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The Euro's Trade Effect: A Meta-Analysis

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Abstract:
The effect of common currency on bilateral trade also called Rose effect has been examined extensively in past decade. There is a huge variance of results in primary research which drives a large debate. Using meta-analysis we exploit 51 studies and 3254 estimates of rose effect and provide empirical review. Our results are in contrast with the most recent studies examining the effect of euro on bilateral trade and we found that publication bias in this area of research is diminishing. This study finds the effect of euro on bilateral trade to be between 2 and 6%. Using meta regression we conclude that data source, data structure and control variables are significantly affecting the estimated effect size, but estimation technique used does not.

Keywords: Rose effect, euro, trade, meta-analysis, publication bias
JEL: C83, O12, O32, D24

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1 Introduction

Currency unions are of a great interest for almost two decades. This topic attracted many researchers mainly due to the article by Rose (2000), who found a very strong positive effect of currency unions (about 200%) on bilateral trade, which resulted in labeling such relation as the ”Rose effect”. Many researches started to question the result, to replicate the original study and also to wonder if the same effect holds for newly created monetary union with the new common currency – euro.

Positive and large effect size is very attractive for policy makers who use it to emphasize the benefits of common currency. Nevertheless estimates vary widely among the studies with ambiguous results. As an example of such variance in primary research is the most recent paper of well-known researcher Glick and Rose (2016) and its working paper version Glick and Rose (2015). This might be a bit surprising, since Rose co-authored several studies focusing on the same topic including meta-analysis Rose and Stanley (2005). That meta-analysis was followed by Havránek (2010), who compared euro zone to other currency areas, but used only one estimate per study and focused on sources of publication bias. This paper takes advantage of two decades of research of the effect of euro currency on bilateral trade and all available estimates. Extensive dataset allows us to go beyond Havránek (2010) by using more advanced methods, avoiding the subjectivity of researchers in picking their preferred estimate and we also get much more robust results. Our new evidence about of the Rose effect and publication bias are based on 3254 observations, the makes this paper is the largest meta-analysis in a field of economics economics so far.

To conduct a proper systematic review of empirical research, this paper exploits meta-analysis. This method helps us find the true effect of euro on bilateral trade, but also examines which aspects of research lead to the variety of results. Meta-analysis introduced to the field of economics by Stanley and Jarrell (1989) is nowadays widely used in many areas, recent applications include for example international economics (Havránek & Havránková, 2015), financial stability (Zigraiova & Havranek, 2015). This is not the first study with meta-analytic methodology and this topic. There are already two meta-analyses focusing on the currency unions. First one by Rose and Stanley (2005) found the effect of currency unions to be between 30 and 90 per cent. Havránek (2010) separated effect for eurozone and other currency unions, making the first meta-analysis with pure focus on eurozone. The result showed, that other currency unions boost the trade by about 60% but that there is no effect for eurozone and that results are biased upwards due to strong publication bias (Havránek, 2010). Next to it, Baldwin and Taglioni (2007) pointed out, that effects of euro are biases upwards due to the estimation techniques used. We follow previous evidence of publication bias and include details about estimation methods in our analysis.

Publication bias has been found in many areas of empirical economics and is proven to be a very serious issue (Stanley, 2005). Publication bias stems from motivation to get published and therefore preferring statistically significant estimates over insignificant ones and estimates being in-line with the theory expectation. For currency unions positive effect of common currency is expected and based on the evidence presented by Havránek (2010) we have to account for the publication bias when estimating the true effect of euro.

We extend the current state of research firstly by extension of the dataset by 18 to 51 papers, secondly by including all reported estimates of effect sizes from examined papers (Havránek (2010) used one preferred estimate from each study), thirdly by including new variables in the explanatory meta regression analysis with focus on methodology, fourthly by using new estimation techniques and fifthly by accounting for the global financial crisis.

This paper is structured as follows. Section 2 presents the theory used for currency unions effect estimation. Section 2 describes process of selection of studies and collection of data along with the properties of data. Section 3 explains meta-analysis methods used for data examination. Section 4 discusses empirical results and section 5 concludes.

2 The Dataset of the Rose Effect

Currency union theory is part of international economics and trade, which is widely examined by gravity models. Gravity model has its roots in physics, where two objects attracted to each other proportionally to their size divided by their distance. In trade, we have countries and their GDP. For more details and specification discussion see e.g. Baldwin (2006). Convention leads to the following form of gravity model used in the international trade:

$$\log T_{ijt} = \alpha_0 + \gamma CU_{ijt} + \chi_1 (\log Y_i \cdot \log Y_j) + \chi_2 \log D_{ij} + \chi_3 RTA_{ij} + \sum_{k=1}^{K} \eta_k X_{ijt} + \epsilon_{ijt} \qquad (1)$$

where T_{ijt} stands for bilateral trade in period t between countries i and j, Y denotes real HDP of, D measures distance between countries (mostly between their geographical center). Dummy variable RTA used for trade agreement such as FTA, EFTA, SM, EU and others, dummy variable CU equals one if both countries are in time t in monetary union and use the same currency. There are also plenty other control variable captured by vector X. Mostly same language, common border, variance of exchange rate etc., and ϵ is a disturbance term. We are interested in coefficient γ – determines effect of monetary union on bilateral trade, *ceteris paribus*. Tested hypothesis $H_0 : \gamma = 0, H_A : \gamma \neq 0$. The actual effect in percentages can be calculated as $\lambda \doteq e^{\gamma} - 1$.

Our analysis is focused on the Eurozone, which was formally established in 1999 in 11 EU member states. Euro as a currency has been in the circulation since 2002 and currently there are 19 EU member states using Euro so far. Primary research is evaluating the ex post effects of joining the EMU on trade flows and since the EMU began from a political impulse, results are used in favor of the single currency. Doucouliagos and Stanley (2013) prove that motivation of finding a positive effect and possibly a larger one can be an important driver of publication bias which in this particular case can largely exaggerate the true effect size.

Data for this study were collected from all studies we found on topic of effect of Euro on trade. We started with studies used by Havránek (2010) and Rose (2008), then searched Google Scholar and RePEC databases for both published and unpublished studies with following key words: *euro, trade, EMU, effec, rose.* When new updated or published versions of working papers were found, we replaced them in our dataset. From found studies only those with empirical framework using gravity equations and focusing on euro zone were taken into account. We ended up with 51 studies – almost double than previous meta-analysis by Havránek (2010) – and 3254 estimates. Some authors Stanley (2001), Krueger (2003) prefer to use only one estimate per study, but recently all estimates are used, which allows also for larger amount of control variables. In comparison with previous works Havránek (2010) and Rose and Stanley (2005) our dataset is more focused on methods and data characteristics and less on researchers characteristics. List of collected variables is based on variables gathered by previous research and best practice in meta-analysis when accounting for publication bias.

Table 1 lists all variables collected from primary studies, provides definition of the variable and basic summary statistics. Collected 26 variables can be separated into groups – data characteristics, estimation method, control variables used, citations and publication outlet. The intention is to examine possible sources of heterogeneity in the estimates euro effect and provide more insight into possible differences between results. We cannot say that these 26 variables will explain all differences between estimates, but we believe that we cover choices faced by researches and methodology issues analyzed by Baldwin and Taglioni (2007). Furthermore we also control for presence of global financial crisis (GFC) which occurred 2008 and 2009.

Table 1: Description of regression variables

Variable	Description	Mean	SD
Euro	The coefficient estimated in a gravity equation on the dummy variable that equals one if country is part of euro zone area	0.1	0.43
SE	Estimated standard error of *Euro*.	0.1	0.14
Data characteristics			
Midyear of data	Midpoint of the sample on which the gravity equation is estimated minus 1970.	27.87	4.62
Sector data	= 1 if data are disaggregated at the sector level.	0.47	0.50
Country data	= 1 if data are disaggregated at the country level (effect size is estimated for particular country)	0.33	0.47
Data source	= 1 if data source if IMF/DOTS, 0 otherwise	0.16	0.36
Coefficient type	= 1 if coefficient was part of appendix or robustness check	0.81	0.39
Dependent variable	= 1 if dependent variable was import only	0.19	0.40
Panel	= 1 if effect size is estimated for particular year	0.12	0.32
No. of years	Number of years in the data.	16.51	8.29
Obs. per year	Number of observations included in the gravity equation.		
GFC data	Dataset covers years from 2009 onwards where trade was affected by the global financial crisis.	0.19	0.40
EU data only	Dataset covers only EU countries.	0.21	0.41
Treatment of multilateral resistance and estimation methods			
Model	= 1 if model used for estimation is not OLS	0.67	0.47
Total trade	= 1 if total trade is used as the dependent variable and imports and exports are summed before taking logs.	0.21	0.41
Country pair fixed eff.	=1 if country pair fixed effects are included.	0.74	0.44
Country fixed eff.	=1 if fixed effects for each country are included.	0.16	0.37
Countries	Number of countries in the data	24.51	24.56
Control variables			
EU dummy	= 1 if dummy variable for EU is used in the gravity equation.	0.53	0.50
Adjancency control	= 1 if gravity equation controls for adjacency.	0.14	0.34
Language control	= 1 if gravity equation controls for shared language.	0.17	0.38
Distance control	= 1 if gravity equation controls for distance between countries.	0.28	0.45
Real exchange rate	= 1 if Real exchange rate is used in the gravity equation.	0.47	0.50
Volatility of ExR	= 1 if volatility of exchange rate is used in the gravity equation.	0.35	0.48
Publication characteristics			
Working paper	= 1 if the study is not published in a peer-reviewed journal.		

Continued on next page

Table 1: Description of regression variables (continued)

Variable	Description	Mean	SD
Impact	Recursive discounted RePEc impact factor of the outler (collected in April 2016).	4.39	9.72
Citations	Log of the mean number of Google Scholar citations received per year since the study appeared in Google Scholar (collected in April 2016).	2.67	1.87
Publication year	Year when the study first appeared in Google Scholar minus 2000.	8.11	3.64

Notes: SD = standard deviation.All variables except for citations and the impact factor are collected from studies estimating the border effect (the search for studies was terminated on March 1, 2016, and the list of studies is available in Appendix). Citations are collected from Google Scholar; the impact factor from RePEc.

3 Methodology

The most common method in meta-analysis for testing for publication bias is using funnel asymmetry test (Stanley & Doucouliagos, 2010). Funnel plot has effect size on horizontal axis and precision of the estimate – mostly inverse of standard error – on the vertical axis. The most precise estimates should be close to the true effect size and less precise estimates would be more spread. This should lead to plot which looks like inverted funnel. Based on large number of observations, we would expect normal distribution around the true effect size. Normal distribution of the estimated elasticities is a standard assumption in meta-analysis for absence of publication bias among estimates (Stanley, 2008). When there is no publication bias, funnel is symmetric since any effect size can be reported. However, that is only visualization of data, any conclusion about presence of publication bias cannot be stated without specialized regression methods. For currency union positive effect is expected and previous meta-analytical study found out, that funnel plot for currency unions is ”missing” negative observations. While using econometric method to analyze funnel plot – so called funnel asymmetry test (FAT), we are also able to estimate precisely true effect beyond the publication bias – precision effect test (PET). Both are empirically tested using model 4.

The funnel plot is graphical representation of effect size and how the size is related to its precision. Methods used for estimation of elasticity yield symmetrical distribution, hence elasticity value and standard errors should be independent from statistical perspective. If researchers prefer statistically significant results, they either seek for large effect size or high precision if effect size is around zero. Either way, this leads to correlation between elasticities and standard errors. To test for funnel asymmetry and publication bias, we follow Havranek, Irsova, and Janda (2012), Stanley, Doucouliagos, and Jarrell (2008) and use following equation:

$$\gamma_{ij} = \gamma_0 + \beta \cdot SE\left(\gamma_{ij}\right) + \epsilon_{ij} \tag{2}$$

where γ_{ij} is the i-th elasticity estimate of euro effect from j-th study, $SE\left(\gamma_{ij}\right)$ is the reported standard error of such estimate, γ_0 is the mean elasticity corrected for publication bias and β is the measure of the publication bias, ϵ_{ij} is a normal disturbance term. Havránek and Havránková (2015) add, that funnel asymmetry test using equation 2 has a low power, if the true effect is close to zero and the only source of publication bias is statistical significance. For the literature relating to euro effect, the publication bias is based rather on sign then significance, since the theory predicts positive effect and it is hard to explain negative effect of joining a monetary union.

In this study we also aim at the sources of heterogeneity between studies. The standard meta regression model uses a set of explanatory variables (X) to capture and describe the diversity of results found in the primary studies. We can add this set to model 2 and get model 3:

$$\gamma_{ij} = \gamma_0 + \beta \cdot SE\left(\gamma_{ij}\right) + \sum_{k=1}^{K} \alpha_k X_{ijk} + \epsilon_{ij} \tag{3}$$

where again γ_{ij} is the i-th elasticity estimate of euro effect from j-th study, X_{ijk} is the independent variable which measures characteristics of the primary study that leads to the diversity of results and coefficient α_k measures the effect of such characteristics on the estimate of interest. Mostly X_{ijk} is a dummy variable like in our data-set (see table 1).

However, models 2 and 3 suffer from heteroskedasticity – the variance of estimated coefficients in the literature is diverse, since primary studies differ in terms of data sources, sample sizes, selection of independent variables and also estimation methods. To cope with heteroskedasticity of errors in meta-regression we use WLS methodology presented by Stanley (2005), recommended by Stanley et al. (2008) and followed by e.g. Havranek et al. (2012). For WLS we use standard error as weight and add study-level effects. We divide regression equations 2 and 3 by the estimated standard errors and get models 4 and 5 accordingly, with the t-statistic as a dependent variable:

$$\frac{\gamma_{ij}}{SE\left(\gamma_{ij}\right)} = t_{ij} = \gamma_0 \cdot \frac{1}{SE\left(\gamma_{ij}\right)} + \beta + e_{ij} \tag{4}$$

$$t_{ij} = \gamma_0 \cdot \frac{1}{SE\left(\gamma_{ij}\right)} + \beta + \sum_{k=1}^{K} \alpha_k \frac{X_{ijk}}{SE(\gamma_{ij})} + e_{ij} \tag{5}$$

After the modification the interpretation of coefficients in equation 4 is still the same – γ_0 is the mean elasticity corrected for publication bias and β is the measure of the publication bias. e_i being disturbance term. Cipollina and Salvatici (2010) emphasizes, that regression 5 may still lead to consistent yet inefficient estimators since estimates from the same study j are not independent. As a remedy, clustering procedure is undertaken to adjust standard errors for intra-study correlation. Each study is taken as a cluster and variance-covariance matrix is affected accordingly. That holds for using OLS method. We also employ mixed-effect model, which adds study-level effect to capture between study heterogeneity.

4 Results

Figure 1 depicts funnel plot for all elasticities in our dataset (about 20 observations are not shown, since ranges on the axes are restricted to capture mainly the distribution). Funnel looks quite symmetric, compared to funnel plot provided by Havránek (2010, Fig. 2) which was highly asymmetric and almost no negative estimates were present. However, Havránek (2010) used only one researcher-preferred estimate per each study, this paper used all available estimates.

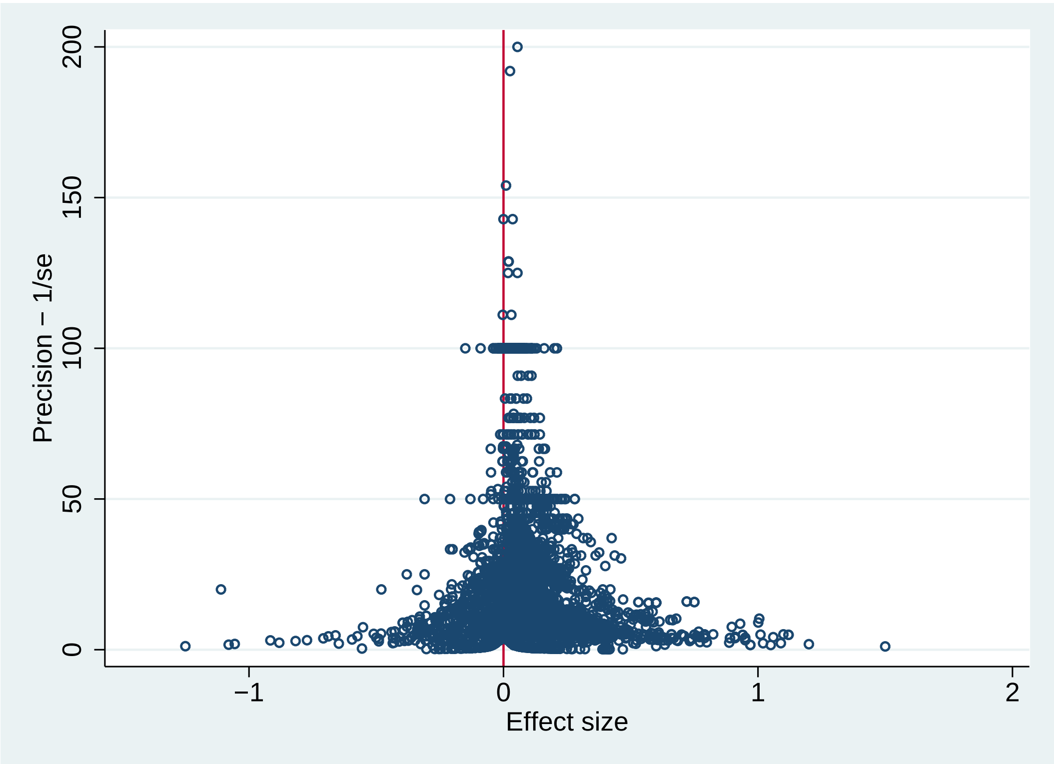

Figure 1: Funnel plot

Depicting the funnel plot may help us to get the idea about present of publication bias, however empirical tests are necessary to reveal the true magnitude. Table 2 provides results of regression based on model 4, when all estimates are used. For estimation we use OLS with clustered errors, fixed effects and instrumental variable with instrument being the inverse of number of observations.

Table 2: FAT – whole dataset

	OLS	PEESE	IV	FE
Precision - 1/se	0.0401**	0.0571**	0.0526**	0.0205**
(True effect)	(6.10)	(40.12)	(4.12)	(2.90)
se		0.130		
		(1.45)		
Constant	0.903**		1.049*	1.347**
(Bias)	(7.79)		(2.44)	(8.44)
Observations	3254	3254	3254	3254
Studies	51	51	51	51

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

t statistics in parentheses, depended variable: tstat

For instrumental variable (IV) inverse number of observations is used as instrument

Results presented in table 2 confirm graphical test and bring two pieces of new evidence. Firstly, that there is a positive significant effect of euro currency on bilateral trade between countries, but such effect is less than 5%, which is ten times smaller than what most recent study by Glick and Rose (2016) provides as preferred estimate. On the other hand, last meta-analysis by Havránek (2010) examining the euro effect found no significant effect at all. Secondly, the magnitude of publication bias is weaker than found previously by Havránek (2010) and Rose and Stanley (2005). The value of bias does not reach value of 2, which is evidence of strong publication bias (Doucouliagos & Stanley, 2013).

New evidence points at change of publication bias in the literature focusing on euro effect on bilateral trade. For deeper analysis, we split the sample into two parts for the next step – studies included in Havránek (2010) and newer (studies are identified in table A1). Redraw-ed funnel plot is depicted on Figure 2 (For more detailed charts see Figures A1 and A2 in the appendix). The funnel plot of already examined studies is skewed – the funnel is not very symmetrical, negative and less precise estimates are "missing". For studies published after Havránek (2010) the funnel is much more symmetric. Publication bias in such part of literature is probably smaller, but to be sure, we made also empirical estimation of regression model 4, for these samples. Results are provided in tables 3 and 4

Results in table 4 confirm our hypothesis, that funnel plot is symmetric and there is not

Table 3: FAT – studies examined by Havránek (2010)

	OLS	IV	FE
Precision - 1/se	0.0301**	0.0452**	0.0232*
(True effect)	(4.42)	(2.81)	(2.33)
Constant	1.805**	1.681**	2.011**
(Bias)	(9.98)	(3.07)	(6.70)
Observations	1592	1592	1592
Studies	24	24	24

t statistics in parentheses

Dependent variable: tstat

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 4: FAT – new studies after Havránek (2010)

	OLS	IV	FE
Precision - 1/se	0.0407**	0.0558**	0.0156†
(Effect size)	(6.39)	(4.66)	(1.83)
Constant	0.319**	0.207	0.707**
(Bias)	(3.32)	(0.77)	(5.39)
Observations	1662	1662	1662
Studies	27	27	27

t statistics in parentheses

Dependent variable: tstat

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

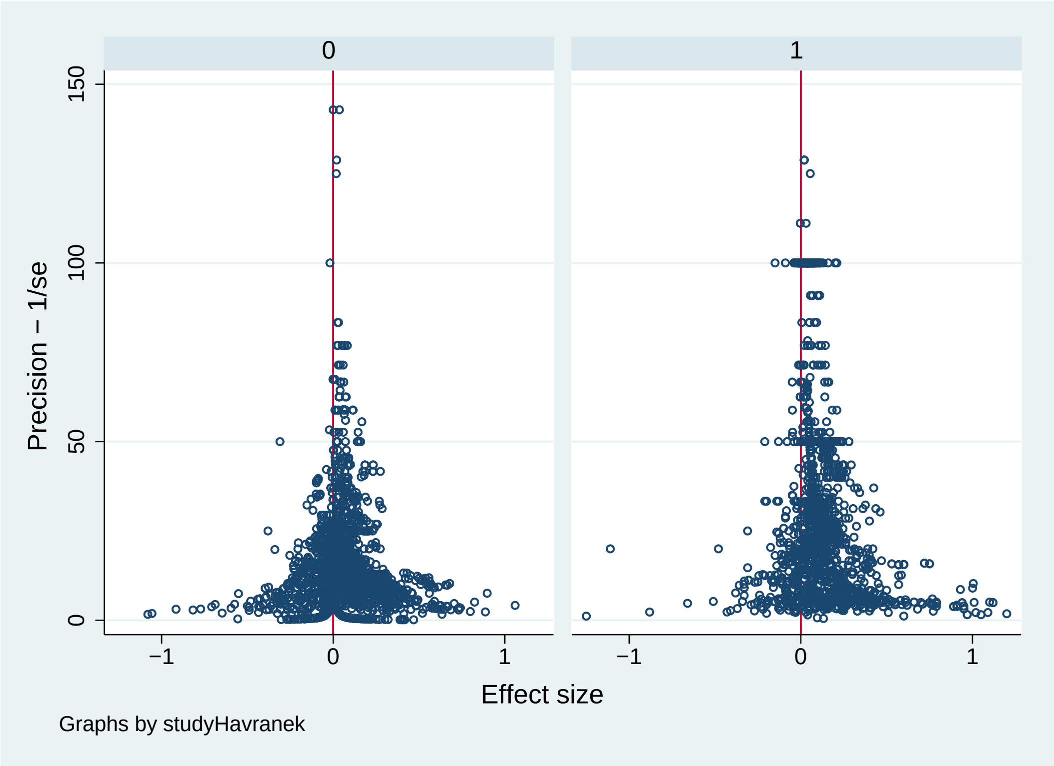

Figure 2: Funnel plot – new studies compared to those examined by Havránek (2010)

strong publication bias. Publication bias is clearly present in studies examined by Havránek (2010), which is confirmed by results in table 3. Regarding the effect size two out of three methods found slightly larger effect in later sample of the studies.

Our preferred methodology pro meta-regression analysis is the mixed effects model, which allows us to make the regression with unbalanced panel (studies have different number of observations). Results are presented in table 5, OLS model with clustered errors is used as robustness check. Second and Fourth column are models with significant variables only created by iteration process when the least significant variable was dropped until all variables are significant. This provides another robustness check for the coefficients in general specification.

None of the previous studies made the meta-regression analysis only for euro studies, which makes it impossible to directly compare our results provided in table 5. To some extent it is possible to compare effect sizes of a few variables with Havránek (2010, Tab. 3). Consistent results are for variables $Countries$, $Impact$ and $Years$ and also the in which study was published.

In the introduction, we highlighted focus of our study on methodology and study design aspects of papers, mainly control for multilateral resistance and using total trade which are both important issues highlighted by Baldwin and Taglioni (2007). It is quite interesting, that

Table 5: "Meta-regression analysis"

	Mixed effects		OLS	
Precision - 1/se	-0.0540	0.0687**	-0.0238	0.0196
	(-1.63)	(4.61)	(-0.44)	(0.82)
Publication year	0.00872**	0.00357**	0.00379†	0.00213†
	(5.13)	(2.72)	(1.78)	(1.65)
Language	0.0649**	0.0296**	0.0347*	0.0356**
	(3.38)	(4.47)	(2.26)	(3.72)
Sector data	-0.0197**		-0.0393**	-0.0404**
	(-2.67)		(-3.94)	(-5.05)
Volatility of ExR	0.0436**		0.0357**	0.0196*
	(4.47)		(2.93)	(2.39)
Real exchange rate	-0.00365		-0.00478	
	(-0.64)		(-0.54)	
Country data	-0.0134†	-0.0156**	-0.0447**	-0.0371**
	(-1.84)	(-2.64)	(-5.00)	(-4.54)
Model	-0.000407		0.0178†	
	(-0.08)		(1.84)	
EU dummy	-0.00666		0.00220	
	(-1.06)		(0.23)	
Midyear of data	0.00210**		0.00402*	0.00274**
	(2.61)		(2.50)	(3.43)
Countries	-0.000295**	-0.000312**	-0.000430**	-0.000571**
	(-2.83)	(-3.36)	(-2.90)	(-3.84)
Distance	-0.0297**	-0.0369**	-0.0411**	-0.0408**
	(-4.29)	(-6.35)	(-3.72)	(-4.79)
Adjacency	-0.0468*		0.00206	
	(-2.46)		(0.13)	
Total trade	0.0126†		0.00307	
	(1.66)		(0.26)	
Panel	-0.0388**	-0.0284**	-0.0330**	
	(-4.19)	(-3.48)	(-2.84)	
Country FE (MR)	0.0155		-0.00991	
	(1.47)		(-0.58)	
Country pair FE (MR)	-0.00872		-0.0125	-0.0176*
	(-1.54)		(-0.98)	(-2.18)
Dependent variable	0.00772*	0.00773*	0.00822	
	(2.17)	(2.16)	(1.45)	
Data from IMF/DOTS	-0.0363**	-0.0378**	-0.0240	
	(-4.45)	(-5.19)	(-1.54)	
Obs. per year	-0.00390**	-0.00554**	-0.00712**	-0.00531**
	(-3.54)	(-7.83)	(-3.70)	(-5.59)
Years	-0.000752†	-0.00152**	0.0000879	
	(-1.85)	(-8.45)	(0.12)	
Coefficient type	0.00130		0.0225**	0.0276**
	(0.30)		(3.37)	(4.16)
Citations	0.0249**	0.0196**	0.00913	
	(5.03)	(5.00)	(1.58)	
Impact factor	-0.00121**	-0.00169**	-0.000575	
	(-2.63)	(-4.99)	(-1.23)	
Working paper	0.00171		-0.0241*	
	(0.21)		(-2.54)	
GFC data	-0.0739**	-0.0501**	-0.0687**	-0.0599**
	(-5.54)	(-4.72)	(-3.51)	(-4.99)
EU data only	-0.0135*		0.00214	
	(-2.40)		(0.20)	
Constant	1.811**	2.165**	0.941**	0.933**
	(5.32)	(6.64)	(10.85)	(9.28)
Observations	3254	3254	3254	3254
Studies	51	51	51	51

t statistics in parentheses
† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$
Dependent variable: tstat

only few researches discuss this issue in their studies, even if they are published after that date. Fortunately enough one of the remedy for gold medal mistake is using country fixed effects and 90% of estimates are estimated using such method. Second mentioned issue is related to the wrong handling of dependent variable in gravity equation, which is logarithm of trade, but very often (in 21 %) sum of import and export is taken before the logarithm. Making such mistake increases the size of the estimate (variable *Totaltrade*). Next to that, using import instead of export data should load to bias as well. Import data are likely to be underestimated because there is an intention to hide some imports and avoid paying import taxes. Export data are therefore more precise. Our results for *Dependentvariable* find higher effect of euro on imports compared to exports. This could mean, that within the eurozone, information about imports are not biased compared to imports reported by other countries.

In the gravity equation mostly used control variables are dummies for distance, language and adjacency. Studies not controlling for distance report higher estimates and studies, on the other hand controlling for the same language results in higher estimate. We cannot say how controlling for common border influences the effect size, since our analysis provides contradicting results.

For our preferred estimation method for – mixed effects – also study characteristics related to publication outlet showed to be relevant. This is quite interesting, since the studies with larger estimates are more referenced, but studies published in journals of higher impact factors report smaller effect size. Possible explanation can include the insignificance of *Workingpaper* variable. Our FAT-PET results prove, that the euro effect is rather small. Larger estimates can be caused by wrong data handling or miscalculation which is removed during the review process. This leads to the fact that studies with higher impact factors provide more relevant results. But from those, the larger ones are referenced more often.

Using less aggregated data and estimating euro effect for each country separately results in smaller effect of common currency. Data source is also important. Researcher using data from IMF/DOTS report smaller estimate of effect size. Next to it, estimates based on dataset of longer time span (variable *Years*) with more countries included (variable *Countries*) and more observations (variable *Obs.peryear*) are smaller than other estimates. This would support the fading out of the euro effect over time or that using more extensive datasets gives us more precise estimates with less bias. Datasets including GFC report smaller effect sizes even if primary research use control variables for the GFC.

5 Conclusion

Rosean literature focusing on effect of euro on bilateral trade has evolved in the last years and this meta-analysis provides new insights. Firstly, we could see that publication bias has diminished in newer studies, which is a positive result and contradicting to previous study by Havránek (2010). In addition to that, we found that euro has a positive effect on trade and such result is supported by almost 3500 estimates from more than 50 studies. Number of estimates make this the largest meta-analysis so far. In this study, focus is shifted from authorship to data and methodology. We expected some differences between studies that do not account for multilateral resistance and others, based on arguments provided by Baldwin and Taglioni (2007) who labels these issues as medals. Our results are on the other hand showing stronger influence of used data and data source as well as control variables. We estimate the true Rose effect to be between 2 and 6%, which much less than the most recent study by Glick and Rose (2016).

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Appendix A: Appendix

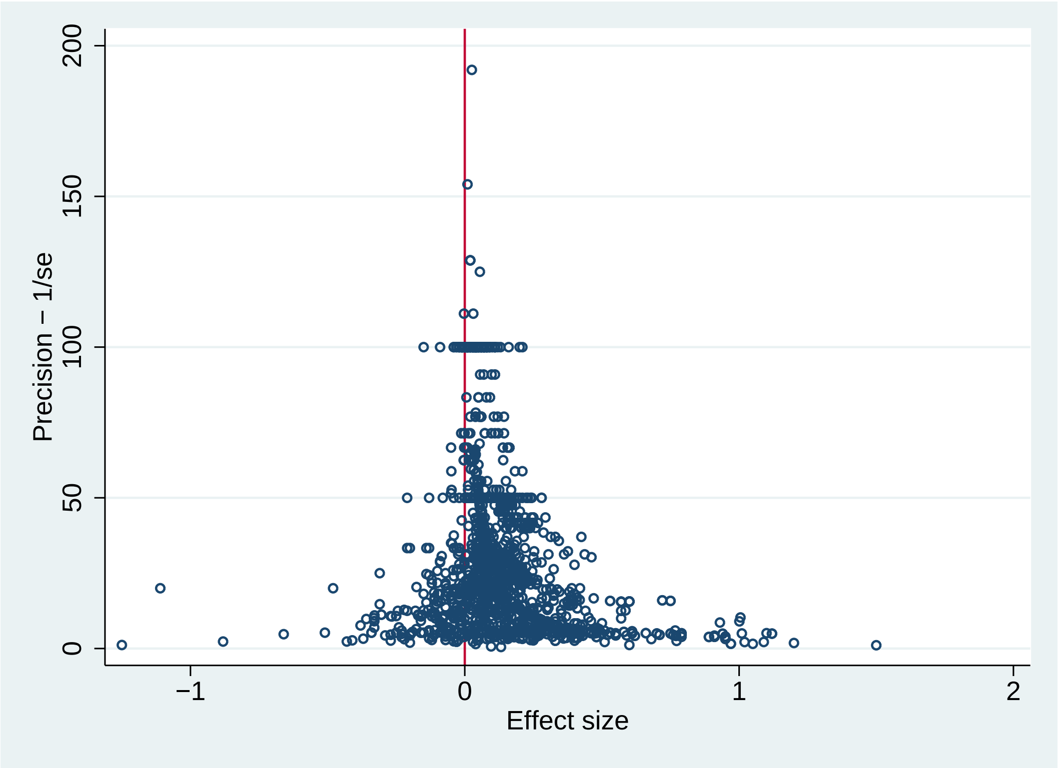

Figure A1: Funnel plot – only studies examined by Havránek (2010)

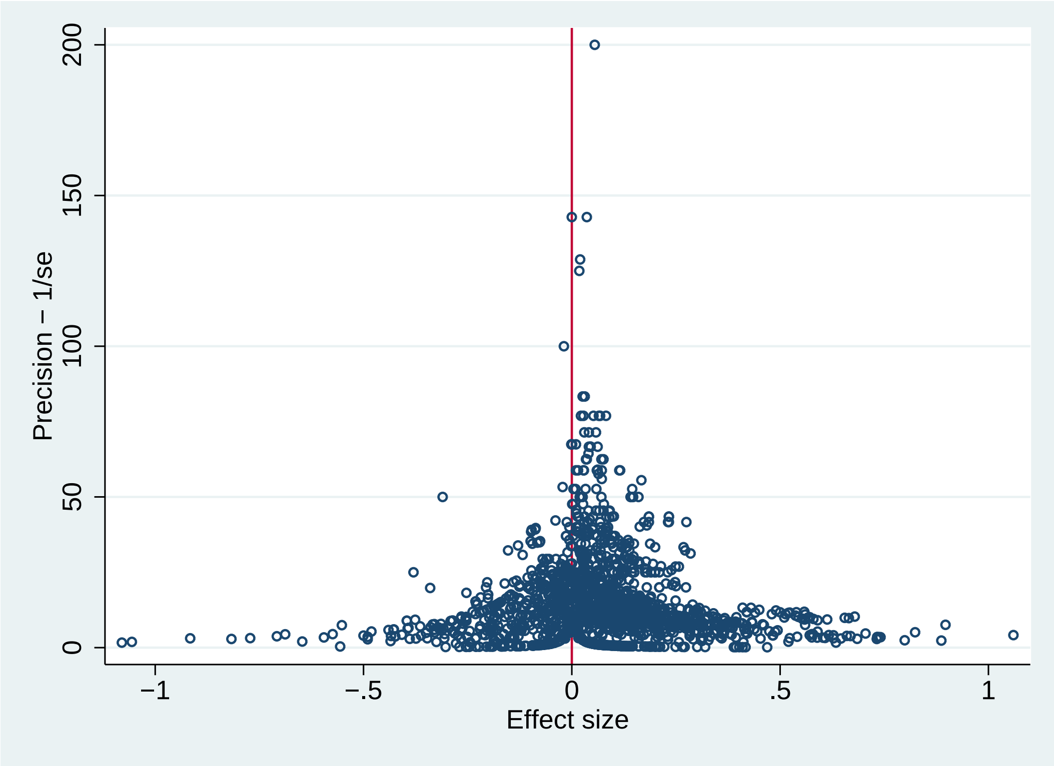

Figure A2: Funnel plot – only studies not examined by Havránek (2010)

Table A1: List of studies

Study	Published	Estimates	Havranek	WP
de Souza (2002)	2002	32	Yes	Yes
Bun and Klaassen (2002)	2002	2	Yes	Yes
Micco, Stein, and Ordoñez (2003)	2003	130	Yes	No
Barr, Breedon, and Miles (2003)	2003	81	Yes	No
de Nardis and Vicarelli (2003b)	2003	2	Yes	Yes
Taglioni (2004)	2004	109	Yes	Yes
Faruqee (2004)	2004	44	Yes	Yes
Baldwin and Taglioni (2004)	2004	6	Yes	Yes
de Nardis and Vicarelli (2003a, 4)	2003	2	Yes	No
Flam and Nordström (2006a)	2006	182	Yes	Yes
Flam and Nordström (2006b)	2006	59	Yes	Yes
Aristotelous (2006)	2006	24	Yes	No
Baldwin and Taglioni (2007)	2007	20	Yes	No
Baldwin (2006)	2006	198	Yes	Yes
Gomes, Helliwell, Kano, and J. Murra and (2006)	2006	44	Yes	No
Shin and Serlenga (2007)	2007	7	Yes	No

Continued on next page

Table A1: List of studies (continued)

Study	Published	Estimates	Havranek	WP
Bun and Klaassen (2007)	2007	35	Yes	No
Cafiso (2011)	2011	44	Yes	No
Berger and Nitsch (2008)	2008	40	Yes	No
Baldwin, DiNino, Fontagné, Santis, and Taglioni (2008)	2008	12	Yes	Yes
Frankel (2010)	2010	116	Yes	Yes
Brouwer, Paap, and Viaene (2008)	2008	8	Yes	No
Chintrakarn (2008)	2008	28	Yes	No
de Nardis, Vicarelli, and De Santis (2008)	2008	225	Yes	No
Flam and Nordström (2007)	2007	12	No	Yes
Flam and Nordström (2008)	2008	10	No	Yes
de Sousa and Lochard (2009)	2009	29	No	Yes
Baldwin, Skudelny, and Taglioni (2005)	2005	142	No	Yes
de Nardis, de Santis, and Vicarelli (2008)	2008	2	No	No
Jung, Hogrefe, and Kohler (2010)	2010	15	No	Yes
Silva and Tenreyro (2010)	2010	3	No	Yes
Bergin and Lin (2012)	2012	117	No	No
Fernandes (2006)	2006	674	No	Yes
Alakbarov (2012)	2012	2	No	Yes
Buongiorno (2015)	2015	104	No	No
Badinger and Türkcan (2014)	2014	4	No	No
Camarero, Gómez, and Tamarit (2014)	2014	4	No	No
Cieślik, Michałek, and Mycielski (2012)	2012	9	No	No
Cieślik, Michałek, and Mycielski (2014)	2014	9	No	No
Costa-Font (2010)	2010	30	No	Yes
Eicher and Henn (2011)	2011	9	No	No
Kelejian, Tavlas, and Petroulas (2012)	2012	4	No	No
Kunrooa and Azad (2015)	2015	2	No	No
Murphy and Siedschlag (2011)	2011	58	No	No
Polyak (2014)	2014	8	No	Yes
Rotili (2014)	2014	462	No	Yes
Ruiz and Vilarrubia (2007)	2007	25	No	Yes
Vicarelli and Pappalardo (2012)	2012	14	No	Yes
Serlenga and Shin (2013)	2013	12	No	Yes
Westphal (2013)	2013	33	No	Yes
McGowan (2008)	2008	13	No	Yes

Notes: WP = working paper, Havranek = study included in Havránek (2010)

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