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EXPLAINING THE VARIABILITY OF DEBT NEUTRALITY TESTS RESULTS: A META-ANALYSIS OF RICARDIAN EQUIVALENCE

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Abstract
Many empirical studies trying to verify (or reject) the Ricardian equivalence theorem have been published since 1974, when Barro re-launched the debate about the consequences of debt-financed tax cuts. The results of those studies are mixed, both favoring and rejecting the equivalence. With such mixed results in hand, no one can definitely say if Ricardian equivalence holds or not. Stanley (1998) provides a meta-analysis of 27 studies testing the Ricardian equivalence hypothesis. He finds strong evidence of the hypothesis' falsity. In this paper, I provide similar meta-analysis to that of Stanley, but I add the newest empirical studies to the sample and change the meta-independent variables structure. The results are very similar to those achieved by Stanley.

JEL Classification: C10, H61
Keywords: Ricardian equivalence, debt neutrality, meta-analysis, effect size

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Introduction

Many empirical studies trying to verify (or reject) the Ricardian equivalence theorem have been published since 1974, when Barro re-launched the debate about the consequences of debt-financed tax cuts. The results of those studies are "...all over the map" (Barro, 1989, p. 49). With such mixed results in hand, no one can definitely say if Ricardian equivalence holds or not.

Stanley (1998) provides a meta-analysis of 27 studies testing the Ricardian equivalence hypothesis. He finds strong evidence of the hypothesis' falsity. Furthermore, he finds several characteristics of the studies which significantly influence their results. This paper provides similar meta-analysis to that of Stanley, but it adds the newest empirical studies to the sample and change the meta-independent variables structure.

The structure of this paper is as follows. First, the theoretical introduction to the meta-analysis is provided. Then the necessary steps for making the meta-analysis are presented. Each step is theoretically discussed and some problems are pointed out. Finally, the meta-analysis of Ricardian equivalence is provided.

What is a meta-analysis?

The term "meta-analysis" was first used by Glass (1976). According to his paper, "... meta-analysis refers to the analysis of analyses... the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings" (p. 3). So, it is a collection of statistical procedures, which help us to integrate different results of studies. It can be used for:

- Computing the effect size for studies containing more than one test
- Computing the aggregate effect size for the sample of studies
- Quantifying the influence of the used methodological approaches on obtained results

Glass (1976) used the term "meta-analysis" for the first time to summarize the results of empirical studies in psychotherapy. Later, this method became more important, especially in medicine, psychology and sociology. However, in the field of economics, this method did not become commonly used. Some meta-analytical attempts were made in the field of labour market economics (see for example Stanley and Jarrell, 1998). In general macroeconomics, only a few meta-analytic papers have been published so far. The meta-analysis of money demand (Knell and Stix, 2003), Lucas' critique (Stanley, 1995), or Ricardian equivalence (Stanley, 1998) could be named as examples. The last mentioned study served as a background for this paper.

To conduct a meta-analysis, several steps are necessary. Although their description differs in various papers, they can be formulated, for example, as follows:

- Formulation of the problem
- Collecting of the data

- Data coding
- Analysis of the data
- Interpretation and presentation of the results

Formulation of the problem

The key question of the analysis is quite simple: Does Ricardian equivalence hold? Although it seems that answering this question is the main goal of the meta-analysis, it is only a part of the truth. When reviewing empirical studies testing for debt neutrality, the average effect size is only a partial result, which has to be a subject of further analysis. There are several more questions, which can be answered by a meta-analysis. Which methodological aspects of the reviewed empirical studies influence the obtained results? How do they influence them? Knowing the answers to these questions allows us to interpret the results of particular studies correctly. Moreover, in the case of providing one's own empirical test of the Ricardian hypothesis, there is a higher probability of reducing the number of errors in model construction and using and interpreting the data.

Collecting the data

"The sample of studies for the meta-analysis must contain each study that answers the defined question". This can be read in every "how-to-do-a-meta-analysis" paper. It means that the sample must not only contain published papers, but also working papers, preliminary versions of papers, internet presentations, dissertations and so on. The meta-analyst should do his utmost to obtain those studies and add them to the sample. Omitting an existing study, which is not presented for several reasons, can substantially affect the results.

Various methods for finding empirical studies for this meta-analysis were used. The keywords *test* Ricardian equivalence* were put in an internet browser. More than 6000 links were found, from which were derived 168 empirical studies testing the validity of Ricardian equivalence. Unfortunately, most of them didn't contain characteristics needed for computing the effect size, so they could not be included in the sample[1]. "Manual" searching (searching in references in papers on debt neutrality) was used as well. Using all possible methods, a sample of 33 studies covering the 1987-2004 period was obtained (see table 1). Comparing this sample with Stanley's, there were only six more studies in my sample. However, the samples differ much more. Stanley's sample contained four dissertations. As I didn't have access to those studies, they are not a part of my sample[2].

1. In some cases, the authors of the studies were contacted and asked to add the results needed for the effect size computing. Unfortunately, this proved unsuccessful.
2. Compare Stanley (1998, p. 720) with the Table 1.

Data coding

One of the most important issues in meta-analysis is a study's quality evaluation. While some authors prefer not to differ between studies of different quality - thus using the same weightings for the data - other scientists promote the necessity of using the weighted data according to the quality of the study. In this paper, the first approach will be used. The reason is, that the measurement of the quality is quite difficult and always increases the risk of subjectivity from the author. And if we admit the possibility of objective quality measuring, there remains a better solution for solving the quality problem – including the study's quality between the meta-independent variables.

However, there are more problems, which must be solved before one's own analysis is started. Studies that include multiple tests can be named as examples. These can be studies that test debt neutrality with different methods (Marinheiro, 2001, Darius, 2001, etc.), or studies that test the Ricardian proposition in more than one country (Dalamagas, 1992 a, b, Evans, 1993, etc.). There are two standard approaches. The traditional "Glassian" meta-analysis uses an effect size computed for each test. If we take the Darius' study (where Ricardian equivalence is tested with two different methods in seven countries) as an example, we get 14 individual effect sizes for further analysis. Another possibility is to use the "study effect meta-analysis". In this case, each study has its own effect size, computed as an average of all partial effect sizes.

None of these approaches seems to be suitable for the meta-analysis of Ricardian equivalence. The Glassian approach would generate a sample containing hundreds of effect sizes, which is hard to work with. However, the usage of the study effects, however, is not without problems, too. The aggregation of the results can be too high, which can significantly bias the final results.

Inspired by Stanley, I chose the 'third way'. In case of multiple tests studies, the results of the most sophisticated test were used[3]. If the study still generated more than one test (testing in more countries or testing with more methods, which were considered as equal), the results were averaged.

3. If the study contained both tests using the intertemporal optimization and reduced-form consumption function, the results of the intertemporal model were used. In the case of more than one reduced-form consumption function in a study, the results were averaged even if the functions were different.

Analysis and interpretation

a) Non-equivalence effect size

The analyzed studies differ not only in used data, samples of countries or methodological aspects, but in the statistical tests used as well. Probably, the most used is the traditional F-test, or (when testing single parameter restriction) t-test. Both of these tests have F-distribution. However, there are more possible tests to use (Wald test, Lagrange multiplier), but they have χ^2 distribution. Both F and χ^2 depend on the degrees of freedom, which differ through the studies. The results of studies using such a heterogeneous mix of statistical tests are difficult to compare and summarize. Because of this, it is necessary to convert the results to a standard normal variable.

The standard normal variable, to which all the results can be converted, is called effect size. This variable has been created for comparing the results of studies, which contained the treatment (experimental) group and the control group. The effect size d[4] is given as:

$$d = \frac{\mu_e - \mu_c}{\sigma} \tag{1}$$

where μ_e is the mean value of treatment group results, μ_c is the mean value of the control group results and σ is the standard deviation of control group results. The effect size is a dimensionless variable, which has the standard normal distribution (0;1). So it allows the results to be compared, aggregated, averaged etc.

In the field of macroeconomics, different approaches of effect size computing must be used, because most empirical tests are based on regressions. In this paper, the non-equivalence effect size (NEES) is computed and then analyzed. Like Cohen's *d*, it is a standard normal variable. To maintain the comparability, the same relations as in Stanley's paper have been used. If F-tests for parameter restrictions were used in the study, the NEES was computed as:

$$NEES = \frac{\sqrt[3]{f}\left(1-\frac{2}{9}v_2\right)-\left(1-\frac{2}{9}v_1\right)}{\sqrt{\left(\frac{2}{9}v_1+\sqrt[3]{f}^2\,\frac{2}{9}v_2\right)}} \tag{2}$$

4. Cohen's *d* shows, the degree at which the phenomenon is present in the society'. See Cohen (1988).

When Wald tests or Lagrange multipliers were used in the study, the NEES was computed as:

$$NEES = \frac{\sqrt[3]{\frac{\chi^2}{v}} - \left(1 - \frac{2}{9}v\right)}{\sqrt{\frac{2}{9}v}} \tag{3}$$

NEES is a dimensionless variable that shows the strength of evidence against the Ricardian hypothesis validity. The higher the NEES value, the higher the probability of rejecting the null hypothesis. The greater the values of NEES close to zero, the higher the probability of debt neutrality[5]. When the results of empirical study are converted to this variable, the standard statistical methods for further analysis can be used. The values of NEES are shown in Table 1.

Table 1. The NEES values for individual studies

Study	**NEES**	Study	**NEES**
Afonso (2001)	2,965	Gupta (1992)	1,252
Ahmed (1987)	1,064	Haque-Montiel (1989)	4,093
Bagliano (1994)	3,152	Haug (1990)	1,853
Bayoumi-Masson (1998)	3,35	Katsaitis (1987)	0,996
Beck (1993)	1,878	Lucke (1999)	4,807
Bernheim (1987)	5,689	Mandel-Tomšík (2003)	2,714
Boothe (1989)	-0,379	Marinheiro (2001)	0,688
Croushore et al (1989)	5,426	Massey et al (2004)	2,862
Dalamagas (1992a)	7,313	Monadjemi - Kearney (1991)	2,038
Dalamagas (1992b)	3,400	Olekalns (1989)	0,892
Darius (2001)	0,212	Poterba-Summers (1987)	2,022
Darrat (1989)	0,808	Viren (1988)	2,622
De Haan – Zelhorst (1988)	2,517	Wheeler (1999)	-1,930
Enders-Lee (1990)	0,482	Whelan (1991)	1,975
Evans (1988)	-1,320	Wroblowský-Macháček (2003)	1,356
Evans (1993)	5,959	Yuli – Tien Ming (2003)	0,451
Graham (1992)	2,552		

5. In some cases, the value of NEES can be lower than zero. This means that households behave as ultra-ricardian. When the government substitutes debt for taxes, they decrease their consumption.

From these values, the average non-equivalence effect size $\tilde{N}$ was computed. To test the statistical significance of $\tilde{N}$, the z variable must be compared with the value 1,96 (critical value for the normal distribution N(0;1)). The z variable can be derived as:

$$z = \tilde{N}.\sqrt{L} \tag{2}$$

where L is the number of studies in the sample.

The value of $\tilde{N}$ is 2,20. The value of z is much higher than the critical value 1,96. The standard deviation of NEES is 2,054. Cohen (1988) takes the effect size values around 0,25σ as small, around 0,50σ as medium and around 1,0σ as high. Following this approach, the value of $\tilde{N}$=2,20 can be considered as strong evidence against the Ricardian equivalence hypothesis. The $\mu_{NEES}=2,20$, $\sigma^2 = 4,090$. The null hypothesis $H_0{:}\mu_N=0$ is strongly rejected (t=6,31, p<0,01). The value of σ^2 significantly exceeds the value of standard normal distribution and indices the excess variance of NEES (χ^2=131,77; p<0,01). These values are fully comparable with those achieved by Stanley (1998).

The high value of σ^2 poses a question: What is the cause of such big differences in the empirical tests results? The answer to this question can be obtained by creating and analyzing the meta-independent variable. These are the study characteristics, which can influence the result of the study. The following meta-independent variables have been created:

b) Meta-independent variables

α) Dependent variables

The first three meta-independent variables were created to find if, and how, the choice of a dependent variable in the test influences the results. ***Cons*** is a variable showing if the private consumption has been used as the dependent variable in the study. ***Inter*** shows if the interest rate has been used as dependent variable, ***Ca*** shows if current account surplus/deficit has been used.[6] Of course, there are more variables that can be used as dependent in the study. All of the studies in the sample, however, use only one of the three named above. So, no other meta-independent variables of that type are necessary.

6. If the variable has been used in the study, then the meta-independent variable is equal to 1. If not, it is equal to zero. See Appendix for the meta-independent variables values.

β) Sample of countries

One can assume that the choice of country can influence the results of empirical tests. These are the variables that have been created for the quantification of such influence. ***US*** is used to show that the hypothesis has been tested only on US data. ***OECD*** shows that the hypothesis has been tested on data from OECD countries. From these countries, the United States and the former socialist countries are excluded. Czech Republic, Poland, Hungary and Slovakia are a part of the ***DeTrans*** variable. This shows if data from either a developing or a post-socialist country have been used. If the hypothesis is tested in more than one country, the value 1 is given to the type of countries that prevailed in the sample.

γ) Methodological approaches

It is obvious, that the final results of each study are influenced by methods and techniques used. I considered it necessary to analyze the following approaches, methods and techniques: ***Expect*** shows, that the model has been based primarily on rational expectations. ***Pih*** shows, that the model has been based on a permanent income hypothesis. ***Keynes*** contains the studies using the Keynesian model with disposable income as an independent variable. ***Diff*** shows if the model has been set primarily in differences. ***Lag*** shows, if the lagged dependent variable has been used as an independent variable. ***Var*** shows, if the vector-autoregressive model has been used.

δ) Data and other characteristics

The results of empirical studies can be influenced by the character and structure of the data. The variable ***annual*** shows if the data with annual frequention has been used (it has the value of zero if quarterly or monthly data has been used). ***Adjust*** shows if the data has been seasonally adjusted.

The measurement of a study‘s quality is very difficult, and it always brings some sort of subjectivity to the analysis. So, a proxy variable for the study’s quality should be added to the meta-independent variables sample. Therefore, this paper uses the simple variable (***publ***) as a proxy. This meta-independent variable shows if the empirical study has been published in a peer reviewed journal. Although not a rule, it can be assumed that the unpublished studies have not been published because of lower quality.

The last meta-independent variable is ***df*** (degrees of freedom). This variable can be taken as a variable measuring the quality of an empirical test as well. The *df* is equal to *n-k*, where *n* is the number of observations and *k* is the number of parameters in the regression. Knowing that, one can say that the higher the *df*, the better the explanatory power (and so, the quality).

c) Estimated influence of meta-independent variables on empirical tests results

To estimate the influence of meta-independent variables we can use simple regression:

$$NEES_i = \alpha_0 + \sum_{j=1}^{J} \alpha_j Z_{ij} + \varepsilon_i \tag{3}$$

where $NEES_i$ is the effect size of the study and Z_{ij} are the values of meta-independent variables for each study.

Before estimating the equation 3, the number of meta-independent variables must be reduced, because some of them show linear dependence. *Inter*, *ca* and *detrans* were removed as a result. Now the equation 3 can be estimated. The results are shown in table 2.

Table 2. Parameters estimation of equation (3)

Dependent variable: NEES Method: OLS Number of observations: 33				
Variable	Coefficient	St. deviation	t-statistics	Prob.
constant	-0.539791	1.837581	-0.293751	0.7720
DF	0.003619	0.002030	1.782980	0.0898
CONS	2.968480	1.085915	2.733621	0.0128
US+OECD	0.829742	0.939414	0.883255	0.3876
EXPECT	-3.093466	1.502192	-2.059302	0.0527
LAG	0.234393	0.746428	0.314019	0.7568
DIFF	-0.219234	0.745985	-0.293885	0.7719
VAR	1.989738	1.540204	1.291867	0.2111
PUBL	1.064771	0.981676	1.084647	0.2910
ANNUAL	-0.919875	0.961951	-0.956260	0.3504
ADJUST	-4.136845	1.835188	-2.254181	0.0356
PIH	0.621606	0.901070	0.689853	0.4982
KEYNES	-0.764186	1.061375	-0.719996	0.4799
R^2 = 0.554175, adj. R^2 =0.286681, DW = 2.314389, F-stat = 2.071725				

The obtained results can be interpreted as follows. The value of the constant is relatively low and statistically not significant. In all following estimations, it will be removed from the regression.

The positive value of parameter in the case of degrees of freedom (statistically significant at 10% significance level) is further evidence against the Ricardian proposition. As mentioned before, the higher the number of observations, the higher the number of degrees of freedom. If the number of observations increases the NEES value, then it's necessary to agree with Stanley (1998, p. 722) that "...such a significant relation is consistent only with the falsity of Ricardian equivalence". If one assumes that the Ricardian equivalence is a good approximation of reality, then the higher number of observations couldn't increase the probability of rejection of the hypothesis.

The parameter of the meta-independent variable *cons* is positive and statistically significant at a 5% significance level. So, it can be said that studies examining the relationship between deficit (or debt) and private consumption tend to reject the Ricardian equivalence. Alternatively, the estimations of equation (3) with variables *inter* and *ca* instead of *cons* have been provided. In both cases, the values of corresponding coefficients are negative, but less statistically significant. Thus, studies testing the relationship between deficit and interest rates (and deficit and current account as well) tend to confirm debt neutrality. However, constant interest rates or constant current account surplus are not sufficient conditions for confirming the Ricardian hypothesis (see Rose – Hakes, 1996 for the discussion of interest rates and Macháček – Wroblowský, 2004 for the discussion of the current account).

The values of meta-independent variables US and OECD have been put together. So, the variable US+OECD shows if the hypothesis has been tested on a sample of developed countries. It can be assumed that debt neutrality is more probable in countries where there are developed financial markets with consumers who have already learned the rules of market economy. On the contrary, the probability of confirming the hypothesis in developing countries or countries in transition should be quite low (see Wroblowský – Macháček, 2003 for more detailed discussion). The results of the estimates do not confirm these assumptions. The US+OECD parameter is positive, which means that studies testing debt neutrality on a sample of developed countries are more likely to reject the hypothesis. The reliability of the data might be a possible explanation. While the data published in developed countries can be taken as relatively reliable, the quality and availability of the data are questionable in the developing countries. Then, the authors of empirical studies often have to use various proxy variables and derive the data from unofficial databases. That approach may (but doesn't have to) bias the obtained results. However, it is necessary to keep in mind that the parameter of *US+OECD* variable has been estimated as statistically insignificant.

For the validity of Ricardian equivalence, it is necessary to have households forming rational expectations. Thus, we can expect that studies based on rational expectations are more likely to confirm debt neutrality. This assumption is confirmed by the estimation, the value of parameter expect is negative (statistically significant at 10% significance level) and the second highest. So, studies based on rational expectations are biased in a pro-Ricardian way. An alternative explanation of the parameter's value is offered by Stanley (1998). According to his paper, studies based on rational expectation models are more frequently misspecified. For further discussion, see Stanley's paper on meta-analysis of Lucas' critique (Stanley, 1995).

Estimation of equation (3) shows, that adding the lagged dependent variable into the sample of independent variables, as well as using the variables in differences, has no significant impact on obtained results. Both parameters of ***lag*** and ***diff*** are quite low and statistically not significant. Authors who want to test the Ricardian equivalence don't have to be afraid that using lagged variables or their values in differences will bias the final result. The usage of a vector autoregressive model appeared to be biasing the results against the Ricardian hypothesis. The value of the parameter is positive and quite high, but not statistically significant at any conventional significance level.

Quite surprising results have been derived in the case of ***pih*** and ***keynes***. The Ricardian equivalence theorem is the permanent income/life cycle hypothesis (PILCH) applied in an infinite horizon. Thus, studies based on a permanent income hypothesis should generate pro-Ricardian results, while studies based on the traditional Keynesian model with disposable income should reject the hypothesis. The results of the estimation, however, are opposites. The ***pih*** coefficient has been estimated positive. This means that studies based on PILCH are biased against the validity of Ricardian equivalence. On the other hand, studies based on the Keynesian disposable income models tend to confirm debt neutrality since the values of the ***keynes*** parameter is negative. One possible explanation of the ***pih*** value may be that a significant amount of households are not able to estimate their permanent income correctly. Finding an explanation of the ***keynes*** variable is much more difficult. According to Barsky *et al.* (1986), the values of marginal propensities to consume as a reaction to debt-financed tax cuts tend to be more Keynesian than Ricardian, but their values are not high enough to reject the Ricardian hypothesis[7]. The researcher still needs to keep in mind the statistical insignificance of both parameters.

7. Presented explanations of the ***keynes*** and ***pih*** parameters can be used only if their values are explained separately. However, there's probably no theoretical explanation of the co-existence of positive ***pih*** and negative ***keynes***. As the same results were obtained in Stanley's study, additional research on this topic is needed.

As far as meta-independent variables examining the treatment of the data are concerned, both parameters of ***annual*** and ***adjust*** are negative. We can say that studies based on the annual data generate results that are more consistent with the Ricardian hypothesis than studies based on data with higher frequency (quarterly, monthly). The parameter of adjustment was estimated as the highest (statistically significant at 5% significance level). This result implies that the seasonal adjustment of the data can significantly bias the results in a pro-Ricardian way. The estimation of the ***annual*** and ***adjust*** parameters reveals that seasonal fluctuations have significant impact on the reaction of households when government substitutes taxes for debt. The seasonal fluctuations can increase the uncertainty about a household's future income, and this could lead to an increase in private consumption.

The last of the estimated parameters is ***publ***. Its value is positive, but not statistically significant. Abstracting from the statistical insignificance, this result can be taken as evidence against the debt neutrality hypothesis, because published (better) studies show a higher chance of rejection of the hypothesis than studies that were not published.

Comparing the obtained results with Stanley (1998), the signs of estimated parameters used in both meta-analyses are the same. The absolute values of the parameters don't show significant differences. However, there are big differences in the statistical significance of the estimated parameters and the whole model. While Stanley's parameters are usually significant at a 1% significance level, this papers estimation generates less statistically significant results. Looking at the model itself, Stanley's R^2 is 0,846, but in this paper it is 0,554. When looking at the adjusted R^2, the difference is even higher. If the change of one third of the sample brings such high differences in statistical significance, the results of the meta-analysis are questionable.

Taking the statistical insignificance of some parameters into account, I decided to reduce the number of meta-independent variables. After experimenting with the model, I found six meta-independent variables to be the most significant. Estimation of a reduced equation (3) is shown in the following table.

After the reduction of the sample of meta-independent variables, only a small drop in the R^2 appeared. This shows that omitted variables had negligible impact on the explanation of NEES behaviour. All parameters have the same signs as before, and the statistical significance of individual parameters increased.

Table 3. Parameters estimation of equation (3) with reduced number of meta-independent variables

Dependent variable: NEES Method: OLS Number of observations: 33				
Variable	Coefficient	St. deviation	t-statistics	Prob.
DF	0.003686	0.001709	2.157269	0.0400
CONS	1.820014	0.497359	3.659357	0.0011
EXPECT	-1.189473	0.620556	-1.916785	0.0659
PIH	1.115514	0.680673	1.638840	0.1128
ADJUST	-2.165129	1.036626	-2.088631	0.0463
PUBL	0.690821	0.510931	1.352082	0.1876
$R^2 = 0.503868$, adj. $R^2 = 0.411991$, $DW = 2.109323$				

Weaknesses of meta-analysis

Meta-analysis, like any other scientific method, has some questionable points. These should be taken into account when interpreting the final results. One of them – high sensitivity of the results on the used sample – has already been documented above, but there are some others that should be mentioned.

The sample for the meta-analysis often contains studies which have units of analysis with different definitions. Here is an example. If the efficiency of new educational approaches is examined, the unit of an analysis can be a student or the whole school. This problem seems to be not very important when meta-analysing the Ricardian equivalence, because the unit for the analysis should always be the entire economy. Of course, there are exceptions. For example, the study of Cadsby and Frank (1991) is a laboratory experiment with students, who are divided into various groups according to the overlapping generations model. Their behavior is examined and the Ricardian equivalence then tested. In this particular study, the unit of an analysis is the student, or created dynasty.

Another problem is the analysis of studies where the same variables are measured in different ways ('apple and orange' problem). This aspect plays a key role in meta-analysis of Ricardian equivalence. The dependent variables used in the studies can be taken as an example. While there are no significant differences in the case of current account deficits, this is not the same in the case of private consumption. This variable is frequently used in different ways, different measurements, and so forth (see the discussion in Graham, 1992). A similar problem can be found in studies which use the interest rates as a dependent variable. The same difficulties appear in the case of independent variables. For example, the deficit is a variable which is constructed and measured differently in almost every study. Aggregation of the studies with so many differently measured variables is always questionable, and it has significant impact on the explanatory power of the analysis.

Every scientist conducting research wants his results to be conclusive. Unfortunately, it frequently happens that the analysis is 'filed and forgotten' if the results are not statistically significant (the 'file-drawer' effect). This phenomenon is, of course, connected with the understandable unwillingness of the publishers to publish such inconclusive studies. As mentioned above, meta-analysis should analyze all studies - not only those that have been published. It must analyze inconclusive studies as well. It goes without saying that unpublished studies are always hard to get. Therefore, some of them may be omitted in the sample. This leads to the so called availability bias.

Conclusion

According to the results provided by meta-analysis, there are several factors which significantly influence the results of empirical studies that test the Ricardian proposition.

The growing number of degrees of freedom, as well as the quality of the study, increase the probability of rejecting the Ricardian hypothesis. These findings can be taken as evidence against Ricardian equivalence. Using private consumption as a dependent variable in the study biases its results against debt neutrality. Using interest rates, or the current account, generates results favoring the equivalence. If the model is based on rational expectations, and if the data are seasonally adjusted, the results are significantly influenced in a pro-Ricardian direction.

The most surprising results of the meta-analysis were obtained in the case of income. According to the theory, studies based on PILCH should generate results favoring the Ricardian proposition, while studies based on a Keynesian approach should reject the hypothesis. However, the meta-analysis shows the opposite results.

Appendix. Values of NEES and meta-independent variables

Studie	NEES	df	cons	inter	CA	US	OECD	DeTrans	Exp	Lag	Diff	Var	Publ	Annual	Adjust	PIH	Keynes
Afonso (2001)	2,965	398	1	0	0	0	1	0	1	0	0	1	0	1	0	1	0
Ahmed (1987)	1,064	92	0	0	1	0	1	0	0	0	1	0	1	1	0	0	0
Bagliano (1994)	3,152	365	1	0	0	0	1	0	1	0	1	0	1	0	0	1	0
Bayoumi-Masson (1998)	3,35	241	1	0	0	0	1	0	0	1	1	0	0	1	0	0	1
Beck (1993)	1,878	570	0	1	0	1	0	0	1	0	1	1	1	0	0	0	0
Bernheim (1987)	5,69	282	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0
Boothe (1989)	-0,38	63	0	1	0	0	1	0	1	0	1	1	1	0	0	1	0
Croushore et al (1989)	5,426	88	1	0	0	1	0	0	0	0	0	0	1	1	0	0	1
Dalamagas (1992a)	7,31	477	1	0	0	0	0	1	1	1	0	1	1	1	0	1	0
Dalamagas (1992b)	3,4	510	1	0	0	0	0	1	1	1	0	1	1	1	0	1	0
Darius (2001)	0,212	205	1	0	0	0	0	1	0	0	0	0	1	1	0	0	1
Darrat (1989)	0,81	31	0	1	0	1	0	0	1	1	1	1	1	1	0	0	0
De Haan – Zelhorst (1988)	2,517	88	1	0	0	0	1	0	0	0	0	0	1	1	0	0	1
Enders-Lee (1990)	0,482	144	1	0	1	1	0	0	1	1	1	1	1	0	0	0	0
Evans (1988)	-1,32	153	1	0	0	1	0	0	1	1	0	0	1	1	0	0	0
Evans (1993)	5,96	494	1	0	0	0	1	0	0	0	1	0	1	1	0	1	0
Graham (1992)	2,552	25	1	0	0	1	0	0	0	0	1	0	1	1	0	0	1
Gupta (1992)	1,252	13	1	0	0	0	0	1	1	1	0	1	1	1	0	0	0
Haque-Montiel (1989)	4,09	50	1	0	0	0	0	1	0	1	0	0	1	1	0	1	0
Haug (1990)	1,853	39	1	0	0	1	0	0	1	1	1	1	1	1	0	1	0
Katsaitis (1987)	0,966	53	1	0	0	0	1	0	1	1	0	1	1	0	1	1	0
Lucke (1999)	4,807	132	1	0	0	0	1	0	0	0	1	0	0	0	0	1	0
Mandel-Tomšík (2003)	2,714	34	1	0	0	0	0	1	0	0	1	0	1	0	0	0	1
Marinheiro (2001)	0,688	36	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1
Massey et al (2004)	1,862	48	0	1	0	1	0	0	0	0	1	0	1	1	0	0	0
Monadjemi - Kearney (1991)	2,038	47	0	1	0	0	1	0	0	1	0	0	1	0	0	0	1
Olekalns (1989)	0,892	53	1	0	0	0	1	0	1	1	0	1	1	0	1	0	0
Poterba-Summers (1987)	2,022	153	1	0	0	1	0	0	0	1	0	0	1	1	0	0	0
Viren (1988)	2,622	198	0	1	0	0	1	0	0	0	0	0	1	1	0	0	0
Wheeler (1999)	-1,93	127	0	1	0	1	0	0	0	0	0	1	1	0	1	1	0
Whelan (1991)	1,975	20	1	0	0	0	1	0	0	0	1	0	1	1	0	0	1
Wroblowský-Macháček (2003)	1,356	33	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1
Yuli – Tien Ming (2003)	0,451	512	0	1	0	0	1	0	0	1	1	0	1	1	0	0	0

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