How Does Exchange Rate Uncertainty interact with International Trade? A Meta-Analysis Revisited

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Abstract: Several factors have been highlighted to explain the controversial effect of exchange rate uncertainty on international trade. However, the empirical evidence is rather mixed. The main focus of this paper is to reconcile the apparently conflicting results from 59 studies published between 1984 and 2014. We found that the interaction between the two variables is likely to be ambiguous when measured in real rather than in nominal terms, when using "naïve models" rather than GARCH extensions as volatility measurement and when less developed countries are considered. Intuitively, the lack of clearer evidence may be also attributed to the scarcity of studies addressing the robustness of this relationship along several econometric methods and to the fact that neither the exchange rate policy nor the trade policy can be designed without considering regulatory and instrumental factors, which are unfortunately excluded in the majority of researches. To find better paths, further researches should focus on the new methods based on additional variables such as institutional quality proxies and financial development indicators.

Keywords: Exchange rate uncertainty; international trade; meta-analysis.

1. Introduction

Economists and policy makers increasingly pay attention to exchange rate uncertainty as an important determinant of international trade. This instability may be defined as a statistical measure of the ups and down exchange rate movements sharply observed in a short-run period. It seems therefore highly important for an accurate and appropriate understanding of the behavior of exchange markets. This excessive volatility of exchange rate creates uncertainty in the development of macroeconomic policies, investment decisions and international trade flows. This is owing to the fact that an increase in exchange rate instability leads to substitution and income consequences. On the one hand, the substitution outcome pushes traders to turn from foreign trade to internal trade. On the other hand, the income consequence may expand trading activities, since higher exchange rate risk gives greater opportunities to take profits and increase trade.

Since the Breakdown of the Bretton Woods system of fixed exchange rates, several countries have adopted the floating exchange rate system in order to improve their exports competitiveness. This transition accompanied with a boom and bust in commodity prices have intensified the excessive volatile behavior of exchange rates which increase the uncertainty about international trade flows and threatens then the economic growth. The fall of bond yields in many developed economies from 15% in 2009 to 3.8% in 2013 favored capital flows to small open economies, putting their currencies into great tensions (BIS report, 2013). It being understood that excessive volatility is deemed disruptive to an open economy (trade and capital flows movements). This instability has stimulated the speculation fueled by the intense capital flows that have grown widely in 2012 reaching 26 trillion dollars or 36 percent of global GDP compared to 5 trillion dollars in 1990 (Manyika et al. 2014). This heavily increase may exacerbate the disconnection between exchange rate and its fundamentals, making very difficult to better cope with speculative effects, especially in countries with weaker financial system.

Developing countries depended on the rest the world and the level of interdependence has increased continuously during the last decade, leading to a great vulnerability to adverse changes, variations and possible negative shocks for which they have no control. The absence of hedging instruments due to their costs may lead to excessive exchange rate instability and therefore to harmful impact on the volume of international trade. The difficulty to tackle the causes of this volatility and to offset their main effects, the strong asymmetry of prices cycle and the high persistence of shocks have improved the plethora of studies analyzing the

interaction dynamic between exchange rate uncertainty and exports performance. Obviously, there is a desire to stabilize the real exchange rate in any case avoid excessive appreciation, synonymous of loss price competitiveness for domestic producers.

Given that the effectiveness of an exchange rate regime is measured through instability, the continuous increase in trade flows has led to a huge amount of studies analyzing the effects of exchange rate uncertainty on exports performance. The empirical literature on the focal issue is rather mixed and inconclusive. Various researches supported a negative and significant effect of exchange rate volatility on exports and linked it to the imperfect exchange and trade markets and the very cost hedging (Cushman (1986), Kenen and Rodrick (1986), Savvides (1992) and Arize et al. (2000)). Others showed that higher exchange rate instability can give opportunities leading to an increase of trade flows, especially when exporters are sufficiently risk-averse (Kiheung and Wooree (1996) and McKenzie and Brooks (1997)). Other strand of literature reached conclusion suggesting an ambiguous relationship between exchange rate uncertainty and exports (Daly (1998), Chan and Wong (1985), McKenzie (1998)).

Given its importance in the formulation of trade policy and the choice of optimal exchange rate policy, an important question relative to the connection between the instability and exchange rate and the performance of exports can be raised: What are the main factors behind the controversial relationship between exchange rate uncertainty and exports? Proper answer to this question may elucidate readers' understanding on the focal issue and help policy makers to improve their decisions-making.

Our contribution to this debate is to resolve these inconsistencies and to point a robust connection between exchange rate uncertainty and exports by carrying out different meta-analysis technique and by adding new findings to the studies of Coric and Pugh (2010) and Haile and Pugh (2011). In particular, we use 59 studies published between 1984 and 2014.

To be effective in our investigation, the remainder of the article is organized as follows: Section 2 presents the previous empirical aspects on the impact of exchange rate uncertainty on international trade. Section 3 describes the data and the methodological framework. Section 4 presents the main empirical results and discusses them. Section 5 concludes the paper.

2. Literature survey

Since the onset of generalized floating, there have been extensive empirical researches into the effect of exchange rate uncertainty on international trade. While the empirical literature gives no such accurate guidance on this relationship, the results have varied widely.

The different outcomes reported in Table-1 can be synthesized into four evidences within literature. Firstly, the largest category shows a negative effect of exchange rate volatility on trade. Krugman (1989) and Daroodian (1999), for example, link this negative connection to the imperfect exchange rate and trade markets and to the hedging costs. Secondly, some works find a positive relationship between the two variables. For instance, Abott et al. (2001) and Aristotelous (2001) suggest that if exporters are sufficiently risk-averse, exchange rate uncertainty acts as an incentive to exporters to strength trade performance. Thirdly, limited stream of literature suggests that exchange rate uncertainty has any effect on trade such as Bailey et al. (1986), Klein (1990) and Doyle (2001). Fourthly, several researches show an ambiguous impact of exchange rate instability on international trade (Chan and Wong (1985), McKenzie (1998) and Sauer and Bohara (2001)) .Accordingly, Clarck et al. (2004) argue that the the weak hedging instruments may contribute to an ambiguous link between an excessive exchange rate volatility and trade performance. More recently, the empirical literature has shown new insights. Coric and Pugh (2010) and Bouoiyour and Selmi (2014 a), for example, argue that the connection between exchange rate uncertainty and international trade is likely to be adverse when measured in real rather than nominal terms. This highlights the role of differential price uncertainty as a contributor for the controversial effect of real exchange rate volatility on exports. Indeed, nominal and real investigations are needed to reach robust outcomes.

The debate within the macroeconomic literature on this issue covers a variety of countries and a wide range of methods, which can reflect the lack of clearer impact of exchange rate uncertainty on international trade and the non-robustness of results (Pugh et al. 2012). When reviewing the existing literature, it is striking to observe the lack of studies that account for asymmetry and nonlinearity when investigating the relationship between exchange rate volatility and exports performance (Table A.1, Appendix). Although this relationship has been widely addressed linearly and symmetrically (Aktar and Hilton (1984) and Nabli et al. (2004)), there are very limited works that assess it in nonlinear framework or in asymmetrical fashion (Baum et al. (2004) and Zhang et al. (2006)). While several models

have been proposed to investigate the link in question, there is no up to now a most convenient method.

Using a multivariate GARCH-in-mean model, Kroner and Lastrapes (1993) put in evidence that the impact of exchange rate uncertainty on trade changes substantially in terms of sign and magnitude depending to country-to-country variation. Other studies carry out asymmetrical GARCH models[1] as measures of volatility (Lee and Saucier (2005) and Bouoiyour and Selmi (2014 b)). Their results reveal that international trade responds positively to exchange rate depreciations and negatively to appreciations. Furthermore, Verheyen (2013) applies a developed nonlinear ARDL bounds testing approach. He concludes that trade responds more strongly to depreciations than appreciations.

3. Methodological framework

Since the findings in several issues were inconclusive, meta-analysis is a helpful tool aimed at reconciling the inconsistencies (Stanley, 2005). Meta-analysis is a statistical technique for combining different results from independent researches. Its validity depends substantially on the quality of systematic review on which it is based. Our focus on this study is to conduct an effective meta-analysis aimed at completing coverage of all relevant and looking for the presence of heterogeneity in order to highlight appropriately the main factors behind this field controversy.

3.1. Meta-analysis technique

The present study follows the same procedure carried out by Hunter et al. (1982). This method enables to improve readers' information about the effect of exchange rate uncertainty on international trade. The procedure is based on five main steps. The first step consists on computing the mean correlation $(\bar{r})$:

$$\bar{r} = \frac{\sum (N_i r_i)}{\sum N_i} \quad (1)$$

Where N_i: is the sample size for study i and r_i is the Pearson correlation coefficient for study i .

Secondly, we determine the unbiased estimate of the population variance S_p^2:

[1] These models describe the behavior of conditional variance depending to the sign of innovations (negative and positive shocks).

$$S_p^2 = \left| S_r^2 - S_e^2 \right| \tag{2}$$

Where S_r^2 is the observed variance equal to $\sum \left[N_i (r_i - \bar{r})^2 \right] / \sum N_i$

S_e^2 is the estimate of sampling error variance equal to $\left[(1 - \bar{r}^2)^2 k \right] / \sum N_i$

Thirdly, we determine the 95 percent confidence interval. As our sample size is larger than 30, the z-statistics are determined as follows:

$$\left[\bar{r} - 0.975 S_P , \bar{r} + 0.975 S_p \right] = \left[\bar{r} - 1.96 S_p , \bar{r} + 1.96 . S_p \right] \tag{3}$$

Fourthly, we test the statistical validity of the considered model using this statistic:

$$\chi_{k-1}^2 = \frac{N S_r^2}{(1 - \bar{r}^2)^2} = k \frac{S_r^2}{S_e^2} \tag{4}$$

If we obtain a high value of χ_{k-1}^2 , there is a need to perform tests using subgroups meta-analysis within four synthesized evidences across the previous studies on the effect of exchange rate uncertainty on international trade (negative effect, positive effect, insignificant effect, ambiguous effect). To this end, we extract our meta data into 08 subgroups depending to the above evidences: studies focused on developing countries (*DC*), on developed countries (*D'C*), on the total and sectoral exports (*T/S*) or on bilateral exports (*B*); studies assessing the focal relationship in nominal terms (*NT)* or in real terms (*RT*); works examining the relationship in question using "naïve models" as measures of exchange rate uncertainty[2] (*NM*) or GARCH extensions as exchange rate volatility measurement (*GARCH*). Table A.1. (Appendix) displays in detail this decomposition.

Finally, with respect to the empirical studies that do not report Pearson's coefficient but includes t-statistics, we mention the conversion into *r* statistics:

$$r_{y,x} = \sqrt{\frac{t^2}{(t^2 + df)}} = \frac{|t|}{\sqrt{(t^2 + df)}} \tag{5}$$

If there is no clear information about the signs of t-statistic and Pearson's coefficient, we can use an approach based on dummy variable following the Bernoulli rule:

$$P(D = d) = p^d (1 - p)^{1-d} ; d \in \{0,1\}; 0 \prec p \prec 1$$

and $P(D = d) = 0$ otherwise, considering the following hypothesis:

$$H_0: p = 0.9 \quad against \quad H_1: p < 0.9 \tag{6}$$

[2] The "naïve models" used to determine volatility include the standard deviation, moving average deviation and absolute average deviation.

Where d is equal to 1 if t-statistic, Pearson's coefficient and $r_{y,x}$ are correlated with the same sign and 0 if not; the p is the proportion of cases in which either the t-statistic or Pearson's coefficient is associated with the same sign as $r_{y,x}$.

3.2.Data

The database for the analysis has been constructed based on several published empirical papers on the effects of exchange rate uncertainty on international trade. They have been collected based on the study of Coric and Pugh (2010), by searching the EconLit database and through the literature review of the different studies on the field. We use 59 empirical studies from 1984 to 2014 (Table-1) to suggest new lines of enquiry on the relationship (29 studies supporting negative effect, 06 studies showing positive effect, 06 studies revealing insignificant effect and 18 works supporting an ambiguous effect). As is the norm in meta-analysis, we excluded the non-empirical researches on this issue such as Stanley (2001) and Doucouliagos and Laroche (2009).

3.3.Testing publication bias and genuine empirical effect

Publication bias occurs when the considered meta data have similar results or when researchers have an incentive to conform. For example, when each study suggests a positive or ambiguous relationship between two variables and the majority of works on the same field show a negative and significant link, the study is unlikely to be accepted for publication (Pugh et al. 2012, pp. 283). As a result, researchers may not submit unconventional or weakly findings and the empirical literature on the concerned issue may be affected by publication bias. Funnel plot is usually used to detect bias selection (Jarell and Stanley (1990) and Doucouliagos (2005)). In the absence of publication bias, the considered works will be distributed symmetrically about the combined effect size. By contrast, in the presence of bias, we would show a higher concentration of studies on one side of the mean than on the other.

The genuine empirical effect may be used also as a precision-effect test. If there is a genuine effect, the plots follow a non-central distribution that is an increasing function of the degrees of freedom or precision. For our case of study, it is well seen from Figure-1 that the asymmetrical plot is unobserved neither for the negative effect, nor positive effect, nor insignificant effect, nor ambiguous effect. This means that the published papers on the issue differ within the concerned evidences. Also, there is a positive genuine effect for all the synthesized evidences (except for the case of insignificant effect, we observe a central distribution implying the absence of genuine effect).

4. Main findings and discussion

The main meta-analysis findings are reported in Table-2. The evidence from the meta-analysis on 29 studies supporting a negative effect of exchange rate uncertainty on international trade is heavily associated to developing countries with $\bar{r} = 0.4129$ and confidence interval $[0.2258;0.5999]$, "naïve models" as measures of exchange rate volatility ($\bar{r} = 0.3896$; $[0.1821;0.5970]$), total and sectoral exports mean correlation ($\bar{r} = 0.4641$) and to real rather than nominal term investigation ($\bar{r} = 0.0162$; $[-0.0705;01034]$).

However, the meta outcomes on 06 articles revealing a positive effect is highly linked to "naïve models" as volatility measurement with mean correlation $\bar{r} = 0.1962$ and confidence interval $[0.1084;0.2839]$and to real term assessment with $\bar{r} = 0.1432$. This evidence is not supported neither for developing countries nor for developed economies with weaker mean correlations that amount respectively to 0.0741 and 0.0293.

The meta-analysis based on 06 works supporting an insignficant effect indicate that these researches are intensely influenced by the nature of countries and the volatility modeling. The results from these studies are closely associated to developing countries with important mean correlation ($\bar{r} = 0.2460$), to "naïve models" as measures of exchange rate volatility ($\bar{r} = 0.1752$) and to total and sectoral exports ($\bar{r} = 0.2811$).

As the evidence supporting the negative exchange rate uncertainty's effect on trade, the 18 studies used in our meta data set showing an ambiguous effect between the two variables are greatly related to the use of "naïve models" with $\bar{r} = 0.3681$ and confidence interval $[0.2854;0.4507]$, to developing countries as cases of studies ($\bar{r} = 0.3015$) and to real term analysis as context of investigation ($\bar{r} = 0.4186$). It seems hardly associated to nominal terms assessment with lower mean correlation $\bar{r} = 0.0350$ and confidence interval $[-0.3882;0.4582]$.

The above outcomes confirm the conclusions of Coric and Pugh (2010) and Haile and Pugh (2011) that the effect of exchange rate uncertainty on international trade varies substantially depending to the country samples (developing or developed countries), the wide range of volatility measurements ("naïve models" or GARCH model), the nature of exports' analysis (total, sectoral or bilateral exports) and to the context of investigations (nominal or real term assessment). It is difficult so far to find clear and robust evidence about the impact of exchange rate uncertainty on international trade, since we cannot identify a precise mean correlation to the relative strength of negative, positive, insignificant or ambiguous effects. It

varies intensely depending to country-to-country variation, econometric methodologies and to the context of investigation. It is likely to be ambiguous when less developed countries are considered, when using "naïve models" rather than GARCH extensions as volatility measurement and when measured in real rather than in nominal terms.

Unsurprisingly, the economic structure and regulatory environment of the studied economies may explain the controversial link between exchange rate volatility and trade widely observed in previous studies. For example, the imperfect capital mobility can decrease the possibility of hedging in some countries but not in others (Gervais et al. 2004), which can reflect the mixed findings. Also, the role that plays monetary policy in each country than other and its ability or not to absorb external shocks may lead to a complex connection between the key variables (Bahmani-Oskooee and Payesteh, 1993).

Furthermore, it is well expected to show a strong association between modeling choice to determine volatility and the inconclusive results. While a variety of exchange rate uncertainty measures has been used in the empirical literature, there is still no consensus on which measure is the most appropriate to explain an accurate nexus between exchange rate volatility and international trade. The standard deviation and the moving average deviation previously applied in several studies (Bailey et al. (1986), Chowdhury (1993) and Dell'Ariccia (1999)) may ignore the information on stochastic processes through which exchange rates are generated. Indeed, the use of more "complex methods" such as GARCH extensions may exert a potential impact on effects' differentiation. GARCH models may be more effective and most convenient because financial markets data often exhibit volatility clustering, where time series show periods of high and low volatility than periods of constant volatility (Bollerslev et al., 1993).

Intuitively, the evidence is suggestive of an intense effect that may play the context of investigation to explain the heterogeneity of results. Clearly, nominal and real effective exchange rate should have different impacts on trade. Alternatively, for floating exchange regime, the nominal exchange rate plays a major role in explaining changes in real effective exchange rate. However, for fixed exchange regime where each currency maintains a stable value against an anchor currency or composite of currencies and where the nominal exchange rate moves into a target, the inclusion of the differential price volatility seems quite legitimate (Egert and Zumaquero (2007) and Bouoiyour and Selmi (2014 b)). Therefore, the findings may be influenced by the inclusion or the exclusion of differential price volatility, depending obviously to the adopted exchange policy.

Another possible explanation of the inconclusive findings is that neither the exchange rate policy nor the trade policy can be designed in each country without considering regulatory or instrumental factors, unfortunately excluded in the majority of studies on the issue. For example, few researches highlight theoretically the association between exchange rate volatility-trade nexus and the weakness in forward markets together with the imperfect capital mobility and the risk preferences of producers (Haile and Pugh, 2011) and the role that plays monetary policy in absorbing external shocks (Bahmani-Oskooee and Payesteh, 1993).

5. Conclusion

The debates relative to the relationship between exchange rate volatility, commodity price uncertainty and international trade is not recent. The controversial relationship between the two variables widely expected either theoretically or empirically (Brooks and McKenzie (1997), Daly (1998), McKenzie (1999), Pattighis et al. (2004), Ozturk (2006), Egert and Zumaquero (2007), Bouoiyour and Selmi (2014 a), Bouoiyour and Selmi (2014 b), etc…) was brought policy makers to worry about the possible effects excessive exchange rate volatility on exports, especially with the recent boom-bust commodity price cycle and the sharply increase in global flows.

The meta-analysis can play a substantial role to improve readers'informations and to help policy makers in their decision-making. The present study integrates different outcomes from several studies on this field with respect to their association with the nature of countries, the econometric methodologies and the context of investigation. To this end, we carried out a meta-analysis technique developed by Hunter et al. (1982) to a sample of 59 studies published between 1984 and 2014.

We found a complex relationship. The effect of exchange rate volatility on trade is likely to be ambiguous when measured in real terms using "naïve methods" as volatility measures and when developing rather than developed countries are considered. Our evidence is in line with Coric and Pugh (2010) and Haile and Pugh (2011). We attribute therefore the dissimilar findings to country samples, the volatility measurement, the context of investigation, the scarcity of researches accounting for the robustness of the connection between exchange rate volatility and exports along several econometric methods (i.e. the use of conventional and new methods to see whether the results are complementary such the study of Bouoiyour and Selmi (2014 c)) and to the fact that neither the exchange policy nor the trade policy can be designed in each country without considering regulatory nor instrumental

factors excluded in the majority of studies on the issue. Further researches should focus more on the new approaches including additional variables such as institutional quality proxies and financial development indicators. It is also recommended to conduct the same analysis when more studies are available to confirm our findings and to find better ways.

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All papers in the meta-analysis database are denoted by an asterisk

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Table 1. Empirical studies on the effects of exchange rate on international trade

Studies	Negative effect	Positive effect	Insignificant effect	Ambiguous effect
Akhtar and Hilton (1984)	1	0	0	0
Gotur (1985)	0	0	0	1
Chan and Wong (1985)	0	0	0	1
Kenen and Rodrick (1986)	1	0	0	0
Bailey et al. (1986)	0	0	1	0
Cushman (1986)	1	0	0	0
Bailey et al. (1987)	0	0	0	1
Cushman (1988)	1	0	0	0
De Grauwe (1988)	1	0	0	0
Pradhan (1988)	0	0	0	1
Anderson and Garcia (1989)	1	0	0	0
Perée and Steinherr (1989)	1	0	0	0
Klein (1990)	0	0	1	0
Bini-Smaghi (1991)	1	0	0	0
Smit (1991)	0	0	1	0
Assery and Peel (1991)	0	1	0	0
Kumar and Dhawan (1991)	1	0	0	0
Pozo (1992)	1	0	0	0
Savvides (1992)	1	0	0	0
Grobar (1993)	1	0	0	0
Bahmani and Payesteh (1993)	1	0	0	0
Chowdhury (1993)	1	0	0	0
Kroner and Lastrapes (1993)	0	0	0	1
Qian and Varangis (1994)	0	0	0	1
Caporale and Doroodian (1994)	1	0	0	0
Arize (1995)	1	0	0	0
Holly (1995)	0	0	1	0
Stokman (1995)	1	0	0	0
Arize (1996a)	1	0	0	0
Arize (1996b)	1	0	0	0
Daly (1996)	0	0	0	1
Kiheung and Wooree (1996)	0	1	0	0
McKenzie and	0	1	0	0

Brooks (1997)				
Arize (1997 a)	1	0	0	0
Arize (1997 b)	1	0	0	0
Arize (1998)	1	0	0	0
Arize and Shwiff (1998)	1	0	0	0
McKenzie (1998)	0	0	0	1
Dell'Ariccia (1999)	1	0	0	0
Lee (1999)	0	0	0	1
Arize et al. (2000)	1	0	0	0
Rose (2000)	1	0	0	0
Chou (2000)	1	0	0	0
Abott et al. (2001)	0	1	0	0
Aristotelous (2001)	0	1	0	0
Doyle (2001)	0	0	1	0
Sauer and Bohara (2001)	0	0	0	1
Sekkat (2001)	0	0	1	0
Achy and Sekkat (2003)	0	0	0	1
Giorgioni and Thomson (2002)	1	0	0	0
Vergil (2002)	1	0	0	0
Véganzonès-Varoudakis and Nabli (2002)	1	0	0	0
Fountas and Aristotelous (2003)	0	1	0	0
Clarck et al. (2004)	0	0	0	1
Arize et al. (2004)	1	0	0	0
Sadikov et al. (2004)	1	0	0	0
Honroyiannis et al. (2005)	1	0	0	0
Lee and Saucier (2005)	0	0	0	1
Rey (2006)	0	0	0	1
Egert and Zumaquero (2007)	0	0	0	1
Hosseini and Moghadssi (2010)	0	0	0	1
Sekkat (2012)	1	0	0	0
Bouoiyour and Selmi (2014 a)	0	0	0	1
Bouoiyour and Selmi (2014 b)	0	0	0	1

Source: Coric and Pugh (2010) and authors'compilation.

Figure 1. Testing publication bias and geniune effect

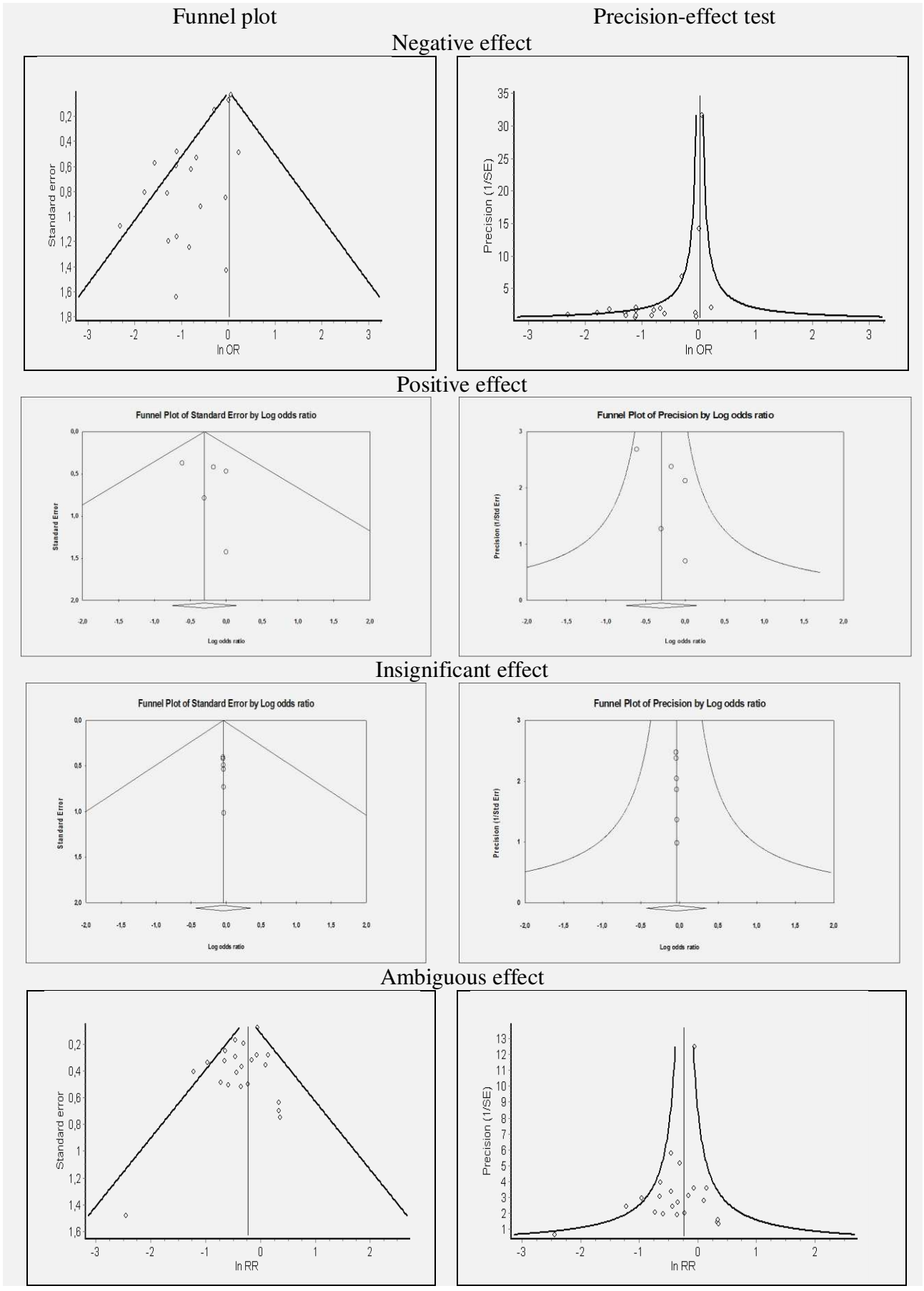

Table 2. Meta-analysis estimates

	k	$\bar{r}$	S_r^2	S_e^2	S_p^2	$95\%LCI$	$95\%HCI$	χ^2_{k-1}
Negative effect								
NM	22	0.3896	0.0003	0.0456	0.0453	0.1821	0.5970	0.0065*
GARCH	07	0.0274	0.1027	0.1134	0.0107	-0.0738	0.1282	0.9056
DC	23	0.4129	0.0002	0.0368	0.0366	0.2258	0.5999	0.0054
DC'	06	0.0232	0.1149	0.1305	0.0156	-0.0984	0.1448	0.8804
T / S	28	0.4641	0.0002	0.1087	0.1085	0.1430	0.7851	0.0018
B	01	0.0117	0.1380	0.1461	0.0081	-0.0760	0.0994	0.9445
NT	02	0.0162	0.1205	0.1285	0.0080	-0.0705	0.1034	0.9377
RT	27	0.5017	0.0001	0.0096	0.0095	0.2012	0.8022	0.0104*
Positive effect								
NM	06	0.1962	0.0018	0.0099	0.0081	0.1084	0.2839	0.1818*
GARCH	00	-	-	-	-	-	-	-
DC	04	0.0741	0.0616	0.0834	0.0218	-0.0691	0.2174	0.7386
DC'	02	0.0293	0.1041	0.1246	0.0201	-0.1081	0.1667	0.8354
T / S	04	0.0687	0.0931	0.1024	0.0093	-0.0249	0.1623	0.9091
B	02	0.0186	0.1237	0.1405	0.0168	-0.1070	0.1444	0.8804
NT	02	0.0215	0.1182	0.1259	0.0077	-0.0633	0.1063	0.9388
RT	05	0.1432	0.0055	0.0113	0.0058	0.0691	0.2173	0.4867
Insignificant effect								
NM	05	0.1752	0.0021	0.0096	0.0075	0.0913	0.2590	0.2187*
GARCH	01	0.0088	0.3419	0.6205	0.2831	-0.5099	0.5275	0.5510
DC	06	0.2460	0.0009	0.0027	0.0018	0.2050	0.2869	0.3333
DC'	00	-	-	-	-	-	-	-
T / S	06	0.2811	0.0005	0.0018	0.0013	0.2460	0.3162	0.2777
B	00	-	-	-	-	-	-	-
NT	01	0.0101	0.2464	0.2903	0.0439	-0.1941	0.2143	0.8487
RT	05	0.0957	0.0118	0.0327	0.0209	-0.3498	0.5412	0.3608
Ambiguous effect								
NM	15	0.3681	0.0089	0.0161	0.0072	0.2854	0.4507	0.5527*
GARCH	08	0.0754	0.1182	0.1476	0.0294	-0.0917	0.2425	0.8008
DC	13	0.3015	0.0102	0.0342	0.0240	0.1504	0.4525	0.2982*
DC'	06	0.0492	0.1375	0.1619	0.0244	-0.1030	0.2014	0.8492
T / S	18	0.5028	0.0007	0.0036	0.0029	0.4503	0.5552	0.1944*
B	00	-	-	-	-	-	-	-
NT	05	0.0350	0.1526	0.3411	0.1885	-0.3882	0.4582	0.4473
RT	17	0.4186	0.0013	0.0124	0.0111	0.3159	0.5212	0.1048

Notes: * significant at 5%.

Appendix

Table A.1. The differences across studies on the effects of exchange rate uncertainty on international trade

Studies	Models		Countries		Trade's analysis		Investigation	
	NM	*GARCH*	*DC*	*DC'*	*T/S*	*B*	*NT*	*RT*
Akhtar and Hilton (1984)	1	0	1	0	1	0	0	1
Gotur (1985)	1	0	1	0	1	0	1	0
Chan and Wong (1985)	1	0	0	1	1	0	0	1
Kenen and Rodrick (1986)	1	0	1	0	1	0	0	1
Bailey et al. (1986)	1	0	1	0	1	0	0	1
Cushman (1986)	1	0	1	0	1	0	0	1
Bailey et al. (1987)	1	0	1	0	1	0	0	1
Cushman (1988)	1	0	1	0	0	1	0	1
De Grauwe (1988)	1	0	1	0	1	0	0	1
Pradhan (1988)	1	0	0	1	1	0	0	1
Anderson and Garcia (1989)	1	0	1	0	1	0	0	1
Perée and Steinherr (1989)	1	0	1	0	1	0	0	1
Klein (1990)	0	1	1	0	1	0	0	1
Bini-Smaghi (1991)	1	0	1	0	1	0	1	0
Smit (1991)	1	0	0	1	1	0	0	1
Assery and Peel (1991)	1	0	1	0	1	0	1	0
Kumar and Dhawan (1991)	1	0	0	1	0	1	0	1
Pozo (1992)	1	0	1	0	1	0	1	0
Savvides (1992)	0	1	1	0	1	0	0	1
Grobar (1993)	1	0	0	1	1	0	0	1
Bahmani and Payesteh (1993)	1	0	0	1	1	0	0	1
Chowdhury (1993)	1	0	1	0	1	0	0	1
Kroner and Lastrapes (1993)	1	0	1	0	1	0	0	1
Qian and Varangis (1994)	1	0	1	0	1	0	1	0
Caporale and Doroodian (1994)	0	1	1	0	1	0	0	1
Arize (1995)	1	0	1	0	1	0	0	1
Holly (1995)	1	0	1	0	1	0	0	1
Stokman (1995)	1	0	1	0	1	0	0	1
Arize (1996a)	1	0	1	0	1	0	1	0
Arize (1996b)	0	1	0	1	1	0	0	1
Daly (1996)	1	0	1	0	0	1	0	1
Kiheung and Wooree (1996)	1	0	0	1	1	0	0	1
McKenzie and Brooks	1	0	1	0	0	1	1	1

(1997)								
Arize (1997 a)	1	1	1	0	1	0	0	1
Arize (1997 b)	1	0	1	0	1	0	0	1
Arize (1998)	0	1	1	0	1	0	0	1
Arize and Shwiff (1998)	1	0	1	0	1	0	0	1
McKenzie (1998)	1	1	1	0	1	0	1	1
Dell'Ariccia (1999)	1	0	1	0	1	0	0	1
Lee (1999)	1	0	0	1	1	0	0	1
Arize et al. (2000)	0	1	0	1	1	0	0	1
Rose (2000)	1	0	1	0	1	0	0	1
Chou (2000)	1	0	0	1	1	0	0	1
Abott et al. (2001)	1	0	1	0	1	0	0	1
Aristotelous (2001)	1	0	1	0	0	1	0	1
Doyle (2001)	1	0	1	0	0	1	0	1
Sauer and Bohara (2001)	1	1	1	1	1	0	0	1
Sekkat (2001)	1	0	1	0	1	0	0	1
Achy and Sekkat (2001)	0	1	0	1	1	0	0	1
Giorgioni and Thomson (2002)	0	1	1	0	1	0	0	1
Vergil (2002)	0	1	0	1	1	0	0	1
Véganzonès and Nabli (2002)	1	0	0	1	1	0	0	1
Fountas and Aristotelous (2003)	1	0	0	1	1	0	0	1
Clarck et al. (2004)	1	1	1	0	1	0	0	1
Arize et al. (2004)	0	1	0	1	1	0	0	1
Sadikov et al. (2004)	1	0	0	1	1	0	0	1
Honroyiannis et al. (2005)	1	0	0	1	1	0	0	1
Lee and Saucier (2005)	1	0	0	1	1	0	0	1
Rey (2006)	1	1	0	1	1	0	0	1
Egert and Zumaquero (2007)	1	0	0	1	1	0	1	1
Hosseini and Moghadssi (2010)	0	1	0	1	1	0	0	1
Sekkat (2012)	1	0	0	1	1	0	0	1
Bouoiyour and Selmi (2014 a)	1	1	0	1	1	0	1	1
Bouoiyour and Selmi (2014 b)	0	1	0	1	1	0	1	1

Notes: *NM:* Naïve models (i.e. standard deviation, moving average deviation, absolute average deviation); *GARCH:* GARCH models; *DC:* Developing countries; *DC':* Developed countries; *T/S:* Analysis of total and sectoral exports; *B:* Analysis of bilateral exports; *NT:* Investigation in nominal terms; *RT:* Investigation in real terms; Source: Coric and Pugh (2010) and authors' compilation.