How Do Exporters React To Different Exchange Rate Shocks?*

Raphael Auer and Raphael Schoenle†
Swiss National Bank and Brandeis University

February 16, 2011

Abstract

In this paper, we study how three different sources of exchange rate shocks affect pass-through into U.S. import prices. First, we examine how global movements of the USD, as separate from trade-partner specific movements relative to the rest of the world, affect U.S. import prices. We find that pass-through of global USD movements is always larger than trade-partner pass-through and almost four times as large at long horizons. We also find substantial heterogeneity in the geographic origin of pass-through of trade-partner movements. Second, we show that risk-induced movements in the exchange rate can have substantially larger pass-through than non-risk-induced movements in the short run while they have similar magnitudes of pass-through in the long run. Safe-haven currencies such as the Swiss Franc show almost full pass-through of the risk-induced exchange rate component after only 4 to 5 months. Third, we show that pass-through appears to be absent when changes in unit labor cost imply exchange rate movements. Our findings have important policy implications such as for estimating how shifts in risk perception create imported inflationary pressure, and can guide us how to model pass-through, for example with respect to assumptions about local versus global "toughness" of competition.

JEL Classification: E3, E31, F41

Keywords: Exchange Rate Pass-Through, U.S. Import Prices, Exchange Rate Risk.

---

*This research was conducted with restricted access to the Bureau of Labor Statistics (BLS) data. The views expressed here are those of the authors and do not necessarily reflect the views of the BLS or the Swiss National Bank. We thank project coordinators Kristen Reed and Rozi Ulics for their substantial help and effort.

†Contact: Raphael Auer, Swiss National Bank, Börsenstr. 15 P.O. box Ch-8022 Zürich Switzerland. Phone: +41 44 631 38 84, e-mail: raphael.auer@snb.ch. Raphael Schoenle, Mail Stop 021, Brandeis University, P.O. Box 9110, 415 South Street, Waltham, MA 02454. Phone: +1-617-680-0114, email: schoenle@brandeis.edu.

1 Introduction

Recent advances in the empirical estimation of exchange rate pass-through at the goods level have yielded important insights for how firms price to market, and how and when they react to exchange rate shocks.[1] At the same time, a separate literature has focused on examining and decomposing the determinants of the exchange rate, which is both an asset as well as the key variable to counteract trade and current account imbalances.

In this paper, we analyze how different sources of the exchange rate movement affect pass-through into import prices. Our motivation is that pass-through should be very different depending on the nature of the underlying shock. For example, one could arguably expect pass-through to differ if the exchange rate moves due to productivity shocks rather than due to changing risk perceptions of investors. We are looking both for quantitative and qualitative differences, for example in the pattern of dynamics. Both types of differences can provide important guidance to quantifying DSGE models and ultimately, to the policy-maker.

To study how different sources of exchange rate shocks affect pass-through, we examine the rate of pass-through following three different kinds of exchange rate movements. In the first part of the analysis, we investigate whether pass-through is different when the USD appreciates vis-a-vis the entire world as opposed to when only one trade partner depreciates against the USD. To this purpose, we split up the bilateral US/Trade Partner exchange rate movement into USD movements and trade-partner specific currency movements against the rest of the world.

In the second part, we evaluate movements of the exchange rate that are induced by investors perception of risk and return. Starting with Dornbusch (1980), there is increasing notion that the exchange rate is an asset and that it therefore moves because of investors' perceptions. A recent literature, for example Lustig et al. (2008) and Hau and Rey (2004), has emphasized the role of risk characteristics for exchange rate movements. We use the impact of changing global risk to identify

[1] While some of these studies focus on structural analysis of exchange rate pass through in single industries (see Knetter (1989) and Knetter (1992) and Goldberg and Verboven (2001) and Goldberg and Verboven (2005) for the car industry, Hellerstein (2008) for the beer industry and Nakamura and Zerom (2010) for the case of the co ee industry), our approach is related to the more reduced form analysis of pass through rates in datasets spanning many industries (see Gopinath and Rigobon (2008), Gopinath and Itskhoki (2010), Gopinath et al. (2010)), and Nakamura and Steinsson (2008).

that part of exchange rate movements that is driven by the asset nature of the exchange rate. We then examine the rate at which import prices react to these risk-induced exchange rate changes.

In the third part, we focus on exchange rate movements that are driven by changes in unit labor costs. For example, if European firms become more productive compared to US firms, the euro appreciates against the dollar. In equilibrium, European firms do not necessarily face higher costs, since the euro appreciation would not necessarily fully offset the productivity increase. Accordingly, the pass through response could then be low, or even negative.

From a policy maker's view, the contribution of our paper is clear-cut: we document that to understand the extent to which exchange rates pass through into import prices and create inflationary pressure, it is expedient to first understand both the geographic origin and the intrinsic cause of the exchange rate shock.

First, regarding the geographic origin, we document that pass-through is very different if the USD appreciates relative to the rest of the world, or when only a trade partner currency moves. This is empirically relevant since it implies that pass-through is substantial exactly when the US appreciates against many currencies. This gives rise to a much larger role of the exchange rate as a determinant of inflationary pressure than in the existing literature.

Second, regarding the origin of the shock, we document that risk-induced exchange rate swings pass through into prices at a much higher rate than residual exchange rate swings. Moreover, the long run rate of pass-through seems to be somewhat higher following risk-induced movements than following other movements. From a policy-maker's point of view, this implies that changes in risk perception and asset market considerations are associated with substantial pass-through into import prices.

Third, again from a perspective of the cause of the shock, we document that pass through is actually absent when changes in unit labor cost imply exchange rate movement. This highlights that many long term trends of exchange rates do not affect prices at all since the exchange rate movement simply compensates the change in unit labor costs.

Since many of our estimations are based on data that is also available in real time, all these findings are directly useful in refining existing models that quantify the effect of exchange rate movements on import prices, trade balances, and imported inflationary pressure.

Our results also have implications for understanding the nature of incomplete pass-through. The first finding that home country appreciation versus highlights in particular the importance of market environment and the local "toughness" of competition for pricing, for example such as in the models of Gust et al. (2010), Atkeson and Burstein (2008), or Chen et al. (2009). For example, the finding that USD movements are associated with very high pass through rates emphasizes the importance of the market environment and the toughness of competition for firms' optimal pricing decisions. Our results indicate that both the size of the pricing response as well as its timing are quite dependent on the source of the exchange rate shocks.

2 Data description

We use a wealth of financial data from Thomason Reuters/Datastream, exchange rate data from the IMF IFS, unit labor cost estimates from the OECD, monthly US import data from the USITC/Census, and, most importantly, import prices at the goods level from the BLS that have been the topic of intense study since the original analysis of this dataset by Gopinath and Rigobon (2008). We refer the reader to Gopinath and Rigobon (2008) for details of the US import price micro data. In this paper, we have extended the data range to span the years from 1994 through 2007. We apply our analysis to the following countries: Australia, Austria, Canada, Denmark, Czech Republic, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Mexico, Netherlands, New Zealand, Norway, Portugal, Singapore, South Korea, Spain, Sweden, Switzerland, Taiwan, United Kingdom.

3 Exercise I: PT Following USD and Trade-Partner Currency Movements

We start our analysis with a very simple decomposition of the exchange rate and relating its components to US import prices. We investigate whether pass-through is different if the USD moves against all of its trade partners or rather, if the change in the bilateral nominal exchange rate is caused by a trade partner movement against the rest of the world.

This exercise is motivated by theoretical considerations relating pass through to how the market environment changes with the exchange rate. For example, if we think along the lines of Atkeson and Burstein (2008), where market power determines pass-through, pass-through should be very different if all foreign firms face the same cost shock as opposed to when only a small set of firms from a country such as Switzerland faces a cost shock. Also theoretical models that highlight price complementarities (see Chen et al. (2010) or Gust et al. (2009)) would predict that if the USD appreciates against all sectors, pass-through should be much higher since all exporter experience the same cost shock. In contrast, if only the trade partner currency moves, pass through should be much smaller since only a small set of consumers moves.

To cleanly identify USD movements and trade partner currency movements, we do the following. For each trade partner we define the USD/ROW Exchange Rate Change as the trade-weighted average change of the log USD exchange rate against all countries other than the trade partner in question. That is, if TP indexes the trade partner, the change of the ROW Exchange Rate Change for trade partner TP equals

$$\Delta USD_{ROW-TP,t} = \sum_{c \neq TP} \omega_{c,t} \Delta USD_{c,t} \tag{1}$$

where country c's weight is its shares of US imports excluding country TP. To make sure that the weights are not contemporaneously related to current exchange rate movements, we take last year's import share as current weights:

$$\omega_{c,t} = \frac{IM^{US}_{c,t-1}}{\sum_{c \neq TP} IM^{US}_{c,t-1}} \tag{2}$$

It is important to note that the USD/ROW Exchange Rate Change differs for each trade partner. Finally, we define the "TP/ROW exchange rate movement" as the difference between the bilateral exchange rate change and the USD/ROW exchange rate change.

We measure pass-through by estimating a stacked regression where we regress monthly import price changes on monthly lags of the respective measure of the exchange rate:

$$\Delta p_{i,c,t} = \alpha_c + \sum_{j=1}^{n} \beta_j \Delta e_{c,t-j+1} + \gamma t + \epsilon_{i,c,t} \tag{3}$$

where i denotes a good, α_c is a country fixed effect, t a linear time trend, n varies from 1 to 25, and $e_{c,t-j+1}$ is one the three exchange rate measures. To obtain the n-month pass-through, we sum the coefficients up to the respective horizon.

To test the robustness of our results and to further break down the sources of pass-through of the different exchange rates, we estimate pass-through of our three exchange rate measures by country of origin and for the different three-digit NAICS sectors in the data.

3.1 Results: Trade-Partner and USD Exchange Rate Movements

When we estimate pass-through of our three exchange rate measures, we find the striking result that aggregate pass-through of global USD movements is up to four times as large trade-partner pass-through, with an estimate of 0.88 at the 24-month horizon. Second, our results show geographic heterogeneity in the rate of pass-through of trade-partner movements. Finally, our results are robust to estimation at the three-digit industry level.

First, our estimates of pass-through of the three measures of the exchange imply that pass-through of global USD movements into U.S. imports prices is substantially larger than pass-through of nominal or trade-partner exchange rate movements. Figure 1 summarizes this finding, based on separate pass-through estimations. It shows the pass-through estimates that can be attributed to a movement of the USD against all partner currencies, a movement of the trade partner currency against the rest of the world or simply a nominal exchange rate movement. While USD pass-through is larger at all monthly horizons, it is at approximately 0.75 at the 24-month horizon. Trade-partner pass-through at that horizon is at 0.21 and nominal exchange rate pass-through at 0.3. Our results also show that nominal exchange rate pass-through is always higher than trade-partner specific pass-through, but economically only by a small magnitude.

When we jointly estimate pass-through of our two components of the nominal exchange rate, of global USD and trade-partner specific movements, we find an even stronger impact of global USD movements on U.S. import prices. Now, the long-horizon estimate of USD pass-through is 0.88, while the estimate of trade-partner pass-through is 0.2. Figure 2 summarizes the result and additionally shows 95% confidence bands. USD pass-through is statistically significantly higher at all monthly horizons.

Second, we present estimates of USD and trade-partner pass-through by country of origin in Table 2. Is the trade-partner response heterogenous across the different trade partners? The table shows substantial heterogeneity across trade partners. At the same time, pass-through of USD movements continues to be generally larger than trade-partner movements. Given the recent debate about the valuation of the Chinese Yuan, it is remarkable to see that movements in the trade-partner specific exchange rate of China are passed through into U.S. import prices at a rate of 0.81 at the 6-month and at a full rate at the 12-month horizon. These results confirm the findings in Auer (2011).

Finally, when we control for sectoral heterogeneity of pass-through, we find robustness of our results: pass-through of global USD movements is larger than trade-partner or nominal exchange rate pass-through when controlling for sectoral effects at the three-digit NAICS level. Figures 3 to 13 show our estimates. Figure 3 gives an example for pass-through of USD and trade-partner movements for two particular industries at all horizons, namely for food manufacturing (NAICS 311) and nonmetallic mineral product manufacturing (NAICS 327). In both cases, global USD movements are passed through into U.S. import prices at a substantially higher rate than trade-partner movements.

Figure 4 to 13 show estimates of pass-through at various horizons in different 3-digit NAICS industries relative to nominal exchange rate pass-through. Here, our results also indicate that trade-partner movements get passed through into U.S. prices much less than do general USD movements while USD movements continue to have higher rates of pass-through than nominal exchange rate movements. The figures also indicate that there is sectoral heterogeneity of USD and trade-partner pass-through.

4 Exercise II: The Pass Through of Risk Induced Exchange Rate Changes

A recent literature demonstrates that changes in investor risk perceptions can explain a substantial part of exchange rate movements.[2] We analyze to what extent such risk-driven exchange rate movements pass through into import prices, asking three questions about risk and prices: First, do changes in risk get passed through directly into import prices? Second, does risk get passed through when the nominal exchange rate is very volatile and risk is “on”?[3] Third, to which exchange rate movements do price-setters most closely pay attention in volatile environments: nominal, USD or TP movements?

At the current juncture, our findings are only very preliminary, but the seem encouraging. First, we find evidence that actually a considerable part of exchange rate swings can be attributed to fluctuations in global risk and also, that these fluctuations are persistent so that firms should plausibly adjust their prices to these shocks. Second, regarding the pass through, we find that risk pass-through is generally higher than pass-through attributed to residual exchange rate fluctuations. Third, we find that over longer horizons (say after 15 months) the difference between risk induced and ”normal” pass through rates tends to decrease.

In order to study the link between risk and pass-through, we take the following two steps. First, we isolate the component of nominal exchange rate movements that can be explained by changes in various measures of perceived risk. The motivation for this step is the recent strand of research documenting that the exchange rates of safe-haven currencies are subject to severe jumps when global risk aversion changes.[4] Second, we project the response of import prices on these risk

[2] Hau and Rey (2004) and subsequent papers examine exchange rate movements due to portfolio ows. There is also a renewed literature on explaining Uncovered interest rate parity (UIP)-deviations based on shocks to consumption growth in a consumption CAPM setting, following works of Lustig et al. (2008) and Lustig and Verdelhan (2007). There are also several important recent papers on carry trades and UIP deviations, like Burnside et al. (2008), as well as Brunnermeier and Pedersen (2009). A more nance oriented literature on the same subject is also developing, like Plantin et al. (2005) on UIP and liquidity constraints, or Jurek (2009) or Farhi et al. (2009) on market expectations and exchange rate movements. Other papers focuse more on market- microstructure and information frictions to explain exchange rate movements on the basis of investor ows (e.g. Bacchetta and vanWincoop, 2007).

[3] Foreign-exchange trading strategies in some hedge funds are based on whether \risk is on" or not to to decide how to invest in the currency markets.

[4] In particular see Farhi and Gabaix (2008), Campbell et al. (2009), Ranaldo and Söderlind (2010), and Farhi et al. (2009)). In addition, other shocks drive portfolio re-allocations and exchange rate movements, for example shocks to

aversion-induced exchange rate swings, resulting in a quantification of how risk-driven exchange rate movements affect inflationary pressure. Third, we identify volatile exchange rate environments as months when the absolute nominal log exchange rate changes are larger than the mean absolute nominal log exchange rate changes plus one standard deviation therein.

Out first set of measures of risk-induced movements of the nominal exchange rate is based on the aforementioned studies relating bilateral exchange rates to standard risk measures. For example, if ΔVIX denotes the log change in the Chicago Board Options Exchange Market Volatility Index, a measure of the implied volatility of the S&P 500 option, then the we estimate the following specification:

$$\Delta e_{US,c,t} = \alpha_c + \beta_c \Delta VIX_t + \epsilon_{(US,c)t} \tag{4}$$

where $\Delta e_{US,c,t}$ is the monthly change in the log nominal exchange rate of the US with country c and α_c is a country fixed effect. It is important to note that the coefficients in the above estimation are always country-specific. Indeed, our prior is that beta can take either positive or negative values. For example, given that Switzerland is a safe haven currency, increases in global risk will lead to an appreciation of the Swiss Franc vis a vis the USD. The same specification estimated for the Hungarian Forint, however, would probably yield a negative coefficient, since the USD is the relatively safer haven.

Out second set of measures of risk-induced movements of the nominal exchange rate is based on models that take into account the recent findings of the "carry trade factor" as in Lustig et al. (2008). This branch of research argues that currencies differ in their risk profiles and that this risk profile is related to the forward premium between the country in question and the USD, or the interest rate differential between the US and the trade partner. Thus, we estimate the following specification:

$$\Delta e_{US,c,t} = \alpha_c + \beta_c \Delta f_{US,c,t} + \epsilon_{(US,c)t} \tag{5}$$

where $f_{US,c,t}$ denotes the USD forward premium of the country in question.

investor information, interest rates shocks, consumption growth in the consumption-CAPM literature. It may even be movements in the spot rate itself that drive portfolio reallocations and thus further movements in the currency rate, like in the reversal of carry-trade positions when a funding currency appreciates.

Given these two sets of coefficients α_c and β_c, we identify the risk-induced component of the nominal exchange rate as the part of the nominal exchange rate predicted by the right-hand side risk measures:

$$\Delta\hat{e}^{Risk}_{US,c,t} = \alpha_c + \beta_c \Delta X_{US,c,t} \tag{6}$$

where $X_{US,c,t}$ is one of the respective observed measures of risk: VIX_t, $f_{US,c,t}$, etc. Additionally, we define the residual, non-risk component in the following way:

$$\Delta\hat{e}^{Residual}_{US,c,t} = \Delta e_{US,c,t} - \Delta\hat{e}^{Risk}_{US,c,t} \tag{7}$$

We then estimate the same stacked pass-through regressions as in equation 3 but substituting the lags of the risk and non-risk component for the nominal exchange rate on the right-hand side of the equation. Again, we add up the jointly estimated risk, and non-risk coefficients to obtain measures of pass-through at the various monthly horizons.

4.1 How much can be explained?

We next investigate the economic and statistical importance of these asset considerations for the exchange rate and we also discuss how we isolate the risk induced component of exchange rate movements for the pass through analysis in the following subsection. In columns 1 to 3 of Table 3, we first exemplify some of the relations that have been pointed out by the above-cited literature for case of the Swiss Franc. In these specifications, the dependent variable is the day to day percentage change in the bilateral exchange rate in terms of USD per CHF.

The CHF is a typical safe haven currency that tends to appreciate when global risk aversion rises. As is standard in the finance literature, we use the Chicago Board Options Exchange Market Volatility Index (VIX) as gauge of global risk perceptions and global risk aversion. The VIX measures the implied volatility of S&P 500 index options and represents the market's expectation of stock market volatility over the next 30 day period. We find that if the VIX rises by 10 percent, the CHF appreciates on average by about 0.155%.

It might be true that exchange rates react to changes in global risk only with a lag and it might also be true that exchange rates are themselves mean-reverting. The Vector Auto Regression (VAR) model of column 2 thus adds the first two and the 20th lag of the exchange rate and the first two lags of the VIX change. There is no evidence that lagged changes in the VIX have any impact on the exchange rate; the exchange rate seems to slightly mean revert slightly, although the mean reversion (the first lag) is only significant at the 5% significance level. We have confirmed the finding that from past history of all variables only the first lag of the exchange rate has any predictive power in various specifications; we thus keep including the first lag of the exchange rate change as independent variable in all the remaining VAR specifications of Table 3.

Column 3 adds a second country risk measure, which is based on the carry trade factor of Lustig et al. (2010). We add the change of the 3-months forward premium, equal to the difference in the spot exchange rate and the 3-months forward rate. As Lustig et al. point out, countries with a high interest rate load more on global risk than do low interest rate currencies. Consequently, to compensate for the increased risk exposure when holding high forward premium currencies, investors demand a higher expected returns, i.e. high forward premium currencies tend to appreciate on average. We use the forward premium instead of the interest rate differential, since covered interest rate parity typically holds, so that the forward discount equals the interest difference. Indeed, in column 3, the coefficient is estimated positive, i.e. if the USD/CHF forward rate is high compared to the USD/CHF spot rate, the CHF tends to appreciate in the future (this specification is estimated for expositional purposes only, we allow for the effect of the carry trade factor to vary throughout time when constructing our risk-induced exchange rate components).

In columns 4 to 6, we reproduce the specification of column 3 for the case of the Australian Dollar (AUD), the Japanese Yen (YEN), and the Euro (EUR). This serves to further explain the economic meaning of the two included risk factors. Consider first the coefficient for the forward rate, which is estimated positive for all currencies since the forward premium is itself time varying and country specific. In contrast, the VIX coefficient differs across the countries because the VIX measure is global and coefficient thus measures the factor loading on the VIX.

The VIX coefficient reflects the average riskiness of each specific currency compared to the USD. For example, the negative coefficient -0.0292 for the AUD implies that on average, the USD is the comparatively safer country. If global risk increases, the AUD depreciates. In contrast, the positive coefficient of 0.019 for the YEN implies that Japan is relatively safer than the US. Last, the small and insignificant coefficient of the Euro implies that USD and Euro are on average perceived as equally risky throughout our sample.

While the Euro does seem to be about as risky as the USD during 1999 to 2010 on average, this masks considerable differences in perceived relative riskiness throughout time (for example: compare September 11 2001 to mid 2010). Ranaldo and Söderlind (2010) document that in general the perceived riskiness of various currencies is highly volatile and also Lustig et al. (2010) document that their approach of grouping countries into risk portfolios requires frequents regrouping. The risk profile of each country is constantly evolving; to address this behavior, we next go to a rolling window time series estimation approach that allows for each countries factor loading on various measures to be time-dependent. The resulting models are then predicted. Columns 7 and 8 of Table compare these predictions to the actual data.

For the prediction presented in column 7, the sample includes 40 countries and the estimated model allows for time-varying and country-specific factor loadings for the VIX, the US Federal Funds Rate, the US Interbank Market Spread (which we include based on Adrian, Etula, and Groen (2010)), and the performance of the global stock market (MSCI in local currency). Unsurprisingly, the coefficient for the predicted value is close to 1 (it is not exactly equal to one owing to the rolling window framework: with window length n, the first n observation are used for the estimation but are not predicted). Quite surprising, however, is the fact that the prediction from this model results in an associated R-square of 12%, that is 12% of all day to day fluctuations in exchange rates can be explained by asset based considerations.

The model in column 8 includes in addition information on the 3-months and 12-months forward premia. In the sample of 14 currencies where we do have enough information on forward rates to estimate this model, the R-squared associated with the prediction is even 28%. This is important, since we do have forward rates for the currencies of the US major trading partners. Since nearly all import price observations in the BLS price dataset originate from these major trading partners, the risk induced component is likely to be sizeable.

We next document directly that these isolated exchange rate components are sizeable enough so that we can use them for meaningful pass through estimations. A key worry is that despite their high statistical significance and good fit in the daily dataset, these risk-induced movements are short-lived and cannot explain any large exchange rate movements that would plausibly lead firms to adjust their prices. We next show that this concern does not apply and that on the contrary, our measures do pick up substantial and persistent exchange rate swings.

In the Figures 14-18, we present line plots that compare the realized cumulated change in the exchange rate to the predicted cumulated change constructed from our estimations. The first plot presents the correlation for the CHF. Panel 1 compares the evolution of the risk-induced cumulative change in the USD/CHF exchange rate (blue dotted line) to the actual cumulated percentage change (red solid line). These cumulated changes are calculated as changes in the natural logarithm from the start of 1990 onwards. Indeed, Figure 14 documents that a significant part of USD/CHF exchange rate swings observed since 1990 can be traced back to risk-related considerations: throughout most of the sample period, the actual path of the exchange rate and the risk-induced component move parallel. Most importantly, Figure 14 documents that risk factors cause both large and non-transitory exchange rate swings. For example, the CHF is predicted to first gradually depreciate by around 23% in the period from 1997 to 2001 and to then appreciate by around 20% in the two year thereafter. Given that pass through happens over the time period of less than 24 months (see Gopinath et al. (2010)), these risk-induced USD/CHF swings seem relevant to examine pass through.

In Figure 15, we compare the same cumulative changes for the case of the USD/ YEN exchange rate change. The actual and the risk-induced exchange rate change again commove, albeit somewhat less closely than for the case of the CHF exchange rate. Again, we find that there are substantial swings (in the order of magnitude of 0.1-0.2 natural log points, or 10,5 to 22.1 percent) that are quite persistent.

In Figures 16 and 17, we next turn to the USD/German Mark (DM) exchange rate for the period leading up to 1999 and to the USD/Euro exchange rate in the period thereafter. Given that also the DM enjoyed a substantial save haven status, it is unsurprising that the major underlying trends of this exchange rate can be attributed to global risk and investor climate perceptions. Also for the Euro, a substantial part of the exchange rate can be explained by risk considerations.

Last in Figure 18, we turn to the USD/AUD exchange rate. Also the latter currency became increasingly involved in the global carry trade, albeit in a different direction. Much of the funds that were borrowed in YEN or CHF were invested in Australia. Plot 5 documents this increasing importance of the carry trade for Australia: while risk has hardly any effect on the currency in the period leading up to 2005, almost all of the sharp depreciation of the AUD vis--vis the USD that happened in the aftermath of the Lehman Brothers collapse (and also the subsequent reversal) can be explained by the risk profile of the AUD.[5]

Overall, these five plots lead us to conclude that changes in global risk and the subsequent asset considerations implied exchange rate fluctuations are substantial and persistent enough so that it makes sense to examine the rate of pass through following these shocks.

4.2 Results: Risk and Exchange Rate Pass-Through

Figures 19 to 28 document our results regarding the pass through rate following risk-induced shocks. Throughout this section, we present the pass through rates for various measures of risk induced exchange rate swings. For each risk measure, we run a joint pass through estimation that relates changes in the risk-induced component of the exchange rate to pass through rates and that also include the cumulative pass through response of US prices to residual exchange rate movements. Residual exchange rate movements refers to the component of exchange rate movements that cannot be explained by the respective risk measure.

For example, consider the risk-related exchange rate movement $risk1$. We measure pass-through by estimating a stacked regression where we regress monthly import price changes on monthly lags of the respective measure of the risk component of the exchange rate as well as to the residual:

$$\Delta p_{i,c,t} = \alpha_c + \sum_{j=1}^{n} \beta_j^{risk1} \Delta e_{c,t-j+1}^{risk1} + \sum_{j=1}^{n} \beta_j^{residual1} \Delta e_{c,t-j+1}^{residual1} + \gamma t + \epsilon_{i,c,t} \qquad (8)$$

[5] It is noteworthy that the BLS import price data ends before the recent economic crisis, so that our pass through results will not include any risk-induced changed observed during the crisis.

where $\Delta e^{risk1}_{c,t-j+1}$ is the projection obtained from a model similar to the ones presented in Table 3, and $\Delta e^{residual1}_{c,t-j+1}$ is the residual defined as

$$\Delta e^{residual1}_{c,t-j+1} = \Delta e_{c,t-j+1} - \Delta e^{risk1}_{c,t-j+1}$$

The main reason for estimating equation (8) jointly is that due to data availability and the rolling window approach, our sample fluctuates, so that the rate of pass through could vary simply due to the changed sample composition. Thus also always including the residual PT rate is helpful to demonstrate whether risk-induced exchange rate movements are truly different from other exchange rate movements.

In the four graphs in Figures 19 to 22, we estimate this specification over various horizons and for four different measures of the risk-induced component of exchange rate movements. In Figure 19, the risk measure is constructed in a specification that restricts the coefficients for the measures of global risk to be constant throughout the sample. Thus, this measure assumes that currencies have a risk profile that is either always more risky or always more safe than the USD. The four included measures are the (change in) the VIX, the MSCI World Index in Local Currencies, the US Federal Funds Rate, and the US spread between the 3 months and the overnight interbank rates.

The main finding emerging from 19 is that risk-induced exchange rate swings pass through into prices at a much faster rate and that do residual exchange rate swings. Moreover, also the rate of pass through seems to be somewhat higher following risk induced movements than following other movements. For example, the rate of pass through following risk induced exchange rate movements (from now on "risk PT") is estimated at over 0.45 at the 4-months horizon, while it is estimated at only 0.2 for the residual exchange rate movements. At longer horizons, this difference is not as marked, but still sizeable: for most of the horizons over 12 months, the risk PT rate is estimated above 0.45, while the residual PT rate hovers below 0.3.

We confirm this finding in the next Figures using three alternative specifications of risk induced exchange rate movements. Figure 20 uses "risk measures 2", which is constructed from a specification including the same four risk variables as in the construction of risk measure 1, but allowing the coefficient of these variables to vary over time (we adopt a 90 trading day moving window estimation). Figure 21 extends the model used for the construction of "risk measures 2" by the presence of autoregressive terms for both exchange rate changes and by adding lags of the independent variables. Finally, Figure 22 uses a model that also includes information on the currencies forward premium vis-à-vis the USD (again in a rolling window approach). This risk measure is available for only 14 countries due to the lack of forward rate data.

Regarding these four measures of risk-induced exchange rate movements, it is noteworthy that during certain periods of time, risk is a more powerful predictor than at other times. For example, most of the recent weakness of the Euro can be attributed to the financial turmoils and fears of future default, rather than to developments in the export sector. Such periods are often called "Risk on" periods in the financial world (see Ranaldo und Sderlind). Figure 23 examines the risk and residual pass through during such risk on periods. We define a month to be high risk if the change in the risk induced component of the exchange rate is larger than 2 standard deviations from the mean. Also during these times, the risk pass through (risk measure 1) takes place much faster than nominal pass through. During these risk on periods, it is also true that the long run risk PT is about 1.

We next turn to a reduced currency sample: it is probably the case that risk PT is only substantially for countries such as Switzerland, Japan, or Australia where risk considerations are responsible for a substantial part of the fluctuations of exchange rates. We thus present the PT following risk induced exchange rate movements for each country separately. Figure 27 documents the risk-PT rate for Swiss, Japanese, Australian, and German (GER/EUR) firms. The used risk measure is measure 3 that uses a rolling window approach and that also allows for the presence of autoregressive terms when constructing the risk measure. For Switzerland and Japan, we also present the residual PT rate in Figure 28.

We next turn to a reduced sample: it is probably the case that risk PT is only substantially for those countries such as Switzlerand, Japan, or New Zealand where Risk considerations are responsible for a substantial part of the fluctuations of exchange rates. We thus present the PT following risk induced exchange rate movements for each country separately.

Pass-Through of risk by country: Figure 27 and Figure 28

We find that there is substantial pass-through of risk for Switzerland. [. . .]

4.3 Price-Setting Behavior When There are Large Risk Swings

When we examine key statistics of price-setting behavior under large exchange rate changes, we find that pricing behavior strongly depends on the nature of the exchange rate shock, as we did in the case of pass-through. We consider pricing under large exchange rate changes because this allows us to most clearly identify differences in the nature of price-setting in response to the different measures of the exchange rate. We find evidence that risk impacts price-setting in a different way which can guide macro-economic modeling of price-setting and country risk, and possibly in making assumptions about variable markups.

First, we show that under high nominal, USD and trade-partner exchange rate vo vs0ity

Instead of a higher fraction of price changes, we observe a substantially lower monthly fraction of prices changes of around 6% to 8% for our first three risk measures. In addition, we observe an even more pronounced effect on the size of price changes, compared to the case of high nominal, USD and trade-partner exchange rate volatility. Now, downwards price changes for risk measures 1 to 3 are consistently more negative with values of -8% to -9%. Upwards price changes are less positive with values of 6% to 6.7%. The fraction of adjustment changing in a different direction, the more pronounced downwards price changes and the meanwhile higher pass-through of risk under high volatility, as Figures 24 and 25 summarize, suggest that a different modeling mechanism than variable markups may be needed to relate risk to pass-through.

Finally, we examine the fraction of small price changes. This is a relevant statistic of price-setting because it is essential in generating large real effects of monetary shocks in state-dependent DSGE models like Midrigan (2010). We find no statistically significant trend for this distributional statistic under our various measures of the exchange rate and high volatility.

5 Exercise III: PT following Unit Labor Costs Induced Exchange Rate Movements

Exchange rate fluctuations are the fundamental channel via which the balance of trade flows is achieved. This implies that if a country faces a real shock, such as productivity growth, or a demand shock for the country's goods, this also moves the real exchange rate. For example, Peltonen and Sager (2009) find evidence of significant correlation between real exchange rates and productivity differentials in both sectors.

5.1 How much can be explained?

We next turn to our third exercise, in which we examine whether productivity growth induces movements in the exchange rate and whether these movements pass through into domestic prices. We have no prior on whether pass through should be lower than when the exchange rate fluctuates for other reasons.

Our analysis uses the OCED System of Unit Labor Cost (ULC) Database (see OECD (2007) for a description, which provides quarterly estimates of unit labor costs for currently 33 countries and dating back to the early 1980s). We focus on their Manufacturing sector ULC estimates, which provides the cost of labor per unit of real output in the manufacturing sector in domestic currency.

Table 4 documents if, to what extent, and over what time horizon the exchange rate reacts to unit labor cost developments. For this analysis, we merge the ULC data with our other data and collapse it to the quarterly frequency. This yields an unbalanced panel spanning 33 countries (the current OECD members, as well as Bulgaria, Latvia, Lithuania, and Romania) and 82 quarters (Q1 1990 to Q2 2010).

In column 1, we present a baseline random effect panel estimation including the quarterly change of the exchange rate as dependent variable and the quarterly change in the countrys ULC as dependent variable. The coefficient is highly significant and estimated at 0.449. This implies that a 1% cost increase is associated with an appreciation of the home currency of 0.44 percentage points. The fact that increases in unit labor costs are associated with exchange rate appreciations is surprising and probably implies that most of the fluctuations in unit labor costs are driven by booms and bust that move both wages and the exchange rate.

It might be the case that changes in unit labor costs on trickle through the real economy slowly over time and that they therefore move the exchange rate only after a lag. We address this issue in Columns 2 and 3, where we first add the quarterly ULC changes over the last year (i.e. the current quarter and three lags) and then the quarterly ULC changes over two years. Doing so substantially improves the fit of the model and shows that indeed, the ULCs affect the exchange rate only over time. However, the main striking fact, that increases in costs are associated with an appreciation of the exchange rate, is still confirmed. The estimation of column 3 suggest that after two years, a 1% increase in ULC is associated with a 0.78% higher exchange rate. This finding is roughly confirmed in the estimation of column 4 also allowing for exchange rate changes to be autoregressive.

A worry with the results presented in Table 4 is that of the 33 countries, 15 are Euro zone member countries that all share the same exchange rate. Given that each member state makes up only a fraction of the Euro Zone economy, changes in its ULC will move the Euro only by little. We thus re-run the baseline estimation separately for the euro zone members in column 5 and the rest of the sample in column 6. Indeed, the impact of ULC changes on the exchange rate is much more marked in the non-Euro zone group (coefficient equal to 0.557) and the Euro zone group (coefficient equal to 0.142).

We next turn to our main prediction for the ULC-cost induced part of the exchange rate. Given the above findings we run two separate estimations for the all countries together and for the non-Euro zone group separately, see columns 7 and 8. In each prediction, we account for the long run impact of ULC on the exchange rate and include the quarterly changes up to a horizon of two years ago.

5.2 Pass-Through of Productivity Shocks into US Import Prices

Figure 29. [Add here.]

6 Conclusion

In this paper, we study how three different sources of exchange rate shocks affect pass-through into U.S. import prices.

First, we examine how global movements of the USD, as separate from trade-partner specific movements relative to the rest of the world, affect U.S. import prices. We find that pass-through with a substantial impact on domestic prices.

Third, we show that pass-through appears to be absent when changes in unit labor cost imply exchange rate movements.

Our findings thus have important policy implications such as for estimating how shifts in risk perception create imported inflationary pressure. Moreover, they can guide us how to model pass-through, for example with respect to assumptions about local versus global "toughness" of competition.

References

Atkeson, A. and A. Burstein (2008): "Pricing-to-Market, Trade Costs, and International Relative Prices," American Economic Review, 98, 1998–2031.

Auer, R. (2011): "Exchange rate pass-through, domestic competition and inflation – evidence from the 2005/08 revaluation of the Renminbi," Globalization and Monetary Policy Institute Working Paper 68, Federal Reserve Bank of Dallas.

Brunnermeier, M. K. and L. H. Pedersen (2009): "Market Liquidity and Funding Liquidity," Review of Financial Studies, 22, 2201–2238.

Burnside, A. C., M. Eichenbaum, I. Kleshchelski, and S. Rebelo (2008): "Do Peso Problems Explain the Returns to the Carry Trade?" CEPR Discussion Papers 6873, C.E.P.R. Discussion Papers.

Chen, Y.-C., K. S. Rogoff, and B. Rossi (2010): "Can Exchange Rates Forecast Commodity Prices?" The Quarterly Journal of Economics, 125, 1145–1194.

Dornbusch, R. (1980): "Exchange Rate Risk and the Macroeconomics of Exchange Rate Determination," NBER Working Papers 0493, National Bureau of Economic Research, Inc.

Farhi, E., S. P. Fraiberger, X. Gabaix, R. Ranciere, and A. Verdelhan (2009): "Crash Risk in Currency Markets," CEPR Discussion Papers 7322, C.E.P.R. Discussion Papers.

Farhi, E. and X. Gabaix (2008): "Rare Disasters and Exchange Rates," NBER Working Papers 13805, National Bureau of Economic Research, Inc.

Goldberg, P. K. and F. Verboven (2001): "The Evolution of Price Dispersion in the European Car Market," Review of Economic Studies, 68, 811–48.

——— (2005): "Market integration and convergence to the Law of One Price: evidence from the European car market," Journal of International Economics, 65, 49–73.

Gopinath, G. and O. Itskhoki (2010): "Frequency of Price Adjustment and Pass-Through," The Quarterly Journal of Economics, 125, 675–727.

Gopinath, G., O. Itskhoki, and R. Rigobon (2010): "Currency Choice and Exchange Rate Pass-Through," American Economic Review, 100, 304–36.

Gopinath, G. and R. Rigobon (2008): "Sticky Borders," Quarterly Journal of Economics, 123, 531–575.

Gust, C., S. Leduc, and N. Sheets (2009): "The adjustment of global external balances: Does partial exchange-rate pass-through to trade prices matter?" Journal of International Economics, 79, 173–185.

Hau, H. and H. Rey (2004): "Can Portfolio Rebalancing Explain the Dynamics of Equity Returns, Equity Flows, and Exchange Rates?" American Economic Review, 94, 126–133.

Hellerstein, R. (2008): "Who bears the cost of a change in the exchange rate? Pass-through accounting for the case of beer," Journal of International Economics, 76, 14–32.

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

——— (1992): "International Comparisons of Pricing-to-Market Behavior," NBER Working Papers 4098, National Bureau of Economic Research, Inc.

Lustig, H., N. Roussanov, and A. Verdelhan (2008): "Common Risk Factors in Currency Markets," NBER Working Papers 14082, National Bureau of Economic Research, Inc.

Lustig, H. and A. Verdelhan (2007): "The Cross Section of Foreign Currency Risk Premia and Consumption Growth Risk," American Economic Review, 97, 89–117.

Midrigan, V. (2010): "Menu Costs, Multi-Product Firms, and Aggregate Fluctuations," forthcoming, Econometrica.

Nakamura, E. and J. Steinsson (2008): "Five Facts about Prices: A Reevaluation of Menu Cost Models," The Quarterly Journal of Economics, 123, 1415–1464.

Nakamura, E. and D. Zerom (2010): "Accounting for Incomplete Pass-Through," Review of Economic Studies, 77, 1192–1230.

Peltonen, T. A. and M. Sager (2009): "Productivity shocks and real exchange rates - a reappraisal," Working Paper Series 1046, European Central Bank.

Plantin, G., H. Sapra, and H.-S. Shin (2005): "Marking to Market, Liquidity, and Financial Stability," Monetary and Economic Studies, 23, 133–155.

Ranaldo, A. and P. Söderlind (2010): "Safe Haven Currencies," Review of Finance, 14, 385–407.

7 Tables

Table 1: Nominal vs USD or Trade Partner Pass Through Rates: Robustness Tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Type of PT:	Nominal	USD	Trade-Partner	USD	Trade-Partner	Nominal	USD	Trade-Partner
Sample:	(1)-(3) All Observations, Single Estimation			(4)-(5) Full sample, joint estimation		(6)-(8) "High Volatility" Observations		
Horizon in Months						Nominal	Nominal	Nominal
1	0.075982	0.160401	0.056523	0.1598632	0.0577026	0.043515	0.150698	0.038827
	0.006579	0.014818	0.007343	0.0148161	0.00073438	0.009663	0.033611	0.011597
3	0.184533	0.315798	0.158452	0.3094034	0.1580078	0.165823	0.297983	0.177513
	0.009433	0.021877	0.010558	0.0218758	0.0105643	0.017621	0.051393	0.021272
6	0.249876	0.419579	0.220195	0.412164	0.2117234	0.19606	0.275609	0.204117
	0.013521	0.032416	0.015082	0.0325178	0.01511168	0.029078	0.084799	0.03263
12	0.311191	0.602546	0.26226	0.6335874	0.2561909	0.445255	0.494448	0.466066
	0.02189	0.061026	0.023494	0.0615382	0.023547	0.062459	0.194406	0.072063
18	0.318445	0.605754	0.28232	0.6842226	0.2797203	0.580702	1.769295	0.598237
	0.030958	0.092738	0.033015	0.0941571	0.0333118	0.099994	0.393909	0.113621
24	0.26383	0.738106	0.206856	0.883091	0.19632	0.662107	0.76073	0.790944
	0.043518	0.136451	0.04577	0.1388885	0.045985	0.208503	0.777754	0.219405

Table 2: Trade-Partner and USD Exchange Rate Pass-Through by Country

	Trade-Partner	USD	Trade-Partner	USD
Country/Horizon	6 months		12 months	
Canada	0.53	1.36	0.31	1.06
Mexico	0.01	0.48	0	0.46
Sweden	0.57	-0.63	0.96	1.1
Norway	0.15	0.34	0.09	0.74
Finland	0.23	0.45	0.51	1.06
Denmark	0	0.07	-0.05	0.28
UK	0.23	0.24	0.31	0.2
Ireland	0.29	0.47	0.42	-0.11
Netherlands	0.29	0.79	0.26	0.73
France	0.07	0.26	0.04	0.44
Germany	0.47	0.22	0.54	0.61
Austria	0.36	0.33	0.36	0.22
Czech Republic	0.07	0.2	-0.07	-0.52
Hungary	-0.13	0.6	-0.7	1.57
Switzerland	0.5	0.15	0.61	-0.17
China	0.81	-0.31	1	0.32
Portugal	0.37	0.43	0.21	0.12
Italy	0.26	0.25	0.21	-0.07
Greece	0.09	0.45	0.53	0.96
Singapore	-0.59	0.68	0.22	0.23
South Korea	0.1	0.32	0.14	0.55
Japan	0.32	0.24	0.37	0.8
Australia	0.44	0.88	0.8	1.18
New Zealand	0.21	0.55	0.1	0.53
Mean	0.24	0.37	0.30	0.51
Median	0.25	0.34	0.29	0.50

Table 3: Global Risk, The Carry Trade Factor and Bilateral Exchange Rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exchange Rate:	USD/CHF	USD/CHF	USD/CHF	USD/AUD	USD/YEN	USD/EUR	all Currencies	
Estimation Type:	Regression	VAR	VAR	VAR	VAR	VAR	FE Panel	FE Panel
d/d Ch. VIX	0.0155	0.0152	0.0161	-0.0292	0.019	-0.0018		
	[0.0019]**	[0.0017]**	[0.0017]**	[0.0017]**	[0.0016]**	[0.0020]		
Lag 1 of d/d Ch. VIX		-0.0008						
		[0.0017]						
Lag 2 of d/d Ch. VIX		-0.0003						
		[0.0017]						
d/d Ch. 3m Forward			0.5814	0.4893	0.5294	0.5983		
Premium			[0.0483]**	[0.0424]**	[0.0452]**	[0.0673]**		
Autoregressive Terms								
Lag 1		-0.0291	-0.0247	-0.0452	-0.019	-0.0271		
		[0.0136]*	[0.0134]	[0.0132]**	[0.0134]	[0.0179]		
Lag 2		-0.0027						
		[0.0136]						
Lag 3		-0.0177						
		[0.0135]						
Lag 20		0.0039						
		[0.0135]						
Predicted Values Obtained From Rolling Window Time Series Estimation								
Model without Carry Trade Factor (no Forward Rate)								
							1.007	
							[0.0064]**	
Model with Forward Rate								
								1.0334
								[0.0065]**
Number of Currencies	1	1	1	1	1	1	40	14
Observations	5398	5396	5295	5295	5295	3048	181858	66587
R-squared	0.02	na	na	na	na	na	0.12	0.28

Dependent Variable is the Daily %Change of the Bilateral Exchange Rate
Robust standard errors in brackets, * significant at 5%; ** significant at 1%

Table 4: The Impact of Unit Labor Cost Changes on the Exchange Rate

	(1) Baseline	(2) Lags	(3) More Lags	(4) Lags, AR	(5) non Euro	(6) Euro	(7) all	(8) Euro
Quarterly Ch. ULC	0.4487	0.3572	0.2814	0.249	0.5568	0.1415	0.2814	0.3485
	[0.0513]**	[0.0493]**	[0.0535]**	[0.0536]**	[0.0631]**	[0.0611]*	[0.0535]**	[0.0793]**
Lag 1 Quarterly Ch. ULC		0.1566	0.1065	0.0811			0.1065	0.1782
		[0.0509]**	[0.0577]	[0.0555]			[0.0577]	[0.0794]*
Lag 2 Quarterly Ch. ULC		0.0406	-0.0449	-0.0454			-0.0449	-0.0478
		[0.0460]	[0.0518]	[0.0512]			[0.0518]	[0.0761]
Lag 3 Quarterly Ch. ULC		0.0811	-0.0228	-0.0403			-0.0228	0.0407
		[0.0435]	[0.0483]	[0.0475]			[0.0483]	[0.0680]
Lag 4 Quarterly Ch. ULC			0.035	0.0153			0.035	-0.0591
			[0.0494]	[0.0487]			[0.0494]	[0.0694]
Lag 5 Quarterly Ch. ULC			0.0962	0.0698			0.0962	0.0512
			[0.0490]*	[0.0483]			[0.0490]*	[0.0645]
Lag 6 Quarterly Ch. ULC			0.1585	0.1275			0.1585	0.1261
			[0.0480]**	[0.0469]**			[0.0480]**	[0.0637]*
Lag 7 Quarterly Ch. ULC			0.1749	0.1488			0.1749	0.2055
			[0.0558]**	[0.0538]**			[0.0558]**	[0.0745]**
Autoregressive Terms								
Lag 1 of the Exchange Rate				0.1142				
				[0.0360]**				
Lag 1 of the Exchange Rate				-0.0506				
				[0.0250]*				
Lag 1 of the Exchange Rate				0.0814				
				[0.0245]**				
Lag 1 of the Exchange Rate				-0.0267				
				[0.0259]				
Lag 1 of the Exchange Rate				0.0328				
				[0.0222]				
Lag 1 of the Exchange Rate				0.079				
				[0.0242]**				
Lag 1 of the Exchange Rate				-0.0072				
				[0.0250]				
Observations (Quarter *Country)	2337	2238	2106	2106	1257	1080	2106	1131
No. Countries	33	33	33	33	18	15	33	18

Dependent Variable is the Quarterly Change in the Bilateral Exchange Rate against the USD
Robust standard errors in brackets, * significant at 5%; ** significant at 1%

Table 5: Monthly Fractions of Price Changes under High Volatility

	Fraction All	Fraction Up	Fraction Down	Fraction Small
Baseline	15.75%	7.98%	7.78%	28.52%
	(0.05%)	(0.04%)	(0.03%)	(1.01%)
High Nominal Volatility	20.90%	10.65%	10.25%	31.55%
	(0.17%)	(0.13%)	(0.13%)	(2.56%)
High USD Volatility	21.36%	11.05%	10.31%	32.12%
	(0.16%)	(0.13%)	(0.12%)	(2.64%)
High Trade-Partner Volatility	21.84%	11.37%	10.47%	31.80%
	(0.17%)	(0.13%)	(0.13%)	(2.47%)
High Risk 1 Volatility	6.28%	3.17%	3.11%	35.82%
	(0.05%)	(0.04%)	(0.04%)	(2.88%)
High Risk 2 Volatility	6.28%	2.98%	3.30%	31.67%
	(0.05%)	(0.04%)	(0.04%)	(2.96%)
High Risk 3 Volatility	8.45%	4.53%	3.93%	30.10%
	(0.06%)	(0.04%)	(0.04%)	(2.82%)
High Risk 4 Volatility	15.54%	7.86%	7.69%	33.13%
	(0.09%)	(0.06%)	(0.06%)	(2.30%)

Table 6: Size of Price Changes

	Δp	$\|\Delta p\|$	$\Delta p > 0$	$\Delta p < 0$
Baseline	0.02%	7.37%	7.29%	-7.44%
	(0.08%)	(0.07%)	(0.10%)	(0.11%)
High Nominal Volatility	-0.25%	7.41%	7.02%	-7.80%
	(0.19%)	(0.18%)	(0.25%)	(0.25%)
High USD Volatility	-0.67%	7.88%	6.97%	-8.86%
	(0.19%)	(0.17%)	(0.21%)	(0.28%)
High Trade-Partner Volatility	0.01%	7.17%	6.89%	-7.47%
	(0.18%)	(0.16%)	(0.21%)	(0.26%)
High Risk 1 Volatility	-0.98%	7.71%	6.66%	-8.78%
	(0.20%)	(0.19%)	(0.25%)	(0.27%)
High Risk 2 Volatility	-1.62%	7.80%	6.53%	-8.96%
	(0.18%)	(0.16%)	(0.19%)	(0.26%)
High Risk 3 Volatility	-0.45%	6.96%	6.08%	-7.98%
	(0.12%)	(0.11%)	(0.13%)	(0.20%)
High Risk 4 Volatility	-0.09%	6.48%	6.32%	-6.64%
	(0.12%)	(0.11%)	(0.15%)	(0.16%)

8 Graphs

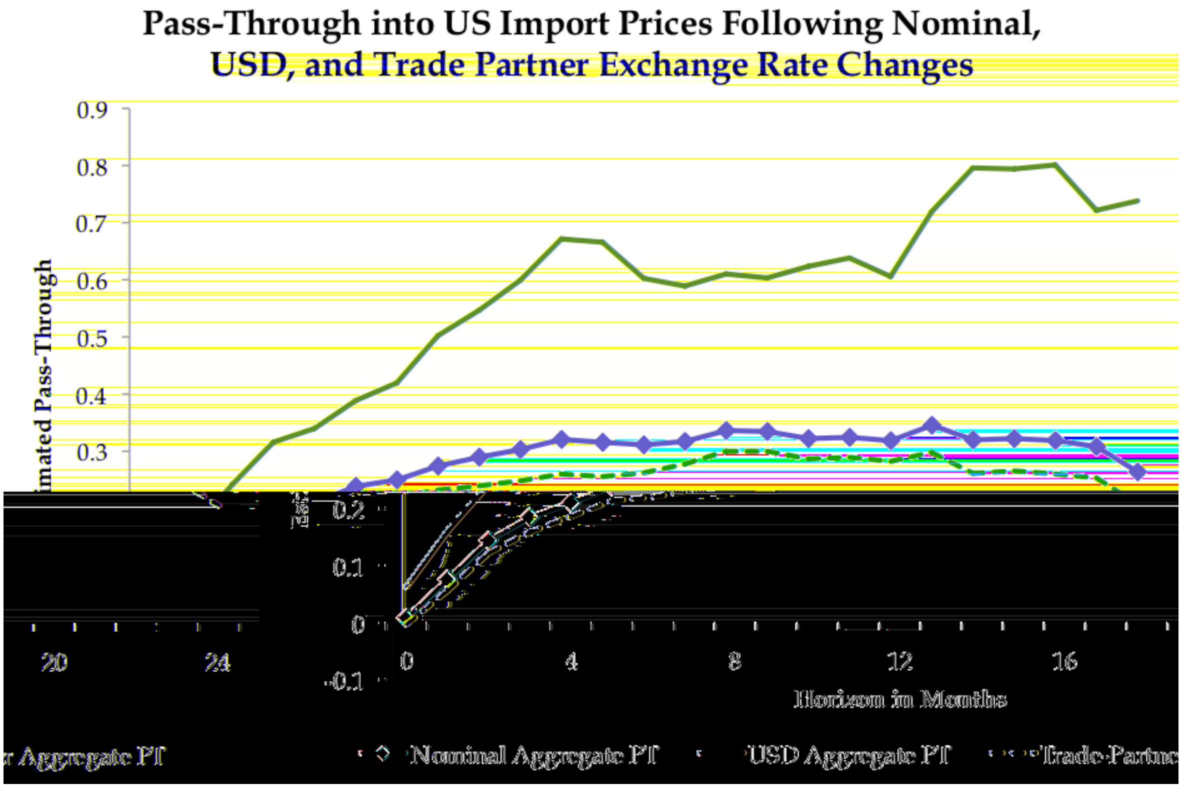


Figure 1: Pass-Through of Different Exchange Measures into US Import Prices

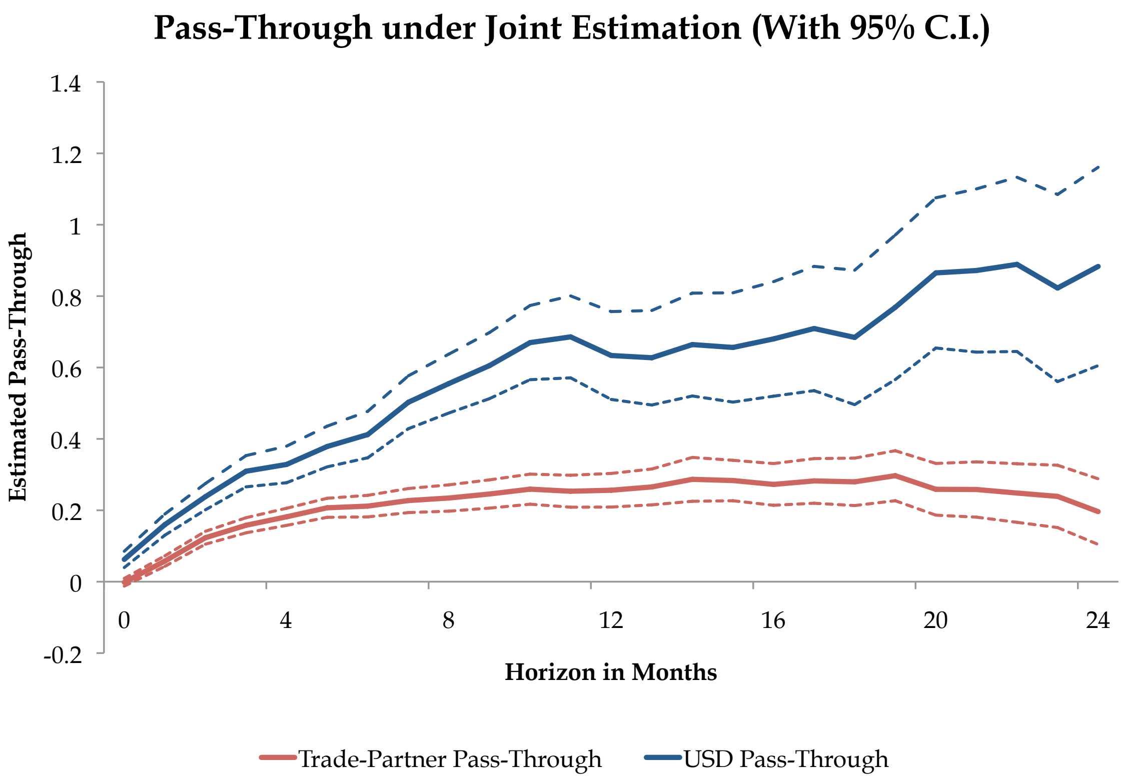


Figure 2: Jointly Estimated Pass-Through of USD and Trade-Partner Exchange Rate Changes into US Import Prices

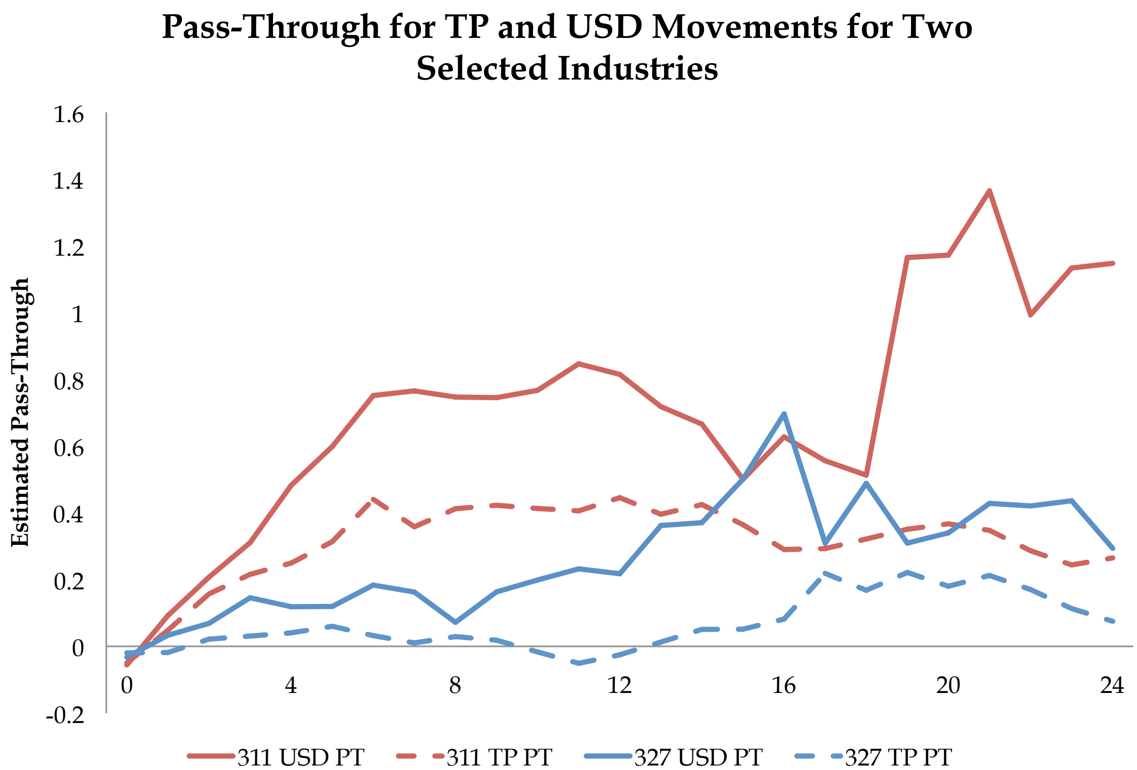


Figure 3: Pass-Through for TP and USD Movements for NAICS Industries 311 and 327

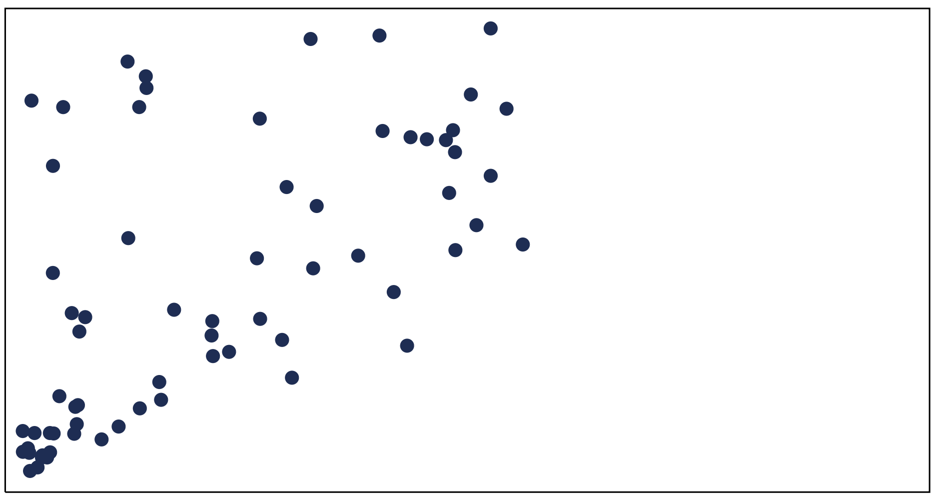


Figure 4: USD and Nominal Exchange Rate Pass-Through into US Import Prices

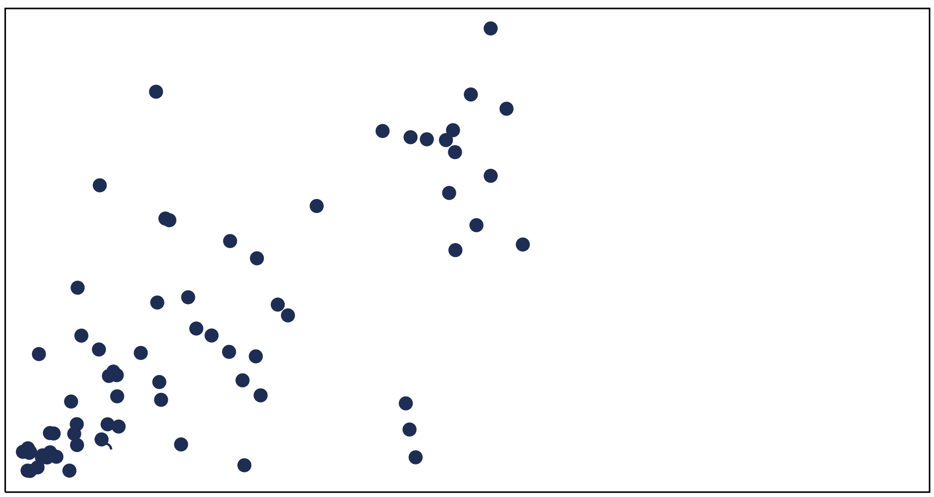


Figure 5: USD and Nominal Exchange Rate Pass-Through into US Import Prices, Manufacturing

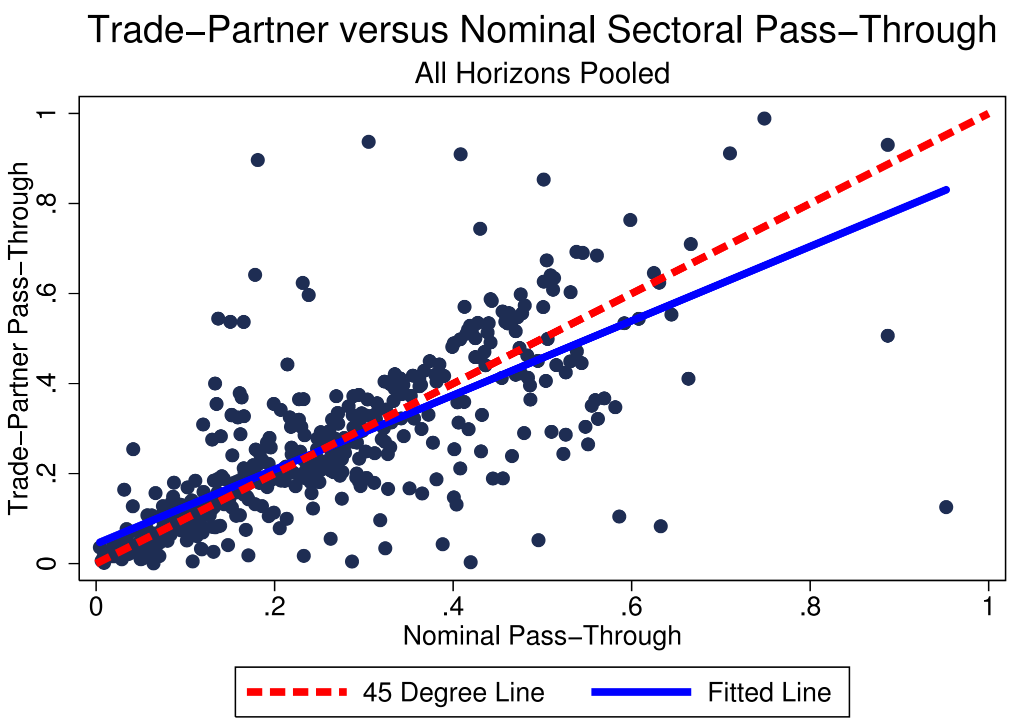


Figure 6: Trade-Partner and Nominal Exchange Rate Pass-Through into US Import Prices

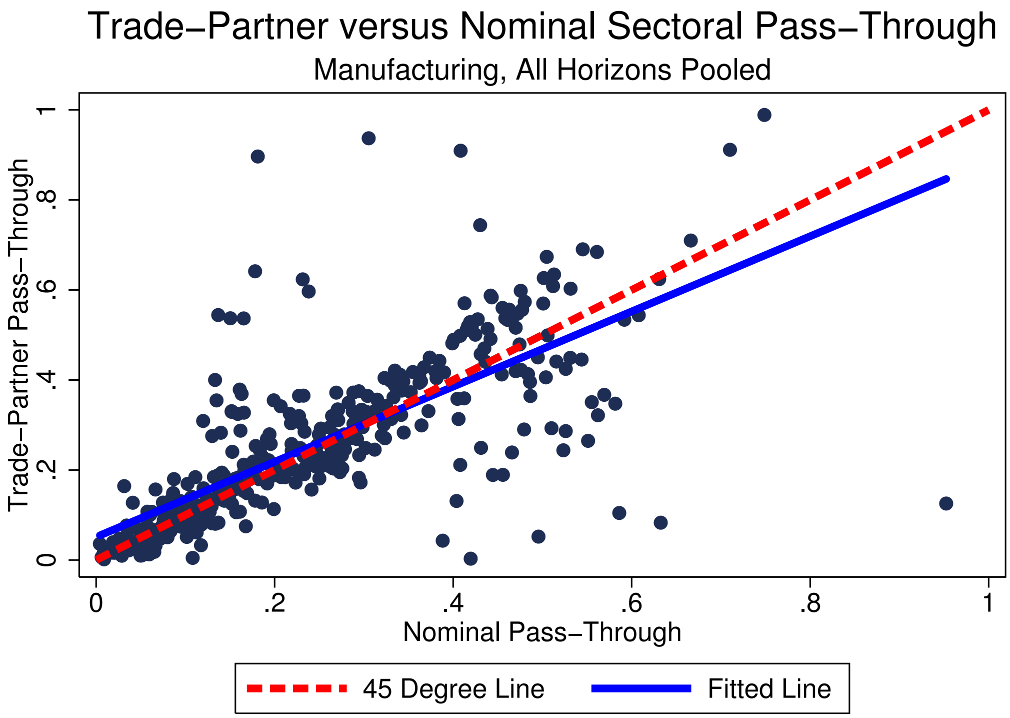


Figure 7: Trade-Partner and Nominal Exchange Rate Pass-Through into US Import Prices, Manufacturing

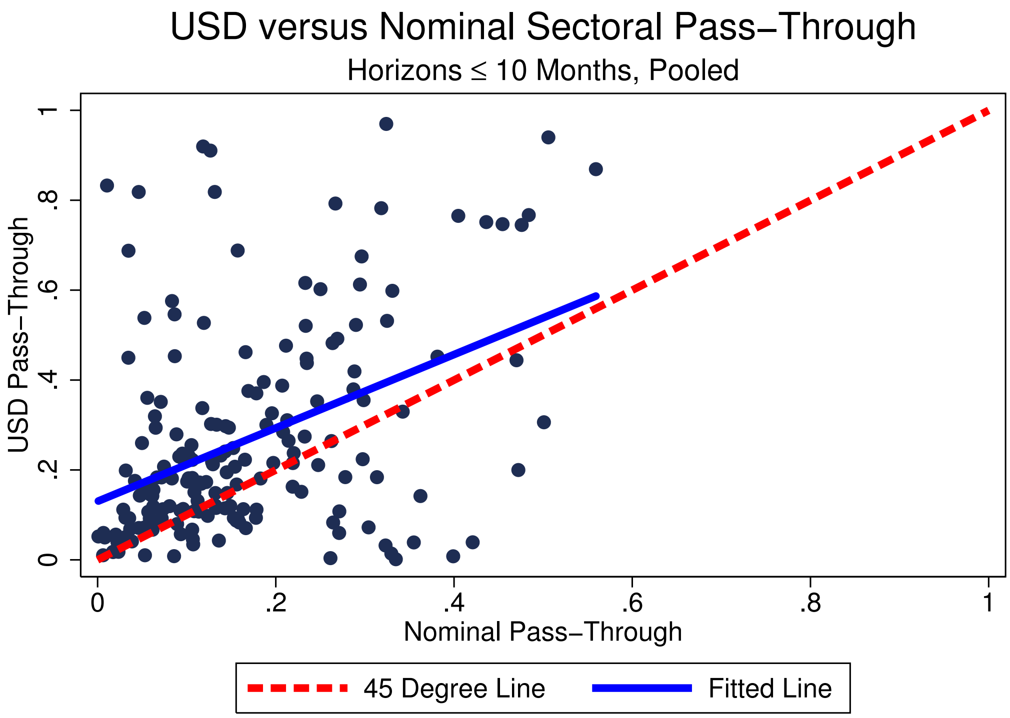


Figure 8: USD and Nominal Exchange Rate Pass-Through into US Import Prices, 0-10 Months Horizon

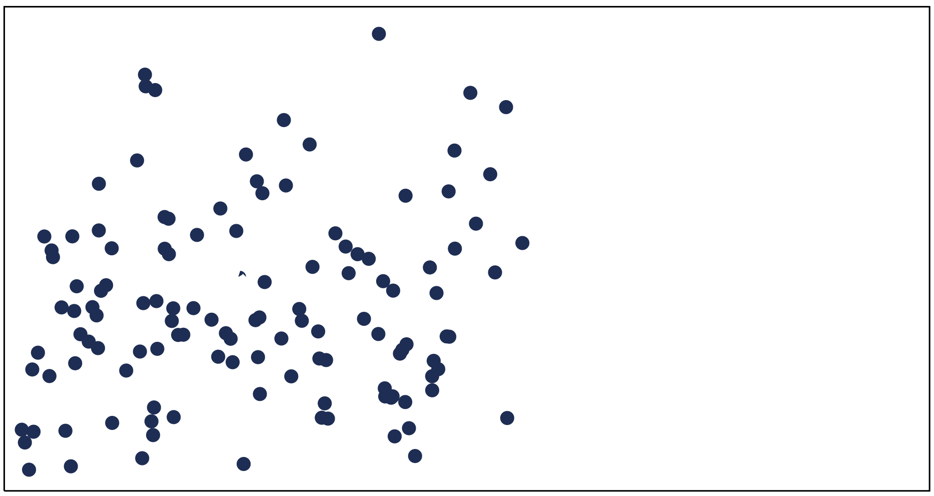


Figure 9: USD and Nominal Exchange Rate Pass-Through into US Import Prices, 11-20 Months Horizon

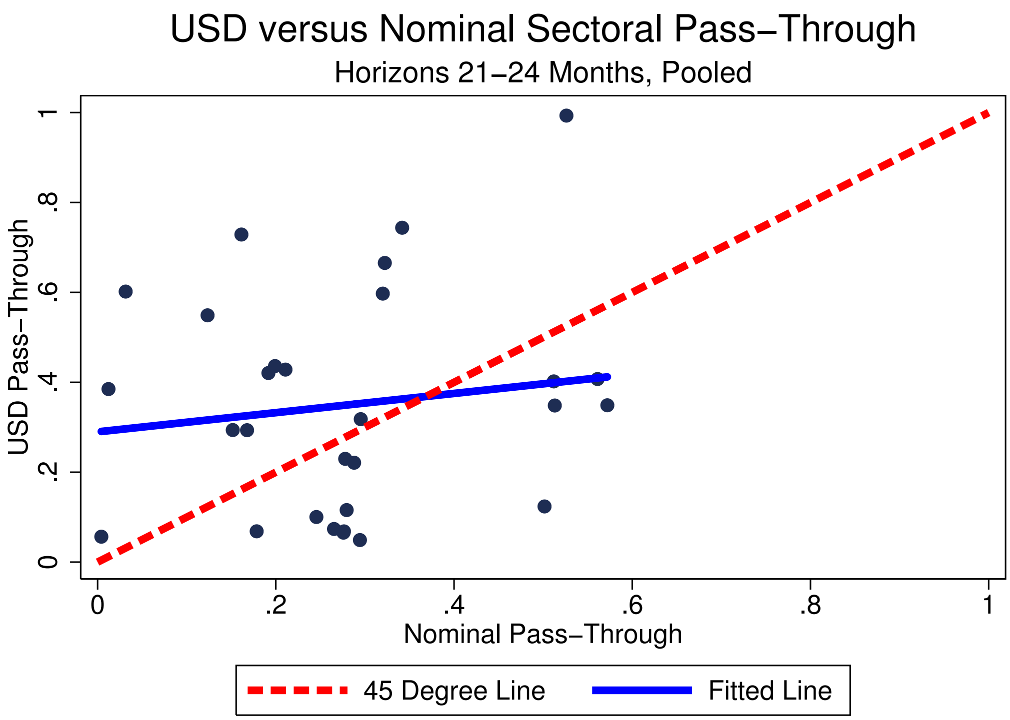


Figure 10: USD and Nominal Exchange Rate Pass-Through into US Import Prices, 21-25 Months Horizon

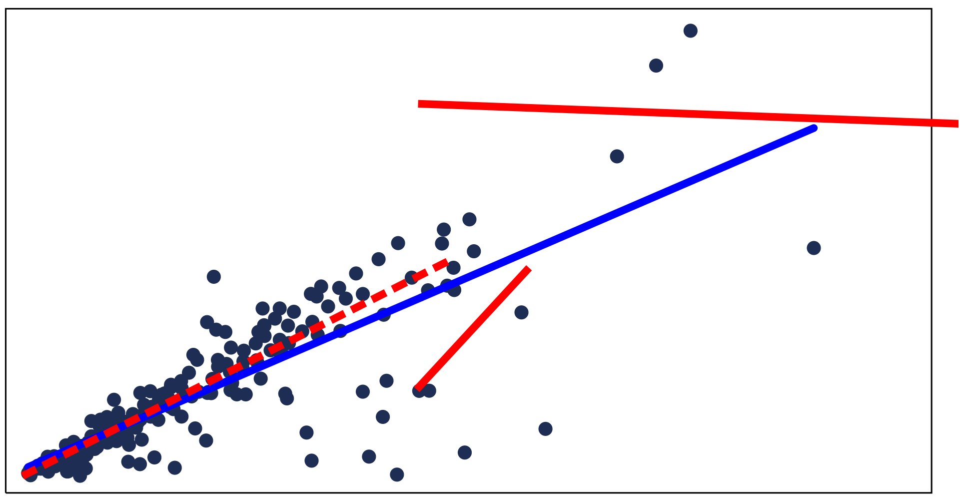


Figure 11: Trade-Partner and Nominal Exchange Rate Pass-Through into US Import Prices, 0-10 Months Horizon

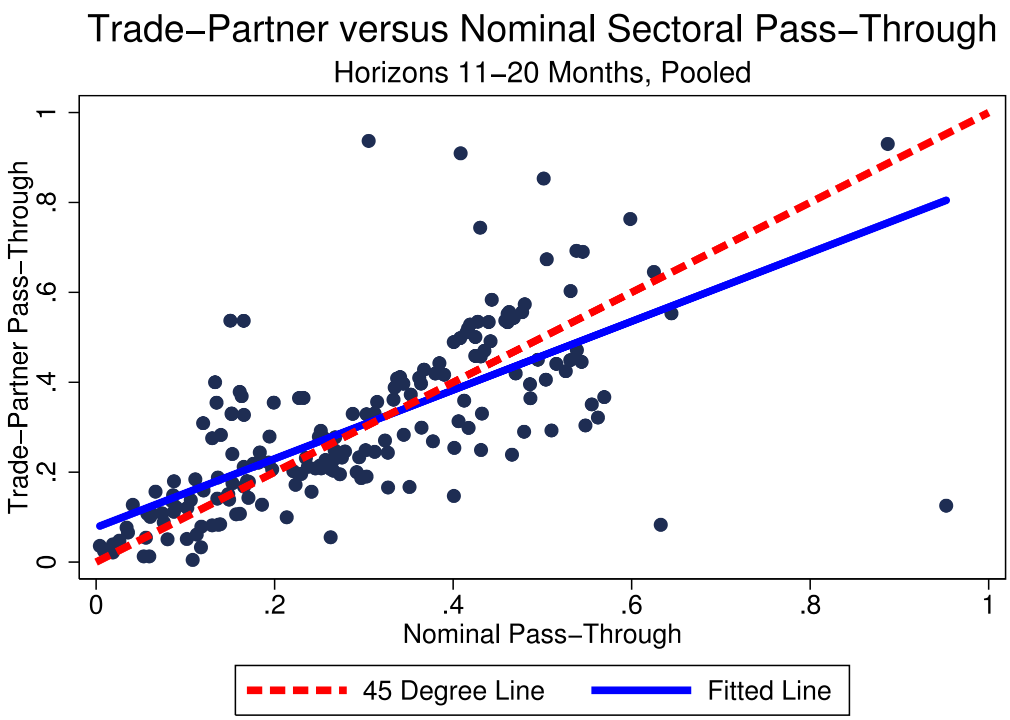


Figure 12: Trade-Partner and Nominal Exchange Rate Pass-Through into US Import Prices, 11-20 Months Horizon

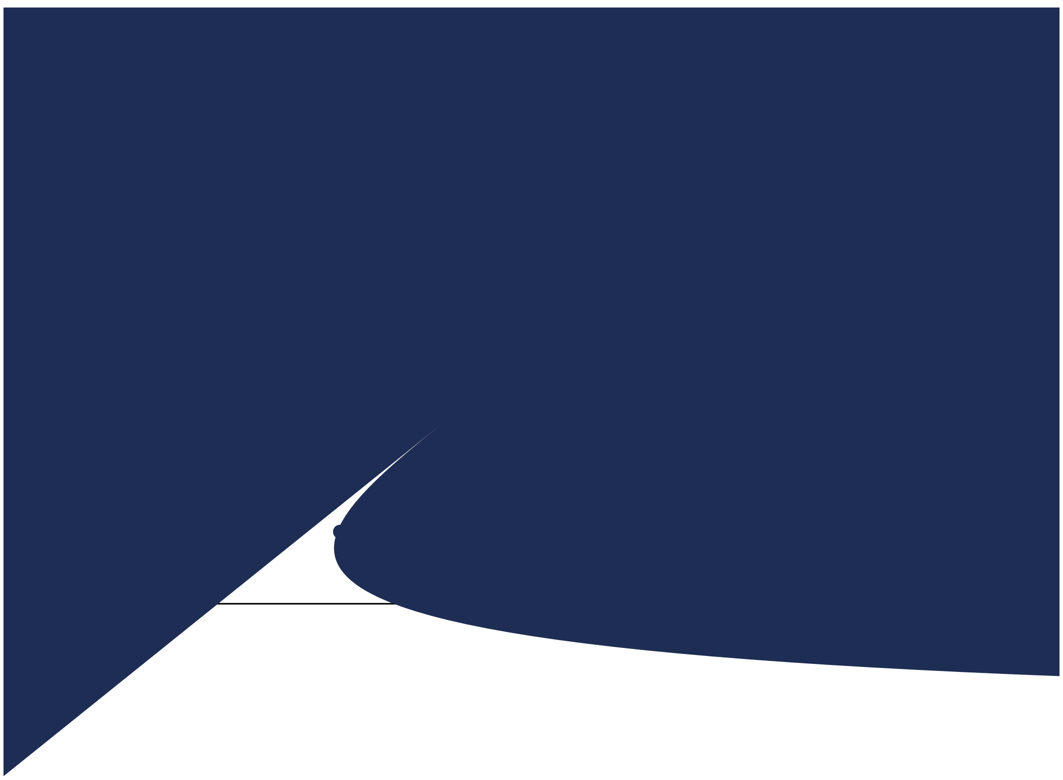


Figure 13: Trade-Partner and Nominal Exchange Rate Pass-Through into US Import Prices, 21-25 Months Horizon

Figure 14:

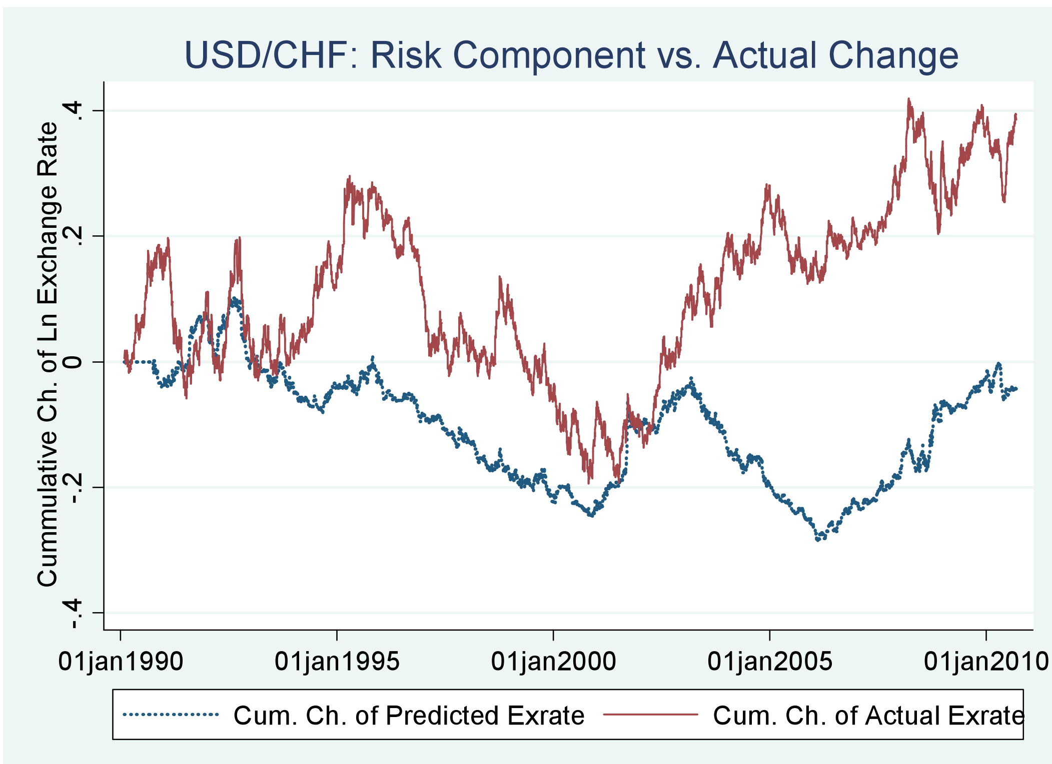

USD/CHF: Risk Component vs. Actual Change
Cummulative Ch. of Ln Exchange Rate
-.4
-.2
0
.2
.4
01jan1990
01jan1995
01jan2000
01jan2005
01jan2010
Cum. Ch. of Predicted Exrate
Cum. Ch. of Actual Exrate

Figure 15:

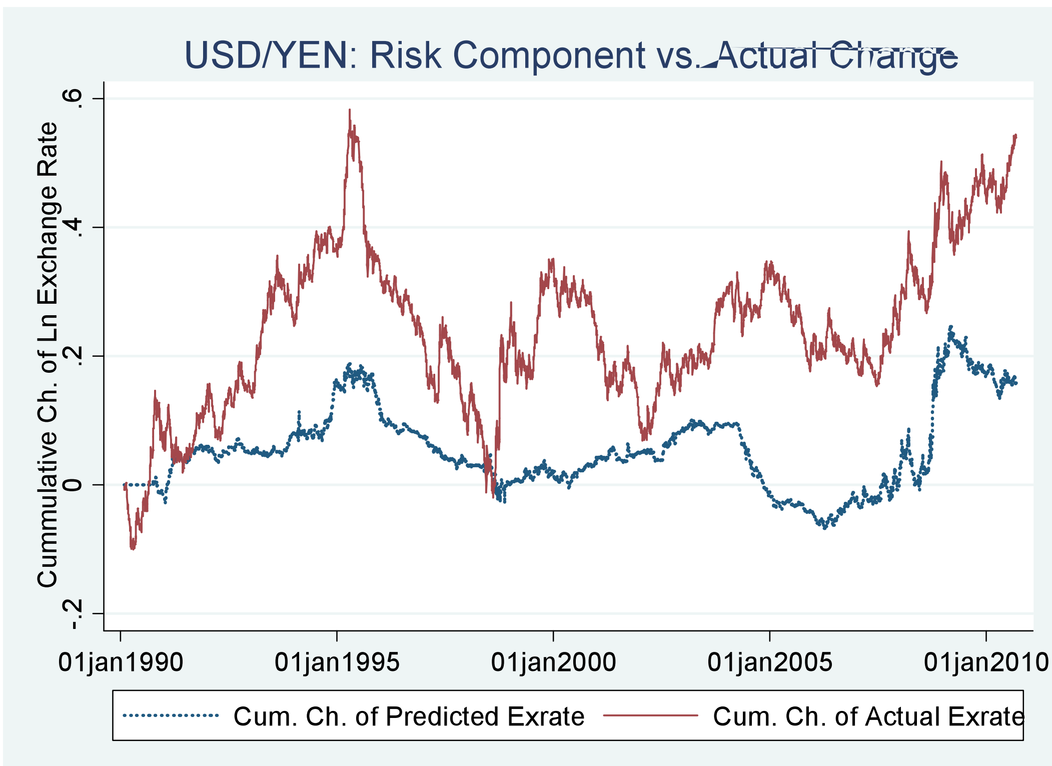

USD/YEN: Risk Component vs. Actual Change
Cummulative Ch. of Ln Exchange Rate
-.2
0
.2
.4
.6
01jan1990
01jan1995
01jan2000
01jan2005
01jan2010
Cum. Ch. of Predicted Exrate
Cum. Ch. of Actual Exrate

Figure 16:

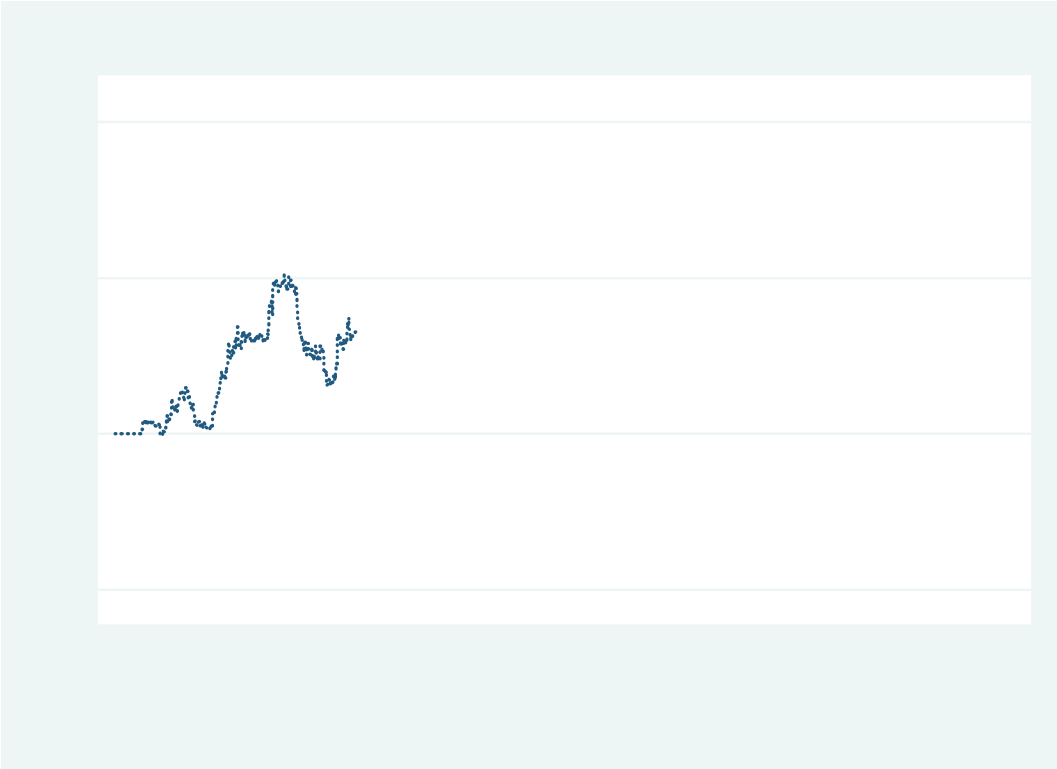


Figure 17:

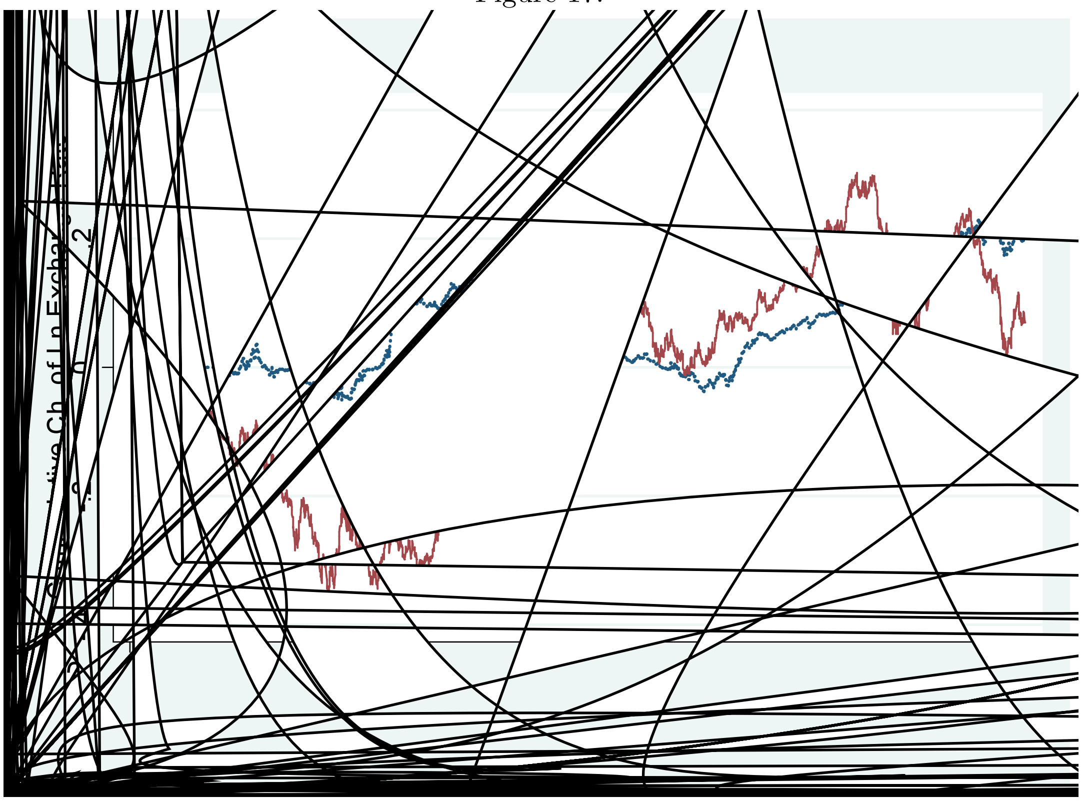
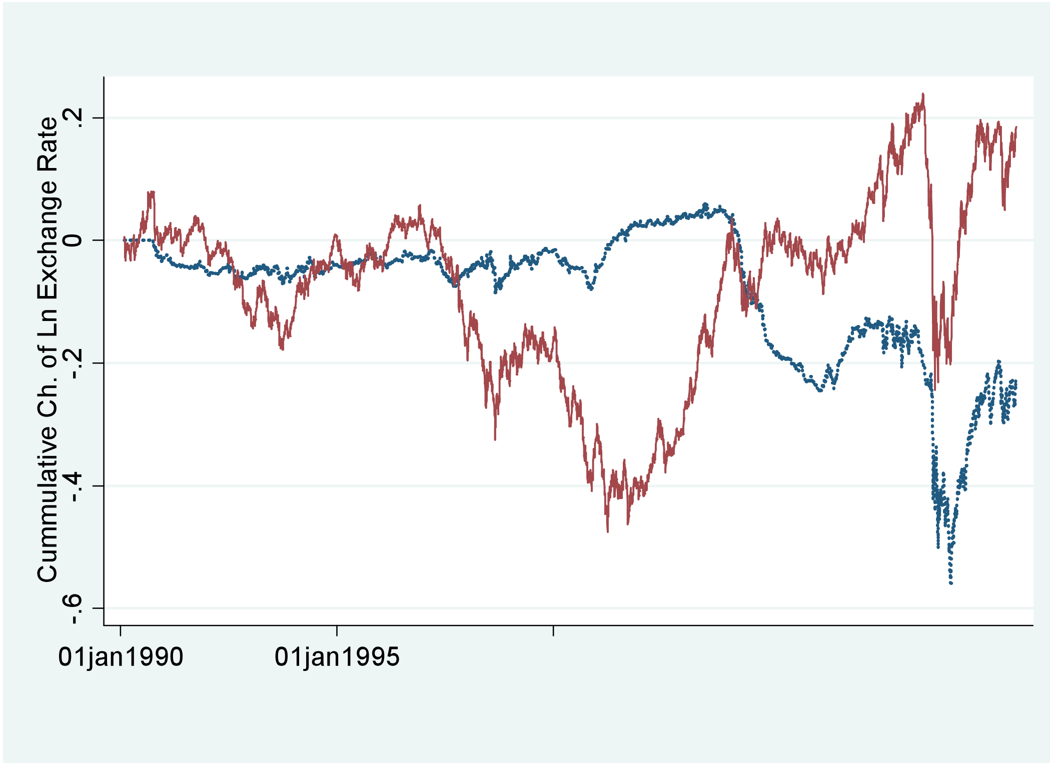


Figure 18:



Cummulative Ch. of Ln Exchange Rate
.2
0
-.2
-.4
-.6
01jan1990
01jan1995

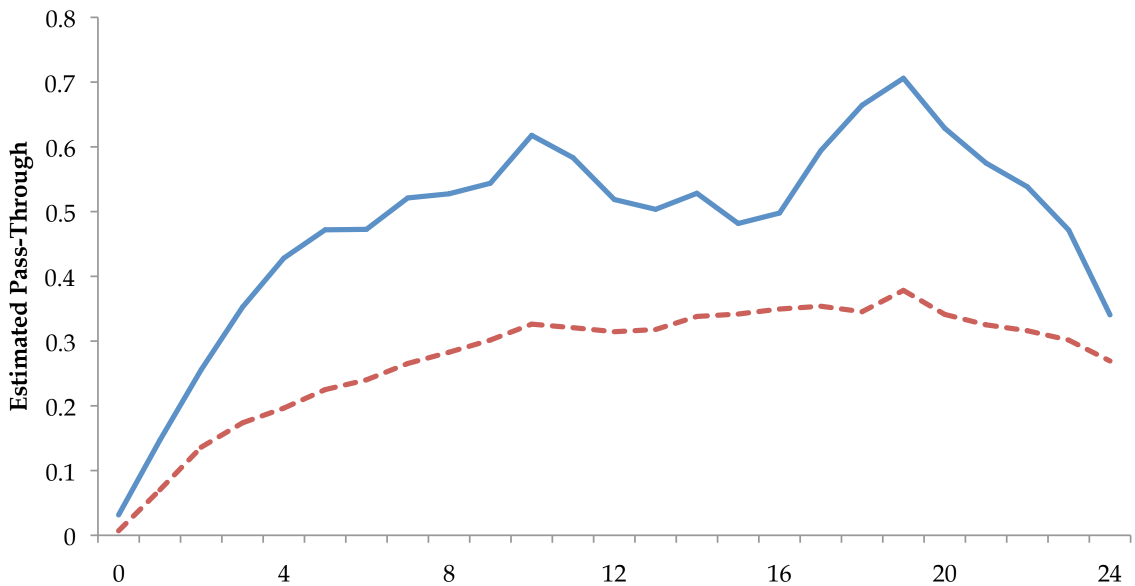


Figure 19: Pass-Through of Exchange Rate Risk Measure 1 into US Import Prices

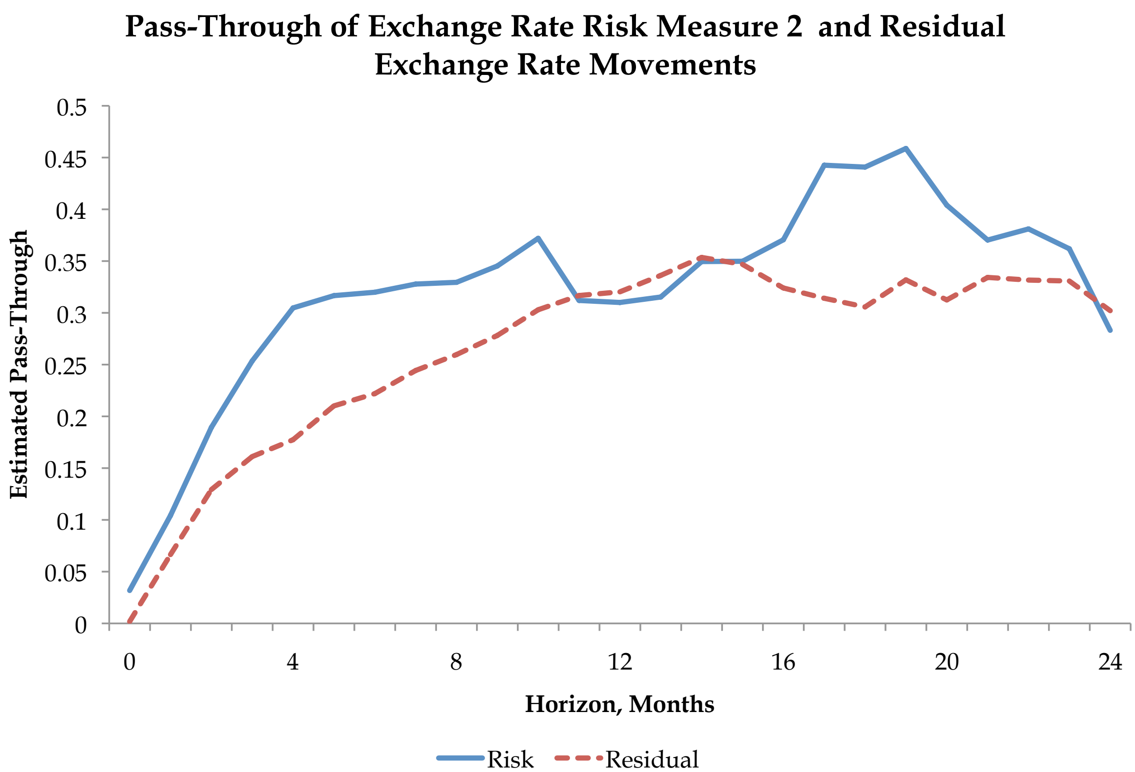


Figure 20: Pass-Through of Exchange Rate Risk Measure 2 into US Import Prices

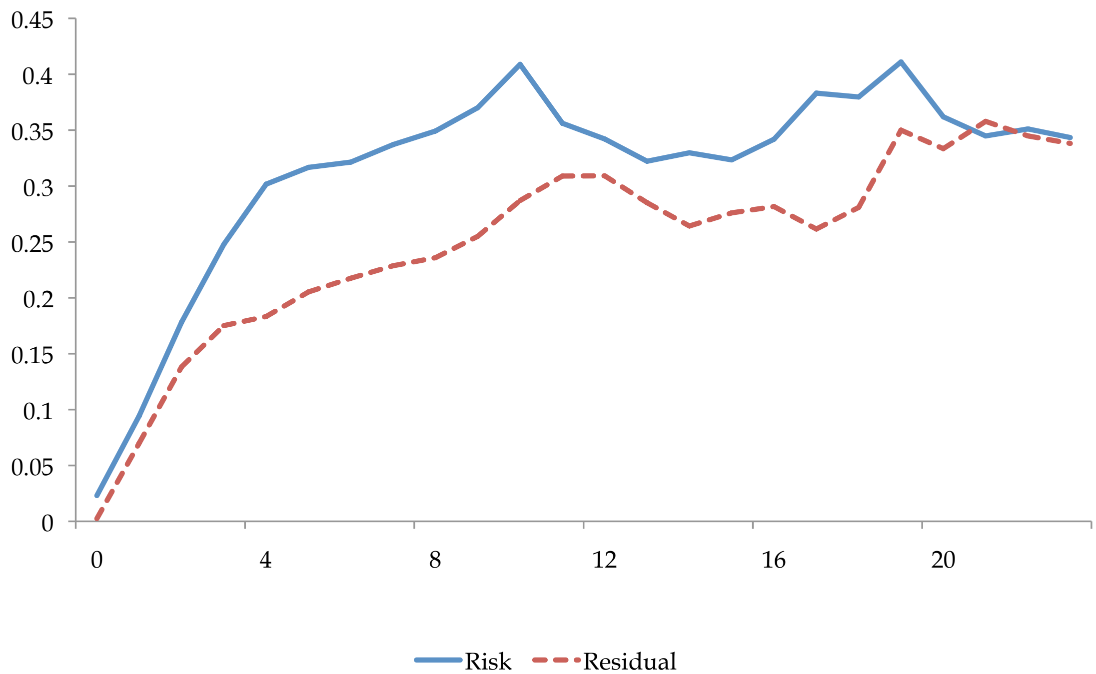


Figure 21: Pass-Through of Exchange Rate Risk Measure 3 into US Import Prices

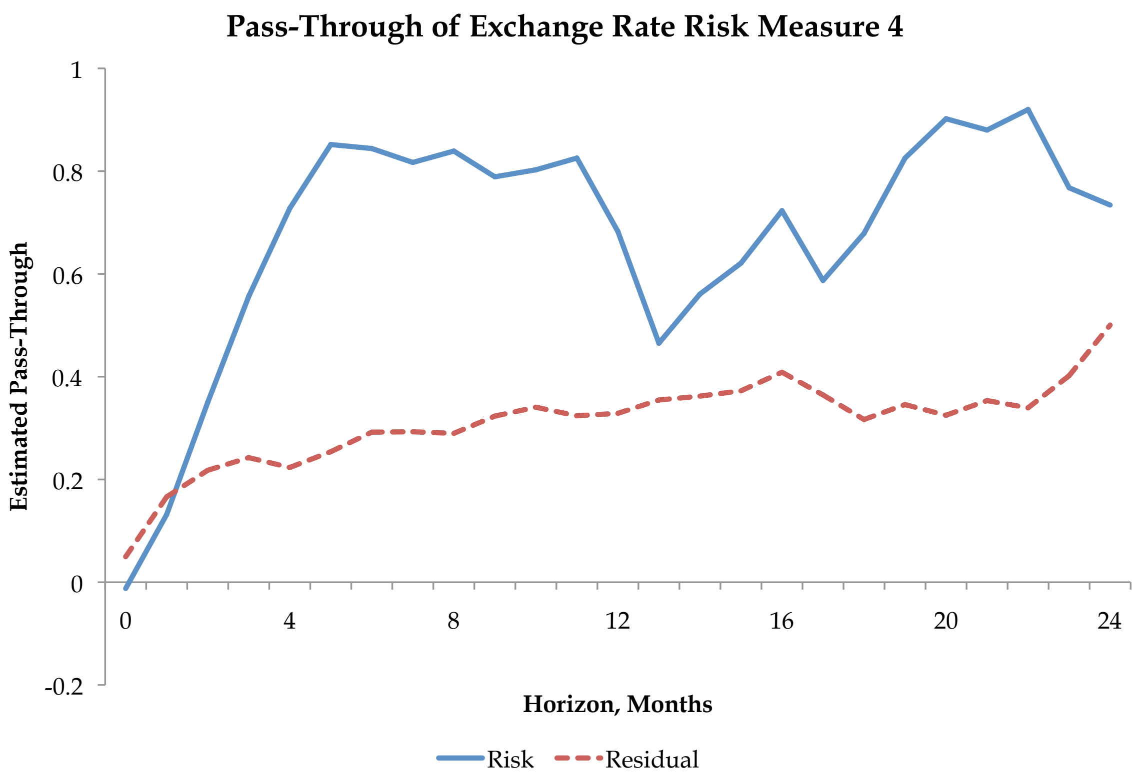


Figure 22: Pass-Through of Exchange Rate Risk Measure 4 into US Import Prices

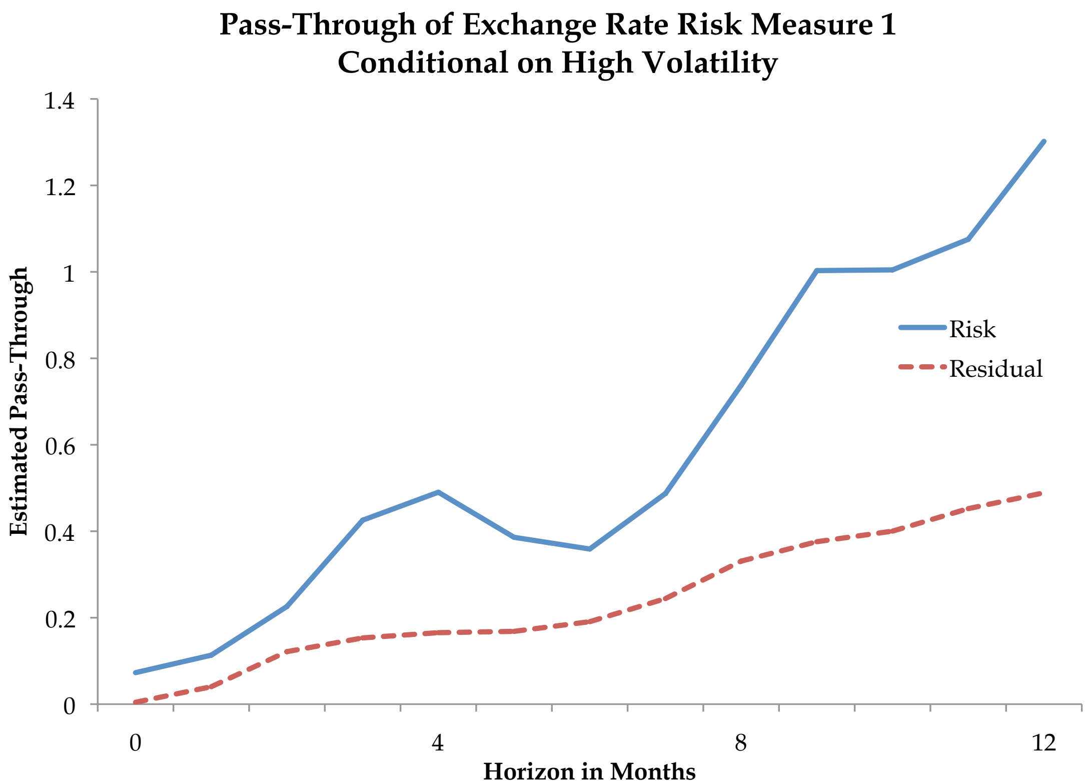


Figure 23: Pass-Through of Exchange Rate Risk Measure 1 into US Import Prices, High Volatility

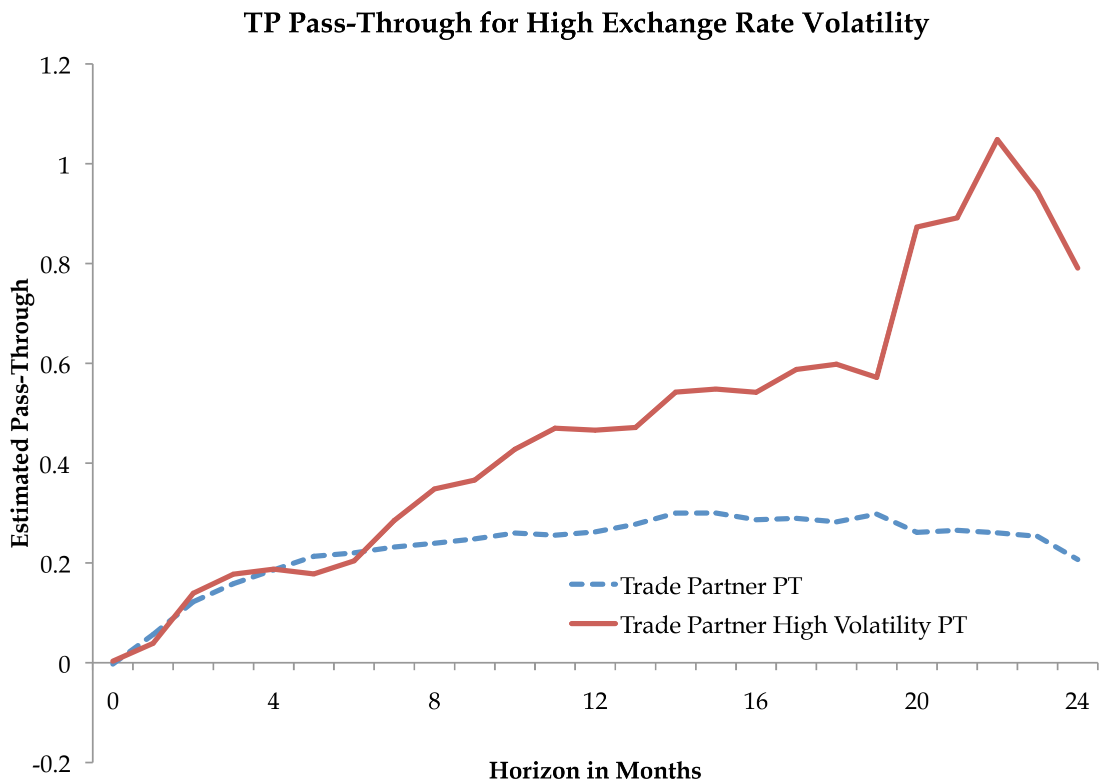


Figure 24: Pass-Through of TP Exchange Rate into US Import Prices, High Volatility

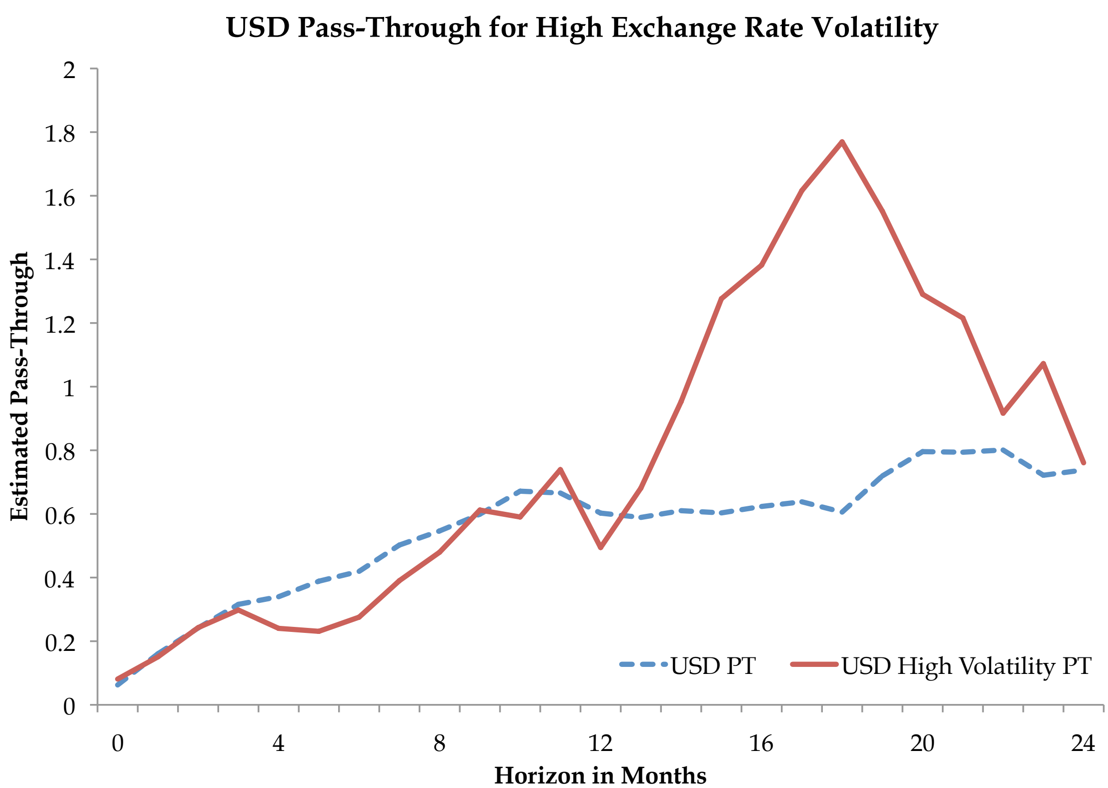


Figure 25: Pass-Through of USD Exchange Rate into US Import Prices, High Volatility

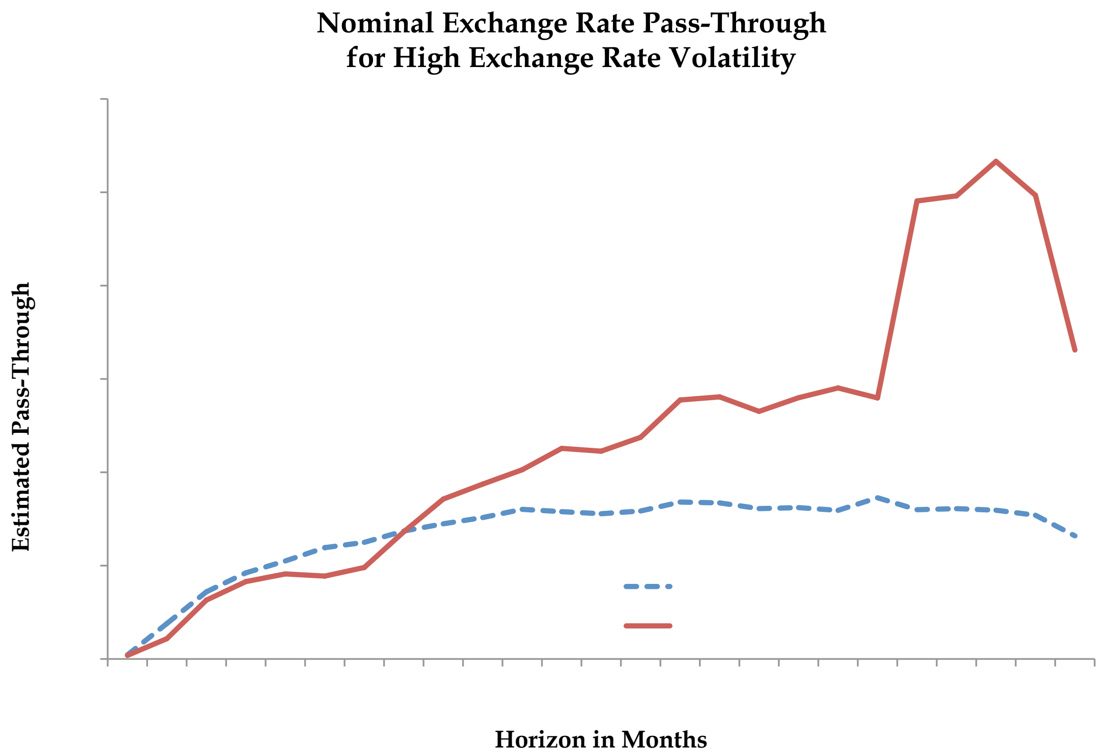


Figure 26: Pass-Through of Nominal Exchange Rate into US Import Prices, High Volatility

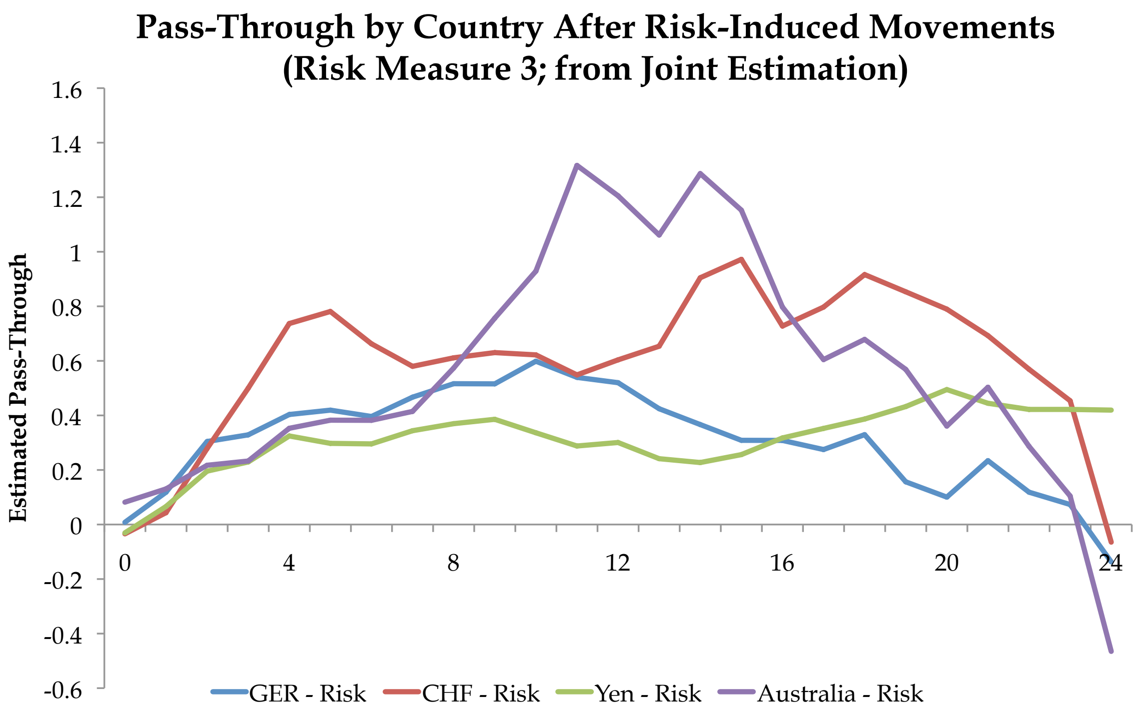


Figure 27: Pass-Through by Country of Risk-Induced Exchange Rate Movements

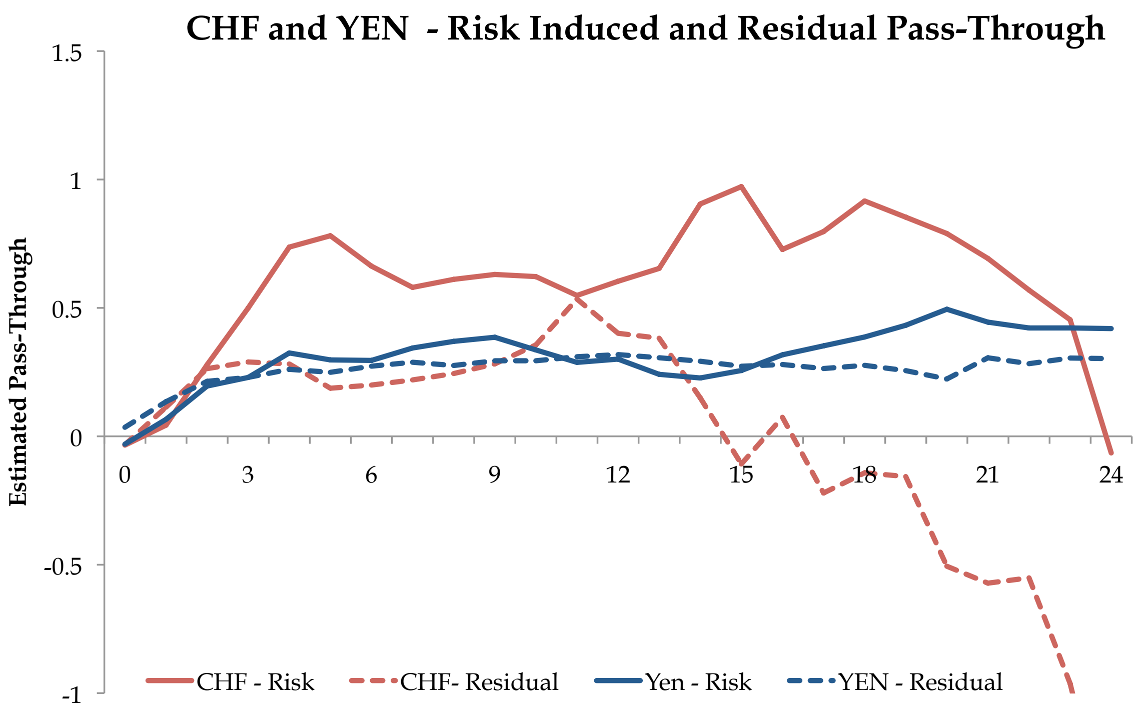


Figure 28: CHF and YEN - Risk Induced vs Residual PT

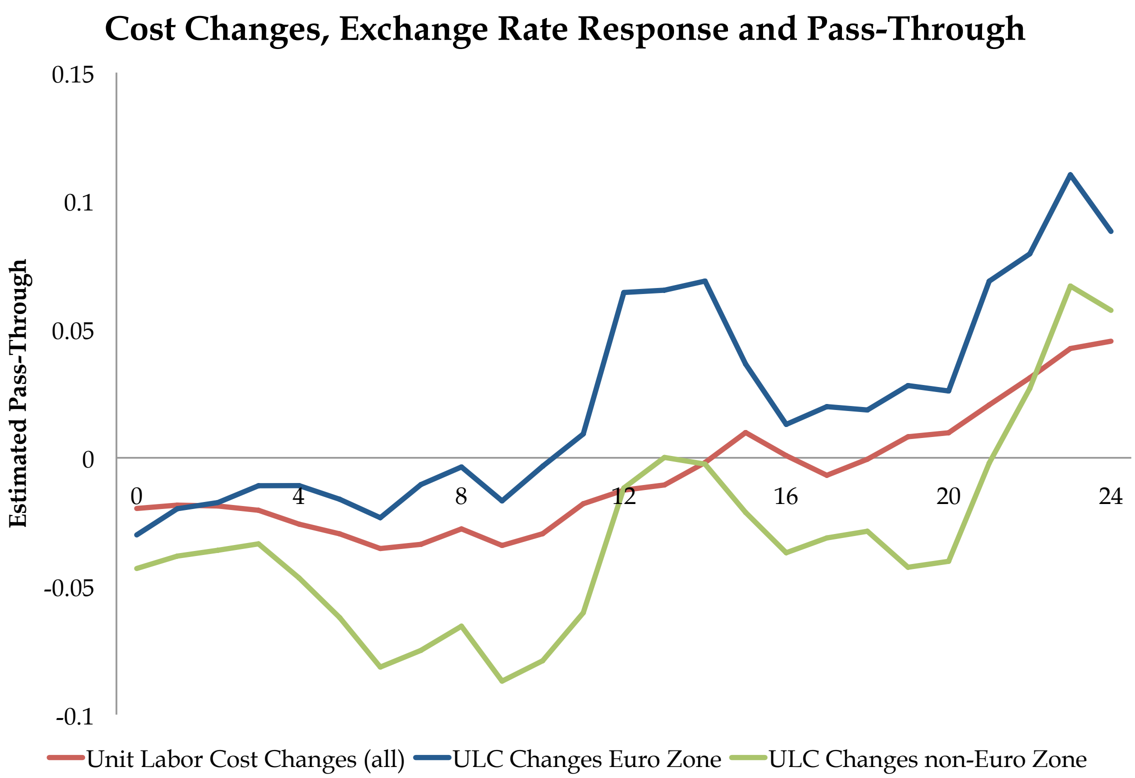


Figure 29: Cost Changes, Exchange Rate Response and Pass-Through