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Interest Rate Pass-Through

A Meta-Analysis of the Literature

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Abstract

The interest rate pass-through describes how changes in a reference rate (the monetary policy, money market, or T-bill rate) transmit to bank lending rates. This paper reviews the empirical literature on the interest rate pass-through and systematizes it by means of meta-analysis and meta-regressions. The paper finds systematically lower estimated pass-through coefficients in studies that focus on transmission to long-term lending rates, consumer lending rates, and average lending rates. The interest rate pass-through is significantly influenced by country macro-financial and institutional factors. The estimated pass-through tends to be stronger for economies with deeper capital markets (measured by market capitalization). Interestingly, central bank independence rising from lower levels can reduce interest rate pass-through, while central bank independence rising from already high levels can boost the pass-through..

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Interest Rate Pass-Through:

A Meta-Analysis of the Literature[*]

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1. Introduction

The interest rate channel of monetary policy is one important transmission channel through which monetary policy affects the real economy. The strength of the pass-through from the monetary policy rate to bank lending rates reflects the effectiveness of monetary policy and how the policy can help manage economic activity and stabilize prices. Central bankers are thus greatly interested in understanding the extent to which changes in the monetary policy rate transmit to lending rates and the factors that affect this transmission.

The interest rate pass-through is a keenly studied economic phenomenon. Because of imperfect information, competition, and other frictions, the pass-through from the monetary policy rate to various lending rates is, in practice, typically incomplete. The broader economic environment and various macro-financial factors may play an important role in different country contexts. Several recent studies summarize the empirical research on the interest rate pass-through. For instance, Sorensen and Werner (2006) survey 22 papers, covering aspects such as the type of data, econometric approach, reference rate, and time period. Andries and Billon (2016) review the empirical literature by comparing methodological approaches across studies and their implications for the estimated pass-through. Several papers also provide insights into the pass-through process from specific perspectives. For instance, Marotta (2009) reviews the literature on short-term business lending rates. Aziakpono and Wilson (2013) focus on the possible asymmetry in the interest rate pass-through, and Grigoli and Mota (2017) survey the pass-through studies for the Dominican Republic. Overall, these literature reviews confirm the heterogeneity in the interest rate pass-through across country contexts and lending rates. They suggest that the transmission of changes in the monetary policy rate to corporate lending rates may be the strongest, while the one to consumer lending rates may be the weakest.[1]

Our paper contributes to the literature by conducting, to our knowledge, the first quantitative survey (a meta-analysis) of the empirical literature on the interest rate pass-through. In our meta-analysis, we

[1] The literature also studies the transmission of changes in the monetary policy rate to deposit rates, which is documented to be weak on average. To ensure greater homogeneity of our meta-analysis, we focus our survey only on the transmission to lending rates.

cover both publications in peer-reviewed journals and the gray literature to address possible issues of a publication bias and consider the latest empirical research. Our dataset includes 52 studies and 1,040 extracted coefficients of the estimated interest rate pass-through. To summarize the empirical estimates from the literature, we start by describing the typical (most frequent) paper on the interest rate pass-through and highlight several relevant factors that might have been under-researched. The meta-analysis considers three types of factors affecting the pass-through estimates. First, we consider the individual characteristics of a study such as the functional form applied in the estimation, the type of data, and the impact factor of the journal/paper. Such consideration allows us to control for possible estimation biases due to different methodological approaches, data, and journal selectivity. Second, we consider the importance of the macro-financial environment. To this end, we use control variables for the level of economic development, openness of the economy, and financial depth, among others. Third, we consider monetary policy characteristics such as central bank independence, monetary policy framework, and exchange rate regime. The macro-financial and monetary policy factors can help identify the economic and institutional environment that boosts or reduces the transmission of the monetary policy rate to bank lending rates.

More than a thousand collected estimates from over 50 studies suggest the average interest rate pass-through to be around 0.8—disregarding research methodologies, modes of publication, and country macro-financial and institutional context. When controlling for these confounding factors in a meta-regression, the average conditional pass-through is estimated to be lower, at about 0.6. The pass-through estimates for consumer lending rates, longer lending rates, and average lending rates tend to be significantly lower. Importantly, country macro-financial and institutional factors markedly influence the transmission process for interest rates. Countries with deeper capital markets experience a significantly higher interest rate pass-through. Furthermore, countries with more independent central banks could experience, on average, a lower interest rate pass-through. This average effect is likely driven by study estimates for countries with lower central bank independence and study estimates for the period before 1998. In contrast, studies for countries with a history of high central bank independence show a strongly positive effect of the independence on the pass-through. Alternative estimations confirm

the results, offering yet another possible explanation: Greater central bank transparency may encourage the market to react more through expectations. The pass-through may also decline because commercial banks respond to changes in the monetary policy rate even before they happen (Woodford, 2005; and Blinder et al., 2008).

The rest of the paper is organized as follows. Section 2 describes the theoretical underpinnings for the estimation of the interest rate pass-through and relates them to existing research. Section 3 describes the selection of studies for the meta-analysis. Section 4 shows descriptive statistics of the overall meta-sample and reviews the typical study estimating the interest rate pass-through. Section 5 describes the meta-regression analysis and discusses the estimation results. Section 6 performs robustness tests. Section 7 concludes.

2. Theoretical Underpinnings of the Empirical Literature

The literature uses three reference rates to study the interest rate pass-through: the monetary policy rate, the money market rate, and the capital market rate. The effect of changes in the monetary policy rate—as a policy instrument—on the bank lending rates could be of interest to policymakers. Finance professionals interested in understanding bank lending behavior may be more interested in the effect of the money market rate on bank lending rates because the money market rate could better reflect the marginal cost of funds for bank loans (Borio and Fritz, 1995).

The empirical model of interest rate pass-through used in the literature can be broadly described as:

$$bank\ lending\ rate_t = a + b \cdot reference\ rate_t + e_t, \tag{1}$$

where coefficient a represents a constant markup (the interest rate spread) over the reference rate and b represents the pass-through coefficient. In conditions of a perfectly competitive market and perfect information, the pass-through coefficient, b, would equal one. e_t is the disturbance term. Although equation 1 might be the most common specification, alternative specifications do appear in the literature.

Some researchers expand equation 1 by including a vector X_t to control for macro-financial factors such as bank competition, credit risk, liquidity premium, or some other variables that can influence the

strength of interest rate pass-through (for instance, Gambacorta et al., 2015; Gregor and Melecký, 2018). The expanded specification of the pass-through model estimated in the literature can be written as:

$$bank\ \ lending\ rate_t = a + b \cdot reference\ rate_t + c \cdot X_t + e_t. \tag{2}$$

Some researchers bring the reference rate over to the left-hand side of equation 2. The vector X_t then contains control variables for the estimated interest rate spread (Hainz et al., 2014; Havránek et al., 2016):

$$interest\ rate\ spread(a)_t = a' + c \cdot X_t + e_t. \tag{3}$$

Some researchers also include interactive terms between the interest rate pass-through and the conditioning variables to make the overall pass-through dependent on macro-financial conditions (van Leuvensteijn et al., 2013; Gregor and Melecký, 2018):

$$\begin{aligned} bank\ \ lending\ rate_t = a + b \cdot refernce\ rate_t + c \cdot X_t \\ + d \cdot reference\ rate_t \cdot X_t + e_t, \end{aligned} \tag{4}$$

where the overall interest rate pass-through conditioned on bank macro financial factors can be calculated as $b + \ d \cdot \bar{X}$. In this computation, $\bar{X}$ represents the sample mean of the significant conditional variables.

To estimate the conditional and unconditional components of the interest rate pass-through, b, some researchers run a second-stage regression of the estimated b coefficients on a set of control variables, which can either be similar to vector X or differ from it (Havránek et al., 2016). To keep the notation simple, let us assume the set of variables on which b is conditioned is the same as in equation 4:

$$\hat{b}_i = \bar{b} + c \cdot \bar{X}_i + \sigma_i, \tag{5}$$

where i stands for cross-section units (countries, sub-regions, or banks), $\bar{b}$ is the unconditional (average) pass-through, and σ_i is the cross-sectional disturbance term. $c \cdot \bar{X}_i$ then represents the conditional pass-through dependent on the average state of the macro-financial environment and loan characteristics, $\bar{X}$.

For the meta-analysis, we collect the b coefficients from empirical studies of interest rate pass-through. In doing so, we focus on studies that estimate the interest rate pass-through using equation 1 or its extended specification as in equations 2 and 4.

The vector X appearing in equations 2-5 typically includes variables capturing the overall macroeconomic environment and bank-level characteristics. For instance, Holton and d'Acri (2015) include into vector X macroeconomic variables such as the government bond yield, unemployment rate, and inflation rate. Van Leuvensteijn et al. (2013) and Leroy and Luccote (2015) control for bank competition using the aggregate Boone and the Lerner indices, respectively, both as a stand-alone control and in an interaction with the money market rate (see equation 4). Studies also control for market expectation of future interest rates, including the spread between the government bond yield and the money market rate (Cifarelli and Paladino, 2016; Gregor and Melecký, 2018), the forecast of the money market rate (Banerjee et al., 2013), and the Volatility Index (VIX), which reflects the expectation of the market's volatility over the next 30 days (Grigoli and Mota, 2017).

As for bank-level characteristics, researchers mostly control for credit risk using the ratio of non-performing loans (Gambacorta et al., 2015; Grigolli and Mota, 2017; Gregor and Melecký, 2018) or determinants of credit risk such as the business climate indicators (Mihaylov, 2016) or the price of credit default swaps (Gambacorta et al., 2015). Other typical bank characteristics include bank assets, bank capital, the leverage ratio, the loans to deposits ratio, and the liquidity ratio (Horváth and Podpiera, 2012; Holton and d'Acri, 2015; Havránek et al., 2016).

The empirical literature, however, does not typically control for broader country context, which is understandable for bank-level studies for a single country. For instance, overall financial depth, capital market development, and penetration of financial services among firms and households may influence the intensity of the interest rate pass-through (Visco, 2007; Khan, 2011; Saborowski and Weber, 2013; Mehrotra and Yetman, 2015; IMF, 2016). Moreover, the intensity of the interest rate pass-through may vary depending on the monetary policy framework and institutions, such as central bank independence, in a given country (Frenkel, 1999; Kharroubi and Zampolli, 2016). The approach of meta-regression

analysis employed in this paper could shed some light on the role of a broader country context in the interest rate pass-through.

The global financial crisis marked a significant shift in the pass-through (Hristov et al., 2014; Aristei and Gallo, 2014; Gambacorta et al., 2015). The interest rate transmission lost much of its strength and the pass-through became more uniform across different lending rates. One explanation for the weakened transmission could be a greater sensitivity to risks and uncertainty in the post-crisis era. However, some studies such as von Borstel et al. (2016) argue that the interest rate pass-through remained strong and mostly complete even after the global financial crisis. They see the difference in the post-crisis transmission in the composition of the pass-through, but not in its overall strength. In particular, they decompose the pass-through from the monetary policy rate to bank lending rates into four individual components. Accordingly, they find that while the overall pass-through has remained unchanged, the individual components such as the term spread, sovereign risk, banks risk, and credit risk have seen significant but offsetting shifts.

3. Method of Paper Selection

To select papers for our meta-analysis, we used the following search approach: First, we created a database of all studies focusing on the interest rate transmission. For the search, we used Google Scholar, Scopus, and the Web of Science. The key words entered in each database were "Interest Rate Pass-Through" and "Interest Rate Transmission." After the primary search, we also performed an alternative search for any other relevant studies cited in the papers retrieved in the first round. The search was completed by mid-2017. Therefore, studies published after July 2017 are not considered. The conducted search produced a data set of over 100 studies.

Not all the 100 studies, however, met our three selection criteria. First, we selected only studies published in peer-reviewed journals, and working, discussion, and research paper series registered in the REPEC database. Further, we selected only studies that estimated the coefficient of long-run interest rate pass-through. This step substantially reduced our data set. Third, we selected papers that publish

the estimated standard errors, standard deviations, t-statistics, or z-statistics. These measures of statistical inference are used in the meta-regression analysis to control for the precision of estimation.

The three co-authors of this paper independently evaluated each retrieved study in the original data set, compared their results, and reconciled their classification to arrive at the final sample of studies for the meta-analysis. The final sample of studies included 52 papers fulfilling all selection criteria. Table A1 in the Appendix lists all selected papers for the meta-analysis. Thirty studies were published in peer-reviewed journals and the remaining 22 were classified as gray literature (working, discussion, and research papers). Figure 1 shows the breakdown of studies in our dataset by type.

[Figure 1 about here]

As for the country focus of the studies, figure 2 shows that they focus mostly on the European Union (EU) countries. Some studies, such as Sander and Kleimeier (2003), among others, analyze the interest rate pass-through in more than one country. Thus, the total sum of the pass-through studies per country exceeds the total number of studies in our dataset. The interest rate transmission is most intensely examined in the old EU member states, particularly in Italy, Germany, France, and Spain.

[Figure 2 about here]

4. Meta-Analysis of Collected Pass-Through Coefficients

We first extract 1,040 long-run pass-through coefficients (*b*) from the 52 selected studies to analyze the estimated long-run pass-through coefficients and the factors influencing the intensity of the pass-through. Second, we collect or compute the estimate standard deviations of each estimated pass-through to control for the precision of the estimates. Figures A1 and A2 in the Appendix show the number of extracted pass-through coefficients by country and study.

Table 1 shows the descriptive statistics of collected pass-through coefficients and associated standard errors and t-statistics. The mean value of the pass-through across all studies is 0.8, which indicates an incomplete pass-through in general. In addition, the median value suggests a mild skewness

in the distribution of the collected coefficients. The maximum and minimum values show a wide range from 5.32 (Horváth and Podpiera, 2012, Table A4, for the Czech Republic and lending rates on large corporate loans with floating rate) to -27.1 (Horváth and Podpiera, 2012, Table A4, for the Czech Republic and consumer lending rate). Both extreme values are insignificant in the referenced study and in our estimation weighted down toward zero.

[Table 1 about here]

Figure 3 plots the extracted interest rate pass-through coefficients against their reverse standard errors. The left panel displays all extracted coefficients, while the right panel omits extreme values,[2] thus offering a more detailed look at the structure of the sample. The full vertical line represents a complete interest rate pass-through ($b = 1$). The dashed vertical line in the plot on the right-hand side shows the mean value of the extracted coefficients (see also Table 1). The histogram on the right-hand side shows that the empirical literature, on average, estimates an incomplete interest rate pass-through rather than an over-adjusting pass-through. The histogram also shows that values close to the mean are more precise (higher value of the inverse standard error) than values that are more distant from the mean.

[Figure 3 about here]

4.1 The Typical Paper in the Literature

The pass-through literature typically examines the transmission from the money market rate to short-term lending rates (see figure 4). From 1,040 estimated pass-through coefficients, 888 are estimated using the money market rate as the reference rate. The rest of the estimates use as the reference rate either the monetary policy rate (71) or the capital market rate (81), represented by the yield on government bonds of different maturities (typically 2, 5, and 10 years). The literature examines the pass-through to short-term lending rates (576) slightly more often than to long-term lending rates (464).

[2] We omit the extreme values only for visual effect in the graph. In the analysis, we keep those observations in the sample to cover as many observations as possible. Since we weight all coefficients by their standards errors, the extreme values have no power to bias the result of the estimation (for more detail see Methodology section).

[Figure 4 about here]

Figure 5 shows that more than half of all estimates focus on the interest rate pass-through to corporate lending rates (541 estimates). The greater focus on corporate lending rates may originate from greater allocations of bank loan books to this market segment.[3] If we compare the amount of loans outstanding in individual segments across countries, we find that corporate loans usually occupy a leading position among credit segments, followed by mortgage and consumer loans. Researchers also focus on the pass-through to the average lending rate across all categories. Other lending rates include rates on loans such as business, debt consolidation, and education.

[Figure 5 about here]

As for the estimation methodology, the typical paper estimates a single-equation model in an error correction form (ECM) for a single country using aggregate data in monthly frequency (see figure 6). Specifically, the approach for estimating the interest rate pass-through is primarily based on a single-equation model (948 estimates). Simple reduced-form models are thus most popular for examining the relationship between the reference rate and bank lending rates. These models are mostly based on the error correction form (790 estimates) using estimation methodologies such as autoregressive distributed lag (ARDL), mean group (MG), and pooled mean group (PMG) estimators.

As for the data, the studies use mostly aggregate (macro level) data for the whole banking system in a single country. More recent studies have been increasingly using micro (bank level) data for better identification. For instance, Holmes et al. (2015) examine the interest rate pass-through in Colombia using data for 15 banking institutions. Holton and d'Acri (2015) analyze the pass-through for 188 Euro Area banks, and Havránek et al. (2016) test the pass-through based on data from 52 Czech banks. Typically, the studies use data for a single country (967 estimates). Only a few studies estimate the pass-through using cross-country panel data (Bernhofer and van Treeck, 2013; Leroy and Lucotte, 2015). One reason may be that the economic, social, and political environment is specific to each country and researchers try to avoid this source of heterogeneity. To increase power of the estimates and help

[3] The ECB Statistics Bulletin: http://sdw.ecb.europa.eu/servlet/desis?node=1000004045.

identification, the studies use micro panel data, higher frequency (monthly) data, or both. In our sample, the most studies use time series data in monthly frequency (940 estimates).

[Figure 6 about here]

Typically, papers do not control for any confounding factors and estimate a bivariate relationship between the reference rate and a specific lending rate. However, some factors may indeed bias the pass-through coefficient (see Section 2). Therefore, we distinguish between literature that controls for confounding factors such as bank credit risk, bank competition, bank concentration, and the effect of the global financial crisis, and literature estimating only a bivariate relationship (see Figure 7). Studies control for credit risk and bank competition only rarely (59 and 71 estimates). This is rather surprising, considering that most studies are motivated by the Rousseas (1985) framework, which assigns a significant role to bank competition. Overall, 122 pass-through estimates control for a possible GFC effect using a crisis dummy. Somewhat less than half of these estimates consider the dummy also in an interaction with the reference rate (60).

[Figure 7 about here]

Next, we review the quality of authors and the publication outlet in which the papers selected for our meta-analysis were published.

To measure the quality of authors, we use the individual author's *h*-index from the ResearchGate and Scopus databases. Because the *h*-index of some co-authors is not available, we use the *h*-index value for the co-author with the highest available *h*-index. We construct three conditioning variables for the meta-regression based on the highest *h*-index from among the co-authors. The first variable is constructed using the Scopus database. The second and third variables are constructed using the ResearchGate database, distinguishing between the overall *h*-index and the *h*-index that excludes self-citations. Due to better data availability, we use the overall *h*-index from the ResearchGate database in our baseline meta-regression. Figure 8 (left panel) shows the histogram of the highest *h*-index from among the co-authors per study. The figure indicates that pass-through coefficients are most often published by authors with *h*-index between 17.5 and 20.

To measure the quality of a paper, we use variables from the RePEc database. The database assesses both journal publications and the gray literature (working papers). In our baseline meta-regression, we use the simple impact factor. Figure 8 (right panel) displays the histogram of the simple impact factor. The figure shows that the pass-through coefficients in our sample are most often collected from studies with a simple impact factor of between five and six.

[Figure 8 about here]

Table 2 shows the expanded descriptive statistics for author and study quality. While both *h*-indices from ResearchGate, with and without self-citations, differ only slightly, the *h*-index from the Scopus database shows substantially lower values. Nevertheless, the variation of the measures is comparable and the correlation coefficient between the *h*-index from the ResearchGate and Scopus databases is 0.94. This high correlation confirms a similar assessment of author quality across the databases. Looking at the ratings of paper quality, one may notice greater differences among the various ratings, owing also to the different construction and scaling of the indices. Interestingly, for all measures of study quality the median value lies bellow the mean value, indicating similar skewness of the ratings' distribution.

[Table 2 about here]

To control for the difference between journal publications and the gray literature, we create a dummy variable (*work_paper*) taking a value of one if the estimated coefficients are collected from working, discussion, or research papers, and zero otherwise. Figure 9 shows the distribution of the estimated coefficients between those collected from gray literature and those collected from journal publications. It reveals that our sample contains slightly more coefficients from journal publications. Using estimates from both the gray literature and journals helps us control for a possible publication bias. The problem of publication bias lies in the review process. Reviewers, especially if they are somehow involved in the topic of study, might force authors to re-estimate their models until the results match the generally known and desired 'truth' for a given area of research. Hence, some original research results may stay unpublished.

[Figure 9 about here]

Next, we review the country context in which the collected coefficients were estimated. We focus on macro-financial factors potentially relevant for the interest rate pass-through: GDP per capita (*gdppc*), trade openness measured as exports over GDP (*openness*), net foreign assets (*nfa*), financial depth measured as credit to GDP ratio (*credit_gdp*), market capitalization (*capitalization*), turnover ratio for stocks (*stock_turnover*), and claims on central government divided by GDP (*claims_gov_gdp*). Each macro-financial variable is measured at the median year of the sample used in the original study. For example, if a research study uses a sample from 2006 to 2010, then the median year for this research is 2008. Table 3 displays descriptive statistics for all macro-financial variables.

[Table 3 about here]

The third group of control variables covers monetary policy characteristics: a measure of central bank independence (*cbi_G*), a dummy for inflation targeting framework (*inf_target*), and a dummy for floating exchange rate arrangement (*floating_exrate*). For the measure of central bank independence, we use the same approach as for macro-financial variables. That is, we choose the median year of the study's sample and match it with the corresponding assessment of central bank independence from the Garriga (2016) data set.[4] Similarly, the median year of the sample determines the setting of the dummies for inflation targeting and floating exchange rate regime. Table A4 in the Appendix presents the descriptive statistics of the central bank independence variable.

The two dummy variables for the type of monetary policy framework and exchange rate arrangement are based on the Annual Reports on Exchange Arrangements and Exchange Restrictions from the IMF.[5] We differentiate inflation targeting from other monetary policy regimes. The corresponding dummy (*inf_target*) takes a value of one if the country targets inflation, and zero otherwise. The dummy *floating_exrate* then takes a value of one for a *de facto* floating exchange rate arrangement as classified by the IMF, and zero otherwise. Figure 10 shows that a floating exchange rate

[4] Garriga, Ana Carolina (2016). Central Bank Independence in the World: A New Data Set. *International Interactions*, 42(5), pp. 849-868.

[5] The reports are available online at the IMF website: https://www.imf.org/en/Publications/Annual-Report-on-Exchange-Arrangements-and-Exchange-Restrictions/Issues/2017/01/25/Annual-Report-on-Exchange-Arrangements-and-Exchange-Restrictions-2016-43741.

arrangement characterizes the country context for a little more than half of the collected coefficients. In contrast, an inflation targeting framework applies to only one quarter of the collected coefficients.

[Figure 10 about here]

5. Meta-Regression Analysis

The meta-regression analysis (MRA) is a method of quantitative literature review. It summarizes and explains the variation of different results across the same research phenomenon (Stanley et al., 2013). In the field of economics, this quantitative tool finds use in several areas. For instance, Crespo-Cuaresma et al. (2014) examine determinants of foreign currency loans in CESEE countries. Havránek et al. (2015) use meta-analysis to test the social cost of carbon, and Arnold et al. (2014) examine the determinants of corporate hedging. The diverse use of meta-regression analysis shows a strong interest and support for the use of this quantitative tool.

In the literature, meta-analyses mostly apply the estimation methodology formulated by Stanley and Jarrell (1989):

$$b_j = \alpha + \sum_{k=1}^{K} \gamma_k \cdot Z_{jk} + \varepsilon_j, \tag{6}$$

where b_j is the variable capturing the effect size of the research phenomenon—in our case the interest rate pass-through—α is a constant reflecting the true size of the effect, Z_{jk} is a vector of control variables, and ε_j is the error term. The subscript j stands for the number of studies in the sample, and k represents the number of conditioning variables. According to Stanley and Jarrell (1989), Z_{jk} might include: (i) dummy variables showing whether the original study includes or omits independent variables possibly relevant to the research, (ii) specification variables that capture the differences in methodology and data definitions or sources, (iii) variables reflecting the sample size, (iv) variables that capture specific authors' characteristics, and (v) variables measuring the research or data quality.

We expand this model to add external factors such as macro-financial variables and monetary-policy characteristics to control for specific country context that could affect the interest rate pass-through.

Moreover, to capture the effect of publication selectivity, we regress the extracted pass-through coefficients on their estimated standard errors as in Stanley et al. (2008) and Havránek and Sedlaříková (2014):

$$b_j = \alpha + \beta se_j + \sum_{k=1}^{K} \gamma_k \cdot Z_{jk} + \sum_{l=1}^{L} \delta_l \cdot M_{jl} + \sum_{r=1}^{R} \theta_r \cdot P_{jr} + \varepsilon_j \quad (j = 1,2, \dots, N), \tag{7}$$

where b_j is the dependent variable extracted from the studies (in our case the coefficient of long-term interest rate pass-through), α represents a constant measuring the true size of the interest rate pass-through, β estimates the publication selectivity bias, se_j is the estimated standard error of the dependent variable, Z_{jk} is a vector of study-specific factors, M_{jl} is a vector of macro-financial factors specific to the studied country, P_{jr} is a vector of monetary policy factors specific to the studied country, and ε_j represents the error term.

Table 4 shows individual variables contained in the vectors Z_{jk}, M_{jk}, and P_{jk}. The composition of vector Z_{jk} follows the Stanley and Jarrell (1989) model, including variables in the five suggested categories: (i) possibly omitted variables, (ii) functional form, (iii) sample size, (iv) authors' characteristics, and (v) research quality. In addition, vector Z_{jk} includes variables reflecting topic-specific factors such as the maturity of loans, type of reference rate, and type of examined lending rate. Vector M_{jk} includes macro-financial variables, and vector P_{jk} includes monetary policy variables to control for specific country context of the sample study.

[Table 4 about here]

To mitigate possible problems with heteroscedasticity, we weight all variables in the model by the standard errors of the pass-through coefficients extracted from the studies as in Stanley and Jarrell (1989), Havránek and Sedlaříková (2014), and Havránek et al. (2015):

$$t\_stat_j \equiv \frac{b_j}{se_j} = \alpha \left(\frac{1}{se_j}\right) + \beta + \sum_{k=1}^{K} \frac{\gamma_k \cdot Z_{jk}}{se_j} + \sum_{l=1}^{L} \frac{\delta_l \cdot M_{jl}}{se_j} + \sum_{r=1}^{R} \frac{\theta_r \cdot P_{jr}}{se_j} + \frac{\varepsilon_j}{se_j} \tag{8}$$

Equation 6, when divided by the standard error of the estimates, *se*, takes the form of equation 7. But the interpretation of the meta-regression coefficients does not change: α reflects the true size of the pass-through coefficient, and β measures a possible asymmetry (publication selectivity) of the pass-through.

Some relevant study-specific factors may still be missing in our specification of the meta-regression. Therefore, we organize the data into a panel and estimate a regression model with fixed effects (FE) to control for study-specific effects:

$$t\_stat_{ij} \equiv \frac{b_{ij}}{se_{ij}} = \alpha\left(\frac{1}{se_{ij}}\right) + \beta + \sum_{k=1}^{K}\frac{\gamma_k \cdot Z_{ijk}}{se_{ij}} + \sum_{l=1}^{L}\frac{\delta_l \cdot M_{ijl}}{se_{ij}} + \sum_{r=1}^{R}\frac{\theta_r \cdot P_{ijr}}{se_{ij}} + \omega_j + \xi_{ij} \qquad (9)$$

where $\xi_{ij} = \frac{\varepsilon_{ij}}{se_{ij}}$, *i* stands for individual pass-through estimates, *j* stands for studies and ω_j is the study-specific fixed effect.

5.1 Estimation Results

Before proceeding to the estimation of the meta-regression model, we transfer all non-dummy macro-financial and policy variables to logarithms. Namely, we log credit to GDP ratio (*credit_gdp*), openness (*openness*), GDP per capita (*gdppc*), market capitalization (*capitalization*), stock turnover ratio (*stock_turnover*), net foreign assets (*nfa*), claims on central government to GDP ratio (*claims_gov_gdp*), and central bank independence (*cbi_G*). In addition, to detect possible outliers that could bias the results, we apply the robust regression method. Based on this regression, we narrow down the sample from 1,040 to 1,037 observations. We drop two observations obtained from the study by Blot and Labondance (2013) and one observation from the study by Matemilola et al. (2015). Since the study by Matemilola et al. (2015) reports only a single pass-through estimate (our dropped observation), we thereby lose this study from our sample, ending up with a sample of 51 studies.

After addressing the possible outlier problem, we estimate five different meta-regression models. To determine the precise effect and possible asymmetry of the pass-through estimates, we start with a simple regression of the dependent variable on constant and reversed standard errors of the interest rate

pass-through (Table 5, column 1). Further, we sequentially add groups of variables into the model. First, we add the study-specific variables (Table 5, column 2), then the study-specific variables and the dummy variables for all lending rates except the corporate rate (Table 5, column 3), and lastly, we estimate the model based on the entire set of variables (Table 5, column 4).[6] To verify the results, we use General to Specific modeling approach (GETS) and display the results in the last column of Table 5.[7]

[Table 5 about here]

The estimation results slightly vary across the meta-regression models. The variable measuring the precision of the interest rate pass-through ranges from 0.69 to 0.95. The lower precision is reported for models that include the macro-financial and policy variables. Therefore, the external environment largely influences the true size of the interest rate pass-through. Figure 11 plots extracted pass-through coefficients against their reverse standard errors. The graph on the left side shows the relationship for our estimated sample of 1,037 observations, but for clearer analysis, we also display a graph that excludes extreme values, showing the relationship based on 1,032 observations (Figure 11, graph on the right side). The right dashed vertical line represents a complete pass-through (equal to one), the left dashed vertical line shows the precise (true) pass-through estimated by the GETS model (0.69; Table 5, column 5), and the middle solid vertical line shows the unconditional mean of the interest rate pass-through measured as a simple mean of all collected pass-through coefficients (0.8; Table 1, first column). Both the unconditional mean and the precise pass-through estimate, α, indicate that the pass-through is overall incomplete. In addition, the discrepancy between the two estimates of 0.11 (0.80 minus 0.69)

[6] Due to high correlation, GDP per capita, claims on central government, and credit to GDP ratio were excluded from the estimated regression.

[7] The General to Specific variable selection approach (GETS) is a data driven methodology that allows selecting from the set of all variables potentially relevant to the specific research only the most important ones, using series of statistical tests. In this paper, we use the GETS modeling approach based on the algorithm defined by Clarke (2014). He applies the stepwise regression procedure, during which in each step the variable that shows the lowest t-statistic is removed (this is the first type of the search path; the second type uses second lowest t-statistics, the third type uses third lowest, and so on). This process continues until the final model is specified. When obtaining more than one final model (depending on the number of search paths), the algorithm chooses the final model using the encompassing procedure (for more information see Clarke, 2014). Employing Monte Carlo simulation, Clarke (2014) showed that the GETS modeling approach performs well and the results of the final model are approximately equal to an accurately specified model.

reveals that omitting relevant conditional variables can lead to an upward bias of the estimated pass-through.

The estimated constant, β, capturing the asymmetry of the pass-through (Table 5, second row), indicates some asymmetry toward pass-through estimates smaller than one. This asymmetry is also apparent from Figure 11, which shows the histogram slightly skewed toward the left side. Therefore, estimated pass-through coefficients take values of less than one more often than value greater than one. Doucouliagos and Stanley (2013) infer that a statistically significant coefficient of asymmetry, β, may reflect a publication selectivity. How large the selectivity is depends on the size of the coefficient. When the coefficient falls between one and two (in absolute terms), as is our case (Table 5, column 1), Doucouliagos and Stanley (2013) rate the publication selectivity as substantial. However, when we add controlling variables into the estimation, the size of the asymmetry drops and becomes statistically insignificant, showing only modest selectivity (β lower than one). In any case, possible publication selectivity may be attributed to missing competing theories—perhaps a demand-based theory of the interest rate pass-through. Based on the current, supply-side theory, researchers might be tempted to publish results that correspond to a complete or nearly complete interest rate pass-through, and less so results with an estimated pass-through greater than one.

[Figure 11 about here]

Next, we discuss the effect of the three groups of factors (explanatory variables) reported in Table 4: study-specific, macro-financial, and monetary policy factors.

For the study-specific factors, we find a statistically significant effect of the maturity of loans on the size of the pass-through estimated in empirical studies. In general, lending rates on long-term loans respond less to changes in the reference rate than lending rates on short-term loans. All models concur on this result. One explanation could be that the lower responsiveness of rates at the long end of the yield curve stems from their dependence on additional and more uncertain factors, such as the risk premium, term premium, and long-term expectations. Further, we find a significant effect of two other variables. Namely, studies that control for credit risk and use a system of equations for their estimation

report higher pass-through on average. This shows that the estimation procedure could affect the identification and estimates of the interest rate pass-through. However, only fully specified models confirm the significance of those two variables (Table 5, column 4 and 5 column).

In addition, we test whether the pass-through differs with the type of lending rate. To do so we include in the meta-regression model the dummy variables for all lending rate types used in the pass-through literature, except the corporate rates that represent the reference category. The results suggest that the pass-through is significantly weaker for average lending rates and for lending rates on loans for other purposes compared with corporate rates. Hence, in the loan market, the corporate segment shows the highest elasticity to changes in monetary or money market rates, while the average rates and rates on loans for other purposes show the lowest elasticity.

For the macro-financial factors, we find only one statistically significant effect. Market capitalization positively influences the estimated size of the pass-through. Thus, in countries with a deeper banking (financial) system, the interest rate transmission seems to be stronger. This result concurs with the findings of Mehrotra and Yetman (2015) that the interest rate as a policy instrument tends to have a larger impact in countries with a higher share of financially included households. We also confirm the results by Singh et al. (2008) who report that developed financial markets aid a faster and stronger interest rate pass-through. The significance of market capitalization holds throughout all estimated models, suggesting a robust effect. In addition, the GETS procedure also selected openness as a variable that adds significant information to the regression as a whole. However, individually the estimated coefficient is not significant at the common levels. The estimated negative sign could stem from the increasing role of trade finance with higher levels of trade openness (Demirguc-Kunt and Maksimovic, 2001; Casey and O'Toole, 2014; and Carbó-Valverde et al., 2016).

For the monetary-policy factors, we find that higher central bank independence may reduce the magnitude of the interest rate pass-through. This negative average effect of central bank independence on the strength of the pass-through is rather puzzling. Although the estimated coefficient on central bank independence is significant only at the 10 percent level, we investigate possible explanations of this negative average effect next.

5.2 Central Bank Independence and the Interest Rate Pass-Through

To get deeper insight into the relationship between the central bank independence (CBI) and the strength of the interest rate pass-through, we first test whether the negative effect of CBI could vary at different CBI levels or occur only at some levels. To this end, we construct three 0/1 dummies for low, medium, and high levels of independence. The primary intention was to split the CBI into three equally-sized groups. The CBI, however, contains numerous repeating values due to the inclusion of developed countries in the sample that have reported the same level of CBI over several years (mostly European countries). Thus, the creation of equally-sized groups was not possible. As a result, we create three unequally-sized groups based on the level of CBI. The group of the least independent central banks contains 390 observations that cover CBI in the range of 0.15 to 0.83. The group with medium CBI levels includes 555 observations covering CBIs in the range of 0.84 to 0.86, and the group with high CBI levels includes 92 observations covering CBIs in the range of 0.87 to 0.90. We rerun the GETS regressions sequentially including the three dummies for low, medium, and high levels of CBI. The results are reported in Table 6, columns 6-8.

[Table 6 about here]

The estimation results using GETS suggest that low levels of CBI can negatively affect the pass-through. However, the estimated coefficient is not statistically significant at the common levels. The medium-level dummy was dropped by the GETS selection procedure, suggesting that the dummy turns out to be insignificant as well. In contrast, high levels of CBI could have overall a highly positive effect on the size of the pass-through (Table 6, column 8). Thus, the relationship between CBI and the interest rate pass-through appears to be negative only at lower levels of CBI, but as central bank independence increases, the effect of CBI on the pass-through becomes significantly positive.[8]

[8] The negative effect of CBI on the pass-through might be associated with more discretionary (less predictive) monetary policy implementation in newly-independent central banks. Over time, as central bank core policy functions develop, their systematic component increases (discretionary component decreases). For instance, after adopting the inflation targeting regime the monetary policy rate typically adjusts in response to expected inflation and the output gap in a manner more predictable for the markets. This may help further strengthen central bank independence, policy predictability, and the interest rate pass-through.

To further examine the relationship between central bank independence (CBI) and the strength of the interest rate pass-through, we replace our baseline measure of independence by Garriga (2016)—which enables us to maximize the estimation sample—with that of Dincer and Eichengreen (D&E; 2014) that can be complemented with a commensurate metric of central bank transparency. However, using the variables from D&E reduces our sample size by about 22 percent, eliminating all estimates with the median year before 1998 (175 estimations). Countries such as Chile, Ghana, Nigeria, and the Slovak Republic drop out of the sample as a result. The estimation results for this subsample using the alternative measure of CBI and the additional variable measuring central bank transparency (CBT) are reported in Table A5 in the Appendix (column 1). Due to increased collinearity among variables, only the GETS results are reported—that is, results after the general to specific variable selection procedure has been applied.

The results show a higher estimated precision of the pass-through compared with the full sample. One explanation might be lower credibility and transparency of monetary policy before 1998 (Crowe and Meade 2008; Blattner et al., 2008), which might have weakened the transmission of interest rates. Hence, the meta-analysis without study estimates from before 1998 shows a higher precision, implying a complete interest rate pass-through. This supplementary meta-regression supports our results of the baseline meta-regression. Namely, we confirm the statistical significance of the credit risk dummy, average lending rates, rates on loans for other purposes, and market capitalization. In addition, other factors turn out to be statistically significant. From the study-specific factors, we find that studies using panel data estimate a lower pass-through than studies using single dimensional data. This result highlights the importance of data structures for estimating the pass-through. From the macro-financial factors, we also find a statistically significant effect of trade openness—similar to our baseline model, in which the estimated negative coefficient did not reach the common significance levels. The removal of about 200 observations with the median year before 1998 leaves us with a sample that includes the pass-through estimates with median year ranging from 1998 to 2011. During those years, global trade, trade openness, and development of global value chains were on the rise (World Bank, 2017). The latter

brought about more supply-chain (intra-company) trade finance, which is less sensitive to changes in interest rates. This lower sensitivity implies a lower overall pass-through.

Interestingly, when we use the alternative measure of CBI by D&E (2014), we find a positive effect of CBI on the pass-through. We see two possible explanations. One, the negative effect prevails in the years before 1998, and for developing countries that dropped out of the alternative estimation sample such as Ghana, Nigeria, and Chile. Two, the negative effect could be largely driven by central bank transparency (CBT), the data on which was not available for our larger baseline sample. Here, one explanation could be that the more transparent the central bank, the higher the probability that the market will react through expectations (Swanson, 2006; Ehrmann et al., 2012). Therefore, commercial banks may respond to changes in the monetary policy rate before they actually happen, which would result in a lower observed pass-through.[9] In addition, commercial banks in a highly transparent monetary-policy environment may exhibit a smoothing behavior, which would result in lower pass-through as well (Kleimeier and Sander, 2006; Frappa et al., 2008; and Kwapil and Scharler, 2010).[10]

Finally, the dummy variables for the inflation-targeting framework and floating exchange regime both turn out to be significant and positive in the alternative estimation. Assuming that, before 1998, central banks in general lacked experience with the "new" policy framework of inflation targeting, markets could have reacted less unanimously to interest rate changes during that period. Once central banks fully adopted inflation targeting, this framework increased the systematic response of central banks to market development, the predictability of interest rate changes, and the size of the pass-through (Davis et al., 2014), which, as a result, becomes statistically significant in our alternative estimation. Also, a greater number of exchange rate regimes have become more flexible after 1998, granting the

[9] Woodford (2005) argues that market players are in general forward-looking and thus central bank communication could help drive market behavior alongside traditional policy tools. Blinder et al. (2008) concur, claiming that central banks affect the economy predominantly through the guidance of the future path of policy rates, rather than through the actual changes of policy rates that may follow.

[10] Anticipating the future steps of the central bank, commercial banks adjust their lending rates only partly not following all hikes, which in general result in an incomplete pass-through. For instance, when bankers anticipate that the central bank will decrease the policy rate, they may decrease their lending rates smoothly and less drastically to avoid to sharp drops in loan pricing.

central banks greater autonomy in setting their monetary policy and the national interest rates (Shambaugh, 2004; Frankel et al., 2004; Crespo-Cuaresma and Wójcik, 2006).

5.3 Other Considered Determinants of Interest Rate Pass-Through

In all previous estimations, we confirmed a statistically significant effect of the market capitalization on the size of the pass-through. To see what drives this effect, we employ additional regression models with different variables that capture a specific aspect of the capital market. First, we use the bond market turnover ratio. Including the variable in the regression, however, reduces our sample size to about one-quarter of the original size. This results in an increased probability of collinearity among variables, especially in the case of the dummy variables. More importantly, the GETS selection procedure excludes this variable from the final specification of the model. Similarly, the use of other alternative determinants, such as the government debt securities ratio, corporate debt securities ratio, and five-year sovereign credit default swap (CDS) yields similar results. The sample reduction in those cases is lower, about half of our original sample. Nevertheless, after we applied the GETS modeling approach, we still could not confirm any significant effect for any of these additional variables.

6. Robustness Tests

We included the country-context variables to help control for how country-specific factors could influence the interest rate pass-through, but the list of included factors may be incomplete. To check the robustness of our results against the possibility of omitted country factors, we estimate a mixed-effects regression. In addition to the study fixed effects, the estimated regression thus includes country fixed-effects to control for possibly omitted country-specific effects common to all pass-through estimates for a given country. The model is specified as follows:

$$t_{stat_{ijc}} \equiv \frac{b_{ijc}}{se_{ijc}} = \alpha\left(\frac{1}{se_{ijc}}\right) + \beta + \sum_{k=1}^{K}\frac{\gamma_k \cdot Z_{ijck}}{se_{ijc}} + \sum_{l=1}^{L}\frac{\delta_l \cdot M_{ijcl}}{se_{ijc}} + \sum_{r=1}^{R}\frac{\theta_r \cdot P_{ijcr}}{se_{ijc}} + \omega_j + \vartheta_c + \xi_{ijc} \tag{10}$$

where $\xi_{ic} = \frac{\varepsilon_{ic}}{se_{ic}}$, i stands for the individual pass-through estimate, j stands for studies, and c stands for countries. Hence, ω_j represents the study-specific effects and ϑ_c is the country-specific effects.

The estimation results of the mixed effects model in equation (9) are reported in Table 7. The results concur with our study fixed effect estimates. In addition, we identify five other significant factors. Namely, we find that researchers using panel data estimate a significantly greater strength of the interest rate pass-through, and those using cross-country data estimate a significantly lower strength. The results also suggest that while higher GDP per capita and stock turnover ratio weaken the transmission process, a higher inflow of foreign assets strengthens the pass-through of interest rates. Applying the GETS selection approach reduces the number of significant factors, however. We find a robust effect for only four study-specific factors (cross-country estimates, rates on loans with long-term maturity, consumer lending rates, and averaged lending rates), one macro-financial factor (market capitalization), and one monetary policy factor (central bank independence). Thus, the results from the GETS mixed effects model confirm the results from the GETS study fixed effects model. Two minor differences can still be identified. First, the coefficient of asymmetry (β) turns out to be insignificant. Recall however that the asymmetry in the GETS study fixed effects model equals -0.8523, which according to Doucouliagos and Stanley (2013) suggests a very modest or even no asymmetry. Second, the mixed effects model identifies the dummy for cross-country estimates as a significant study-based factor. It suggests that researchers estimating the pass-through using cross-country data typically find a lower pass-through strength than those with data for a single country.

[Table 7 about here]

In addition, a large part of the sample covers Euro Area countries with ostensibly much greater institutional, legal, and structural homogeneity. We test the possibility that the results for our entire sample are driven solely by the Euro Area subsample, and do not apply to non-Euro Area countries. The estimation results for such split samples are reported in Table A6 in the Appendix (columns 2 and 3). Due to increased collinearity among variables, we report only the GETS results after the variable selection procedure has been applied.

The estimation results for the Euro Area show a greater precision of the interest rate pass-through that the one estimated for the entire sample. The precision approaches one—that is, an almost complete pass-through. Interestingly, the Euro Area results reveal a substantial asymmetry of the pass-through. Therefore, for the Euro Area countries the study estimates may suffer from a significant publication selectivity bias. Regarding study-specific, macro-financial, and monetary policy factors, the results show a statistical significance of only three factors: market capitalization, the stock turnover ratio, and the dummy for rates on loans for other purposes. The significance of market capitalization and the dummy appear in all previous estimations regardless of the sample size and the estimation method. As for the stock turnover ratio, the effect seems to be rather small and statistically significant only at the 10% level. Nevertheless, it suggests that more actively-trading (liquid) stock markets can reduce the size of the pass-through.

For the non-EA countries, the estimation sample covers only about one-quarter of our original sample. Therefore, the regression estimation faces the problem of increased collinearity among variables, which could bias the results even after applying the GETS selection procedure. Nevertheless, the model still largely confirms the results of our previous estimations. We confirm significant effects of the dummy for rates on long-term loans, consumer loan rates, average rates, market capitalization, central bank independence (using the Garriga (2016) data series), and the inflation targeting regime. Several additional factors appear significant in this case. Namely, for the non-Euro Area countries, we find that using data in quarterly frequency reduces the size of the estimated pass-through. Further, using the monetary policy rate rather than the money market rate as the reference rate increases the size of the estimated pass-through. Looking at the macro-financial factors, two additional variables appear significant. One, the stock turnover ratio lowers the size of the pass-through—much more so than for the Euro Area subsample. This could suggest that active stock markets may serve as competing source of capital to finance both firms and banks alike. For this reason, changes in the central bank rate and money market rate might have a lower impact on funding costs of banks and firms—resulting in a lower interest rate pass-through. Two, increasing net foreign asset balances strengthen the interest rate pass-through. This estimated effect may imply that as more domestic savings are exported abroad (relative

to imported savings), the competition for the remaining savings in the domestic funding market increases, and so does the market's sensitivity to changes in domestic interest rates. As a result, the interest rate pass-through rises as well.

Overall, the main results could be driven by the EA subsample, but they largely apply to non-EA countries as well. In fact, some estimates for the non-EA country subsample could also drive the overall significance of some variables in the baseline estimations.

7. Conclusion

This paper reviewed the empirical literature on the pass-through of monetary policy, money market, and T-bill rates to bank lending rates. This review covered 52 studies, of which 30 were published in journals and the remaining 22 appeared in the gray literature (working and discussion papers). Overall, we observe that researchers typically focus on the transmission from the money market rate to short-term lending rates for non-financial companies. To examine such a transmission, they typically employ single-equation models in the error correction form using aggregate data for a single country in monthly frequency. The collected estimates from the reviewed studies suggest the average interest rate pass-through could be about 0.8—disregarding research methodologies, modes of publication, as well as country macro-financial and institutional context.

Using meta-data for the reviewed studies and collected estimates, this paper also conducted a quantitative review of the literature by running meta-regressions to explain the pass-through estimates across studies. First, the paper attempted to identify any research and methodological biases that could exist in the literature and affect the size of researchers' pass-through estimates. To that end, the meta-regressions controlled for study-specific characteristics such as the functional form, type of data, possibly omitted variables, sample size, authors' characteristics, quality of research, type of reference rate, and type of examined lending rate. We found that studies using cross-country data report lower estimates of the pass-through than studies using single-country data. Controlling for the type of lending rate, we find a weaker pass-through to consumer rates, to average rates, and to rates on loans with long-

term maturity. This has important implications for central bankers, who might be advised not to expect to affect pricing of consumer loans as effectively as shorter-term corporate loans.

Second, the paper tried to explain the variation in pass-through estimates across studies by controlling for macro-financial and institutional developments. The considered macro-financial factors included credit to GDP, openness, GDP per capita, market capitalization, stock-turnover ratio, net foreign assets, and claims on central government. The relevant institutional development reflected central bank independence, inflation targeting, and floating exchange rate regime. Absent the supporting macro-financial and institutional environment, the average size of the pass-through falls to about 0.6—much lower than the unconditional mean estimate across studies of 0.8. Namely, one robust finding is that countries with deeper capital markets experience a higher interest rate pass-through. Encouraging further capital market deepening could thus help policymakers improve interest rate transmission and potentially also better manage the credit and business cycles. For example, increasing the depth of the capital market (market capitalization to GDP) from 30% to 90% can boost the pass-through from 0.59 to 0.68.

Furthermore, we found that greater central bank independence may lower the interest rate pass-through on average. Further examining this average effect showed that study estimates for countries with lower central bank independence and study estimates for the period before 1998 could drive this average negative estimate. In contrast, countries with high central bank independence experience a strong positive effect of this variable on the pass-through. Also, robustness checks using an alternative measure of central bank independence confirmed the results. In addition, they offered the alternative explanation that greater central bank transparency might encourage the market to react more through expectations. In such cases, the pass-through declines because commercial banks may respond to changes in the monetary policy rate before they actually happen (Woodford, 2005; and Blinder et al., 2008).

References

ANDRIES, N. and S. BILLON. (2016). Retail bank interest rate pass-through in the euro area: An empirical survey. *Economic Systems*, 40, pp. 170–194.

ARISTEI, D. and M. GALLO (2014). Interest rate pass-through in the Euro area during the financial crisis: A multivariate regime-switching approach. *Journal of Policy Modeling*, 36, pp. 273-295.

ARNOLD, M. M., RATHGEBER, A. W. and S. STÖCKL. (2014). Determinants of corporate hedging: A (statistical) meta-analysis. *The Quarterly Review of Economics and Finance*, 54, pp. 443-458.

AZIAKPONO, M. J. and M. K. WILSON. (2013). Interest Rate Pass-through and Monetary Policy Regimes in South Africa. *African Economic Research Consortium*, No. 259.

BANERJEE A., BYSTROV, V. and P. MIZEN. (2013). How Do Anticipated Changes to Short-Term Market Rates Influence Banks' Retail Interest Rates? Evidence from the Four Major Euro Area Economies. *Journal of Money, Credit and Banking*, 45(7), pp. 1375-1414.

BERNHOFER, D. and T. van TREECK. (2013). New evidence of heterogeneous bank interest rate pass-through in the euro area. *Economic Modelling*, 35, pp. 418–429.

BLATTNER, T., CATENARO, M., EHRMANN, M., STRAUCH, R. and J. TURUNEN. (2008). The predictability of monetary policy. *ECB Occasional Paper Series*, No. 83.

BLINDER, A. S., EHRMANN, M., FRATZSCHER, M., de HAAN, J. and D.-J. JANSEN. (2008). Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence. *Journal of Economic Literature*, 46(4), pp. 910–945.

BLOT, CH. and F. LABONDANCE. (2013). Business lending rate pass-through in the Eurozone: monetary policy transmission before and after the financial crash. *Economics Bulletin*, 33(2), pp. 973-985.

BORIO, C. E. V. and W. FRITZ. (1995). The response of short-term bank lending rates to policy rates: A cross-country perspective. *BIS Working Paper*, No. 27.

CARBÓ-VALVERDE, S., RODRÍGUEZ-FERNÁNDEZ, F., and UDELL, G. F. (2016). Trade credit, the financial crisis, and SME access to finance. *Journal of Money, Credit and Banking*, 48(1), 113-143.

CASEY, E. and M. C. O'TOOLE (2014). Bank lending constraints, trade credit and alternative financing during the financial crisis: Evidence from European SMEs. *Journal of Corporate Finance*, 27(C), pp. 173-193.

CIFARELLI, G. and G. PALADINO. (2016). Time-varying mark-up and the ECB monetary policy transmission in a highly non linear framework. *International Review of Economics and Finance*, 45, pp. 247–262.

CLARKE, D. (2014). General-to specific modeling in Stata. *The Stata Journal*, 14 (4), pp. 895-908.

CRESPO-CUARESMA, J. and C. WÓJCIK. (2006). Measuring monetary independence: Evidence from a group of new EU member countries. *Journal of Comparative Economics*, 34, pp. 24-43.

CRESPO-CUARESMA, J., FIDRMUC, J. and M. HAKE (2014). Demand and supply drivers of foreign currency loans in CEECs: A meta-analysis. *Economic Systems*, 38(1), pp. 26-42.

CROWE, CH. and E. E. MEADE. (2008). Central bank independence and transparency: Evolution and effectiveness. *European Journal of Political Economy*, 24(4), pp. 763-777.

DAVIS, J. S., MACK, A. and M. A. WYNNE. (2014). Central Bank Transparency Anchors Inflation Expectations. *Economics Letters*, 9(4).

DEMIRGUC-KUNT, A. and V. MAKSIMOVIC, (2001). Firms as financial intermediaries - evidence from trade credit data. *The World Bank Policy Research Working Paper Series*, No. 2696.

DINCER, N. N. and B. EICHENGREEN. (2014). Central Bank Transparency and Independence: Updates and New Measures. *International Journal of Central Banking*, 10(1), pp. 189-259.

DOUCOULIAGOS, CH. and T. D. STANLEY. (2013). Are All Economic Facts Greatly Exaggerated? Theory Competition and Selectivity. *Journal of Economic Surveys*, 27(2), pp. 316-339.

EHRMANN, M., EIJFFINGER, S. and M. FRATZSCHER. (2012). The Role of Central Bank Transparency for Guiding Private Sector Forecasts. *Scandinavian Journal of Economics*, 114(3), pp. 1018-1052.

FRANKEL, J. A., SCHMUKLER, S. L. and L. SERVEN. (2004). Global transmission of interest rates: monetary independence and currency regime. *Journal of International Money and Finance*, 23(5), pp. 701-733.

FRAPPA, S., MUREZ, M., MONTORNES, J. and A. B. de la SERRE. (2008). Bank interest rates pass-through: new evidence from French panel data. MPRA Working Paper, No. 26709.

FRENKEL, J.A. (1999). Central-Bank Independence and Monetary Policy. In: *Central Banking, Monetary Policies, and the Implications for Transition Economies*. Springer, Boston, MA

GAMBACORTA, L., ILLES A. and M. J. LOMBARDI. (2015). Has the Transmission of Policy Rates to Lending Rates Changed in the Wake of the Global Financial Crisis? *International Finance*, 18(3), pp. 263-280.

GARRIGA, A. C. (2016). Central Bank Independence in the World: A New Data Set. *International Interactions*, 42(5), pp. 849-868.

GREGOR, J. and M. MELECKÝ. (2018). The Pass-Through of Monetary Policy Rate to Lending Rates: The Role of Macro-financial Factors. *Economic Modelling*, 73, pp. 71-88.

GRIGOLI, F. and J. M. MOTA. (2017). Interest Rate Pass-Through in the Dominican Republic. *Latin American Economic Review, 26(4), pp. 1-25*.

HAINZ, CH., HORVÁTH, R. and M. HLAVÁČEK. (2014). The interest rate spreads in the Czech Republic: Different loans, different determinants? *Economic Systems*, 38, pp. 43–54.

HARROUBI, E. and F. ZAMPOLLI. (2016). Monetary independence in a financially integrated world: what do measures of interest rate co-movement tell us? *BIS Papers,* No. 88.

HAVRÁNEK, T. and J. SEDLAŘÍKOVÁ. (2014). Meta-analýza důchodové elasticity poptávky po penězích. *Politická ekonomie*, 3, pp. 366-382.

HAVRÁNEK, T., IRŠOVÁ Z., JANDA, K. and D. ZILBERMAN. (2015). Selective Reporting and the Social Cost of Carbon. *CERGE-EI Working paper series*, No. 533.

HAVRÁNEK, T., IRŠOVÁ, Z. and J. LEŠANOVSKÁ. (2016). Bank efficiency and interest rate pass-through: Evidence from Czech loan products. *Economic Modelling*, 54, pp. 153-169.

HOLMES, M. J., IREGUI, A. M. and J. OTERO. (2015). Interest rate pass-through and asymmetries in retail deposit and lending rates: An analysis using data from Colombian banks. *Economic Modelling*, 49, pp. 270-277.

HOLTON, S. and C. R. d'ACRI. (2015). Jagged cliffs and stumbling blocks: interest rate pass-through fragmentation during the euro area crisis. *ECB Working Paper Series*, No 1850.

HORVÁTH, R. and A. PODPIERA. (2012). Heterogeneity in bank pricing policies: The Czech evidence. *Economic Systems*, 36, pp. 87-108.

HRISTOV, N., HÜLSEWIG, O. and T. WOLLMERSHÄUSER. (2014). The interest rate pass-through in the Euro area during the global financial crisis. *Journal of Banking and Finance*, 48, pp. 104-119.

IMF. (2014). *Annual Report on Exchange Arrangements and Exchange Restrictions*. International Monetary Fund, Washington, October 2014. ISBN: 978-1-49832-332-1 (PDF).

IMF. (2016). *Global Financial Stability Report: Fostering Stability in a Low-Growth, Low-Rate Era*. International Monetary Fund, Washington, October 2016. ISBN 978-1-47553-879-3 (PDF).

KHAN, H. R. (2011). Financial inclusion and financial stability: are they two sides of the same coin? Speech by Shri H. R. Khan, Deputy Governor of the Reserve Bank of India, at BANCON 2011, organized by the Indian Bankers Association and Indian Overseas Bank, Chennai, 4 November 2011.

KLEIMEIER, S. and H. SANDER. (2006). Expected versus unexpected monetary policy impulses and interest rate pass-through in euro-zone retail banking markets. Journal of Banking & Finance, 30, pp. 1839–1870.

KWAPIL, C. and J. SCHARLER. (2010). Interest rate pass-through, monetary policy rules and macroeconomic stability. Journal of International Money and Finance, 29, pp. 236–251.

LEROY, A. and Y. LUCOTTE. (2015). Heterogeneous monetary transmission process in the Eurozone: Does banking competition matter? *International Economics*, 141, pp. 115-134.

MAROTTA, G. (2009). Structural breaks in the lending interest rate pass-through and the euro. *Economic Modelling*, 26, pp. 191-205.

MATEMILOLA B.T., BANY-ARIFFIN, A.N. and F. E. MUHTAR. (2015). The impact of monetary policy on bank lending rate in South Africa. *Borsa Istanbul Review*, 15(1), pp. 53-59.

MEHROTRA, A. and J. YETMAN. (2015). Financial inclusion – issues for central banks. *BIS Quarterly Review*, March 2015.

MIHAYLOV, M. (2016). Determinants of loan interest rates in a country with a currency board: Evidence from Bulgaria. *Economic Systems*, 40, pp. 355-372.

ROUSSEAS, S. (1985). A Markup Theory of Bank Loan Rates. *Journal of Post Keynesian Economics*, 8, pp. 135-144.

SABOROWSKI, CH. and S. WEBER. (2013). Assessing the Determinants of Interest Rate Transmission Through Conditional Impulse Response Functions. *IMF Working Paper*, No. 13/23.

SANDER, H. and S. KLEIMEIER. (2003). Convergence in Eurozone Retail Banking? What Interest Rate Pass-Through tells us about Monetary Policy Transmission, Competition and Integration. *LIFE Working Paper,* No. 03-009.

SHAMBAUGH, J. C. (2004). The Effect of Fixed Exchange Rates on Monetary Policy. *The Quarterly Journal of Economics*, 119(1), pp. 301-352.

SINGH, S., RAZI, A., ENDUT, N. and H. RAMLEE. (2008). Impact of financial market developments on the monetary transmission mechanism. *BIS Papers*, No. 39.

SORENSEN, CH. K. and T. WERNER. (2006). Bank Interest Rate Pass-through in the Euro area: A Cross Country Comparison. *ECB Working Paper Series*, No. 580.

STANLEY, T. D. and S. B. JARRELL. (1989). Meta-regression analysis: A quantitative method of literature surveys. *Journal of Economic Surveys*, 19(3), pp. 300-308.

STANLEY, T. D., DOUCOULIAGOS, CH. and S. B. JARRELL. (2008). Meta-regression analysis as the socio-economics of economics research. *The Journal of Socio-Economics*, 37, pp. 276–292.

STANLEY, T. D., DOUCOULIAGOS, H., GILES, M., HECKEMEYER, J. H., JOHNSTON, R. J., LAROCHE, P., NELSON, J. P., PALDAM, M., POOT, J., PUGH, G., ROSENBERGER, R. S. and K. ROST. (2013). Meta-Analysis of Economics Research Reporting Guidelines. *Journal of Economic Surveys*, 27(2), pp. 390-394.

SWANSON, E. T. (2006). Have Increases in Federal Reserve Transparency Improved Private Sector Interest Rate Forecasts? *Journal of Money, Credit and Banking*, 38(3), pp. 791-819.

van LEUVENSTEIJN, M., SORENSEN, CH.K., BIKKER, J.A. and van RIXTEL, A. A.R.J.M. (2013). Impact of bank competition on the interest rate pass-through in the euro area. *Applied Economics*, 45(11), pp. 1359-1380.

VISCO, I. (2007). Financial deepening and the monetary policy transmission mechanism. *Speech by Mr. Ignazio Visco*, Deputy Director General of the Bank of Italy, at the IV Joint High-Level Eurosystem – Bank of Russia Seminar, Moscow, 10-12 October 2007.

von BORSTEL, J., EICKMEIER, S. and L. KRIPPNER. (2016). The interest rate pass-through in the euro area during the sovereign debt crisis. *Journal of International Money and Finance*, 68(C), pp. 386-402.

WOODFORD, M. (2005). Central Bank Communication and Policy Effectiveness. *NBER Working Paper Series*, No. 11898.

WORLD BANK. (2017). *Global Value Chain Development Report 2017: Measuring and Analyzing the Impact of GVCs on Economic Development*. Joint Research of the World Bank Group, the Institute of Developing Economies, the Organisation for Economic Co-operation and Development, the Research Center of Global Value Chains headquartered at the University of International Business and Economics, and the World Trade Organization.

Tables in the Main Text

Table 1: Descriptive Statistics of Pass-Through Estimates Extracted from the Studies

	Long run pass-through coef. (*b*)	Standard error	1/standard error	t-statistic	Absolute value of t-statistic
Maximum	5.320	42.662	824.621	832.867	832.867
Minimum	-27.100	0.001	0.023	-5.093	0.015
Mean	0.800	0.249	23.986	20.371	20.456
Median	0.854	0.062	16.129	12.290	12.290
St. dev.	0.953	1.663	43.743	42.433	42.392
Observations	1040	1040	1040	1040	1040

Table 2: Measures of Author and Research Quality

	Author Quality			Study Quality					
	h-max *Research Gate*	*h*-max excl. self-citation *Research Gate*	*h*-max *Scopus*	Impact Simple	Citation Score	Impact Recursive	Impact Discounted	Impact Recursive Discounted	Series *h*-index
Maximum	53	51	33	20.94	3211.8	0.773	4.405	0.886	103
Minimum	1	1	1	0.008	1.48	0.001	0.008	0.001	1
Mean	16.31	15.07	9.06	7.32	873.43	0.202	1.719	0.247	40.15
Median	16	15	11	5.36	582.07	0.112	1.533	0.142	25
St. dev.	12.09	10.90	6.56	5.57	843.61	0.21	1.08	0.22	31.60
Observations	1040	1040	1040	1040	1040	1040	1040	1040	1040

Table 3: Descriptive Statistics for Macro-Financial Country Context

	GDPPC (USD ths.)	OPENNESS (% of GDP)	NFA (local crcy. bn.)	CREDIT (% of GDP)	CAPITALIZATION (% of GDP)	STOCK TURNOVER (turnover ratio %)	CLAIMS GOV (% of GDP)
Maximum	376.585	184.177	49758.20	172.411	326.359	694.429	72.895
Minimum	1.163	9.132	-221.611	7.090	0.867	0.147	-13.016
Mean	32.489	37.206	1036.296	80.048	64.541	82.158	12.082
Median	35.562	27.427	50.151	83.973	49.538	82.570	8.502
Std. Dev.	26.183	19.809	5969.102	37.752	47.665	56.458	12.236
Observations	1040	1040	1040	1040	1040	1040	1040

Table 4: Variables in Vectors Z, M, and P

Z_{jk}						M_{jk}	P_{jk}
(i)	(ii)	(iii)	(iv)	(v)	Study Specific Factors	Other Factors	
Possibly omitted variables	**Functional form**	**Sample size**	**Authors' characteristics**	**Research quality**	**Topic-specific factors**	**Macro-financial variables**	**Monetary policy characteristics**
Credit risk (*dum_cr_risk*)	Panel data (*panel*)	Sample size (*sample_size*)	Authors max h-index - Research gate (*h_max_rg*)	Paper impact factor – simple (*impact_simple*)	Long term loans (*maturity_long*)	Credit to GDP (*credit_gdp*)	Central bank independence (*cbi_G*)
Bank competition (*dum_comp*)	Micro bank level data (*micro_data*)			Working Paper (*work_paper*)	Monetary policy rate as the reference rate (*ref_mpr*)	Openness (*openness*)	Inflation targeting (*inf_target*)
Crisis dummy (*dum_crisis*)	Cross country estimates (*cross_country_est*)				Capital market rate as reference rate (*ref_cmr*)	GDP per capita (*gdppc*)	Floating exchange rate regime (*floating_exrate*)
	Quarterly frequency (*freq_q*)				Consumer lending rate as dependent variable (*lr_cons*)	Market capitalization (*capitalization*)	
	Error correction based estimates (*ecm_est*)				Mortgage lending rate as dependent variable (*lr_mort*)	Stocks traded value – turnover ratio (*stock_turnover*)	
	System of equations (*sys_of_eq*)				Other lending rate as dependent variable (*lr_other*)	Net foreign assets (*nfa*)	
					Average of lending rates as dependent variable (*lr_average*)	Claims on central government (*claims_gov_gdp*)	

Note: Table A3 in the Appendix displays all variables used in the research, together with a short description and data sources.

Table 5: Estimation Results

	Model	(1)	(2)	(3)	(4)	(5)
	Dependent Variable	**t_stat**	**t_stat**	**t_stat**	**t_stat**	**t_stat**
	Model Specification	Study FE	Study FE	Study FE	Study FE	GETS Study FE
	α (*precision*)	0.9267***	0.9322***	0.9483***	0.7424***	0.6898***
		(0.0274)	(0.0801)	(0.0784)	(0.2291)	(0.1976)
	β (*asymmetry*)	-1.8927***	-0.9632	-0.7778	-0.6644	-0.8523
		(0.6019)	(0.6887)	(0.6454)	(0.6053)	(0.5804)
Study-specific factors	dum_cr_risk		0.0192	0.0186	0.0893**	0.0622**
			(0.0377)	(0.0330)	(0.0416)	(0.0307)
	dum_crisis		0.0122	-0.0098	-0.0108	
			(0.1000)	(0.1035)	(0.1066)	
	dum_comp		0.0324	0.0232	0.0368	
			(0.0493)	(0.0383)	(0.0434)	
	panel_data		0.0240	-0.0460	-0.0207	
			(0.1376)	(0.0892)	(0.0985)	
	micro_data		-0.1222	-0.0631	-0.0367	
			(0.1202)	(0.0749)	(0.0871)	
	cross_country_est		-0.0912	-0.0199	-0.0193	
			(0.1374)	(0.0841)	(0.0974)	
	freq_q		-0.0262	-0.0357	-0.0697	
			(0.1019)	(0.0822)	(0.0864)	
	ecm_est		0.0402	0.0286	0.0565	0.0514
			(0.0585)	(0.0590)	(0.0586)	(0.0552)
	sys_of_eq		0.0348	0.1005	0.1594**	0.1660***
			(0.0813)	(0.0854)	(0.0775)	(0.0604)
	sample_size		0.0003	0.0003	-0.0001	
			(0.0004)	(0.0004)	(0.0003)	
	h_max_rg		-0.0001	-0.0004	-0.0006	-0.0005
			(0.0017)	(0.0018)	(0.0017)	(0.0017)
	impact_simple		-0.0042	-0.0041	-0.0037	-0.0051
			(0.0042)	(0.0048)	(0.0050)	(0.0045)
	work_paper		0.0030	0.0147	-0.0251	-0.0101
			(0.0432)	(0.0408)	(0.0453)	(0.0501)
	maturity_long		-0.1035*	-0.0654*	-0.0696**	-0.0563*
			(0.0560)	(0.0335)	(0.0315)	(0.0308)
	ref_mpr		-0.1026	0.0195	0.0659	
			(0.0744)	(0.0916)	(0.0970)	
	ref_cmr		0.0689	0.0911	0.1258	
			(0.1139)	(0.1337)	(0.1204)	
	lr_cons			-0.0915	-0.0831	-0.0803
				(0.0616)	(0.0637)	(0.0619)
	lr_mort			-0.0656	-0.0647	-0.0415
				(0.0789)	(0.0792)	(0.0627)
	lr_other			-0.1612***	-0.1344**	-0.1351***
				(0.0518)	(0.0569)	(0.0418)
	lr_average			-0.3206***	-0.2798**	-0.1920**
				(0.0729)	(0.1140)	(0.0920)
Macro-Financial Factors	log(openness)				-0.0769	-0.0563
					(0.0873)	(0.0693)
	log(capitalization)				0.1843***	0.1803***
					(0.0572)	(0.0559)
	log(stock_turnover)				-0.0301	
					(0.0343)	
	log(nfa)				0.0072	
					(0.0109)	
Monetary-Policy Factors	log(cbi_G)				-0.2689*	-0.2679*
					(0.1456)	(0.1543)
	inf_target				0.0521	
					(0.1020)	
	floating_exrate				-0.0572	-0.0502
					(0.0557)	(0.0471)
	N	1037	1037	1037	1037	1037
	aic	6615	6571	6542	6479	6476
	bic	6620	6655	6646	6617	6555
	Cross-Section	51	51	51	51	51

Notes: ***, **, * shows statistical significance at the 1%, 5%, and 10% levels. Standard errors are clustered at the study level and shown in parentheses.

Table 6: Central Bank Independence in Interaction with Dummy and Macro-Financial Factors

Model	(6)	(7)	(8)
Dependent Variable	**t_stat**	**t_stat**	**t_stat**
Model Specification	GETS Study FE	GETS Study FE	GETS Study FE
log(cbi_w)	0.5059	-	-0.2171**
	(0.8843)	-	(0.1079)
dummy_lowCBI * log(cbi_w)	-0.7164		
	(0.8146)		
dummy_mediumCBI * log(cbi_w)		-	
		-	
dummy_highCBI * log(cbi_w)			8.4074**
			(1.1903)
N	1037	1037	1037
aic	6516	6551	6443
bic	6540	6570	6527
Cross-Section	51	51	51

Notes: ***, **, * shows statistical significance at the 1%, 5%, and 10% levels. Standard errors are clustered at the study level and shown in parentheses. We only report the results of the CBI variable.

Table 7: Study and Country Mixed Effect Estimation Results

	Model	(9)	(10)
	Dependent Variable	**t_stat**	**t_stat**
	Model Specification	Study and Country ME (Non-nested - Crossed)	GETS Study and Country ME (Non-nested - Crossed)
	α (*precision*)	0.7010***	0.6204***
		(0.2193)	(0.0501)
	β (*asymmetry*)	-0.7082	-0.7605
		(0.5906)	(0.5613)
Study-specific factors	dum_cr_risk	0.0615	
		(0.0477)	
	dum_crisis	0.0257	
		(0.0482)	
	dum_comp	0.0045	
		(0.0598)	
	panel_data	0.0827*	
		(0.0448)	
	micro_data	-0.0993**	
		(0.0430)	
	cross_country_est	-0.1742***	-0.1131***
		(0.0509)	(0.0343)
	freq_q	0.0124	
		(0.0438)	
	ecm_est	0.0609***	
		(0.0207)	
	sys_of_eq	0.0894**	
		(0.0436)	
	sample_size	0.0003*	
		(0.0002)	
	h_max_rg	-0.0020**	
		(0.0009)	
	impact_simple	0.0025	
		(0.0023)	
	work_paper	-0.0274	
		(0.0209)	
	maturity_long	-0.0860***	-0.0953***
		(0.0202)	(0.0142)
	ref_mpr	0.0390	
		(0.0485)	
	ref_cmr	0.0835***	
		(0.0311)	
	lr_cons	-0.0883***	-0.0780***
		(0.0254)	(0.0250)
	lr_mort	-0.0588***	
		(0.0224)	
	lr_other	-0.0919	
		(0.0953)	
	lr_average	-0.1900***	-0.1321***
		(0.0537)	(0.0390)
Macro-Financial Factors	log(credit)	0.1845***	
		(0.0638)	
	log(openness)	0.0199	
		(0.0473)	
	log(gdppc)	-0.1319**	
		(0.0584)	
	log(capitalization)	0.1538***	0.1645***
		(0.0328)	(0.0268)
	log(stock_turnover)	-0.0518**	
		(0.0244)	
	log(nfa)	0.0106*	
		(0.0058)	
	log(claims_gov_gdp)	0.0234**	
		(0.0118)	
Monetary Policy Factors	log(cbi_G)	-0.2504***	-0.2450***
		(0.0631)	(0.0488)
	inf_target	0.0491*	
		(0.0285)	
	floating_exrate	-0.0290	
		(0.0207)	
	N	1037	1037
	aic	6568	6575
	bic	6741	6629

Notes: *, **, * shows statistical significance at the 1%, 5%, and 10% levels. Standard errors are clustered at the study level and shown in parentheses.**

Figures in Main Text

Figure 1: Papers According to Type of Publication

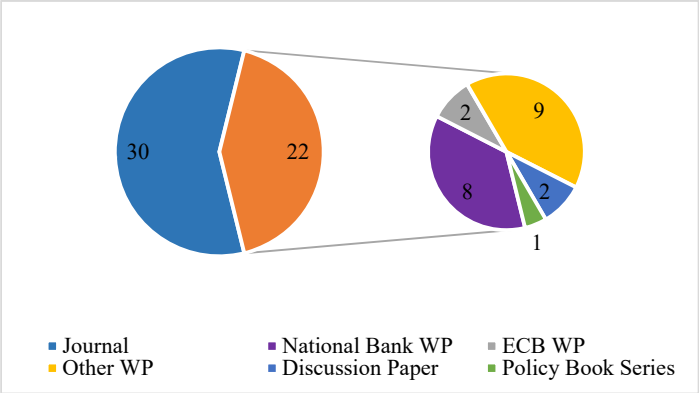
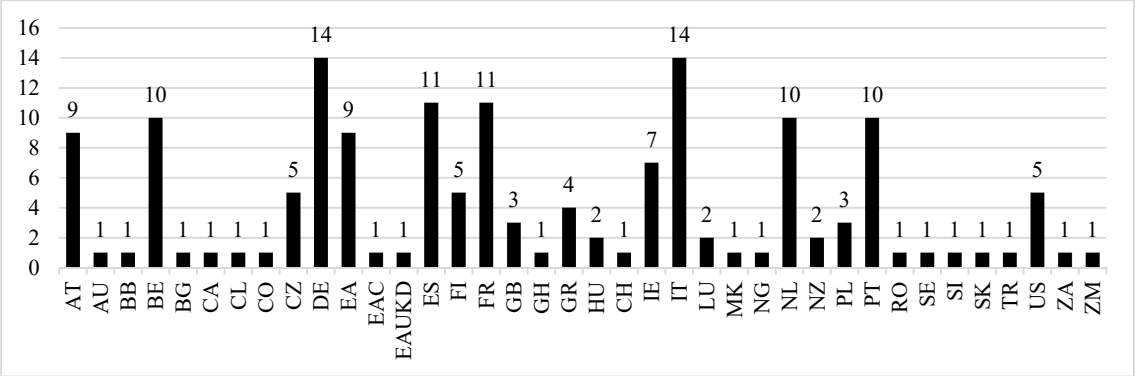
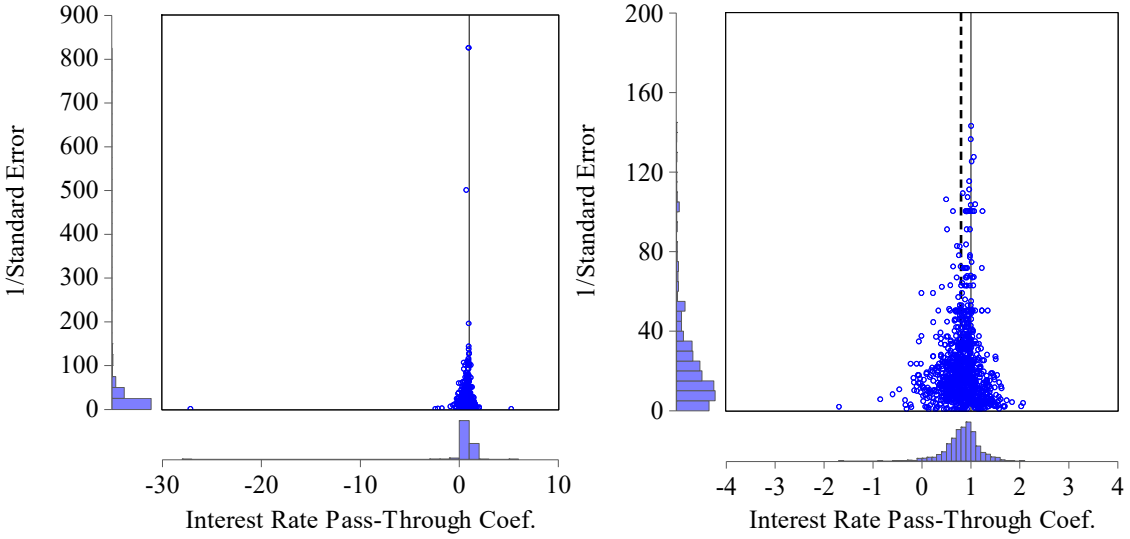


Figure 2: Country Focus of Meta-Analyzed Studies



Notes: EA = Euro Area; EAC = Euro Area Core; EAUKD = Euro Area, UK, and Denmark estimated as a panel. We show the list of countries with their country code in the Appendix (Table A2)

Figure 3: Funnel Plots – Full Sample (1,040 obs.) and Sample Without Extreme Values (1,032 obs.)



Notes: Full vertical line equals to one showing a complete interest rate pass-through. Dashed vertical line displays the unconditional mean of the pass-through estimates. Extreme values are defined as values more than three standard deviations from the mean. This applies to values on both axes.

Figure 4: Number of Extracted Pass-through Coefficients by Reference Rate and Loan Maturity

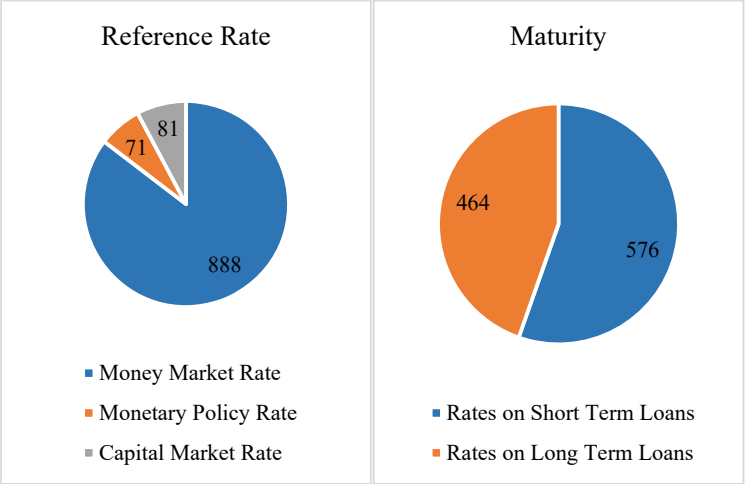


Figure 5: Rate Pass-Through Coefficients by Type of Lending Rate

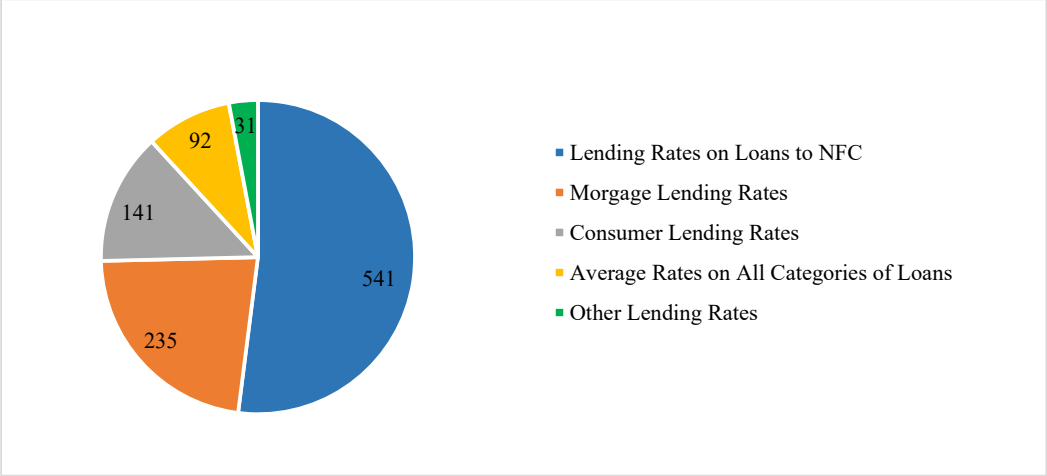


Figure 6: Pass-Through Coefficients by Form of Estimation and Type of Data

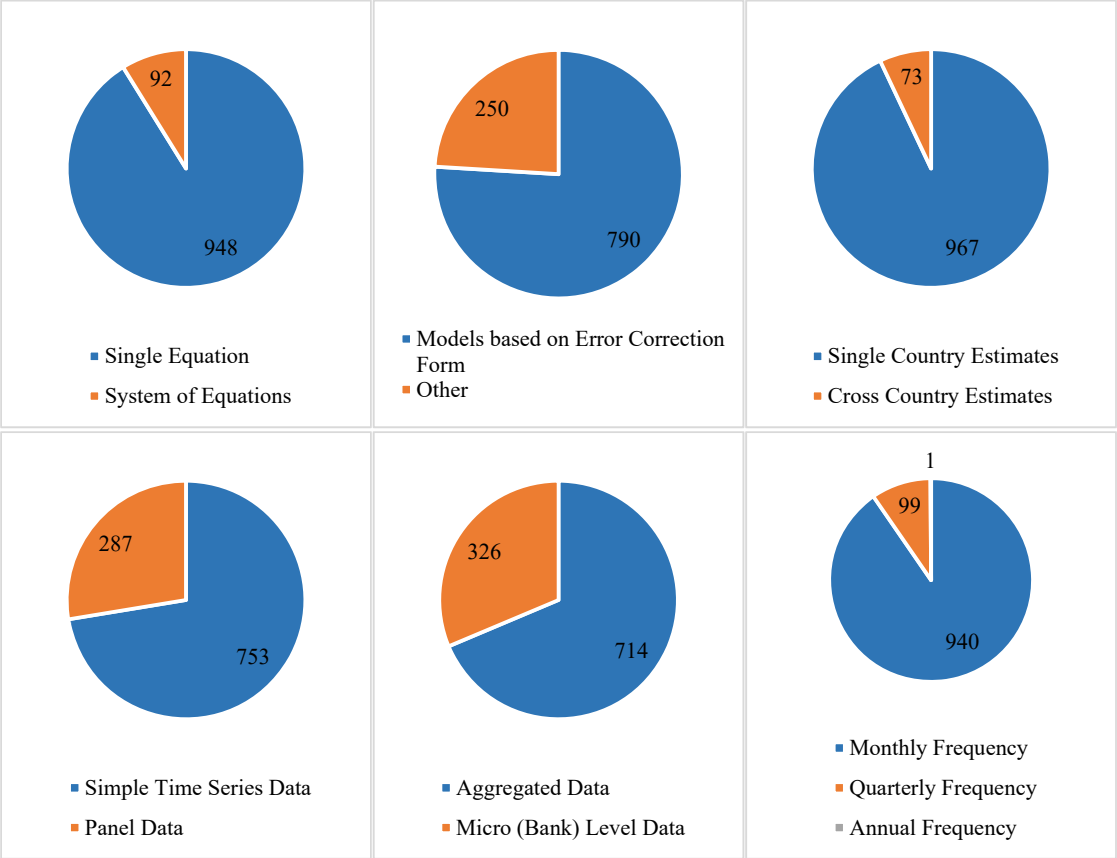


Figure 7: Factors Typically Controlled for in Pass-Through Estimations

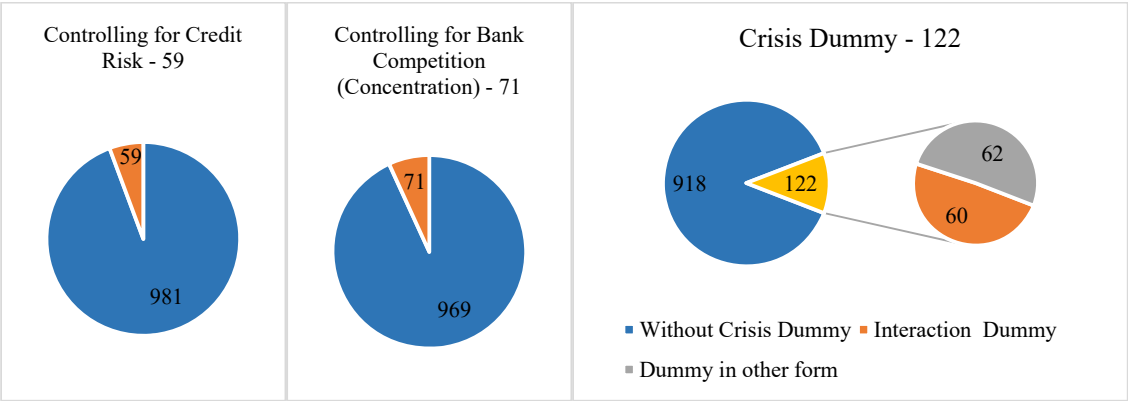
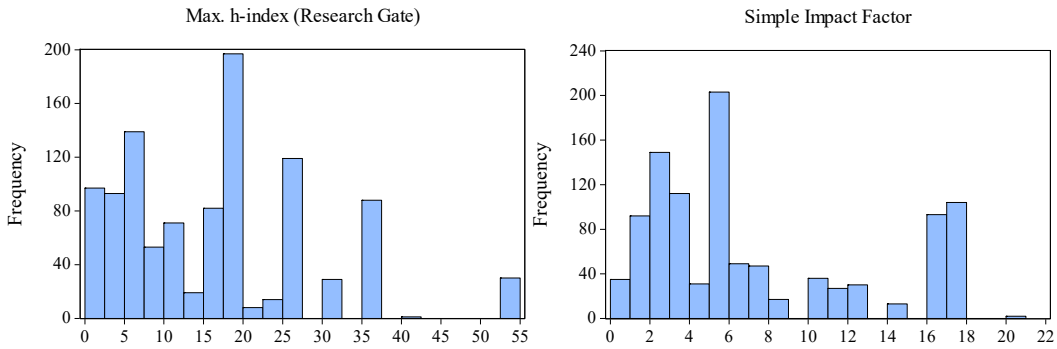


Figure 8: Histogram of Author and Research Quality Variables



Notes: The frequency (left axis) shows the number of pass-through coefficients extracted from collected studies. Bottom axis describes maximum h-index (left panel) or simple impact factor (right panel).

Figure 9: Journal Publication and Gray Literature

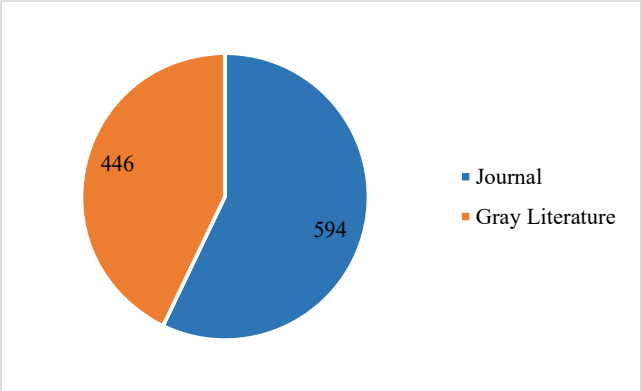


Figure 10: Pass-through Estimates in the Context of Inflation Targeting and Floating Exchange Rates

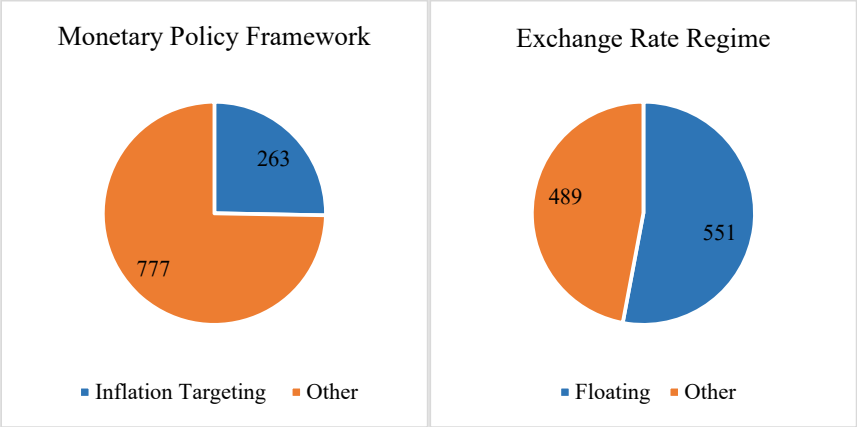
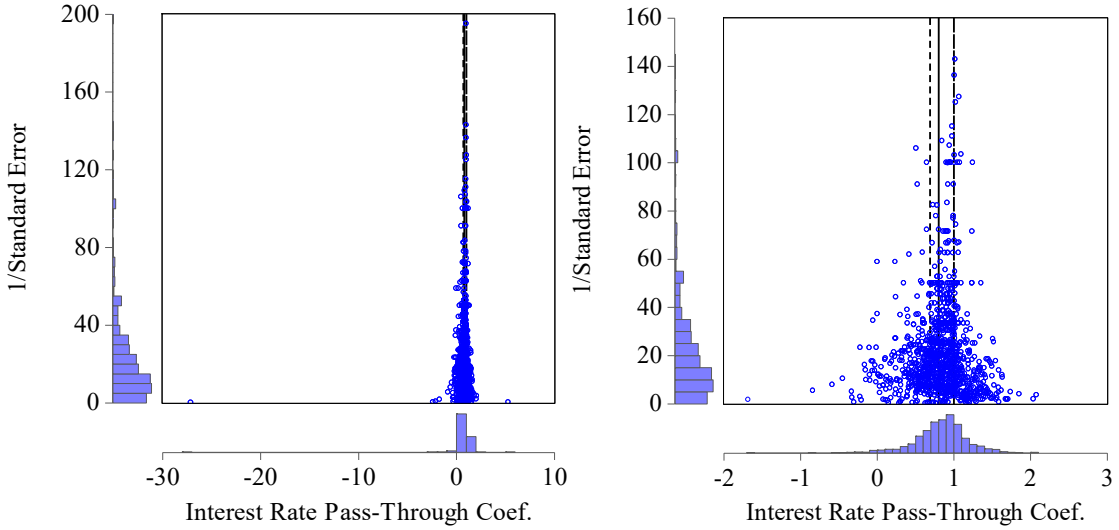


Figure 11: Funnel Plot of Collected Study Estimates (1,037 obs.) With and Without Extreme Values (1,032 obs.)



Notes: The dashed vertical line on the right hand side equals to one and shows a complete interest rate pass-through. The dashed vertical line on the left hand side equals to 0.69 and shows the precise pass-through effect based on the results of the GETS model (Table 5, column v). We also plot the unconditional mean of the collected pass-through coefficients (full vertical line in the middle, which equals to 0.800 (Table 1, first column)). Extreme values are defined as values more than three standard deviation from the mean. This applies to values on both axes.

Appendix

Tables

Table A1: List of Selected Studies

	Paper	Paper Index	Year of Publication
1	ANTAO, Paula *Banco de Portugal Working paper*s, No. 5/2009.	A09	2009
2	ARISTEI, D. and M. GALLO *Journal of Policy Modeling,* 36, pp. 273-295.	AG14	2014
3	AYDIN, H. I. *Working Paper*, No. 07/05, The Central Bank of the Republic of Turkey, Research and Monetary Policy Department.	A07	2007
4	BANERJEE, A., BYSTROV, V and P. MIZEN *Journal of Money, Credit and Banking,* 45(7), pp. 1375-1414.	BBM13	2013
5	BELKE, A., BECKMANN, J. and F. VERHEYEN *Discussion paper,* No. 1223, German Institute for Economic Research.	BBV12	2012
6	BELKE, A., BECKMANN, J. and F. VERHEYEN *Journal of International Money and Finance,* 37, pp. 1-24.	BBV13	2013
7	BERNHOFER, D. and van TREECK, T. *Economic Modelling,* 35, pp. 418-429.	BT13	2013
8	BLOT, CH. and F. LABONDANCE *Economics Bulletin,* 33(2), pp. 973-985.	BL13	2013
9	BOAMAH D. O., MAMINGI, N. and M. N. JACKMAN *Revista CEPAL*, Naciones Unidas Comisión Económica para América Latina y el Caribe (CEPAL).	MBJ11	2011
10	BOGOEV, J. and B. S. SERGI *Intereconomics,* 47(6), pp. 361–367.	BS12	2012
11	CECCHIN, I. *Swiss National Bank Working Paper,* No. 2011-8.	C11	2011
12	CIFARELLI, G. and G. PALADINO *International Review of Economics and Finance*, 45, pp. 247-262.	CP16	2016
13	De BONDT, G. *ECB Working Paper Series,* No. 136.	B02	2002
14	De BONDT, G. *German Economic Review,* 6(1), pp. 37-78.	B05	2005
15	De GRAEVE, F., De JONGHE, O. and R. V. VENNET *Journal of Banking and Finance,* 31, pp. 259-278.	GJV07	2007
16	ESPINOSA-VEGA, M. A and A. REBUCCI *Central Banking, Analysis, and Economic Policies Book Series*	ER04	2004
17	FRAPPA, S., MUREZ, M., MONTORNES, J. and A. B. SERRE *MPRA Paper,* No. 26709.	FMMS08	2008
18	GAMBACORTA, L., ILLES A. and M. J. LOMBARDI *International Finance,* 18(3), pp. 263-280.	GIL15	2015
19	GAMBACORTA, L. and S. IANNOTTI *Temi di discussione del Servizio Studi*, No. 566, BANCA D'ITALIA.	GI05	2005
20	GREGOR, J. and M. MELECKÝ *European Union Research Center (EURC) Working Paper Series,* George Washington University (GWU)	GM17	2017
21	HARBO HANSEN, N. - J. and P. WELZ *OECD Economics Department Working Papers*, No. 855.	HW11	2011
22	HAVRÁNEK, T., IRŠOVÁ, Z and J. LEŠANOVSKÁ *Economic Modelling,* 54, pp. 153-169.	HIL16	2016
23	HOFMANN, B and P. MIZEN *Economica,* 71, pp. 99-123.	HM04	2004
24	Holmes, M. J., Iregui, A. M and J. Otero *Economic Modelling,* 49, pp. 270-277.	HIO15	2015
25	HOLTON, S. and C. R. d'ACRI *ECB working paper series,* No 1850.	HA15	2015
26	HORVÁTH, C., KREKÓ, J. and A. NASZÓDI *MNB Working Papers*, No. 2004/8, Magyar Nemzeti Bank.	HKN04	2004
27	HORVÁTH, R. and A. PODPIERA *Economic Systems,* 36, pp. 87-108.	HP12	2012

28	CHILESHE, P. M. and O. A. AKANBI *International Journal of Economic Sciences*, 5(3), pp. 10-32.	CA16	2016
29	ILLES A., LOMBARDI, M. and P. MIZEN *BIS working papers,* No. 486.	ILM15	2015
30	JOBST, C. and C. KWAPIL *Monetary Policy and Economy,* Q4/08, pp. 54-67.	JK08	2008
31	KAPUŚCIŃSKI M. et al. *NBP Working Paper*, No. 249.	KKKLPSSW16	2016
32	Karagiannis, S., Panagopoulos, Y. and P. Vlamis *Journal of Policy Modeling,* 32, pp. 323-338.	KPV10	2010
33	BABECKÁ-KUCHARČUKOVÁ, O. et al. *Research and Policy Notes*, No. 1, Czech National Bank.	K13	2013
34	KWAPIL, C. and J. SCHARLER *Journal of International Money and Finance,* 29, pp. 236-251.	KS10	2010
35	LEROY, A. and Y. LUCCOTE *International Economics,* 141, pp. 115-134.	LL15	2015
36	LIU, M-H., MARGARITIS, D. and A. TOURANI-RAD *Journal of Banking and Finance,* 32, pp. 501-511.	LMT08	2008
37	MARISCAL, I. B. and P. HOWELLS *Centre for Global Finance Working Paper Series*, No. 7/10, Bristol Business School.	MH10	2010
38	MAROTTA, Giuseppe *CEFIN Working Papers*, No 12.	M08	2008
39	MAROTTA, Giuseppe *Economic Modelling*, 26, pp. 191-205	M09	2009
40	MATEMILOLA B.T., BANY-ARIFFIN, A.N. and F. E. MUHTAR *Borsa Istanbul Review,* 15(1), pp. 53-59.	MBM15	2015
41	MIHAYLOV, M. *Economic Systems,* 40(3), pp. 355-372.	M16	2016
	MOAZZAMI, B. *Applied Financial Economics,* 9(6), pp. 533-538.	M99	1999
42	MONTAGNOLI A., NAPOLITANO O. and B. SILIVERSTOVS *Regional Studies.*	MNS15	2015
43	OGUNDIPE, A. A. and P. O. ALEGE *International Journal of Economics and Finance,* 5(10).	OA13	2013
	PAYNE, J. E. and G. A. WATERS *Applied Economics,* 40(11), pp. 1355-1362.	PW08	2008
44	PAYNE, J. E. *Journal of Post Keynesian Economics,* 29(2), pp. 247-257.	P0607	2006
45	SAKYI, D., MENSAH, I. O. and S. K. OBENG *Journal of African Business*, 2017.	SMO17	2017
46	SANDER, H. and S. KLEIMER *Research Memorandum,* No. 051, Maastricht University, Maastricht Research School of Economics of Technology and Organization (METEOR).	SK03	2003
47	TIEMAN, A. *IMF Working Paper,* WP/04/211.	T04	2004
48	TOOLSEMA-VELDMAN, L., STURM, J. E. and J. de HAAN *CCSO Working Papers,* University of Groningen, CCSO Centre for Economic Research.	TSH02	2002
49	van LEUVENSTEIJN, M., SORENSEN, CH. K., BIKKER, J. A. and A. A.R.J.M. van RIXTEL *Applied Economics,* 45(11), pp. 1359-1380.	LSBR13	2013
50	WETH, M. *Economic Research Centre of the Deutsche Bundesbank Discussion paper,* No. 11/02	W02	2002
51	WINKER, P. *Applied Economics,* 31(3), pp. 267-277.	W99	1999
52	WROBEL, E. and M. PAWLOWSKA *NBP Working Papers,* No. 24, Narodowy Bank Polski, Economic Research Department; 2002.	WP02	2002

Table A2: List of Examined Countries and Their Country Codes

Country	Country Code
Australia	AU
Austria	AT
Barbados	BB
Belgium	BE
Bulgaria	BG
Canada	CA
Chile	CL
Colombia	CO
Czech Republic	CZ
Euro Area	EA
Euro Area Core	EAC
Euro Area, UK and Denmark	EAUKD
Finland	FI
France	FR
Germany	DE
Ghana	GH
Great Britain	GB
Greece	GR
Hungary	HU
Ireland	IE
Italy	IT
Luxembourg	LU
Macedonia	MK
Netherlands	NL
New Zealand	NZ
Nigeria	NG
Poland	PL
Portugal	PT
Romania	RO
Slovak Republic	SK
Slovenia	SI
South Africa	ZA
Spain	ES
Sweden	SE
Switzerland	CH
Turkey	TR
United States	US
Zambia	ZM

Table A3: Data Series and Their Sources

Variable	Index	Description	Source
Dependent Variable			
Long-run pass-through coefficient	*lrpt*	Value of the long-run pass-through coefficient obtained from the examined papers	Constructed by the Authors - papers' estimates
Standard error	*se*	Standard error obtained from the papers (missing values calculated from t-stat (z-stat) or st. dev.)	Constructed by the Authors - papers' estimates
1/standard error	*1_se*	One divided by standard error obtained from the papers (missing values calculated from t-stat (z-stat) or st. dev.)	Constructed by the Authors - papers' estimates
t-statistic	*t_stat*	t-statistics obtained from the papers (missing values calculated from z-stat, st. error or st. dev.)	Constructed by the Authors - papers' estimates
(i) Dummy Variables Showing Whether Original Paper Includes or Omits Independent Variables Possibly Relevant to the Research			
Controlling for credit risk	*dum_cr_risk*	Value 1 if paper controls for credit risk, 0 otherwise	Constructed by the Authors
Controlling for bank competition (concentration)	*dum_comp*	Value 1 if paper controls for bank competition (concentration), 0 0 otherwise	Constructed by the Authors
Crisis dummy	*dum_crisis*	Value 1 if paper controls for the banking crisis, 0 otherwise	Constructed by the Authors
(ii) Specification Variables that Capture Differences in Methodology and Data Definitions or Sources			
Panel data	*panel_data*	Value 1 for panel data estimation, 0 otherwise	Constructed by the Authors
Micro bank level data	*micro_data*	Value 1 for use of bank level data, 0 otherwise	Constructed by the Authors
Cross country estimation	*cross_country_est*	Value 1 for cross-country estimation, 0 otherwise	Constructed by the Authors
Monthly frequency	*freq_m*	Value 1 for data in monthly frequency, 0 otherwise	Constructed by the Authors
Quarterly frequency	*freq_q*	Value 1 for data in quarterly frequency, 0 otherwise	Constructed by the Authors
System of equations	*sys_of_eq*	Value 1 for estimation as a system of equations, 0 otherwise	Constructed by the Authors
Error correction based models	*ecm_est*	Value 1 for estimation using ECM, ARDL, MG, or PMG model, 0 otherwise	Constructed by the Authors
(iii) Variable Reflecting Sample Size			
Sample size	*sample_size*	Number of periods in the sample	Constructed by the Authors
(iv) Variables that Capture Specific Authors' Characteristics			
Authors' max ***h***-index - Research gate	*h_max_rg*	Authors' h-index - highest value from among all co-operating authors	Research gate
(v) Variables Accounting for Research or Data Quality			
Paper Impact Factor - simple	*impact_simple*	Paper Impact Factor - simple	Repec
Working Paper Series	*work_paper*	Value 1 for working, discussion, or policy book series, 0 otherwise	Constructed by the Authors
Study Specific Variables			
Rates on long-term loans	*maturity_long*	Value 1 for rates on loans with maturity over 1 year, 0 otherwise (if the maturity is not explicitly defined in the paper, then the loan is considered a short-term loan; exceptions are mortgage and saving bonds, which are considered long-term loans	Constructed by the Authors
Money market rate as reference rate	*ref_mmr*	Value 1 if the money market rate was used as the main reference rate, 0 otherwise	Constructed by the Authors
Monetary policy rate as reference rate	*ref_mpr*	Value 1 if the monetary policy rate was used as the main reference rate, 0 otherwise	Constructed by the Authors
Capital market rate as reference rate	*ref_cmr*	Value 1 if the capital market rate was used as the main reference rate, 0 otherwise	Constructed by the Authors
Rates on loans to NFC	*lr_nfc*	Value 1 for lending rates on all loans to NFC, 0 otherwise	Constructed by the Authors
Consumer lending rates	*lr_cons*	Value 1 for consumer lending rates, 0 otherwise	Constructed by the Authors
Mortgage lending rates	*lr_mort*	Value 1 for mortgage lending rates, 0 otherwise	Constructed by the Authors
Rates on other loans	*lr_other*	Value 1 for lending rates on all other loans, 0 otherwise	Constructed by the Authors
Average of all lending rates	*lr_average*	Value 1 for averaged lending rates, 0 otherwise	
Macro-Financial Control Variables			
Credit to GDP Ratio	*credit*	Domestic credit provided to private sector (% of GDP)	IMF

Openness of the economy	*openness*	Export of goods and services (% of GDP)	World Bank (WB)
GDP per capita	*gdppc*	GDP per capita (constant 2010 US$)	WB
Market capitalization	*capitalization*	Market capitalization of listed domestic companies (% of GDP)	World Federation of Exchanges database
Stocks traded - turnover ratio	*stock_turnover*	Stocks traded, turnover ratio of domestic shares (%)	World Federation of Exchanges database
Net foreign assets	*nfa*	Net foreign assets are the sum of foreign assets held by monetary authorities and deposit money banks, less their foreign liabilities. Data is in current local currency.	IMF
Claims on central government	*claims_gov_gdp*	Claims on central government (% of GDP) - includes loans to central government institutions, net of deposits.	IMF
Monetary Policy Variables			
Central Bank Independence - Garriga - weighted	*cbi_G*	Measure of Central Bank Independence according to Ana Carolina Garriga - weighted average	Ana Carolina Garriga data set
Central Bank Independence - Garriga - average	*cbi_G_a*	Measure of Central Bank Independence according to Ana Carolina Garriga - average	Ana Carolina Garriga data set
Central Bank Independence - D&E	*cbi_D&E*	Measure of Central Bank Independence according to Dincer and Eichengreen	Dincer and Eichengreen data set
Central Bank Transparency	*cbt_D&E*	Measure of Central Bank Independence according to Dincer and Eichengreen	Dincer and Eichengreen data set
Inflation targeting	*inf_target*	Value 1 if the country uses inflation targeting as the monetary policy framework (referring to median year), 0 otherwise	IMF - AREAER; Bank of England Handbook No. 29
Floating exchange rate regime	*floating_exrate*	Value 1 if the country uses floating rate in any form as the exchange rate regime (referring to median year), 0 otherwise	IMF - AREAER; NBER Working Paper No. 8963

Table A4: Descriptive Statistics of Central Bank Independence

	cbi_G
Maximum	0.899
Minimum	0.157
Mean	0.770
Median	0.857
St. dev.	0.166
Observations	1040

Table A5: Estimation Results with Alternative Measure of CBI by Dincer and Eichengreen (2014), including their central bank transparency measure (CBT)

	Model	(1)
	Dependent Variable	**t_stat**
	Model Specification	GETS Study FE
	α (*precision*)	1.0451***
		(0.3074)
	β (*asymmetry*)	-0.2798
		(0.6138)
Study-Specific Factors	dum_cr_risk	0.0387*
		(0.0211)
	panel_data	-0.2330**
		(0.1053)
	cross_country_est	0.1551
		(0.1162)
	impact_simple	-0.0020
		(0.0030)
	maturity_long	-0.0867
		(0.0598)
	lr_cons	-0.0795
		(0.1054)
	lr_other	-0.0828***
		(0.0253)
	lr_average	-0.2511*
		(0.1380)
Macro-Financial Factors	log(openness)	-0.2004***
		(0.0706)
	log(capitalization)	0.2215***
		(0.0416)
Monetary Policy Factors	log(cbi_D&E)	0.4700***
		(0.0897)
	log(cbt_D&E)	-0.6402***
		(0.1987)
	inf_target	0.1573**
		(0.0583)
	floating_exrate	0.1132**
		(0.0483)
	N	810
	aic	4866
	bic	4942
	Cross-Section	42

Notes: ***, **, * shows statistical significance at the 1%, 5%, and 10% levels. Standard errors are clustered at the study level and shown in parentheses. In the table, we report only variables validated by the GETS variable selection approach.

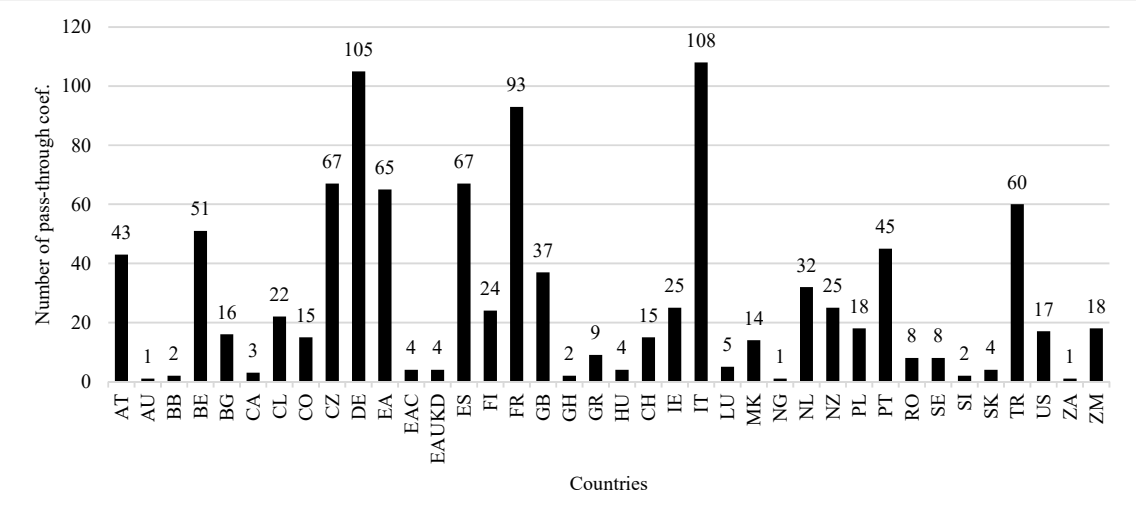
Table A6: Estimation Results of the Split Sample between EA Countries and Non-EA Countries

	Model	(2) EA Countries	(3) Non-EA Countries
	Dependent Variable	**t_stat**	**t_stat**
	Model Specification	GETS Study FE	GETS Study FE
	α (*precision*)	0.9086***	0.3593
		(0.2065)	(0.4690)
	β (*asymmetry*)	-1.2549**	1.8736**
		(0.5824)	(0.8879)
Study-Specific Factors	dum_cr_risk	0.0433	0.0494
		(0.0325)	(0.0441)
	panel_data	0.0535	0.3100
		(0.1073)	(0.2292)
	micro_data	-0.0659	-0.1863
		(0.0647)	(0.1695)
	cross_country	-0.1079	
		(0.0968)	
	freq_q	0.0870	-0.1599*
		(0.0580)	(0.0932)
	ecm_est		-0.0730
			(0.0793)
	sys_of_eq	-0.0084	-0.0805
		(0.0410)	(0.0807)
	sample_size	0.0004	
		(0.0003)	
	h_max_rg	-0.0006	-0.0062
		(0.0023)	(0.0060)
	impact_simple		-0.0161
			(0.0117)
	work_paper	-0.0160	
		(0.0587)	
	maturity_long	-0.0788	-0.2745***
		(0.0575)	(0.0892)
	ref_mpr		0.6256***
			(0.1478)
	ref_cmr	0.0327	0.2024
		(0.0857)	(0.1307)
	lr_cons		-0.2180***
			(0.0727)
	lr_other	-0.0708***	
		(0.0209)	
	lr_average	-0.2400	-0.5671***
		(0.2247)	(0.1643)
Macro-Financial Factors	log(openness)	-0.1626	-0.3399
		(0.1043)	(0.2959)
	log(capitalization)	0.2023***	0.3121*
		(0.0378)	(0.1740)
	log(stock_turnover)	-0.0416*	-0.2838**
		(0.0244)	(0.1307)
	log(nfa)		0.0971***
			(0.0337)
	log(claims_gov_gdp)		0.0062
			(0.0406)
Monetary Policy Factors	log(cbi_G)		-1.7626***
			(0.4863)
	inf_target		0.4015**
			(0.1685)
	N	684	353
	aic	4321	1995
	bic	4398	2076
	Cross-Section	29	26

Notes: ***, **, * shows statistical significance at the 1%, 5%, and 10% levels. Standard errors are clustered at the study level and shown in parentheses. In the table, we report only variables validated by the GETS variable selection approach.

Figures

Figure A1: Collected Interest Rate Pass-Through Coefficients by Country (Area)



Notes: EA = Euro Area; EAC = Euro Area Core; EAUKD = Euro Area, UK, and Denmark estimated as a panel.

Figure A2: Collected Interest Rate Pass-Through Coefficients by Study (Area)