interest rate i_t will be regressed on Equation (2.7) first and then excess return on a foreign interest-bearing asset will be estimated by fitted values from Equation (2.8).

The last stage is to compare the actual value of λ_t with its estimated values (λ_{1t} and λ_{2t}). λ_{1t} and λ_{2t} present the estimation of λ_t by the fitted values from Taylor rule-based regressions with and without the FSI variable. λ_t is modelled by three approaches, where three different values are employed to predict the expected foreign exchange rate. Next-period value of exchange rate, 3-month spot rate, 3-month forward rate are employed to estimate expected exchange rate, as Equation (2.9), (2.10) and (2.11) demonstrates.

$$\lambda_{rt} = e_{t+1} - e_t + \frac{1}{4}(i_t^* - i_t^h) \quad (2.9)$$

$$\lambda_{st} = sp_t - e_t + \frac{1}{4}(i_t^* - i_t^h) \quad (2.10)$$

$$\lambda_{ft} = f_t - e_t + \frac{1}{4}(i_t^* - i_t^h) \quad (2.11)$$

2.3.2. Data Description

Financial stress index (FSI)

IMF FSI is defined by:

$\mu_t = \beta$ + TED spreads + Inverted term spreads+ Corporate debt spreads + Stock market returns + Stock market volatility + Exchange market volatility, where $\beta = \frac{\mathrm{COV}(r_{i,t}^M, r_{i,t}^B)}{\sigma_{i,M}^2}$

which is an unweighted average of 7 variables in total. The FSI is structured to capture three financial market sectors: the banking, securities and foreign exchange markets. Three components, β (banking-sector data), TED spreads and inverted term spreads draw the attention of the banking sector. The following three components: corporate debt spreads, stock market returns and stock market volatility are used to observe the security market. Lastly, exchange market volatility captures movements in the foreign exchange market. Positive FSI indicates a financial strain while a value of zero suggests neutral conditions in financial markets. A negative (positive) effect of FSI on the policy rate will be expected if the central bank intends to lower (higher) nominal interest rates to adjust the economy under (without) financial strain.

The Federal Reserve Bank of Kansas City FSI defined is by 11 variables by principal component methods, as the table shows below:

Variable	**Coefficient in KCFSI**
TED spread	0.099
2-year swap spread	0.116
Off-the-run/on-the-run-Treasury spread	0.107
Aaa/Treasury spread	0.107
Baa/Aaa spread	0.125
High-yield bond/Baa spread	0.124
Consumer ABS/Treasury spread	0.130
Stock-bond correlation	0.081
Stock market volatility (VIX)	0.129
Idiosyncratic volatility (IVOL) of banking industry	0.130
Cross-section dispersion (CSD) of bank stock returns	0.116

Inflation rate is calculated by an annual ex-post inflation measure

$$\pi_t = 100 * (\frac{cpi_t - cpi_{t-4}}{cpi_{t-4}})$$

Inflation gap is calculated in three ways:

$\pi_t - \pi^T$, where the target (%) is $\pi^T = 2$

$\pi_{t+1} - \pi^T$, where the target (%) is $\pi^T = 2$

$\pi_{t-1} - \pi^T$, where the target (%) is $\pi^T = 2$.

Table 2: Data Sources

Variable	Data		Source
$\mathbf{i_t}$	nominal interest rate	US	DataStream (Reuters)
		UK	DataStream (Bank of England)
		Japan	DataStream (Bank of Japan)
$\mathbf{y_t}$	GDP gap	US/UK/Japan	DataStream (oxford economics)
$\mathbf{cpi_t}$	CPI	US	Bureau of Labour Statistics, U.S. Department of Labour
		UK	Federal Reserve Bank of St. Louis
		Japan	Thomson Reuters/Statistics Bureau, Ministry of Internal Affairs & Communication, Japan
$\mathbf{e_t}$	Exchange rates	US/UK	DataStream(WM/Reuters)
		US/Japan	Bank of England
$\mathbf{SP}_t$	Spot exchange rates	US/UK; US/Japan	Bank of England (Codes: XUDLGBD, XUDLJYD)
$\mathbf{F}_t$	Forward exchange rates	US/UK; US/Japan	Bank of England (Codes: XUQADS3, XUQAJYD)
μ_t	financial stress index	US/UK/Japan	International Monetary Fund; Federal bank of Kansas

Note: Two different financial stress indexes (FSI) have been applied. The first FSI is provided by the International Monetary Fund (IMF) covered from 1980 Q1 to 2018 Q4 for each country. The FSI by Federal bank of Kansas is provided from 1990 Q1, but only for US. US FSI is also employed for the UK and Japan FSI in the regressions since US FSI is regarded as a representation of financial stress as the US is the major financial market in the world.

Table 3: Data Description

	Mean	Median	Max	Min	S.D.	Skew.	Kurt.	Obser.
Japan								
μ_t	-0.03	-0.09	13.42	-5.07	2.56	1.76	10.56	152
π_t	0.87	0.51	7.64	-2.21	1.55	1.19	5.28	152
i_t	1.66	0.50	7.25	-0.10	2.16	0.99	2.42	152
y_t	-0.70	-0.75	3.30	-6.90	1.58	-0.37	4.06	152
e_t	131.49	117.73	259.27	77.32	45.72	1.56	4.38	152
F_t	130.30	116.69	266.50	76.58	44.77	1.57	4.48	152
SP_t	131.96	118.12	270.82	76.76	45.91	1.55	4.38	152
UK								
μ_t	-0.01	-0.39	15.10	-4.96	2.93	2.00	10.47	152
π_t	3.33	2.44	15.28	0.30	2.62	1.95	7.33	152
i_t	5.99	5.57	14.88	0.25	4.35	0.31	2.10	152
y_t	0.18	-0.62	5.13	-4.82	2.58	0.27	1.84	152
e_t	0.63	0.63	0.90	0.42	0.08	0.35	3.96	152
F_t	0.63	0.63	0.90	0.42	0.08	0.33	4.09	152
SP_t	0.63	0.62	0.87	0.41	0.08	0.31	3.87	152
US								
μ_t	-0.11	-0.81	18.20	-4.66	3.30	2.42	13.45	152
π_t	3.06	2.82	12.54	-1.61	2.00	1.92	9.36	152
i_t	4.59	4.75	19.00	0.25	3.88	1.09	4.63	152
y_t	-2.17	-2.00	1.50	-8.31	1.96	-0.73	3.33	152

The table exhibits the descriptive statistics for all the data used in this chapter, including mean, median, maximum value, minimum value, standard deviation, skewness, kurtosis and the number of the observations for each variable.

2.4. Empirical Results

2.4.1. Interest Rate Estimation by Taylor Rule Fundamentals

2.4.1.1. OLS Estimation

In this section the results for regressions of nominal interest rates for the US, UK and Japan will be reported. The regressions are run by the following equations using OLS estimation

$$i_t = \rho_i i_{t-1} + (1-\rho_i)\{\bar{\imath} + \rho_\pi(\pi_t - \pi^T) + \rho_y y_t\} + \varepsilon_t \quad (2.4)$$

$$i_t = \rho_i i_{t-1} + (1-\rho_i)\{\bar{\imath} + \rho_\pi(\pi_t - \pi^T) + \rho_y y_t + \rho_\mu \mu_t\} + \varepsilon_t \quad (2.7)$$

For each country, regressions will be run over the full period from 1980 Q1 to 2018 Q3, and the pre-crisis sample is 1980 Q1-2007 Q1 while the crisis & post-crisis sample is 2007 Q2-2018 Q3 by IMF FSI. Kansas' FSI has also been used for the robustness check.

Table 4: US Regressions with IMF FSI

US Nominal interest rate	Full Sample		Pre-crisis sample		Crisis & Post-crisis sample	
OLS	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.932***	0.938***	0.888***	0.879***	0.795***	0.851***
	(0.0287)	(0.0291)	(0.0447)	(0.0483)	(0.0479)	(0.0500)
$\boldsymbol{(1-\rho_i)\bar{\imath}}$	0.367***	0.330**	0.650***	0.704***	0.333***	0.188
	(0.135)	(0.140)	(0.221)	(0.247)	(0.113)	(0.120)
$\boldsymbol{(1-\rho_i)\rho_\pi}$	0.0206	0.0198	0.0804	0.0772	-0.00726	-0.0251
	(0.0601)	(0.0601)	(0.0872)	(0.0878)	(0.0448)	(0.0426)
$\boldsymbol{(1-\rho_i)\rho_y}$	0.0814**	0.0774**	0.0946*	0.0889*	0.0813***	0.0444
	(0.0336)	(0.0337)	(0.0481)	(0.0497)	(0.0290)	(0.0308)
$\boldsymbol{(1-\rho_i)\rho_\mu}$		-0.0226		0.0230		-0.0318**
		(0.0211)		(0.0472)		(0.0123)
Observations	151	151	105	105	46	46
R^2	0.955	0.955	0.927	0.927	0.923	0.933
Adjusted R^2	0.954	0.954	0.925	0.925	0.917	0.927
F	1031	774.4	429.1	319.5	166.9	143.7
LM Test	0.3888	0.2846	0.3098	0.3927	0.9463	0.5440
Breusch-Pagan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Jarque-Bera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

The table shows the results of the regression of US nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10%, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively.

Table 4 above shows the results of Taylor rule regression for the US's policy rate, for the sample 1980 Q1-2018 Q3, 1980 Q1-2007 Q1 and 2007 Q2-2018 Q3. The financial stress index variable is only significant in the crisis & post-crisis sample. The output gap coefficient is significant for all three samples, but not for the crisis & post-crisis in regression (vi). The smoothing parameter and constant equilibrium interest rate are all strongly significant in all samples. However, the constant equilibrium interest rate is not significant for the crisis & post-crisis sample, it seems likely that the constant equilibrium interest rate does not exist during the crisis & post-crisis period, interpreted by regression (vi).

The financial stress index is insignificant in the full and pre-crisis sample, but significant in the crisis & post-crisis sample. In the crisis & post-crisis sample, FSI is significant with negative marginal effects on the interest rates, and adjusted R^2 is improved, compared with the regression without FSI. The US's policy rate-setting during the crisis & post-crisis is impacted by FSI.

Table 5: UK Regressions with IMF FSI

US Nominal interest rate	**Full Sample**		**Pre-crisis sample**		**Crisis & Post-crisis sample**	
OLS	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.946***	0.949***	0.926***	0.962***	0.588***	0.830***
	(0.0244)	(0.0235)	(0.0441)	(0.0546)	(0.0680)	(0.0904)
$\boldsymbol{(1-\rho_i)\bar{\iota}}$	0.135	0.0972	0.290	-0.0119	0.766***	0.332*
	(0.118)	(0.114)	(0.297)	(0.398)	(0.151)	(0.180)
$\boldsymbol{(1-\rho_i)\rho_\pi}$	0.0672	0.0810*	0.0925	0.0761	0.113*	0.0798
	(0.0465)	(0.0448)	(0.0607)	(0.0623)	(0.0661)	(0.0591)
$\boldsymbol{(1-\rho_i)\rho_y}$	0.0853***	0.0823***	0.0884**	0.0979**	0.310***	0.141**
	(0.0305)	(0.0294)	(0.0400)	(0.0408)	(0.0566)	(0.0687)
$\boldsymbol{(1-\rho_i)\rho_\mu}$		-0.0732***		-0.0544		-0.0720***
		(0.0201)		(0.0478)		(0.0201)
Observations	151	151	105	105	46	46
R^2	0.972	0.974	0.942	0.942	0.954	0.965
Adjusted R^2	0.971	0.974	0.940	0.940	0.951	0.962
F	1698	1384	543.7	409.3	291.5	283.6
LM Test	0.0356	0.1256	0.1342	0.2366	0.0705	0.6613
Breusch-Pagan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0047
Jarque-Bera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

The table shows the results of the regression of UK nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10%, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively.

Table 5 above shows the results of Taylor rule regression for the UK's policy rate, for the samples 1980 Q1-2018 Q3, 1980 Q1-2007 Q1 and 2007 Q2-2018 Q3. It shows the inflation gap and constant equilibrium interest rate are not significant in the UK's policy rate-setting behaviour, while FSI is significant with negative marginal effects in the regressions of the full sample and the crisis & post-crisis sample.

Table 6: Japan Regressions with IMF FSI

Japan Nominal interest rate	**Full Sample**		**Pre-crisis sample**		**Crisis & Post-crisis sample**	
OLS	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.957***	0.957***	0.930***	0.932***	0.893***	0.981***
	(0.0147)	(0.0147)	(0.0240)	(0.0250)	(0.0530)	(0.0506)
$\boldsymbol{(1-\rho_i)\bar{\imath}}$	0.0632	0.0651	0.181*	0.172*	-0.00441	0.00687
	(0.0514)	(0.0516)	(0.0933)	(0.0976)	(0.0180)	(0.0157)
$\boldsymbol{(1-\rho_i)\rho_\pi}$	0.0165	0.0171	0.0479	0.0452	-0.00559	0.000770
	(0.0234)	(0.0235)	(0.0377)	(0.0387)	(0.00887)	(0.00780)
$\boldsymbol{(1-\rho_i)\rho_y}$	0.0292*	0.0301**	0.0496**	0.0527**	0.00686	-0.00251
	(0.0151)	(0.0152)	(0.0232)	(0.0251)	(0.00591)	(0.00561)
$\boldsymbol{(1-\rho_i)\rho_\mu}$		-0.00625		-0.00530		-0.0130***
		(0.00836)		(0.0163)		(0.00328)
Observations	151	151	105	105	46	46
R^2	0.985	0.985	0.982	0.982	0.877	0.911
Adjusted R^2	0.985	0.985	0.981	0.981	0.869	0.903
F	3282	2454	1835	1364	100.1	105.4
LM Test	0.0090	0.0087	0.0438	0.0417	0.4750	0.0096
Breusch-Pagan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0295
Jarque-Bera	0.0000	0.0000	0.0002	0.0002	0.0000	0.0000

The table shows the results of the regression of Japan nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10%, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively.

As illustrated in the table above, these Taylor rule-based regressions fit better for the pre-crisis sample and the full sample for 1980 Q1-2007 Q1. The above results indicate that the inflation gap is not significant in policy rate-setting and the output gap is not significant during the crisis & post-crisis period. FSI is significant in determining the policy rate during the crisis & post-crisis period. The constant equilibrium interest rate is only significant in the pre-crisis period.

To summarize, the OLS-estimated Taylor rule-based regressions generally are fitted over the full sample and pre-crisis sample, for all three countries, except the inflation gap is surprisingly insignificant, and the Taylor rule fits better for the US and UK. The estimations over the crisis & post-crisis period, either do not fit well or are moderately fitted, especially for the US. This implies that the interest rate setting is more complicated during and post the crisis, which may be due to unexpected market shocks and central bank interventions. However, the estimation fits the UK's crisis & post-crisis sample better surprisingly compared with the other two countries.

The inflation gap is insignificant, for all three countries among regressions in all samples. A constant equilibrium interest rate exists in the US, but not the UK or Japan, over the full sample. The financial stress index variable indeed plays an important role in explaining interest rate-setting behaviour during the crisis & post-crisis period. FSI also has significant negative effects on the policy rate-setting for all three countries at crisis & post-crisis time, and is significant for the UK only in the full sample. In addition, the inflation gap is surprisingly insignificant, for all three countries, while output remains significant in policy rate decisions, as the Taylor rule suggests.

In the robustness check, with Kansas's FSI, the results show that it performs better in terms of the significance of parameters. The number of regressions where all parameters are significant, is slightly greater with IMF's FSI than with Kansas's FSI. However, the inflation gap is still insignificant in interest rate-setting behaviour, contradicting the Taylor rule. This contradiction has yet to be fully explained, a one time period forward inflation gap will be employed as an additional regressor, to test whether this problem still remains. From the p-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests, displayed in the tables, it can be concluded the regressions violate the OLS assumptions, concerning autocorrelation, homoscedasticity and normality. Thus, the GMM estimation will be employed for regressions in the next section.

2.4.1.2. GMM Estimation

All the tables in this section show the results of the regression of nominal interest rates for each country, run by the following equations using GMM estimation:

$$i_t = \rho_i i_{t-1} + (1 - \rho_i)\{\bar{\imath} + \rho_\pi(\pi_t - \pi^T) + \rho_y y_t\} + \varepsilon_t \quad (2.4)$$

$$i_t = \rho_i i_{t-1} + (1 - \rho_i)\{\bar{\imath} + \rho_\pi(\pi_t - \pi^T) + \rho_y y_t + \rho_\mu \mu_t\} + \varepsilon_t \quad (2.7)$$

The instruments of GMM estimation are $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}$ for Equation (2.4), and $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}, \mu_{t-1}$ for Equation (2.7). The HAC (Bartlett) estimation weight matrix is used. For each country, regressions will be run over the full period from 1980 Q1 to 2018 Q3, and the pre-crisis sample is 1980 Q1-2007 Q1 while the crisis & post-crisis sample is 2007 Q2-2018 Q3 by IMF FSI. Kansa FSI has also been used for the robustness check.

Table 7: US Regressions with IMF FSI

US Nominal interest rate	**Full Sample**		**Pre-crisis sample**		**Crisis & Post-crisis sample**	
GMM	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.970***	0.972***	0.927***	0.983***	0.878***	0.908***
	(0.00981)	(0.00739)	(0.0153)	(0.0215)	(0.0360)	(0.0348)
$\boldsymbol{(1-\rho_i)\bar{\imath}}$	0.203***	0.170***	0.445***	0.147	0.133	0.0511
	(0.0642)	(0.0518)	(0.0602)	(0.130)	(0.0902)	(0.113)
$\boldsymbol{(1-\rho_i)\rho_\pi}$	-0.0507*	-0.0284	0.0270	0.0354	-0.147*	-0.113**
	(0.0278)	(0.0296)	(0.0490)	(0.0398)	(0.0804)	(0.0471)
$\boldsymbol{(1-\rho_i)\rho_y}$	0.0486***	0.0521***	0.0661***	0.112***	0.0461**	0.0214
	(0.00930)	(0.0148)	(0.0176)	(0.0209)	(0.0182)	(0.0235)
$\boldsymbol{(1-\rho_i)\rho_\mu}$		-0.0422***		-0.119**		-0.0284***
		(0.0160)		(0.0502)		(0.0102)
Observations	150	150	104	104	45	45
R^2	0.952	0.952	0.922	0.916	0.900	0.924
Adjusted R^2	0.951	0.951	0.920	0.912	0.893	0.917

The table shows the results of the regression of US nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. HAC (Bartlett) estimation weight matrix is used. Instruments for regressions (i), (iii) and (v) are $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}$, and instruments for regressions (ii), (iv) and (vi) are $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}, \mu_{t-1}$.

Table 8: UK Regressions with IMF FSI

UK Nominal interest rate	**Full Sample**		**Pre-crisis sample**		**Crisis & Post-crisis sample**	
GMM	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.965***	0.962***	0.922***	1.040***	0.630***	0.737***
	(0.0143)	(0.0107)	(0.0249)	(0.0431)	(0.0874)	(0.154)
$\boldsymbol{(1-\rho_i)\bar{\imath}}$	0.0913	0.0607	0.371**	-0.594**	0.670**	0.473
	(0.0748)	(0.0466)	(0.184)	(0.302)	(0.263)	(0.366)
$\boldsymbol{(1-\rho_i)\rho_\pi}$	0.0273	0.0602**	0.0858***	0.0318	0.0517*	0.0293
	(0.0331)	(0.0269)	(0.0292)	(0.0514)	(0.0311)	(0.0262)
$\boldsymbol{(1-\rho_i)\rho_y}$	0.0469*	0.0571*	0.0617*	0.0914***	0.267***	0.192
	(0.0247)	(0.0305)	(0.0326)	(0.0289)	(0.0845)	(0.123)
$\boldsymbol{(1-\rho_i)\rho_\mu}$		-0.0808***		-0.166***		-0.0257
		(0.0106)		(0.0181)		(0.0213)
Observations	150	150	104	104	45	45
R^2	0.972	0.975	0.944	0.941	0.953	0.959
Adjusted R^2	0.972	0.974	0.942	0.939	0.950	0.955

The table shows the results of the regression of UK nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. HAC (Bartlett) estimation weight matrix is used. Instruments for regressions (i), (iii) and (v) are $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}$, and instruments for regressions (ii), (iv) and (vi) are $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}, \mu_{t-1}$.

Table 9: Japan Regressions with IMF FSI

Japan Nominal interest rate	**Full Sample**		**Pre-crisis sample**		**Crisis & Post-crisis sample**	
GMM	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.951***	0.950***	0.909***	0.914***	0.906***	0.879***
	(0.0169)	(0.0164)	(0.0159)	(0.0145)	(0.0241)	(0.0613)
$\boldsymbol{(1-\rho_i)\bar{\iota}}$	0.100	0.107	0.286***	0.266***	-0.0206	-0.0247
	(0.0775)	(0.0748)	(0.0740)	(0.0722)	(0.0161)	(0.0247)
$\boldsymbol{(1-\rho_i)\rho_\pi}$						
	(0.0343)	(0.0321)	(0.0270)	(0.0241)	(0.0131)	(0.0198)
$\boldsymbol{(1-\rho_i)\rho_y}$	0.0107	0.0134*	0.0218*	0.0310***	0.00717	0.00901
	(0.00684)	(0.00785)	(0.0118)	(0.0119)	(0.00661)	(0.0110)
$\boldsymbol{(1-\rho_i)\rho_\mu}$		-0.00666**		-0.0114		0.00292
		(0.00319)		(0.00806)		(0.00512)
Observations	150	150	104	104	45	45
R^2	0.986	0.986	0.983	0.983	0.870	0.851
Adjusted R^2	0.986	0.986	0.983	0.983	0.860	0.836

The table shows the results of the regression of Japan nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. HAC (Bartlett) estimation weight matrix is used. Instruments for regressions (i), (iii) and (v) are $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}$, and instruments for regressions (ii), (iv) and (vi) are $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}, \mu_{t-1}$.

Table 7 to 9 display the estimation results of the interest rate for the US, the UK and Japan from the Taylor-rule based regression. From above, it can be seen that GMM estimation does improve the estimation performance. Higher adjusted R^2, from the adoption of FSI, also shows that FSI plays an important role in policy rate-setting. In addition, the findings show that the constant equilibrium interest rate only significantly exists during the pre-crisis period, not in the full sample nor the crisis & post-crisis sample.

The Inflation gap remains insignificant, therefore, the inflation gap with one lead and one lag are employed to the regression, to test the policy rate-setting behaviour under the framework of the Taylor rule. The results also show that Japan does not seem to follow the linear Taylor rule in policy rate-setting, under GMM estimation, especially during the crisis & post-crisis period, which is consistent with its OLS estimation results.

2.4.1.3. OLS Estimation with the One-quarter Lead Inflation Gap

Since there is an issue related to the insignificance of the inflation gap, in previous OLS and GMM estimations, inflation gap with one lead and one lag will be replaced with the original inflation gap variable, to test the regression performance. In this section, the one-lead inflation gap will be adopted as an alternative regressor, in the estimation process, to check whether this would eliminate this problem. Tables below show the regressions results of nominal interest rates for the US, UK and Japan.

Tables 10 to 12 demonstrate the OLS estimation results of interest rates, based on a Taylor rule regression for the US, the UK and Japan. It can be seen that the replacement of the inflation gap, by the inflation gap with one leap, significantly improved the estimation results for all those three countries.

The regressions are run by the following equations using OLS estimation.

$$i_t = \rho_i i_{t-1} + (1-\rho_i)\left\{\bar{\imath} + \rho_\pi(\pi_{t+1} - \pi^T) + \rho_y y_t\right\} + \varepsilon_t \qquad (2.4.1)$$

$$i_t = \rho_i i_{t-1} + (1-\rho_i)\left\{\bar{\imath} + \rho_\pi(\pi_{t+1} - \pi^T) + \rho_y y_t + \rho_\mu \mu_t\right\} + \varepsilon_t \qquad (2.7.1)$$

Table 10: US Regressions with IMF FSI

US Nominal interest rate	**Full Sample**		**Pre-crisis sample**		**Crisis & Post-crisis sample**	
OLS	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.882***	0.887***	0.819***	0.816***	0.778***	0.860***
	(0.0263)	(0.0273)	(0.0386)	(0.0421)	(0.0484)	(0.0549)
$\boldsymbol{(1-\rho_i)\bar{\iota}}$	0.455***	0.425***	0.784***	0.806***	0.331***	0.142
	(0.129)	(0.135)	(0.196)	(0.224)	(0.116)	(0.131)
$\boldsymbol{(1-\rho_i)\rho_\pi}$	0.169***	0.164***	0.281***	0.279***	0.0288	-0.0287
	(0.0590)	(0.0595)	(0.0817)	(0.0826)	(0.0453)	(0.0478)
$\boldsymbol{(1-\rho_i)\rho_y}$	0.0781**	0.0752**	0.0892*	0.0870*	0.0744**	0.0328
	(0.0330)	(0.0333)	(0.0455)	(0.0470)	(0.0297)	(0.0321)
$\boldsymbol{(1-\rho_i)\rho_\mu}$		-0.0161		0.00930		-0.0358**
		(0.0208)		(0.0451)		(0.0137)
Observations	150	150	105	105	45	45
R^2	0.957	0.957	0.934	0.934	0.922	0.934
Adjusted R^2	0.956	0.956	0.932	0.932	0.917	0.927
F	1081	808.7	478.8	355.7	162.0	140.4
LM Test	0.6301	0.5157	0.5838	0.6331	0.9729	0.4307
Breusch-Pagan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Jarque-Bera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

The table shows the results of the regression of US nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10%, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively.

Table 11: UK Regressions with IMF FSI

UK Nominal interest rate	**Full Sample**		**Pre-crisis sample**		**Crisis & Post-crisis sample**	
OLS	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.925***	0.930***	0.882***	0.910***	0.604***	0.840***
	(0.0228)	(0.0218)	(0.0428)	(0.0530)	(0.0625)	(0.0873)
$\boldsymbol{(1-\rho_i)\bar{\imath}}$	0.194*	0.151	0.522*	0.295	0.722***	0.301*
	(0.115)	(0.110)	(0.294)	(0.393)	(0.142)	(0.174)
$\boldsymbol{(1-\rho_i)\rho_\pi}$	0.124***	0.135***	0.168***	0.156**	0.114*	0.0767
	(0.0446)	(0.0428)	(0.0592)	(0.0608)	(0.0611)	(0.0551)
$\boldsymbol{(1-\rho_i)\rho_y}$	0.101***	0.0960***	0.0959**	0.104***	0.293***	0.130*
	(0.0278)	(0.0267)	(0.0368)	(0.0380)	(0.0519)	(0.0655)
$\boldsymbol{(1-\rho_i)\rho_\mu}$		-0.0749***		-0.0406		-0.0710***
		(0.0197)		(0.0466)		(0.0203)
Observations	150	150	105	105	45	45
R^2	0.973	0.975	0.945	0.945	0.955	0.966
Adjusted R^2	0.972	0.975	0.943	0.943	0.952	0.962
F	1737	1427	576.0	431.1	291.8	282.0
LM Test	0.0403	0.1706	0.1073	0.1699	0.1967	0.9924
Breusch-Pagan	0.0000	0.0000	0.0000	0.0000	0.0001	0.0029
Jarque-Bera	0.0000	0.0000	0.0000	0.0000	0.0036	0.0000

The table shows the results of the regression of UK nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10%, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively.

Table 12: Japan Regressions with IMF FSI

Japan Nominal interest rate	**Full Sample**		**Pre-crisis sample**		**Crisis & Post-crisis sample**	
OLS	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.941***	0.941***	0.901***	0.900***	0.889***	0.980***
	(0.0139)	(0.0139)	(0.0217)	(0.0227)	(0.0547)	(0.0510)
$\boldsymbol{(1-\rho_i)\bar{\iota}}$	0.135***	0.135***	0.313***	0.317***	0.00901	0.0182
	(0.0509)	(0.0510)	(0.0881)	(0.0929)	(0.0186)	(0.0159)
$\boldsymbol{(1-\rho_i)\rho_\pi}$	0.0624**	0.0618**	0.123***	0.125***	0.00345	0.00817
	(0.0252)	(0.0253)	(0.0387)	(0.0401)	(0.0101)	(0.00860)
$\boldsymbol{(1-\rho_i)\rho_y}$	0.0125	0.0136	0.0252	0.0234	0.00406	-0.00555
	(0.0162)	(0.0163)	(0.0237)	(0.0260)	(0.00674)	(0.00614)
$\boldsymbol{(1-\rho_i)\rho_\mu}$		-0.00543		0.00273		-0.0135***
		(0.00825)		(0.0158)		(0.00324)
Observations	150	150	105	105	45	45
R^2	0.986	0.986	0.983	0.983	0.873	0.911
Adjusted R^2	0.985	0.985	0.983	0.983	0.863	0.903
F	3372	2519	1990	1478	93.71	102.8
LM Test	0.0085	0.0080	0.0479	0.0485	0.6227	0.0137
Breusch-Pagan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0497
Jarque-Bera	0.0000	0.0000	0.0016	0.0018	0.0000	0.0000

The table shows the results of the regression of Japan nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10%, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively.

2.4.1.4. GMM Estimation with the One-quarter Lead Inflation Gap

After reporting results of OLS estimation, GMM estimation with one-quarter forward inflation gap will be employed, to test whether this will eliminate the problem in insignificance of the inflation gap. It can be seen that both GMM estimation and OLS estimation give better estimation results for all the three countries, with the adoption of the one-lead inflation gap in the regression, and estimation results from GMM and OLS are consistent in the estimation of policy rates for all three countries as well. However, unlike the US and UK, GMM did explain Japan's interest rate-setting behaviour, with a quarter lead of inflation gap.

Below are the results of GMM estimation for Japanese interest rates presented by regression equations:

$$\mathrm{i_t} = \rho_i \mathrm{i_{t-1}} + (1-\rho_i)\{\bar{\imath} + \rho_\pi(\pi_{t+1} - \pi^T) + \rho_y y_t\} + \varepsilon_t \tag{2.4.1}$$

$$\mathrm{i_t} = \rho_i \mathrm{i_{t-1}} + (1-\rho_i)\{\bar{\imath} + \rho_\pi(\pi_{t+1} - \pi^T) + \rho_y y_t + \rho_\mu \mu_t\} + \varepsilon_t \tag{2.7.1}$$

Table 13: US Regressions with IMF FSI

US Nominal interest rate	Full Sample		Pre-crisis sample		Crisis & Post-crisis sample	
GMM	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.939***	0.951***	0.906***	0.962***	0.806***	0.848***
	(0.00726)	(0.00739)	(0.0106)	(0.0238)	(0.0358)	(0.0680)
$\boldsymbol{(1-\rho_i)\bar{\imath}}$	0.260***	0.209***	0.481***	0.174	0.223*	0.140
	(0.0660)	(0.0538)	(0.0604)	(0.133)	(0.116)	(0.193)
$\boldsymbol{(1-\rho_i)\rho_\pi}$	0.0367*	0.0299	0.0917**	0.109***	0.000539	-0.0227
	(0.0206)	(0.0210)	(0.0460)	(0.0390)	(0.0343)	(0.0567)
$\boldsymbol{(1-\rho_i)\rho_y}$	0.0484***	0.0513***	0.0637***	0.111***	0.0442*	0.0280
	(0.00973)	(0.0145)	(0.0203)	(0.0220)	(0.0244)	(0.0406)
$\boldsymbol{(1-\rho_i)\rho_\mu}$		-0.0394**		-0.124***		-0.0176
		(0.0190)		(0.0451)		(0.0179)
Observations	149	149	104	104	45	45
R^2	0.953	0.953	0.926	0.921	0.919	0.928
Adjusted R^2	0.952	0.952	0.924	0.918	0.913	0.921

The table shows the results of the regression of US nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. HAC (Bartlett) estimation weight matrix is used. Instruments for regressions (i), (iii) and (v) are $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}$, and instruments for regressions (ii), (iv) and (vi) are $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}, \mu_{t-1}$.

Table 14: UK Regressions with IMF FSI

UK Nominal interest rate	**Full Sample**		**Pre-crisis sample**		**Crisis & Post-crisis sample**	
GMM	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.936***	0.938***	0.862***	0.979***	0.613***	0.696***
	(0.0202)	(0.0170)	(0.0328)	(0.0495)	(0.0936)	(0.180)
$\boldsymbol{(1-\rho_i)\bar{\imath}}$	0.171	0.127	0.692***	-0.247	0.688***	0.537
	(0.112)	(0.0782)	(0.231)	(0.323)	(0.258)	(0.398)
$\boldsymbol{(1-\rho_i)\rho_\pi}$	0.103**	0.130***	0.190***	0.127*	0.111***	0.0908*
	(0.0440)	(0.0415)	(0.0421)	(0.0675)	(0.0323)	(0.0471)
$\boldsymbol{(1-\rho_i)\rho_y}$	0.0696***	0.0757**	0.0720*	0.102***	0.274***	0.217
	(0.0260)	(0.0336)	(0.0385)	(0.0351)	(0.0840)	(0.136)
$\boldsymbol{(1-\rho_i)\rho_\mu}$		-0.0851***		-0.153***		-0.0203
		(0.0145)		(0.0170)		(0.0258)
Observations	149	149	104	104	45	45
R^2	0.974	0.976	0.948	0.945	0.955	0.960
Adjusted R^2	0.973	0.976	0.946	0.943	0.952	0.956

The table shows the results of the regression of UK nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. HAC (Bartlett) estimation weight matrix is used. Instruments for regressions (i), (iii) and (v) are $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}$, and instruments for regressions (ii), (iv) and (vi) are $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}, \mu_{t-1}$.

Table 15: Japan Regressions with IMF FSI

Japan Nominal interest rate	**Full Sample**		**Pre-crisis sample**		**Crisis & Post-crisis sample**	
GMM	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.943***	0.943***	0.896***	0.896***	0.893***	0.901***
	(0.0204)	(0.0200)	(0.0195)	(0.0216)	(0.0315)	(0.0281)
$\boldsymbol{(1-\rho_i)\bar{\imath}}$	0.145	0.146	0.356***	0.358***	-0.00349	-0.00318
	(0.0992)	(0.0969)	(0.100)	(0.112)	(0.00704)	(0.00707)
$\boldsymbol{(1-\rho_i)\rho_\pi}$	0.0778	0.0775	0.160***	0.160***	-0.00313	-0.00293
	(0.0489)	(0.0481)	(0.0431)	(0.0476)	(0.00878)	(0.00845)
$\boldsymbol{(1-\rho_i)\rho_y}$	-0.00488	-0.00305	0.00124	0.000329	0.00242	0.00213
	(0.00739)	(0.00762)	(0.00924)	(0.0150)	(0.00625)	(0.00611)
$\boldsymbol{(1-\rho_i)\rho_\mu}$		-0.00317		0.00114		-0.000795
		(0.00312)		(0.0128)		(0.00115)
Observations	149	149	104	104	45	45
R^2	0.987	0.987	0.985	0.985	0.870	0.874
Adjusted R^2	0.986	0.986	0.984	0.984	0.860	0.862

The table shows the results of the regression of Japan nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. HAC (Bartlett) estimation weight matrix is used. Instruments for regressions (i), (iii) and (v) are $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}$, and instruments for regressions (ii), (iv) and (vi) are $i_{t-1}, \pi_{t-1} - \pi^T, y_{t-1}, \mu_{t-1}$.

2.4.1.5. OLS Estimation with One-quarter Lag Inflation Gap

To solve the issue related to the insignificance of inflation gap in previous OLS and GMM estimations, one-lag inflation gap will be adopted as an alternative regressor in the estimation process to check whether this would eliminate the counterfactual problem. Following three tables show the results of regressions of nominal interest rates for the US, UK and Japan. The results show that inflation gap with one lag is not significant. Thus, based on the results, it can be concluded that the inflation with one lead is significant in determine the interest rate for all those three countries but not the inflation gap nor one-lag inflation gap. This may be because prices take more time to respond to previous economic policies or environment, so inflation gap with a lead is information effective but not its past values.

The regressions are run by the following equations using OLS estimation.

$$i_t = \rho_i i_{t-1} + (1-\rho_i)\{\bar{\imath} + \rho_\pi(\pi_{t-1} - \pi^T) + \rho_y y_t\} + \varepsilon_t \qquad (2.4.2)$$

$$i_t = \rho_i i_{t-1} + (1-\rho_i)\{\bar{\iota} + \rho_\pi(\pi_{t-1} - \pi^T) + \rho_y y_t + \rho_\mu \mu_t\} + \varepsilon_t \quad (2.7.2)$$

Table 16: US Regressions with IMF FSI

US Nominal interest rate	**Full Sample**		**Pre-crisis sample**		**Crisis & Post-crisis sample**	
OLS	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
ρ_i	0.955***	0.957***	0.908***	0.897***	0.833***	0.860***
	(0.0290)	(0.0291)	(0.0451)	(0.0495)	(0.0450)	(0.0455)
$(1-\rho_i)\bar{\iota}$	0.309**	0.284**	0.598**	0.661**	0.276**	0.186
	(0.141)	(0.143)	(0.231)	(0.259)	(0.108)	(0.114)
$(1-\rho_i)\rho_\pi$	-0.0363	-0.0282	0.0288	0.0280	-0.0948**	-0.0707*
	(0.0565)	(0.0570)	(0.0812)	(0.0815)	(0.0409)	(0.0414)
$(1-\rho_i)\rho_y$	0.0762**	0.0734**	0.0943*	0.0880*	0.0792***	0.0506
	(0.0342)	(0.0343)	(0.0497)	(0.0512)	(0.0273)	(0.0300)
$(1-\rho_i)\rho_\mu$		-0.0212		0.0258		-0.0245*
		(0.0213)		(0.0472)		(0.0123)
Observations	151	151	105	105	46	46
R^2	0.955	0.955	0.927	0.927	0.931	0.937
Adjusted R^2	0.954	0.954	0.925	0.924	0.926	0.931
F	1033	775.2	425.8	317.2	189.8	153.3
LM Test	0.3020	0.2287	0.2970	0.3927	0.8830	0.7620
Breusch-Pagan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Jarque-Bera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

The table shows the results of the regression of US nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10%, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively.

Table 17: UK Regressions with IMF FSI

UK Nominal interest rate	**Full Sample**		**Pre-crisis sample**		**Crisis & Post-crisis sample**	
OLS	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.980***	0.983***	0.979***	1.023***	0.617***	0.859***
	(0.0249)	(0.0240)	(0.0419)	(0.0511)	(0.0747)	(0.0919)
$\boldsymbol{(1-\rho_i)\bar{\iota}}$	-0.0106	0.00289	-0.000894	-0.0160	0.0575	0.0439
	(0.0449)	(0.0435)	(0.0560)	(0.0567)	(0.0728)	(0.0637)
$\boldsymbol{(1-\rho_i)\rho_\pi}$	0.0515	0.0498	0.0601	0.0725*	0.291***	0.122*
	(0.0326)	(0.0314)	(0.0428)	(0.0434)	(0.0633)	(0.0715)
$\boldsymbol{(1-\rho_i)\rho_y}$		-0.0703***		-0.0702		-0.0755***
		(0.0203)		(0.0476)		(0.0202)
$\boldsymbol{(1-\rho_i)\rho_\mu}$	0.0357	0.000220	0.0352	-0.334	0.720***	0.284
	(0.119)	(0.115)	(0.285)	(0.378)	(0.165)	(0.185)
Observations	151	151	105	105	46	46
R^2	0.972	0.974	0.940	0.942	0.952	0.964
Adjusted R^2	0.971	0.973	0.939	0.939	0.948	0.960
F	1675	1353	530.7	403.2	275.8	274.4
LM Test	0.0445	0.1316	0.1848	0.3519	0.1118	0.9191
Breusch-Pagan	0.0000	0.0000	0.0000	0.0000	0.0001	0.0010
Jarque-Bera	0.0000	0.0000	0.0000	0.0000	0.0015	0.0000

The table shows the results of the regression of UK nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10%, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively.

Table 18: Japan Regressions with IMF FSI

Japan Nominal interest rate	**Full Sample**		**Pre-crisis sample**		**Crisis & Post-crisis sample**	
OLS	Sample: 1980Q1-2018Q3		Sample: 1980Q1-2007Q1		Sample: 2007Q2-2018Q3	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$\boldsymbol{\rho_i}$	0.965***	0.964***	0.947***	0.951***	0.896***	0.980***
	(0.0151)	(0.0152)	(0.0246)	(0.0258)	(0.0519)	(0.0509)
$\boldsymbol{(1-\rho_i)\bar{\iota}}$	-0.00154	-0.000180	0.0132	0.00847	-0.0120	-0.00148
	(0.0215)	(0.0216)	(0.0343)	(0.0357)	(0.00809)	(0.00766)
$\boldsymbol{(1-\rho_i)\rho_\pi}$	0.0332**	0.0341**	0.0564**	0.0610**	0.00701	-0.00190
	(0.0145)	(0.0145)	(0.0227)	(0.0245)	(0.00539)	(0.00532)
$\boldsymbol{(1-\rho_i)\rho_y}$		-0.00605		-0.00834		-0.0127***
		(0.00840)		(0.0166)		(0.00346)
$\boldsymbol{(1-\rho_i)\rho_\mu}$	0.0313	0.0348	0.111	0.0956	-0.0155	0.00332
	(0.0512)	(0.0515)	(0.0916)	(0.0969)	(0.0178)	(0.0164)
Observations	151	151	105	105	46	46
R^2	0.985	0.985	0.982	0.982	0.882	0.911
Adjusted R^2	0.985	0.985	0.981	0.981	0.874	0.903
F	3271	2445	1808	1346	104.9	105.4
LM Test	0.0072	0.0069	0.0241	0.0244	0.4647	0.0096
Breusch-Pagan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Jarque-Bera	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000

The table shows the results of the regression of Japan nominal interest rate run with IMF FSI. ***, **, and * denotes significance at the 1%, 5%, and 10%, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively.

2.4.2. Risk Premium of Foreign Currencies

Based on the previous regression results, the OLS estimation, with one-quarter forward inflation lag, will be adopted to calculate the excess return on a foreign currency interest-bearing asset. λ_t denotes the nominal currency excess return, by definition, which is a composite of interest rate differentials and expected home currency depreciation. In this article, λ_t is estimated by three approaches of the expected exchange rate. The first approach uses the one-quarter forward rate of the exchange rate as the expected exchange rate ($E_t e_{t+1} = e_{t+1}$), and estimated currency excess return is denoted by λ_{rt}. The second approach uses the 3-month spot exchange rate as the expected exchange rate ($E_t e_{t+1} = sp_t$), and estimated currency excess return is denoted by λ_{st}. The last approach uses a 3-month forward rate as the expected exchange rate ($E_t e_{t+1} = f_t$), and estimated currency excess return is denoted by λ_{ft}. The calculation of λ_t is explained by the equations below

$$\lambda_t \equiv i_t^* - i_t^h + E_t e_{t+1} - e_t \tag{2.1}$$

$$\lambda_{rt} = e_{t+1} - e_t + \frac{1}{4}\left(\widehat{i_t^*} - \widehat{i_t^h}\right) \tag{2.9}$$

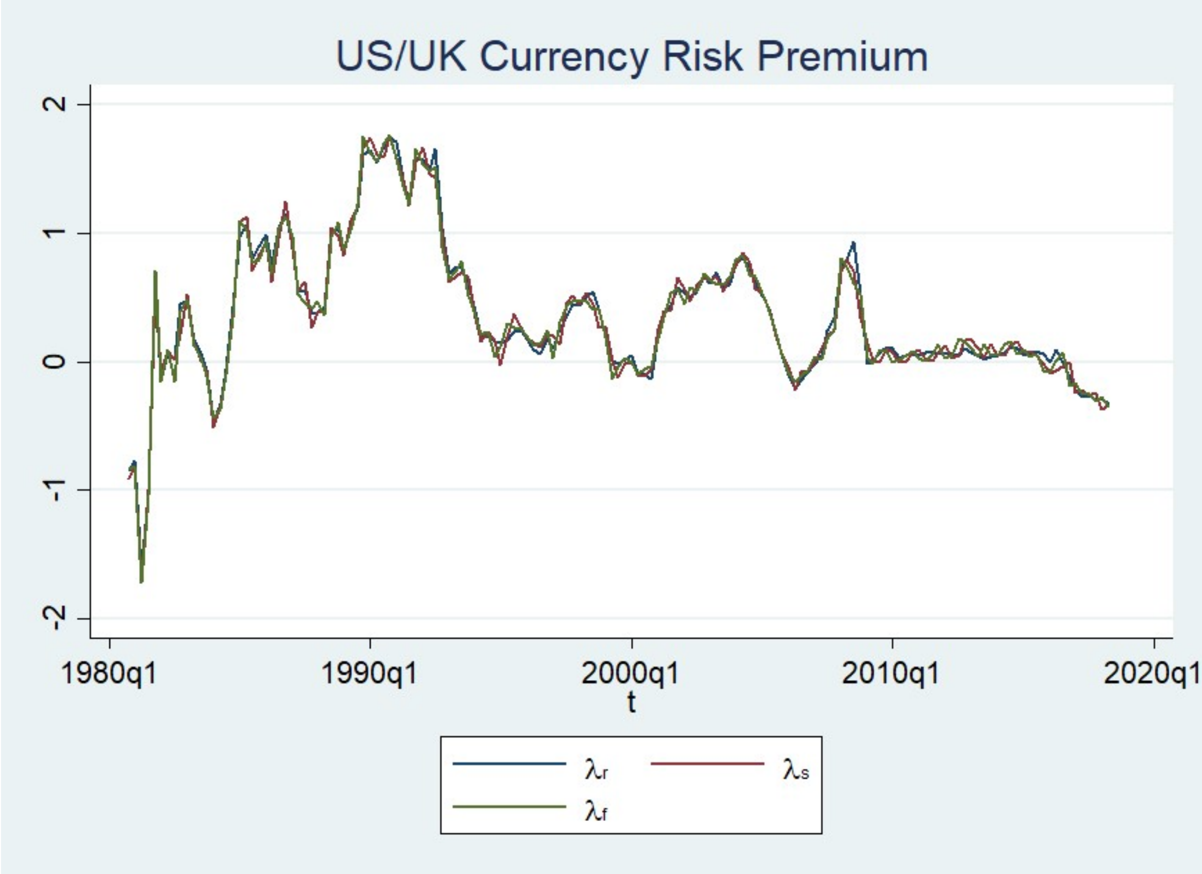
$$\lambda_{st} = sp_t - e_t + \frac{1}{4}(\widehat{i_t^*} - \widehat{i_t^h}) \tag{2.10}$$

$$\lambda_{ft} = f_t - e_t + \frac{1}{4}(\widehat{i_t^*} - \widehat{i_t^h}) \tag{2.11}$$

Figure 1 demonstrates the estimated currency risk premium by $\lambda_{rt}, \lambda_{st}$ *and* λ_{ft} for the UK interest-bearing assets against the US interest-bearing assets and Figure 2 demonstrates the estimated currency risk premium by $\lambda_{rt}, \lambda_{st}$ *and* λ_{ft} for Japanese interest-bearing assets against US interest-bearing assets.

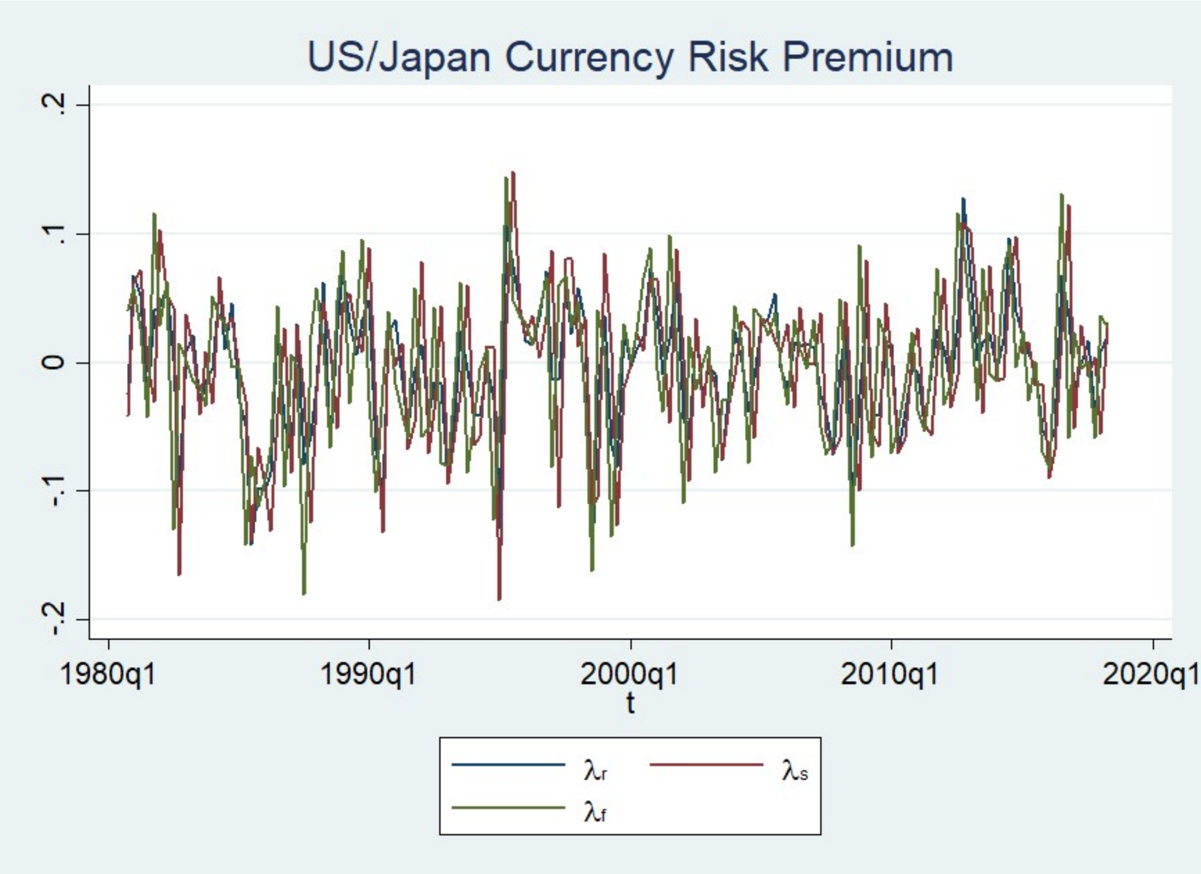
For the risk premiums of UK interest-bearing assets against US interest-bearing assets, shown by Figure 1, three estimations by next-period actual foreign exchange rates, and 3-month forward rates, are more similar than the estimations by 3-month spot rates, as seen by the blue line and green line which tends to move closer to each other in comparison to the red line. There are some differences between forward rate estimations and next period actual value estimations in the late 1980s and around 2008. As shown in Figure 2, the currency risk premium of Japanese interest-bearing assets, against the US interest-bearing assets, from the three estimations, are very similar and hover around 0%, unlike in the UK's case.

Figure 1: US/JAP Currency Risk Premiums by Three Estimations of Expected Exchange Rates



The figure presents the currency excess return of UK interest-bearing assets against US interest-bearing assets. λ_r (blue line) represents the currency risk premium estimated by Equation (2.9). λ_s (red line) represents the currency risk premium estimated by Equation (2.10). λ_f (green line) represents the currency risk premium estimated by Equation (2.11).

Figure 2: US/JAP Currency Risk Premiums by Three Estimations of Expected Exchange Rates



The figure presents the currency excess return of Japanese interest-bearing assets against US interest-bearing assets. λ_r (blue line) represents the currency risk premium estimated by Equation (2.9). λ_s (red line) represents the currency risk premium estimated by Equation (2.10). λ_f (green line) represents the currency risk premium estimated by Equation (2.11).

2.4.2.1. Next-period Exchange Rate ($E_t e_{t+1} = e_{t+1}$)

λ_t is defined as currency risk premium and λ_{rt} is the actual value of the excess return, by definition when $E_t e_{t+1} = e_{t+1}$, while λ_{1r} and λ_{2rt} are fitted values of λ_{rt}, estimated by a modified Taylor rule regression, without and with an FSI variable respectively. Specifically, λ_{rt} , λ_{1rt} and λ_{2rt} are calculated by the following equations and the figures below in this section exhibit the results of estimations. The annual interest rate is divided by four, in order to get the effective quarterly interest rate.

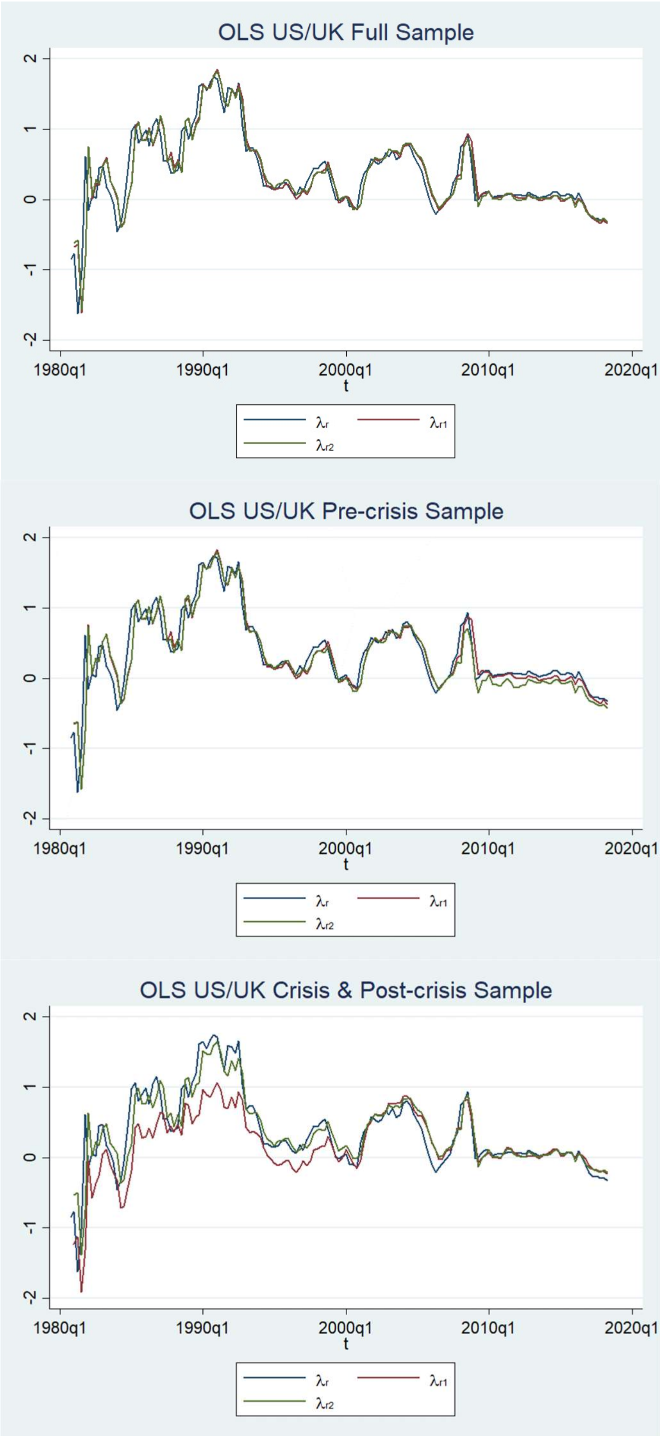
$$\lambda_t = E_t e_{t+1} - e_t + \frac{1}{4}(i_t^* - i_t^h)$$

$$\lambda_{rt} = e_{t+1} - e_t + \frac{1}{4}(i_t^* - i_t^h) \tag{2.9}$$

$$\lambda_{1rt} = (e_{t+1} - e_t) + \frac{1}{4}\,(\widehat{\iota_t^* - \iota_t^h})^{Fitted\ value\ witho\quad FSI\ variable}$$

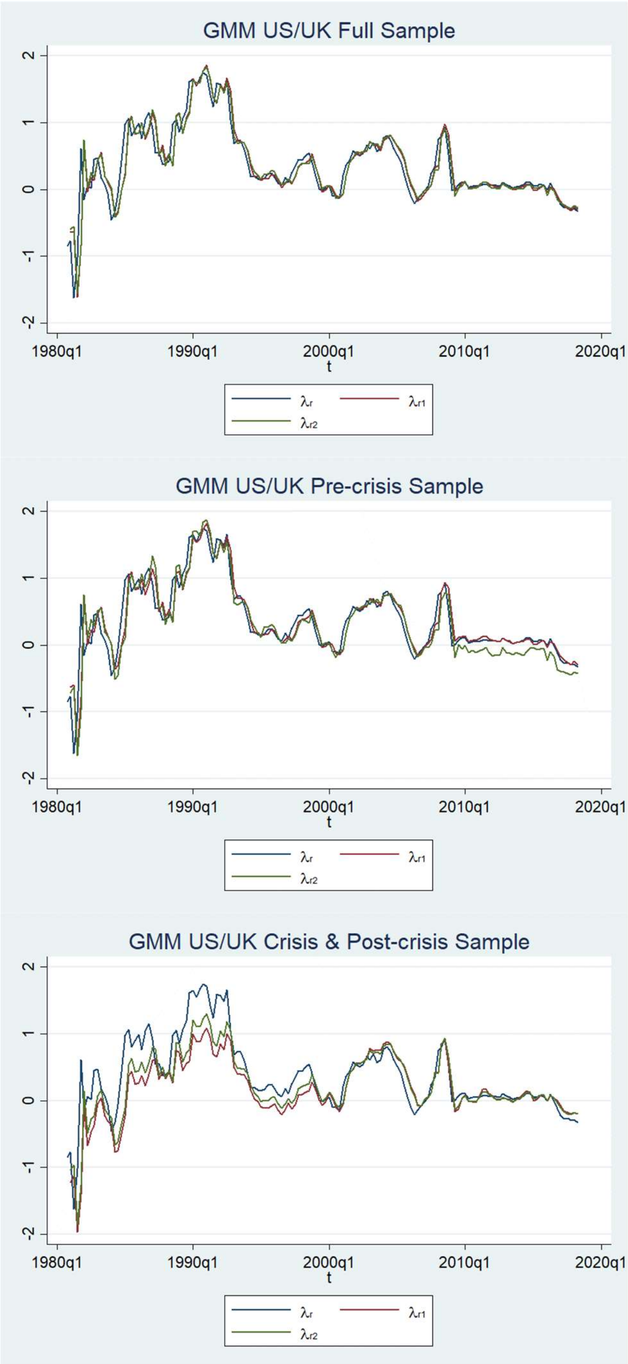
$$\lambda_{2rt} = (e_{t+1} - e_t) + \frac{1}{4}\,(\widehat{\iota_t^* - \iota_t^h})^{Fitted\ value\ with\ FSI\ variable}$$

Figure 3: US/UK Currency Risk Premium Estimated by Next-period Exchange Rate (OLS)



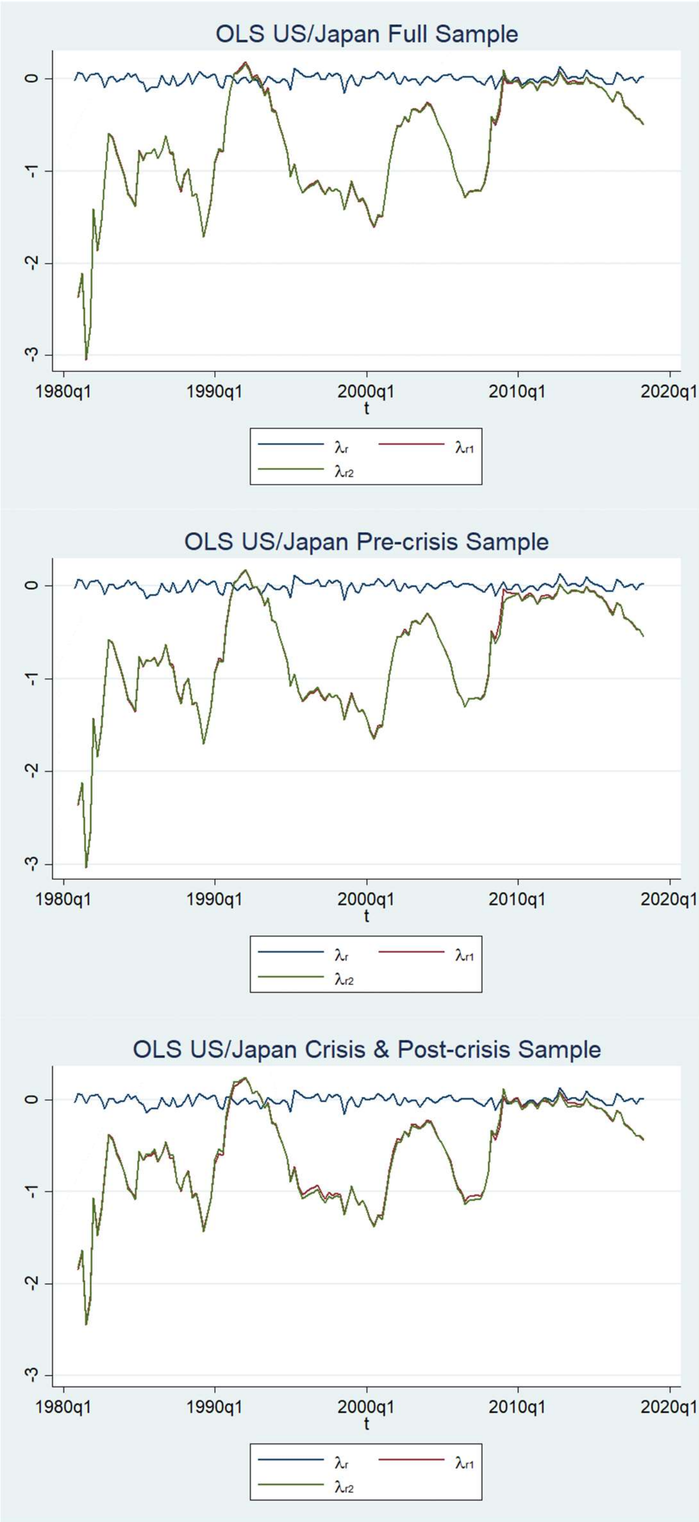
The Figure demonstrates the estimation for the currency excess return of UK interest-bearing assets against US interest-bearing assets. The first-row plot shows in-sample estimations of currency risk premiums predicted by the full sample. The second-row plot shows out-of-sample estimations predicted by the pre-crisis sample. The third-row plot shows out-of-sample estimations predicted by the crisis & post-crisis sample. λ_r presents the actual currency risk premium. λ_{r1} presents estimated λ_r without FSI and λ_{r2} presents estimated λ_r with FSI. OLS estimation is employed for regressions.

Figure 4: US/UK Risk Premium Estimated by Next-period Exchange Rate (GMM)



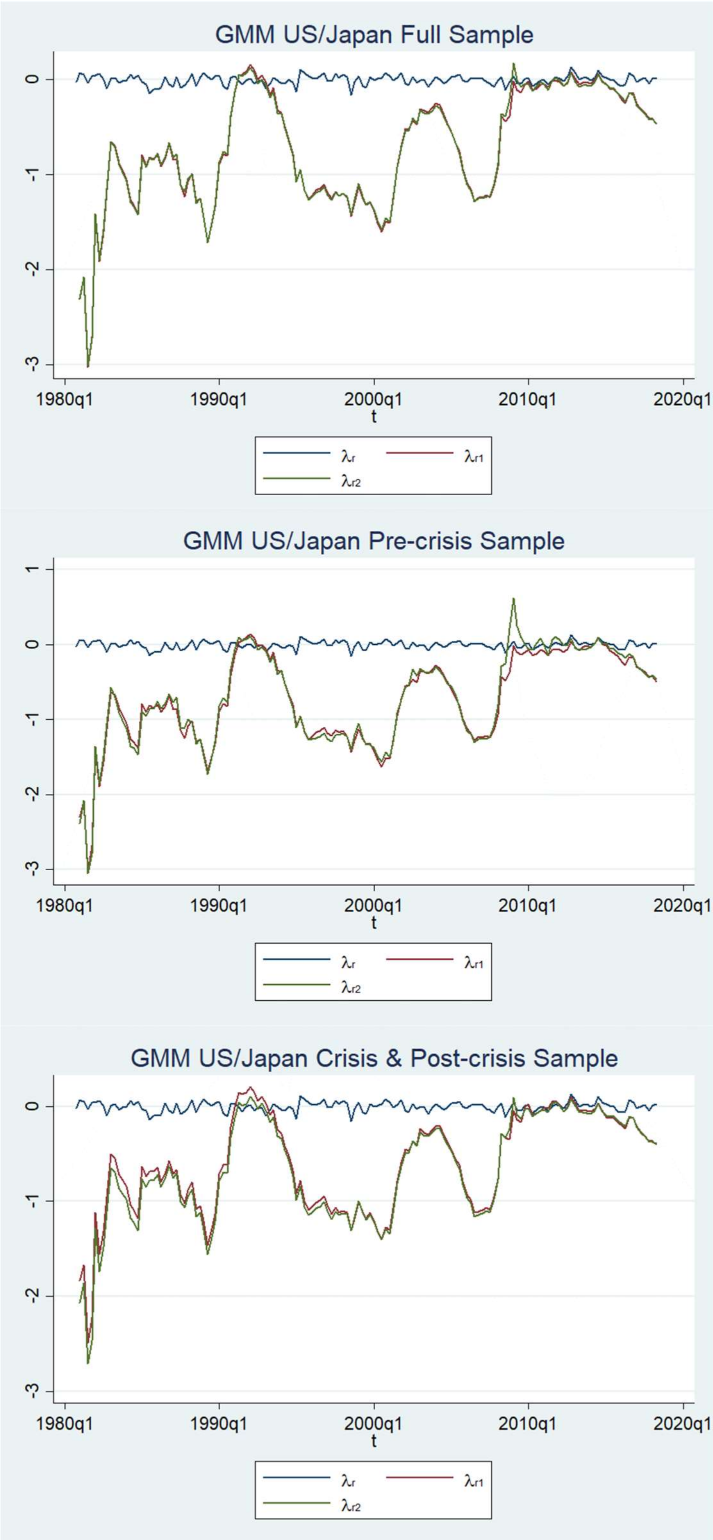
The Figure demonstrates the estimation for the currency excess return of UK interest-bearing assets against US interest-bearing assets. The first-row plot shows in-sample estimations of currency risk premiums predicted by the full sample. The second-row plot shows out-of-sample estimations predicted by the pre-crisis sample. The third-row plot shows out-of-sample estimations predicted by the crisis & post-crisis sample. λ_r presents the actual currency risk premium. λ_{r1} presents estimated λ_r without FSI and λ_{r2} presents estimated λ_r with FSI. GMM estimation is employed for regressions.

Figure 5: US/JAP Risk Premium Estimated by Next-period Exchange Rate (OLS)



The Figure demonstrates the estimation for the currency excess return of Japanese interest-bearing assets against US interest-bearing assets. The first-row plot shows in-sample estimations of currency risk premiums predicted by the full sample. The second-row plot shows out-of-sample estimations predicted by the pre-crisis sample. The third-row plot shows out-of-sample estimations predicted by the crisis & post-crisis sample. λ_r presents the actual currency risk premium. λ_{r1} presents estimated λ_r without FSI and λ_{r2} presents estimated λ_r with FSI. OLS estimation is employed for regressions.

Figure 6: US/JAP Risk Premium Estimated by Next-period Exchange Rate (GMM)



The Figure demonstrates the estimation for the currency excess return of Japanese interest-bearing assets against US interest-bearing assets. The first-row plot shows in-sample estimations of currency risk premiums predicted by the full sample. The second-row plot shows out-of-sample estimations predicted by the pre-crisis sample. The third-row plot shows out-of-sample estimations predicted by the crisis & post-crisis sample. λ_r presents the actual currency risk premium. λ_{r1} presents estimated λ_r without FSI and λ_{r2} presents estimated λ_r with FSI. GMM estimation is employed for regressions.

Figure 3 and Figure 4 display the estimation of excess returns on UK pound interest-bearing assets against US dollar interest-bearing assets by the OLS and GMM estimation method respectively. Both figures indicate that both λ_{1rt} and λ_{2rt} modelled the actual value λ_{rt} very well since the difference between estimations and actual values are close to zero in both models.

Figure 5 and Figure 6 display the estimations of excess return on Japanese yen interest-bearing assets against US dollar interest-bearing assets by the OLS and GMM estimation method respectively. Both figures indicate that λ_{rt} is volatile and varies across time for the pair of US/JAP. It can be seen that the λ_{rt} was rising from -2% to the peak of around 2% during the period 1980-1990 and then declines close to 0% and stays. λ_{rt} fluctuates between 0 to 1% in the period 2000 to 2009, and after that λ_{rt} moves around 0%. There is a decline trend starting at year 2016. Both figures indicate that both λ_{1rt} and λ_{2rt} modelled actual values of excess return λ_{rt} relatively poorly since λ_{rt} stays close to 0% for the whole period while both λ_{1rt} and λ_{2rt} clearly are more volatile and have up and downs driven by markets shocks. It may also be implied, from figures 3 and 4, that λ_{rt} is mean-reverting around 0% and probably slightly lower than 0%.

The Taylor rule-based estimation seems not to predict the currency risk premium for pair US/JAP. This may be because the model is not well-defined, as Japan does not follow the Taylor rule as much as the US and the UK. Alternatively, this may be due to the fact $(e_{t+1} - e_{t})$ is relatively small than $\frac{1}{4}\left(\widehat{\iota_t^*} - \widehat{\iota_t^h}\right)$ in value. Thus, the nominal exchange rate will be employed for estimation in the next session, instead of using the logarithm of the US/Japan exchange rate.

2.4.2.2. 3-Month Spot Exchange Rate ($E_t e_{t+1} = sp_t$)

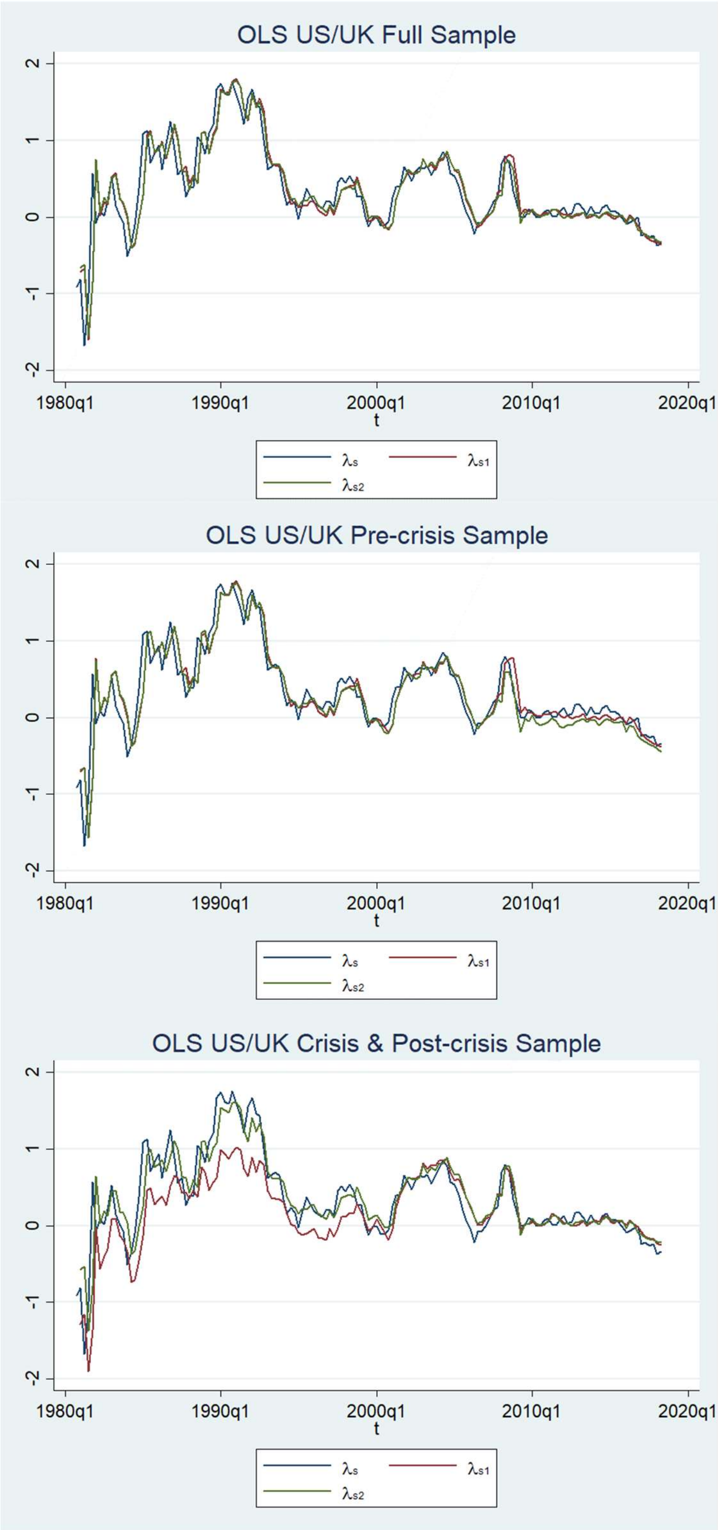
When setting $E_t e_{t+1} = sp_t$, where sp_t is the three-month spot rate, λ_{st} denotes the excess return when spot rates are adopted to predict market expectation, while λ_{1s} and λ_{2st} are fitted values of λ_{st} estimated by the modified Taylor-rule regression without and with the FSI variable respectively. λ_{1st} , λ_{2st} and λ_{st} are calculated by the following equations and figures below exhibit the results of it.

$$\lambda_{st} = sp_t - e_t + \frac{1}{4}(i_t^* - i_t^h) \tag{2.10}$$

$$\lambda_{1st} = (sp_t - e_t) + \frac{1}{4}\left(\widehat{i_t^*} - \widehat{i_t^h}\right)^{Fitted\ value\ without\ FSI\ variable}$$

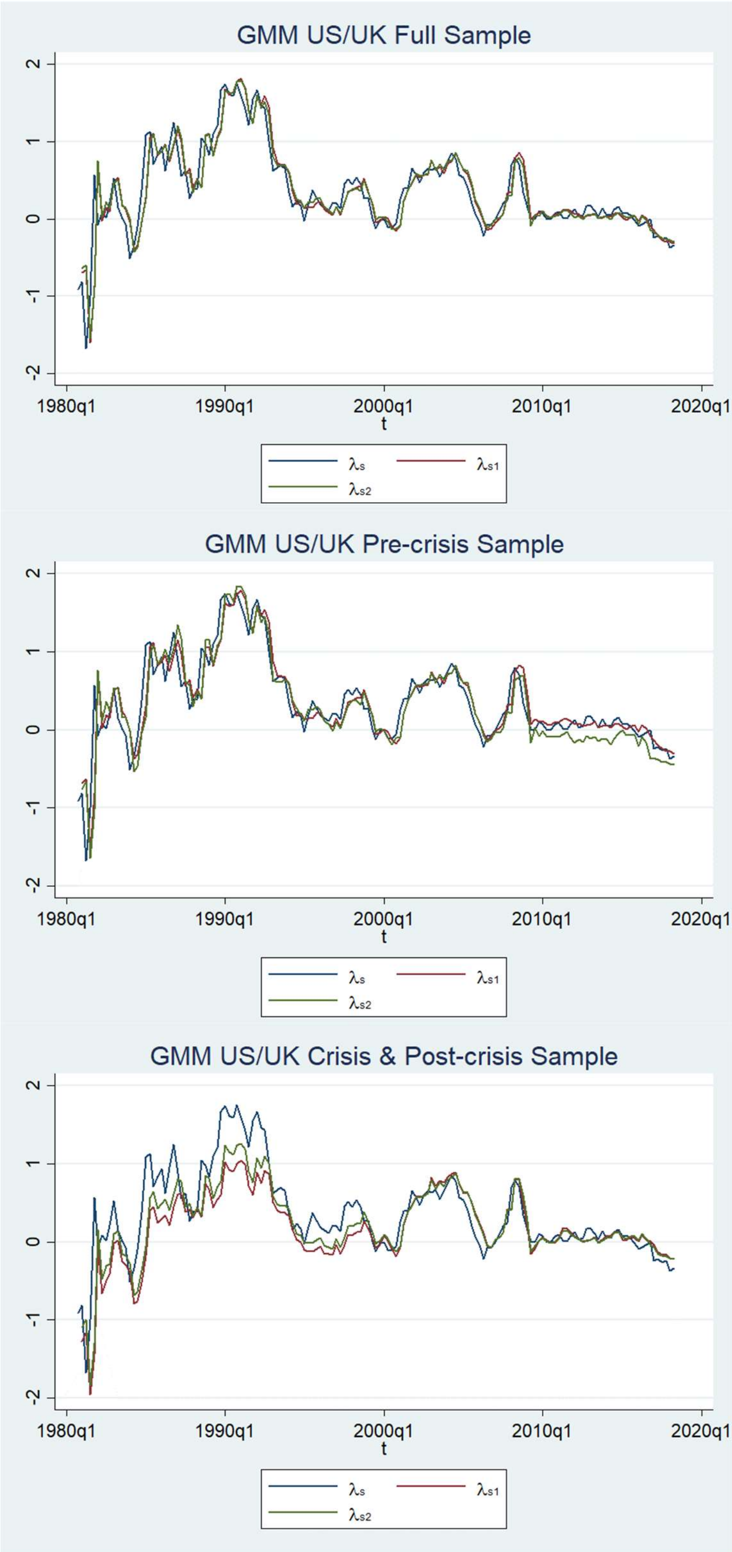
$$\lambda_{2st} = (sp_t - e_t) + \frac{1}{4}\left(\widehat{i_t^*} - \widehat{i_t^h}\right)^{Fitted\ value\ with\ FSI\ variable}$$

Figure 7: US/UK Risk Premium Estimated by Spot Rate (OLS)



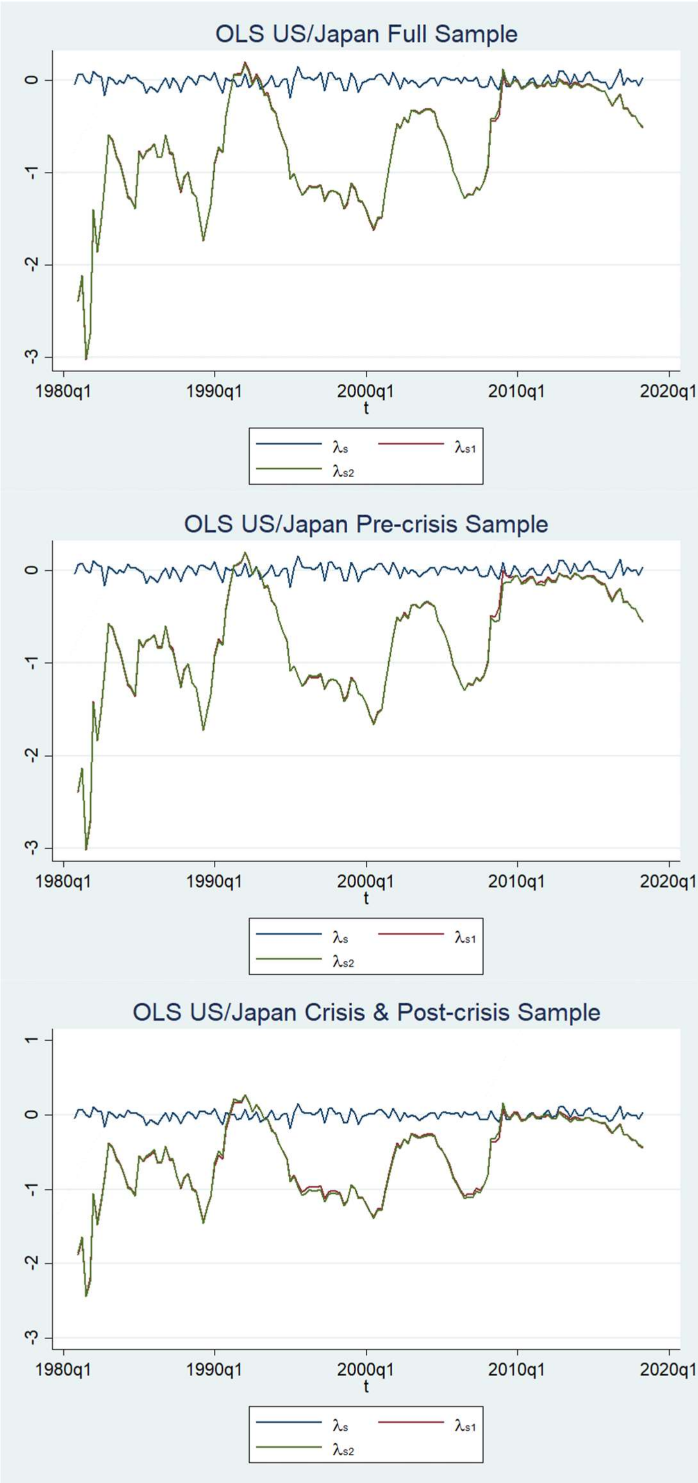
The Figure demonstrates the estimation for the currency excess return of UK interest-bearing assets against US interest-bearing assets. The first-row plot shows in-sample estimations of currency risk premiums predicted by the full sample. The second-row plot shows out-of-sample estimations predicted by the pre-crisis sample. The third-row plot shows out-of-sample estimations predicted by the crisis & post-crisis sample. λ_s presents the actual currency risk premium. λ_{s1} presents estimated λ_s without FSI and λ_{s2} presents estimated λ_s with FSI. OLS estimation is employed for regressions.

Figure 8: US/UK Risk Premium Estimated by Spot Rate (GMM)



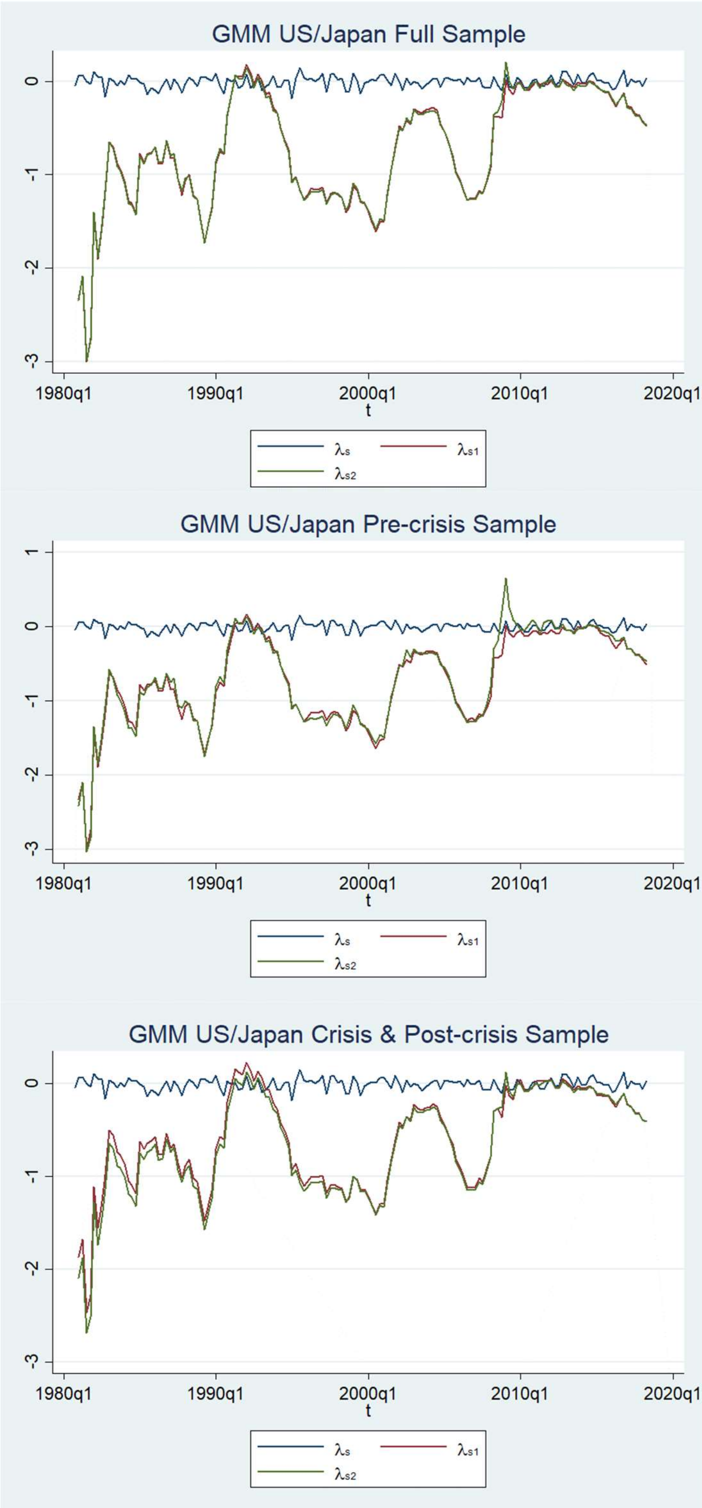
The Figure demonstrates the estimation for the currency excess return of UK interest-bearing assets against US interest-bearing assets. The first-row plot shows in-sample estimations of currency risk premiums predicted by the full sample. The second-row plot shows out-of-sample estimations predicted by the pre-crisis sample. The third-row plot shows out-of-sample estimations predicted by the crisis & post-crisis sample. λ_s presents the actual currency risk premium. λ_{s1} presents estimated λ_s without FSI and λ_{s2} presents estimated λ_s with FSI. GMM estimation is employed for regressions.

Figure 9: US/JAP Risk Premium Estimated by Spot Rate (OLS)



The Figure demonstrates the estimation for the currency excess return of Japanese interest-bearing assets against US interest-bearing assets. The first-row plot shows in-sample estimations of currency risk premiums predicted by the full sample. The second-row plot shows out-of-sample estimations predicted by the pre-crisis sample. The third-row plot shows out-of-sample estimations predicted by the crisis & post-crisis sample. λ_s presents the actual currency risk premium. λ_{s1} presents estimated λ_s without FSI and λ_{s2} presents estimated λ_s with FSI. OLS estimation is employed for regressions.

Figure 10: US/JAP Risk Premium Estimated by Spot Rate (GMM)



The Figure demonstrates the estimation for the currency excess return of Japanese interest-bearing assets against US interest-bearing assets. The first-row plot shows in-sample estimations of currency risk premiums predicted by the full sample. The second-row plot shows out-of-sample estimations predicted by the pre-crisis sample. The third-row plot shows out-of-sample estimations predicted by the crisis & post-crisis sample. λ_s presents the actual currency risk premium. λ_{s1} presents estimated λ_s without FSI and λ_{s2} presents estimated λ_s with FSI. GMM estimation is employed for regressions.

Similar to the previous case, where the next-period of exchange rate is applied as the expected exchange rate, the estimations of risk premium by using 3-month spot rate, without FSI and with FSI, are adequate to plot the UK's excess premium. However, this case does not apply to the estimation of Japanese currency excess. Figure 7 and Figure 8 display the estimations of excess return on Japanese yen interest-bearing assets, against US dollar interest-bearing assets, by OLS and GMM estimation methods respectively. Both figures indicate that both λ_{1rt} and λ_{2rt} modelled actual values of excess return λ_{rt} relatively poorly, since λ_{rt} stays close to 0% for the whole period ,while both λ_{1r} and λ_{2rt} clearly are more volatile and have up and downs driven by market shocks.

2.4.2.3. 3-Month Forward Exchange Rate ($E_t e_{t+1} = f_t$)

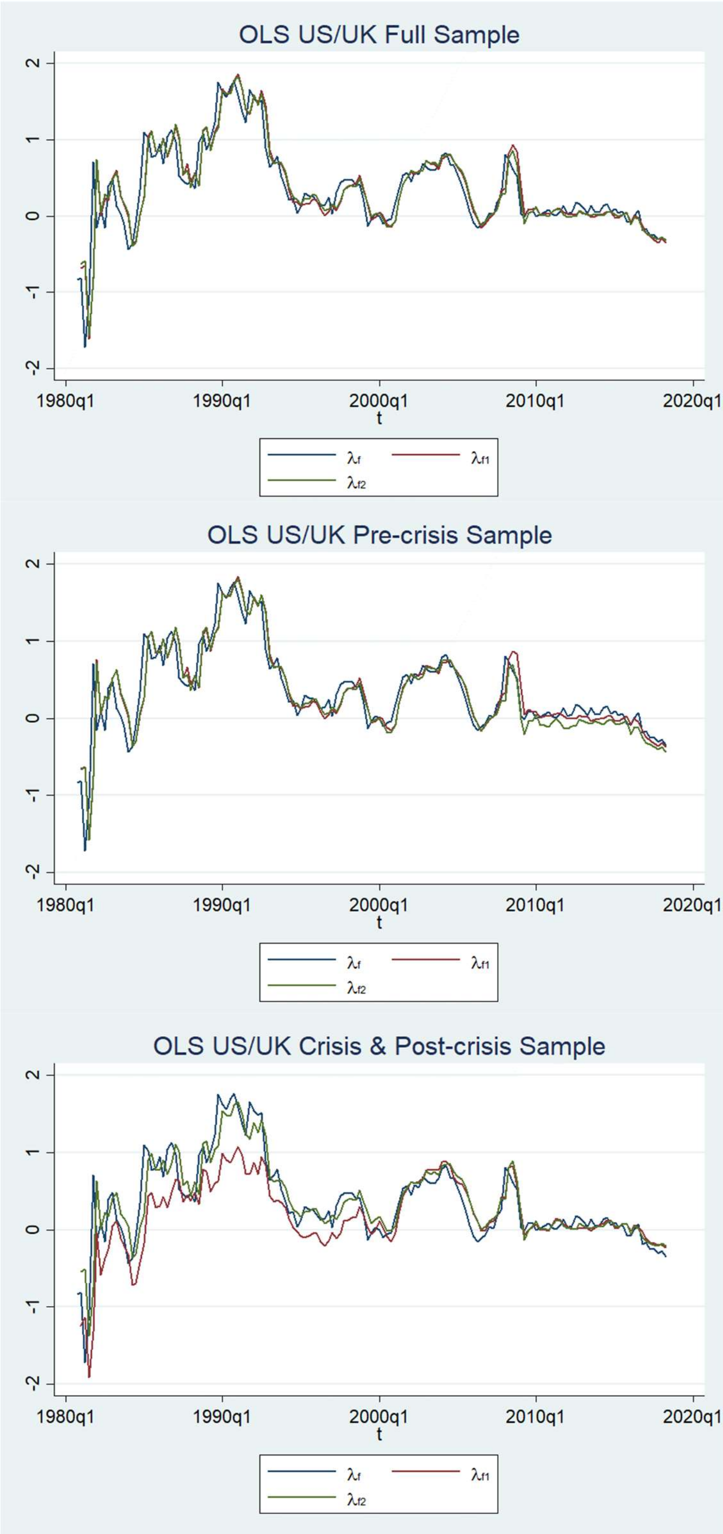
Similarly, when $E_t e_{t+1} = f_t$, where f_t is the three-month forward rate, λ_{ft} denotes the value of the excess return when forward rates are adopted to predict market expectation, while λ_{1ft} and λ_{2ft} are fitted values of λ_{ft}, estimated by the modified Taylor-rule regression, without and with the FSI variable respectively. λ_{1ft} , λ_{2ft} and λ_{ft} are calculated by the following equations, and figures below exhibit the results of it.

$$\lambda_{ft} = f_t - e_t + \frac{1}{4}(i_t^* - i_t^h) \tag{2.11}$$

$$\lambda_{1ft} = (f_t - e_t) + \frac{1}{4}\,(\widehat{i_t^*} - \widehat{i_t^h})^{Fitted\ value\ without\ FSI\ variable}$$

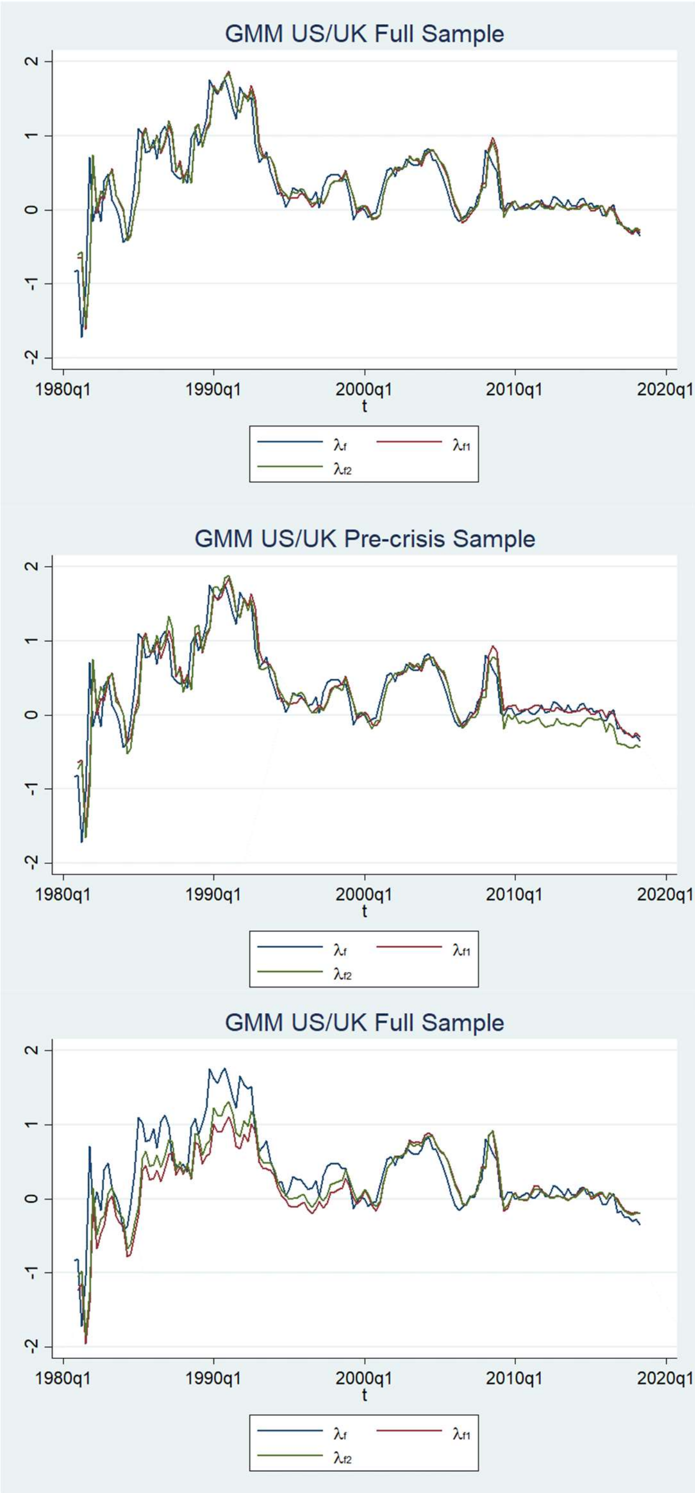
$$\lambda_{2ft} = (f_t - e_t) + \frac{1}{4}\,(\widehat{i_t^*} - \widehat{i_t^h})^{Fitted\ value\ with\ FSI\ variable}$$

Figure 11: US/UK Risk Premium Estimated by Forward Rate (OLS)



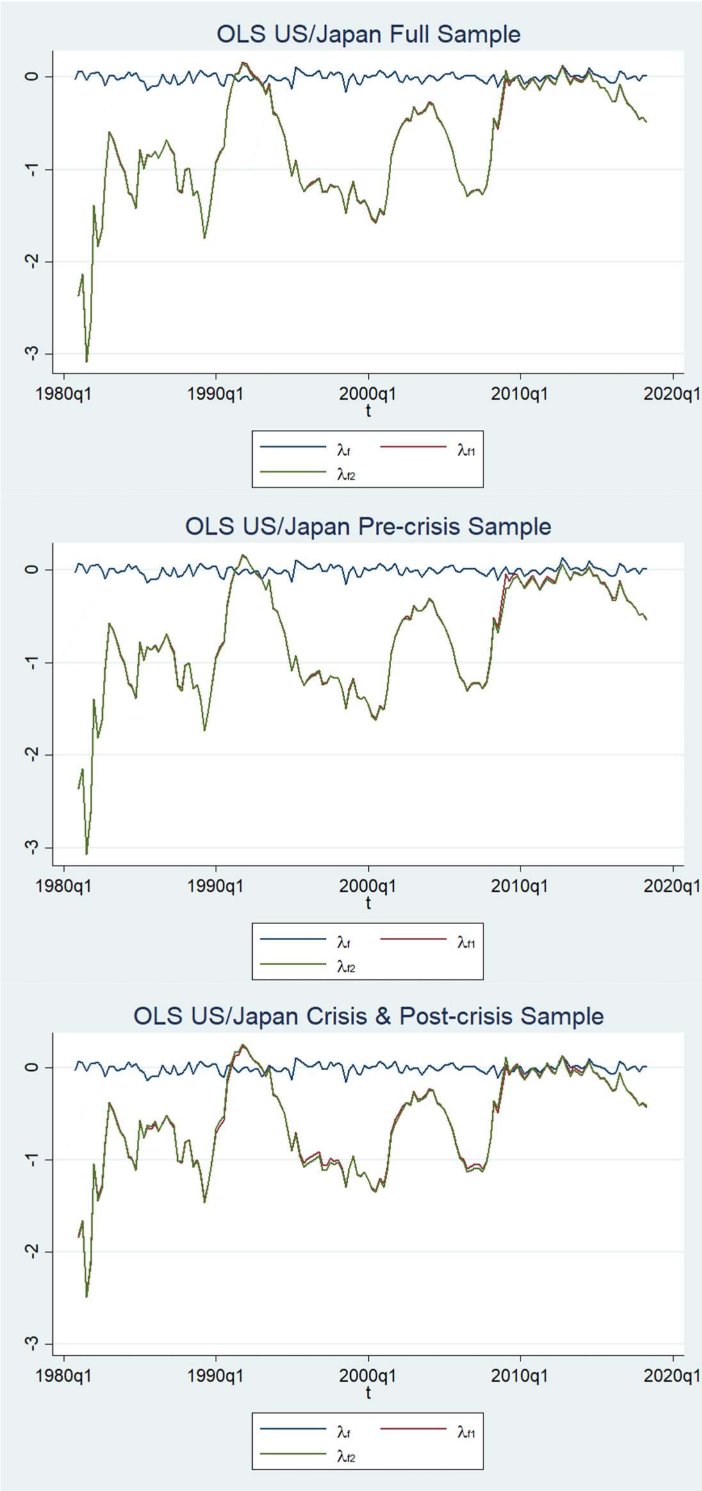
The Figure demonstrates the estimation for the currency excess return of UK interest-bearing assets against US interest-bearing assets. The first-row plot shows in-sample estimations of currency risk premiums predicted by the full sample. The second-row plot shows out-of-sample estimations predicted by the pre-crisis sample. The third-row plot shows out-of-sample estimations predicted by the crisis & post-crisis sample. λ_f presents the actual currency risk premium. λ_{f1} presents estimated λ_f without FSI and λ_{f2} presents estimated λ_f with FSI. OLS estimation is employed for regressions.

Figure 12: US/UK Risk Premium Estimated by Forward Rate (GMM)



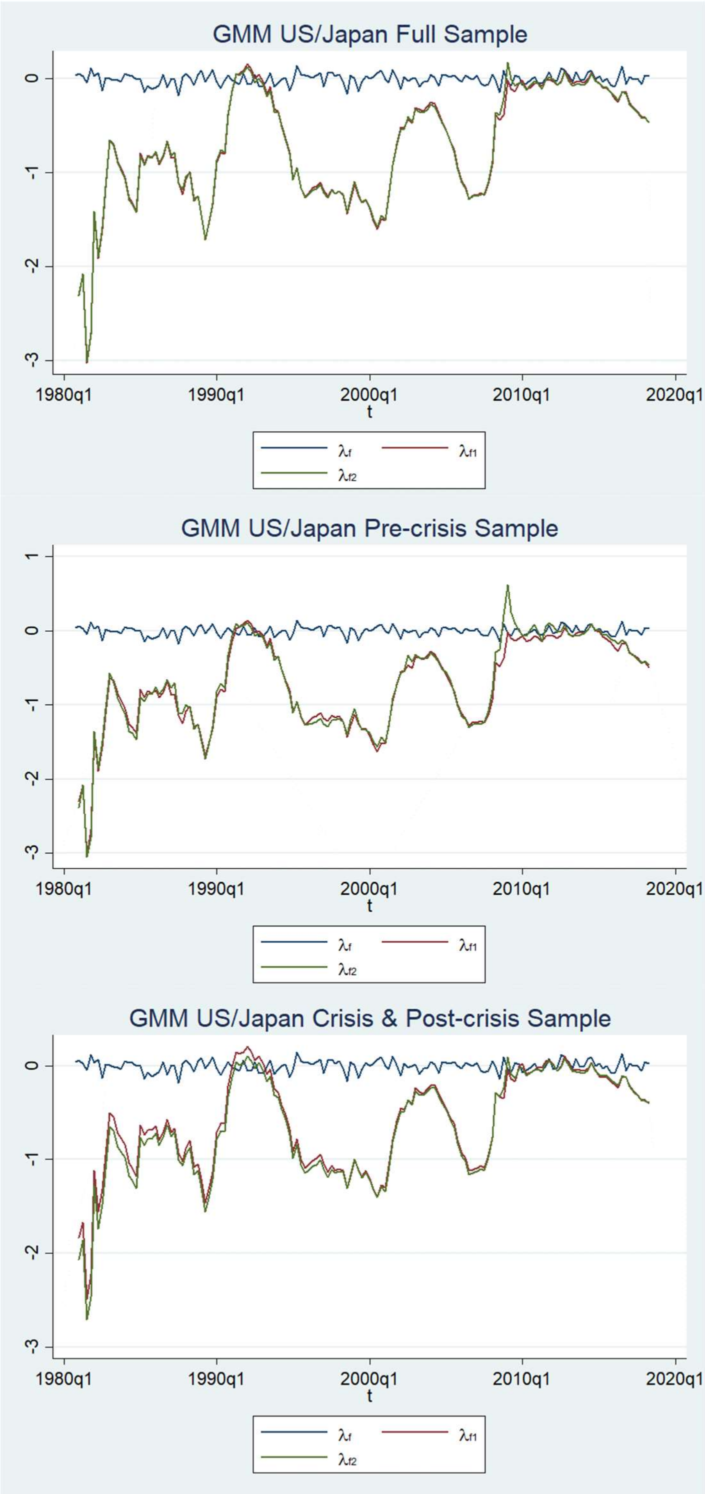
The Figure demonstrates the estimation for the currency excess return of UK interest-bearing assets against US interest-bearing assets. The first-row plot shows in-sample estimations of currency risk premiums predicted by the full sample. The second-row plot shows out-of-sample estimations predicted by the pre-crisis sample. The third-row plot shows out-of-sample estimations predicted by the crisis & post-crisis sample. λ_f presents the actual currency risk premium. λ_{f1} presents estimated λ_f without FSI and λ_{f2} presents estimated λ_f with FSI. GMM estimation is employed for regressions.

Figure 13: US/JAP Risk Premium Estimated by Forward Rate (OLS)



The Figure demonstrates the estimation for the currency excess return of Japanese interest-bearing assets against US interest-bearing assets. The first-row plot shows in-sample estimations of currency risk premiums predicted by the full sample. The second-row plot shows out-of-sample estimations predicted by the pre-crisis sample. The third-row plot shows out-of-sample estimations predicted by the crisis & post-crisis sample. λ_f presents the actual currency risk premium. λ_{f1} presents estimated λ_f without FSI and λ_{f2} presents estimated λ_f with FSI. OLS estimation is employed for regressions.

Figure 14: US/JAP Risk Premium Estimated by Forward Rate (GMM)



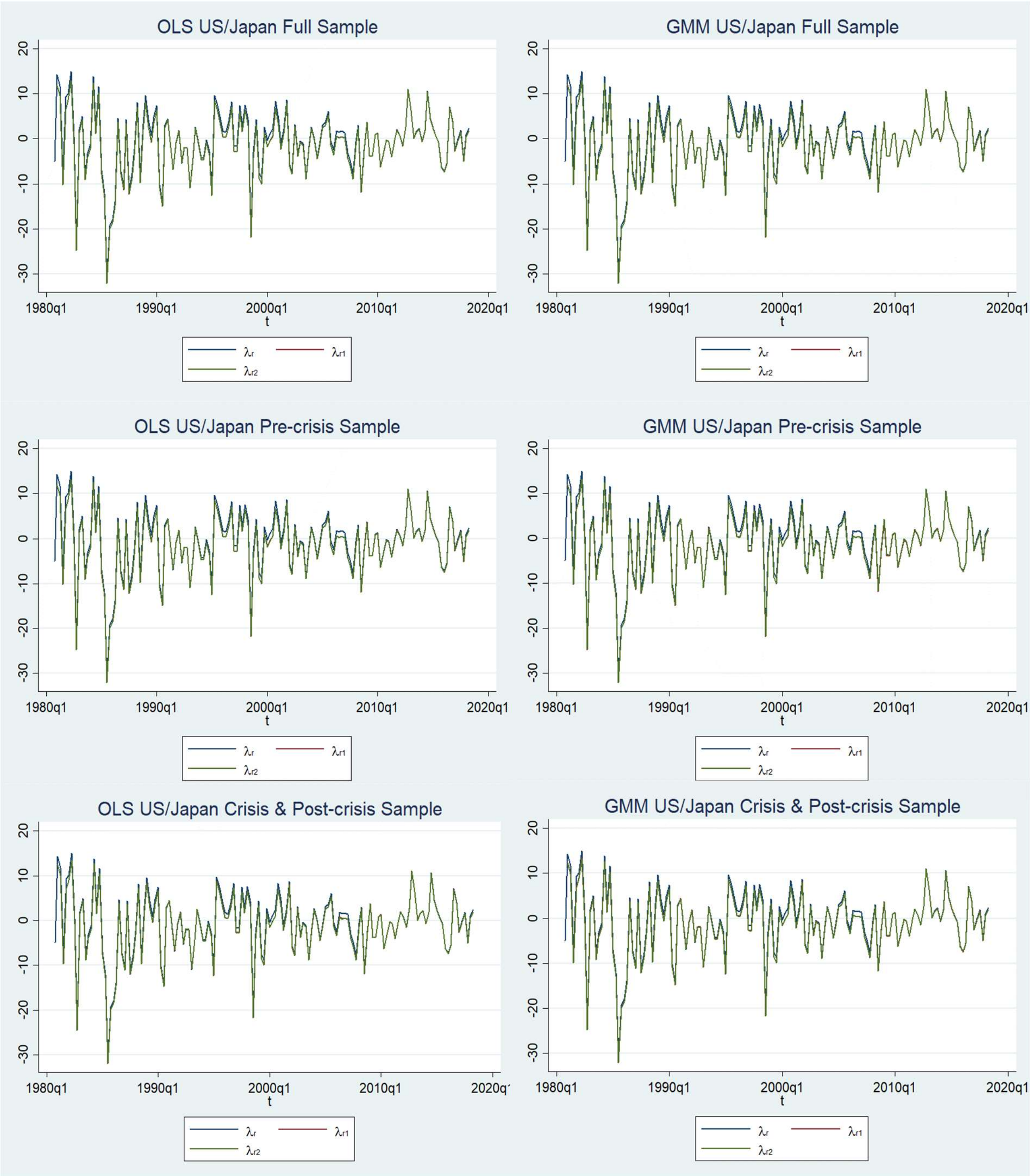
The Figure demonstrates the estimation for the currency excess return of Japanese interest-bearing assets against US interest-bearing assets. The first-row plot shows in-sample estimations of currency risk premiums predicted by the full sample. The second-row plot shows out-of-sample estimations predicted by the pre-crisis sample. The third-row plot shows out-of-sample estimations predicted by the crisis & post-crisis sample. λ_f presents the actual currency risk premium. λ_{f1} presents estimated λ_f without FSI and λ_{f2} presents estimated λ_f with FSI. GMM estimation is employed for regressions.

Similar to the previous case where the expected value equals its spot rate, the estimations of risk premium without FSI, and with FSI are all adequate to plot UK's excess premium but not for Japan's excess premium.

2.4.2.4. US/JAP Currency Risk Premium Re-estimation

In previous estimations, the results have shown the model fails to estimate the US/JAP currency risk premium and this may be because $(e_{t+1} - e_t)$ is relatively smaller in value compared with $\frac{1}{4}\left(\widehat{\iota_t^*} - \widehat{\iota_t^h}\right)$. Therefore, in this section, the actual value of exchange rates, spot rates and forward rates will be used in the equation for Japan, instead of their values in logarithm. The new estimation results show that this solves the problem and the Taylor rule-based method performs well in estimating risk premium for currency pairs US/JAP. Figure 15 displays the estimation results, for the US/JAP currency risk premium, by using the next-period exchange rate as the expected exchange rate **(**$E_t e_{t+1} = e_{t+1}$). In addition, the both spot rate and forward rate give the similar result as the next-period exchange rate in the estimation of λ_t, and both of them can estimate the currency risk premium well for UK/JAP.

Figure 15: US/JAP Risk Premiums by Next-period Exchange Rate (OLS, GMM)



The Figure demonstrates the estimation for the currency excess return of Japanese interest-bearing assets against US interest-bearing assets. The first row shows in-sample estimations of currency risk premiums predicted by the full sample. The second row shows out-of-sample estimations predicted by the pre-crisis sample. The third row shows out-of-sample estimations predicted by the crisis & post-crisis sample. λ_r presents the actual currency risk premium. λ_{r1} presents estimated λ_r without FSI and λ_{r2} presents estimated λ_r with FSI. Left column is OLS estimation. Right column is GMM estimation.

2.5. Conclusion

Results of risk premium estimation indicate that this Taylor rule-based model performs well in estimating the excess return on foreign currency interest-bearing assets of the US/UK and US/Japan pairs. This risk premium is decomposed, by the modified Taylor rule, into five factors: exchange rate, equilibrium interest rate, inflation gap, output gap and FSI variable. The structure of risk premium can be considered as a deviation from UIP theory, which demonstrates the risks of economic fundamentals that were not captured by interest rates, whilst on the other hand, the Taylor rule develops a link between interest rate and price level, which includes the macroeconomic fundamentals of PPP.

For interest rate estimations, both OLS and GMM have been used and GMM improves the model's fitness significantly. In these modified, smoothed Taylor rule-based regressions, the FSI variable does play a role in interest rate-setting behaviour for all three countries US, UK and Japan. The result also show that the adoption of FSI data could be sensitive, as Kansas's FSI data seems to be more significant in the regressions than IMF FSI data. In addition, the current inflation gap is not significant in determining the policy rate, but the inflation gap with one lead, i.e. next-period inflation gap, is significant.

The reason why the estimated parameters of the current rate of inflation gap is insignificant, for all three countries, over all sub-samples, may be because it takes time for price levels in the commodity market to react to new information, such as economic shocks, instead of responding to it immediately. The slower transmission pace of price levels will produce a lagged impact on the inflation gap. The inflation rate today is the result of past information. Therefore, it is reasonable to replace the inflation gap input with its one-quarter lead, which proves significant by the empirical results.

In addition, the empirical results reveal significant differences in the estimated coefficients during 1980-2013, 1980-2007, and 2007-2018. The implication is that structural breaks may be present, or more plausibly, Taylor rules may operate in a non-linear way, which is a natural extension to this chapter.

Chapter 3: Cross-Country Exchange Rate Pass-through into Aggregated Import Prices: Developed Economies

3.1. Introduction

Pegged exchange rates were first introduced between 1870 and 1914 before World War I, known as the gold standard, in order to create a stable environment for foreign investment. This allowed international investors to ensure the value of their investments and encouraged international investment and trade. This also led to greater capital mobility and global stability in international trade and currencies. After Bretton Woods Conference, at the end of World War II, the system of pegged exchange rates is adopted to member countries. This time the US dollar was officially fixed to the price of gold at 35 US dollars per ounce, which allowed the currency to be the most dominant one in the international market due to this direct tie with the value of gold. Prices of products in different markets would normally be expressed in US dollars since the value of such products could be then expressed as the value of gold in turn. This pegged currency system was suspended in 1971 when the US dollar could no longer afford to hold the pegged rate with gold and was abandoned by all the countries in 1985. A floating exchange rate has been a mainstream regime by the majority of governments since then.

The governments who opt for a fixed exchange rate regime may face a situation where they inevitably implement policies that could harm their real economy in order to maintain the preset peg since local currency would be overvalued or undervalued relative to its equilibrium level, which may provoke financial crisis. This is what was previously seen in Mexico (1995), Asia (1997) and Russia (1997). However, the initial expectation on the equilibrating role of floating exchange rate regime still failed since the trade balances remained resilient to changes in exchange rates. The exchange rate pass-through has been examined by a number of authors to explain this sluggish adjustment in the international trading system, known as adjustment puzzle (Menon, 1995).

Exchange rate pass-through measures the degree to which the price of traded goods in terms of destination currency would change in response to fluctuations in exchange rates. One possible reason for the sluggish trade flows relative to exchange rate changes in the presence of high demand elasticity may be due to the assumption that the changes in exchange rates are fully reflected in the prices of traded goods. The anticipated quantity adjustment could be postponed if exchange rate changes are not substantially or fully-passed through to traded goods' prices, despite the demand elasticity being sufficiently large. That is, a low exchange rate pass-through rate could be a possible reason for trade flows staying insensitive to exchange rate changes, to a certain extent, even if demand elasticity is high.

Recent literature has shown some of the determinants of exchange rate pass-through. It has been argued that market structure and product differentiation could be the reasons for incomplete pass-through (Menon, 1995), since a particular type of market organization always results in a restricted price response to exchange rate changes, if short run profit margins by exporters reflect pass-through.

The currency denomination in international trade can also affect the level of exchange rate pass-through rates. Devereux and Engel (2001) conclude that exporters would like to set a price of products in a currency with the most stable monetary policy, according to their simple two-country general equilibrium model. However, a simple two-country general equilibrium model by Obstfeld and Rogoff (1998) suggest that firms would opt to set prices in their domestic currency when exporting. A growing number of literature has been built on the New Keynesian sticky price framework to provide an analysis of open economies at a microeconomic level. The New Keynesianism provides theoretical macroeconomic fundamentals for sticky nominal prices. Due to inconclusive price changes, imperfectly competitive firms may think it would be profitable to maintain prices when a shock is presented in costs or demand.

More recently, exchange rate pass-through has been intensively discussed in heated debate over appropriateness of monetary policy and optimality of exchange rate regimes in general equilibrium models. Those debates focus on whether exchange rate pass-through is endogenous to its domestic monetary policy, and the issue of pervasiveness of producer-currency pricing

(PCP) against local-currency pricing (LCP). PCP implies producers set prices in their own currency while with LCP firms set prices in the currency of consumers. With PCP, prices that home consumers pay for the imported goods fluctuates corresponding to exchange rate changes. The exchange rate pass-through is complete and high. On the other hand, with LCP, prices home consumers pay for the imported goods do not respond to exchange rate fluctuations. The exchange rate pass-through is incomplete and low. Low exchange rate pass-through arguably implies that fluctuations in nominal exchange rates would result in smaller expenditure switching impacts of domestic monetary policy. Therefore, it is argued that monetary policy could be implemented more effectively by isolating price level from exchange rate changes. In other words, periods with more stable inflation and monetary performance would also hold a more effective monetary policy as a stabilization instrument, as Taylor (2000a) stated.

In this chapter, the short run and long run exchange rate pass-through elasticity of import prices will be first derived to provide empirical evidence of the role that exchange rate pass-through plays in macroeconomic stabilization, in the context of the following five countries: France, Germany, Japan, UK and US. By using quarterly time series data, the level of exchange rate pass-through across the period of 1980-2016 will be examined. The second objective of this chapter is to examine the determinants of exchange rate pass-through, for each country, by testing money growth rate, annualised money growth rate, inflation, annualized inflation, exchange rate volatility and real GDP.

3.2. Methodology

The dynamics of exchange rate pass-through into import prices is explored by the micro fundamental model of exporter pricing behaviours. This model relies on the study by Campa and Goldberg's work (2005).

The import prices for country j, $P_t^{m,j}$, is regarded as a transformation of the corresponding export prices of country j's trading partners, $P_t^{x,j}$. By adopting the exchange rate (domestic currency per unit foreign currency) E_t^j, it can be expressed by the following equation:

$$P_t^{m,j} = E_t^j\, P_t^{x,j}$$

Using lowercase letters to denote logarithm forms, the equation is written as:

$$p_t^m = e_t + p_t^x$$

The export prices consist of a markup and exporter's marginal costs (mc_t^x), hence it can be expressed as:

$$p_t^x = markup_t^x + mc_t^x$$

In turn, markups can be decomposed into a specific fixed effect of an industry and a flexible effect which is sensitive to macroeconomic conditions. In this chapter, such conditions are specified as a function of the exchange rate for simplicity as follows:

$$markup_t^x = \phi_0 + \phi_1 e_t$$

Marginal costs are expressed as a function of destination market demand conditions y_t and wages in export market:

$$mc_t^x = c_0 y_t + c_1 w_t^x$$

Rearranging above equations, import prices are expressed as:

$$p_t^m = \phi_0 + (1 + \phi_1)e_t + c_0 y_t + c_1 w_t^x \qquad (3.1)$$

Equation (3.1) gives the exchange rate pass-through $\beta = 1 + \phi_1$. If $\beta = 1$, then PCP takes place in the international market; while $\beta = 0$ implies LCP. When local currency depreciate, e_t rises, therefore the import prices are expected to increase in this case. This implies that import prices and exchange rate are positively correlated.

3.2.1. Estimation Method

Table 19: Variable Definition and Data Source

Variable	**Definition**		**Source**
$\mathbf{p_t}$	Local currency import prices		Organisation for Economic Development and Cooperation (2016): OECD Economic Outlook 100, Edition 2016/2. UK Data Service. DOI: 10.5257/oecd/econ/2016ed2 (German data only starts from 1990 with 10 years' data missing)
$\mathbf{e_t}$	Nominal exchange rate in log forms (domestic currency per unit foreign currency)		International Financial Statistics (IFS). Code in IFS database: NECZF
$\mathbf{NEX_t^j}$	Nominal effective exchange rate of country j (domestic currency per unit foreign currency)		International Financial Statistics (IFS). Code in IFS database: NECZF
$\mathbf{REX_t^j}$	Real effective exchange rate of country j (domestic currency per unit foreign currency)		International Financial Statistics (IFS). Code in IFS database: RECZF
$\mathbf{w_t}$	A control variable reflecting exporters' costs		Constructed by the author
$\mathbf{y_t}$	Control variables which represents the destination market demand conditions, e.g. GDP in the current chapter		DataStream
$\mathbf{Exvol}_t$	Exchange rate volatility		Constructed by the author
$\mathbf{gdp_t^j}$	Real GDP of country j in log forms		International Financial Statistics. Code in IFS database: 99BVRZF
$\mathbf{z_t^j}$	The determinants of exchange rate pass-through for country j in log forms	money growth_t,	z_t^j
		inflation_t,	Annual inflation rates based on CPI France, Germany, Japan, US: International Financial Statistics. Code in IFS database: 64XZF UK: Federal Reserve Bank of St. Louis
		Exvol_t,	
		real gdp_t	International Financial Statistics. Code in IFS database: 99BVRZF
		real gdp_t	International Financial Statistics. Code in IFS database: 99BVRZF

Note: Variables in lower case letters denote logarithmic form of corresponding variables.

Similar to the tests of exchange rate pass-through throughout existing literature, a log liner regression is adopted to capture the arguments of Equation (1):

$$p_t = \alpha + \beta e_t + \delta w_t + \varphi y_t + \epsilon_t \tag{3.2}$$

Analogously to the study by Campa and Goldberg (2005), a proxy reflecting exporter costs is constructed since finding a control variable is difficult. Such a proxy mirrors the changing costs of a country's aggregated trading partners and is expressed as:

$$W_t^j = REX_t^j * P_t^j / NEX_t^j \tag{3.3}$$

To denote logarithmic form of these variables by lower case letters, the above definition is equivalent to:

$$w_t^j = rex_t^j + p_t^j - nex_t^j.$$

This measure takes into account overall export costs of trading partners with each partner weighted by its proportion and importance to the importing country j.

Exchange rate pass–through measures how responsive international prices of traded goods would be to fluctuations in exchange rates. Following the convention in the existing literature, exchange rate pass-through on import prices in this chapter is measured by the elasticity of import prices in the domestic currency.

Firstly, the short run and long run exchange rate pass-through elasticity will be estimated using the quarterly data. The first-order differenced regressions are adopted to eliminate the stochastic trends and unit root in variables.

Furthermore, to allow for possible sluggish adjustments of import prices to exchange rates, lagged exchange rate and foreign production costs are included up to the fourth lagged order. Therefore, the regression model to be estimated is:

$$\Delta p_t^j = \alpha + \textstyle\sum_{i=0}^{4} a_i^j \, \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \, \Delta w_{t-i}^j + c^j \, \Delta gdp_t^j + \epsilon_t^j \tag{3.4}$$

a_0^j gives the short run price elasticity of exchange rate while the long run elasticity is given by $\sum_{i=0}^{4} a_i^j$. The use of four lags as long run is empirically verified since pass-through rates generally respond over the first and second lags after a change in exchange rate. b_i^j is expected to be positive since a rise in w_t^j indicates an increase in aggregated costs of trading partners, which would normally raises the price of import goods.

It has been argued in literature that the cross-country variations in the exchange rate pass-through can be explained by monetary volatility of the importing country, exchange rate volatility and country size. In the current model, the money growth rate and inflation rate of the local country are included to describe the monetary volatility, and an annualized money growth rate is proxied by M2. An annualized inflation rate is calculated based on Consumer Price Index (CPI). Exchange rates' volatility is measured by the average of the corresponding monthly squared changes in nex_t^j to the previous year's value. The following Equations (3.5) and (3.6) give the re-estimation of the regression derived from Equation (3.4), which structure the determinants of exchange rate pass-through as a function of macroeconomic variables:

$$a_i^j = \beta_i z_t^j \quad \text{for } i = 0, \dots, 4$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \qquad (3.5)$$

where

$z_{1t} = \text{money growth}_t$,

$z_{2t} = \text{inflation}_t$,

$z_{3t} = \text{exvol}_t$ and

$z_{4t} = \text{real gdp}_t$.

Furthermore,

$\text{money growth}_t = \log(\text{Money Supply}_t) - \log(\text{Money Supply}_{t-1})$,

$\text{inflation}_t = \log(\text{CPI}_t) - \log(\text{CPI}_{t-1})$,

$\text{Exvol}_t = [\text{nex}_t - \text{average}(\sum_{i=t-8}^{t-1} \text{nex}_i)]^2$ and

$\text{real gdp}_t = \log(\frac{\text{GDP}_t}{1+\text{Inflatio}\ _t})$.

Moreover, annualized money growth rate and inflation rate are incorporated into the regression (3.5) in the following manner:

$\text{annualized money growth}_t = \log(\text{Money Supply}_t) - \log(\text{Money Supply}_{t-4})$,

$\text{annualized inflation}_t = \log(\text{CPI}_t) - \log(\text{CPI}_{t-4})$.

In addition, the estimation results will be checked by an alternative model specification including a lagged dependent variable to obtain a more dynamic estimation. The regression equation of this partial adjustment model is as follows.

$$\Delta p_t^j = \alpha + \ \Delta p_{t-1}^j + \sum_{i=0}^4 \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^4 b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \qquad (3.6)$$

where

$z_{1t} = \text{money growth}_t$,

$z_{2t} = \text{inflation}_t$,

$z_{3t} = \text{Exvol}_t$,

$z_{4t} = \text{real gdp}_t$.

$z_{5t} = \text{annualized money growth}_t$ and

$z_{6t} = \text{annualized inflation}_t$.

A second approach to test the significance of determinants of exchange rate pass-through is to compare the results of regression based on Equation (3.5) and (3.7), where the latter is defined as:

$$\Delta p_t^j = \alpha + \sum_{i=0}^4 a_i^j \Delta e_{t-i}^j + \sum_{i=0}^4 \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^4 b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \qquad (3.7)$$

Significant β_i^j implies the determinacy of variable z_t in exchange rate pass-through.

All the regressions defined above are estimated by OLS. All variables in regressions appear to be stationary according to ADF tests.

Table 20: Data Description

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	ADF Test	Obser.
j: France									
CPI	80.96897	82.53935	106.07	36.8962	18.21499	-0.4974	2.450407	0.0000	148
$Exvol_t$	0.000211	0.000171	0.000564	6.50E-05	0.000124	1.193998	3.666534	0.0896	140
gdp_t^j	83.17052	81.3308	106.035	58.1927	15.56538	-0.08097	1.577366	0.8393	147
IMPORT PRICE	0.959823	0.958533	1.131354	0.635308	0.07772	-1.42107	7.477234	0.0000	148
M2	4.69E+12	3.74E+12	1.07E+13	1.09E+12	2.85E+12	0.583009	1.99544	1.0000	148
nex_t^j	0.010649	0.010386	0.01262	0.009619	0.000761	0.954744	2.973701	0.5342	147
rex_t^j	0.009835	0.009814	0.010867	0.008549	0.000487	0.08075	3.00435	0.2335	147
w_t	0.891468	0.880516	1.089319	0.563368	0.111769	-0.3392	3.29813	0.0225	147
j: Germany									
CPI	91.09663	90.0242	107.642	68.7876	10.73892	-0.07212	1.956008	0.0112	104
$Exvol_t$	0.000202	0.000185	0.000389	8.28E-05	7.58E-05	0.605462	2.421199	0.0176	103
gdp_t^j	93.69272	93.3236	110.309	77.7886	9.426598	-0.03163	1.851366	0.9555	103
IMPORT PRICE	0.982217	0.974024	1.077116	0.904602	0.043985	0.536565	2.299247	0.5988	104
M2	5.93E+12	5.30E+12	1.07E+13	2.60E+12	2.52E+12	0.327485	1.656391	1.0000	104
nex_t^j	0.010348	0.010255	0.011414	0.009503	0.000468	0.526912	2.477928	0.3040	103
rex_t^j	0.009706	0.009706	0.010804	0.008367	0.000585	-0.31209	2.449423	0.8197	103
w_t	0.924842	0.917284	1.094665	0.782977	0.099832	0.182857	1.749404	0.9092	103
j: Japan									
CPI	7.22E+10	100.3715	1.07E+13	74.7096	8.78E+11	12.04188	146.0068	0.9929	148
$Exvol_t$	0.001085	0.000827	0.004617	1.84E-04	8.75E-04	2.095961	7.569528	0.0135	147
gdp_t^j	86.60403	91.7451	106.288	51.2245	16.04038	-0.8342	2.418816	0.0600	147
IMPORT PRICE	1.121174	1.023591	1.80275	0.8354	0.266025	1.254846	3.312495	0.2138	148
M2	5.71E+14	5.90E+14	9.43E+14	1.92E+14	2.05E+14	-0.2302	2.06869	0.8941	147
nex_t^j	0.01774	0.012804	0.049405	0.009076	0.010016	1.547361	4.152443	0.0000	147
rex_t^j	0.010534	0.0099	0.014755	0.006853	0.001911	0.494419	2.209072	0.1897	147
w_t	0.764293	0.663307	1.376777	0.368401	0.271372	0.777585	2.340302	0.8348	147
j: UK									
CPI	7.95E+01	80.66	1.13E+02	42.89	2.00E+01	-0.07385	2.107056	0.7095	137
$Exvol_t$	0.000304	0.000255	0.000964	6.94E-05	1.78E-04	1.366869	4.795053	0.1175	140
gdp_t^j	82.61931	82.01495	112.545	51.4623	18.08209	-0.05972	1.633537	0.8889	136
IMPORT PRICE	0.779273	0.761135	1.021135	0.542086	0.117991	0.35286	2.339078	0.5993	137
M2	6.62E+05	5.26E+05	1.53E+06	1.22E+05	4.20E+05	0.51888	1.937787	1.0000	134
nex_t^j	0.008534	0.00819	0.010398	0.006665	0.00089	0.427849	2.048541	0.3378	137
rex_t^j	0.009384	0.009294	0.01118	0.007867	0.000869	0.328656	2.093778	0.2122	137
w_t	0.850684	0.826752	0.996628	0.704573	0.065151	0.473999	2.14383	0.1703	137
j: US									
CPI	7.22E+10	74.78985	1.07E+13	36.2039	8.78E+11	12.04188	146.0068	0.9980	148
$Exvol_t$	0.000611	0.000392	0.002615	1.06E-04	5.67E-04	1.841231	5.736625	0.6614	145
gdp_t^j	77.32691	77.3211	112.976	43.1283	21.79088	-0.03452	1.606006	0.9843	147
IMPORT PRICE	0.903961	0.859982	1.176276	0.736685	0.120696	0.828977	2.47561	0.6477	148
M2	5.36E+12	4.18E+12	1.30E+13	1.50E+12	3.10E+12	0.825485	2.586809	1.0000	147
nex_t^j	0.012189	0.010242	0.029311	0.007776	0.004859	1.872723	6.15384	0.0000	147
rex_t^j	0.009069	0.009236	0.0107	0.006388	0.000941	-0.74787	3.050847	0.5082	147
w_t	0.768285	0.836706	1.157502	0.24852	0.279663	-0.47547	2.035383	0.2722	147

The table exhibits the descriptive statistics for all the data used in this chapter, including mean, median, maximum value, minimum value, standard deviation, skewness, kurtosis, the p-value of the Augmented Dickey-Fuller (ADF) test, and the number of the observations for each variable. Most of the variables cannot reject a unit root as ADF test shows.

3.3. Results

This section will first show the estimations of exchange rate pass-through for these five counties: France, Germany, Japan, UK and US for the sample collected in 1980-2016 (Germany data is limited to 1990-2016), and then will discuss the macroeconomic determinants of the exchange rate pass-through. They are money growth rates, inflation rates, exchange rate volatility and real GDP. In the first part, the empirical results disprove absolute LCP and PCP of exchange rate pass-through while they indicate a dynamic exchange rate pass-through that changes over time. In the second part, the exchange rate pass-through is first modelled as a function of observable macroeconomic variables, followed by a robustness test, in which a cross product term is added in the regression. All the macroeconomic variables have been shown to be significant to determine the exchange rate pass-through. Three consistent results have been obtained. Money growth rate and Inflation rate are significant in determining exchange rate pass-through for France, Germany, Japan and the US. Exchange rate volatility is the most significant determinant of exchange rate pass-through in general. It also suggests a negative impact of real GDP on exchange rate pass-through.

3.3.1. Short run and Long run Exchange Rate Pass-through

As defined in the previous section, the current section aims to estimate the following equation.

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \qquad (3.4)$$

Table 21 and Table 22 show the estimation results from Equation (3.4). Both tables demonstrate that both the short run and long run exchange rate pass-through elasticity are between zero and one, hence neither absolute LCP nor PCP holds in international trade. On the other hand, partial exchange rate pass-through holds, which is consistent with previous literature. However, it can be seen that the exchange rate pass-through for Germany is distinct from others in terms of the magnitude. This could be due to the limited availability of German data as noted in the previous section, hence it cannot be concluded that Germany has a lower exchange rate pass-through than other countries. However, this result may imply that the exchange rate pass-through varies over time. It can be seen that France has the exchange rate pass-through of around 0.5 for both the short run and long run, which are the highest among these five nations. This is followed by the US whose exchange rate pass-through is in the second largest at 0.3 in both the long and short run. The rank by the value of the exchange rate pass-through from high to low for the rest countries is: the UK, Japan, and Germany.

Table 21: Short run Exchange Rate Pass-Through Elasticity into Aggregate Import Prices (one lag differenced regression, Equation (3.4))

Country	**Elasticity**
	short run
France	0.57050 (0.0056)
Germany	0.04019 (0.0464)
Japan	0.12716 (0.0817)
UK	0.25287 (0.0553)
US	0.35057 (0.0046)

Note: The p-value of the t-test is reported parentheses. The short run exchange rate pass-through elasticity is represented by a_0^j.

Table 22: Long run Exchange Rate Pass-Through Elasticity into Aggregate Import Prices (one lag differenced regression, Equation (3.4))

Country	**Elasticity**
	long run
France	0.55589 (0.0007)
Germany	0.03317 (0.3790)
Japan	0.21976 (0.0000)
UK	0.3592 (0.1103)
US	0.45367 (0.0000)

Note: The p-value of the F-test with $H_0: \sum_{i=0}^{4} a_i^j = 0$ is reported in parentheses. The long run exchange rate pass-through elasticity is represented $\sum_{i=0}^{4} a_i^j$.

3.3.2. Determinants of Exchange Rate Pass-through by Country

This Section will explore the macro determinants of exchange rate pass-through. In section 3.3.2.1., Equation (3.5) and (3.6) are employed to test the determination of exchange rate pass-through, where Equation (3.5) is a first-order difference equation on a quarterly basis while Equation (3.6) is a first-order difference equation on an annualized basis to take the seasonal effects into account. Then, the cross-product term of the determinants and exchange rates is included in the regression for a robustness check to testify the impacts of the determinants.

3.3.2.1. Estimation by Equations (3.5) and (3.6)

This section will show the empirical results on the determinants of exchange rate pass-through by Equation (3.5) and (3.6) for all those five countries: France, Germany, Japan, UK and US. Equation (3.5) is based on a first-order difference equation on a quarterly basis, while Equation (3.6) is a dynamic first-order difference equation with a lagged dependent variable. Five determinants will be examined: money growth, inflation, exchange rate volatility and real GDP. In addition, annualized macro variables of money growth rate and inflation rate will also be considered and compared based on these two equations.

Table 23, 25, 27, 29, and 31 demonstrate the results of the OLS estimation using Equations (3.5) as follows for France, Germany, Japan, UK, and US, respectively:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \tag{3.5}$$

where

$z_t = \text{money growth}_t$,

$z_t = \text{inflation}_t$,

$z_t = \text{exvol}_t$ and

$z_t = \text{real gdp}_t$.

Hence the tested regressions are more specifically expressed as follows:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} \beta_i^j * (\text{money growth})_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} \beta_i^j * (\text{inflation})_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} \beta_i^j * (\text{exvol})_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j$$

$\Delta p_t^j = \alpha + \sum_{i=0}^{4} \beta_i^j * (\text{real gdp})_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j$.

Table 24, 26, 28, 30 and 32 demonstrates the results of the OLS estimation using the following equations for France, Germany, Japan, UK, and US respectively:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \qquad (3.5)$$

where

$z_{5t} = \text{annualized money growth}_t$ and

$z_{6t} = \text{annualized inflation}_t$.

Specifically, the following equations are obtained:

$\Delta p_t^j = \alpha + \sum_{i=0}^{4} \beta_i^j * (\text{annualized money growth})_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j$

$\Delta p_t^j = \alpha + \sum_{i=0}^{4} \beta_i^j * (\text{annualized inflation})_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j$.

$$\Delta p_t^j = \alpha + \Delta p_{t-1}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \qquad (3.6)$$

where

$z_{5t} = \text{annualized money growth}_t$ and

$z_{6t} = \text{annualized inflation}_t$.

Specifically, the following equations are obtained:

$\Delta p_t^j = \alpha + \Delta p_{t-1}^j + \sum_{i=0}^{4} \beta_i^j * (\text{annualized money growth})_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j$

$\Delta p_t^j = \alpha + \Delta p_{t-1}^j + \sum_{i=0}^{4} \beta_i^j * (\text{annualized inflation})_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j$.

Table 23: OLS estimation results for France (Equation(3.5))

France	(1)	(2)	(3)	(4)
Determinant (z_t)	Money Growth	Inflation	Exvol	Real GDP
VARIABLES	Δp	Δp	Δp	Δp
z	2.180***	2.494	288.5***	0.0135**
	(0.801)	(1.580)	(67.91)	(0.00571)
z(-1)	4.392***	5.209***	117.5**	0.0112*
	(0.807)	(1.569)	(57.94)	(0.00596)
z(-2)	4.164***	7.783***	282.4***	0.0120**
	(0.775)	(1.503)	(54.10)	(0.00595)
z(-3)	3.432***	5.102***	137.0**	0.0106*
	(0.774)	(1.501)	(54.64)	(0.00580)
z(-4)	1.200	2.447*	95.94*	0.00120
	(0.791)	(1.435)	(52.78)	(0.00555)
Wage	0.946***	0.945***	0.970***	0.959***
	(0.0181)	(0.0166)	(0.0157)	(0.0208)
Wage(-1)	-0.0251	-0.0388**	-0.0264	-0.0132
	(0.0185)	(0.0177)	(0.0171)	(0.0218)
Wage(-2)	0.0190	0.00405	-0.0185	0.0235
	(0.0180)	(0.0176)	(0.0176)	(0.0224)
Wage(-3)	0.00684	0.00926	-0.00497	0.0128
	(0.0185)	(0.0177)	(0.0168)	(0.0223)
Wage(-4)	-0.0214	-0.0338**	-0.0307*	-0.00242
	(0.0171)	(0.0166)	(0.0157)	(0.0208)
gdp	-0.0864	-0.140***	-0.174***	-0.123*
	(0.0547)	(0.0498)	(0.0458)	(0.0635)
Constant	-0.000392	-0.000983***	-0.000754**	-0.000726*
	(0.000359)	(0.000321)	(0.000292)	(0.000413)
Observations	142	142	136	142
R^2	0.973	0.977	0.978	0.963
Adjusted R^2	0.970	0.975	0.977	0.960
F	420.3	504.0	512.2	309.0
LM Test	0.0000	0.0000	0.0000	0.0000
Breusch-Pagan	0.0004	0.0000	0.2930	0.0004
Jarque-Bera	0.0252	0.0000	0.1018	0.0042

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money $growth_t$, $inflation_t$, $exvol_t$ and real gdp_t, respectively.

Table 24: OLS estimation results for France with Annualized Money Growth Rates and Inflation

France	Equation(3.5)		Equation(3.6)	
	(1)	(2)	(3)	(4)
Determinant (z_t)	Annualized Money Growth	Annualized Inflation	Annualized Money Growth	Annualized Inflation
VARIABLES	Δp	Δp	Δp	Δp
z	0.523*	0.429	-0.0582	-0.596
	(0.299)	(0.437)	(0.264)	(0.366)
z(-1)	0.700**	0.00752	0.572**	-0.155***
	(0.314)	(0.0696)	(0.265)	(0.0583)
z(-2)	0.964***	-0.106	0.506*	0.0815
	(0.300)	(0.105)	(0.260)	(0.0858)
z(-3)	0.837***	0.0617	0.386	0.0645
	(0.301)	(0.104)	(0.261)	(0.0824)
z(-4)	0.349	0.0880	-0.283	0.0178
	(0.291)	(0.0627)	(0.260)	(0.0504)
Wage	0.954***	0.976***	0.951***	0.984***
	(0.0178)	(0.0188)	(0.0150)	(0.0150)
Wage(-1)	-0.0333*	-0.00661	-0.569***	-0.651***
	(0.0189)	(0.0193)	(0.0753)	(0.0755)
Wage(-2)	0.00466	0.0218	0.0296*	0.0367**
	(0.0192)	(0.0183)	(0.0166)	(0.0146)
Wage(-3)	-0.000878	0.000617	-0.00643	-0.00549
	(0.0189)	(0.0185)	(0.0159)	(0.0147)
Wage(-4)	-0.0177	-0.0353**	-0.0139	-0.0259*
	(0.0176)	(0.0177)	(0.0148)	(0.0141)
gdp	-0.144***	-0.126**	-0.0579	-0.0562
	(0.0540)	(0.0554)	(0.0470)	(0.0446)
$\Delta p(-1)$			0.559***	0.662***
			(0.0768)	(0.0759)
Constant	-0.000660*	-0.00243***	-0.000328	-0.000751*
	(0.000347)	(0.000460)	(0.000296)	(0.000413)
Observations	139	139	139	139
R^2	0.972	0.970	0.980	0.981
Adjusted R^2	0.969	0.968	0.978	0.980
F	394.9	377.3	514.6	556.4
LM Test	0.0000	0.0000	0.4393	0.1333
Breusch-Pagan	0.0217	0.0080	0.1607	0.3705
Jarque-Bera	0.0832	0.0000	0.0212	0.0951

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by $\text{annualized money growth}_t$, $\text{annualized inflation}_t$, $\text{annualized money growth}_t$, $\text{annualized inflation}_t$, repectively.

Estimations presented by Table 23 and Table 24 imply that the money growth does have a significant effect on determining exchange rate pass-through rates at both quarterly and yearly horizon, while the inflation is only significant in determining it at a quarterly level. Table 23 also tells that exchange rate volatility and real GDP is significant in determining the exchange rate pass-through for France. Annualized money growth and annualized inflation rate are employed for both Equation (3.5) and (3.6), as shown by Table 24. It shows that annualized money growth has less impacts on the exchange rate pass-through compared with their quarterly rates. In addition, the estimation by Equation (3.6) shows that the price is correlated with its one-period lagged value with the coefficient around 0.6. This means the last period import prices (Δp_{t-1}) has an impact on the current import prices (Δp_t) at the rate of 0.6.

Table 25: OLS estimation results for Germany (Equation(3.5))

Germany	(1)	(2)	(3)	(4)
Determinant (z_t)	Money Growth	Inflation	Exvol	Real GDP
VARIABLES	Δp	Δp	Δp	Δp
z	1.522*	7.305**	205.3**	0.00895**
	(0.851)	(3.187)	(85.73)	(0.00440)
z(-1)	0.827	-2.011	-14.41	0.00230
	(0.858)	(3.153)	(86.04)	(0.00449)
z(-2)	-1.112	-4.541	-80.99	-0.00390
	(0.803)	(2.924)	(85.69)	(0.00445)
z(-3)	0.189	-4.714	-77.32	-0.00203
	(0.808)	(2.964)	(82.86)	(0.00426)
z(-4)	0.477	-0.125	40.82	0.00251
	(0.778)	(2.663)	(77.21)	(0.00408)
Wage	0.945***	0.937***	0.932***	0.935***
	(0.0256)	(0.0264)	(0.0269)	(0.0266)
Wage(-1)	-0.0211	0.00481	-0.00105	-0.0138
	(0.0251)	(0.0271)	(0.0272)	(0.0272)
Wage(-2)	-0.0221	-0.0287	-0.0322	-0.0273
	(0.0247)	(0.0270)	(0.0280)	(0.0282)
Wage(-3)	0.0320	0.0448	0.0361	0.0313
	(0.0252)	(0.0272)	(0.0281)	(0.0279)
Wage(-4)	-0.0412*	-0.0382	-0.0329	-0.0324
	(0.0226)	(0.0232)	(0.0246)	(0.0248)
gdp	-0.0587	-0.0559	-0.0626*	-0.0650*
	(0.0362)	(0.0356)	(0.0362)	(0.0368)
Constant	-0.00149***	-0.00166***	-0.00155***	-0.00151***
	(0.000284)	(0.000262)	(0.000274)	(0.000274)
Observations	98	98	98	98
R^2	0.966	0.967	0.967	0.966
Adjusted R^2	0.962	0.963	0.962	0.962
F	223.8	231.3	227.3	224.6
LM Test	0.0001	0.0001	0.0000	0.0000
Breusch-Pagan	0.0493	0.0001	0.2881	0.1631
Jarque-Bera	0.0003	0.2000	0.0129	0.0059

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money $growth_t$, $inflation_t$, $exvol_t$ and real gdp_t, respectively.

Table 26: OLS estimation results for Germany with Annualized Money Growth Rates and Inflation

Germany	Equation(3.5)		Equation(3.6)	
	(1)	(2)	(3)	(4)
Determinant (z_t)	Annualized Money Growth	Annualized Inflation	Annualized Money Growth	Annualized Inflation
VARIABLES	Δp	Δp	Δp	Δp
z	0.797**	3.174***	0.934***	3.284***
	(0.350)	(1.022)	(0.330)	(0.914)
z(-1)	0.0941	-0.127**	-0.277	-0.273***
	(0.372)	(0.0605)	(0.363)	(0.0625)
z(-2)	-0.355	0.110	-0.367	0.288***
	(0.368)	(0.0748)	(0.344)	(0.0771)
z(-3)	-0.128	0.0729	0.0319	0.0389
	(0.352)	(0.0741)	(0.333)	(0.0667)
z(-4)	-0.134	0.0157	-0.0257	-0.0266
	(0.348)	(0.0573)	(0.327)	(0.0521)
Wage	0.932***	0.950***	0.936***	0.965***
	(0.0266)	(0.0254)	(0.0249)	(0.0230)
Wage(-1)	-0.00390	0.0292	-0.335***	-0.425***
	(0.0287)	(0.0258)	(0.0965)	(0.100)
Wage(-2)	-0.0284	-0.0386	-0.0266	-0.0488**
	(0.0298)	(0.0258)	(0.0279)	(0.0232)
Wage(-3)	0.0393	0.0360	0.0452*	0.0527**
	(0.0289)	(0.0241)	(0.0271)	(0.0219)
Wage(-4)	-0.0291	-0.0250	-0.0362	-0.0334*
	(0.0243)	(0.0205)	(0.0229)	(0.0184)
gdp	-0.0476	-0.0329	-0.0609*	-0.0287
	(0.0378)	(0.0329)	(0.0356)	(0.0294)
$\Delta p(-1)$			0.361***	0.488***
			(0.101)	(0.105)
Constant	-0.00171***	-0.00314***	-0.000993***	-0.00153***
	(0.000283)	(0.000485)	(0.000332)	(0.000554)
Observations	95	95	95	95
R^2	0.968	0.973	0.972	0.979
Adjusted R^2	0.964	0.970	0.968	0.976
F	226.8	274.9	238.4	316.7
LM Test	0.0013	0.0000	0.0956	0.2339
Breusch-Pagan	0.1470	0.7924	0.6099	0.5329
Jarque-Bera	0.0016	0.2154	0.0019	0.3282

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by $\text{annualized money growth}_t$, $\text{annualized inflation}_t$, $\text{annualized money growth}_t$, $\text{annualized inflation}_t$, repectively.

Table 25 and Table 26 summarize the OLS estimation results of the determinants of exchange rate pass-through for Germany. Table 25 indicates all four variables have an impact on determining the exchange rate pass-through. Similarly, annualized money growth and inflation rates are also significant in determining exchange rate pass-through and have a smaller effect on the determination compared with their quarterly rates, as Table 26 shows. In addition, the estimation by Equation (3.6) shows that the price is correlated with its one period lag value and the coefficient is around 0.4. This implies one unit increase in the last period import prices (Δp_{t-1}) will result in an increase about 0.6 unit in the current import prices (Δp_t).

Table 27: OLS estimation results for Japan (Equation(3.5))

Japan	(1)	(2)	(3)	(4)
Determinant (z_t)	Money Growth	Inflation	Exvol	Real GDP
VARIABLES	Δp	Δp	Δp	Δp
z	1.468	-1.353	27.78**	0.0101***
	(1.068)	(1.726)	(12.14)	(0.00327)
z(-1)	0.0909	0.217	3.529	0.00244
	(1.075)	(1.696)	(12.61)	(0.00351)
z(-2)	2.564**	1.772	31.36**	0.0106***
	(1.037)	(1.635)	(12.63)	(0.00347)
z(-3)	1.311	0.880	13.84	0.00472
	(1.075)	(1.650)	(13.00)	(0.00345)
z(-4)	2.647**	3.797**	34.73***	0.0101***
	(1.013)	(1.486)	(11.98)	(0.00312)
Wage	0.945***	0.963***	0.934***	0.925***
	(0.0151)	(0.0127)	(0.0158)	(0.0154)
Wage(-1)	0.0127	0.0193	0.0104	0.0160
	(0.0157)	(0.0139)	(0.0160)	(0.0173)
Wage(-2)	-0.0291*	-0.00758	-0.0349**	-0.0383**
	(0.0159)	(0.0139)	(0.0162)	(0.0176)
Wage(-3)	-0.00256	0.00966	0.00105	-0.00175
	(0.0158)	(0.0138)	(0.0159)	(0.0171)
Wage(-4)	-0.0152	0.00847	-0.0201	-0.0247*
	(0.0144)	(0.0127)	(0.0146)	(0.0149)
gdp	-0.138***	-0.190***	-0.151***	-0.157***
	(0.0472)	(0.0492)	(0.0459)	(0.0404)
Constant	-0.00662***	-0.00762***	-0.00608***	-0.00588***
	(0.000580)	(0.000556)	(0.000650)	(0.000529)
Observations	142	142	137	142
R^2	0.985	0.983	0.986	0.988
Adjusted R^2	0.984	0.982	0.984	0.987
F	786.4	700.0	780.8	982.5
LM Test	0.0000	0.0000	0.0000	0.0001
Breusch-Pagan	0.0848	0.4024	0.2819	0.1372
Jarque-Bera	0.0010	0.0119	0.0198	0.0037

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money growth$_t$, inflation$_t$, exvol$_t$ and real gdp$_t$, respectively.

Table 28: OLS estimation results for Japan with Annualized Money Growth Rates and Inflation

Japan	Equation(3.5)		Equation(3.6)	
	(1)	(2)	(3)	(4)
Determinant (z_t)	Annualized Money Growth	Annualized Inflation	Annualized Money Growth	Annualized Inflation
VARIABLES	Δp	Δp	Δp	Δp
z	0.444	1.088	0.349	0.566
	(0.277)	(0.927)	(0.236)	(0.752)
z(-1)	0.0196	-0.100	-0.254	-0.300***
	(0.290)	(0.0933)	(0.249)	(0.0793)
z(-2)	0.540*	-0.0346	0.353	0.191*
	(0.286)	(0.121)	(0.245)	(0.102)
z(-3)	0.124	0.0604	-0.0346	0.0753
	(0.293)	(0.123)	(0.250)	(0.0996)
z(-4)	0.547**	-0.0490	0.317	-0.0350
	(0.270)	(0.0848)	(0.232)	(0.0686)
Wage	0.944***	0.951***	0.960***	0.969***
	(0.0156)	(0.0134)	(0.0134)	(0.0111)
Wage(-1)	0.0185	0.0202	-0.479***	-0.569***
	(0.0166)	(0.0138)	(0.0717)	(0.0722)
Wage(-2)	-0.0266	-0.00678	-0.0239	-0.00428
	(0.0170)	(0.0140)	(0.0144)	(0.0113)
Wage(-3)	0.00563	0.0159	0.00911	0.0199*
	(0.0168)	(0.0140)	(0.0143)	(0.0114)
Wage(-4)	-0.0131	0.0118	-0.00724	0.00839
	(0.0152)	(0.0134)	(0.0129)	(0.0109)
gdp	-0.146***	-0.151***	-0.109**	-0.0955**
	(0.0486)	(0.0475)	(0.0417)	(0.0390)
$\Delta p(-1)$			0.524***	0.611***
			(0.0740)	(0.0740)
Constant	-0.00670***	-0.00681***	-0.00309***	-0.00256***
	(0.000604)	(0.000617)	(0.000723)	(0.000716)
Observations	139	139	139	139
R^2	0.985	0.984	0.989	0.990
Adjusted R^2	0.983	0.983	0.988	0.989
F	742.8	729.7	948.2	1029
LM Test	0.0000	0.0000	0.0033	0.0104
Breusch-Pagan	0.1029	0.6183	0.6322	0.9352
Jarque-Bera	0.0003	0.0216	0.0757	0.0359

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by $\text{annualized money growth}_t$, $\text{annualized inflation}_t$, $\text{annualized money growth}_t$, $\text{annualized inflation}_t$, repectively.

Table 27 and 28 summarize the OLS estimation results of determinants of short run exchange rate pass-through for Japan. The results imply that all the four variables are significant in determining the exchange rate pass-through but at different lags and money growth and inflation is less significant than exchange rate volatility and real GDP in the determination process. In addition, the estimation also shows that the price is correlated with its one period lag value and the coefficient is around 0.5. This implies one unit increase in the last period import prices (Δp_{t-1}) will result in an increase about 0.5 unit in the current import prices (Δp_t).

Table 29: OLS estimation results for UK (Equation(3.5))

UK	(1)	(2)	(3)	(4)
Determinant (z_t)	Money Growth	Inflation	Exvol	Real GDP
VARIABLES	Δp	Δp	Δp	Δp
z	0.584	1.032	-22.22	0.00129
	(0.833)	(1.325)	(42.36)	(0.00428)
z(-1)	-0.109	1.018	-96.38**	-0.00744*
	(0.834)	(1.334)	(42.09)	(0.00431)
z(-2)	0.967	1.916	27.17	0.00326
	(0.804)	(1.266)	(43.78)	(0.00431)
z(-3)	-0.0958	0.452	-42.84	-0.00209
	(0.708)	(1.235)	(40.23)	(0.00408)
z(-4)	-0.240	1.081	42.28	0.00118
	(0.708)	(1.173)	(38.32)	(0.00400)
Wage	0.913***	0.915***	0.935***	0.925***
	(0.0281)	(0.0268)	(0.0268)	(0.0292)
Wage(-1)	0.0138	0.00204	0.0474*	0.0439
	(0.0288)	(0.0277)	(0.0279)	(0.0295)
Wage(-2)	-0.0175	-0.0173	-0.0193	-0.0175
	(0.0284)	(0.0268)	(0.0280)	(0.0290)
Wage(-3)	-0.0128	-0.0160	-0.00555	-0.0124
	(0.0287)	(0.0273)	(0.0283)	(0.0297)
Wage(-4)	0.00989	0.00261	-0.0157	-0.00740
	(0.0267)	(0.0252)	(0.0258)	(0.0273)
gdp	0.0732	0.0823	0.0213	0.0531
	(0.0647)	(0.0639)	(0.0661)	(0.0653)
Constant	0.00225***	0.00228***	0.00262***	0.00243***
	(0.000544)	(0.000530)	(0.000539)	(0.000544)
Observations	129	131	131	131
R^2	0.946	0.947	0.949	0.947
Adjusted R^2	0.941	0.943	0.944	0.943
F	188.2	195.2	201.6	195.0
LM Test	0.0000	0.0000	0.0000	0.0000
Breusch-Pagan	0.5682	0.4696	0.8887	0.9977
Jarque-Bera	0.0000	0.0000	0.0000	0.0000

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money $growth_t$, $inflation_t$, $exvol_t$ and real gdp_t, respectively.

Table 30: OLS estimation results for UK with Annualized Money Growth Rates and Inflation

UK	Equation(3.5)		Equation(3.6)	
	(1)	(2)	(3)	(4)
Determinant (z_t)	Annualized Money Growth	Annualized Inflation	Annualized Money Growth	Annualized Inflation
VARIABLES	Δp	Δp	Δp	Δp
z	0.104	-0.111	0.326*	0.296
	(0.217)	(0.450)	(0.187)	(0.405)
z(-1)	-0.00557	0.282***	-0.0770	0.0609
	(0.217)	(0.0735)	(0.185)	(0.0758)
z(-2)	0.284	-0.381***	0.320*	-0.272***
	(0.218)	(0.112)	(0.185)	(0.101)
z(-3)	-0.0588	0.136	-0.209	0.286***
	(0.216)	(0.112)	(0.185)	(0.103)
z(-4)	0.159	0.0110	0.130	-0.0650
	(0.211)	(0.0737)	(0.179)	(0.0667)
Wage	0.921***	0.934***	0.911***	0.913***
	(0.0287)	(0.0268)	(0.0244)	(0.0241)
Wage(-1)	0.0136	-0.000725	-0.488***	-0.505***
	(0.0292)	(0.0231)	(0.0784)	(0.0907)
Wage(-2)	-0.0213	-0.00413	-0.0241	0.00118
	(0.0292)	(0.0226)	(0.0247)	(0.0201)
Wage(-3)	-0.0121	-0.0319	0.00616	-0.0114
	(0.0299)	(0.0232)	(0.0255)	(0.0209)
Wage(-4)	-0.00121	0.0100	0.0126	0.0236
	(0.0280)	(0.0217)	(0.0239)	(0.0194)
gdp	0.0683	0.0838	0.128**	0.107*
	(0.0662)	(0.0641)	(0.0569)	(0.0569)
$\Delta p(-1)$			0.545***	0.559***
			(0.0808)	(0.0981)
Constant	0.00232***	0.000978	0.000460	0.000270
	(0.000555)	(0.000886)	(0.000546)	(0.000795)
Observations	126	128	126	128
R^2	0.946	0.953	0.962	0.963
Adjusted R^2	0.941	0.949	0.958	0.960
F	182.1	213.9	235.9	252.0
LM Test	0.0000	0.0000	0.9186	0.0478
Breusch-Pagan	0.3112	0.4004	0.1353	0.3899
Jarque-Bera	0.0000	0.0000	0.0011	0.0000

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by $\text{annualized money growth}_t$, $\text{annualized inflation}_t$, $\text{annualized money growth}_t$, $\text{annualized inflation}_t$, repectively.

Table 29 and 30 summarize the OLS estimation results of determinants of short run exchange rate pass-through for UK. The results imply that all the four variables are significant in determining the exchange rate pass-through but at different time scopes. Money growth and inflation only significantly determines the exchange rate pass-through at annualized rate not at quarterly rate. In addition, the estimation also shows that price is correlated with its one period lag value and the coefficient is around 0.5. This implies that one unit increase in the last quarter import prices (Δp_{t-1}) will lead to about a half unit increase in the current import prices (Δp_t).

Table 31: OLS estimation results for US (Equation(3.5))

US	(1)	(2)	(3)	(4)
Determinant (z_t)	Money Growth	Inflation	Exvol	Real GDP
VARIABLES	Δp	Δp	Δp	Δp
z	5.697***	0.861	84.13***	0.0236***
	(1.349)	(1.851)	(27.27)	(0.00582)
z(-1)	4.300***	3.657**	50.08*	0.0220***
	(1.396)	(1.798)	(29.71)	(0.00613)
z(-2)	3.565**	3.283*	62.58**	0.0213***
	(1.434)	(1.806)	(29.50)	(0.00602)
z(-3)	1.089	2.942	2.235	0.00621
	(1.398)	(1.788)	(29.21)	(0.00615)
z(-4)	2.351*	4.109**	8.036	0.0152***
	(1.303)	(1.786)	(26.06)	(0.00560)
Wage	0.843***	0.944***	0.929***	0.862***
	(0.0441)	(0.0427)	(0.0403)	(0.0389)
Wage(-1)	-0.121**	-0.0714	-0.0978**	-0.130***
	(0.0518)	(0.0498)	(0.0488)	(0.0451)
Wage(-2)	-0.0833	-0.0666	-0.0899*	-0.0881**
	(0.0510)	(0.0508)	(0.0494)	(0.0438)
Wage(-3)	-0.0677	-0.0494	-0.0423	-0.0470
	(0.0495)	(0.0497)	(0.0479)	(0.0448)
Wage(-4)	-0.0863**	-0.0968**	-0.113***	-0.0802**
	(0.0403)	(0.0412)	(0.0394)	(0.0377)
gdp	-0.288***	-0.182	-0.193*	-0.147*
	(0.0959)	(0.115)	(0.102)	(0.0871)
Constant	0.00161	-0.00251**	-0.000626	0.000749
	(0.00105)	(0.00114)	(0.00102)	(0.000915)
Observations	142	142	140	142
R^2	0.885	0.843	0.876	0.906
Adjusted R^2	0.875	0.830	0.866	0.898
F	91.12	63.67	82.36	113.7
LM Test	0.0000	0.0000	0.0000	0.0000
Breusch-Pagan	0.0380	0.3136	0.0050	0.8272
Jarque-Bera	0.0002	0.0000	0.0000	0.0006

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by annualized money growth$_t$, annualized inflation$_t$, annualized money growth$_t$, annualized inflation$_t$, repectively.

Table 32: OLS estimation results for US with Annualized Money Growth Rates and Inflation

US	Equation(3.5)		Equation(3.6)	
	(1)	(2)	(3)	(4)
Determinant (z_t)	Annualized Money Growth	Annualized Inflation	Annualized Money Growth	Annualized Inflation
VARIABLES	Δp	Δp	Δp	Δp
z	1.267***	3.811***	1.214***	2.184***
	(0.430)	(0.743)	(0.333)	(0.572)
z(-1)	1.186***	0.253	0.304	-0.277**
	(0.445)	(0.155)	(0.357)	(0.126)
z(-2)	1.106**	-0.0898	0.325	0.259*
	(0.445)	(0.192)	(0.354)	(0.146)
z(-3)	0.0654	0.111	-0.622*	0.0422
	(0.440)	(0.165)	(0.348)	(0.122)
z(-4)	0.890**	-0.315***	0.502	-0.0938
	(0.394)	(0.108)	(0.308)	(0.0827)
Wage	0.877***	0.932***	0.942***	0.980***
	(0.0439)	(0.0408)	(0.0347)	(0.0306)
Wage(-1)	-0.137***	-0.117**	-0.739***	-0.707***
	(0.0511)	(0.0589)	(0.0759)	(0.0720)
Wage(-2)	-0.0847*	-0.0937*	0.0325	0.00186
	(0.0503)	(0.0517)	(0.0409)	(0.0394)
Wage(-3)	-0.0457	-0.149***	-0.00509	-0.0134
	(0.0497)	(0.0546)	(0.0387)	(0.0425)
Wage(-4)	-0.108**	-0.0685	-0.0452	-0.0271
	(0.0415)	(0.0432)	(0.0328)	(0.0322)
gdp	-0.168*	-0.329***	-0.0536	-0.0800
	(0.101)	(0.104)	(0.0790)	(0.0809)
$\Delta p(-1)$			0.643***	0.695***
			(0.0692)	(0.0675)
Constant	0.000369	0.00192	0.000126	0.00149
	(0.00102)	(0.00190)	(0.000787)	(0.00140)
Observations	139	139	139	139
R^2	0.887	0.880	0.933	0.935
Adjusted R^2	0.877	0.870	0.927	0.929
F	90.69	85.04	146.1	151.3
LM Test	0.0000	0.0000	0.0878	0.0026
Breusch-Pagan	0.0030	0.1370	0.7162	0.0371
Jarque-Bera	0.0000	0.0000	0.0000	0.0000

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by $\text{annualized money growth}_t$, $\text{annualized inflation}_t$, $\text{annualized money growth}_t$, $\text{annualized inflation}_t$, repectively.

Table 31 and 32 summarize the OLS estimation results of determinants of short run exchange rate pass-through for the US. The results imply that all the four variables are significant in determining the exchange rate pass-through and consistently significant at different lags. Annualized inflation has bigger effects on the determination than quarterly rates. In addition, the estimation also shows that the price is correlated with its one period lag value and the coefficient is around 0.5, implying that one unit increase in the last quarter import prices (Δp_{t-1}) will contribute about a half unit increase in the current import prices (Δp_t).

Table 33 Summary Results of the significance level of the determinants

Time Horizon	**Regression**	**Z**	**France**		**Germany**		**Japan**		**UK**		**US**	
Determinants in Quarterly rate	Equation (3.5)	Money Growth	4.392***	2	1.522*	0	2.647**	4	0.584	0	5.697***	0
			(0.807)		(0.851)		(1.013)		(0.833)		(1.349)	
		Inflation	7.783***	2	7.305**	0	3.797**	4	1.032	0	3.657**	1
			(1.503)		(3.187)		(1.486)		(1.325)		(1.798)	
		Exchange Rate Volatility	288.5***	0	205.3**	0	34.73***	0	-96.38**	1	84.13***	0
			(67.91)		(85.73)		(11.98)		(42.09)		(27.27)	
		Real GDP	0.0135**	0	0.00895**	0	0.0101***	0	-0.0074*	1	0.024***	0
			(0.00571)		(0.00440)		(0.00327)		(0.0043)		(0.0058)	
Determinants in Annualized rate	Equation (3.5)	Money Growth	0.964***	2	0.797**	0	0.547**	4	0.104	0	1.267***	0
			(0.300)		(0.350)		(0.270)		(0.217)		(0.430)	
		Inflation	0.429	0	3.174***	0	0.540*	2	0.282***	1	3.811***	0
			(0.437)		(1.022)		(0.286)		(0.0735)		(0.743)	
	Equation (3.6)	Money Growth	0.572**	1	0.934***	0	1.088	0	0.326*	0	1.214***	0
			(0.265)		(0.330)		(0.927)		(0.187)		(0.333)	
		Inflation	-0.155***	1	3.284***	0	-0.300***	0	0.286***	3	2.184***	0
			(0.0583)		(0.914)		(0.0793)		(0.103)		(0.572)	

Standard errors are in parentheses. ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Number denotes the lag in time of the parameter that is reported in the table. The most significant estimated coefficients among all lags in the regression are reported in the table.

Table 33 summarizes general results of the determinants of exchange rate pass-through (z_t) from Table 23 to Table 32 for five countries, i.e. France, Germany, Japan, UK and US. The largest and the most significant coefficients among the estimated coefficients of the present and four lagged variables ($z_t, z_{t-1}, \dots, z_{t-4}$) are reported. The results reveal three findings. Both real GDP and exchange rate volatility is significant across all five countries, which is consistent with previous literature regarding exchange rate volatility. Moreover, all four variables appear to be significant and positive in exchange rate pass-through determination for all countries except for the UK. All those four variables have similar scalar effects on the exchange rate determination for France and Germany. Those two countries' exchange rate pass-through are determined by the inflation and exchange rate volatility with the highest impacts, while the

US's exchange rate pass-through is affected by money growth with the highest value. In addition, the impacts of annualized money growth and inflation rates are all smaller than their quarterly rates for all the five countries. Most of them are significant, annualized inflation in France and annualized money growth rates in the UK and Japan are insignificant. This implies prices of commodity goods for the UK are stickier than the other four countries and the delay is about more than a quarter, while the price of commodity goods for France is more responsive.

3.3.2.2. Estimation by Equation (3.7)

A second approach to test the significance of determinants of exchange rate pass-through is expressed as:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \qquad (3.7)$$

where

$z_{1t} = \text{money growth}_t$,

$z_{2t} = \text{inflation}_t$,

$z_{3t} = \text{exvol}_t$,

$z_{4t} = \text{real gdp}_t$.

Significant β_i^j implies the determinacy of variable z_t in exchange rate pass-through.

Table 34 to Table 38 presents the regression results from Equation (3.7) for the five countries respectively and Table 39 gives a summary of it.

Table 34 OLS estimation results for France (Equation(3.7))

France	(1)	(2)	(3)	(4)
Determinant (z_t)	Money Growth	Inflation	Exvol	Real GDP
VARIABLES	Δp	Δp	Δp	Δp
z	2.061*	1.391	304.9**	-0.237**
	(1.133)	(2.176)	(143.2)	(0.101)
z(-1)	5.191***	5.525***	17.78	-0.494***
	(1.173)	(2.089)	(112.9)	(0.0970)
z(-2)	5.034***	8.060***	610.0***	-0.277***
	(1.090)	(1.998)	(107.3)	(0.100)
z(-3)	4.310***	4.803**	141.2	-0.129
	(1.111)	(1.946)	(113.4)	(0.0966)
z(-4)	2.311**	4.754**	337.1***	-0.0570
	(1.059)	(1.895)	(106.3)	(0.0979)
Exchange Rate	0.00946	0.0145	-0.00743	0.289
	(0.0296)	(0.0270)	(0.0395)	(0.425)
Exchange Rate(-1)	-0.0274	-0.00332	0.0391	1.081**
	(0.0294)	(0.0264)	(0.0371)	(0.437)
Exchange Rate(-2)	-0.0169	-0.0116	-0.122***	2.204***
	(0.0288)	(0.0267)	(0.0372)	(0.421)
Exchange Rate(-3)	-0.0212	0.00741	0.00721	1.258***
	(0.0287)	(0.0265)	(0.0376)	(0.435)
Exchange Rate(-4)	-0.0371	-0.0472*	-0.0932***	0.555
	(0.0266)	(0.0260)	(0.0353)	(0.419)
Wage	0.942***	0.943***	0.973***	0.931***
	(0.0189)	(0.0168)	(0.0148)	(0.0178)
Wage(-1)	-0.0214	-0.0397**	-0.0222	-0.0483**
	(0.0204)	(0.0181)	(0.0166)	(0.0187)
Wage(-2)	0.0200	0.00638	-0.0230	-0.00433
	(0.0202)	(0.0185)	(0.0167)	(0.0190)
Wage(-3)	0.00819	0.00984	-0.000874	0.00382
	(0.0201)	(0.0184)	(0.0159)	(0.0187)
Wage(-4)	-0.0157	-0.0292*	-0.0320**	-0.00762
	(0.0185)	(0.0174)	(0.0151)	(0.0174)
gdp	-0.0693	-0.127**	-0.142***	-0.0659
	(0.0560)	(0.0507)	(0.0439)	(0.0517)
Constant				
	-0.000410	-0.00109***	-0.00109***	-0.000972***
	(0.000360)	(0.000332)	(0.000288)	(0.000333)
Observations	142	142	136	142
R^2	0.974	0.978	0.982	0.977
Adjusted R^2	0.970	0.975	0.979	0.974
F	288.1	345.1	399.5	336.4
LM Test	0.0000	0.0000	0.0000	0.0000
Breusch-Pagan	0.0001	0.0000	0.8671	0.0000
Jarque-Bera	0.0165	0.0000	0.4392	0.0002

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money $growth_t$, $inflation_t$, $exvol_t$ and real gdp_t, respectively.

Table 35 OLS estimation results for Germany (Equation(3.7))

Germany	(1)	(2)	(3)	(4)
Determinant (z_t)	Money Growth	Inflation	Exvol	Real GDP
VARIABLES	Δp	Δp	Δp	Δp
z	0.622	3.124	219.7	0.104
	(1.106)	(4.319)	(257.2)	(0.188)
z(-1)	0.994	-7.016	-394.7	0.127
	(1.113)	(4.415)	(269.3)	(0.191)
z(-2)	-0.770	-4.811	79.69	0.403**
	(1.030)	(3.840)	(269.7)	(0.186)
z(-3)	0.0844	-5.109	-346.0	-0.00598
	(1.065)	(3.960)	(264.0)	(0.190)
z(-4)	0.462	-2.488	-90.89	0.0799
	(1.039)	(3.633)	(257.5)	(0.170)
Exchange Rate	0.0337	0.0286	-0.0160	-0.428
	(0.0262)	(0.0257)	(0.0586)	(0.849)
Exchange Rate(-1)	-0.00654	0.0372	0.0967	-0.566
	(0.0260)	(0.0263)	(0.0624)	(0.862)
Exchange Rate(-2)	-0.00798	-8.40e-05	-0.0457	-1.846**
	(0.0250)	(0.0248)	(0.0625)	(0.842)
Exchange Rate(-3)	-0.00790	0.00947	0.0634	0.0154
	(0.0243)	(0.0245)	(0.0608)	(0.858)
Exchange Rate(-4)	0.00318	0.0226	0.0295	-0.351
	(0.0245)	(0.0245)	(0.0602)	(0.765)
Wage	0.936***	0.931***	0.933***	0.940***
	(0.0272)	(0.0271)	(0.0277)	(0.0265)
Wage(-1)	-0.0129	-0.00429	-0.00799	-0.00689
	(0.0278)	(0.0285)	(0.0284)	(0.0271)
Wage(-2)	-0.0289	-0.0319	-0.0276	-0.0266
	(0.0291)	(0.0295)	(0.0290)	(0.0279)
Wage(-3)	0.0341	0.0387	0.0381	0.0307
	(0.0290)	(0.0289)	(0.0289)	(0.0277)
Wage(-4)	-0.0343	-0.0390	-0.0378	-0.0263
	(0.0255)	(0.0250)	(0.0252)	(0.0245)
gdp	-0.0581	-0.0438	-0.0531	-0.0535
	(0.0379)	(0.0375)	(0.0376)	(0.0374)
Constant	-0.00150***	-0.00154***	-0.00160***	-0.00169***
	(0.000291)	(0.000274)	(0.000278)	(0.000277)
Observations	98	98	98	98
R^2	0.967	0.969	0.968	0.969
Adjusted R^2	0.961	0.963	0.962	0.963
F	148.8	158.3	154.5	160.1
LM Test	0.0000	0.0001	0.0000	0.0001
Breusch-Pagan	0.0593	0.1329	0.1627	0.3837
Jarque-Bera	0.0004	0.0029	0.0276	0.2636

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money growth$_t$, inflation$_t$, exvol$_t$ and real gdp$_t$, respectively.

Table 36 OLS estimation results for Japan (Equation(3.7))

Japan	(1)	(2)	(3)	(4)
Determinant (z_t)	Money Growth	Inflation	Exvol	Real GDP
VARIABLES	Δp	Δp	Δp	Δp
z	-1.814	-2.353	2.688	-0.0407
	(1.349)	(1.540)	(16.83)	(0.0588)
z(-1)	-1.764	-0.476	-8.569	0.0852
	(1.352)	(1.522)	(18.01)	(0.0657)
z(-2)	1.494	0.693	20.62	-0.117*
	(1.328)	(1.483)	(18.05)	(0.0622)
z(-3)	0.361	-0.231	-3.252	0.0332
	(1.371)	(1.490)	(18.03)	(0.0636)
z(-4)	0.986	1.435	12.60	-0.00186
	(1.308)	(1.349)	(16.24)	(0.0548)
Exchange Rate	0.0678***	0.0523***	0.0447*	0.230
	(0.0210)	(0.0155)	(0.0227)	(0.263)
Exchange Rate(-1)	0.0268	0.0104	0.0186	-0.370
	(0.0220)	(0.0166)	(0.0252)	(0.293)
Exchange Rate(-2)	0.0342	0.0444***	0.0302	0.569**
	(0.0212)	(0.0165)	(0.0243)	(0.277)
Exchange Rate(-3)	0.0179	0.0217	0.0276	-0.124
	(0.0212)	(0.0164)	(0.0235)	(0.283)
Exchange Rate(-4)	0.0304	0.0375**	0.0330	0.0502
	(0.0193)	(0.0149)	(0.0210)	(0.244)
Wage	0.922***	0.919***	0.921***	0.921***
	(0.0164)	(0.0162)	(0.0175)	(0.0160)
Wage(-1)	0.0215	0.0178	0.0133	0.0163
	(0.0183)	(0.0182)	(0.0190)	(0.0175)
Wage(-2)	-0.0411**	-0.0374**	-0.0415**	-0.0365**
	(0.0185)	(0.0185)	(0.0193)	(0.0177)
Wage(-3)	-0.00369	-0.00326	-0.00680	-0.00690
	(0.0179)	(0.0180)	(0.0187)	(0.0173)
Wage(-4)	-0.0222	-0.0196	-0.0262	-0.0232
	(0.0153)	(0.0156)	(0.0163)	(0.0150)
gdp	-0.173***	-0.172***	-0.163***	-0.167***
	(0.0429)	(0.0420)	(0.0433)	(0.0430)
Constant	-0.00572***	-0.00575***	-0.00547***	-0.00564***
	(0.000538)	(0.000536)	(0.000623)	(0.000558)
Observations	142	142	137	142
R^2	0.989	0.989	0.988	0.989
Adjusted R^2	0.987	0.987	0.986	0.987
F	680.4	673.1	618.8	675.5
LM Test	0.0002	0.0001	0.0002	0.0000
Breusch-Pagan	0.1767	0.1007	0.0868	0.0528
Jarque-Bera	0.0095	0.0031	0.0031	0.0018

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money growth$_t$, inflation$_t$, exvol$_t$ and real gdp$_t$, respectively.

Table 37 OLS estimation results for UK(Equation(3.7))

UK	(1)	(2)	(3)	(4)
Determinant (z_t)	Money Growth	Inflation	Exvol	Real GDP
VARIABLES	Δp	Δp	Δp	Δp
z	1.453	0.837	-131.8	0.0172
	(1.710)	(1.531)	(84.25)	(0.0631)
z(-1)	4.410**	2.285	-158.5**	-0.0672
	(1.709)	(1.520)	(78.79)	(0.0675)
z(-2)	1.768	1.800	-59.17	-0.00901
	(1.701)	(1.516)	(82.49)	(0.0702)
z(-3)	0.287	0.434	-74.43	-0.0491
	(1.471)	(1.505)	(73.81)	(0.0617)
z(-4)	-1.399	1.018	41.95	-0.00357
	(1.472)	(1.457)	(74.29)	(0.0597)
Exchange Rate	-0.0215	0.00208	0.0500	-0.0657
	(0.0395)	(0.0216)	(0.0352)	(0.273)
Exchange Rate(-1)	-0.118***	-0.0395*	0.0374	0.260
	(0.0398)	(0.0222)	(0.0352)	(0.292)
Exchange Rate(-2)	-0.0194	0.00670	0.0397	0.0579
	(0.0403)	(0.0229)	(0.0348)	(0.301)
Exchange Rate(-3)	-0.0182	-0.00223	0.0214	0.201
	(0.0375)	(0.0220)	(0.0327)	(0.262)
Exchange Rate(-4)	0.0350	-0.00187	-0.00209	0.0199
	(0.0363)	(0.0215)	(0.0336)	(0.254)
Wage	0.925***	0.921***	0.922***	0.923***
	(0.0291)	(0.0310)	(0.0294)	(0.0300)
Wage(-1)	0.0416	0.0252	0.0238	0.0390
	(0.0294)	(0.0313)	(0.0308)	(0.0306)
Wage(-2)	-0.0166	-0.0230	-0.0284	-0.0230
	(0.0300)	(0.0299)	(0.0304)	(0.0306)
Wage(-3)	0.00296	-0.0163	-0.00789	-0.00904
	(0.0308)	(0.0306)	(0.0312)	(0.0313)
Wage(-4)	0.00431	0.00645	-0.00125	-0.000123
	(0.0285)	(0.0285)	(0.0284)	(0.0296)
gdp	0.0252	0.0695	0.00227	0.0273
	(0.0673)	(0.0664)	(0.0685)	(0.0735)
Constant	0.00247***	0.00240***	0.00263***	0.00253***
	(0.000540)	(0.000548)	(0.000544)	(0.000567)
Observations	129	131	131	131
R^2	0.952	0.949	0.951	0.948
Adjusted R^2	0.945	0.942	0.944	0.941
F	138.8	132.7	138.1	130.1
LM Test	0.0000	0.0000	0.0000	0.0000
Breusch-Pagan	0.6366	0.9041	0.7953	0.6915
Jarque-Bera	0.0000	0.0000	0.0000	0.0000

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money growth$_t$, inflation$_t$, exvol$_t$ and real gdp$_t$, respectively.

Table 38 OLS estimation results for US (Equation(3.7))

US	(1)	(2)	(3)	(4)
Determinant (z_t)	Money Growth	Inflation	Exvol	Real GDP
VARIABLES	Δp	Δp	Δp	Δp
z	2.456	-4.315**	38.41	0.0813
	(2.010)	(1.697)	(36.04)	(0.0710)
z(-1)	0.278	-1.585	-10.44	0.0843
	(1.970)	(1.639)	(37.05)	(0.0778)
z(-2)	0.202	-0.371	16.12	-0.0134
	(1.932)	(1.680)	(36.94)	(0.0801)
z(-3)	-0.841	0.353	-13.91	0.0405
	(1.924)	(1.623)	(36.13)	(0.0768)
z(-4)	-0.893	0.270	-47.94	-0.0140
	(1.933)	(1.635)	(34.84)	(0.0725)
Exchange Rate	0.0564	0.134***	0.0720*	-0.240
	(0.0390)	(0.0289)	(0.0378)	(0.298)
Exchange Rate(-1)	0.0785*	0.106***	0.0977**	-0.259
	(0.0398)	(0.0297)	(0.0381)	(0.327)
Exchange Rate(-2)	0.0807**	0.0914***	0.0847**	0.149
	(0.0375)	(0.0294)	(0.0370)	(0.335)
Exchange Rate(-3)	0.0372	0.0160	0.0341	-0.146
	(0.0387)	(0.0295)	(0.0372)	(0.322)
Exchange Rate(-4)	0.0811**	0.0685**	0.0954***	0.126
	(0.0393)	(0.0274)	(0.0364)	(0.303)
Wage	0.858***	0.827***	0.895***	0.841***
	(0.0419)	(0.0420)	(0.0401)	(0.0420)
Wage(-1)	-0.112**	-0.126***	-0.140***	-0.134***
	(0.0497)	(0.0483)	(0.0448)	(0.0466)
Wage(-2)	-0.0881*	-0.0800*	-0.0997**	-0.0869*
	(0.0484)	(0.0467)	(0.0450)	(0.0455)
Wage(-3)	-0.0424	-0.0350	-0.0456	-0.0374
	(0.0477)	(0.0468)	(0.0455)	(0.0473)
Wage(-4)	-0.0829**	-0.0850**	-0.102***	-0.0827**
	(0.0387)	(0.0390)	(0.0382)	(0.0400)
gdp	-0.179*	-0.206**	-0.198**	-0.149
	(0.0942)	(0.0912)	(0.0935)	(0.0903)
Constant	0.000819	0.00149	0.000996	0.000844
	(0.000991)	(0.000995)	(0.000934)	(0.000949)
Observations	142	142	140	142
R^2	0.905	0.910	0.913	0.907
Adjusted R^2	0.893	0.898	0.901	0.896
F	74.66	78.87	80.38	76.63
LM Test	0.0000	0.0000	0.0000	0.0000
Breusch-Pagan	0.5839	0.0257	0.4611	0.9501
Jarque-Bera	0.0008	0.0001	0.0003	0.0023

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money $growth_t$, $inflation_t$, $exvol_t$ and real gdp_t, respectively.

Table 39 Summary Results of the significance level of the determinants

Determinant	France	Germany	Japan	UK	US
Money Growth	5.191***	0.622	-1.814	4.410**	2.456
	(1.173)	(1.106)	(1.349)	(1.709)	(2.010)
Inflation	5.525***	3.124	-2.353	0.837	-4.315**
	(2.089)	(4.319)	(1.540)	(1.531)	(1.697)
Exchange rate Volatility	610.0***	219.7	20.62	-158.5**	38.41
	(107.3)	(257.2)	(18.05)	(78.79)	(36.04)
Real GDP	-0.237**	0.403**	-0.117*	0.0172	0.0813
	(0.101)	(0.186)	(0.0622)	(0.0631)	(0.0710)

Standard errors are in parentheses. ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.

After testing the determinants of exchange rate pass-through with the second approach by using Equation (3.7), the results show that the four macro variables have consistently significant impacts on France. The results from both approaches also imply real GDP plays an important role in the exchange rate determination for most of the countries.

3.3.3. Lagged Dependent Variable Model

An alternative model including a lagged dependent variable will be used in this section to obtain a more dynamic estimation, by allowing a partial adjustment part. The estimation regression is:

$$\Delta p_t^j = \alpha + \rho \Delta p_{t-1}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \qquad (3.6)$$

where

$z_{1t} = \text{money growth}_t$,

$z_{2t} = \text{inflation}_t$,

$z_{3t} = \text{exvol}_t$,

$z_{4t} = \text{real gdp}_t$.

$z_{5t} = \text{annualized money growth}_t$,

$z_{6t} = \text{annualized inflation}_t$.

The new estimation results have been reported and discussed in the previous tables when $z_t = z_{5t}, z_{6t}$. The estimation results are similar to the result that were obtained with the previous model, the one without lagged dependent variable. Campa and Goldberg (2012) also obtained similar estimations between regressions with and without the lagged dependent variables. They also found that the majority regression failed to meet the constraints of coefficients imposed by the lagged dependent variable model. From new estimation results, the statistic inference of the new estimations has improved in terms of autocorrelations, as a partial adjustment term is added to the estimation equation. The estimations results are attached in the Appendix when $z_t = z_{1t}, z_{2t}, z_{3t}, z_{4t}$.

3.4. Conclusion

This chapter first looks at the exchange rate pass-through for five developed economies: France, Germany, Japan, UK and US. Then the significance of macro determinants of exchange rate pass-through into aggregated import prices is investigated to discuss the cross-country differences in exchange rate pass-through rates. Two approaches were used in the examination of determination. Firstly, the exchange rate pass-through is structured as a function of observable macroeconomic variables. Secondly, the cross-product term is employed in the regression, to test the significance of macroeconomic variables for robustness test. The sample is from 1980 to 2016, under the floating exchange rate regime.

When the exchange rate pass-through is modelled as a function of observable macroeconomic variables, results reveal four findings. Firstly, both real GDP and exchange rate volatility is significant across all five countries, which is consistent with previous literature regarding exchange rate volatility. Secondly, it also suggests a negative impact of real GDP on exchange rate pass-through. Thirdly, in the case of France and the US, their present quarterly inflation rate is not significant, however, the lagged quarterly and annualised inflation rate tend to be significant. For other countries, their quarterly inflation rates appear insignificant versus the significance of their annualized inflation rates. In general, the annualised inflation rate seems more significant than quarterly inflation rate, and also the exchange rate pass-through responds to inflation rates faster in France and the US than other countries. This implies the feature of price stickiness for commodity goods and the delay is about more than a quarter. Fourthly, money growth rate seems to have an opposite story. It can be shown that money growth rate tends to be more significant on a quarterly basis rather than a yearly basis, which implies money growth rate has more timely effects on the exchange rate pass-through than the inflation rate.

In the robustness test of the determinants of exchange rate pass-through, in which cross product term was added in the regression, three consistent results are found. Inflation rate is significant in France and US, on exchange rate pass-through determination on a quarterly basis. Exchange rate volatility is the most significant determinant of exchange rate pass-through in general. It also suggests a negative impact of real GDP on exchange rate pass-through.

A rise in real GDP, resulting in a decrease in exchange rate pass-through, may suggest that a boost in real GDP will reduce a country's import dependence on other countries. Alternatively, a country's real GDP rise could possibly boost the market confidence of that country's currency, and this may influence international firms' behaviour, such as invoice currency choice, absorbing exchange rate fluctuations for a market expansion.

Chapter 4: Exchange Rate Pass-through into Disaggregated Import Prices: UK

4.1. Introduction

Import prices always show fewer changes than the depreciation of the currency. For example, the Dollar depreciated by almost 35 percent against a broad index of currencies between 2002 and 2008, while the prices of import commodities declined far less. This is a similar case to what happened in the UK after the BREXIT referendum. This intriguing phenomenon, of incomplete exchange rate pass-through, is worth examining; the degree of this incompleteness, and how and why this could happen. After having examined the exchange rate pass-through of aggregated import prices and its determinants for five developed economies, Chapter 3 will switch the focus on exchange rate pass-through of dis-aggregated import prices for one economy, the UK.

The exchange rate pass-through measures the degree to which destination currency prices of traded goods would change in response to fluctuations in exchange rates. Theoretically, the price of imported commodities equals the foreign currency price of those imported commodities converted into domestic prices, if the transport costs are ignored. The exchange rate changes are expected to be fully reflected in the prices and exchange rate pass-through is complete. Therefore, a depreciation of the domestic currency must result in a rise in the import prices at the same scale, if foreign producers keep the selling price unchanged. However, the previous empirical results indicate that changes in the exchange rate are not fully passed through into import prices, implying that foreign producers must absorb some of the price changes by altering the selling price.

The transmission between import price changes and exchange rate movements is complicated. The reason why exchange rate movements do not fully pass-through into import prices has been studied moderately. Starting in the late 1980s, industrial organization and price discrimination became the focus of exchange rate pass-through studies (Menon, 1995). Afterwards, appropriate monetary policies and exchange rate regime optimality in general equilibrium models have gained scholarly attention in exchange rate pass-through studies (Corsetti and Pesenti, 2005; Obstfeld, 2001; Devereux, 2001; Storgaard, Devereux and Engel, 2003).

Pollard (2004) claimed three possibilities behind the behaviour of foreign producers in markets, to explain the absorption of the exchange rate pass-through. The first possibility is that movements in the exchange rate will not have a spontaneous effect on import prices because the prices could have been contracted at a fixed value in the past and invoiced in a specific currency. The second possibility is that foreign producers would adjust their markup in accordance with local market conditions, for example intending to increase their share in the foreign market. Thirdly, the firm would only choose to lower or raise the selling prices with regards to reasonably large movements in the exchange rate, if the cost of changing invoice prices is fairly substantial. Pollard and Coughlin (2003) have found that many industries' import prices do not respond to small changes in exchange rates.

One explanation for the puzzle of sluggish trade flows in comparison to exchange rate changes may be because the assumption that exchange rate changes are fully reflected in the prices of traded goods was taken as granted-in the presence of high demand elasticity (the change of quantity of products is sensitive to the change of the price) (Menon, 1995). The anticipated quantity adjustment could be postponed if exchange rate changes are not substantially, or fully, passed through to traded goods' prices despite the demand elasticity being sufficiently high. That is, a low exchange rate pass-through rate could be a possible reason for trade flows to stay insensitive to exchange rate changes to a certain extent even if demand elasticity is high.

Jabara's (2009) work published at the US International Trade Commission also points out three reasons why exchange rate pass-through may be low. Firstly, it could be that exporters price to the market differently because of market share or low demand elasticity by lowering or raising their markup to offset the fluctuations in exchange rates. Secondly, exporters set their contracts in the local currency of the importing country, thus, exchange rate changes do not impact on import prices. Thirdly, cross-border production will lead to lower exchange rate pass-through, if production costs are denominated in multiple currencies. Other previous works have also tried to explain the currency choice and PCP and LCP determinations (Gopinath, Itskhoki and Rigobon, 2010; Choudhri and Hakura, 2015).

Taylor (2000b) has also proposed that exchange rate pass-through is endogenous to a country's monetary policies, relating to monetary stability and monetary policy effectiveness. Monetary stability and monetary policy effectiveness are considered complementary in his paper as well. The intense debate over producer-currency pricing (PCP) versus local-currency pricing (LCP) of imports has dominated recent studies. High exchange rate pass-through implies high PCP power while low exchange rate pass-through indicates high LCP power. Low exchange rate pass-through also leads to the implication that nominal exchange rate movements may result in lower influence of the intervention of domestic monetary policy in expenditure switching. Thus, monetary policy is more effective in stimulating the economy due to this detachment. The question whether monetary policy becomes more effective as a stabilization instrument when inflation and monetary performance are more stable has been raised by Campa and Linda (2005). Campa and Goldberg (2002) provided critical insights into the issue of PCP and LCP for over 25 OECD countries. They found a rejection of both PCP and LCP in the short run, and PCP dominates over the long run for different types of imported commodities. They also claimed that a higher exchange rate volatility and inflation are not strongly correlated to higher exchange rates pass-through. Gagnon and Ihrig (2004) pointed out that exchange rate pass-through has declined in many countries since 1980, and they found robust evidence of the association between inflation variability and estimated exchange rate pass-through. Therefore, monetary policy may be a factor in the declining exchange rate pass-through as they proposed. This demonstrates the importance of studies on the concept of exchange rate pass-through and their implications for macroeconomic policy, such as studying the degree of the exchange rate pass-through, and its determinants. This chapter focuses on the macroeconomic determinants in terms of the explanation of exchange rate pass-through. Thus, five factors are picked to explain the determination of exchange rate pass-through based on previous literature: money growth, inflation, exchange rate volatility, real GDP and central bank credibility.

The current body of literature on exchange rate pass-through is largely concerned with the US economy and is not industry-specific. However, adjusting the focus to a different national context, such as the UK will offer a new perspective. The UK constitutes an interesting case as the UK will experience significant challenges post-Brexit, and it is also one of the biggest importing economies. This study will increase the understanding of British foreign trading and thus offer recommendations as to how the UK government may be able to successfully develop a future international trading strategy. To achieve this, this chapter will focus on investigating exchange rate pass-through and the determinants of it for the UK at an industry-specific level. In addition, the data after the financial crisis will also be examined in this chapter to fill the blank page of previous studies which are mostly pre-crisis. The degree of the exchange rate pass-through will be investigated for the UK at a disaggregated import price level, and six potential factors will also be examined to explain the determination of exchange rate pass-through to import prices for the UK. Meanwhile, this chapter also aims to investigate how exchange rate pass-though would respond differently if production cost is dominated by macroeconomic cost and industry-specific cost.

Based on the previous literature model (Campa and Goldberg, 2005; Jabara, 2009), an adjusted model is used with quarterly data from 1998 to 2016 to test the degree of exchange rate pass-through for the UK, using disaggregated import prices of six different import sectors: manufacture (MAN), semi-manufacture (SMAN), finished-manufacture (FMAN), Food & Beverage & Tobacco (FBT) basic material (BM) and fuels. The model is based on Campa and Goldberg's (2005) work for testing the degree of exchange rate pass-through. Moreover, five different measures have been explored to describe the domestic market demand condition. Those five measures are: GDP, GDP growth rate, industrial manufacture production (IMP) index, IMP growth rate, Business Climate Index for Eurozone (BCI_Euro) and Business Climate Index for UK (BCI_UK). The results show that the indices of IMP and BCI for Eurozone perform better than others.

Subsequently, this chapter will look at the determinants of exchange rate pass-through rates for the UK. Five macroeconomic variables are picked: money growth, inflation, exchange rate volatility, real GDP and central bank credibility. Moreover, the marginal exchange rate pass-through from one trading partner country will be explored, by using the bilateral exchange rate instead of the effective exchange rate. The marginal exchange rate pass-through of import prices will be investigated from six different trading partners (Australia, Canada, China, Eurozone, Japan, and the US) for the UK in six industry sectors (MAN, SMAN, FMAN, FBT, BM and fuels).

In summary, this chapter will provide empirical evidence of the impacts of exchange rate pass-through on import prices of the UK. Firstly, the degree of exchange rate pass-through of the UK is examined at six industry levels: MAN, SMAN, FMAN, FBT, BM and fuels. Meanwhile, five different measures have been explored to describe the domestic market demand conditions, as part of the robustness check. Additionally, how a positive or negative business climate will impact on the UK's exchange rate pass-through is also studied in the chapter. In particular, how exchange rate pass-though would respond to the dominance of macroeconomic cost and industry-specific cost in production will be investigated. Next, this chapter will explore the determinants of the exchange rate pass-through by five macroeconomic factors: money growth, inflation, exchange rate volatility, real GDP and central bank credibility. Lastly, partial exchange rate pass-through, at a two-country level, will be delved into for five countries: Australia, Canada, China, Eurozone, Japan, and the US. The implications of the research can be used for the UK's policy decision maker, in terms of international trade strategy under the challenge of BREXIT.

4.2. Methodology

4.2.1. Exchange rate Pass-through

The baseline equation to estimate the exchange rate pass-through follows the work of Campa and Goldberg (2005):

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \, \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \, \Delta w_{t-i}^j + c^j \Delta {y_t}^j + \epsilon_t^j \qquad (4.1)$$

where p_t denotes import prices of a specific industrial sector for country j at time t, e_t presents the nominal effective exchange rate (domestic currency per unit foreign currency), w_t presents a primary control variable reflecting exporters costs, and y_t captures destination market demand condition. All variables are expressed in logarithm and in their first differences. To take the gradual adjustment of import prices to exchange rate changes into accounts, the variables of exchange rates and exporter production cost are structured into the regression up to their fourth lags. The clarification of four lags as long run is empirically certified as pass-through rates generally respond over the first and second lags after an exchange rate adjustment. The import prices generally respond to exchange rates' changes up to the second lag, thus four lags are validated to describe the long run effects of exchange rates' changes, as most of past literature verified.

The underlying micro foundation of this regression can be expressed as:

$$p_t^m = \phi_0 + (1 + \phi_1)e_t + c_0 y_t + c_1 w_t^x \tag{4.2}$$

where p_t^m denotes import prices and w_t^x denotes the changing costs in the exporting countries. This structure gives the exchange rate pass-through $\beta = 1 + \phi_1$. If $\beta = 1$, then producer currency pricing (PCP) takes place in the international market; if $\beta = 0$, then local currency pricing (LCP) takes place. Various empirical work shows that the exchange rate pass-through is neither pure PCP nor LCP. When e_t increases, local currency depreciates, therefore the import prices are expected to increase in this case. This indicates import prices and exchange rate are supposed to be positively related. In addition, this allows the exchange rate pass-through to rely on the market structure, which consists with the previous theoretical and empirically literature stating that exchange rate pass-through rates are affected by the market structure, such as Dornbusch (1987) and Marston (1990), and empirically supported by Knetter (1992) and Yang (1997).

The short run exchange rate elasticity on import prices is estimated by a_0^j, while the long run relationship between exchange rates and the import prices is measured by $\sum_{i=0}^{4} a_i^j$, the sum of the current and four lags of exchange rates' coefficients. The clarification of four lags as long run is empirically certified as pass-through rates generally respond over the first and second lags after an exchange rate adjustment. The foreign production cost is measured by a constructed proxy which tends to model the changing costs of a country's aggregated trading partners, expressed as:

$$W_t^j = REX_t^j * P_t^j / NEX_t^j,$$

using the lower-case letters to denote the log forms, the following equation is obtained:

$w_t^j = rex_t^j + p_t^j - nex_t^j$.

The aim of this measure is to present a comprehensive weighted cost of country j's trading partners, with each partner weighted by its trading importance to the importing country. The trading importance of each partner to the importing country is reflected by the effective exchange rate of the importing country. This variable w_t^j is interpreted as the comprehensive wage of all exporting countries for country j. The destination market demand conditions y_t is explored by five measurements: GDP, GDP growth rate, IMP, IMP growth rate, BCI_Euro, BCI_UK.

Table 40 : Variables Definition

Variable	Definition
p_t^j	Import prices of a specific industrial sector for country j in period t
e_t	Nominal effective exchange rate in log (domestic currency per unit foreign currency)
NEX_t^j	Nominal effective exchange rate (domestic currency per unit foreign currency)
REX_t^j	Real effective exchange rate (domestic currency per unit foreign currency)
w_t	Primary control variable reflecting exporters costs
y_t	Destination market demand condition
z_t	Tested determinants of exchange rate pass-through

The table summarizes the definition of each variable used.

4.2.1.1. Negative and Positive BCIs

Dummy variables are also adopted to test effects of the negative and positive Business Climate Index (BCI_Euro, BCI_UK) on the import prices changes by using the following equation:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=1}^{4} b_i^j \Delta w_{t-i}^j + c^{j(-)} BCI^{j(-)} + c^{j(+)} BCI^{j(+)} + \epsilon_t^j \quad (4.3)$$

4.2.1.2. Macroeconomic Environment Cost and Industry-specific Cost

Exchange rate pass-through is closely related to the costs in production and trading strategies behind international trades, therefore, here two different production cost measures are constructed to depict exporters' behaviours. In the market, producers can choose to adjust their product prices to the general macroeconomic environment to meet their own conditions, or to the industry-specific shocks that will impacts on the production. The generalization of those two indicators comes from the idea to test how exchange rate pass-through will respond to the different situations where macro environment shock is more dominant over the industry, or the industry shock is more dominant over the macro environment in terms of production cost. Since producers need to cooperate with shocks occurred both in the general market and in its specific industry, while those shocks are not necessarily spontaneous or at the same level. It is hypothesized that an exporter will choose to adjust their prices along with the general macroeconomic environments if the exporter is less competitive in this industry. Similarly, an exporter will choose to adjust their prices along with the general industry condition if the exporter is more competitive in this industry. This is under the assumption that the shocks in the specific industry will not have strong influences on macroeconomic environment.

When general macroeconomic environment is more dominant in exporting producers' cost than the industry condition, in other words, when the exporter is less competitive in the industry, the following cost variable is employed:

$$W_t^{Mj} = REX_t^j * P_t^{j(\text{manufacture})}/NEX_t^j$$

$$w_t^{Mj} = rex_t^j + p_t^j - nex_t^j$$

Following Regression will be tested:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^{Mj} + c^j \Delta y_t{}^j + \epsilon_t^j \quad (4.4)$$

When the specific industry production condition is more dominant in the production condition than the general macroeconomic environment for exporting producers, that is, when the exporter is more competitive in the industry, the following cost variable is employed:

$$W_t^j = REX_t^j * P_t^j/NEX_t^j$$

$$w_t^j = rex_t^j + p_t^j - nex_t^j$$

where P_t^j is the corresponding industry import prices, which is the same as the dependent variable on the left side of the equation. Regression (4.1) will be tested.

4.2.1.3. Robustness Check for Exchange Rate Pass-through

Considering the resilience and sluggishness as the features of price response, and the how variable w_t^j is constructed, the following regression equation can be used to compare the results as a robustness check by taking out the contemporaneous foreign production cost variable w_0^j of baseline Equation (4.1):

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=1}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta y_t{}^j + \epsilon_t^j \tag{4.5}$$

.

4.2.2. The Determinants of Exchange Rate Pass-through

Many scholars has investigated factors that cause the differences in the exchange rate pass-through across countries, such as monetary volatility of the importing country, exchange rate volatility and country size. Money growth rate and inflation rate are employed to describe the monetary volatility, and money growth rate is proxied by UK's M2, while inflation is calculated based on the UK's CPI. Exchange rates volatility is measured by the backward moving average of the variance of the nominal exchange rates to its eighth lag. Central bank credibility's structure follows the work from Lopez-Villavicencio and Mignon (2017).

To explore the determinants of exchange rate pass-through, the following regression equations (4.6) and (4.7) are used to test the impact of variable z_t on exchange rate pass-through:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta IMP_t^j + \epsilon_t^j \tag{4.6}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=1}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta IMP_t^j + \epsilon_t^j \tag{4.7}$$

Five factors are tested and denoted by z_t in the regressions. Those five factors are: money growth rate, inflation, exchange rate volatility, real GDP and central bank credibility. Table 41 demonstrates how those factors are calculated.

Table 41 : The Determinants of Exchange Rates

z_t	**Definition**
z_{1t} = money growth$_t$	money growth$_t = \frac{\text{Money Supply}_t - \text{Money Supply}_{t-1}}{\text{Money Supply}_{t-1}}$,
z_{2t} = inflation$_t$	$\text{Inflation}_t = \frac{\text{CPI}_t - \text{CPI}_{t-4}}{\text{CPI}_{t-4}} * 100$,
z_{3t} = exvol$_t$	$\text{Exvol}_t = \text{average}\left(\sum_{i=t-8}^{t-1} \text{Var}(\text{nex}_i)\right)$],
z_{4t} = real gdp$_t$	
$z_{5t} = C_t$ (central bank credibility)	$C_t = (\text{Observed inflation}_t - \text{inflation target}_t)^2$

The table demonstrates the five determinants tested in regressions: money growth rate, inflation, exchange rate volatility, real GDP and central bank credibility.

4.2.3. Bilateral Exchange Rate pass-through

To examine the marginal impacts from one trading partner, the bilateral exchange rate will be used to estimate the bilateral exchange rate pass-through, instead of the effective exchange rate. Regressions are run based on Equation (4.4) for five countries: Australia, Canada, China, Eurozone, Japan, and the US. The bilateral exchange rate can be considered as a specific case of the effective exchange rate when importing country j's effective exchange rate is calculated by assigning the full unit weight to the corresponding exporting country, while ignoring the effects of exchange rate pass-through from other trading partners.

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \, \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \, \Delta w_{t-i}^{Mj} + c^j \Delta y_t{}^j + \epsilon_t^j \qquad (4.4)$$

where e_t^j is the bilateral exchange rate of the UK and the grading partner j, and

$$w_t^{Mj} = rex_{t(\text{Bilateral})}^j + p_t^j - nex_{t(\text{Bilateral})}^j$$

In addition, following Equation (4.4.1) will be employed for a robustness check

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \, \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \, \Delta w_{t-i}^{Mj} + c^j \Delta y_t{}^j + \epsilon_t^j \qquad (4.4.1)$$

where e_t^j is the bilateral exchange rate of the UK and trading partner j, and

$$w_t^{Mj} = rex_{t(\text{Effective})}^j + p_t^j - nex_{t(\text{Effective})}^j$$

Equation (4.4) and Equation (4.4.1) are different in terms of the structure of production cost. Exchange rate pass-through estimated by Equation (4.4.1) can be considered as a marginal exchange rate pass-through from the UK's trading partner, while Equation (4.4.) tests a bilateral relationship between the UK and its trading partner j.

4.2.4. Lagged Dependent Variable

An alternative model specification including a lagged dependent variable is used to give a more dynamic estimation by relying on a partial adjustment model. The regression with a lagged dependent is used to estimate the both exchange rate pass-through and determinants of exchange rate pass-through. The estimation equations are:

$$\Delta p_t^j = \alpha + \rho \Delta p_{t-1}^j + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta {y_t}^j + \epsilon_t^j \quad (4.8)$$

$$\Delta p_t^j = \alpha + \rho \Delta p_{t-1}^j + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta y_t^j + \epsilon_t^j \quad (4.9)$$

The estimation results can be found in Appendix Tables as it generates very similar results to the previous regressions, without the lagged dependent variable. Campa and Goldberg (2012) also obtained similar estimations from regressions, with and without the lagged dependent variables. They also found that the majority regression failed to meet the constraints of coefficients imposed by the lagged dependent variable model. Therefore, only the results from one estimation method will be reported in the context.

In the estimation, all regressions employ the heteroscedasticity-consistent (HC) standard errors OLS (White) estimator. All variables in their first differences in the regression are stationary tested by ADF test.

4.3. Data Description

Table 42 : Data Source

Variable	Index		Source
p_t^j	Manufacture (MAN)		Office for National Statistics (ONS)
	Semi-manufacture (SMAN)		
	Finished-manufacture (FMAN)		
	Food & Beverage & Tobacco (FBT)		
	Basic Materials (BM)		
	Fuels		
e_t	Effective Exchange Rate		International Financial Statistics (IFS), with the series code: NELZF, RELZF
	Bilateral Exchange Rate		DataStream
y_t	Domestic Demand Condition	GDP	ONS
		IMP	ONS
		BCI	The Directorate-General Economic and Financial Affairs (centered by its mean)
z_t	The Determinants of the exchange rate pass-through	Real GDP	Federal Reserve Bank of St. Louis
		CPI	Federal Reserve Bank of St. Louis
		M2	Federal Reserve Bank of St. Louis

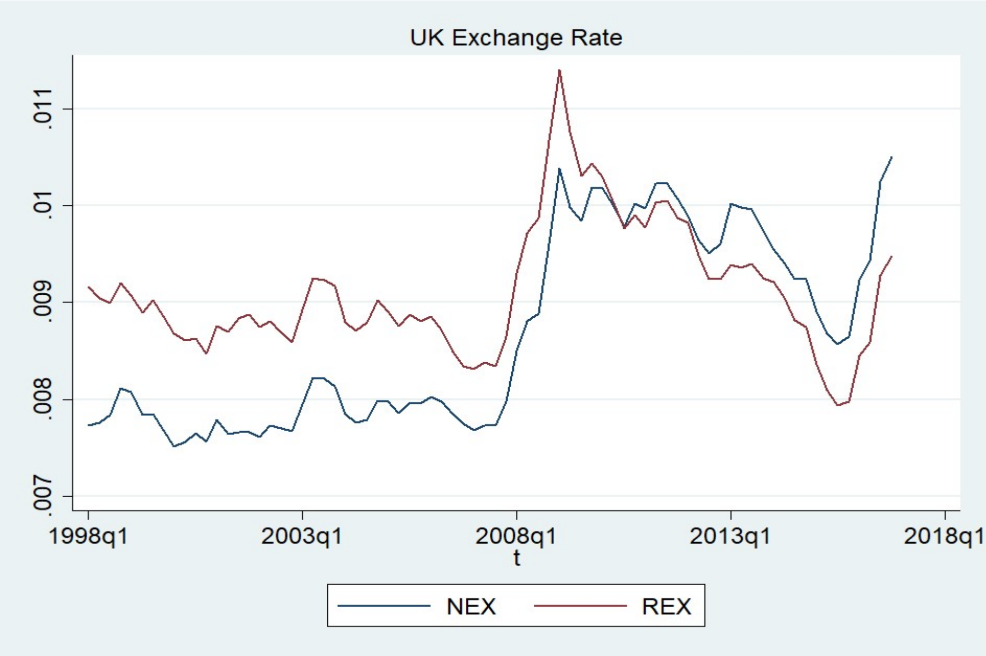
Note: BCI is collected from The Directorate-General Economic and Financial Affairs (DG ECFIN) of the European Commission, which could be found at: https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/business-and-consumer-surveys/download-business-and-consumer-survey-data/time-series_en.

Table 43 : Data Description

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	ADF Test	Obser.
BCI	-1.33E-16	0.112062	1.403729	-3.6096	0.9920	-1.3556	5.7758	0.2822	80
CPI	85.1873	82.6	103.7	70.5	10.9457	0.2716	1.5332	0.9965	79
EXVOL	17.9367	5.9628	126.3906	0.9003	26.9938	2.3153	8.1064	0.1027	80
IMP	101.35	101.9377	106.3343	92.71073	3.2583	-0.6742	3.1380	0.4869	80
IMP_GR	0.0224	0.2338	2.1252	-5.3962	1.1912	-1.9301	9.2520	0.0000	80
INFLATION	1.9061	1.7103	4.6674	0.0000	1.0677	0.5584	3.0348	0.3327	79
M2	1002992	1029659	1613804	490018	331277.9	0.0307	1.7791	1.0000	75
MONEY_GR	1.6206	1.6164	3.1630	0.2689	0.6335	0.1605	2.6066	0.0000	75
NEX	0.0087	0.0082	0.0105	0.0075	0.0010	0.4158	1.5214	0.8980	76
GDP	89.6388	91.3791	104.3946	72.2063	8.5669	-0.2958	2.2900	0.5889	79
GDP_GR	0.476522	0.553375	1.754532	-2.1765	0.5973	-2.0155	9.6496	0.0013	79
P_ MAN	94.59494	92	110	84	8.0024	0.2174	1.5998	0.9849	79
P_ SMAN	91.35443	85	116	74	14.6104	0.2272	1.3944	0.9671	79
P_ FMAN	96.37975	98	109	86	5.7631	-0.1875	2.1807	0.9651	79
P_ FBT	81.73418	76	107	58	17.0893	0.0822	1.3516	0.9745	79
P_ BM	88.41772	89	125	58	23.0193	0.1323	1.4606	0.9135	79
P_Fuels	95.07595	92	193	17	53.3685	0.3085	1.8808	0.5596	79
REAL_GDP	389139.5	396694.3	453197.2	313461.7	37190.46	-0.2958	2.2900	0.5889	79
REX	0.009123	0.008958	0.011403	0.007939	0.0007	0.9771	4.0351	0.4487	76
BCI_UK	-5.33E-16	1.610833	20.0775	-36.0225	11.3278	-0.8641	3.9398	0.2403	80

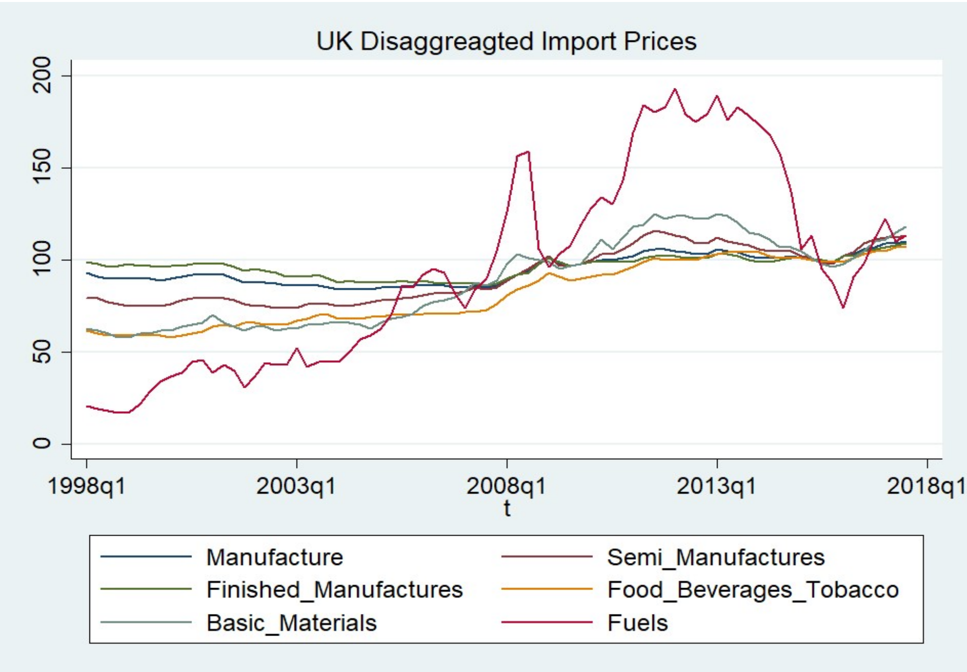
The table exhibits the descriptive statistics for all the data used in this chapter, including mean, median, maximum value, minimum value, standard deviation, skewness, kurtosis, the p-value of the Augmented Dickey-Fuller (ADF) test, and the number of the observations for each variable. Most of the variables cannot reject a unit root as ADF test shows.

Figure 16 : UK Effective Exchange Rate (Domestic per unit of Foreign Currency)



The figure demonstrates the nominal (NEX) and real (REX) UK effective exchange rate from 1998 to 2018.

Figure 17：UK Disaggregated Import Prices Index



The figure demonstrates the UK's disaggregated import prices of six industry from 1998 to 2018.

4.4. Estimation Results

Firstly, the results of the degree of exchange rate pass-through for the UK will be demonstrated at six industry level: MAN, SMAN, FMAN, FBT, BM and fuels, by using five different measures respectively. Meanwhile, how positive and negative BCI impact differently on the UK's exchange rate pass-through will be investigated and reported. Additionally, the different results from employing macroeconomic environment cost or industry specific cost will be discussed in this part. Then, the estimation results for five determinants of the exchange rate pass-through will be presented. Five factors are: money growth, inflation, exchange rate volatility, real GDP and central bank credibility. Lastly, bilateral exchange rate pass-through on a country level will be examined for five countries: Australia, Canada, China, Eurozone, Japan, and the US.

All regressions employed the HC standard errors OLS (White) estimation. All first-differenced variables in the regression are stationary interpreted by ADF test. Jarque-Bera test is used to test the normality for the residual of the regression.

4.4.1. Exchange Rate Pass-Through at Different Domestic Market Demand Condition Measures

The empirical results are exhibited by the following Equation (4.1) and Equation (4.2) in this section, with six different domestic market demand condition measures: GDP, IMP, GDP growth rate, IMP growth rate, BCI_Euro and BCI_UK. Equation (4.1) assumes industry-specific cost dominates in foreign trading partner's production cost, while Equation (4.4) assumes that the macroeconomic condition dominates in foreign trading partner's production cost. Meanwhile, four different measures have been employed to capture the variable of domestic demand y_t in this section. These six measurements are: industrial manufacture, GDP growth rate, industrial manufacture growth rate, BCI_Euro and BCI_UK.

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta y_t{}^j + \epsilon_t^j \quad (4.1)$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^{Mj} + c^j \Delta y_t{}^j + \epsilon_t^j \quad (4.4)$$

4.4.1.1. GDP Measure

Setting $y_t = gdp_t$, and the following regression equations will be run:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t{}^j + \epsilon_t^j \quad (4.1)$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^{Mj} + c^j \Delta gdp_t{}^j + \epsilon_t^j \quad (4.4)$$

In the equation, w_t^j denotes the situation where the exporter is more competitive in the industry, i.e., where the macroeconomic environment is less dominant on exporting producers' cost than the industry condition. w_t^{Mj} denotes the situation where the exporter is less competitive in the industry, i.e., where the macroeconomic environment is more dominant on exporting producers' cost than the industry condition.

Table 44 and 45 demonstrate the regression results of the exchange rate pass-through for the UK when using GDP to explore domestic demand condition. Table 44 presents the regression result from Equation (4.1) and Table 55 presents the regression result from Equation (4.4).

Table 44 : Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Equation (4.1))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.166*** +++	0.156*** +++	0.128*** +++	0.107* +++	0.0594 +++	0.00749 +++
	(0.0458)	(0.0580)	(0.0422)	(0.0597)	(0.0502)	(0.0456)
Exchange Rate(-1)	0.0243	0.0291	0.0433	0.0465	0.0191	-0.00974
	(0.0485)	(0.0527)	(0.0542)	(0.0555)	(0.0495)	(0.0531)
Exchange Rate(-2)	0.0196	0.00275	0.0314	-0.0246	0.0396	0.0398
	(0.0516)	(0.0692)	(0.0547)	(0.0721)	(0.0562)	(0.0633)
Exchange Rate(-3)	-0.0422	-0.0139	-0.0159	-0.0460	-0.000744	0.0165
	(0.0455)	(0.0638)	(0.0466)	(0.0647)	(0.0480)	(0.0581)
Exchange Rate(-4)	-0.0503	-0.0781	-0.0524	-0.0978	-0.0329	-0.00919
	(0.0380)	(0.0499)	(0.0415)	(0.0617)	(0.0423)	(0.0595)
Long run elasticity ($\sum_{i=0}^{4} a_i^j$)	0.1174* +++	0.09585 +++	0.1344** +++	-0.0149 +++	0.084456 +++	0.04486 +++
Wage	0.543***	0.717***	0.598***	0.735***	0.890***	0.995***
	(0.0744)	(0.0912)	(0.0654)	(0.0932)	(0.0356)	(0.00899)
Wage(-1)	-0.0567	-0.0566	-0.114*	-0.0142	-0.0212	0.00516
	(0.0625)	(0.0747)	(0.0642)	(0.0734)	(0.0319)	(0.00701)
Wage(-2)	-0.0399	0.0468	-0.0577	0.0559	0.0392	0.00631
	(0.0495)	(0.0596)	(0.0683)	(0.0704)	(0.0319)	(0.00779)
Wage(-3)	0.0465	0.0123	-0.0262	0.132	0.0467	0.0156
	(0.0553)	(0.0630)	(0.0709)	(0.0907)	(0.0284)	(0.0120)
Wage(-4)	0.0321	0.106	0.0773	0.0922	0.0715**	0.00385
	(0.0665)	(0.0677)	(0.0637)	(0.0884)	(0.0308)	(0.0104)
gdp	-0.169	0.129	-0.181	0.191	0.525**	0.290
	(0.190)	(0.227)	(0.188)	(0.201)	(0.214)	(0.233)
Constant	-0.000204	-0.00245	-0.000593	-0.00400*	-0.00584***	-0.00519***
	(0.00144)	(0.00176)	(0.00133)	(0.00233)	(0.00153)	(0.00152)
Observations	71	71	71	71	71	71
R^2	0.821	0.864	0.805	0.796	0.947	0.996
Adjusted R^2	0.787	0.838	0.769	0.758	0.937	0.995
F	23.75	41.24	20.48	19.90	164.6	1995
Jarque-Bera	0.9022	0.1388	0.9178	0.1130	0.2292	0.6978

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

Table 45 : Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Manufacture Cost, Equation (4.4))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.166*** +++	0.306*** +++	0.238*** +++	0.420*** +++	0.224 +++	-0.310
	(0.0458)	(0.0809)	(0.0589)	(0.101)	(0.191)	(0.834)
Exchange Rate(-1)	0.0243	0.0318	-0.0285	0.139	0.0511	0.320
	(0.0485)	(0.0804)	(0.0640)	(0.0860)	(0.198)	(0.788)
Exchange Rate(-2)	0.0196	0.0153	0.0109	-0.109	0.235	1.477**
	(0.0516)	(0.0912)	(0.0678)	(0.0920)	(0.179)	(0.729)
Exchange Rate(-3)	-0.0422	-0.0397	-0.0563	-0.0474	-0.109	0.261
	(0.0455)	(0.0707)	(0.0703)	(0.0836)	(0.179)	(0.645)
Exchange Rate(-4)	-0.0503	-0.0827	-0.00200	-0.135	-0.00534	0.634
	(0.0380)	(0.0771)	(0.0623)	(0.0809)	(0.189)	(0.671)
Long run elasticity ($\sum_{i=0}^{4} a_i^j$)	0.1174* +++	0.18306 +++	0.1826** +++	0.192 +++	0.4759* ++	2.018
Wage_M	0.543***	0.554***	0.306***	-0.182	0.825***	1.727
	(0.0744)	(0.117)	(0.102)	(0.142)	(0.246)	(1.082)
Wage(-1)	-0.0567	-0.0853	0.0679	0.0798	0.164	1.010
	(0.0625)	(0.114)	(0.0869)	(0.153)	(0.266)	(1.143)
Wage(-2)	-0.0399	0.0632	-0.0637	0.00457	-0.158	-1.101
	(0.0495)	(0.115)	(0.0947)	(0.116)	(0.294)	(1.014)
Wage(-3)	0.0465	0.0767	0.0119	0.153	0.215	-0.846
	(0.0553)	(0.105)	(0.0968)	(0.126)	(0.261)	(1.083)
Wage(-4)	0.0321	0.0848	0.0244	0.0698	0.213	0.710
	(0.0665)	(0.0950)	(0.0975)	(0.0842)	(0.264)	(1.085)
gdp	-0.169	0.177	-0.320	-0.294	2.226***	10.19**
	(0.190)	(0.318)	(0.255)	(0.260)	(0.494)	(3.884)
Constant	-0.000204	-3.89e-05	1.17e-05	0.00756***	-0.00931**	-0.0344
	(0.00144)	(0.00264)	(0.00194)	(0.00230)	(0.00461)	(0.0298)
Observations	71	71	71	71	71	71
R^2	0.821	0.655	0.648	0.543	0.326	0.213
Adjusted R^2	0.787	0.591	0.582	0.458	0.201	0.0666
F	23.75	12.95	11.36	8.209	3.662	1.471
Jarque-Bera	0.9022	0.3935	0.0844	0.4138	0.1335	0.7872

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

4.4.1.2. Industrial Manufacture Production (IMP) Measure

Setting $y_t = imp_t$, and the following regression equations will be run:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta imp_{t-i}^j + \epsilon_t^j \quad (4.1)$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta iw_{t-i}^{Mj} + c^j \Delta imp_{t-i}^j + \epsilon_t^j \quad (4.4)$$

In the equation, w_t^j denotes the situation where the exporter is more competitive in the industry, i.e., where the macroeconomic environment is less dominant on exporting producers' cost than the industry condition. w_t^{Mj} denotes the situation where the exporter is less competitive in the industry, i.e., where the macroeconomic environment is more dominant on exporting producers' cost than the industry condition.

Table 46 and 47 demonstrate the regression results of the exchange rate pass-through for the UK when using IMP to explore domestic demand condition. Table 46 presents the regression result from Equation (4.1) and Table 47 presents the regression result from Equation (4.4).

Table 46: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Equation (4.1))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.169***	0.164*** +++	0.130*** +++	0.103 +++	0.0448 +++	-0.0134 +++
	(0.0478)	(0.0578)	(0.0449)	(0.0652)	(0.0534)	(0.0483)
Exchange Rate(-1)	0.0248	0.0374	0.0456	0.0442	0.00754	-0.0174
	(0.0481)	(0.0532)	(0.0547)	(0.0567)	(0.0519)	(0.0545)
Exchange Rate(-2)	0.0273	-0.00488	0.0390	-0.0334	0.0155	0.0236
	(0.0539)	(0.0709)	(0.0562)	(0.0727)	(0.0603)	(0.0642)
Exchange Rate(-3)	-0.0353	-0.0148	-0.00900	-0.0474	-0.00903	0.00826
	(0.0448)	(0.0640)	(0.0465)	(0.0649)	(0.0530)	(0.0608)
Exchange Rate(-4)	-0.0438	-0.0831	-0.0460	-0.103	-0.0496	-0.0244
	(0.0369)	(0.0506)	(0.0400)	(0.0619)	(0.0460)	(0.0594)
Long run elasticity ($\sum_{i=0}^{4} a_i^j$)	0.142** +++	0.09862 +++	0.1596** +++	-0.0366 +++	0.00921 +++	-0.02334 +++
Wage	0.557***	0.711***	0.616***	0.722***	0.894***	0.999***
	(0.0732)	(0.0901)	(0.0677)	(0.0921)	(0.0390)	(0.00905)
Wage(-1)	-0.0462	-0.0763	-0.109*	-0.0136	-0.0234	0.00680
	(0.0599)	(0.0756)	(0.0636)	(0.0759)	(0.0349)	(0.00693)
Wage(-2)	-0.0375	0.0498	-0.0519	0.0495	0.0323	0.00685
	(0.0485)	(0.0592)	(0.0665)	(0.0679)	(0.0345)	(0.00797)
Wage(-3)	0.0415	0.0144	-0.0312	0.130	0.0445	0.0140
	(0.0551)	(0.0616)	(0.0737)	(0.0910)	(0.0316)	(0.0125)
Wage(-4)	0.0373	0.107	0.0818	0.0833	0.0587*	0.00158
	(0.0667)	(0.0666)	(0.0648)	(0.0883)	(0.0298)	(0.0102)
imp	-0.0169	0.0801	-0.0257	0.0301	0.136	0.00377
	(0.0725)	(0.0838)	(0.0819)	(0.0865)	(0.106)	(0.116)
Constant	-0.00120	-0.00171	-0.00161*	-0.00273	-0.00302***	-0.00372***
	(0.000810)	(0.00104)	(0.000862)	(0.00170)	(0.00106)	(0.00111)
Observations	71	71	71	71	71	71
R^2	0.817	0.864	0.802	0.793	0.943	0.995
Adjusted R^2	0.783	0.839	0.765	0.755	0.932	0.995
F	22.04	42.42	17.57	19.61	119.3	1958
Jarque-Bera	0.7573	0.1481	0.8677	0.1779	0.6471	0.7019

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

Table 47: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Manufacture Cost, Equation (4.4))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.169*** +++	0.325*** +++	0.240*** +++	0.420*** +++	0.273 +++	-0.100
	(0.0478)	(0.0788)	(0.0598)	(0.104)	(0.210)	(0.834)
Exchange Rate(-1)	0.0248	0.0471	-0.0301	0.136	0.109	0.573
	(0.0481)	(0.0799)	(0.0668)	(0.0897)	(0.176)	(0.859)
Exchange Rate(-2)	0.0273	0.00305	0.0262	-0.0948	0.116	0.936
	(0.0539)	(0.0924)	(0.0674)	(0.0889)	(0.176)	(0.771)
Exchange Rate(-3)	-0.0353	-0.0313	-0.0458	-0.0397	-0.136	0.128
	(0.0448)	(0.0736)	(0.0702)	(0.0827)	(0.198)	(0.691)
Exchange Rate(-4)	-0.0438	-0.0853	0.00968	-0.124	-0.0742	0.316
	(0.0369)	(0.0755)	(0.0650)	(0.0789)	(0.205)	(0.707)
Long run elasticity ($\sum_{i=0}^{4} a_i^j$)	0.142** +++	0.1973 +++	0.23675*** +++	0.3723 +++	0.3162 +++	1.203
Wage_M	0.557***	0.553***	0.330***	-0.161	0.694**	1.120
	(0.0732)	(0.112)	(0.103)	(0.143)	(0.275)	(1.091)
Wage(-1)	-0.0462	-0.125	0.0922	0.106	-0.0905	-0.136
	(0.0599)	(0.115)	(0.0932)	(0.157)	(0.261)	(1.289)
Wage(-2)	-0.0375	0.0794	-0.0621	0.00374	-0.115	-0.912
	(0.0485)	(0.115)	(0.0934)	(0.120)	(0.287)	(1.072)
Wage(-3)	0.0415	0.0628	0.00543	0.149	0.204	-0.885
	(0.0551)	(0.103)	(0.0988)	(0.126)	(0.290)	(1.133)
Wage(-4)	0.0373	0.0836	0.0335	0.0777	0.162	0.475
	(0.0667)	(0.0974)	(0.103)	(0.0876)	(0.294)	(1.181)
imp	-0.0169	0.188*	-0.0592	-0.0760	0.913***	4.076**
	(0.0725)	(0.103)	(0.118)	(0.109)	(0.282)	(1.586)
Constant	-0.00120	0.000887	-0.00184	0.00587***	0.00328	0.0233
	(0.000810)	(0.00155)	(0.00139)	(0.00180)	(0.00381)	(0.0189)
Observations	71	71	71	71	71	71
R^2	0.817	0.665	0.638	0.538	0.311	0.186
Adjusted R^2	0.783	0.603	0.570	0.452	0.183	0.0344
F	22.04	15.06	10.36	9.712	2.690	1.226
Jarque-Bera	0.7573	0.4443	0.5138	0.6353	0.0605	0.8520

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

4.4.1.3. GDP Growth Rate Measure

Setting $y_t = \mathrm{GDP\_gr_t}$, and the following regression equations will be run:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \mathrm{GDP\_gr_t}^j + \epsilon_t^j \tag{4.1}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^{Mj} + c^j \mathrm{GDP\_gr_t}^j + \epsilon_t^j \tag{4.4}$$

In the equation, w_t^j denotes the situation where the exporter is more competitive in the industry, in other words, where the macroeconomic environment is less dominant on exporting producers' cost than the industry condition. w_t^{Mj} denotes the situation where the exporter is less competitive in the industry, in other words, where the macroeconomic environment is more dominant on exporting producers' cost than the industry condition.

Table 48 and 49 demonstrate the regression results of the exchange rate pass-through for the UK when using GDP growth rate to explore domestic demand condition. Table 53 presents the regression result from Equation (4.1) and Table 54 presents the regression result from Equation (4.4).

Table 48: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Equation (4.1))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.123*** +++	0.132** +++	0.0846* +++	0.0648 +++	0.0305 +++	-0.0117 +++
	(0.0434)	(0.0544)	(0.0443)	(0.0615)	(0.0557)	(0.0597)
Exchange Rate(-1)	0.0504	0.0779	0.0591	0.0576	0.0537	0.0127
	(0.0396)	(0.0473)	(0.0497)	(0.0561)	(0.0435)	(0.0542)
Exchange Rate(-2)	0.00432	0.00151	0.0132	0.00425	0.0599	0.0425
	(0.0466)	(0.0599)	(0.0527)	(0.0763)	(0.0591)	(0.0700)
Exchange Rate(-3)	-0.0626	-0.0650	-0.0290	-0.0415	-0.00526	0.00867
	(0.0409)	(0.0549)	(0.0446)	(0.0650)	(0.0483)	(0.0602)
Exchange Rate(-4)	-0.0438	-0.0453	-0.0513	-0.0795	0.00159	0.0281
	(0.0333)	(0.0404)	(0.0405)	(0.0618)	(0.0411)	(0.0690)
Long run elasticity ($\sum_{i=0}^{4} a_i^j$)	0.07132 +++	0.10111 +++	0.0766 +++	0.00565 +++	0.14043* +++	0.08027 +++
Wage	0.537***	0.681***	0.599***	0.754***	0.896***	0.997***
	(0.0669)	(0.0761)	(0.0610)	(0.0928)	(0.0321)	(0.0103)
Wage(-1)	-0.0595	-0.0837	-0.0958	-0.0102	-0.0487*	-0.000532
	(0.0560)	(0.0685)	(0.0590)	(0.0753)	(0.0291)	(0.00817)
Wage(-2)	0.000203	0.0626	-0.00238	0.0147	0.0137	-0.00582
	(0.0477)	(0.0587)	(0.0717)	(0.0797)	(0.0321)	(0.00789)
Wage(-3)	0.0387	0.0597	-0.0533	0.102	0.0463	0.0157
	(0.0488)	(0.0559)	(0.0692)	(0.0918)	(0.0281)	(0.0112)
Wage(-4)	0.0725	0.116*	0.119*	0.113	0.0886***	0.00662
	(0.0594)	(0.0580)	(0.0616)	(0.0953)	(0.0293)	(0.00994)
GDP_gr	6.21e-05	0.00146	0.000825	0.00187	0.00299	0.00257
	(0.00136)	(0.00162)	(0.00134)	(0.00195)	(0.00201)	(0.00190)
	-0.00128	-0.000447	-0.00127	-0.00130	-0.000176	-0.00114
Constant	(0.000977)	(0.00125)	(0.00111)	(0.00166)	(0.00139)	(0.00167)
Observations	64	64	64	64	64	64
R^2	0.821	0.880	0.777	0.779	0.954	0.995
Adjusted R^2	0.784	0.855	0.729	0.732	0.944	0.994
F	22.52	38.65	18.32	13.39	203.6	1771
Jarque-Bera	0.3891	0.4729	0.6354	0.2460	0.0917	0.7525

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

Table 49: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Manufacture Cost, Equation (4.4))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate	0.123***	0.259***	0.191**	0.396***	0.241	0.292
(Short run elasticity a_0^j)	+++	+++	+++	+++	+++	
	(0.0434)	(0.0683)	(0.0642)	(0.116)	(0.227)	(0.905)
Exchange Rate(-1)	0.0504	0.111	-0.00180	0.165*	0.140	-0.0653
	(0.0396)	(0.0713)	(0.0670)	(0.0981)	(0.212)	(0.896)
Exchange Rate(-2)	0.00432	0.0259	-0.00176	-0.0783	0.328*	1.481*
	(0.0466)	(0.0841)	(0.0688)	(0.102)	(0.188)	(0.850)
Exchange Rate(-3)	-0.0626	-0.0634	-0.0766	-0.0702	-0.123	0.362
	(0.0409)	(0.0747)	(0.0662)	(0.0870)	(0.188)	(0.696)
Exchange Rate(-4)	-0.0438	-0.0271	-0.0165	-0.102	0.178	1.309*
	(0.0333)	(0.0737)	(0.0672)	(0.0858)	(0.195)	(0.722)
Long run elasticity	0.07132	0.27135**	0.11435	0.2629*	0.823***	3.048*
($\sum_{i=0}^{4} a_i^j$)	+++	+++	+++	+++		
Wage_M	0.537***	0.531***	0.320***	-0.207	0.706**	1.355
	(0.0669)	(0.119)	(0.0963)	(0.145)	(0.273)	(1.138)
Wage(-1)	-0.0595	-0.0760	0.0712	0.119	0.243	0.985
	(0.0560)	(0.128)	(0.0857)	(0.170)	(0.289)	(1.265)
Wage(-2)	0.000203	0.115	-0.0359	0.0136	-0.169	-1.129
	(0.0477)	(0.115)	(0.0953)	(0.118)	(0.295)	(1.040)
Wage(-3)	0.0387	0.0503	-0.000897	0.179	0.264	-0.278
	(0.0488)	(0.107)	(0.101)	(0.133)	(0.290)	(1.083)
Wage(-4)	0.0725	0.133	0.0754	0.0728	0.0874	-0.112
	(0.0594)	(0.0911)	(0.102)	(0.0865)	(0.276)	(1.042)
GDP_gr	6.21e-05	-7.43e-05	0.000948	-0.000356	0.00259	0.0124
	(0.00136)	(0.00220)	(0.00166)	(0.00259)	(0.00544)	(0.0299)
	-0.00128	0.00133	-0.00152	0.00515**	0.00707	0.0379
Constant	(0.000977)	(0.00189)	(0.00172)	(0.00218)	(0.00468)	(0.0235)
	0.537***	0.531***	0.320***	-0.207	0.706**	1.355
Observations	64	64	64	64	64	64
R^2	0.821	0.662	0.556	0.488	0.348	0.154
Adjusted R^2	0.784	0.591	0.463	0.380	0.210	-0.0253
F	22.52	13.10	8.459	4.355	3.646	1.113
Jarque-Bera	0.3891	0.1172	0.1185	0.2835	0.1230	0.9837

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

4.4.1.4. IMP Growth Rate Measure

Setting $y_t = \mathrm{IMP\_gr_t}$, and the following regression equations will be run:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \, \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \, \Delta w_{t-i}^j + c^j \mathrm{IMP\_gr_t}^j + \epsilon_t^j \tag{4.1}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \, \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \, \Delta w_{t-i}^{Mj} + c^j \mathrm{IMP\_gr_t}^j + \epsilon_t^j \tag{4.4}$$

In the equation, w_t^j denotes the situation where the exporter is more competitive in the industry, in other words, where the macroeconomic environment is less dominant on exporting producers' cost than the industry condition. w_t^{Mj} denotes the situation where the exporter is less competitive in the industry, in other words, where the macroeconomic environment is more dominant on exporting producers' cost than the industry condition.

Table 50 and 51 demonstrate the regression results of the exchange rate pass-through for the UK when using IMP growth rate to explore domestic demand condition. Table 55 presents the regression result from Equation (4.1) and Table 56 presents the regression result from Equation (4.4).

Table 50：Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Equation (4.1))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.173*** +++	0.131* +++	0.157** +++	0.266*** +++	0.0883 +++	0.0474 +++
	(0.0609)	(0.0760)	(0.0579)	(0.0861)	(0.0918)	(0.0752)
Exchange Rate(-1)	-0.0214	0.0341	-0.0245	-0.0365	-0.0769	-0.129*
	(0.0483)	(0.0668)	(0.0460)	(0.0537)	(0.0725)	(0.0655)
Exchange Rate(-2)	0.0672	0.0855	0.131***	0.107	0.122	0.132*
	(0.0569)	(0.0727)	(0.0449)	(0.0749)	(0.0778)	(0.0742)
Exchange Rate(-3)	-0.0313	0.0110	-0.0436	0.00383	0.0247	0.0165
	(0.0467)	(0.0546)	(0.0535)	(0.0598)	(0.0595)	(0.0640)
Exchange Rate(-4)	-0.0950*	-0.156**	-0.0796	-0.0912	-0.0562	-0.0465
	(0.0533)	(0.0661)	(0.0524)	(0.0705)	(0.0762)	(0.0744)
Long run elasticity ($\sum_{i=0}^{4} a_i^j$)	0.1875+++	0.1056+++	0.1403+++	0.24913*+++	0.1019+++	0.0204+++
Wage	0.640***	0.861***	0.632***	0.653***	0.964***	1.010***
	(0.0761)	(0.0975)	(0.0753)	(0.101)	(0.0464)	(0.0121)
Wage(-1)	-0.156**	-0.256**	-0.139*	-0.0805	-0.0748	0.0178
	(0.0726)	(0.0984)	(0.0759)	(0.0860)	(0.0572)	(0.0108)
Wage(-2)	-0.0271	-0.00818	-0.119**	0.0416	-0.0263	-0.00305
	(0.0623)	(0.0674)	(0.0565)	(0.0676)	(0.0410)	(0.0113)
Wage(-3)	0.0544	0.0145	0.0704	-0.0253	0.0444	-0.0119
	(0.0580)	(0.0556)	(0.0685)	(0.0917)	(0.0388)	(0.0115)
Wage(-4)	0.0671	0.177**	0.0537	0.0987	0.0246	0.00107
	(0.0735)	(0.0831)	(0.0612)	(0.0979)	(0.0459)	(0.0142)
IMP_gr	0.000427	0.000954	0.000435	-0.000140	-0.000417	-0.00196
	(0.00105)	(0.00140)	(0.00108)	(0.00152)	(0.00168)	(0.00155)
Constant	-0.000108	0.000651	-0.000714	0.000748	-0.00119	-0.00419*
	(0.00125)	(0.00183)	(0.00121)	(0.00209)	(0.00204)	(0.00222)
Observations	44	44	44	44	44	44
R^2	0.839	0.903	0.823	0.860	0.957	0.995
Adjusted R^2	0.783	0.869	0.762	0.812	0.942	0.993
F	13.72	25.64	15.94	15.48	159.7	973.7
Jarque-Bera	0.7208	0.3902	0.2396	0.3049	0.7497	0.2379

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

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Table 51 : Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Manufacture Cost, Equation (4.4))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate	0.173***	0.356***	0.240***	0.556***	0.332	0.523
(Short run elasticity a_0^j)	+++	+++	+++	+++		
	(0.0609)	(0.122)	(0.0865)	(0.106)	(0.323)	(1.173)
Exchange Rate(-1)	-0.0214	0.0207	-0.0633	0.0285	0.153	-0.00405
	(0.0483)	(0.102)	(0.0788)	(0.0917)	(0.245)	(1.086)
Exchange Rate(-2)	0.0672	-0.0122	0.121	0.112	0.175	1.943*
	(0.0569)	(0.133)	(0.0874)	(0.106)	(0.357)	(1.118)
Exchange Rate(-3)	-0.0313	-0.0904	-0.0573	-0.108	-0.113	-0.435
	(0.0467)	(0.0990)	(0.0861)	(0.0796)	(0.325)	(0.650)
Exchange Rate(-4)	-0.0950*	-0.185*	-0.0417	-0.132	-0.0643	0.629
	(0.0533)	(0.103)	(0.0911)	(0.0844)	(0.278)	(0.793)
Long run elasticity	0.1875	0.0678	0.2144	0.39384*	0.5863	2.1614
	+++	+++	+++	+++	+	
($\sum_{i=0}^{4} a_i^j$)						
Wage_M	0.640***	0.654***	0.352***	0.140	0.997**	2.098
	(0.0761)	(0.130)	(0.119)	(0.136)	(0.427)	(1.419)
Wage(-1)	-0.156**	-0.264*	0.0288	0.0128	-0.166	-1.067
	(0.0726)	(0.150)	(0.101)	(0.141)	(0.341)	(1.029)
Wage(-2)	-0.0271	0.0697	-0.180*	-0.0584	-0.131	-0.943
	(0.0623)	(0.160)	(0.0946)	(0.112)	(0.341)	(0.938)
Wage(-3)	0.0544	0.182	-0.0302	0.152	0.191	1.754
	(0.0580)	(0.123)	(0.111)	(0.107)	(0.384)	(1.284)
Wage(-4)	0.0671	0.141	0.0709	0.0726	0.313	-0.368
	(0.0735)	(0.104)	(0.108)	(0.123)	(0.370)	(1.185)
IMP_gr	0.000427	0.00162	0.00148	0.00274	0.00109	0.0209
	(0.00105)	(0.00191)	(0.00161)	(0.00227)	(0.00590)	(0.0210)
Constant	-0.000108	0.00433*	3.91e-05	0.00793***	0.00891	0.0503*
	(0.00125)	(0.00219)	(0.00188)	(0.00228)	(0.00734)	(0.0258)
Observations	44	44	44	44	44	44
R^2	0.839	0.695	0.587	0.704	0.347	0.207
Adjusted R^2	0.783	0.591	0.445	0.602	0.123	-0.0660
F	13.72	9.957	4.479	5.821	1.744	1.957
Jarque-Bera	0.7208	0.2386	0.4494	0.2865	0.1241	0.1640

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

4.4.1.5. BCI Measure

This section presents the empirical results when BCI is adopted as the domestic demand in Equation (4.1) and Equation (4.4). Equation (4.1) assumes industry-specific cost dominates in foreign trading partner's production cost, while Equation (4.4) assumes macroeconomic condition dominates in foreign trading partner's production cost. A dummy regression will also be examined to test the positive and negative effects of BCI by Equation (4.3).

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta y_t{}^j + \epsilon_t^j \tag{4.1}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^{Mj} + c^j \Delta y_t{}^j + \epsilon_t^j \tag{4.4}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=1}^{4} b_i^j \Delta w_{t-i}^j + c^{j(-)} BCI^{j(-)} + c^{j(+)} BCI^{j(+)} + \epsilon_t^j \tag{4.3}$$

Since the Directorate-General Economic and Financial Affairs (DGEFA) only provides the Eurozone BCI but not at a country level, the variable BCI_UK is constructed by using the survey data from DGEFA. BCI_UK is calculated by (Q2 - Q4 + Q5) / 3,

where Q2=Assessment of order-book levels,

Q4=Assessment of stocks of finished products,

Q5=Production expectations for the months ahead.

Setting $y_t = \text{BCI\_Euro}_t$ and $y_t = \text{BCI\_UK}_t$, following regressions will be tested:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \mathit{BCI\_Euro}_t{}^j + \epsilon_t^j \tag{4.1}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^{Mj} + c^j \mathit{BCI\_Euro}_t{}^j + \epsilon_t^j \tag{4.4}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \mathit{BCI\_UK}_t{}^j + \epsilon_t^j \tag{4.1}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^{Mj} + c^j \mathit{BCI\_UK}_t{}^j + \epsilon_t^j \tag{4.4}$$

Dummy variables are also used for testing the effects of negative and positive BCI (BCI_Euro, BCI_UK) on the import prices changes based on the following equations:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=1}^{4} b_i^j \Delta w_{t-i}^j + c^{j(-)} \text{BCI\_Euro}^{j(-)} + c^{j(+)} \text{BCI\_Euro}^{j(+)} + \epsilon_t^j \tag{4.3}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=1}^{4} b_i^j \Delta w_{t-i}^j + c^{j(-)} BCI\_UK^{j(-)} + c^{j(+)} BCI\_UK^{j(+)} + \epsilon_t^j \quad (4.3)$$

4.4.1.5.1. Euro Zone BCI

Setting $y_t = BCI\_Euro_t$, and the following regression equations will be run:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta BCI\_Euro_t{}^j + \epsilon_t^j \quad (4.1)$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^{Mj} + c^j \Delta BCI\_Euro_t{}^j + \epsilon_t^j \quad (4.4)$$

In the equation, w_t^j denotes the situation where the exporter is more competitive in the industry, in other words, where the macroeconomic environment is less dominant on exporting producers' cost than the industry condition. w_t^{Mj} denotes the situation where the exporter is less competitive in the industry, in other words, where the macroeconomic environment is more dominant on exporting producers' cost than the industry condition.

Table 52 to 54 demonstrate the regression results of the exchange rate pass-through for the UK when using BCI_Euro to explore the domestic demand condition. Table 52 presents the regression result from Equation (4.1) and Table 53 presents the regression result from Equation (4.4). Table 54 presents the regression result for testing the effects of negative and positive BCI_Euro with a dummy variable.

Table 52: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Equation (4.1))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate	0.148***	0.135**	0.113***	0.0731	0.00615	-0.0588
(Short run elasticity a_0^j)	+++	+++	+++	+++	+++	+++
	(0.0445)	(0.0554)	(0.0415)	(0.0584)	(0.0498)	(0.0444)
Exchange Rate(-1)	0.0128	0.0195	0.0209	0.0228	-0.00592	-0.0398
	(0.0465)	(0.0545)	(0.0471)	(0.0517)	(0.0548)	(0.0485)
Exchange Rate(-2)	0.0249	-0.00252	0.0343	-0.0322	0.00724	0.0142
	(0.0504)	(0.0687)	(0.0505)	(0.0645)	(0.0601)	(0.0560)
Exchange Rate(-3)	-0.0352	-0.0164	-0.0152	-0.0324	-0.00698	0.0122
	(0.0413)	(0.0617)	(0.0415)	(0.0573)	(0.0522)	(0.0519)
Exchange Rate(-4)	-0.0395	-0.0780	-0.0382	-0.0819	-0.0479	-0.0183
	(0.0358)	(0.0488)	(0.0393)	(0.0567)	(0.0457)	(0.0520)
Long run elasticity	0.111	0.05758	0.1148*	-0.0506	-0.04741	-0.0905
	+++	+++	+++	+++	+++	+++
($\sum_{i=0}^{4} a_i^j$)						
Wage	0.575***	0.726***	0.612***	0.721***	0.920***	1.012***
	(0.0704)	(0.0904)	(0.0623)	(0.0869)	(0.0373)	(0.00858)
Wage(-1)	-0.0446	-0.0553	-0.0834	-7.31e-05	-0.0126	0.0133*
	(0.0591)	(0.0742)	(0.0591)	(0.0697)	(0.0351)	(0.00783)
Wage(-2)	-0.0327	0.0429	-0.0462	0.0422	0.0407	0.00289
	(0.0500)	(0.0595)	(0.0660)	(0.0669)	(0.0326)	(0.00801)
Wage(-3)	0.0458	0.0115	-0.0111	0.0948	0.0245	0.0118
	(0.0551)	(0.0657)	(0.0675)	(0.0863)	(0.0296)	(0.0105)
Wage(-4)	0.0368	0.0964	0.0794	0.0600	0.0533*	-0.00593
	(0.0649)	(0.0671)	(0.0624)	(0.0812)	(0.0306)	(0.00946)
BCI_Euro	-0.00336*	-0.00147	-0.00498***	-0.00490**	-0.00172	-0.00846**
	(0.00175)	(0.00241)	(0.00183)	(0.00232)	(0.00275)	(0.00319)
Constant	-0.00118	-0.00169	-0.00156*	-0.00201	-0.00306***	-0.00358***
	(0.000820)	(0.00108)	(0.000848)	(0.00172)	(0.00110)	(0.00109)
Observations	71	71	71	71	71	71
R^2	0.827	0.863	0.823	0.808	0.941	0.996
Adjusted R^2	0.795	0.838	0.790	0.772	0.930	0.995
F	24.60	33.43	27.67	15.98	120.2	2183
Jarque-Bera	0.8590	0.1989	0.9087	0.6392	0.6567	0.9539

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

Table 53: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Manufacture Cost, Equation (4.4))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.148*** +++	0.330*** +++	0.197*** +++	0.389*** +++	0.329 +++	0.360
	(0.0445)	(0.0830)	(0.0571)	(0.101)	(0.218)	(0.778)
Exchange Rate(-1)	0.0128	0.0467	-0.0538	0.119	0.124	0.764
	(0.0465)	(0.0818)	(0.0601)	(0.0876)	(0.175)	(0.786)
Exchange Rate(-2)	0.0249	0.0102	0.0203	-0.100	0.153	1.121
	(0.0504)	(0.0937)	(0.0626)	(0.0867)	(0.175)	(0.721)
Exchange Rate(-3)	-0.0352	-0.0467	-0.0434	-0.0352	-0.209	-0.185
	(0.0413)	(0.0753)	(0.0635)	(0.0833)	(0.189)	(0.660)
Exchange Rate(-4)	-0.0395	-0.0948	0.0195	-0.116	-0.125	0.0534
	(0.0358)	(0.0749)	(0.0635)	(0.0815)	(0.194)	(0.658)
Long run elasticity ($\sum_{i=0}^{4} a_i^j$)	0.111 +++	0.17927 +++	0.16366* +++	0.199 +++	0.2604 +++	1.486
Wage_M	0.575***	0.516***	0.372***	-0.125	0.493*	0.0700
	(0.0704)	(0.113)	(0.0994)	(0.137)	(0.268)	(1.111)
Wage(-1)	-0.0446	-0.0990	0.0919	0.101	0.0305	0.364
	(0.0591)	(0.118)	(0.0870)	(0.143)	(0.277)	(1.250)
Wage(-2)	-0.0327	0.0550	-0.0493	0.0172	-0.237	-1.484
	(0.0500)	(0.113)	(0.0923)	(0.114)	(0.300)	(0.965)
Wage(-3)	0.0458	0.0761	0.0121	0.151	0.260	-0.687
	(0.0551)	(0.101)	(0.0914)	(0.122)	(0.306)	(0.967)
Wage(-4)	0.0368	0.0802	0.0329	0.0779	0.146	0.413
	(0.0649)	(0.0932)	(0.0961)	(0.0838)	(0.252)	(1.065)
BCI_Euro	-0.00336*	0.00424	-0.00724***	-0.00585**	0.0250***	0.141***
	(0.00175)	(0.00348)	(0.00243)	(0.00268)	(0.00795)	(0.0341)
Constant	-0.00118	0.000978	-0.00183	0.00586***	0.00369	0.0249
	(0.000820)	(0.00149)	(0.00133)	(0.00177)	(0.00355)	(0.0170)
Observations	71	71	71	71	71	71
R^2	0.827	0.662	0.683	0.557	0.322	0.285
Adjusted R^2	0.795	0.599	0.624	0.474	0.195	0.152
F	24.60	13.83	12.31	9.629	2.944	2.368
Jarque-Bera	0.8590	0.3579	0.0366	0.4995	0.2307	0.9834

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

Regression with a Dummy Variable for BCI_Euro

Table 54：Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Dummy Regression, BCI Euro)

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Negative BCI_Euro	0.00614***	0.00856***	0.00541***	0.00699***	0.00982***	0.00897***
	(0.00143)	(0.00138)	(0.00148)	(0.00180)	(0.00152)	(0.00198)
Positive BCI_Euro	-0.000407	0.000491	-0.00157	-0.000999	-0.00335	-0.00373
	(0.00162)	(0.00216)	(0.00182)	(0.00190)	(0.00264)	(0.00247)
Exchange Rate (Short run elasticity a_0^j)	0.171***	0.181***	0.127***	0.0869	0.0478	0.0278
	(0.0392)	(0.0456)	(0.0378)	(0.0525)	(0.0350)	(0.0389)
Exchange Rate(-1)	0.0424	0.0725	0.0484	0.0535	0.0422	0.00910
	(0.0389)	(0.0435)	(0.0427)	(0.0492)	(0.0361)	(0.0410)
Exchange Rate(-2)	0.0749*	0.0836*	0.0739	0.0355	0.0892*	0.0794
	(0.0407)	(0.0452)	(0.0443)	(0.0613)	(0.0461)	(0.0515)
Exchange Rate(-3)	0.00721	0.0361	0.0280	-0.0107	0.0380	0.0402
	(0.0368)	(0.0436)	(0.0432)	(0.0585)	(0.0415)	(0.0479)
Exchange Rate(-4)	0.0287	0.0204	0.0127	-0.0300	0.0415	0.0791
	(0.0304)	(0.0368)	(0.0394)	(0.0653)	(0.0451)	(0.0626)
	0.597***	0.696***	0.674***	0.809***	0.908***	0.993***
	(0.0496)	(0.0521)	(0.0595)	(0.0821)	(0.0278)	(0.00845)
Wage(-1)	-0.0330	-0.0811	-0.0674	-0.0213	-0.0474	-0.00408
	(0.0459)	(0.0488)	(0.0609)	(0.0710)	(0.0300)	(0.00729)
Wage(-2)	-0.0373	0.00904	-0.0454	0.0349	-0.00598	-0.00207
	(0.0405)	(0.0414)	(0.0613)	(0.0677)	(0.0289)	(0.00654)
Wage(-3)	0.00728	-0.0179	-0.0598	0.101	0.0220	0.0104
	(0.0467)	(0.0458)	(0.0649)	(0.0810)	(0.0242)	(0.00816)
Wage(-4)	0.0507	0.105**	0.0995*	0.125	0.0909***	0.00915
	(0.0521)	(0.0437)	(0.0555)	(0.0768)	(0.0248)	(0.00878)
Constant	0.000761	0.00153	0.000345	-0.000867	0.00177	0.000967
	(0.000964)	(0.000984)	(0.00113)	(0.00184)	(0.00122)	(0.00147)
Observations	71	71	71	71	71	71
R^2	0.878	0.928	0.841	0.843	0.966	0.997
Adjusted R^2	0.853	0.914	0.808	0.810	0.959	0.996
F	33.98	75.26	19.77	19.97	159.1	1640
Jarque-Bera	0.3248	0.2347	0.8036	0.8779	0.5989	0.3042

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

4.4.1.5.2. UK Business Confidence Indicator

Setting $y_t = BCI\_UK_t$, and the following regression equations will be run:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta BCI\_UK_t{}^j + \epsilon_t^j \tag{4.1}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^{Mj} + c^j \Delta BCI\_UK_t{}^j + \epsilon_t^j \tag{4.4}$$

In the equation, w_t^j denotes the situation where the exporter is more competitive in the industry, in other words, where the macroeconomic environment is less dominant on exporting producers' cost than the industry condition. w_t^{Mj} denotes the situation where the exporter is less competitive in the industry, in other words, where the macroeconomic environment is more dominant on exporting producers' cost than the industry condition.

Table 55 to 57 demonstrate the regression results of the exchange rate pass-through for the UK when using BCI_UK to explore domestic demand condition. Table 55 presents the regression result from Equation (4.1) and Table 56 presents the regression result from Equation (4.4). Table 57 presents the regression result for testing the effects of negative and positive BCI_UK with a dummy variable.

Table 55: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Equation (4.1))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate	0.159***	0.144**	0.122***	0.0867	0.0222	-0.0317
(Short run elasticity a_0^j)	+++	+++	+++	+++	+++	+++
	(0.0455)	(0.0566)	(0.0407)	(0.0567)	(0.0479)	(0.0427)
Exchange Rate(-1)	0.0225	0.0244	0.0339	0.0323	0.00336	-0.0227
	(0.0469)	(0.0541)	(0.0508)	(0.0540)	(0.0553)	(0.0538)
Exchange Rate(-2)	0.0233	-0.00316	0.0350	-0.0389	0.0102	0.0183
	(0.0531)	(0.0702)	(0.0548)	(0.0710)	(0.0614)	(0.0642)
Exchange Rate(-3)	-0.0256	-0.0151	0.00393	-0.0198	-0.0138	0.0241
	(0.0456)	(0.0644)	(0.0454)	(0.0591)	(0.0546)	(0.0579)
Exchange Rate(-4)	-0.0410	-0.0813	-0.0432	-0.0943	-0.0528	-0.0260
	(0.0361)	(0.0496)	(0.0389)	(0.0570)	(0.0455)	(0.0547)
Long run elasticity	0.1382**	0.06884	0.15163**	-0.034	-0.03084	-0.038
	+++	+++	+++	+++	+++	+++
($\sum_{i=0}^{4} a_i^j$)						
Wage_M	0.562***	0.716***	0.609***	0.705***	0.906***	1.004***
	(0.0742)	(0.0936)	(0.0659)	(0.0912)	(0.0381)	(0.00863)
Wage(-1)	-0.0514	-0.0582	-0.0923	0.00297	-0.0175	0.00839
	(0.0611)	(0.0756)	(0.0584)	(0.0713)	(0.0347)	(0.00735)
Wage(-2)	-0.0285	0.0439	-0.0490	0.0506	0.0393	0.00425
	(0.0482)	(0.0594)	(0.0646)	(0.0660)	(0.0339)	(0.00803)
Wage(-3)	0.0387	0.0136	-0.0302	0.0949	0.0330	0.0132
	(0.0540)	(0.0646)	(0.0716)	(0.0880)	(0.0311)	(0.0120)
Wage(-4)	0.0320	0.0992	0.0801	0.0734	0.0585*	-0.00163
	(0.0652)	(0.0675)	(0.0640)	(0.0833)	(0.0300)	(0.00973)
BCI_UK	-0.000163	-5.88e-05	-0.000246	-0.000281	5.77e-05	-0.000279
	(0.000151)	(0.000168)	(0.000154)	(0.000171)	(0.000203)	(0.000212)
Constant	-0.00111	-0.00166	-0.00151*	-0.00211	-0.00308***	-0.00356***
	(0.000839)	(0.00107)	(0.000859)	(0.00166)	(0.00109)	(0.00111)
Observations	71	71	71	71	71	71
R^2	0.821	0.863	0.809	0.800	0.941	0.996
Adjusted R^2	0.787	0.837	0.774	0.763	0.930	0.995
F	23.38	36.60	19.21	17.90	119.7	2049
Jarque-Bera	0.8019	0.1587	0.9025	0.2369	0.5675	0.6770

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

Table 56: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Manufacture Cost, Equation (4.2))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate	0.159***	0.316***	0.221***	0.390***	0.296	0.133
(Short run elasticity a_0^j)	+++	+++	+++	+++	+++	
	(0.0455)	(0.0801)	(0.0587)	(0.104)	(0.210)	(0.825)
Exchange Rate(-1)	0.0225	0.0346	-0.0335	0.130	0.0697	0.441
	(0.0469)	(0.0812)	(0.0616)	(0.0809)	(0.197)	(0.797)
Exchange Rate(-2)	0.0233	0.0124	0.0163	-0.109	0.182	1.270*
	(0.0531)	(0.0934)	(0.0653)	(0.0864)	(0.182)	(0.696)
Exchange Rate(-3)	-0.0256	-0.0591	-0.0215	-0.00578	-0.317	-0.767
	(0.0456)	(0.0785)	(0.0687)	(0.0820)	(0.201)	(0.740)
Exchange Rate(-4)	-0.0410	-0.0930	0.0166	-0.115	-0.125	0.0640
	(0.0361)	(0.0753)	(0.0656)	(0.0772)	(0.196)	(0.670)
Long run elasticity	0.1382**	0.14823	0.221**	0.2183	0.1337	
	+++	+++	+++	+++	+++	0.768
($\sum_{i=0}^{4} a_i^j$)						
Wage_M	0.562***	0.533***	0.345***	-0.141	0.570**	0.517
	(0.0742)	(0.111)	(0.103)	(0.136)	(0.255)	(1.144)
Wage(-1)	-0.0514	-0.0902	0.0768	0.0853	0.0919	0.703
	(0.0611)	(0.116)	(0.0896)	(0.131)	(0.296)	(1.209)
Wage(-2)	-0.0285	0.0495	-0.0392	0.0354	-0.299	-1.813*
	(0.0482)	(0.119)	(0.0912)	(0.111)	(0.320)	(1.045)
Wage(-3)	0.0387	0.0851	-0.00323	0.138	0.317	-0.372
	(0.0540)	(0.106)	(0.0923)	(0.117)	(0.307)	(0.956)
Wage(-4)	0.0320	0.0864	0.0217	0.0606	0.208	0.741
	(0.0652)	(0.0938)	(0.103)	(0.0846)	(0.257)	(0.985)
BCI_UK	-0.000163	0.000211	-0.000377*	-0.000538**	0.00194***	0.0104***
	(0.000151)	(0.000258)	(0.000213)	(0.000256)	(0.000696)	(0.00313)
Constant	-0.00111	0.000884	-0.00166	0.00613***	0.00273	0.0198
	(0.000839)	(0.00154)	(0.00138)	(0.00167)	(0.00365)	(0.0170)
Observations	71	71	71	71	71	71
R^2	0.821	0.657	0.655	0.563	0.312	0.246
Adjusted R^2	0.787	0.593	0.591	0.481	0.184	0.105
F	23.38	13.96	9.926	9.004	2.862	1.920
Jarque-Bera	0.8019	0.3450	0.2450	0.5634	0.0302	0.9921

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

Regression with a Dummy Variable for BCI_UK

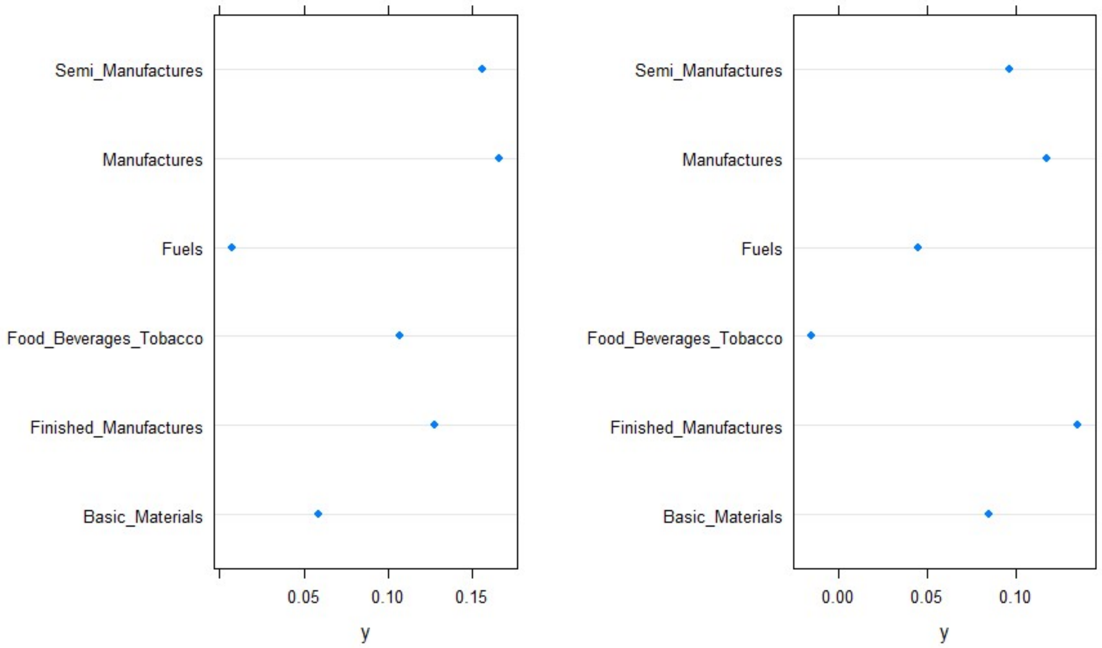
Table 57: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Dummy Regression, BCI_UK)

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Negative BCI_UK	0.000441***	0.000638***	0.000319*	0.000425**	0.000840***	0.000456*
	(0.000145)	(0.000169)	(0.000162)	(0.000206)	(0.000233)	(0.000267)
Positive BCI_UK	0.000110	4.55e-05	0.000160	3.04e-05	-0.000198	0.000222
	(0.000174)	(0.000198)	(0.000190)	(0.000242)	(0.000239)	(0.000282)
Exchange Rate	0.180***	0.172***	0.137***	0.0955*	0.0382	0.00677
(Short run elasticity a_0^j)						
	(0.0377)	(0.0443)	(0.0420)	(0.0495)	(0.0400)	(0.0446)
Exchange Rate(-1)	0.0466	0.0697	0.0562	0.0621	0.0461	-0.000518
	(0.0393)	(0.0472)	(0.0427)	(0.0524)	(0.0438)	(0.0469)
Exchange Rate(-2)	0.0845*	0.0785	0.0805*	0.0276	0.105**	0.0796
	(0.0426)	(0.0497)	(0.0461)	(0.0617)	(0.0508)	(0.0538)
Exchange Rate(-3)	-0.00286	0.0202	0.0208	-0.0245	0.0429	0.0338
	(0.0412)	(0.0474)	(0.0457)	(0.0570)	(0.0469)	(0.0507)
Exchange Rate(-4)	0.0124	-0.0120	0.000221	-0.0594	0.0235	0.0378
Wage	(0.0429)	(0.0489)	(0.0474)	(0.0619)	(0.0485)	(0.0557)
	0.568***	0.702***	0.634***	0.758***	0.897***	0.996***
Wage(-1)	(0.0605)	(0.0581)	(0.0667)	(0.0835)	(0.0307)	(0.00916)
	-0.0499	-0.0860	-0.0984	-0.0315	-0.0539	0.00120
Wage(-2)	(0.0630)	(0.0608)	(0.0669)	(0.0850)	(0.0342)	(0.0103)
	-0.0529	0.0172	-0.0556	0.0263	-0.0135	0.00415
Wage(-3)	(0.0622)	(0.0589)	(0.0664)	(0.0859)	(0.0342)	(0.00953)
	0.0217	0.00161	-0.0583	0.126	0.0271	0.0150
Wage(-4)	(0.0631)	(0.0594)	(0.0671)	(0.0827)	(0.0313)	(0.00936)
	0.0406	0.113*	0.0804	0.103	0.0842**	0.00634
Constant	-.0001401	.0005957	-.0012379	-.0015673	.0012944	-.0029854
	(0.0597)	(0.0569)	(0.0645)	(0.0802)	(0.0317)	(0.00953)
Observations	71	71	71	71	71	71
R^2	0.849	0.893	0.821	0.810	0.953	0.996
Adjusted R^2	0.818	0.871	0.784	0.771	0.943	0.995
F	27.19	40.48	22.20	20.63	96.95	1186
Jarque-Bera	0.4951	0.6975	0.9132	0.7487	0.9696	0.8519

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

4.4.2. Summary

Figure 18: Scatter Plot of the Short Run and the Long run Exchange Rate Pass-through of the UK (GDP Measure)



(Left hand side shows short run elasticity, and right-hand side shows long run elasticity)

Table 58: Estimated Coefficients of Domestic Demand Condition for Disaggregated Import Sector (Six Measurements)

Domestic Demand Measure	MAN	SMAN	FMAN	FBT	BM	Fuels
GDP	-0.169	0.129	-0.181	0.191	0.525**	0.29
GDP^{M}	-0.169	0.177	-0.320	-0.294	2.226***	10.19**
IMP	-0.0169	0.0801	-0.0257	0.0301	0.136	0.00377
IMP^{M}	-0.0169	0.188*	-0.0592	-0.0760	0.913***	4.076**
GDP_gr	6.21E-05	0.00146	0.000825	0.00187	0.00299	0.00257
GDP_gr^{M}	6.21e-05	-7.43e-05	0.000948	-0.000356	0.00259	0.0124
IMP_gr	0.000427	0.000954	0.000435	-0.00014	-0.000417	-0.00196
IMP_gr^{M}	0.000427	0.00162	0.00148	0.00274	0.00109	0.0209
BCI	-0.00336*	-0.00147	-0.00498***	-0.00490**	-0.00172	-0.00846**
BCI^{M}	-0.00336*	0.00424	-0.00724***	-0.00585**	0.0250***	0.141***
BCI_UK	-0.000163	-5.88E-05	-0.000246	-0.000281	5.77E-05	-0.000279
BCI_UK^{M}	-0.000163	0.000211	-0.000377*	-0.000538**	0.00194***	0.0104***

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
Superscript ^{M} denotes the results computed when using the general macroeconomic production cost in the market if macroeconomic condition is more dominant in production costs, while no scripts denotes the results computed when using the industry-specific production cost if industry condition is more dominant in production costs.

Table 59: Adjusted R^2 of the Estimated Regressions for Disaggregated Import Sector (Six Measurements)

Domestic Demand Measure	MAN	SMAN	FMAN	FBT	BM	Fuels
GDP	0.787	0.838	0.769	0.758	0.937	0.995
GDP^M	0.787	0.591	0.582	0.458	0.201	0.0666
IMP	0.783	0.839	0.765	0.755	0.932	0.995
IMP^M	0.783	0.603	0.570	0.452	0.183	0.0344
GDP_gr	0.784	0.855	0.729	0.732	0.944	0.994
GDP_gr^M	0.784	0.591	0.463	0.380	0.210	-0.0253
IMP_gr	0.783	0.869	0.762	0.812	0.942	0.993
IMP_gr^M	0.783	0.591	0.445	0.602	0.123	-0.0660
BCI	0.827	0.863	0.823	0.808	0.941	0.996
BCI^M	0.795	0.599	0.624	0.474	0.195	0.152
BCI_UK	0.878	0.928	0.841	0.843	0.966	0.997
BCI_UK^M	0.787	0.593	0.591	0.481	0.184	0.105

Superscript ^{M} denotes the results computed when using the general macroeconomic production cost in the market if macroeconomic condition is more dominant in production costs, while no scripts denotes the results computed when using the industry-specific production cost if industry condition is more dominant in production costs.

Table 58 shows the estimated coefficient for the different domestic demand condition at six measurements: GDP, IMP, GDP growth rate, IMP growth rate, BCI and BCI_UK. As shown in Table 58, GDP growth rate and IMP growth rate seem not to be efficient indicators when compared with the rest of four indicators in terms of significance of the estimated coefficients, while BCI and UK BCI gives the most significant estimation results.

Table 59 illustrates the adjusted R^2 of all estimated regressions. Firstly, the estimation from the industry specific producer cost has lower adjusted R^2 by a small amount than the general macro environment producer cost. This could be expected from the structure of the wage variable, hence, this may not be a good criterion to make the judgements of which wage measure is better. Secondly, the adjusted R^2 is extremely low for fuels, which indicates the failure of the model to estimate the fuels industry. There may be some missing variables in the estimation regression for fuels.

Table 60: UK Short run Elasticity for the Disaggregated Import Sectors

Domestic Demand Measure	MAN	SMAN	FMAN	FBT	BM	Fuels
GDP	0.1660***+++	0.1560***+++	0.128***+++	0.107*+++	0.0594+++	0.00749+++
GDP^M	0.166***+++	0.306*** +++	0.238*** +++	0.420***+++	0.224+++	-0.310
IMP	0.1690***	0.1640***+++	0.130***+++	0.103+++	0.0448+++	-0.0134+++
IMP^M	0.169***+++	0.325***+++	0.240***+++	0.420***+++	0.273+++	-0.100
GDP_gr	0.1230***+++	0.1320**+++	0.0846*+++	0.0648+++	0.0305+++	-0.0117+++
GDP_gr^M	0.123***+++	0.259***+++	0.191**+++	0.396***+++	0.241+++	0.292
IMP_gr	0.1730***+++	0.1310*+++	0.157**+++	0.266***+++	0.0883+++	0.0474+++
IMP_gr^M	0.173***+++	0.356***+++	0.240***+++	0.556***+++	0.332	0.523
BCI	0.1480***+++	0.1350**+++	0.113***+++	0.0731+++	0.00615+++	-0.0588+++
BCI^M	0.148***+++	0.330***+++	0.197***+++	0.389***+++	0.329+++	0.360
BCI_UK	0.1590***+++	0.1440**+++	0.122***+++	0.0867+++	0.0222+++	-0.0317
BCI_UK^M	0.159***+++	0.316***+++	0.221***+++	0.390***+++	0.296+++	0.133
Macroeconomic condition dominates in production costs (Average#)	0.1563	0.1437	0.1224	0.1168	0.0419	-0.0101
Industry condition dominates in production costs (Average#)	0.1563	0.3467	0.1993	0.4122	0.2883	0.0557

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Superscript ^{M} denotes the results computed when using the general macroeconomic production cost in the market if macroeconomic condition is more dominant in production costs, while no scripts denotes the results computed when using the industry-specific production cost if industry condition is more dominant in production costs.

Table 61: UK Long run Elasticity for the Disaggregated Import Sectors

Domestic Demand Measure	MAN	SMAN	FMAN	FBT	BM	Fuels
GDP	0.1174* +++	0.09585+++	0.1344**+++	-0.0149+++	0.084456+++	0.04486+++
GDP^{M}	0.1174*+++	0.18306+++	0.1826**+++	0.1920+++	0.4759*++	2.018
IMP	0.142**+++	0.09862+++	0.1596**+++	-0.0366+++	0.00921+++	-0.0233+++
IMP^{M}	0.142**+++	0.1973+++	0.23675***+++	0.3723+++	0.3162+++	1.203
GDP_gr	0.07132+++	0.10111+++	0.0766+++	0.00565+++	0.14043*+++	0.08027+++
GDP_gr^{M}	0.07132+++	0.27135**+++	0.11435+++	0.2629*+++	0.823***	3.048*
IMP_gr	0.1875+++	0.1056+++	0.1403+++	0.24913*+++	0.1019+++	0.0204+++
IMP_gr^{M}	0.1875+++	0.0678+++	0.2144+++	0.39384*+++	0.5863+	2.1614
BCI	0.111+++	0.05758+++	0.1148*+++	-0.0506+++	-0.04741+++	-0.0905+++
BCI^{M}	0.111+++	0.17927+++	0.16366*+++	0.199+++	0.2604+++	1.486
BCI_UK	0.1382**+++	0.06884+++	0.15163**+++	-0.034+++	-0.03084+++	-0.038+++
BCI_UK^{M}	0.1382**+++	0.14823+++	0.221**+++	0.2183+++	0.1337+++	0.768
Macroeconomic condition dominates in production costs (Average#)	0.7674	0.5276	0.7773	0.1187	0.2577	-0.0063
Industry condition dominates in production costs (Average#)	0.7674	1.0470	1.1328	1.6383	2.5955	10.6844

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Superscript ^{M} denotes the results computed when using the general macroeconomic production cost in the market if macroeconomic condition is more dominant in production costs, while no scripts denotes the results computed when using the industry-specific production cost if industry condition is more dominant in production costs.

Table 60 demonstrates the estimated results of the short run elasticity and Table 61 demonstrates the estimated results of the long run elasticity. The short run elasticity of manufacture is estimated at a value around 16% in the sample from 1998 to 2017. The findings show that both the short run and long run exchange rate pass-through appears to be higher when using the cost variable, thus, reflecting the macroeconomic environment production cost, rather than, the industry-specific production cost, for all six different industry sectors. Out of all six industries studied, semi-manufacture has the highest exchange rate pass-through. The highest value of it occurs when using the macro production cost instead of using industry-specific production cost. This may imply that exporters are more flexible in adjusting their product prices when macro production cost dominates in production according to the finding that macroeconomic environment relates to a higher exchange rate pass-though. This is also consistent with the assumption that exporters are more competitive in the market under this situation.

Table 62: LCP PCP Tests for the Short run Elasticity

Domestic Demand Measure	Wald Test	MAN	SMAN	FMAN	FBT	BM	Fuels
GDP	LCP					✓	✓
	PCP						
GDP^{M}	LCP					✓	✕
	PCP						
IMP	LCP				✓	✓	✓
	PCP						
IMP^{M}	LCP					✓	✕
	PCP						
GDP_gr	LCP				✓	✓	✓
	PCP						
GDP_gr^{M}	LCP					✓	
	PCP						
IMP_gr	LCP					✓	✓
	PCP						
IMP_gr^{M}	LCP					✕	✕
	PCP						
BCI	LCP				✓	✓	✓
	PCP						
BCI^{M}	LCP					✓	✕
	PCP						
BCI_UK	LCP				✓	✓	✕
	PCP						
BCI_UK^{M}	LCP					✓	✕
	PCP						

Notes: The mark of '✓' denotes the case when LCP is not rejected and PCP is rejected. The mark of '✕' denotes the case when LCP is not rejected and PCP is not rejected. The mark of '*' denotes the case when LCP is rejected and PCP is not rejected. Superscript ^{M} denotes the results computed when using the general macroeconomic production cost in the market if macroeconomic condition is more dominant in production costs, while no scripts denotes the results computed when using the industry-specific production cost if industry condition is more dominant in production costs.

Table 63: UK Long run Elasticity for the Disaggregated Import Sectors

Domestic Demand Measure	Wald Test	MAN	SMAN	FMAN	FBT	BM	Fuels
GDP	LCP		✓		✓	✓	✓
	PCP						
GDP	LCP		✓		✓		
	PCP						
IMP	LCP		✓		✓	✓	✓
	PCP						
IMP	LCP		✓		✓	✓	
	PCP						
GDP_gr	LCP	✓	✓	✓	✓		✓
	PCP						
GDP_gr	LCP	✓		✓			
	PCP					*	*
IMP_gr	LCP	✓	✓	✓		✓	✓
	PCP						
IMP_gr	LCP	✓	✓	✓		✓	
	PCP						
BCI	LCP	✓	✓		✓	✓	✓
	PCP						
BCI	LCP	✓	✓		✓	✓	
	PCP						
BCI_UK	LCP		✓		✓	✓	✓
	PCP						
BCI_UK	LCP		✓		✓	✓	
	PCP						

Notes: The mark of '✓' denotes the case when LCP is not rejected and PCP is rejected. The mark of '✕' denotes the case when LCP is not rejected and PCP is not rejected. The mark of '*' denotes the case when LCP is rejected and PCP is not rejected. Superscript ^{M} denotes the results computed when using the general macroeconomic production cost in the market if macroeconomic condition is more dominant in production costs, while no scripts denotes the results computed when using the industry-specific production cost if industry condition is more dominant in production costs.

Table 62 shows the results of LCP and PCP tests for the short run elasticity of exchange rate while Table 63 gives the results of LCP and PCP tests for the long run elasticity.

As shown in table 62, in the importing sectors of MAN, SMAN, FMAN, and FBT, neither LCP or PCP hold in the short run, however, the short run exchange rate pass-through is in the between of LCP and PCP. For BM and fuels, it can be seen that LCP takes place in the short run. Table 63 shows the long run exchange rate elasticity lies between 0 and 1 in MAN and

FMAN sector for most of the cases. This interprets neither LCP nor PCP takes place in those two sectors. While LCP takes place in SMAN and FBT in the long run.

4.5. Determinants of Exchange Rate Pass-through

To explore the determinants of exchange rate pass-through, the following Equation (4.6) and (4.7) are used to estimate the impact of variable z_t on exchange rate pass-through:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \, \Delta e_{t-i}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \, \Delta w_{t-i}^j + c^j \Delta IMP_t^j + \epsilon_t^j \qquad (4.6)$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \, \Delta e_{t-i}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=1}^{4} b_i^j \, \Delta w_{t-i}^j + c^j \Delta IMP_t^j + \epsilon_t^j \qquad (4.7)$$

$z_{1t} = money\ growth_t,$

$z_{2t} = inflation_t,$

$z_{3t} = exvol_t,$

$z_{4t} = real\ gdp_t,$

$z_{5t} = C_t\ (central\ bank\ credibility)$

and

$money\ growth_t = \frac{Money\ Supply_t - Money\ Supply_{t-1}}{Money\ Supply_{t-1}},$

$Inflation_t = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}},$

$Exvol_t = aerage(\sum_{i=t-8}^{t-1} Var(nex_i)],$

$C_t = (\ Observed\ inflation_t - inflation\ target_t)^2$

The difference between equation (4.6) and (4.7) is that Δw_0^j is included in equation (4.6) and excluded in equation (4.7).

4.5.1. Estimation by Equation (4.6)

Table 64: Determinants of Exchange Rate Pass-Through Elasticity of UK's Manufacture Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
z	-0.0867*	0.0642**	0.0792	0.630*	0.0198
	(0.0493)	(0.0312)	(0.0574)	(0.339)	(0.0193)
z(-1)	-0.00546	0.000183	-0.0389	-0.193	-0.203
	(0.0808)	(0.0324)	(0.0472)	(0.178)	(0.276)
z(-2)	0.103	-0.0251	-0.0995*	-0.544**	-1.015***
	(0.0642)	(0.0357)	(0.0539)	(0.261)	(0.280)
z(-3)	0.0611	-0.0308	-0.125***	-0.310	-0.980***
	(0.0614)	(0.0423)	(0.0398)	(0.207)	(0.279)
z(-4)	0.0730*	-0.0408	-0.0902**	-0.297	-0.820***
	(0.0400)	(0.0382)	(0.0442)	(0.191)	(0.288)
Exchange Rate	0.278***	0.0511	0.0531	-2.707*	0.133***
	(0.0892)	(0.0640)	(0.0620)	(1.529)	(0.0454)
Exchange Rate(-1)	0.0537	0.0320	0.0359	0.0249	0.0425
	(0.128)	(0.0641)	(0.0681)	(0.0450)	(0.0398)
Exchange Rate(-2)	-0.124	0.0764	0.140*	0.0781	0.0560
	(0.109)	(0.0729)	(0.0788)	(0.0472)	(0.0415)
Exchange Rate(-3)	-0.104	0.0265	0.115*	0.0389	0.0249
	(0.111)	(0.0751)	(0.0625)	(0.0431)	(0.0332)
Exchange Rate(-4)	-0.163**	0.0180	0.0587	0.0170	-0.0199
	(0.0677)	(0.0857)	(0.0644)	(0.0385)	(0.0317)
Wage	0.591***	0.575***	0.627***	0.635***	0.635***
	(0.0676)	(0.0710)	(0.0590)	(0.0656)	(0.0578)
Wage(-1)	-0.0806	-0.0674	-0.0110	0.00619	-0.0434
	(0.0572)	(0.0609)	(0.0525)	(0.0559)	(0.0480)
Wage(-2)	-0.0272	-0.0119	-0.0294	-0.0252	-0.0126
	(0.0548)	(0.0489)	(0.0517)	(0.0524)	(0.0494)
Wage(-3)	0.0181	0.0352	0.0202	0.0262	0.0527
	(0.0599)	(0.0574)	(0.0584)	(0.0628)	(0.0557)
Wage(-4)	0.0739	0.0972	0.0675	0.0806	0.0966
	(0.0621)	(0.0627)	(0.0624)	(0.0717)	(0.0586)
imp	0.0384	0.0581	0.00542	-0.0204	0.0485
	(0.0810)	(0.0854)	(0.0863)	(0.0729)	(0.0685)
Constant	-0.00131*	-0.00128	-0.00109	0.00132	0.000122
	(0.000782)	(0.000787)	(0.000814)	(0.00108)	(0.000820)
Observations	70	71	71	71	71
R^2	0.848	0.852	0.871	0.864	0.891
Adjusted R^2	0.802	0.808	0.833	0.824	0.858
F	17.77	19.89	28.29	22.27	34.05
Jarque-Bera	0.2931	0.8613	0.0581	0.2524	0.0089

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money growth_t, inflation_t, exvol_t, real gdp_t, and C_t, respectively.

Table 65: Determinants of Exchange Rate Pass-Through Elasticity of UK's Semi-Manufacture Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
z	-0.0485	0.0306	0.0478	0.571	0.0261*
	(0.0576)	(0.0320)	(0.0545)	(0.376)	(0.0156)
z(-1)	-0.0363	0.00363	-0.0680	-0.315*	-0.232
	(0.0889)	(0.0356)	(0.0501)	(0.179)	(0.262)
z(-2)	0.137*	-0.0571	-0.124**	-0.580**	-1.183***
	(0.0811)	(0.0387)	(0.0564)	(0.284)	(0.356)
z(-3)	0.0725	-0.0173	-0.189***	-0.376*	-1.181***
	(0.0696)	(0.0410)	(0.0389)	(0.215)	(0.338)
z(-4)	0.107**	-0.0821**	-0.128***	-0.450*	-0.998***
	(0.0429)	(0.0356)	(0.0444)	(0.229)	(0.288)
Exchange Rate	0.208*	0.104	0.0847	-2.440	0.141***
	(0.108)	(0.0660)	(0.0645)	(1.690)	(0.0449)
Exchange Rate(-1)	0.116	0.0349	0.0800	0.0631	0.0751*
	(0.148)	(0.0678)	(0.0704)	(0.0560)	(0.0406)
Exchange Rate(-2)	-0.200	0.124	0.153*	0.0624	0.0474
	(0.146)	(0.0813)	(0.0863)	(0.0628)	(0.0501)
Exchange Rate(-3)	-0.0920	0.0241	0.220***	0.0819	0.0541
	(0.131)	(0.0801)	(0.0730)	(0.0580)	(0.0434)
Exchange Rate(-4)	-0.249***	0.0924	0.0815	0.0213	-0.0384
	(0.0752)	(0.0856)	(0.0733)	(0.0476)	(0.0368)
Wage	0.749***	0.723***	0.770***	0.773***	0.749***
	(0.0702)	(0.0704)	(0.0565)	(0.0603)	(0.0505)
Wage(-1)	-0.110*	-0.0747	-0.0534	-0.0402	-0.104**
	(0.0638)	(0.0578)	(0.0465)	(0.0517)	(0.0447)
Wage(-2)	0.0395	0.0315	0.0173	0.0372	0.0299
	(0.0626)	(0.0618)	(0.0486)	(0.0502)	(0.0531)
Wage(-3)	-0.00630	0.0171	-0.0215	-0.0221	0.0311
	(0.0651)	(0.0621)	(0.0498)	(0.0629)	(0.0430)
Wage(-4)	0.145**	0.138**	0.133***	0.109*	0.128***
	(0.0592)	(0.0587)	(0.0484)	(0.0564)	(0.0459)
imp	0.132	0.117	0.0682	0.0717	0.168**
	(0.0984)	(0.103)	(0.0906)	(0.0708)	(0.0716)
	-0.00188*	-0.00135	-0.00102	0.00206	0.000504
Constant	(0.000989)	(0.00103)	(0.000960)	(0.00133)	(0.000932)
Observations	70	71	71	71	71
R^2	0.887	0.892	0.918	0.908	0.928
Adjusted R^2	0.853	0.859	0.894	0.880	0.906
F	30.03	38.05	83.23	48.64	79.81
Jarque-Bera	0.8386	0.4190	0.0895	0.5161	0.8757

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money growth_t, inflation_t, exvol_t, real gdp_t, and C_t, respectively.

Table 66: Determinants of Exchange Rate Pass-Through Elasticity of UK's Finished-Manufacture Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
z	-0.0646	0.0575	0.0989	0.324	0.00696
	(0.0579)	(0.0346)	(0.0646)	(0.303)	(0.0230)
z(-1)	-0.0228	-0.00662	0.00394	-0.0786	-0.131
	(0.0692)	(0.0380)	(0.0525)	(0.203)	(0.320)
z(-2)	0.0878	-0.00857	-0.107*	-0.650***	-0.798***
	(0.0563)	(0.0304)	(0.0538)	(0.237)	(0.211)
z(-3)	0.0667	-0.0255	-0.106**	-0.261	-1.045***
	(0.0726)	(0.0495)	(0.0483)	(0.242)	(0.375)
z(-4)	0.0860	-0.0566	-0.0783	-0.425**	-1.020**
	(0.0567)	(0.0458)	(0.0531)	(0.212)	(0.384)
Exchange Rate	0.210**	0.0305	0.00238	-1.354	0.115**
	(0.0997)	(0.0672)	(0.0694)	(1.370)	(0.0494)
Exchange Rate(-1)	0.0816	0.0588	0.00661	0.0318	0.0479
	(0.114)	(0.0766)	(0.0781)	(0.0530)	(0.0452)
Exchange Rate(-2)	-0.0891	0.0523	0.151**	0.0967**	0.0584
	(0.101)	(0.0569)	(0.0682)	(0.0439)	(0.0379)
Exchange Rate(-3)	-0.0915	0.0471	0.111	0.0507	0.0529
	(0.119)	(0.0853)	(0.0772)	(0.0445)	(0.0386)
Exchange Rate(-4)	-0.171**	0.0530	0.0330	0.0212	-0.0214
	(0.0808)	(0.107)	(0.0879)	(0.0440)	(0.0397)
Wage	0.641***	0.626***	0.668***	0.705***	0.704***
	(0.0629)	(0.0659)	(0.0632)	(0.0665)	(0.0585)
Wage(-1)	-0.117*	-0.105	-0.0710	-0.0503	-0.0756
	(0.0635)	(0.0651)	(0.0667)	(0.0658)	(0.0637)
Wage(-2)	-0.0449	-0.0238	-0.0222	-0.0109	-0.0235
	(0.0678)	(0.0674)	(0.0674)	(0.0715)	(0.0676)
Wage(-3)	-0.0446	-0.0444	-0.0298	-0.0340	0.00401
	(0.0687)	(0.0645)	(0.0649)	(0.0727)	(0.0647)
Wage(-4)	0.0900	0.144**	0.0880	0.137*	0.141**
	(0.0667)	(0.0638)	(0.0647)	(0.0714)	(0.0622)
imp	0.0166	0.0405	0.0161	-0.0115	0.0511
	(0.0837)	(0.0897)	(0.0944)	(0.0797)	(0.0801)
	-0.00170**	-0.00165*	-0.00156*	0.00107	-0.000360
Constant	(0.000849)	(0.000841)	(0.000882)	(0.00125)	(0.000887)
Observations	70	71	71	71	71
R^2	0.830	0.834	0.852	0.848	0.863
Adjusted R^2	0.779	0.785	0.809	0.803	0.823
F	14.56	20.85	18.27	18.67	25.15
Jarque-Bera	0.5131	0.9026	0.1564	0.6454	0.7049

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable $\mathrm{z_t}$ and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by $\mathrm{money\ growth_t}$, $\mathrm{inflation_t}$, $\mathrm{exvol_t}$, $\mathrm{real\ gdp_t}$, and C_t, respectively.

Table 67: Determinants of Exchange Rate Pass-Through Elasticity of UK's Food & Beverages & Tobacco Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
z	-0.0392	0.0439	-0.0131	-0.0462	-0.0213
	(0.0729)	(0.0331)	(0.0625)	(0.545)	(0.0257)
z(-1)	0.00486	0.00115	-0.0252	-0.171	-0.357
	(0.0815)	(0.0326)	(0.0570)	(0.189)	(0.330)
z(-2)	0.121	-0.0500*	-0.158***	-0.590**	-1.013***
	(0.0756)	(0.0297)	(0.0583)	(0.224)	(0.226)
z(-3)	0.0892	-0.0555	-0.190***	-0.618**	-1.196***
	(0.0856)	(0.0442)	(0.0563)	(0.236)	(0.396)
z(-4)	0.0857	-0.0602	-0.112	-0.544***	-1.261***
	(0.0739)	(0.0398)	(0.0766)	(0.199)	(0.323)
Exchange Rate	0.141	0.0306	0.0794	0.325	0.158**
	(0.128)	(0.0616)	(0.0909)	(2.481)	(0.0614)
Exchange Rate(-1)	0.0482	0.0466	0.0214	0.0563	0.0768
	(0.129)	(0.0756)	(0.0789)	(0.0604)	(0.0497)
Exchange Rate(-2)	-0.189	0.0913	0.162*	0.0532	0.0396
	(0.123)	(0.0812)	(0.0904)	(0.0617)	(0.0548)
Exchange Rate(-3)	-0.150	0.0559	0.216**	0.0705	0.0538
	(0.156)	(0.0974)	(0.0931)	(0.0658)	(0.0591)
Exchange Rate(-4)	-0.220*	0.0165	0.0862	0.0197	-0.0465
	(0.115)	(0.0976)	(0.117)	(0.0628)	(0.0530)
Wage	0.750***	0.715***	0.823***	0.793***	0.744***
	(0.100)	(0.0795)	(0.0799)	(0.0718)	(0.0625)
Wage(-1)	-0.0437	-0.0404	0.00217	-0.0260	-0.0385
	(0.0875)	(0.0711)	(0.0641)	(0.0702)	(0.0682)
Wage(-2)	0.0318	0.0292	0.0334	0.0401	0.000308
	(0.0741)	(0.0678)	(0.0771)	(0.0754)	(0.0700)
Wage(-3)	0.0981	0.160*	0.0555	0.0774	0.0960
	(0.107)	(0.0902)	(0.0919)	(0.0884)	(0.0906)
Wage(-4)	0.109	0.118	0.0462	0.105	0.112
	(0.0943)	(0.0887)	(0.0838)	(0.0891)	(0.0871)
imp	0.0534	0.0795	-0.0182	0.0864	0.111
	(0.0972)	(0.107)	(0.105)	(0.0812)	(0.0865)
	-0.00258	-0.00227	-0.00158	0.00175	0.000398
Constant	(0.00179)	(0.00161)	(0.00176)	(0.00209)	(0.00176)
Observations	70	71	71	71	71
R^2	0.816	0.836	0.852	0.866	0.874
Adjusted R^2	0.760	0.787	0.808	0.827	0.836
F	15.67	20.13	21.79	25.08	36.36
Jarque-Bera	0.7566	0.0751	0.5318	0.5924	0.2916

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable $\mathrm{z_t}$ and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by $\mathrm{money\ growth_t}$, $\mathrm{inflation_t}$, $\mathrm{exvol_t}$, $\mathrm{real\ gdp_t}$, and C_t, respectively.

Table 68: Determinants of Exchange Rate Pass-Through Elasticity of UK's Basic Materials Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
z	0.00463	-0.00629	-0.0236	0.515	0.000716
	(0.0781)	(0.0329)	(0.0591)	(0.379)	(0.0222)
z(-1)	-0.0163	-0.00980	-0.0768	-0.212	-0.484
	(0.0908)	(0.0362)	(0.0525)	(0.189)	(0.397)
z(-2)	0.144*	-0.0596	-0.145***	-0.626**	-1.084***
	(0.0821)	(0.0369)	(0.0523)	(0.257)	(0.339)
z(-3)	0.0409	-0.0191	-0.222***	-0.637***	-1.064**
	(0.0733)	(0.0468)	(0.0551)	(0.211)	(0.400)
z(-4)	0.127**	-0.0862*	-0.0990*	-0.411*	-1.111***
	(0.0551)	(0.0433)	(0.0547)	(0.234)	(0.364)
Exchange Rate	0.0200	0.0583	0.0614	-2.260	0.0703
	(0.129)	(0.0612)	(0.0887)	(1.723)	(0.0616)
Exchange Rate(-1)	0.0404	0.0254	0.0601	0.0289	0.0460
	(0.150)	(0.0756)	(0.0785)	(0.0531)	(0.0431)
Exchange Rate(-2)	-0.201	0.151*	0.184**	0.0889	0.0662
	(0.137)	(0.0852)	(0.0822)	(0.0577)	(0.0499)
Exchange Rate(-3)	-0.0382	0.0385	0.274***	0.107**	0.0788*
	(0.124)	(0.0905)	(0.0810)	(0.0484)	(0.0452)
Exchange Rate(-4)	-0.222***	0.166*	0.105	0.0668	0.0148
	(0.0795)	(0.0991)	(0.0857)	(0.0499)	(0.0465)
Wage	0.897***	0.888***	0.922***	0.909***	0.910***
	(0.0324)	(0.0336)	(0.0302)	(0.0298)	(0.0316)
Wage(-1)	-0.0220	-0.0214	-0.0168	-0.0258	-0.0335
	(0.0332)	(0.0306)	(0.0275)	(0.0279)	(0.0308)
Wage(-2)	0.0264	0.00862	0.0113	0.0133	-0.00351
	(0.0367)	(0.0361)	(0.0303)	(0.0301)	(0.0308)
Wage(-3)	0.0242	0.0362	0.00441	0.0171	0.0152
	(0.0329)	(0.0311)	(0.0279)	(0.0294)	(0.0261)
Wage(-4)	0.0703*	0.0573*	0.0608**	0.0302	0.0435
	(0.0361)	(0.0318)	(0.0258)	(0.0279)	(0.0303)
imp	0.137	0.121	0.0439	0.141	0.189**
	(0.114)	(0.119)	(0.0988)	(0.0866)	(0.0913)
Constant	-0.00304***	-0.00193*	-0.00160*	0.00207	0.000206
	(0.00107)	(0.00108)	(0.000945)	(0.00146)	(0.00115)
Observations	70	71	71	71	71
R^2	0.949	0.952	0.962	0.961	0.961
Adjusted R^2	0.934	0.937	0.950	0.950	0.949
F	63.95	99.32	104.7	89.50	106.7
Jarque-Bera	0.9589	0.3640	0.1185	0.4334	0.4478

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money $growth_t$, $inflation_t$, $exvol_t$, real gdp_t, and C_t, respectively.

Table 69: Determinants of Exchange Rate Pass-Through Elasticity of UK's Fuel Import Prices

	(1)	(2)	(3)	(4)	(5)
DETERMINANTS (z)	Money Growth	Inflation	Exvol	Real GDP	Credibility
VARIABLES	Δp	Δp	Δp	Δp	Δp
z	0.0164	-0.0199	-0.0179	0.157	0.0145
	(0.0620)	(0.0335)	(0.0674)	(0.416)	(0.0236)
z(-1)	-0.0186	-0.0267	-0.00850	-0.0645	-0.179
	(0.0893)	(0.0424)	(0.0695)	(0.204)	(0.483)
z(-2)	0.0801	-0.0122	-0.193**	-0.662**	-1.005**
	(0.0815)	(0.0364)	(0.0750)	(0.296)	(0.415)
z(-3)	0.118	-0.0278	-0.209***	-0.696**	-1.422***
	(0.0938)	(0.0595)	(0.0621)	(0.297)	(0.532)
z(-4)	0.166***	-0.117**	-0.166**	-0.708***	-1.775***
	(0.0584)	(0.0483)	(0.0732)	(0.208)	(0.363)
Exchange Rate	-0.0538	0.0357	0.00750	-0.686	0.00695
	(0.113)	(0.0613)	(0.0838)	(1.885)	(0.0608)
Exchange Rate(-1)	0.00910	0.0334	-0.0294	0.00114	0.0155
	(0.136)	(0.105)	(0.101)	(0.0591)	(0.0493)
Exchange Rate(-2)	-0.0954	0.0556	0.225**	0.0978	0.0493
	(0.126)	(0.0958)	(0.0966)	(0.0660)	(0.0594)
Exchange Rate(-3)	-0.138	0.0749	0.264***	0.109**	0.106**
	(0.146)	(0.121)	(0.0863)	(0.0537)	(0.0515)
Exchange Rate(-4)	-0.248***	0.263**	0.190*	0.119**	0.0532
	(0.0861)	(0.116)	(0.108)	(0.0494)	(0.0530)
Wage	1.003***	0.995***	1.006***	0.994***	1.000***
	(0.00938)	(0.00901)	(0.00818)	(0.00763)	(0.00841)
Wage(-1)	0.00931	0.00485	0.00847	0.00845	0.00383
	(0.00754)	(0.00752)	(0.00776)	(0.00829)	(0.00959)
Wage(-2)	0.00699	0.00148	0.000579	0.00109	-0.00439
	(0.00820)	(0.00812)	(0.00771)	(0.00819)	(0.00961)
Wage(-3)	0.0123	0.0159	0.00229	0.00566	0.000278
	(0.0107)	(0.0110)	(0.00971)	(0.0103)	(0.0110)
Wage(-4)	-0.000958	-0.00269	-0.00141	-0.0101	-0.0128
	(0.00925)	(0.00950)	(0.00906)	(0.0105)	(0.00876)
imp	-0.00745	-0.00240	-0.0844	0.0388	0.0892
	(0.115)	(0.133)	(0.119)	(0.101)	(0.105)
Constant	-0.00394***	-0.00258**	-0.00217**	0.00209	0.000117
	(0.00117)	(0.00121)	(0.00107)	(0.00173)	(0.00138)
Observations	70	71	71	71	71
R^2	0.996	0.996	0.997	0.997	0.997
Adjusted R^2	0.995	0.995	0.996	0.996	0.996
F	1570	1858	2122	2464	2191
Jarque-Bera	0.5491	0.5997	0.4491	0.8882	0.5180

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money growth_t, $\mathrm{inflation}_t$, exvol_t, real gdp_t, and C_t, respectively.

4.5.2. Robustness Check (Estimation by Equation (4.7))

Table 70: Determinants of Exchange Rate Pass-Through Elasticity of UK's Manufacture Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
z	-0.102	0.122**	0.197*	1.395***	0.0534*
	(0.0813)	(0.0480)	(0.101)	(0.497)	(0.0305)
z(-1)	0.103	-0.0169	-0.0883	-0.135	-0.281
	(0.144)	(0.0395)	(0.0847)	(0.252)	(0.464)
z(-2)	0.0591	-0.0232	0.0482	-0.288	-1.040*
	(0.0835)	(0.0516)	(0.0889)	(0.351)	(0.531)
z(-3)	0.00956	-0.0234	-0.0152	0.0891	-0.203
	(0.0721)	(0.0457)	(0.0773)	(0.342)	(0.424)
z(-4)	0.0103	0.0531	-0.0405	0.321	0.194
	(0.0761)	(0.0557)	(0.0916)	(0.329)	(0.404)
Exchange Rate	0.527***	0.149	0.165	-5.967**	0.298***
	(0.138)	(0.111)	(0.122)	(2.253)	(0.0737)
Exchange Rate(-1)	-0.181	0.0103	0.0507	-0.0527	-0.0179
	(0.208)	(0.0900)	(0.120)	(0.0696)	(0.0654)
Exchange Rate(-2)	-0.0782	0.0579	-0.0368	0.0378	0.0321
	(0.131)	(0.125)	(0.142)	(0.0817)	(0.0837)
Exchange Rate(-3)	-0.102	-0.0585	-0.102	-0.0796	-0.0922
	(0.122)	(0.115)	(0.112)	(0.0823)	(0.0728)
Exchange Rate(-4)	0.00431	-0.138	0.0538	-0.0103	0.0292
	(0.125)	(0.145)	(0.131)	(0.0707)	(0.0575)
Wage(-1)	0.158	0.113	0.183	0.196*	0.177
	(0.105)	(0.108)	(0.113)	(0.108)	(0.109)
Wage(-2)	-0.0260	-0.00623	-0.0242	-0.0552	0.000523
	(0.0896)	(0.0875)	(0.0848)	(0.0803)	(0.0977)
Wage(-3)	0.0999	0.0962	0.0710	0.113	0.121
	(0.102)	(0.101)	(0.101)	(0.104)	(0.111)
Wage(-4)	-0.0847	-0.0634	-0.0699	-0.102	-0.0963
	(0.103)	(0.105)	(0.0992)	(0.111)	(0.104)
imp	-0.0578	0.0287	0.0353	-0.150	-0.0813
	(0.104)	(0.103)	(0.120)	(0.0950)	(0.0934)
Constant	0.000477	0.000196	0.000210	0.000371	0.00122
	(0.00142)	(0.00130)	(0.00134)	(0.00159)	(0.00147)
Observations	70	71	71	71	71
R^2	0.620	0.641	0.637	0.642	0.643
Adjusted R^2	0.514	0.543	0.538	0.544	0.545
F	11.24	12.58	9.566	10.11	15.91
Jarque-Bera	0.9535	0.2043	0.8675	0.8354	0.2729

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money growth_t, inflation_t, exvol_t, real gdp_t, and C_t, respectively.

Table 71: Determinants of Exchange Rate Pass-Through Elasticity of UK's Semi-Manufacture Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
z	-0.112	0.0770	0.208	2.043**	0.0838**
	(0.106)	(0.0644)	(0.147)	(0.821)	(0.0364)
z(-1)	0.160	-0.0310	-0.334***	-0.369	-0.438
	(0.163)	(0.0602)	(0.106)	(0.361)	(0.521)
z(-2)	0.0955	-0.133**	0.193*	-0.337	-2.075**
	(0.156)	(0.0655)	(0.107)	(0.589)	(0.799)
z(-3)	-0.0338	0.0821	-0.217**	0.287	0.273
	(0.107)	(0.0712)	(0.1000)	(0.506)	(0.710)
z(-4)	0.0314	-0.0451	-0.0105	-0.0173	-0.151
	(0.105)	(0.0854)	(0.0931)	(0.503)	(0.578)
Exchange Rate	0.680***	0.338**	0.318*	-8.765**	0.398***
	(0.187)	(0.161)	(0.176)	(3.715)	(0.105)
Exchange Rate(-1)	-0.280	0.0223	0.234	-0.0428	-0.0202
	(0.261)	(0.132)	(0.142)	(0.119)	(0.0889)
Exchange Rate(-2)	-0.184	0.218	-0.192	-0.0378	0.0134
	(0.262)	(0.160)	(0.145)	(0.0979)	(0.0987)
Exchange Rate(-3)	-0.0650	-0.280*	0.0579	-0.111	-0.144
	(0.195)	(0.155)	(0.157)	(0.108)	(0.0883)
Exchange Rate(-4)	-0.0338	0.0858	0.0929	0.00692	0.0439
	(0.195)	(0.196)	(0.150)	(0.100)	(0.0770)
Wage(-1)	0.147	0.164	0.243**	0.192	0.151
	(0.119)	(0.108)	(0.116)	(0.119)	(0.122)
Wage(-2)	0.122	0.134	0.0657	0.132	0.147
	(0.118)	(0.115)	(0.100)	(0.100)	(0.114)
Wage(-3)	0.176	0.139	0.151	0.143	0.180
	(0.108)	(0.117)	(0.105)	(0.120)	(0.113)
Wage(-4)	-0.0767	-0.0413	-0.0612	-0.0480	-0.0820
	(0.106)	(0.112)	(0.0972)	(0.0988)	(0.0917)
imp	0.0946	0.105	0.147	-0.0184	0.0763
	(0.131)	(0.120)	(0.153)	(0.111)	(0.112)
Constant	0.00135	0.00151	0.00140	0.00188	0.00286
	(0.00175)	(0.00166)	(0.00171)	(0.00224)	(0.00178)
Observations	70	71	71	71	71
R^2	0.610	0.632	0.668	0.641	0.671
Adjusted R^2	0.502	0.532	0.577	0.543	0.581
F	10.49	12.39	11.30	13.15	13.23
Jarque-Bera	0.7643	0.7531	0.9128	0.9087	0.6549

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money growth_t, inflation_t, exvol_t, real gdp_t, and C_t, respectively.

Table 72: Determinants of Exchange Rate Pass-Through Elasticity of UK's Finished-Manufacture Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
z	-0.110	0.125**	0.289**	0.933*	0.0385
	(0.114)	(0.0581)	(0.110)	(0.515)	(0.0450)
z(-1)	0.0163	-0.0119	0.0216	0.101	-0.0232
	(0.129)	(0.0514)	(0.0812)	(0.332)	(0.577)
z(-2)	0.0780	0.00961	0.0311	-0.511	-0.485
	(0.0872)	(0.0514)	(0.107)	(0.337)	(0.410)
z(-3)	-0.0229	-0.0255	0.0531	0.338	-0.506
	(0.0942)	(0.0551)	(0.0970)	(0.439)	(0.512)
z(-4)	0.0397	0.0332	-0.0123	0.232	0.219
	(0.0933)	(0.0619)	(0.0925)	(0.337)	(0.567)
Exchange Rate	0.535***	0.151	0.0537	-3.881	0.322***
	(0.199)	(0.125)	(0.115)	(2.342)	(0.0727)
Exchange Rate(-1)	-0.0317	0.0205	-0.0325	-0.0411	-0.0174
	(0.186)	(0.124)	(0.116)	(0.0841)	(0.0727)
Exchange Rate(-2)	-0.125	-0.00776	-0.0227	0.0487	0.0146
	(0.122)	(0.139)	(0.158)	(0.0979)	(0.0966)
Exchange Rate(-3)	-0.0308	-0.0219	-0.160	-0.0799	-0.0541
	(0.143)	(0.133)	(0.142)	(0.0942)	(0.0914)
Exchange Rate(-4)	-0.0253	-0.0849	-0.0117	0.00701	0.0425
	(0.139)	(0.165)	(0.138)	(0.0851)	(0.0742)
Wage(-1)	0.0671	0.0467	0.0556	0.0680	0.103
	(0.109)	(0.117)	(0.120)	(0.132)	(0.122)
Wage(-2)	0.0237	-0.00670	0.00309	0.0244	0.0110
	(0.135)	(0.124)	(0.112)	(0.125)	(0.131)
Wage(-3)	-0.0306	-0.0180	-0.0299	-0.0491	0.0194
	(0.134)	(0.127)	(0.117)	(0.139)	(0.142)
Wage(-4)	-0.0179	0.0197	-0.00941	-0.0255	-0.0399
	(0.129)	(0.129)	(0.121)	(0.134)	(0.137)
imp	-0.0118	0.0760	0.122	-0.118	-0.0352
	(0.131)	(0.129)	(0.140)	(0.143)	(0.135)
Constant	-0.000334	-0.000730	-0.00105	-0.000731	4.63e-05
	(0.00160)	(0.00158)	(0.00158)	(0.00202)	(0.00172)
Observations	70	71	71	71	71
R^2	0.545	0.579	0.597	0.560	0.549
Adjusted R^2	0.419	0.464	0.487	0.440	0.426
F	5.868	6.637	7.514	9.355	7.448
Jarque-Bera	0.5522	0.1331	0.2392	0.7200	0.4755

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money growth_t, inflation_t, exvol_t, real gdp_t, and C_t, respectively.

Table 73: Determinants of Exchange Rate Pass-Through Elasticity of UK's Food & Beverages & Tobacco Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
z	-0.194*	0.147**	0.0531	-1.337	-0.0543
	(0.105)	(0.0589)	(0.146)	(1.005)	(0.0606)
z(-1)	0.113	0.00288	-0.0657	-0.304	-0.294
	(0.0927)	(0.0386)	(0.102)	(0.291)	(0.509)
z(-2)	0.0982	-0.0977*	-0.00784	-0.444	-1.602***
	(0.109)	(0.0546)	(0.127)	(0.326)	(0.333)
z(-3)	-0.00185	-0.0550	-0.149	-0.454	-0.713
	(0.0875)	(0.0510)	(0.0905)	(0.317)	(0.426)
z(-4)	-0.0521	0.0328	0.0658	-0.0318	-0.713
	(0.118)	(0.0599)	(0.0963)	(0.376)	(0.674)
Exchange Rate	0.639***	0.0730	0.295	6.425	0.443***
	(0.169)	(0.141)	(0.196)	(4.547)	(0.107)
Exchange Rate(-1)	-0.0144	0.134	0.159	0.184*	0.161*
	(0.126)	(0.105)	(0.155)	(0.100)	(0.0946)
Exchange Rate(-2)	-0.275	0.0842	-0.109	-0.0232	-0.0182
	(0.168)	(0.150)	(0.186)	(0.0931)	(0.0781)
Exchange Rate(-3)	-0.0364	0.0363	0.134	0.0555	0.0154
	(0.160)	(0.140)	(0.164)	(0.113)	(0.103)
Exchange Rate(-4)	-0.0604	-0.261	-0.174	-0.0851	-0.0899
	(0.187)	(0.175)	(0.166)	(0.119)	(0.0892)
Wage(-1)	0.134	0.0997	0.171	0.117	0.125
	(0.133)	(0.125)	(0.136)	(0.128)	(0.140)
Wage(-2)	0.0493	0.0482	0.0472	0.0169	-0.00438
	(0.135)	(0.139)	(0.140)	(0.142)	(0.144)
Wage(-3)	0.178	0.235	0.168	0.141	0.173
	(0.193)	(0.159)	(0.186)	(0.190)	(0.181)
Wage(-4)	0.0101	0.0799	-0.0143	0.0223	0.0471
	(0.131)	(0.117)	(0.131)	(0.123)	(0.122)
imp	0.0434	0.132	-0.00594	0.0633	0.0296
	(0.143)	(0.146)	(0.168)	(0.124)	(0.125)
Constant	0.00314	0.00226	0.00327	0.00705**	0.00572**
	(0.00205)	(0.00206)	(0.00266)	(0.00334)	(0.00259)
Observations	70	71	71	71	71
R^2	0.578	0.614	0.557	0.596	0.620
Adjusted R^2	0.460	0.509	0.437	0.486	0.516
F	6.913	8.513	7.439	9.365	35.10
Jarque-Bera	0.2407	0.8155	0.8722	0.8729	0.9469

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable $\mathrm{z_t}$ and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by $\mathrm{money\ growth_t}$, $\mathrm{inflation_t}$, $\mathrm{exvol_t}$, $\mathrm{real\ gdp_t}$, and C_t, respectively.

Table 74: Determinants of Exchange Rate Pass-Through Elasticity of UK's Basic Materials Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
z	-0.339	0.0849	0.0790	2.141	-0.0514
	(0.266)	(0.104)	(0.282)	(1.843)	(0.0900)
z(-1)	0.161	-0.0413	-0.300	0.330	-1.350
	(0.256)	(0.132)	(0.268)	(0.809)	(1.170)
z(-2)	0.164	-0.273**	0.494*	-0.795	-2.243**
	(0.270)	(0.123)	(0.248)	(0.892)	(1.100)
z(-3)	-0.485*	0.164	-0.408*	-0.771	2.070
	(0.265)	(0.153)	(0.219)	(1.221)	(1.291)
z(-4)	0.253	-0.0964	0.249	1.348	-0.427
	(0.277)	(0.189)	(0.202)	(1.082)	(1.679)
Exchange Rate	1.061**	0.306	0.552	-9.176	0.595**
	(0.441)	(0.232)	(0.340)	(8.388)	(0.223)
Exchange Rate(-1)	-0.224	0.162	0.252	-0.115	0.126
	(0.399)	(0.284)	(0.362)	(0.242)	(0.189)
Exchange Rate(-2)	-0.169	0.663**	-0.383	0.229	0.208
	(0.412)	(0.311)	(0.344)	(0.218)	(0.227)
Exchange Rate(-3)	0.478	-0.538*	0.193	-0.0880	-0.299
	(0.449)	(0.320)	(0.332)	(0.229)	(0.201)
Exchange Rate(-4)	-0.329	0.282	-0.112	-0.0694	0.121
	(0.496)	(0.495)	(0.351)	(0.246)	(0.201)
Wage(-1)	0.224	0.167	0.201	0.147	0.142
	(0.137)	(0.140)	(0.135)	(0.136)	(0.147)
Wage(-2)	-0.0731	-0.0548	-0.0472	-0.0355	-0.0339
	(0.138)	(0.135)	(0.118)	(0.121)	(0.124)
Wage(-3)	0.230*	0.231*	0.236*	0.267**	0.235*
	(0.119)	(0.115)	(0.130)	(0.129)	(0.119)
Wage(-4)	-0.00686	-0.0150	-0.00264	-0.0448	-0.0318
	(0.112)	(0.111)	(0.118)	(0.115)	(0.112)
imp	1.022***	0.935**	1.030**	0.878**	0.832**
	(0.355)	(0.406)	(0.424)	(0.334)	(0.334)
Constant	0.00317	0.00434	0.00250	0.00306	0.00532
	(0.00364)	(0.00380)	(0.00435)	(0.00630)	(0.00492)
Observations	70	71	71	71	71
R^2	0.364	0.365	0.372	0.354	0.360
Adjusted R^2	0.187	0.191	0.201	0.178	0.185
F	2.922	3.126	2.959	2.631	4.171
Jarque-Bera	0.1848	0.6658	0.9323	0.4393	0.5215

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable $\mathrm{z_t}$ and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by $\mathrm{money\ growth_t}$, $\mathrm{inflation_t}$, $\mathrm{exvol_t}$, $\mathrm{real\ gdp_t}$, and C_t, respectively.

Table 75: Determinants of Exchange Rate Pass-Through Elasticity of UK's Fuel Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
z	-0.755	-0.112	-1.423	13.44	-0.615
	(1.637)	(0.883)	(1.641)	(10.40)	(0.539)
z(-1)	-0.933	-0.126	0.383	6.749*	8.731
	(1.374)	(0.726)	(1.516)	(3.580)	(8.420)
z(-2)	0.151	-0.472	-0.489	-1.289	-8.218
	(0.913)	(0.598)	(1.104)	(4.493)	(7.281)
z(-3)	-1.447	0.125	1.311	-2.954	3.115
	(0.961)	(0.541)	(0.854)	(4.677)	(5.222)
z(-4)	-0.864	-0.799	-0.0435	-2.819	-2.151
	(1.087)	(0.716)	(1.121)	(3.875)	(5.821)
Exchange Rate	1.372	0.315	1.502	-60.40	0.853
	(2.612)	(1.920)	(2.089)	(47.09)	(0.929)
Exchange Rate(-1)	1.934	0.911	0.403	-0.710	0.142
	(1.882)	(1.647)	(2.173)	(0.886)	(0.898)
Exchange Rate(-2)	0.189	1.447	0.925	0.201	1.153
	(1.312)	(1.486)	(1.285)	(0.986)	(0.836)
Exchange Rate(-3)	1.465	-0.523	-1.584	-0.0963	-0.783
	(1.169)	(1.372)	(1.210)	(0.708)	(0.717)
Exchange Rate(-4)	1.527	2.524	0.614	0.903	0.842
	(1.494)	(2.032)	(1.985)	(0.901)	(0.725)
Wage(-1)	0.169	0.157	0.171	0.197	0.293*
	(0.135)	(0.131)	(0.143)	(0.155)	(0.155)
Wage(-2)	-0.0808	-0.103	-0.0297	-0.0275	-0.142
	(0.131)	(0.129)	(0.139)	(0.149)	(0.157)
Wage(-3)	0.0955	0.110	0.135	0.129	0.134
	(0.109)	(0.121)	(0.124)	(0.127)	(0.122)
Wage(-4)	-0.00506	-0.0552	-0.0347	-0.0202	-0.0781
	(0.132)	(0.134)	(0.143)	(0.117)	(0.144)
imp	3.919**	3.331**	2.706	3.412**	3.181**
	(1.719)	(1.630)	(1.644)	(1.667)	(1.449)
Constant	0.0195	0.0252	0.0173	0.0124	0.0163
	(0.0168)	(0.0164)	(0.0196)	(0.0272)	(0.0247)
Observations	70	71	71	71	71
R^2	0.217	0.221	0.222	0.280	0.260
Adjusted R^2	-0.000612	0.00793	0.0102	0.0837	0.0579
F	1.109	1.351	1.101	1.375	1.252
Jarque-Bera	0.8906	0.5275	0.5557	0.6152	0.6055

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money $growth_t$, $inflation_t$, $exvol_t$, real gdp_t, and C_t, respectively.

From the estimation results by Equation (4.6) shown by Table 64, it can be found that all determinants are significant in determining import prices of manufacture but at different lagged time. Money growth is significant in affecting the import prices of manufacture at its second lag, while inflation has a timely effect at its current quarter. Exchange rate volatility is significant at all four lags. The second lag for the real GDP, and the second and third lags for credibility are significant.

Table 65 presents the estimation results for the determinants of semi-manufacture import prices. It suggests that money growth, exchange rate volatility, real GDP and credibility are all statistically significant in controlling the import prices of semi-manufacture via the exchange rate pass-through, but not inflation. The second lag of the money growth is significant, and exchange rate volatility is significant at all four lags. The second lag for the real GDP, and the second and third lags for credibility are significant.

Table 66 presents the estimation results for the determinants of finished-manufacture import prices. It shows that inflation, exchange rate volatility, and real GDP, and credibility are significantly but not money growth rate. Inflation has a spontaneous effect, and exchange rate volatility has significant effects on its second, third and fourth lags, while other variables are significant at their second lag.

Table 67 presents the estimation results for the determinants of Food & Beverages & Tobacco import prices. Exchange rate volatility, real GDP and credibility are significant at their second and third lags, while money growth and inflation are insignificant.

Estimation results given by Equation (4.7) are not very different from those of Equation (4.6). Following tables summarize the estimation results of equations (4.6) and (4.7). Table 76 summarizes the information from tables 64 to 69, indicating the significance of the determinants of exchange rate pass-through based on the estimation of Equation (4.6). Those tested determinants are money growth, inflation, exchange rate volatility, real GDP and credibility. Table 77 summarizes the information from tables 70 to 77, showing the significance of the determinants of exchange rate pass-through based on the estimation of Equation (4.7), and the determinants of money growth, inflation, exchange rate volatility, real GDP and credibility have been tested.

Table 76: Summary Estimation Results of Equation (4.6)

	MAN	SMAN	FMAN	FBT	BM	Fuels
Money Growth	*	*	*		**	**
Inflation	*	*	*			
Exvol	***	***	***	***	***	*
Real GDP	**	**	***	**	***	*
Credibility	***	***	***	***	***	**

The table presents the summary of estimation results from Table 64 to 69 based on Equation (4.6). ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. The most significant sign of the coefficients is recorded among their contemporaneous and lagged variables.

From the estimation results of Equation (4.6), it can be seen that exchange rate volatility, real GDP and central bank credibility are essential in determining import prices as they are all significant in all six sectors. However, it shows that the money growth rate is only significant in affecting the import price for manufacture, semi-manufacture, finished-manufacture, basic materials and fuels, but not significant in Food & Beverages & Tobacco. Inflation is significant in manufacture, semi-manufacture, finished-manufacture, but not in basic materials, Food & Beverages & Tobacco, and fuels.

Table 77: Summary Estimation Results of Equation (4.7)

	MAN	SMAN	FMAN	FBT	BM	Fuels
Money Growth						
Inflation	**	*	*		**	
Exvol	*	***	***	***	*	
Real GDP	**	**	*	**		*
Credibility	*	***	***	***		

The table presents the summary of estimation results from Table 70 to 76 based on Equation (4.67. ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. The most significant sign of the coefficients is recorded among their contemporaneous and lagged variables.

Estimation results given by Equation (4.7) are not very different from those given by Equation (4.6). However, Table 77 generally shows the less degree of significance than Table 76 in terms of the five determinants of the exchange rate pass-through. It shows that money growth is insignificant in determining the import prices at all six importing sectors. Only real GDP is significant at the fuel industry.

4.6. Bilateral Exchange Rate Pass-through

To examine the marginal impacts from one trading partner, the bilateral exchange rate will be used to estimate the bilateral exchange rate pass-through, instead of using effective exchange rate. Regressions are run based on Equation (4.4) for five countries: Australia, Canada, China, Eurozone, Japan, and the US. The bilateral exchange rate can be considered as a specific case of the effective exchange rate when importing country j's effective exchange rate is calculated by assigning the full unit weight to the corresponding exporting country, while ignoring the effects of exchange rate pass-through from other trading partners.

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^{Mj} + c^j y_t{}^j + \epsilon_t^j \tag{4.4}$$

where e_t^j is the bilateral exchange rate of UK with the grading partner j, and

$$w_t^{Mj} = rex_{t(Bilateral)}^j + p_t^j - nex_{t(Bilateral)}^j$$

In addition, the Equation (4.4.1) will be adopted for a robustness check

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^{Mj} + c^j y_t{}^j + \epsilon_t^j \tag{4.4.1}$$

where e_t^j is the bilateral exchange rate of UK with the grading partner j, and

$$w_t^{Mj} = rex_{t(Effective)}^j + p_t^j - nex_{t(Effective)}^j$$

In the estimation, setting $y_t = gdp_t$, and e_t^j is the bilateral exchange rate with trading partner j's currency. Equation (4.4.1) and Equation (4.4.) is different in terms of the structure of production cost. Exchange rate pass-through estimated by Equation (4.4.1) can be considered as a marginal exchange rate pass-through from the UK's trading partner, while Equation (4.4.) tests an absolute bilateral relationship between the UK and its trading partner j. This chapter aims to estimate the bilateral exchange rate pass-through of the UK with Australia, Canada, China, Eurozone, Japan and the US.

4.6.1. Estimation by Equation (4.4)

In this section, the following equation is used for the estimation of bilateral exchange rate pass-though:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^{Mj} + c^j y_t{}^j + \epsilon_t^j \tag{4.4}$$

where e_t^j is the bilateral exchange rate of UK with the grading partner j, and

$$w_t^{Mj} = rex_{t(Bilateral)}^j + p_t^j - nex_{t(Bilateral)}^j$$

Tables from Table 78 to 85 display the estimation results of the bilateral exchange rate pass-through for the UK with six trading partners: Australia, Canada, China, Eurozone, Japan and the US. The results are estimated by Equation (4.4.), where this bilateral exchange rate pass-through is estimated under an absolute two-country structure. It tests a bilateral relationship between the UK and its trading partner j. The results are similar to what the previous section shows Tables 84 and 85 summarize the results from Table 78 to 85. Table 84 summarizes the short run bilateral exchange rate pass-through of six countries and compares them with the total short run exchange rate pass-through estimated by the effective exchange rates. Table 85 summarizes the long run bilateral exchange rate pass-through of six countries and compares them with the total long run exchange rate pass-through estimated by the effective exchange rates.

From Table 80, it can be seen that China has the highest short run exchange rate pass-through in the manufacture, while the Eurozone has the highest short run exchange rate pass-through in the semi-manufacture and Food & Beverage & Tobacco, and the US has the highest value in finished-manufacture. Australia has the highest rates in the basic material and fuels sector. For the long run, from Table 78, it shows that Australia has a very high rate at 2.4970 in the fuels, most of the exchange rate pass-through rates remain relatively small. It can be suggested that a country's import composition and its bargaining power play an essential role in the bilateral exchange rate pass-through. China, Eurozone and the US are large exporting countries of manufacture to the UK, this could be the reason that leads to their higher exchange rate pass-through rates in the corresponding sectors. This can also apply to as Australia as the country is one of the most important importers in energy industry for the UK.

Table 78: UK/Australia Bilateral Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Manufacture Cost, Equation (4.4))

Australia	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.0148+++	0.0639*+++	0.00768+++	0.0122+++	0.217***+++	0.799**
	(0.0171)	(0.0353)	(0.0242)	(0.0297)	(0.0658)	(0.349)
Exchange Rate(-1)	0.00838	0.00602	0.00663	0.0123	0.0797	0.631**
	(0.0175)	(0.0329)	(0.0232)	(0.0425)	(0.0671)	(0.243)
Exchange Rate(-2)	0.0209	0.0342	0.0300	0.0202	0.0591	0.319
	(0.0183)	(0.0406)	(0.0217)	(0.0366)	(0.0672)	(0.316)
Exchange Rate(-3)	-0.000188	0.0392	-0.0264	-0.00618	-0.0111	0.420
	(0.0196)	(0.0298)	(0.0276)	(0.0438)	(0.0735)	(0.270)
Exchange Rate(-4)	-0.00450	-0.0119	-0.0311	-0.0228	-0.0447	0.328
	(0.0168)	(0.0353)	(0.0243)	(0.0360)	(0.0687)	(0.239)
Long run elasticity ($\sum_{i=0}^{4} a_i^j$)	0.0394+++	0.1314+++	-0.0132+++	0.0157+++	0.3000+++	2.4970***++
Wage_M	0.671***	0.769***	0.535***	0.168	0.879***	0.0425
	(0.0731)	(0.159)	(0.0845)	(0.163)	(0.204)	(0.917)
Wage(-1)	-0.0587	-0.0685	-0.0836	0.286	-0.0458	0.0409
	(0.0866)	(0.117)	(0.0986)	(0.180)	(0.116)	(0.121)
Wage(-2)	-0.0167	0.169	-0.0698	-0.105	0.0784	-0.0912
	(0.0835)	(0.118)	(0.0936)	(0.155)	(0.103)	(0.112)
Wage(-3)	-0.0242	-0.0264	-0.0798	0.149	0.232**	0.0984
	(0.0702)	(0.0896)	(0.108)	(0.160)	(0.109)	(0.101)
Wage(-4)	0.0250	0.0276	0.0833	-0.111	0.195*	0.00133
	(0.0682)	(0.101)	(0.0716)	(0.115)	(0.111)	(0.121)
gdp	-0.293	0.0744	-0.601**	-0.506	2.030***	6.863*
	(0.189)	(0.330)	(0.268)	(0.312)	(0.555)	(3.519)
Constant	0.000249	-0.000530	0.00150	0.00689**	-0.0119***	-0.0199
	(0.00153)	(0.00312)	(0.00210)	(0.00333)	(0.00410)	(0.0249)
Observations	71	71	71	71	71	71
R^2	0.755	0.583	0.579	0.249	0.460	0.292
Adjusted R^2	0.710	0.506	0.501	0.109	0.359	0.160
F	23.21	11.64	8.581	3.507	7.869	2.306
Jarque-Bera	0.0436	0.0359	0.7602	0.0286	0.9019	0.1796

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. HC OLS estimator is employed.

Table 79: UK/ Canada Bilateral Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Manufacture Cost, Equation (4.4))

Canada	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.0450**+++	0.0980**+++	0.0505*+++	0.0533+++	0.130+++	0.608
	(0.0212)	(0.0460)	(0.0301)	(0.0419)	(0.0855)	(0.416)
Exchange Rate(-1)	0.00504	-0.0106	0.0213	0.0614	-0.0461	0.163
	(0.0216)	(0.0405)	(0.0269)	(0.0467)	(0.0973)	(0.362)
Exchange Rate(-2)	0.0114	0.00377	0.00886	0.0122	0.173**	0.578
	(0.0223)	(0.0471)	(0.0297)	(0.0421)	(0.0831)	(0.352)
Exchange Rate(-3)	-0.0160	0.0152	-0.0571	-0.0773*	0.0106	0.544*
	(0.0228)	(0.0408)	(0.0357)	(0.0423)	(0.0855)	(0.300)
Exchange Rate(-4)	-0.000263	0.0131	-0.0170	0.0161	-0.107	-0.0411
	(0.0255)	(0.0446)	(0.0348)	(0.0536)	(0.0896)	(0.351)
Long run elasticity ($\sum_{i=0}^{4} a_i^j$)	0.0452+++	0.1195+++	0.0066+++	0.0657+++	0.1605+++	1.8519*
Wage_M	0.668***	0.758***	0.518***	0.120	1.058***	0.847
	(0.0710)	(0.149)	(0.0820)	(0.160)	(0.244)	(0.989)
Wage(-1)	-0.0941	-0.0644	-0.151	0.234	-0.0104	0.101
	(0.0818)	(0.121)	(0.0933)	(0.170)	(0.101)	(0.121)
Wage(-2)	-0.00261	0.177	-0.0740	-0.0734	0.0915	-0.110
	(0.0841)	(0.114)	(0.0883)	(0.127)	(0.103)	(0.124)
Wage(-3)	-0.0146	0.0211	-0.0367	0.160	0.154	0.0482
	(0.0659)	(0.0932)	(0.0895)	(0.136)	(0.100)	(0.0892)
Wage(-4)	0.0244	-0.00152	0.0813	-0.0769	0.160	-0.0573
	(0.0699)	(0.104)	(0.0786)	(0.131)	(0.101)	(0.126)
gdp	-0.306	0.137	-0.666**	-0.550*	2.078***	7.304*
	(0.183)	(0.318)	(0.271)	(0.315)	(0.611)	(4.168)
Constant	0.000350	-0.000836	0.00184	0.00673*	-0.0113**	-0.0195
	(0.00152)	(0.00292)	(0.00199)	(0.00340)	(0.00511)	(0.0293)
Observations	71	71	71	71	71	71
R^2	0.765	0.586	0.611	0.330	0.422	0.213
Adjusted R^2	0.722	0.509	0.538	0.206	0.314	0.0662
F	27.12	11.13	9.091	5.061	5.583	1.790
Jarque-Bera	0.0889	0.0993	0.3865	0.0107	0.4438	0.4140

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. HC OLS estimator is employed.

Table 80: UK/China Bilateral Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Manufacture Cost, Equation (4.4))

China	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.0571**+++	0.0411+++	0.118***+++	0.0561+++	-0.0326+++	0.247++
	(0.0228)	(0.0291)	(0.0303)	(0.0454)	(0.0688)	(0.367)
Exchange Rate(-1)	-0.0207	-0.108***	0.00520	-0.0437	-0.0941	0.111
	(0.0200)	(0.0400)	(0.0299)	(0.0529)	(0.0628)	(0.405)
Exchange Rate(-2)	-0.0524***	-0.0631*	-0.0414	-0.0354	0.0610	0.0873
	(0.0188)	(0.0354)	(0.0253)	(0.0496)	(0.0701)	(0.307)
Exchange Rate(-3)	-0.0534***	-0.109***	-0.0327	-0.0690*	-0.130*	0.0335
	(0.0165)	(0.0344)	(0.0277)	(0.0386)	(0.0757)	(0.296)
Exchange Rate(-4)	-0.0231	-0.00734	-0.0106	-0.00212	0.0742	0.0663
	(0.0171)	(0.0310)	(0.0243)	(0.0434)	(0.0875)	(0.259)
Long run elasticity ($\sum_{i=0}^{4} a_i^j$)	-0.0925*+++	-0.2463***+++	0.0385+++	-0.0941+++	-0.1215+++	0.5451
Wage_M	0.690***	0.785***	0.541***	0.182	1.022***	1.037
	(0.0491)	(0.122)	(0.0741)	(0.129)	(0.262)	(0.938)
Wage(-1)	-0.129**	-0.0735	-0.253***	0.242	0.0897	0.209
	(0.0509)	(0.0794)	(0.0832)	(0.147)	(0.0977)	(0.133)
Wage(-2)	0.0183	0.199**	-0.0190	-0.00609	0.0773	-0.0713
	(0.0452)	(0.0842)	(0.0804)	(0.151)	(0.0954)	(0.123)
Wage(-3)	0.0811	0.134	0.0422	0.205	0.168	0.0681
	(0.0496)	(0.0862)	(0.0742)	(0.167)	(0.122)	(0.125)
Wage(-4)	0.0846	0.0784	0.0677	-0.0782	0.164	-0.0181
	(0.0600)	(0.0947)	(0.0770)	(0.148)	(0.103)	(0.148)
gdp	-0.308	-0.222	-0.371	-0.444	1.726**	7.364*
	(0.200)	(0.321)	(0.247)	(0.286)	(0.661)	(4.379)
Constant	0.000320	0.00126	0.000213	0.00571*	-0.00890	-0.0218
	(0.00138)	(0.00251)	(0.00183)	(0.00322)	(0.00563)	(0.0325)
Observations	71	71	71	71	71	71
R^2	0.837	0.675	0.694	0.308	0.380	0.149
Adjusted R^2	0.807	0.614	0.636	0.179	0.264	-0.0102
F	24.70	9.956	13.25	5.019	3.528	0.811
Jarque-Bera	0.1046	0.6154	0.5122	0.0094	0.8305	0.2332

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. HC OLS estimator is employed.

Table 81: UK/Euro Bilateral Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Manufacture Cost, Equation (4.4))

Eurozone	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.0492*+++	0.0944*+++	0.0326+++	0.198***+++	0.171+++	0.253
	(0.0252)	(0.0484)	(0.0295)	(0.0451)	(0.103)	(0.456)
Exchange Rate(-1)	0.0164	0.00507	0.0234	-0.0311	0.0219	0.512
	(0.0336)	(0.0762)	(0.0361)	(0.0525)	(0.0702)	(0.348)
Exchange Rate(-2)	0.0175	0.0271	-0.00556	-0.00796	0.170**	0.532*
	(0.0392)	(0.0480)	(0.0412)	(0.0483)	(0.0672)	(0.318)
Exchange Rate(-3)	-0.00846	-0.0116	0.000242	-0.0694	-0.0900	0.165
	(0.0281)	(0.0445)	(0.0322)	(0.0513)	(0.0668)	(0.395)
Exchange Rate(-4)	-0.0194	-0.0198	0.0116	-0.0610	0.0979	0.220
	(0.0180)	(0.0338)	(0.0306)	(0.0478)	(0.0940)	(0.290)
Long run elasticity ($\sum_{i=0}^{4} a_i^j$)	0.0552+++	0.0952+++	0.0623+++	0.0285+++	0.3708**+++	1.6820*
Wage_M	0.679***	0.781***	0.538***	0.0855	0.960***	1.306
	(0.0763)	(0.147)	(0.0922)	(0.111)	(0.202)	(0.905)
Wage(-1)	-0.0755	-0.0518	-0.101	0.223	0.0786	0.176
	(0.0630)	(0.103)	(0.0933)	(0.152)	(0.100)	(0.125)
Wage(-2)	-0.0131	0.152	-0.0485	-0.00827	0.0578	-0.0722
	(0.0573)	(0.0943)	(0.0941)	(0.146)	(0.108)	(0.119)
Wage(-3)	-0.00960	0.0304	-0.0448	0.133	0.213*	0.103
	(0.0508)	(0.0831)	(0.0866)	(0.183)	(0.119)	(0.100)
Wage(-4)	0.0368	0.0434	0.0245	0.0107	0.111	0.00278
	(0.0624)	(0.104)	(0.0800)	(0.123)	(0.116)	(0.152)
gdp	-0.158	0.288	-0.427	-0.223	2.586***	9.045**
	(0.227)	(0.379)	(0.323)	(0.311)	(0.544)	(4.230)
Constant	-0.000414	-0.00168	0.000671	0.00454	-0.0140***	-0.0322
	(0.00163)	(0.00322)	(0.00220)	(0.00279)	(0.00463)	(0.0297)
Observations	71	71	71	71	71	71
R^2	0.768	0.585	0.563	0.463	0.432	0.196
Adjusted R^2	0.725	0.507	0.481	0.363	0.326	0.0459
F	20.21	8.612	7.987	5.175	5.044	1.492
Jarque-Bera	0.1151	0.2793	0.9295	0.1077	0.9218	0.2732

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. HC OLS estimator is employed.

Table 82: UK/Japan Bilateral Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Manufacture Cost, Equation (4.4))

Japan	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.0320*+++	0.0514+++	0.0438**+++	0.0438+++	0.0139+++	0.241+++
	(0.0181)	(0.0316)	(0.0186)	(0.0264)	(0.0502)	(0.203)
Exchange Rate(-1)	-0.00103	-0.0229	-0.00687	-0.0249	0.0460	0.394*
	(0.0179)	(0.0362)	(0.0195)	(0.0329)	(0.0593)	(0.232)
Exchange Rate(-2)	-0.0161	-0.0141	-0.00842	-0.0111	0.0636	0.446***
	(0.0198)	(0.0266)	(0.0230)	(0.0302)	(0.0401)	(0.161)
Exchange Rate(-3)	-0.0264*	-0.0314	-0.0224	-0.0382*	-0.0503	0.0243
	(0.0136)	(0.0250)	(0.0156)	(0.0219)	(0.0471)	(0.205)
Exchange Rate(-4)	-0.0194*	-0.0170	0.000198	0.00593	0.00612	0.0419
	(0.0115)	(0.0214)	(0.0134)	(0.0285)	(0.0625)	(0.176)
Long run elasticity ($\sum_{i=0}^{4} a_i^j$)	-0.0309+++	-0.0340+++	0.0063+++	-0.0245+++	0.0793+++	1.1472***
Wage_M	0.708***	0.809***	0.538***	0.182	1.024***	0.554
	(0.0608)	(0.134)	(0.0782)	(0.143)	(0.272)	(0.821)
Wage(-1)	-0.0550	-0.0200	-0.113	0.298**	0.0625	0.154
	(0.0560)	(0.0892)	(0.105)	(0.148)	(0.103)	(0.129)
Wage(-2)	0.0223	0.182**	-0.00793	-0.0439	0.0832	-0.0675
	(0.0490)	(0.0845)	(0.0826)	(0.139)	(0.0995)	(0.119)
Wage(-3)	0.0153	0.0504	-0.0440	0.147	0.201*	0.111
	(0.0528)	(0.0790)	(0.0850)	(0.167)	(0.110)	(0.115)
Wage(-4)	0.0550	0.0448	0.0438	-0.100	0.117	-0.0736
	(0.0587)	(0.0914)	(0.0786)	(0.135)	(0.102)	(0.138)
gdp	-0.167	0.187	-0.427	-0.400	2.312***	8.614**
	(0.221)	(0.358)	(0.283)	(0.262)	(0.569)	(3.998)
Constant	-0.000783	-0.00155	0.000587	0.00577*	-0.0127***	-0.0264
	(0.00160)	(0.00309)	(0.00210)	(0.00325)	(0.00444)	(0.0272)
Observations	71	71	71	71	71	71
R^2	0.785	0.593	0.592	0.287	0.386	0.250
Adjusted R^2	0.744	0.517	0.516	0.154	0.271	0.110
F	22.19	9.974	7.721	5.844	4.557	3.009
Jarque-Bera	0.5534	0.7430	0.1368	0.0395	0.7245	0.3557

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. HC OLS estimator is employed.

Table 83: UK/US Bilateral Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (Manufacture Cost, Equation (4.4))

US	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.0453**+++	0.0353+++	0.108***+++	0.0340+++	-0.0488+++	0.0349++
	(0.0217)	(0.0283)	(0.0273)	(0.0420)	(0.0702)	(0.373)
Exchange Rate(-1)	-0.0281	-0.105**	-0.00167	-0.0479	-0.0912	0.0932
	(0.0194)	(0.0399)	(0.0274)	(0.0519)	(0.0640)	(0.387)
Exchange Rate(-2)	-0.0592***	-0.0603	-0.0534**	-0.0450	0.0609	0.0831
	(0.0188)	(0.0363)	(0.0249)	(0.0485)	(0.0731)	(0.308)
Exchange Rate(-3)	-0.0517***	-0.0909**	-0.0348	-0.0695*	-0.105	0.00377
	(0.0171)	(0.0346)	(0.0278)	(0.0364)	(0.0756)	(0.291)
Exchange Rate(-4)	-0.0225	0.00954	-0.0224	0.000892	0.0792	0.0825
	(0.0179)	(0.0321)	(0.0247)	(0.0443)	(0.0899)	(0.266)
Long run elasticity ($\sum_{i=0}^{4} a_i^j$)	-0.1162**+++	-0.2114**+++	-0.0043+++	-0.1275+++	-0.1049+++	0.2975
Wage_M	0.692***	0.776***	0.543***	0.187	1.026***	1.124
	(0.0506)	(0.125)	(0.0693)	(0.133)	(0.266)	(0.950)
Wage(-1)	-0.104*	-0.0450	-0.220***	0.269*	0.0903	0.199
	(0.0519)	(0.0859)	(0.0781)	(0.150)	(0.0980)	(0.132)
Wage(-2)	0.0303	0.201**	-0.00986	-0.0138	0.0735	-0.0711
	(0.0480)	(0.0887)	(0.0780)	(0.148)	(0.0979)	(0.126)
Wage(-3)	0.0857	0.126	0.0548	0.204	0.162	0.0963
	(0.0531)	(0.0858)	(0.0752)	(0.167)	(0.121)	(0.124)
Wage(-4)	0.0720	0.0316	0.0741	-0.0957	0.152	-0.0148
	(0.0626)	(0.0950)	(0.0761)	(0.144)	(0.103)	(0.148)
gdp	-0.222	-0.0233	-0.348	-0.406	1.778***	6.736
	(0.189)	(0.289)	(0.212)	(0.282)	(0.611)	(4.090)
Constant	-0.000522	-0.000364	3.15e-05	0.00526	-0.00931*	-0.0172
	(0.00130)	(0.00244)	(0.00162)	(0.00333)	(0.00523)	(0.0298)
Observations	71	71	71	71	71	71
R^2	0.833	0.664	0.693	0.307	0.378	0.143
Adjusted R^2	0.802	0.601	0.636	0.177	0.262	-0.0170
F	23.58	10.17	14.14	4.885	3.236	0.778
Jarque-Bera	0.1216	0.5967	0.3435	0.0141	0.8917	0.3295

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. HC OLS estimator is employed.

Table 84: Bilateral Short run Exchange Rate Pass-through on Disaggregated Import Prices

Short run Exchange Rate Pass-through	MAN	SMAN	FMAN	FBT	BM	Fuels
Australia	0.0148+++	0.0639*+++	0.00768+++	0.0122+++	0.217***+++	0.799**
Canada	0.0450**+++	0.0980**+++	0.0505*+++	0.0533+++	0.130+++	0.6080
China	0.0571**+++	0.0411+++	0.118***+++	0.0561+++	-0.0326+++	0.247++
Euro	0.0492*+++	0.0944*+++	0.0326+++	0.198***+++	0.171+++	0.2530
Japan	0.0320*+++	0.0514+++	0.0438**+++	0.0438+++	0.0139+++	0.241+++
US	0.0453**+++	0.0353+++	0.108***+++	0.0340+++	-0.0488+++	0.0349++
Overall(Table 50)	0.166***+++	0.332*** +++	0.212*** +++	0.400***+++	0.19+++	-0.386

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.

Table 85: Bilateral Long run Exchange Rate Pass-through on Disaggregated Import Prices

Long run Exchange Rate Pass-through	MAN	SMAN	FMAN	FBT	BM	Fuels
Australia	0.0394+++	0.1314+++	-0.0132+++	0.0157+++	0.3000+++	2.4970***++
Canada	0.0452+++	0.1195+++	0.0066+++	0.0657+++	0.1605+++	1.8519*
China	-0.0925*+++	-0.2463***+++	0.0385+++	-0.0941+++	-0.1215+++	0.5451
Euro	0.0552+++	0.0952+++	0.0623+++	0.0285+++	0.3708**+++	1.6820*
Japan	-0.0309+++	-0.0340+++	0.0063+++	-0.0245+++	0.0793+++	1.1472***
US	-0.1162**+++	-0.2114**+++	-0.0043+++	-0.1275+++	-0.1049+++	0.2975
Overall(Table 50)	0.1174*+++	0.18306+++	0.1826**+++	0.192+++	0.4759*++	2.018

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
For test of LCP: elasticity=1, +++, ++, and + denotes significance at the 1%, 5%, and 10% levels, respectively.

4.6.2. Robustness Check (Estimation by Equation (4.4.1))

In this section, the Equation (4.4.1) is employed to estimate bilateral exchange rate pass-through for a robustness check:

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^{Mj} + c^j y_t{}^j + \epsilon_t^j \qquad (4.4.1)$$

where e_t^j is the bilateral exchange rate of UK with the grading partner j, and

$$w_t^{Mj} w_t^{Mj} = rex_{t(Effective)}^j + p_t^j - nex_{t(Effective)}^j$$

Tables from Table 86 to 91 display the estimation results of bilateral exchange rate pass-through for the UK with six trading countries: Australia, Canada, China, Eurozone, Japan and the US. The results are estimated by Equation (4.4.1), where this bilateral exchange rate pass-through can be interpreted as a marginal contribution from a single trading partner to its total exchange rate pass-though. The results are similar to what the previous section shows.

Table 86: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices of the UK with Australia (Manufacture Cost, Equation (4.4.1))

Australia	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate	-0.00216	0.0340	0.00291	0.0151	0.201***	0.790**
(Short run elasticity a_0^j)						
	(0.0120)	(0.0295)	(0.0215)	(0.0292)	(0.0635)	(0.335)
Exchange Rate(-1)	0.0219	0.0299	0.00619	0.0159	0.118	0.656***
	(0.0219)	(0.0306)	(0.0256)	(0.0358)	(0.0761)	(0.235)
Exchange Rate(-2)	0.0357**	0.0583**	0.0281	0.0425	0.128*	0.281
	(0.0163)	(0.0283)	(0.0226)	(0.0354)	(0.0717)	(0.318)
Exchange Rate(-3)	0.00301	0.0451	-0.0213	-0.00280	0.0131	0.337
	(0.0153)	(0.0282)	(0.0248)	(0.0388)	(0.0717)	(0.270)
Exchange Rate(-4)	0.00337	0.0139	-0.0253	-0.0205	0.00231	0.252
	(0.0132)	(0.0264)	(0.0201)	(0.0324)	(0.0708)	(0.238)
Wage_M	0.757***	0.900***	0.623***	0.240	0.941***	-0.150
	(0.0739)	(0.134)	(0.0956)	(0.175)	(0.200)	(1.199)
Wage(-1)	-0.0176	0.0206	-0.0913	0.307**	-0.0683	0.0318
	(0.0486)	(0.0908)	(0.0789)	(0.151)	(0.121)	(0.117)
Wage(-2)	-0.120**	-0.0705	-0.0117	-0.241*	-0.136	-0.0915
	(0.0501)	(0.0941)	(0.0783)	(0.133)	(0.122)	(0.113)
Wage(-3)	-0.0267	-0.0296	-0.0552	0.0199	0.245**	0.122
	(0.0565)	(0.0741)	(0.0915)	(0.161)	(0.108)	(0.104)
Wage(-4)	0.0392	-0.0701	0.112	-0.0730	0.171	-0.0204
	(0.0472)	(0.0580)	(0.0712)	(0.129)	(0.106)	(0.116)
gdp	-0.229	0.0595	-0.431	-0.607*	2.138***	6.563*
	(0.170)	(0.219)	(0.327)	(0.310)	(0.563)	(3.453)
Constant	0.00161	0.00230	0.00183	0.00951***	-0.00706*	-0.0197
	(0.00118)	(0.00199)	(0.00213)	(0.00240)	(0.00399)	(0.0232)
Observations	74	74	74	74	74	74
R^2	0.817	0.699	0.616	0.307	0.466	0.278
Adjusted R^2	0.785	0.646	0.548	0.184	0.372	0.149
F	46.43	22.96	14.97	4.178	7.297	2.300
Jarque-Bera	0.00000	0.9496	0.5433	0.0436	0.1931	0.2662

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. HC OLS estimator is employed.

Table 87: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices of the UK with Canada (Manufacture Cost, Equation (4.4.1))

Canada	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate	-0.00607	0.0440	0.00279	0.0258	0.0836	0.672
(Short run elasticity a_0^j)						
	(0.0213)	(0.0325)	(0.0262)	(0.0427)	(0.0774)	(0.426)
Exchange Rate(-1)	-0.0147	-0.00771	-0.000959	0.0520	-0.00713	0.154
	(0.0195)	(0.0385)	(0.0306)	(0.0366)	(0.102)	(0.350)
Exchange Rate(-2)	-0.0136	-0.00841	-0.0212	0.0222	0.182**	0.549
	(0.0139)	(0.0347)	(0.0264)	(0.0367)	(0.0747)	(0.342)
Exchange Rate(-3)	-0.0254	0.00765	-0.0606*	-0.0758**	0.0264	0.414
	(0.0189)	(0.0316)	(0.0313)	(0.0369)	(0.0747)	(0.282)
Exchange Rate(-4)	0.0113	0.0403	0.00469	0.0266	0.000182	-0.0770
	(0.0163)	(0.0358)	(0.0251)	(0.0460)	(0.0808)	(0.332)
Wage_M	0.839***	1.006***	0.672***	0.409**	1.286***	0.0232
	(0.0487)	(0.110)	(0.0802)	(0.187)	(0.231)	(1.119)
Wage(-1)	0.0118	-0.0290	-0.0198	0.161	-0.0493	0.107
	(0.0449)	(0.0686)	(0.0796)	(0.0995)	(0.111)	(0.120)
Wage(-2)	-0.0278	0.0453	-0.0367	-0.163*	-0.0220	-0.106
	(0.0472)	(0.0747)	(0.0733)	(0.0881)	(0.0929)	(0.125)
Wage(-3)	0.00908	-0.0130	0.0415	0.129	0.0841	0.0560
	(0.0513)	(0.0685)	(0.0922)	(0.126)	(0.0965)	(0.0966)
Wage(-4)	0.0257	-0.0678	0.0895	-0.0976	0.0957	-0.0761
	(0.0431)	(0.0706)	(0.0567)	(0.110)	(0.0891)	(0.118)
gdp	-0.0218	0.284	-0.286	-0.386	2.353***	6.202
	(0.132)	(0.266)	(0.296)	(0.329)	(0.605)	(4.008)
Constant	0.000700	0.00132	0.00121	0.00797***	-0.00693	-0.0118
	(0.00104)	(0.00212)	(0.00189)	(0.00279)	(0.00469)	(0.0266)
Observations	74	74	74	74	74	74
R^2	0.881	0.742	0.674	0.435	0.455	0.199
Adjusted R^2	0.881	0.742	0.674	0.435	0.455	0.199
F	73.37	22.59	16.55	5.714	6.084	1.753
Jarque-Bera	0.0451	0.6164	0.9925	0.0574	0.6590	0.3361

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. HC OLS estimator is employed.

Table 88: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices of the UK with China (Manufacture Cost, Equation (4.4.1))

China	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	0.0491**	0.0421	0.0685**	0.0646	-0.0240	0.165
	(0.0233)	(0.0379)	(0.0291)	(0.0451)	(0.0832)	(0.373)
Exchange Rate(-1)	-0.0245	-0.0937**	-0.0181	-0.0320	-0.151**	0.126
	(0.0246)	(0.0426)	(0.0303)	(0.0375)	(0.0712)	(0.386)
Exchange Rate(-2)	0.00822	0.0160	-0.0266	0.0306	0.0792	0.110
	(0.0306)	(0.0525)	(0.0328)	(0.0526)	(0.0955)	(0.330)
Exchange Rate(-3)	-0.00341	-0.0481	-0.0206	-0.0340	-0.126	0.0603
	(0.0343)	(0.0505)	(0.0319)	(0.0367)	(0.0911)	(0.306)
Exchange Rate(-4)	0.00454	0.0547	-0.00481	0.0402	0.121	0.153
	(0.0257)	(0.0428)	(0.0315)	(0.0440)	(0.0915)	(0.268)
Wage_M	0.475***	0.459***	0.407***	0.230*	0.497**	1.083
	(0.0682)	(0.111)	(0.0703)	(0.121)	(0.205)	(0.798)
Wage(-1)	0.000829	0.0106	-0.0346	0.0607	0.0989	0.172
	(0.0659)	(0.0792)	(0.0728)	(0.0986)	(0.128)	(0.124)
Wage(-2)	-0.104	-0.0138	-0.129	-0.0889	-0.00912	-0.114
	(0.0739)	(0.119)	(0.0825)	(0.108)	(0.142)	(0.129)
Wage(-3)	-0.114	-0.0921	0.0899	-0.0178	0.0427	0.0591
	(0.0772)	(0.0909)	(0.0677)	(0.0967)	(0.124)	(0.116)
Wage(-4)	0.175**	0.00794	0.110	-0.0558	0.148	-0.0837
	(0.0752)	(0.110)	(0.0767)	(0.0916)	(0.111)	(0.136)
gdp	-0.0696	-0.200	-0.195	-0.375	1.509*	8.432*
	(0.244)	(0.366)	(0.310)	(0.362)	(0.792)	(4.503)
Constant	0.00181	0.00584**	0.00146	0.00941***	7.54e-05	-0.0209
	(0.00152)	(0.00239)	(0.00229)	(0.00259)	(0.00591)	(0.0311)
Observations	74	74	74	74	74	74
R^2	0.660	0.470	0.592	0.305	0.195	0.152
Adjusted R^2	0.599	0.376	0.520	0.182	0.0526	0.00159
F	17.85	10.31	8.014	5.441	1.781	1.026
Jarque-Bera	0.8948	0.6013	0.4966	0.0174	0.8851	0.2107

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. HC OLS estimator is employed.

Table 89: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices of the UK with Eurozone (Manufacture Cost, Equation (4.4.1))

Eurozone	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate (Short run elasticity a_0^j)	-0.0111	0.0195	-0.00576	0.164***	0.0994	0.212
	(0.00959)	(0.0309)	(0.0249)	(0.0378)	(0.0931)	(0.484)
Exchange Rate(-1)	-0.0138	-0.0279	-0.0141	-0.0300	-0.00668	0.506
	(0.0101)	(0.0395)	(0.0307)	(0.0448)	(0.0714)	(0.359)
Exchange Rate(-2)	-0.0226**	-0.0131	-0.0517*	0.0118	0.139*	0.414
	(0.00960)	(0.0296)	(0.0265)	(0.0449)	(0.0810)	(0.310)
Exchange Rate(-3)	-0.0104	-0.0145	-0.00676	-0.0538	-0.107	0.0551
	(0.0105)	(0.0325)	(0.0239)	(0.0489)	(0.0774)	(0.374)
Exchange Rate(-4)	-0.0134	-0.00777	0.0304	-0.0333	0.105	0.119
	(0.0102)	(0.0291)	(0.0263)	(0.0505)	(0.0904)	(0.274)
Wage_M	0.937***	1.112***	0.781***	0.298**	1.236***	1.324
	(0.0303)	(0.101)	(0.0759)	(0.142)	(0.218)	(1.284)
Wage(-1)	-0.0331	-0.0198	-0.0858	0.186	0.0472	0.151
	(0.0361)	(0.0809)	(0.0897)	(0.132)	(0.106)	(0.124)
Wage(-2)	0.0288	0.105	0.0961	-0.0868	-0.0392	-0.0936
	(0.0327)	(0.0784)	(0.0836)	(0.149)	(0.107)	(0.126)
Wage(-3)	0.0542	0.0650	0.0456	0.118	0.214*	0.0739
	(0.0342)	(0.0767)	(0.0869)	(0.187)	(0.113)	(0.0982)
Wage(-4)	0.0161	-0.0545	-0.0190	-0.0734	0.0943	-0.0276
	(0.0279)	(0.0704)	(0.0752)	(0.138)	(0.109)	(0.145)
gdp	0.139	0.542**	-0.114	-0.0993	2.800***	8.754**
	(0.0841)	(0.226)	(0.289)	(0.296)	(0.598)	(3.976)
	-0.000436	-0.000386	-8.76e-05	0.00632***	-0.00975**	-0.0249
Constant	(0.000635)	(0.00185)	(0.00175)	(0.00214)	(0.00466)	(0.0269)
Observations	74	74	74	74	74	74
R^2	0.954	0.766	0.714	0.489	0.440	0.184
Adjusted R^2	0.954	0.766	0.714	0.489	0.440	0.184
F	214.9	27.90	16.11	9.097	5.338	1.271
Jarque-Bera	0.8770	0.2815	0.6207	0.1952	0.3598	0.2019

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. HC OLS estimator is employed.

Table 90: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices of the UK with Japan (Manufacture Cost, Equation (4.4.1))

Japan	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate	0.00588	0.0240	0.0258*	0.0384*	0.00281	0.182
(Short run elasticity a_0^j)						
	(0.00887)	(0.0194)	(0.0132)	(0.0219)	(0.0490)	(0.165)
Exchange Rate(-1)	-0.00678	-0.0263	-0.0153	-0.0329	0.0216	0.406*
	(0.0104)	(0.0243)	(0.0172)	(0.0229)	(0.0505)	(0.213)
Exchange Rate(-2)	-0.00241	0.000664	-0.00318	-0.00316	0.0725*	0.393***
	(0.00935)	(0.0169)	(0.0165)	(0.0269)	(0.0424)	(0.147)
Exchange Rate(-3)	-0.0232***	-0.0296	-0.0183	-0.0353*	-0.0554	-0.0161
	(0.00842)	(0.0185)	(0.0152)	(0.0207)	(0.0428)	(0.197)
Exchange Rate(-4)	0.00360	0.0187	0.0245*	0.0115	0.0574	0.0604
	(0.00937)	(0.0164)	(0.0129)	(0.0300)	(0.0538)	(0.156)
Wage_M	0.777***	0.893***	0.617***	0.347**	1.061***	1.487
	(0.0452)	(0.112)	(0.0798)	(0.149)	(0.228)	(0.922)
Wage(-1)	0.0610	0.0467	-0.0709	0.187	0.0586	0.121
	(0.0490)	(0.0856)	(0.0858)	(0.115)	(0.105)	(0.119)
Wage(-2)	-0.0556	0.0842	0.00734	-0.00847	-0.0231	-0.0860
	(0.0542)	(0.0864)	(0.0723)	(0.127)	(0.0892)	(0.122)
Wage(-3)	-0.00106	0.0289	-0.0507	0.00531	0.193*	0.0661
	(0.0414)	(0.0754)	(0.0838)	(0.150)	(0.0982)	(0.0947)
Wage(-4)	0.0356	-0.0703	0.00634	-0.0185	0.0982	-0.0371
	(0.0455)	(0.0665)	(0.0695)	(0.169)	(0.0966)	(0.124)
gdp	-0.132	0.124	-0.408	-0.343	2.266***	9.501**
	(0.107)	(0.204)	(0.254)	(0.310)	(0.565)	(3.838)
	0.00125	0.00220	0.00177	0.00758***	-0.00684*	-0.0299
Constant	(0.000885)	(0.00196)	(0.00170)	(0.00270)	(0.00399)	(0.0250)
Observations	74	74	74	74	74	74
R^2	0.891	0.699	0.677	0.324	0.385	0.269
Adjusted R^2	0.872	0.646	0.620	0.205	0.276	0.140
F	52.24	20.71	10.35	8.082	4.343	3.394
Jarque-Bera	0.6480	0.6837	0.2206	0.0234	0.2315	0.1317

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. HC OLS estimator is employed.

Table 91: Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices of the UK with the US (Manufacture Cost, Equation (4.4.1))

China	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
Exchange Rate	0.00510	-0.0206	0.0686***	-0.00830	-0.126*	0.113
(Short run elasticity a_0^j)						
	(0.0183)	(0.0311)	(0.0253)	(0.0440)	(0.0736)	(0.370)
Exchange Rate(-1)	-0.00928	-0.0837**	0.00672	-0.0151	-0.0556	0.0449
	(0.0214)	(0.0315)	(0.0249)	(0.0433)	(0.0601)	(0.376)
Exchange Rate(-2)	-0.0112	-0.0122	-0.0267	-0.0307	0.0800	0.0904
	(0.0140)	(0.0323)	(0.0302)	(0.0483)	(0.0715)	(0.300)
Exchange Rate(-3)	-0.00226	-0.0303	-0.0149	-0.0331	-0.0393	-0.0704
	(0.0201)	(0.0343)	(0.0330)	(0.0377)	(0.0697)	(0.300)
Exchange Rate(-4)	0.00662	0.0578**	-0.0207	0.0200	0.117	0.129
	(0.0145)	(0.0289)	(0.0261)	(0.0426)	(0.0732)	(0.251)
Wage_M	0.840***	0.942***	0.692***	0.361**	1.358***	0.118
	(0.0498)	(0.116)	(0.0748)	(0.172)	(0.246)	(1.278)
Wage(-1)	-0.0251	0.0843	-0.169**	0.234**	0.0724	0.215
	(0.0671)	(0.0868)	(0.0750)	(0.112)	(0.0964)	(0.131)
Wage(-2)	-0.0391	0.0367	0.0212	-0.172	-0.0359	-0.0802
	(0.0551)	(0.0849)	(0.0804)	(0.143)	(0.103)	(0.132)
Wage(-3)	0.00791	0.0623	0.00661	0.150	0.131	0.104
	(0.0492)	(0.0772)	(0.0893)	(0.196)	(0.100)	(0.123)
Wage(-4)	0.0831	-0.0626	0.195**	-0.116	0.0956	-0.0669
	(0.0547)	(0.0814)	(0.0806)	(0.166)	(0.0944)	(0.140)
gdp	0.196	0.378	0.0460	-0.285	2.408***	5.611
	(0.141)	(0.296)	(0.256)	(0.325)	(0.731)	(3.714)
Constant	-0.000504	0.000900	-0.000688	0.00770***	-0.00718	-0.00596
	(0.00104)	(0.00224)	(0.00157)	(0.00254)	(0.00542)	(0.0258)
Observations	74	74	74	74	74	74
R^2	0.868	0.698	0.749	0.329	0.402	0.126
Adjusted R^2	0.844	0.645	0.705	0.210	0.296	-0.0293
F	71.38	13.81	40.05	6.784	3.648	0.781
Jarque-Bera	0.0648	0.2778	0.8090	0.0145	0.1612	0.2686

For test of PCP: elasticity=0, ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.
Standard errors are in parentheses. HC OLS estimator is employed.

4.7. Conclusion

This chapter examines the degree of exchange rate pass-through for UK disaggregated import prices, in six import sectors: manufacture, semi-manufacture, finished-manufacture, Food & Beverage & Tobacco, basic material and fuels. In the exchange rate pass-through estimation, the first finding is that SMAN has the highest exchange rate pass-through, while FBT has the lowest value, and exchange rate pass-through for the fuels' import price is not linearly significant. Secondly, the exploration of domestic demand conditions, by six indices, has shown that the IMP and BCI indexes perform better than GDP, GDP growth rate, IMP growth rate and BCI UK, in describing domestic market demand conditions. Thirdly, the determinants of exchange rate pass-through have been investigated for the UK's disaggregated import prices in six import sectors, by testing the following five factors: money growth, inflation, exchange rate volatility, real GDP, and central bank credibility.

The results also show all factors are significant in determining changes of import prices, though at different timing lags. Inflation tends to have more immediate effects on import prices, while real GDP and central bank credibility seem to have a lagged influence on import prices (about two to three quarters lagged). Exchange rate volatility also has an impact on import prices, up to three lagged quarters, implying that exchange rate volatility has longer and more consistent impact, on import prices, than other factors. One possible explanation could be the currency invoices; foreign producers prefer to choose a more stable and reliable currency when they are making an international deal, to avoid unnecessary risk. This could be used as an indicator, when predicting the changes of import prices, at a qualitative or quantitative level. In particular, both the short run and the long run exchange rate pass-through appears to be higher when using the cost variable, reflecting the macroeconomic environment production cost rather than industry-specific production cost, for all six different industry sectors. Out of all six industries studied, semi-manufacture has the highest estimation of the exchange rate pass-through, when using the macro production cost versus using industry-specific production cost. This may indicate that exporters' increased flexibility in adjusting their product prices under the macroeconomic environment production cost, leads to a higher exchange rate pass-through. The findings for this chapter is crucial for monetary policy studies, macroeconomic policy studies, pass-through studies and international trading strategy studies.

There are four suggestions for future studies on the exchange rate pass-through. Firstly, in the structure of this estimation model, the use of indices for domestic market demand conditions should be taken into consideration, also, the way to structure the variable of the cost of foreign producers. In this chapter, the cost variable employs a labour cost index to plot the foreign producers' changing production conditions. In future studies, these measures could be explored further. Secondly, the findings show that exchange rate pass-through is related to macroeconomic conditions, such as money growth, inflation and central bank credibility; however, how monetary policies influence exchange rate pass-through has not been investigated in this chapter. Under which conditions exchange rate pass-through would be endogenous to monetary policy, and how the effectiveness of the monetary policy impacts on exchange rate pass-through, would be an interesting topic for future studies. Thirdly, more corporate studies can focus on the international trades, by exploring international firms' behaviour, to explain the observed exchange rate pass-through. For example, how exchange rate pass-through could impact on foreign producers' behaviour, or how those two factors interact with each other, and the extent to which exchange rate pass-through studies can help firms to adjust their strategies in the international trades would be interesting to explore.

Chapter 5: Conclusion

This thesis investigates the workings of the exchange rate as it plays a key role in the financial market and international trading. Moreover, it has essential impacts on the monetary policy effectiveness. In Chapter 2, a model to estimate the risk premium based on the Taylor Rule fundamentals was built and then the focus was switched to the exchange rate pass-through into import prices in Chapter 3 and Chapter 4. Chapter 3 studies the exchange rate pass-through into aggregated import prices for five developed economies while Chapter 4 studies it on a disaggregated import price level for the UK.

In Chapter 2, a model that links the currency risk premium and macroeconomic variables was constructed. Interest rates and exchange rate risk premiums are predicted based on Taylor rule fundamentals through an autoregressive distributed lag model regression by both OLS and GMM estimations, while an FSI variable is also incorporated into the regression to test the impacts of financial stress. The interest rate for the US, UK and Japan is estimated, and the exchange risk premium for two currency pairs: US/UK and US/Japan. This chapter uses quarterly data from 1980 to 2018 and divided the full sample into two subsamples: pre-crisis sample and crisis & post-crisis sample, due to a structural break, and also for an investigation of how FSI has different impacts during different periods. The results can be summarized as follows: First, Taylor Rule fundamental based autoregressive distributed lag model performs well in the estimation of currency risk premiums. It did not show much difference when using three different rates to plot the expected exchange rate: actual exchange rate, 3-month spot exchange rate and 3-month forward exchange rate. Second, the results imply that FSI is significant in determining the interest rates, however, it seems to be data sensitive as IMF FSI data shows less significance than Kansas FSI data. Furthermore, the research reveals that FSI has a negative effect on interest rate for all countries. Moreover, its impacts are slightly higher during the pre-crisis period than the crisis & post-crisis period for all the countries that have been examined by GMM estimation while OLS gives similar values. Third, the inflation gap with one lead is significant in determining the current policy rates, while the inflation gap independently is not.

Furthermore, the empirical results reveal significant differences in the estimated coefficients during 1980-2018, 1980-2007, and 2007-2018. The implication is that structural breaks may be present, or, more plausibly, Taylor rule may operate in a non-linear way which is a natural extension to this chapter. In addition, the construction of FSI variable should also be taken into account as results can vary due to different proxies of FSI.

Chapter 3 and Chapter 4 shift the interest in the transmission of exchange rates into import prices, and the process is named as exchange rate pass-through. Chapter 3 looks at the exchange rate pass-through and the determinants of it for five developed economies: France, Germany, Japan, UK and US at an aggregated import price level; using quarterly data from 1980 to 2016 under the floating exchange rate regime. The findings indicate cross-country differences in exchange rate pass-through and both LCP and PCP have been rejected for all the countries. Based on that, the work is developed to examine the determinants of exchange rate pass-through. The results show that the real GDP, money growth rate, and inflation have all displayed the significance in determination, to some extent, while exchange rate volatility is very consistently significant for all countries across all the tests. Furthermore, the quarterly inflation rate tends to be significant in exchange rate pass-through determination for Germany and the UK, while the annualized inflation rate is significant in France and the US's case. This may indicate the exchange rate pass-through of Germany and the UK responds to its currency inflation faster than it does in France and US. The across-country different exchange rate pass-through intrigues us to investigate exchange rate pass-through for one specific country in detail. The UK was chosen as most past literature has focused on the US and it constitutes an interesting case as the UK will experience significant challenges post-Brexit.

Chapter 4 provides a more detailed study of exchange rate pass-through rates for the UK at a disaggregated import price level. In this chapter, the degree of exchange rate pass-through for the UK disaggregated import prices was tested at six different import sectors: MAN, SMAN, FMAN, FBT, BM and fuels. The determinants of the UK's exchange rate pass-through rates was also examined in these six disaggregated import sectors respectively by testing 5 factors: money growth, inflation, exchange rate volatility, real GDP, and central bank credibility. Meanwhile, six measurements of domestic demand conditions indices have been explored, and the finding is that: IMP and BCI indexes perform better than GDP, GDP growth rate, IMP growth rate and BCI UK. In particular, the scenario analysis of the situation where macroeconomic cost or industry-specific cost takes place in the foreign trading partners production cost is taken into consideration. In addition, the bilateral exchange rate pass-through rates of the UK is also considered. The main findings in Chapter 4 are as follows: First, SMAN has the highest exchange rate pass-through while FBT has the lowest value, and exchange rate pass-through for fuels' import price is not linearly significant. Second, in terms of the determinants, the results show that all factors are significant in determining the changes of import prices, however at different timing lags. Additionally, inflation tends to have more immediate effects on the import prices than other factors while real GDP and central bank credibility seem to have a lagged influence on the import prices (about two to three quarters lagged), and exchange rate volatility has very consistent significance in exchange rate pass-through in all industries. Third, a trading partner, who has large-volume exports in the UK's import bundle, tends to have a higher exchange rate pass-through rates in that specific industry.

In Chapter 4 shows that exchange rate pass-through is closely related to macroeconomic conditions, such as money growth, inflation and central bank credibility; however, how monetary policies influence exchange rate pass-through has not been investigated in this chapter. The conditions in which would exchange rate pass-through be endogenous to monetary policy and the effectiveness of the monetary policy impact on exchange rate pass-through would be interesting topics for future studies. Moreover, more corporate studies could focus on international trading by exploring the international firms' behaviours to explain the observed exchange rate pass-through; as firms' behaviours and strategies are the major reasons of exchange rate absorption. For example, they could explore how exchange rate pass-through would impact on foreign producers' behaviour, or how those two factors interact with each other, or how exchange rate pass-through studies can help firms to adjust their strategies in the international trades.

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Appendix

Equations

Chapter 2

$$\lambda_{t} \equiv i_t^* - i_t^h + E_t e_{t+1} - e_t \quad (2.1)$$

$$i_t = \rho_i i_{t-1} + (1-\rho_i)\hat{i}_t \quad (2.2)$$

$$\hat{i}_t = \left\{\bar{i} + \rho_\pi(\pi_t - \pi^T) + \rho_y y_t\right\} + \varepsilon_t \quad (2.3)$$

$$i_t = \rho_i i_{t-1} + (1-\rho_i)\left\{\bar{i} + \rho_\pi(\pi_t - \pi^T) + \rho_y y_t\right\} + \varepsilon_t \quad (2.4)$$

$$\lambda_{1t} = (E_t e_{t+1} - e_t) + \frac{1}{4}\left\{(\rho_i^* i_{t-1} + (1-\rho_i^*)\left(\bar{i}^* + \rho_\pi^*(\pi_t - \pi^T)^* + \rho_y^* y_t^*\right)\right\} - \frac{1}{4}\left\{\rho_i^h i_{t-1} + \left(1-\rho_i^h\right)\left(\bar{i}^h + \rho_\pi^h(\pi_t - \pi^T)^h + \rho_y^h y_t^h\right)\right\} \quad (2.5)$$

$$\hat{i}_t = \left\{\bar{i} + \rho_\pi(\pi_t - \pi^T) + \rho_y y_t + \rho_\mu \mu_t\right\} + \varepsilon_t \quad (2.6)$$

$$i_t = \rho_i i_{t-1} + (1-\rho_i)\left\{\bar{i} + \rho_\pi(\pi_t - \pi^T) + \rho_y y_t + \rho_\mu \mu_t\right\} + \varepsilon_t \quad (2.7)$$

$$\lambda_{2t} = (E_t e_{t+1} - e_t) + \frac{1}{4}\left\{(\rho_i^* i_{t-1} + (1-\rho_i^*)\left(\bar{i}^* + \rho_\pi^*(\pi_t - \pi^T)^* + \rho_y^* y_t^* + \rho_\mu^* \mu_t{}^*\right)\right\} - \frac{1}{4}\left\{\rho_i^h i_{t-1} + \left(1-\rho_i^h\right)\left(\bar{i}^h + \rho_\pi^h(\pi_t - \pi^T)^h + \rho_y^h y_t^h + \rho_\mu^h \mu_t\right)\right\} \quad (2.8)$$

$$\lambda_{rt} = e_{t+1} - e_t + \frac{1}{4}(i_t^* - i_t^h) \quad (2.9)$$

$$\lambda_{st} = sp_t - e_t + \frac{1}{4}(i_t^* - i_t^h) \quad (2.10)$$

$$\lambda_{ft} = f_t - e_t + \frac{1}{4}(i_t^* - i_t^h) \quad (2.11)$$

Chapter 3

$$p_t^m = \phi_0 + (1 + \phi_1)e_t + c_0 y_t + c_1 w_t^x \quad (3.1)$$

$$p_t = \alpha + \beta e_t + \delta w_t + \varphi y_t + \epsilon_t \quad (3.2)$$

$$W_t^j = REX_t^j * P_t^j / NEX_t^j \quad (3.3)$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j\, \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j\, \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \tag{3.4}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j\, \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \tag{3.5}$$

$$\Delta p_t^j = \alpha + \Delta p_{t-1}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j\, \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \tag{3.6}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j\, \Delta e_{t-i}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j\, \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \tag{3.7}$$

Chapter 4

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j\, \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j\, \Delta w_{t-i}^j + c^j \Delta {y_t}^j + \epsilon_t^j \tag{4.1}$$

$$p_t^m = \phi_0 + (1 + \phi_1) e_t + c_0 y_t + c_1 w_t^x \tag{4.2}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j\, \Delta e_{t-i}^j + \sum_{i=1}^{4} b_i^j\, \Delta w_{t-i}^j + c^{j(-)} BCI^{j(-)} + c^{j(+)} BCI^{j(+)} + \epsilon_t^j \tag{4.3}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j\, \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j\, \Delta w_{t-i}^{Mj} + c^j \Delta {y_t}^j + \epsilon_t^j \tag{4.4}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j\, \Delta e_{t-i}^j + \sum_{i=1}^{4} b_i^j\, \Delta w_{t-i}^j + c^j \Delta {y_t}^j + \epsilon_t^j \tag{4.5}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j\, \Delta e_{t-i}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j\, \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \tag{4.6}$$

$$\Delta p_t^j = \alpha + \sum_{i=0}^{4} a_i^j\, \Delta e_{t-i}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=1}^{4} b_i^j\, \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \tag{4.7}$$

$$\Delta p_t^j = \alpha + \Delta p_{t-1}^j + \sum_{i=0}^{4} a_i^j\, \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j\, \Delta w_{t-i}^j + c^j \Delta {y_t}^j + \epsilon_t^j \tag{4.8}$$

$$\Delta p_t^j = \alpha + \Delta p_{t-1}^j + \sum_{i=0}^{4} a_i^j\, \Delta e_{t-i}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j\, \Delta w_{t-i}^j + c^j \Delta y_t^j + \epsilon_t^j \tag{4.9}$$

Tables

3.3.3. Lagged Dependent Variable

Tables from Table 92 to 96 show the regression results by running the following equation:

$$\Delta p_t^j = \alpha + \rho \Delta p_{t-1}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta gdp_t^j + \epsilon_t^j \qquad (3.6)$$

where

$z_{1t} = \text{money growth}_t$,

$z_{2t} = \text{inflation}_t$,

$z_{3t} = \text{exvol}_t$,

$z_{4t} = \text{real gdp}_t$.

$z_{5t} = \text{annualized money growth}_t$, and

$z_{6t} = \text{annualized inflation}_t$.

Table 92: OLS estimation results for France (Equation(3.6))

France z VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real gdp Δp
$\Delta p(-1)$	0.539***	0.478***	0.440***	0.664***
	(0.0771)	(0.0834)	(0.0759)	(0.0701)
z	0.922	-0.958	169.2***	0.00205
	(0.708)	(1.539)	(63.86)	(0.00456)
z(-1)	2.842***	4.305***	94.85*	0.00612
	(0.724)	(1.415)	(51.71)	(0.00463)
z(-2)	1.858**	5.273***	200.0***	0.00412
	(0.740)	(1.416)	(50.21)	(0.00467)
z(-3)	1.394*	2.678*	66.14	0.00351
	(0.723)	(1.410)	(50.14)	(0.00454)
z(-4)	-0.371	-0.123	2.841	-0.00739*
	(0.712)	(1.362)	(49.65)	(0.00437)
Wage	0.945***	0.951***	0.966***	0.955***
	(0.0155)	(0.0149)	(0.0140)	(0.0160)
Wage(-1)	-0.533***	-0.499***	-0.452***	-0.657***
	(0.0743)	(0.0817)	(0.0751)	(0.0701)
Wage(-2)	0.0320**	0.0257	0.00672	0.0426**
	(0.0155)	(0.0162)	(0.0162)	(0.0174)
Wage(-3)	-0.00131	0.00636	-0.00583	-0.00293
	(0.0159)	(0.0159)	(0.0150)	(0.0173)
Wage(-4)	-0.0219	-0.0285*	-0.0212	-0.00875
	(0.0146)	(0.0149)	(0.0141)	(0.0161)
gdp	-0.0380	-0.0822*	-0.106**	-0.0332
	(0.0473)	(0.0458)	(0.0424)	(0.0499)
Constant	-0.000186	-0.000462	-0.000353	-0.000296
	(0.000308)	(0.000301)	(0.000269)	(0.000322)
Observations	142	142	136	142
R^2	0.980	0.982	0.983	0.978
Adjusted R^2	0.978	0.980	0.981	0.976
F	531.5	578.1	595.6	483.9
LM Test	0.9864	0.9280	0.0327	0.6133
Breusch-Pagan	0.0000	0.0001	0.1498	0.0003
Jarque-Bera	0.0018	0.0002	0.0494	0.0008

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money $growth_t$, $inflation_t$, $exvol_t$ and real gdp_t, respectively.

Table 93: OLS estimation results for Germany (Equation(3.6))

Germany z VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real gdp Δp
Δp(−1)	0.359***	0.376***	0.403***	0.400***
	(0.0978)	(0.0985)	(0.0989)	(0.0998)
z	1.660**	8.938***	258.9***	0.0124***
	(0.796)	(2.993)	(79.98)	(0.00415)
z(-1)	0.194	-5.218*	-122.4	-0.00277
	(0.820)	(3.048)	(83.50)	(0.00433)
z(-2)	-1.414*	-3.644	-80.56	-0.00493
	(0.755)	(2.727)	(78.85)	(0.00411)
z(-3)	0.692	-2.588	-28.93	0.000168
	(0.767)	(2.810)	(77.17)	(0.00397)
z(-4)	0.419	1.510	75.70	0.00386
	(0.727)	(2.511)	(71.56)	(0.00378)
Wage	0.951***	0.939***	0.939***	0.940***
	(0.0240)	(0.0245)	(0.0248)	(0.0246)
Wage(-1)	-0.358***	-0.340***	-0.367***	-0.379***
	(0.0948)	(0.0936)	(0.0934)	(0.0945)
Wage(-2)	-0.0133	-0.0333	-0.0350	-0.0260
	(0.0233)	(0.0251)	(0.0258)	(0.0260)
Wage(-3)	0.0379	0.0536**	0.0443*	0.0380
	(0.0236)	(0.0254)	(0.0259)	(0.0258)
Wage(-4)	-0.0457**	-0.0468**	-0.0383*	-0.0361
	(0.0211)	(0.0217)	(0.0227)	(0.0229)
gdp	-0.0608*	-0.0590*	-0.0713**	-0.0738**
	(0.0339)	(0.0331)	(0.0334)	(0.0340)
Constant	-0.000863***	-0.000954***	-0.000814**	-0.000785**
	(0.000316)	(0.000305)	(0.000310)	(0.000312)
Observations	98	98	98	98
R^2	0.971	0.972	0.972	0.972
Adjusted R^2	0.967	0.968	0.968	0.968
F	236.0	246.7	247.5	243.3
LM Test	0.4912	0.6666	0.2372	0.2127
Breusch-Pagan	0.1868	0.2702	0.8782	0.7962
Jarque-Bera	0.0001	0.0054	0.0239	0.0086

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money $growth_t$, $inflation_t$, $exvol_t$ and real gdp_t, respectively.

Table 94: OLS estimation results for Japan (Equation(3.6))

Japan	(1)	(2)	(3)	(4)
z	Money Growth	Inflation	Exvol	Real gdp
VARIABLES	Δp	Δp	Δp	Δp
Δp(−1)	0.498***	0.550***	0.481***	0.409***
	(0.0740)	(0.0697)	(0.0767)	(0.0761)
z	1.040	-2.049	21.69**	0.00937***
	(0.924)	(1.426)	(10.66)	(0.00297)
z(-1)	-0.839	0.392	-12.29	-0.00253
	(0.938)	(1.399)	(11.31)	(0.00332)
z(-2)	1.841**	0.868	23.55**	0.00868***
	(0.902)	(1.354)	(11.12)	(0.00317)
z(-3)	0.294	-0.0251	-2.173	0.00112
	(0.940)	(1.366)	(11.66)	(0.00321)
z(-4)	1.492*	2.498**	22.61**	0.00677**
	(0.892)	(1.237)	(10.66)	(0.00290)
Wage	0.961***	0.973***	0.955***	0.936***
	(0.0132)	(0.0105)	(0.0142)	(0.0141)
Wage(-1)	-0.459***	-0.512***	-0.441***	-0.363***
	(0.0714)	(0.0684)	(0.0734)	(0.0723)
Wage(-2)	-0.0256*	-0.0118	-0.0304**	-0.0385**
	(0.0138)	(0.0115)	(0.0142)	(0.0159)
Wage(-3)	0.00462	0.00969	0.0111	0.00774
	(0.0137)	(0.0114)	(0.0140)	(0.0156)
Wage(-4)	-0.00707	0.00424	-0.0135	-0.0172
	(0.0125)	(0.0105)	(0.0128)	(0.0136)
gdp	-0.107**	-0.130***	-0.118***	-0.116***
	(0.0410)	(0.0413)	(0.0405)	(0.0375)
Constant	-0.00322***	-0.00326***	-0.00310***	-0.00334***
	(0.000710)	(0.000719)	(0.000742)	(0.000675)
Observations	142	142	137	142
R^2	0.989	0.989	0.989	0.990
Adjusted R^2	0.988	0.988	0.988	0.989
F	970.5	948.5	938.5	1096
LM Test	0.0023	0.0005	0.0117	0.0092
Breusch-Pagan	0.4869	0.6654	0.8029	0.4328
Jarque-Bera	0.0552	0.3187	0.1329	0.1358

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money $growth_t$, $inflation_t$, $exvol_t$ and real gdp_t, respectively.

Table 95: OLS estimation results for the UK (Equation(3.6))

UK	(1)	(2)	(3)	(4)
z	Money Growth	Inflation	Exvol	Real gdp
VARIABLES	Δp	Δp	Δp	Δp
$\Delta p(-1)$	0.542***	0.512***	0.526***	0.539***
	(0.0796)	(0.0786)	(0.0796)	(0.0788)
z	1.242*	1.285	3.138	0.00356
	(0.714)	(1.142)	(36.55)	(0.00365)
z(-1)	-0.438	0.795	-83.56**	-0.00805**
	(0.710)	(1.150)	(36.17)	(0.00367)
z(-2)	1.148*	1.860*	87.01**	0.00836**
	(0.683)	(1.090)	(38.64)	(0.00374)
z(-3)	-0.629	-0.257	-52.14	-0.00365
	(0.606)	(1.070)	(34.54)	(0.00348)
z(-4)	-0.381	1.070	57.66*	0.00176
	(0.602)	(1.010)	(32.96)	(0.00340)
Wage	0.910***	0.921***	0.935***	0.926***
	(0.0239)	(0.0231)	(0.0230)	(0.0248)
Wage(-1)	-0.484***	-0.471***	-0.447***	-0.460***
	(0.0772)	(0.0765)	(0.0786)	(0.0777)
Wage(-2)	-0.0217	-0.0212	-0.0441*	-0.0420*
	(0.0241)	(0.0230)	(0.0243)	(0.0249)
Wage(-3)	0.00226	-0.00545	0.00661	0.000823
	(0.0245)	(0.0236)	(0.0243)	(0.0253)
Wage(-4)	0.0260	0.0120	-0.00864	0.00567
	(0.0228)	(0.0217)	(0.0222)	(0.0233)
gdp	0.120**	0.116**	0.0805	0.104*
	(0.0554)	(0.0553)	(0.0574)	(0.0559)
Constant	0.000492	0.000677	0.000831	0.000653
	(0.000529)	(0.000518)	(0.000536)	(0.000530)
Observations	129	131	131	131
R^2	0.962	0.961	0.963	0.962
Adjusted R^2	0.958	0.957	0.959	0.959
F	243.0	244.7	254.6	251.5
LM Test	0.6133	0.9804	0.9983	0.9025
Breusch-Pagan	0.2850	0.1634	0.3481	0.3316
Jarque-Bera	0.0004	0.0008	0.0000	0.0003

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money $growth_t$, $inflation_t$, $exvol_t$ and real gdp_t, respectively.

Table 96: OLS estimation results for the US (Equation(3.6))

US	(1)	(2)	(3)	(4)
z	Money Growth	Inflation	Exvol	Real gdp
VARIABLES	Δp	Δp	Δp	Δp
$\Delta p(-1)$	0.665***	0.724***	0.650***	0.571***
	(0.0683)	(0.0621)	(0.0662)	(0.0737)
z	4.996***	-0.241	65.07***	0.0210***
	(1.031)	(1.300)	(20.74)	(0.00484)
z(-1)	0.588	3.470***	17.15	0.0102*
	(1.131)	(1.259)	(22.75)	(0.00531)
z(-2)	1.220	-0.143	25.86	0.00737
	(1.119)	(1.298)	(22.64)	(0.00531)
z(-3)	-1.517	1.005	-24.86	-0.00536
	(1.099)	(1.263)	(22.29)	(0.00531)
z(-4)	0.785	0.971	-6.627	0.00718
	(1.006)	(1.280)	(19.79)	(0.00476)
Wage	0.914***	1.014***	0.984***	0.915***
	(0.0344)	(0.0305)	(0.0311)	(0.0330)
Wage(-1)	-0.731***	-0.818***	-0.742***	-0.664***
	(0.0740)	(0.0729)	(0.0754)	(0.0784)
Wage(-2)	0.0174	0.0355	0.00832	0.0146
	(0.0402)	(0.0366)	(0.0387)	(0.0387)
Wage(-3)	-0.00985	-0.0441	-0.0205	-0.00890
	(0.0382)	(0.0348)	(0.0363)	(0.0375)
Wage(-4)	-0.0209	0.00396	-0.0264	-0.0307
	(0.0314)	(0.0301)	(0.0311)	(0.0319)
gdp	-0.0696	0.0273	-0.0427	-0.0148
	(0.0765)	(0.0824)	(0.0789)	(0.0743)
Constant	0.000335	-0.00122	-0.000364	3.68e-05
	(0.000808)	(0.000804)	(0.000770)	(0.000765)
Observations	142	142	140	142
R^2	0.934	0.924	0.930	0.936
Adjusted R^2	0.928	0.917	0.923	0.930
F	151.7	130.3	139.7	156.4
LM Test	0.0204	0.0215	0.0135	0.0326
Breusch-Pagan	0.5321	0.0308	0.2682	0.0360
Jarque-Bera	0.0000	0.0000	0.0000	0.0000

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values of Breusch-Godfrey LM test, Breusch-Pagan and Jarque-Bera tests are reported for testing the null of no-autocorrelation, homoscedasticity and normality, respectively. The determinant variable z_t and its lagged variables in each regression (1), (2), (3) and (4) is substituted by money $growth_t$, $inflation_t$, $exvol_t$ and real gdp_t, respectively.

4.2.4. Lagged Dependent Variable

Exchange Rate Pass-through

Tables from Table 97 to 102 display the regression results by running the following equation:

$$p_t^j = \alpha + \rho\Delta p_{t-1}^j + \sum_{i=0}^{4} a_i^j\,\Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j\,\Delta w_{t-i}^j + c^j\Delta y_t{}^j + \epsilon_t^j \tag{4.8}$$

where $y_t = \mathrm{gdp}_t, \mathrm{imp}_t, \mathrm{GDP\_gr}_t, \mathrm{IMP\_gr}_t, \mathrm{BCI\_Euro}_t, and\ \mathrm{BCI\_UK}_t$, respectively.

Table 97 : Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (GDP, Equation (4.7))

INDUSTRY VARIABLES	(1) MAN Δp	(2) SMAN Δp	(3) FMAN Δp	(4) FBT Δp	(5) BM Δp	(6) Fuels Δp
$\Delta p(-1)$	0.567***	0.592***	0.412***	0.538***	0.487***	0.557***
	(0.113)	(0.112)	(0.140)	(0.132)	(0.125)	(0.124)
Exchange Rate (Short run elasticity a_0^j)	0.151***	0.133***	0.114***	0.0593	0.0438	-0.00107
	(0.0391)	(0.0429)	(0.0379)	(0.0448)	(0.0424)	(0.0411)
Exchange Rate(-1)	-0.0676	-0.0553	-0.00948	-0.0166	-0.000546	-0.00303
	(0.0442)	(0.0464)	(0.0487)	(0.0457)	(0.0402)	(0.0449)
Exchange Rate(-2)	0.0212	0.0119	0.0286	-0.0192	0.0397	0.0484
	(0.0398)	(0.0485)	(0.0473)	(0.0568)	(0.0458)	(0.0445)
Exchange Rate(-3)	-0.0425	-0.00112	-0.0190	-0.0299	-0.00722	0.00151
	(0.0326)	(0.0421)	(0.0390)	(0.0487)	(0.0388)	(0.0373)
Exchange Rate(-4)	-0.0185	-0.0525	-0.0424	-0.0562	-0.0184	-0.0123
	(0.0319)	(0.0391)	(0.0379)	(0.0515)	(0.0404)	(0.0433)
Wage	0.604***	0.754***	0.674***	0.856***	0.928***	0.999***
	(0.0608)	(0.0620)	(0.0635)	(0.0779)	(0.0333)	(0.00759)
Wage(-1)	-0.369***	-0.472***	-0.372***	-0.430***	-0.467***	-0.551***
	(0.0803)	(0.0937)	(0.122)	(0.118)	(0.116)	(0.124)
Wage(-2)	-0.0103	0.0624	-0.0167	0.0622	0.0400	0.00234
	(0.0415)	(0.0467)	(0.0664)	(0.0681)	(0.0275)	(0.00594)
Wage(-3)	0.0486	-0.0355	-0.0134	0.0833	0.0201	0.0119
	(0.0459)	(0.0576)	(0.0625)	(0.0755)	(0.0242)	(0.00894)
Wage(-4)	0.0217	0.0938*	0.0942*	0.0485	0.0500*	-0.00466
	(0.0608)	(0.0506)	(0.0498)	(0.0790)	(0.0274)	(0.00789)
gdp	0.0774	0.242*	0.00458	0.271*	0.430**	0.245
	(0.121)	(0.144)	(0.168)	(0.158)	(0.164)	(0.181)
Constant	-0.00111	-0.00232*	-0.00119	-0.00422*	-0.00424***	-0.00293**
	(0.00111)	(0.00133)	(0.00122)	(0.00221)	(0.00136)	(0.00140)
Observations	71	71	71	71	71	71
R^2	0.872	0.913	0.833	0.852	0.960	0.997
Adjusted R^2	0.845	0.895	0.799	0.821	0.952	0.996
F	27.07	53.42	24.44	31.11	202.6	3498
Jarque-Bera	0.8878	0.7909	0.7859	0.1039	0.2285	0.5061

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

Table 98 : Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (IMP, Equation (4.7))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
$\Delta p(-1)$	0.578***	0.595***	0.467***	0.579***	0.536***	0.591***
	(0.114)	(0.113)	(0.146)	(0.144)	(0.129)	(0.132)
Exchange Rate (Short run elasticity a_0^j)	0.157***	0.145***	0.123***	0.0645	0.0424	0.000669
	(0.0408)	(0.0417)	(0.0408)	(0.0470)	(0.0420)	(0.0429)
Exchange Rate(-1)	-0.0641	-0.0430	-0.0171	-0.0229	-0.00926	-0.00748
	(0.0449)	(0.0471)	(0.0510)	(0.0455)	(0.0391)	(0.0440)
Exchange Rate(-2)	0.0160	-0.00200	0.0293	-0.0310	0.0233	0.0369
	(0.0404)	(0.0498)	(0.0470)	(0.0573)	(0.0461)	(0.0441)
Exchange Rate(-3)	-0.0404	-0.00359	-0.0143	-0.0284	-0.0143	0.000440
	(0.0316)	(0.0426)	(0.0369)	(0.0481)	(0.0410)	(0.0376)
Exchange Rate(-4)	-0.0195	-0.0616	-0.0388	-0.0674	-0.0291	-0.0214
	(0.0330)	(0.0400)	(0.0365)	(0.0538)	(0.0407)	(0.0421)
Wage	0.603***	0.743***	0.683***	0.850***	0.929***	0.999***
	(0.0580)	(0.0599)	(0.0605)	(0.0781)	(0.0346)	(0.00764)
Wage(-1)	-0.390***	-0.507***	-0.402***	-0.460***	-0.517***	-0.587***
	(0.0816)	(0.0988)	(0.121)	(0.126)	(0.121)	(0.134)
Wage(-2)	-0.00442	0.0668	-0.0180	0.0506	0.0311	0.00221
	(0.0404)	(0.0438)	(0.0627)	(0.0659)	(0.0285)	(0.00600)
Wage(-3)	0.0444	-0.0316	-0.0152	0.0854	0.0220	0.0118
	(0.0450)	(0.0547)	(0.0599)	(0.0726)	(0.0254)	(0.00890)
Wage(-4)	0.0205	0.0931*	0.0942*	0.0503	0.0382	-0.00520
	(0.0600)	(0.0529)	(0.0488)	(0.0795)	(0.0264)	(0.00775)
imp	0.0675	0.133**	0.0779	0.142**	0.168**	0.114
	(0.0592)	(0.0627)	(0.0802)	(0.0681)	(0.0799)	(0.0972)
Constant	-0.000685	-0.000914	-0.00115	-0.00277*	-0.00180*	-0.00159
	(0.000731)	(0.000850)	(0.000794)	(0.00157)	(0.000936)	(0.00105)
Observations	71	71	71	71	71	71
R^2	0.874	0.915	0.837	0.853	0.959	0.997
Adjusted R^2	0.848	0.897	0.803	0.823	0.951	0.996
F	29.71	60.51	25.86	40.32	174.7	3328
Jarque-Bera	0.8383	0.9219	0.8584	0.2227	0.6922	0.6679

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

Table 99 : Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (GDP growth rate, Equation (4.7))

INDUSTRY VARIABLES	(1) MAN Δp	(2) SMAN Δp	(3) FMAN Δp	(4) FBT Δp	(5) BM Δp	(6) Fuels Δp
$\Delta p(-1)$	0.499***	0.514***	0.420***	0.554***	0.458***	0.577***
	(0.132)	(0.115)	(0.151)	(0.154)	(0.156)	(0.135)
Exchange Rate (Short run elasticity a_0^j)	0.120***	0.125***	0.0769**	0.0239	0.0232	-0.0193
	(0.0374)	(0.0413)	(0.0368)	(0.0453)	(0.0479)	(0.0524)
Exchange Rate(-1)	-0.0184	0.00671	0.0164	0.0119	0.0358	0.0280
	(0.0386)	(0.0421)	(0.0477)	(0.0486)	(0.0407)	(0.0487)
Exchange Rate(-2)	0.0193	0.0251	0.0172	0.0118	0.0606	0.0587
	(0.0393)	(0.0486)	(0.0463)	(0.0641)	(0.0520)	(0.0504)
Exchange Rate(-3)	-0.0560*	-0.0422	-0.0270	-0.0325	-0.0124	-0.00363
	(0.0317)	(0.0417)	(0.0382)	(0.0504)	(0.0402)	(0.0377)
Exchange Rate(-4)	0.000185	-0.0140	-0.0219	-0.0282	0.0177	0.0305
	(0.0311)	(0.0351)	(0.0387)	(0.0518)	(0.0394)	(0.0472)
Wage	0.594***	0.712***	0.677***	0.870***	0.924***	0.997***
	(0.0554)	(0.0525)	(0.0611)	(0.0799)	(0.0317)	(0.00823)
Wage(-1)	-0.344***	-0.439***	-0.360***	-0.451***	-0.455***	-0.574***
	(0.0728)	(0.0845)	(0.117)	(0.126)	(0.138)	(0.136)
Wage(-2)	0.0137	0.0565	0.0283	0.0216	0.0184	-0.00507
	(0.0390)	(0.0452)	(0.0677)	(0.0809)	(0.0283)	(0.00623)
Wage(-3)	0.0429	0.0168	-0.0412	0.0789	0.0243	0.0128
	(0.0421)	(0.0507)	(0.0611)	(0.0729)	(0.0276)	(0.00893)
Wage(-4)	0.0502	0.0954**	0.125**	0.0552	0.0616**	-0.00122
	(0.0559)	(0.0465)	(0.0502)	(0.0876)	(0.0301)	(0.00833)
GDP_gr	-0.000131	0.000454	0.000591	0.000625	0.00141	0.000602
	(0.00124)	(0.00157)	(0.00123)	(0.00172)	(0.00190)	(0.00159)
Constant	-0.000645	-0.000164	-0.000629	-0.00153	-0.000142	-0.000321
	(0.000873)	(0.000977)	(0.00108)	(0.00144)	(0.00123)	(0.00143)
Observations	64	64	64	64	64	64
R^2	0.862	0.917	0.806	0.835	0.963	0.997
Adjusted R^2	0.830	0.897	0.760	0.796	0.954	0.996
F	25.69	75.47	22.11	27.74	248.9	2597
Jarque-Bera	0.5033	0.7386	0.7993	0.2327	0.3561	0.7238

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

Table 100 : Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (IMP growth rate, Equation (4.7))

	(1)	(2)	(3)	(4)	(5)	(6)
INDUSTRY	MAN	SMAN	FMAN	FBT	BM	Fuels
VARIABLES	Δp	Δp	Δp	Δp	Δp	Δp
$\Delta p(-1)$	0.289	0.438**	0.139	0.341*	0.440**	0.507***
	(0.213)	(0.171)	(0.201)	(0.187)	(0.192)	(0.152)
Exchange Rate (Short run elasticity a_0^j)	0.173***	0.147*	0.154**	0.202**	0.0953	0.0495
	(0.0611)	(0.0740)	(0.0560)	(0.0751)	(0.0676)	(0.0513)
Exchange Rate(-1)	-0.0634	-0.0249	-0.0410	-0.0486	-0.0669	-0.0910*
	(0.0522)	(0.0579)	(0.0557)	(0.0504)	(0.0622)	(0.0509)
Exchange Rate(-2)	0.0731	0.0757	0.130***	0.0856	0.129*	0.163***
	(0.0572)	(0.0755)	(0.0460)	(0.0779)	(0.0733)	(0.0590)
Exchange Rate(-3)	-0.0320	0.0138	-0.0435	-0.0233	0.00719	-0.00754
	(0.0469)	(0.0644)	(0.0529)	(0.0576)	(0.0559)	(0.0508)
Exchange Rate(-4)	-0.0596	-0.106	-0.0689	-0.0628	-0.0150	-0.0349
	(0.0612)	(0.0656)	(0.0573)	(0.0773)	(0.0716)	(0.0647)
Wage	0.658***	0.828***	0.661***	0.757***	0.966***	1.001***
	(0.0831)	(0.114)	(0.0905)	(0.115)	(0.0496)	(0.0109)
Wage(-1)	-0.290**	-0.491***	-0.220	-0.337*	-0.448**	-0.486***
	(0.132)	(0.147)	(0.152)	(0.182)	(0.180)	(0.154)
Wage(-2)	-0.0207	0.0159	-0.107	0.0581	-0.0128	-0.00562
	(0.0549)	(0.0612)	(0.0632)	(0.0721)	(0.0362)	(0.00798)
Wage(-3)	0.0491	-0.0197	0.0696	0.0432	0.0262	-0.0109
	(0.0598)	(0.0749)	(0.0696)	(0.0898)	(0.0368)	(0.00951)
Wage(-4)	0.0553	0.160**	0.0600	0.0456	0.0253	-0.0109
	(0.0775)	(0.0769)	(0.0611)	(0.106)	(0.0409)	(0.0124)
IMP_gr	0.000497	0.000794	0.000554	0.000414	-0.000192	-0.000367
	(0.00116)	(0.00108)	(0.00111)	(0.00153)	(0.00148)	(0.00138)
Constant	6.87e-05	0.000625	-0.000443	0.000352	-0.000508	-0.000874
	(0.00121)	(0.00145)	(0.00137)	(0.00193)	(0.00178)	(0.00210)
Observations	44	44	44	44	44	44
R^2	0.849	0.922	0.826	0.878	0.966	0.997
Adjusted R^2	0.790	0.892	0.758	0.831	0.953	0.996
F	12.48	33.87	16.02	19.32	228.0	1877
Jarque-Bera	0.9173	0.3730	0.3666	0.2637	0.3308	0.0253

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

Table 101 : Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (BCI, Equation (4.7))

INDUSTRY VARIABLES	(1) MAN Δp	(2) SMAN Δp	(3) FMAN Δp	(4) FBT Δp	(5) BM Δp	(6) Fuels Δp
Δp(−1)	0.553***	0.636***	0.325**	0.493***	0.525***	0.504***
	(0.127)	(0.118)	(0.136)	(0.146)	(0.133)	(0.128)
Exchange Rate (Short run elasticity a_0^j)	0.151***	0.150***	0.105***	0.0453	0.0133	-0.0385
	(0.0412)	(0.0472)	(0.0390)	(0.0476)	(0.0439)	(0.0426)
Exchange Rate(-1)	-0.0652	-0.0558	-0.0127	-0.0203	-0.0132	-0.0201
	(0.0449)	(0.0504)	(0.0460)	(0.0478)	(0.0447)	(0.0425)
Exchange Rate(-2)	0.0182	0.00173	0.0275	-0.0317	0.0155	0.0295
	(0.0407)	(0.0510)	(0.0467)	(0.0571)	(0.0470)	(0.0429)
Exchange Rate(-3)	-0.0459	-0.0151	-0.0216	-0.0303	-0.0159	-0.00254
	(0.0329)	(0.0442)	(0.0379)	(0.0506)	(0.0425)	(0.0378)
Exchange Rate(-4)	-0.0224	-0.0678	-0.0390	-0.0590	-0.0345	-0.0225
	(0.0336)	(0.0409)	(0.0383)	(0.0524)	(0.0444)	(0.0440)
Wage	0.595***	0.717***	0.658***	0.827***	0.943***	1.007***
	(0.0587)	(0.0660)	(0.0611)	(0.0827)	(0.0362)	(0.00768)
Wage(-1)	-0.365***	-0.508***	-0.303**	-0.392***	-0.501***	-0.494***
	(0.0844)	(0.0936)	(0.117)	(0.125)	(0.125)	(0.129)
Wage(-2)	-0.0131	0.0591	-0.0200	0.0520	0.0409	0.00144
	(0.0421)	(0.0443)	(0.0641)	(0.0661)	(0.0292)	(0.00621)
Wage(-3)	0.0510	-0.0269	-0.00447	0.0727	0.00675	0.00983
	(0.0467)	(0.0556)	(0.0607)	(0.0781)	(0.0249)	(0.00859)
Wage(-4)	0.0197	0.0932*	0.0903*	0.0279	0.0386	-0.00913
	(0.0612)	(0.0502)	(0.0515)	(0.0741)	(0.0283)	(0.00804)
BCI	0.000254	0.00308	-0.00298	-0.00116	0.000669	-0.00372
	(0.00166)	(0.00188)	(0.00188)	(0.00223)	(0.00251)	(0.00281)
Constant	-0.000668	-0.000857	-0.00122	-0.00216	-0.00187*	-0.00182
	(0.000726)	(0.000824)	(0.000819)	(0.00161)	(0.000971)	(0.00110)
Observations	71	71	71	71	71	71
R^2	0.871	0.913	0.840	0.846	0.957	0.997
Adjusted R^2	0.845	0.895	0.807	0.814	0.948	0.996
F	28.80	57.00	28.48	23.26	178.5	3296
Jarque-Bera	0.9008	0.7621	0.7247	0.3814	0.5720	0.6481

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

Table 102 : Exchange Rate Pass-Through Elasticity into Disaggregate Import Prices (UK BCI, Equation (4.7))

INDUSTRY VARIABLES	(1) MAN Δp	(2) SMAN Δp	(3) FMAN Δp	(4) FBT Δp	(5) BM Δp	(6) Fuels Δp
$\Delta p(-1)$	0.500***	0.510***	0.386***	0.507***	0.474***	0.525***
	(0.0970)	(0.0963)	(0.128)	(0.130)	(0.131)	(0.127)
Exchange Rate (Short run elasticity a_0^j)	0.161***	0.140***	0.120***	0.0501	0.0221	-0.00571
	(0.0370)	(0.0395)	(0.0364)	(0.0433)	(0.0366)	(0.0367)
Exchange Rate(-1)	-0.0475	-0.0313	0.000742	-0.00962	-0.00233	-0.000582
	(0.0411)	(0.0453)	(0.0466)	(0.0435)	(0.0398)	(0.0430)
Exchange Rate(-2)	0.0584	0.0508	0.0613	0.00599	0.0555	0.0693
	(0.0381)	(0.0440)	(0.0438)	(0.0545)	(0.0475)	(0.0436)
Exchange Rate(-3)	-0.0249	0.0116	0.00163	-0.0231	-0.000439	0.00885
	(0.0294)	(0.0390)	(0.0337)	(0.0474)	(0.0390)	(0.0355)
Exchange Rate(-4)	0.0135	-0.0234	-0.00619	-0.0299	0.000232	0.0124
	(0.0296)	(0.0360)	(0.0371)	(0.0551)	(0.0446)	(0.0481)
Wage	0.594***	0.734***	0.679***	0.855***	0.940***	1.000***
	(0.0521)	(0.0533)	(0.0605)	(0.0787)	(0.0311)	(0.00754)
Wage(-1)	-0.326***	-0.421***	-0.347***	-0.408***	-0.456***	-0.520***
	(0.0770)	(0.0903)	(0.120)	(0.123)	(0.123)	(0.127)
Wage(-2)	-0.0247	0.0395	-0.0182	0.0474	0.0259	0.00212
	(0.0418)	(0.0402)	(0.0620)	(0.0604)	(0.0302)	(0.00545)
Wage(-3)	0.0328	-0.0425	-0.0354	0.0822	0.00590	0.0118
	(0.0448)	(0.0499)	(0.0602)	(0.0746)	(0.0248)	(0.00819)
Wage(-4)	0.0225	0.0928*	0.0904*	0.0350	0.0426*	-0.00312
	(0.0510)	(0.0511)	(0.0470)	(0.0756)	(0.0251)	(0.00720)
BCI_UK	0.000243***	0.000286***	0.000222**	0.000222**	0.000243**	0.000244**
	(8.21e-05)	(8.19e-05)	(8.66e-05)	(0.000105)	(0.000109)	(0.000121)
Constant	-0.000863	-0.00102	-0.00136*	-0.00271	-0.00200**	-0.00198*
	(0.000698)	(0.000841)	(0.000778)	(0.00165)	(0.000997)	(0.00109)
Observations	71	71	71	71	71	71
R^2	0.890	0.922	0.848	0.856	0.960	0.997
Adjusted R^2	0.867	0.906	0.817	0.826	0.951	0.997
F	37.38	72.19	25.69	36.62	171.7	2869
Jarque-Bera	0.5958	0.9325	0.6931	0.4122	0.8231	0.7429

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions.

Determinants of Exchange Rate Pass-Through on Disaggregated Import Prices

Tables from Table 103 to 108 display the regression results by running the following equation:

$$\Delta p_t^j = \alpha + \rho \Delta p_{t-1}^j + \sum_{i=0}^{4} a_i^j \Delta e_{t-i}^j + \sum_{i=0}^{4} \beta_i^j * z_t * \Delta e_{t-i}^j + \sum_{i=0}^{4} b_i^j \Delta w_{t-i}^j + c^j \Delta y_t^j + \epsilon_t^j \quad (4.9)$$

Table 103: Determinants of Exchange Rate Pass-Through Elasticity of UK's Manufacture Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
Δp(−1)	0.529***	0.494***	0.436***	0.501***	0.410***
	(0.114)	(0.119)	(0.112)	(0.120)	(0.117)
z	-0.0657	0.0434*	-0.000417	0.650**	0.0114
	(0.0532)	(0.0255)	(0.000653)	(0.324)	(0.0170)
z(-1)	0.0141	-0.0162	-0.00147***	-0.221	-0.365
	(0.0644)	(0.0254)	(0.000409)	(0.142)	(0.234)
z(-2)	0.105**	-0.0149	-0.00185***	-0.430*	-0.928***
	(0.0509)	(0.0311)	(0.000451)	(0.217)	(0.281)
z(-3)	0.0117	-0.0222	-0.00135***	-0.108	-0.557**
	(0.0431)	(0.0292)	(0.000353)	(0.185)	(0.272)
z(-4)	0.0425	-0.0201	-0.000779	-0.0683	-0.310
	(0.0390)	(0.0317)	(0.000533)	(0.168)	(0.321)
Exchange Rate	0.241**	0.0776	0.125***	-2.801*	0.136***
	(0.0955)	(0.0568)	(0.0442)	(1.463)	(0.0442)
Exchange Rate(-1)	-0.0534	-0.0211	-0.0195	-0.0424	-0.0128
	(0.105)	(0.0607)	(0.0402)	(0.0425)	(0.0395)
Exchange Rate(-2)	-0.142	0.0489	0.0827*	0.0634	0.0520
	(0.0848)	(0.0686)	(0.0415)	(0.0436)	(0.0385)
Exchange Rate(-3)	-0.0438	0.000810	0.00924	0.00185	-0.00819
	(0.0744)	(0.0611)	(0.0351)	(0.0386)	(0.0325)
Exchange Rate(-4)	-0.0900	0.00853	0.0274	0.00374	-0.0135
	(0.0631)	(0.0713)	(0.0403)	(0.0335)	(0.0302)
Wage	0.616***	0.604***	0.645***	0.626***	0.631***
	(0.0595)	(0.0586)	(0.0571)	(0.0628)	(0.0558)
Wage(-1)	-0.391***	-0.344***	-0.280***	-0.303***	-0.282***
	(0.0897)	(0.0836)	(0.0779)	(0.0835)	(0.0763)
Wage(-2)	0.0117	0.00636	-0.00498	-0.00617	0.00696
	(0.0460)	(0.0441)	(0.0442)	(0.0426)	(0.0426)
Wage(-3)	0.0261	0.0415	0.0382	0.0354	0.0530
	(0.0449)	(0.0447)	(0.0510)	(0.0523)	(0.0475)
Wage(-4)	0.0460	0.0579	0.0502	0.0469	0.0650
	(0.0574)	(0.0587)	(0.0588)	(0.0636)	(0.0557)
imp	0.0915	0.0812	-0.00904	0.0289	0.0563
	(0.0671)	(0.0779)	(0.0754)	(0.0596)	(0.0593)
Constant	-0.000796	-0.000795	-0.000474	0.000870	0.000216
	(0.000742)	(0.000735)	(0.000720)	(0.000867)	(0.000720)
Observations	70	71	71	71	71
R^2	0.891	0.888	0.909	0.899	0.909
Adjusted R^2	0.855	0.852	0.880	0.867	0.880
F	24.39	27.67	441.0	27.33	41.70
Jarque-Bera	0.3989	0.8332	0.2842	0.3131	0.3196

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money growth_t, inflation_t, exvol_t, real gdp_t, and C_t respectively.

Table 104: Determinants of Exchange Rate Pass-Through Elasticity of UK's Semi-Manufacture Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
Δp(−1)	0.563***	0.514***	0.361***	0.459***	0.371***
	(0.104)	(0.119)	(0.115)	(0.116)	(0.120)
z	-0.0407	0.0177	-0.000637	0.525	0.0130
	(0.0511)	(0.0254)	(0.000651)	(0.355)	(0.0151)
z(-1)	-0.0364	-0.00200	-0.00167***	-0.270*	-0.279
	(0.0585)	(0.0254)	(0.000450)	(0.153)	(0.239)
z(-2)	0.143**	-0.0451	-0.00213***	-0.429*	-1.078***
	(0.0542)	(0.0322)	(0.000611)	(0.249)	(0.310)
z(-3)	0.00576	0.00939	-0.00194***	-0.142	-0.686**
	(0.0471)	(0.0286)	(0.000424)	(0.162)	(0.326)
z(-4)	0.0632	-0.0565*	-0.00128**	-0.173	-0.427
	(0.0385)	(0.0328)	(0.000580)	(0.217)	(0.341)
Exchange Rate	0.184**	0.111*	0.130***	-2.243	0.142***
	(0.0909)	(0.0590)	(0.0467)	(1.603)	(0.0433)
Exchange Rate(-1)	0.0469	-0.0238	0.0197	0.00205	0.0203
	(0.104)	(0.0589)	(0.0413)	(0.0536)	(0.0432)
Exchange Rate(-2)	-0.216**	0.0935	0.0762	0.0499	0.0484
	(0.0904)	(0.0792)	(0.0515)	(0.0546)	(0.0455)
Exchange Rate(-3)	0.00756	-0.0215	0.0664	0.0445	0.0255
	(0.0807)	(0.0600)	(0.0438)	(0.0460)	(0.0407)
Exchange Rate(-4)	-0.167**	0.0590	0.0113	-0.0158	-0.0409
	(0.0668)	(0.0755)	(0.0482)	(0.0458)	(0.0352)
Wage	0.765***	0.738***	0.766***	0.759***	0.743***
	(0.0491)	(0.0528)	(0.0531)	(0.0547)	(0.0476)
Wage(-1)	-0.518***	-0.437***	-0.331***	-0.388***	-0.361***
	(0.103)	(0.101)	(0.0938)	(0.102)	(0.0950)
Wage(-2)	0.0701	0.0537	0.0434	0.0552	0.0543
	(0.0501)	(0.0532)	(0.0486)	(0.0425)	(0.0481)
Wage(-3)	-0.0470	-0.0250	-0.0282	-0.0391	-0.000473
	(0.0518)	(0.0537)	(0.0431)	(0.0539)	(0.0422)
Wage(-4)	0.126**	0.111**	0.119**	0.0986**	0.108**
	(0.0503)	(0.0531)	(0.0464)	(0.0472)	(0.0459)
imp	0.171**	0.140	0.0517	0.0995	0.146**
	(0.0795)	(0.0928)	(0.0851)	(0.0610)	(0.0656)
Constant	-0.00106	-0.000774	-0.000467	0.00120	0.000415
	(0.000838)	(0.000866)	(0.000820)	(0.00111)	(0.000852)
Observations	70	71	71	71	71
R^2	0.929	0.924	0.942	0.930	0.940
Adjusted R^2	0.905	0.900	0.923	0.908	0.920
F	43.79	51.35	720.7	55.52	92.19
Jarque-Bera	0.3645	0.9504	0.8177	0.8420	0.8176

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money $growth_t$, $inflation_t$, $exvol_t$, real gdp_t, and C_t respectively.

Table 105: Determinants of Exchange Rate Pass-Through Elasticity of UK's Finished-Manufacture Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
Δp(−1)	0.426***	0.392***	0.331**	0.397***	0.333***
	(0.142)	(0.136)	(0.142)	(0.137)	(0.121)
z	-0.0604	0.0435	-0.000239	0.249	0.00289
	(0.0586)	(0.0308)	(0.000913)	(0.263)	(0.0199)
z(-1)	-0.0196	-0.0127	-0.000770	-0.185	-0.321
	(0.0598)	(0.0362)	(0.000568)	(0.204)	(0.302)
z(-2)	0.100*	-0.00316	-0.00221***	-0.597***	-0.761***
	(0.0524)	(0.0264)	(0.000451)	(0.200)	(0.211)
z(-3)	0.0298	-0.0237	-0.00158***	-0.124	-0.829**
	(0.0611)	(0.0418)	(0.000468)	(0.235)	(0.344)
z(-4)	0.0663	-0.0487	-0.00105	-0.337*	-0.705*
	(0.0574)	(0.0426)	(0.000688)	(0.196)	(0.388)
Exchange Rate	0.199*	0.0490	0.0888*	-1.022	0.114**
	(0.104)	(0.0607)	(0.0482)	(1.192)	(0.0443)
Exchange Rate(-1)	0.0283	0.0144	-0.00913	-0.000589	0.0137
	(0.105)	(0.0804)	(0.0522)	(0.0532)	(0.0467)
Exchange Rate(-2)	-0.120	0.0344	0.0987**	0.0900**	0.0546
	(0.0933)	(0.0532)	(0.0382)	(0.0409)	(0.0353)
Exchange Rate(-3)	-0.0455	0.0379	0.0470	0.0305	0.0358
	(0.100)	(0.0745)	(0.0424)	(0.0376)	(0.0332)
Exchange Rate(-4)	-0.135*	0.0492	0.0127	0.0150	-0.0223
	(0.0803)	(0.101)	(0.0586)	(0.0430)	(0.0388)
Wage	0.694***	0.682***	0.731***	0.742***	0.733***
	(0.0587)	(0.0592)	(0.0622)	(0.0607)	(0.0543)
Wage(-1)	-0.388***	-0.348***	-0.283**	-0.303***	-0.284***
	(0.116)	(0.108)	(0.118)	(0.113)	(0.0974)
Wage(-2)	-0.0100	0.000317	-0.00121	0.00961	-0.00427
	(0.0641)	(0.0660)	(0.0634)	(0.0645)	(0.0644)
Wage(-3)	-0.0248	-0.0293	-0.00984	-0.0238	0.0115
	(0.0534)	(0.0560)	(0.0558)	(0.0632)	(0.0583)
Wage(-4)	0.0933*	0.145***	0.101*	0.141**	0.140***
	(0.0517)	(0.0529)	(0.0511)	(0.0578)	(0.0514)
imp	0.105	0.104	0.0218	0.0661	0.0923
	(0.0829)	(0.0901)	(0.0958)	(0.0784)	(0.0796)
Constant	-0.00124	-0.00124	-0.000953	0.00120	-0.000120
	(0.000774)	(0.000788)	(0.000820)	(0.00115)	(0.000825)
Observations	70	71	71	71	71
R^2	0.857	0.857	0.878	0.870	0.877
Adjusted R^2	0.810	0.812	0.838	0.829	0.838
F	20.25	22.65	49.13	24.66	29.96
Jarque-Bera	-0.0646	0.0575	0.0989	0.324	0.00696
imp	0.3162	0.8871	0.5404	0.8031	0.8646

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money growth$_t$, inflation$_t$, exvol$_t$, real gdp$_t$, and C_t respectively.

Table 106: Determinants of Exchange Rate Pass-Through Elasticity of UK's Food & Beverages & Tobacco Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
Δp(−1)	0.551***	0.457***	0.391***	0.354**	0.320**
	(0.142)	(0.149)	(0.142)	(0.140)	(0.126)
z	-0.0489	0.0264	-0.000783	-0.0172	-0.0170
	(0.0688)	(0.0296)	(0.000843)	(0.536)	(0.0235)
z(-1)	-0.0240	-0.00249	-0.000737	-0.107	-0.181
	(0.0556)	(0.0290)	(0.000532)	(0.167)	(0.285)
z(-2)	0.120*	-0.0338	-0.00259***	-0.506**	-0.886***
	(0.0639)	(0.0295)	(0.000641)	(0.222)	(0.247)
z(-3)	0.0252	-0.0354	-0.00180***	-0.445**	-0.911**
	(0.0697)	(0.0380)	(0.000453)	(0.215)	(0.390)
z(-4)	0.0473	-0.0306	-0.00101	-0.287	-0.781**
	(0.0624)	(0.0426)	(0.000834)	(0.215)	(0.329)
Exchange Rate	0.125	0.0273	0.0525	0.164	0.123**
	(0.123)	(0.0553)	(0.0528)	(2.443)	(0.0588)
Exchange Rate(-1)	0.0319	-0.00247	-0.0128	0.00673	0.0274
	(0.0933)	(0.0649)	(0.0482)	(0.0571)	(0.0502)
Exchange Rate(-2)	-0.198**	0.0502	0.0711	0.0457	0.0343
	(0.0976)	(0.0764)	(0.0597)	(0.0610)	(0.0547)
Exchange Rate(-3)	-0.0535	0.0317	0.0612	0.0502	0.0345
	(0.127)	(0.0782)	(0.0531)	(0.0623)	(0.0557)
Exchange Rate(-4)	-0.138	-0.0140	-0.00160	-0.00431	-0.0453
	(0.101)	(0.0956)	(0.0727)	(0.0612)	(0.0503)
Wage	0.860***	0.817***	0.876***	0.846***	0.803***
	(0.0891)	(0.0813)	(0.0773)	(0.0743)	(0.0672)
Wage(-1)	-0.470***	-0.381***	-0.327**	-0.296**	-0.277**
	(0.136)	(0.131)	(0.124)	(0.124)	(0.105)
Wage(-2)	0.0515	0.0421	0.0416	0.0402	0.0118
	(0.0676)	(0.0702)	(0.0709)	(0.0753)	(0.0708)
Wage(-3)	0.0635	0.114	0.0414	0.0673	0.0788
	(0.0882)	(0.0794)	(0.0787)	(0.0773)	(0.0814)
Wage(-4)	0.0689	0.0774	0.0568	0.0745	0.0858
	(0.0844)	(0.0783)	(0.0758)	(0.0838)	(0.0805)
imp	0.164**	0.140	0.0396	0.131	0.146*
	(0.0796)	(0.0950)	(0.104)	(0.0798)	(0.0805)
Constant	-0.00260	-0.00251	-0.00172	0.000496	-0.000391
	(0.00165)	(0.00154)	(0.00157)	(0.00198)	(0.00176)
Observations	70	71	71	71	71
R^2	0.866	0.866	0.886	0.882	0.886
Adjusted R^2	0.823	0.823	0.850	0.844	0.849
F	30.91	36.48	174.3	30.49	41.75
Jarque-Bera	-0.0392	0.0439	-0.0131	-0.0462	-0.0213
imp	0.5965	0.0555	0.5873	0.3325	0.1413

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money $growth_t$, $inflation_t$, $exvol_t$, real gdp_t, and C_t respectively.

Table 107: Determinants of Exchange Rate Pass-Through Elasticity of UK's Basic Materials Import Prices

DETERMINANTS (z) VARIABLES	(1) Money Growth Δp	(2) Inflation Δp	(3) Exvol Δp	(4) Real GDP Δp	(5) Credibility Δp
$\Delta p(-1)$	0.531***	0.452***	0.303**	0.353**	0.362***
	(0.128)	(0.141)	(0.140)	(0.142)	(0.125)
z	-0.0312	-0.00197	-0.00156**	0.316	-0.00750
	(0.0638)	(0.0273)	(0.000714)	(0.411)	(0.0195)
z(-1)	-0.0466	-0.00128	-0.00162**	-0.163	-0.344
	(0.0583)	(0.0314)	(0.000660)	(0.166)	(0.330)
z(-2)	0.155**	-0.0391	-0.00272***	-0.513**	-0.881***
	(0.0609)	(0.0338)	(0.000674)	(0.241)	(0.325)
z(-3)	-0.0158	-0.00698	-0.00239***	-0.451**	-0.749*
	(0.0629)	(0.0406)	(0.000509)	(0.188)	(0.377)
z(-4)	0.0768	-0.0504	-0.00103	-0.159	-0.542
	(0.0561)	(0.0452)	(0.000679)	(0.238)	(0.348)
Exchange Rate	0.0741	0.0471	0.0526	-1.372	0.0663
	(0.108)	(0.0537)	(0.0532)	(1.869)	(0.0564)
Exchange Rate(-1)	0.0778	-0.00275	0.0240	0.0105	0.0257
	(0.0992)	(0.0642)	(0.0488)	(0.0484)	(0.0398)
Exchange Rate(-2)	-0.215**	0.109	0.112**	0.0888	0.0702
	(0.0932)	(0.0838)	(0.0523)	(0.0567)	(0.0482)
Exchange Rate(-3)	0.0318	0.00640	0.104**	0.0709	0.0435
	(0.106)	(0.0755)	(0.0422)	(0.0471)	(0.0426)
Exchange Rate(-4)	-0.143	0.0922	0.0407	0.0308	0.00137
	(0.0964)	(0.0994)	(0.0622)	(0.0519)	(0.0450)
Wage	0.926***	0.919***	0.935***	0.924***	0.927***
	(0.0326)	(0.0338)	(0.0331)	(0.0304)	(0.0330)
Wage(-1)	-0.512***	-0.438***	-0.315**	-0.351**	-0.369***
	(0.125)	(0.135)	(0.129)	(0.132)	(0.121)
Wage(-2)	0.0310	0.0177	0.00150	0.0173	0.00883
	(0.0325)	(0.0332)	(0.0271)	(0.0275)	(0.0296)
Wage(-3)	0.00105	0.0207	0.000804	0.0111	0.00899
	(0.0279)	(0.0267)	(0.0265)	(0.0262)	(0.0243)
Wage(-4)	0.0513*	0.0408	0.0613**	0.0249	0.0368
	(0.0298)	(0.0286)	(0.0253)	(0.0263)	(0.0280)
imp	0.191**	0.161	0.0332	0.158**	0.183**
	(0.0885)	(0.107)	(0.0945)	(0.0770)	(0.0795)
Constant	-0.00174*	-0.00137	-0.000767	0.00135	6.16e-05
	(0.000973)	(0.00100)	(0.000920)	(0.00144)	(0.00112)
Observations	70	71	71	71	71
R^2	0.964	0.962	0.970	0.966	0.966
Adjusted R^2	0.953	0.950	0.961	0.956	0.955
F	94.60	113.1	238.7	103.7	121.2
Jarque-Bera	0.9629	0.6405	0.7220	0.6329	0.4826

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money $growth_t$, $inflation_t$, $exvol_t$, real gdp_t, and C_t respectively.

Table 108: Determinants of Exchange Rate Pass-Through Elasticity of UK's Fuel Import Prices

	(1)	(2)	(3)	(4)	(5)
DETERMINANTS (z)	Money Growth	Inflation	Exvol	Real GDP	Credibility
VARIABLES	Δp	Δp	Δp	Δp	Δp
Δp(−1)	0.561***	0.524***	0.409***	0.417***	0.430***
	(0.137)	(0.141)	(0.129)	(0.139)	(0.129)
z	-0.0249	-0.00392	-0.00112	-0.134	0.00100
	(0.0620)	(0.0283)	(0.000867)	(0.426)	(0.0195)
z(-1)	-0.0427	-0.0152	-0.000901	-0.0837	-0.134
	(0.0647)	(0.0389)	(0.000778)	(0.189)	(0.424)
z(-2)	0.111*	-0.00148	-0.00292***	-0.576**	-0.912**
	(0.0640)	(0.0322)	(0.000673)	(0.276)	(0.345)
z(-3)	0.0519	-0.0209	-0.00203***	-0.469**	-0.992**
	(0.0705)	(0.0472)	(0.000532)	(0.232)	(0.465)
z(-4)	0.0908	-0.0659	-0.00132	-0.362	-0.968**
	(0.0556)	(0.0550)	(0.000807)	(0.254)	(0.434)
Exchange Rate	0.0237	0.0159	0.0113	0.619	0.0182
	(0.104)	(0.0594)	(0.0538)	(1.932)	(0.0550)
Exchange Rate(-1)	0.0656	0.0190	-0.00653	0.00733	0.0141
	(0.103)	(0.0906)	(0.0550)	(0.0529)	(0.0459)
Exchange Rate(-2)	-0.130	0.0432	0.122**	0.110*	0.0705
	(0.0925)	(0.0822)	(0.0474)	(0.0625)	(0.0494)
Exchange Rate(-3)	-0.0591	0.0492	0.0874*	0.0716	0.0621
	(0.113)	(0.0903)	(0.0446)	(0.0438)	(0.0396)
Exchange Rate(-4)	-0.148	0.139	0.0584	0.0636	0.0282
	(0.0927)	(0.129)	(0.0715)	(0.0521)	(0.0431)
Wage	1.001***	0.997***	1.002***	0.997***	0.999***
	(0.00763)	(0.00789)	(0.00702)	(0.00745)	(0.00763)
Wage(-1)	-0.554***	-0.521***	-0.408***	-0.410***	-0.427***
	(0.139)	(0.143)	(0.130)	(0.140)	(0.131)
Wage(-2)	0.00195	-0.000712	-0.00311	-0.00175	-0.00575
	(0.00598)	(0.00671)	(0.00655)	(0.00676)	(0.00752)
Wage(-3)	0.00882	0.0133	0.00271	0.00484	0.00201
	(0.00854)	(0.00883)	(0.00851)	(0.00854)	(0.00937)
Wage(-4)	-0.00500	-0.00732	-0.00205	-0.0122	-0.0116
	(0.00731)	(0.00835)	(0.00764)	(0.00875)	(0.00797)
imp	0.124	0.108	-0.00457	0.0880	0.127
	(0.102)	(0.120)	(0.113)	(0.0980)	(0.0951)
Constant	-0.00176	-0.00119	-0.000784	0.00196	0.000544
	(0.00113)	(0.00112)	(0.00106)	(0.00160)	(0.00131)
Observations	70	71	71	71	71
R^2	0.997	0.997	0.998	0.998	0.998
Adjusted R^2	0.996	0.996	0.997	0.997	0.997
F	2636	3091	5947	3734	3860
Jarque-Bera	0.5834	0.6473	0.6353	0.8482	0.4822

***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses. F-test statistics are presented for testing the null hypothesis that all coefficients (except the intercept term) are jointly equal to zero. P-values for Jarque-Bera test are reported for testing the null of normality. HC OLS (White) estimation is used for regressions. The determinant variable z_t and its lagged variables in each regression (1), (2), (3), (4) and (5) is substituted by money $growth_t$, $inflation_t$, $exvol_t$, real gdp_t, and C_t respectively.