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Meta-Regression Analysis as the Socio-Economics of Economic Research

T.D. Stanley, Chris Doucouliagos, Stephen B. Jarrell

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By

*T.D. Stanley, Chris Doucouliagos, Stephen B. Jarrell **

Abstract:

Meta-regression analysis (MRA) provides an empirical framework through which to integrate disparate economic research results, filter out likely publication bias, and explain their wide variation using socio-economic and econometric explanatory variables (Stanley and Jarrell, 1989, Stanley, 2001, Doucouliagos, 2005, Stanley, 2005a). In dozens of applications, MRA has found excess variation among reported research findings, some of which is explained by socio-economic variables (e.g., researcher's gender) and most of which contains publication bias (Card and Krueger, 1995, Stanley, 1998, Stanley and Jarrell, 1998, Ashenfelter *et al*.,1999, Görg and Strobl, 2001, Stanley, 2001, Doucouliagos and Laroche, 2003, Abreu, de Groot and Florax, 2005, Doucouliagos, 2005, Rose and Stanley, 2005, Stanley, 2005a). Publication bias is itself a socio-economic phenomenon. When researchers' compensation is based on their publication records, all available research degrees of freedom will be used to increase its probability. MRA can empirically model and test socio-economic theories about economic research. The socio-economics of the academy can explain why excess variation (beyond the classical, random sampling errors that conventional standard errors measure) will likely dominate many areas of empirical economic research, and MRA can explain how. Here, we make two strong claims: socio-economic MRAs, broadly conceived, explain much of the excess variation routinely found in empirical economic research; whereas, any other type of literature review (or summary) is biased. A14, B41, C10.

* Department of Economics and Business
Hendrix College
1600 Washington St.
Conway, AR 72032
Stanley@Hendrix.edu

Accounting, Economics and Finance
Faculty of Business and Law
Deakin University
221 Burwood Highway, Burwood, 3193
Victoria, Australia
Chris.doucouliagos@deakin.edu.au

Department of Management and International Business
College of Business
Western Carolina University
Cullowhee, NC 28723
Jarrell@email.wcu.edu

I. Introduction

Recently, the *Journal of Socio-Economics* devoted a *Special Issue* to the abuses of statistical significance in economics (Altman, 2004, Ziliak and McCloskey, 2004, Gigerenzer, 2004). "Most researchers. . . are not really interested in statistical thinking, but only in how to get their papers published" (Gigerenzer, 2004, p. 588). Our paper attempts to advance this important discussion a step or two. The common abuse of statistical significance testing routinely found in empirical economics leaves an empirical trace. This trace of statistical selection can be identified by meta-regression analysis (MRA) and used to correct the magnitude of reported empirical effects for their publication selection biases (Stanley, 2005a). When a research literature is viewed as a whole, the abuse of statistical reasoning may be rendered harmless.

We present an empirical framework, a meta-regression model, that allows reviewers to identify and correct the overuse of statistical significance. But publication selection is more than a simple misunderstanding, or naiveté, of statistics; it is a quintessential socio-economic phenomenon that is transmitted by the academy and formalized by our professional promotion, tenure and compensation systems. "It should be noted that if prospective authors perceive that publishing as well as tenure and promotion requires that one adapt to current cultural statistical practices, they will engage in the bad practices irrespective of cost and state of knowledge" (Altman, 2004, p.659). With the aid of our MRA model, the statistics that economists choose to report can reveal as much about the socio-economics of economic research as about the economic phenomenon for which the research is purportedly conducted. Furthermore, these MRA methods can correct important empirical economic magnitudes for the current research culture of statistical abuse.

Meta-analysis serves as a quantitative literature review (Stanley, 2001). "Meta-analysis is the analysis of empirical-analyses that attempts to integrate and explain the literature about some important parameter" (Stanley and Jarrell, 1989, p. 163). It can explain the excess study-to-study variation typically found in empirical economics, uncover the trace of statistical power that is associated with a false theory, and see through the distortion of publication bias when each test potentially contains misspecification and publication biases (Stanley, 2005a).

Meta-analysis has long been relied upon by medical and social science researchers to make the most of costly experimental treatments and to uncover their underlying message. Experimental studies typically come to very different conclusions, making intelligent

summary difficult. By combining the results of all studies on a particular phenomenon into one statistical analysis, meta-regression analysis (MRA) is better positioned to distinguish the primary effects from background variation and contaminating influences.[1] Also, meta-regression analysis may be used to shed light on the research process itself by explaining the variation in findings across different studies. It is "how science takes stock" (Hunt, 1997). "Meta-analysis is now a widely used technique for summarizing evidence from multiple studies" (Sutton *et al.* 2000a, p.421).

In economics, MRA has been employed to explain dozens of areas of research including: estimates of the union wage gap and gender wage discrimination (Jarrell and Stanley 1990, Stanley and Jarrell, 1998, Jarrell and Stanley, 2004), evaluations of recreation benefits (Smith and Kaoru 1990, Rosenberger and Loomis 2000), the spillover effects of multinational corporations (Görg and Strobl 2001), identifying environmental impacts (Bergh, et al. 1997), tests of unemployment hysteresis, the natural rate hypothesis and Ricardian equivalence (Stanley 1998, 2004, 2005b) and the relationship between freedom and economic growth (Doucouliagos, 2005), to mention but a few.[2]

Many modern economic methodologists have called for 'the recovery of practice,' that is, a more empirical and less *a priori*, normative appraisal of economic theory (*e.g.*, Caldwell, 1994). Meta-analysis is designed to provide an internal evaluation of empirical economic research, using the same standards professed by orthodox empirical economics without imposing outside normative philosophical criteria. Rather than using methodological selective bias to discount evidence unfavorable to the reviewer's prior theoretical beliefs, as conventional reviews often do, meta-analysis forces the reviewer to include all research and permits her to employ more objective measures of research quality (sample size, number of specification tests passed, omissions of relevant variables, *etc*.) to help explain the wide variation of reported research results (Stanley, 2001). With meta-analysis, it is the research record itself, through objective statistical testing, that determines the research literature's 'message.'

Research dimensions such as: socio-economic characteristics of the researcher (gender, experience, income, ideology, funding source, etc.), measures of research quality,

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[1] Meta-regression analysis is a subset of meta-analysis. It is a regression analysis of the estimates from previous regression analyses, which attempts to explain the wide variation in their values (Stanley and Jarrell, 1989). The great majority of meta-analyses in economics have been MRAs, but MRAs are rather rare in the broader social and medical sciences.

[2] See Stanley (2001, *Table 1*) and Florax, deGroot, and deMooij (2001) for longer lists.

model adequacy and past research findings, which cannot be used in the original research studies due to the absence of variation, are routinely used in meta-regression analysis to explain the observed excess variation in economic results. How can simple statistical techniques meaningfully evaluate the rich and complex socio-economic phenomena that we call 'research?' Does the selective presentation and publication of orthodox economic research results irreparably bias any evaluation of the empirical literature? What strategies and MRA models have been found useful in separating the wheat from the chaff?

The next section offers a general framework in which to model economic research and accommodate routine problems such as publication and misspecification biases. Section III reviews the economic literature on economic research; that is, how economists have chosen to explain and investigate the scientific research enterprise. Section IV, "Novelty and Fashion in Economic Research," applies this socio-economic model of research to three separate meta-analyses and, in the process, tests the 'Goldfarb conjecture,' that economic research fashion has a predicable life-cycle (Goldfarb, 1995). Section V concludes.

II. Meta-Regression Analysis as a Solution to Publication Bias

> "Some people hate the very name of statistics, but I find them full of beauty and interest. . . They are the only tools by which an opening can be cut through the formidable thicket of difficulties that bars the path of those who pursue the Science of man." – Galton (1889)

a. The Meta-Regression Model[3]

Applied economic research usually entails a conventional regression model:

$$Y = X\beta + \varepsilon \qquad (1)$$

Where Y is the nx1 dependent variable vector representing the measures of the economic phenomenon at issue, $X\beta$ is the explanatory model used in the original empirical literature, and ε is the random error vector, i.i.d. Here, the regression equation is denoted as the 'original' model to differentiate it clearly from various meta-regression models.

Empirical economic studies attempt to identify the determinants of economic phenomena, to estimate the magnitude of the interconnections among economic phenomena, or to test particular economic hypotheses. When an empirical investigation is explanatory,

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[3] This section is a restatement and extension of the original MRA model presented in (Stanley and Jarrell, 1989).

the magnitude and significance of some particular regression coefficient, say β (which is typically only one parameter in the Kx1 vector β of equation (1)) becomes the key issue. For example, the magnitude of the gender wage gap and its trend (Stanley and Jarrell, 1998, Jarrell and Stanley, 2004), the relationship of economic freedom to economic growth (Doucouliagos, 2005), the increase in international trade attributed to the adoption of a common currency (*e.g.,* the euro) (Rose and Stanley, 2005), or the elasticity for the demand of water (Dalhuisen *et al*., 2003) all involve the magnitude of underlying regression parameters that are routinely estimated by empirical economics.

> *Such an empirical research environment suggests the following meta-regression model to integrate and explain its diverse findings.*
>
> $$b_j = \beta + \sum_{k=1}^{K} \alpha_k Z_{jk} + e_j \qquad (j=1, 2, \ldots L) \qquad (2)$$
>
> *Here b_j is the reported estimate of β of the j^{th} study in a literature comprised of L studies, β is the 'true' value of the parameter of interest, Z_{jk} are the meta-independent variables which measure relevant characteristics of an empirical study and explain its systematic variation from other results in the literature, α_ks are the meta-regression coefficients which reflect the biasing effect of particular study characteristics, and e_j is the meta-regression disturbance term.*
>
> (Stanley and Jarrell, 1989, p. 165).

Experience over the past two decades of applying meta-regression analysis (MRA) to economics suggests that the moderator variables, Z_{jk}, should include:

1. a measure of the estimate's precision or accuracy (Se_j or df_j).
2. selected model specification characteristics of equation (1).
3. quality measures, such as: the number of specification tests passed by the original model or degrees of freedom (df_j) used in its estimation.
4. characteristics of the author, such as her gender and institutional affiliations.
5. characteristics of the data.

"Like all other empirical economic investigations, the final selection of equation (2) should be determined by reference to the data, in this case, the entire empirical literature on a particular issue" (Stanley and Jarrell, 1989, p. 165). The precision of the estimator, (1) above, is key to modeling and correcting publication selection bias, a topic we turn to next.

b. Publication Selection Bias as a Socio-Economic Phenomenon and its MRA Correction

> "Many other commentators have addressed the issue of publication bias. . . . All agree that it is a serious problem." – Begg and Berlin (1988, p.421)

Publication bias has long been a major concern for meta-analysts. Researchers, reviewers and editors treat 'statistically significant' results more favorably; hence, they are more likely to be published. Studies that find relatively small and 'insignificant' effects are much less likely to be published, because they may be thought to say little about the phenomenon in question. The problem for intelligent summary or review is that publication selection biases make empirical effects seem larger than they are. For example, publication bias distorts the average measure of the price elasticities of water demand by a factor of three or four-fold (Stanley, 2005a).

For nearly a half century, medical researchers and social scientists have acknowledged the seriousness of publication selection (Sterling, 1959, Rosenthal, 1979, Begg and Berlin, 1988). More recently, economists have uncovered significant publication selection bias (both statistically and practically) in many areas of economic research with the help of meta-regression analysis (Card and Krueger, 1995, Ashenfelter *et al*., 1999, Görg and Strobl, 2001, Doucouliagos, Laroche and Stanley, 2005, Abreu, de Groot and Florax, 2005, Doucouliagos, 2005, Rose and Stanley, 2005, Stanley, 2005a, Mookerjee, 2006). The publicity of the tragic effects of publication bias (*e.g.*, the increased teen suicides attributed in the media to taking Paxil) have caused the leading medical journals to require prior registration of clinical trials as a condition for their later publication (Krakovsky, 2004). It speaks volumes when the editors of our most respected economics journals are sufficiently concerned about the harmful effects of publication selection to model publication bias and attempt to filter it out using MRA (Card and Krueger, 1995, Ashenfelter *et al*., 1999, Ashenfelter and Greenstone, 2004).

Promotion, tenure and compensation are largely determined by an economist's publication record. Worse still, the incentive structure of the academy often recognizes only the quantity of a researcher's publications.[4] Regardless of the importance of incentive structures to the broader culture, economists respond to incentives. Bright young economists will quickly learn how to produce publications. If statistical significance is required, they will produce that too. Thus, publication selection is a quintessential socio-economic phenomenon.

Professional rewards reflect a researcher's publication record and thereby promote searching for statistical significance. Doucouliagos and Paldam (2005c) argue that this data-

[4] It is partly because of this that policy makers in several countries (notably the U.K., New Zealand and Australia) have implemented research assessment exercises to shift research focus towards quality.

mining is a common-resource-pool problem, i.e. researchers join a "mining collective" and mine the data thoroughly. "It is a fact of life that people polish their goods to make them shine as much as possible to attract customers" (Doucouliagos and Paldam 2005c, p.17). The culture of our profession reinforces and transmits these research practices.

Those of us who have acquired a reputation as 'quant jocks' know from personal experience that colleagues who ask for help in analyzing their data also demand statistically significant results. In fact, it is often at the point where researchers exhaust their knowledge of econometric methods and fail to produce the needed significant results that an econometrician is called in. The culture of the editorial process and of the academy institutionalizes publication selection bias. Yet incredibly, this complex culture of research can be modeled and its bias corrected by a simple regression.

A compact, but elegant, MRA between a study's reported effect and its standard error has been successfully employed to model and correct publication selection bias.

$$b_j = \beta + \sum_{k=1}^{K} \alpha_k Z_{jk} + \beta_0 Se_j + e_j \qquad (j=1, 2, \ldots L) \qquad (3)$$

(Ashenfelter *et al*., 1999, Stanley, 2005a, Stanley, 2007). In the absence of publication selection and misspecification biases, reported estimates will vary randomly around the 'true' effect, β. Equation (3) can be easily derived from statistical theory when all studies are selected for their statistical significance but there is no genuine effect (Stanley, 2007).

With publication bias, authors of small-sample studies are tempted to specification search until they find larger estimates because small-sample studies tend to have large standard errors. Otherwise, their results will not be statistically significant and thereby less likely to be published. Similarly, larger studies need not search so hard from the practically infinite model specifications to find statistical significance and can be published with smaller estimated effects.[5] Thereby, if publication selection is present, it will cause the reported effect to be proportional to its standard error, *ceteris paribus*. It is this selection for significance that generates equation (3).

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[5] Specification searches can be matched also with data searches. In some cases, the sample size is deemed to be too small to produce significant effects and hence researchers access more data points. In other cases, the sample size is too large to produce the desired effects, and hence researchers find reasons to remove 'outliers' (see, for example, the study by Burnside and Dollar, 2000, where for the same specification, a smaller sample size is needed to produce the desired statistically significant finding).

Due to obvious heteroscedasticity, equation (3) is rarely estimated. Rather, its weighted least squares (WLS) version, which divides equation (3) by Se_j, becomes the obvious method of obtaining efficient estimates of equation (3).

$$t_j = \beta_0 + \beta(1/Se_j) + \sum_{k=1}^{K} \alpha_k Z_{jk}/Se_j + v_i \qquad (4)$$

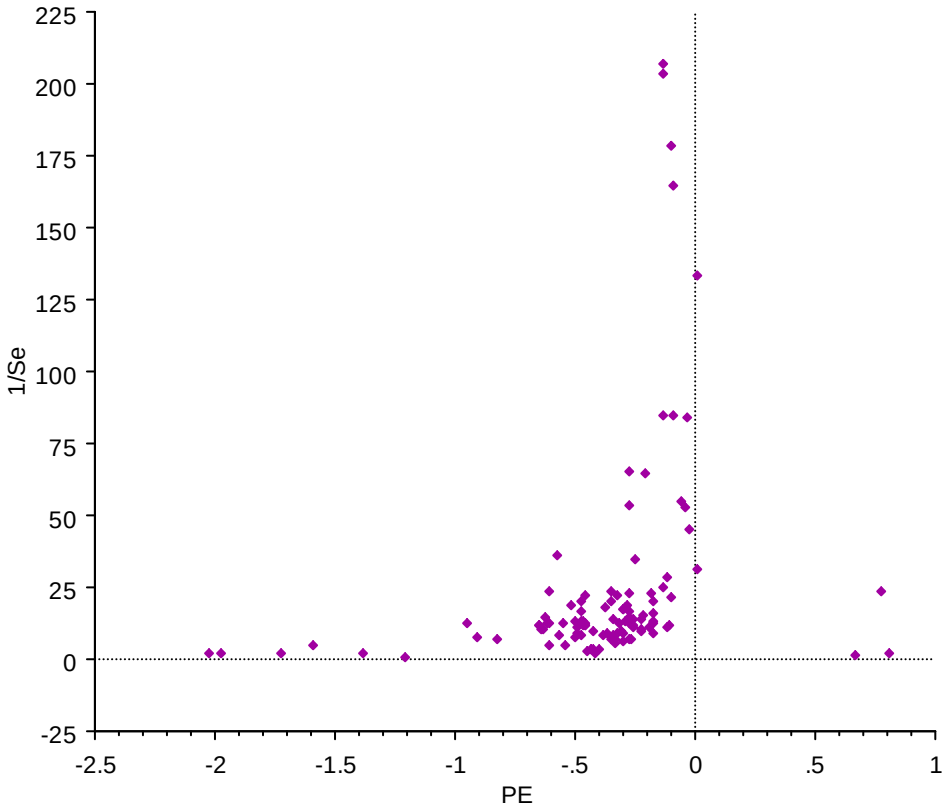
Note that the intercept and slope coefficients are reversed from equation (3), and precision, $1/Se_j$, becomes the key independent variable for this meta-regression model. Egger *et al*. (1997) argue that the conventional t-test of the intercept of equation (4) is a test for publication bias—*i.e.*, the funnel asymmetry test or FAT (Stanley, 2005a). Similarly, testing β in equation (4) may be considered a test of authentic effect, corrected for publication selection— *i.e.*, the precision-effect test or PET (Stanley 2005a). Note that the $\sum \alpha_k Z_{jk}/Se_j$ term, used to explain variation in research results, is now divided by the standard error.

To illustrate the use of this simple meta-regression model, we turn to estimates of the price elasticity of water demand. Dalhuisen *et al*. (2003) conducted a meta-analysis of 110 estimates of this price elasticity, the average of which is -0.38. Figure 1 graphs these estimated elasticities with the precision of their estimation (*i.e.*, $1/Se_j$). This graph is termed a 'funnel' graph because in the absence of publication bias it should look like an inverted funnel (Sutton *et al*., 2000b, Stanley, 2005a). Note how this 'funnel' graph looks nothing like a funnel. This area of research serves as the paradigm of publication selection bias. With the exception of three positive elasticities, it appears that the right half of the funnel has been cut off entirely. Researchers who obtain positive (or insignificant) elasticities do not report them; or if they do, these papers are less likely to be accepted for publication.

Personal experience suggests that even some meta-analysts do not regard the selection of negative price elasticities as publication bias. After all, we all know that price elasticity must be negative. If it were otherwise, a bedrock of orthodox economics would be false—the 'law' of demand. Economists use the finding of a significantly negative price elasticity as a specification test of their empirical model and methods. Thus, by this reasoning, researchers who throw away positive price elasticities are only making their reported estimates more accurate, right? Regardless, of the 'truth' of the 'law' of demand, an empirical literature where researchers behave in this manner will produce very inaccurate estimates, on average. This is the essence of publication bias. Because our empirical estimation methods are not

very accurate (that is, they have large standard errors), positive estimates should result from time to time even if the 'law' of demand holds universally. To suppress such estimates biases the remaining ones, making water usage appear much more elastic than it truly is. Here, price elasticities may be exaggerated by a factor of three or four. Such a bias in the estimation of water elasticity can have a great effect on policy, especially water conservation. Pity the poor economist who uses the average reported elasticity as the justification for doubling or tripling water prices only to find that doing so has little effect on water usage.

Figure 1: Funnel Graph of Price Elasticities for Water Demand



In the water demand literature, the publication selection bias is obvious and this simple graph suffices to identify it. However, many cases will be more subtle, and the visual interpretation of a funnel graph ambiguous. For this reason, the funnel asymmetry test (FAT) and its associated MRA have been developed—see Table 1 and recall equations (3) and (4). When the funnel graph is inverted and the axes are reversed MRA equation (3) is the result, and it should have a zero slope in the absence of bias. As discussed above, equation (4) is the WLS version. The intercept of this simple MRA—equation (4)—is a test for publication

bias. Unsurprisingly, for water elasticities, the test results are clear. We reject the absence of publication bias (t= -7.27; p<.0001) and accept the funnel's asymmetry.[6]

Table 1: Funnel Asymmetry and Precision-Effect Tests

Moderator Variables:	*Dependent Variable = t*
Intercept	-2.86 (-7.27)*
1/Se	-0.0817(-5.34)
n	110
R^2	0.356
Standard Error	4.18

*t-values are reported in parenthesis and are calculated from heteroscedasticity-consistent standard errors.

The slope of this meta-regression, model (4), also serves as a test for genuine empirical effect beyond publication bias. This precision-effect test (PET) finds clear evidence of a negative price elasticity after allowance is made for publication bias (t=-5.34; p<.0001).[7]

The purpose of the present discussion is to illustrate how a simple meta-regression model can capture a very complex socio-economic phenomenon in economic research—publication selection bias. Like Galton's original 'regression' (Galton, 1889), a simple statistical model can cut through the 'thicket of difficulties' found in the economic research record. Although FAT is known to have low power in detecting publication selection (Egger et al., 1997, Stanley, 2007), the $\beta_0 Se_j$ term in equation (3) and thereby the intercept of equation (4) does an adequate job in representing publication selection.

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[6] It may seem ironic that we use statistical significance with meta-analysis while criticizing its overuse at for conventional econometric analysis. Nonetheless, we do not see any conflict or irony in using statistical significance appropriately, at any level. Problems occur *only* when practical importance is confused with statistical significance or when individual results are selected after repeated model experimentation for their statistical significance. Publication bias is caused when such selection for statistical significance is common. In our application, evidence of publication selection is clear with or without using statistical tests (recall Figure 1). Furthermore, the MRA results are not selected because of their statistical significance. Like autocorrleation, evidence of publication selection, significant or not, is always worthy of note.

[7] Simulations show that PET can be relied upon if the heterogeneity (or the magnitude of misspecification biases) is not too large. Testing whether $\sigma^2_v \leq 2$, the error variance in MRA model (4), may serve as a screening test for PET (Stanley, 2005b). However, in this application, we fail to pass this screening test for excess heterogeneity and thereby cannot fully reply upon PET to determine genuine effect. There is so much publication selection and misspecification bias that we cannot be sure there is, in fact, a negative price elasticity for water demand.

But of course, the socio-economics of publication selection is a more complex phenomenon, and the socio-economic phenomenon that is economic research is much richer than mere publication selection. To capture these dimensions, we include the term $\Sigma\alpha_k Z_{jk}/Se_j$ in equation (4), and replace β_0 with a socio-economic process, $\beta_0+\Sigma\gamma_i S_{ji}$. This leads to a general model for publication bias:

$$t_j = \beta_0+\sum_{i=1}^{I}\gamma_i S_{ji}+\beta(1/Se_j) + \sum_{k=1}^{K}\alpha_k Z_{jk}/Se_j + v_j \quad (5)$$

where S is a vector of socio-economic variables thought to affect publication selection, and Z is a vector of other variables that influence the magnitude of the published results. Moderator variables that are divided by the standard error, Z_{jk}/Se_j, are postulated to affect the magnitude of the phenomenon in question; those that appear alone, $S_{ji,}$ are believed to affect the magnitude of the selection bias. This difference between Z and S-type moderator variables is illustrated in Section IV. The success of this simple MRA framework for modeling and testing publication selection bias has now been confirmed in several areas of economic research (Doucouliagos, 2005, Rose and Stanley, 2005, Stanley, 2005a and 2005b).

But before we illustrate more complex MRAs for various areas of economic research (see Section IV), we turn to a discussion of what economists consider to be important socio-economic determinants of economic research.

III. Meta-Economic Research

Research is the central enterprise of academic economists. Like many other industries that economists study, research production itself may be investigated. You might say that this is yet another meta-perspective—economic research of economic research. The most prominent research in the economics of research counts and weights the citations made to a particular research paper (*e.g.*, Coupé, 2003, Frey, 2003). However, meta-analysis seeks to better understand authors' behavior as they engage in research. Here, we briefly review the economics of economic research to identify additional explanatory variables ($\Sigma\alpha_k Z_{jk}$) for the meta-regression analysis of research results.

For example, Faria (2002) mentions income and age as potentially important determinants of research findings. Perhaps, a researcher's income level might influence her selection of results in the analysis of the effect of marginal tax rates on work effort.

Similarly, a researcher's age might affect his research decisions when studying social security or even in the effectiveness of various merit pay schemes on faculty output.

Needless to say, ideology plays a large role in the determination of research findings. For example, Neumark (2002) claims that it is unnecessary to read the findings of empirical papers in labor economics. According to him, it is sufficient to note the names of the authors to infer what their findings will be. Doucouliagos and Paldam (2005a) find that researchers from either a Marxist or libertarian orientation report that development aid is detrimental to capital accumulation, consistent with their ideological positions in this matter.[8]

Also, an author's gender has proven to be an important determinant of reported empirical findings (Eagly and Carli, 1981, Stanley and Jarrell, 1989, Jarrell and Stanley, 2004). Happily, economic researchers seem to take a position on gender wage discrimination contrary to their obvious group membership (Stanley and Jarrell, 1989, Jarrell and Stanley, 2004). In this way, economists have been observed to systematically adopt a scientific perspective even when it is contrary to their own self-interest. However, Medoff (2003) finds that gender does not affect the quality of research, in general. Thus, the socio-economics of economic research need not lead to cynicism about our field. In fact, it has thus far revealed some admirable traits.

Does nationality matter? Neary *et al*. (2003) and Coupé (2003) suggest that there is a large difference in the quality of economists' output between Europe and the US but that this gap is shrinking. However, Medoff (2003) finds that nationality does not affect quality (as measured by citations). On a related issue, Stanley (2005a) finds that there is a greater tendency to engage in publication selection bias among US studies. In any case, nationality of the researcher and the data used are candidates for MRA moderator variables (*S* and *Z*).

Does a class system exist among economic researchers (Wachtel, 2000, Faria, 2002)? Within each institution there is a rank and tenure system that can affect a researcher's decisions, such as taking risk in pursuing creative or unique lines of inquiry (Mein, 2002, Frey, 2003). The quest for personal prestige and reputation in an academic setting shapes research. The importance of personal reputation varies among prestigious research universities, teaching-oriented schools, government agencies and private foundations, and the institutional reputation affects the stature of the individual and possibly the likelihood of publication.

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[8] The New Left's position is that aid creates dependency on the capitalist world and this has long run detrimental consequences. The libertarian position is that aid allows LDCs to pursue unsound socialist policies with detrimental long run consequences.

Moreover, the source of funding can affect research. Such sources include governments (and the agencies within the government), foundations, firms, and industries as well as one's own academic unit (presumably non-sponsored and most objective). For example, Doucouliagos and Paldam (2005b) find institutional affiliation and funding to be key determinants of research findings in the development aid and economic growth literature. According to the 'good policy model', development aid works *only* if the recipient country pursues 'good' polices.[9] Aid is harmful in countries pursuing bad policies. This model was proposed initially by Burnside and Dollar (2000) from the World Bank, and has probably affected World Bank lending. A competing model is the so-called 'medicine model' where aid is said to work regardless of policy if given in moderation but harms if taken in excess. This model was developed and publicized by DERG (Development Economics Research Group) at Copenhagen University. Doucouliagos and Paldam (2005b) use meta-analysis to show that researchers from the World Bank tend to report results in favor of the 'good policy model,' while researchers financed by the DERG tend to find in favor of the 'medicine model.' Meta-analysis shows that the key coefficients in both models are not significant but that the results are driven by institutional affiliations.

Wachtel (2000) argues that government funding discourages creativity from researchers who want to be funded initially and continuously. Private foundations typically have an agenda; hence, one would be wise to discount research that they support. However, important results could be lost by such a cavalier dismissal. Even if privately funded research findings are highly biased, in the context of the rest of the literature, they might offer added accuracy or even greater insight into the use of various models and methods. Thus, a meta-regression analysis that makes funding source a moderator variable (S_i) could control for the potentially distorting effect of advocacy research without throwing away the implicit information contained in such research. In any case, it is an empirical question whether and how funding source biases the research record, and MRA is the only method capable of modeling and testing its importance for any given area of economic research.

Then there is the incentive to stay in bounds of what has been published already (Dasgupta and Maskin, 1987). When researchers are forced to put their research in the context of previous research, to use similar methods, and to report similar results (recall price elasticities of water demand), research results will exhibit patterns over time. Such research fashion may be seen as auto-regression in reported findings. For example, Doucouliagos,

9 'Good policies' are defined as a weighted index involving the budget surplus, the inflation rate and the trade openness

Laroche and Stanley (2005) find a negative auto-regressive pattern in union-productivity research. Apparently, labor research can be so contentious that there is a tendency to negate the most recent findings.

More generally, Goldfarb (1995) argues that economic research has a predictable time pattern of fashion and novelty. Initially, researchers tend to report evidence that confirms a recently offered hypothesis. After confirmations accumulate, the informative content of yet more confirmations diminishes. The economics profession rewards manufactured novelty. Hence, further replications will not be deemed to be interesting or publishable by reviewers and editors unless they contain something surprising. After the passage of sufficient time, therefore, refutations will be more likely to be published. This then defines the 'Goldfarb conjecture' that there will be predictable cycles of fashion and novelty in empirical economic research.[10] Or for more fledgling areas of economic research, we might merely find a negative trend; that is, a tendency for reported results to become continually less and less supportive of the 'new' hypothesis over time.

To illustrate the potential of meta-regression analysis for a socio-economics of economic research, the next section embeds the possibility of research fashions into our previous MRA models—equations (3) and (4). Aside from implicit illustrative value of this exercise, we test for the presence of research trends in three areas of economic research.

IV. Fashion and Novelty in Economic Research

We have access to three meta-analyses where the year in which a study was published has been coded. Here, these meta-analyses are used to illustrate what an empirical socio-economics of economic research might look like.

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[10] Actually, Goldfarb's (1995) hypothesis is more simplistic than our generalization about fashion and novelty in economic research. '(A) null finding becomes attractive and interesting *only after* a literature exists that creates a presumption against the null. . . . there may be a publications bias towards 'positive' in the early stages of the development of an empirical literature, but this bias diminishes as the literature matures. . . 'positive' here means results showing a statistically significant effect" (Goldfarb, 1995, p. 208). Goldfarb's specific hypothesis is easily rejected by economic research. For example, unemployment hysteresis research tended initially to accept the null hypothesis (*i.e.*, early stages did not find any significant effects), and later there was a rather strong tendency to find significant departures from hysteresis (see below). Likewise, this same pattern is shown in an area of research erroneously used by Goldfarb to support his hypothesis—macroeconomic unit roots. As Goldfarb's Table 1 indicates, macroeconomic unit roots tended to be confirmed, at first. However, Goldfarb misclassifies this as a 'positive' result. Evidence can 'support' a unit root only if the null hypothesis (that the AR(1) coefficient {or the sum of several AR coefficients} =1) is *accepted*, meaning that there is *no* statistically significant effect. Our 'Goldfarb conjecture' is a generalization that 'new' research hypotheses tend to be supported initially, whether that means accepting or rejecting the associated working hypothesis, and later this tendency is reversed. Should this research area be sufficiently long-lived, other reversals of results become likely.

1. Tests of unemployment hysteresis (*UH):* investigates 98 tests of the falsifying hypothesis to the natural rate hypothesis (Stanley, 2004).

2. Tests of the natural rate hypothesis (*NRH*): investigates 34 tests of the natural rate hypothesis's restrictions contained in nine studies (Stanley, 2005b).
3. Union-productivity effects (*Union*): consists of 73 published studies and their estimates of the productivity effects of unionization (Doucouliagos and Laroche, 2003).

Our first illustration concerns macroeconomics and unemployment hysteresis (*UH*). Unemployment hysteresis is a misnomer used to describe a nonstationary unemployment rate. If the unemployment rate is truly nonstationary; it does not adjust towards any 'natural' rate, falsifying the natural rate hypothesis (NRH) (Stanley, 2004). This meta-analysis of unemployment hysteresis is the companion research to the meta-analysis of tests of the natural rate hypothesis itself (Stanley, 2005b). Here, we investigate 98 tests of unemployment hysteresis for research fashion or any other discernible time pattern (Table 2).

Table 2: MRA of the Socio-Economics of Economic Research

Dependent Variable=t

Moderator Variables:	*UH*
Intercept	-143.8 (-3.09)*
1/Se	-.0165 (-6.63)
Year	3.11 (3.11)
Year-sq	-.0169 (-3.14)
Breaks	-2.71 (-8.42)
Alogoskoufis	-2.03 (-5.66)
Graafland	-2.63 (-2.16)
Phanuef	.92 (2.75)
UK/Se	.0133 (5.69)
France/Se	.0155 (2.73)
Germany/Se	.0103 (2.75)
Greece/Se	.00935 (4.36)
n	98
R^2	.734
Standard Error	1.22

*t-values are reported in parenthesis and are calculated from heteroscedasticity-consistent standard errors.

Accepting the null hypothesis that the unemployment rate has a unit root (i.e., its persistence, AR(1), coefficient equals one) is taken as evidence against NRH. Initially, researchers investigated this alternative to NRH and, as Goldfarb's conjecture implies, tended to offer evidence in support. After the passage of time and confirmations (see Figure 2), rejections became more frequent.[11] One might speculate that rejections became more imperative as the threat to orthodox macroeconomics became more widely understood.

Figure 2 reflects exactly the type of time pattern suggested by Goldfarb (1995).[12] Relatively small and confirming t-values are later followed by increasing large ones (in magnitude). Figure 2 superimposes a statistically significant, quadratic time trend on the t-values for unemployment hysteresis. In this literature it is doubtful that the actual persistence of unemployment changes (*i.e.*, structural change). Rather, the observed quadratic time pattern is almost certainly a reflection of economic fashion. The time span investigated changed little, and the wide range of countries investigated makes it unlikely that this data reflects structural change. What did change were the methods used to investigate unemployment hysteresis. In particular, it became more popular to use a deterministic time trend with endogenously defined break points to model the unemployment series as an alternative to UH.[13] In any case, we have a very clear corroboration of the 'Goldfarb's conjecture.'

For this literature, we hypothesize that various research practices will affect the amount of selection bias, $\Sigma\gamma_i S_{ji}$, rather than the true magnitude of unemployment's persistence. Thus, the appropriate MRA model becomes equation (5). Recall that moderator variables that are divided by the standard error, Se_j, are postulated to affect the magnitude of the phenomenon in question; those that appear alone, S_{ji}, are believed to affect the magnitude of the selection bias. An example of the latter is the quadratic time trend, Table 2. Also, several research teams that report multiple tests of unemployment hysteresis (Alogoskoufis and Graafland) exhibit a greater tendency to select results that reject UH. As suggested

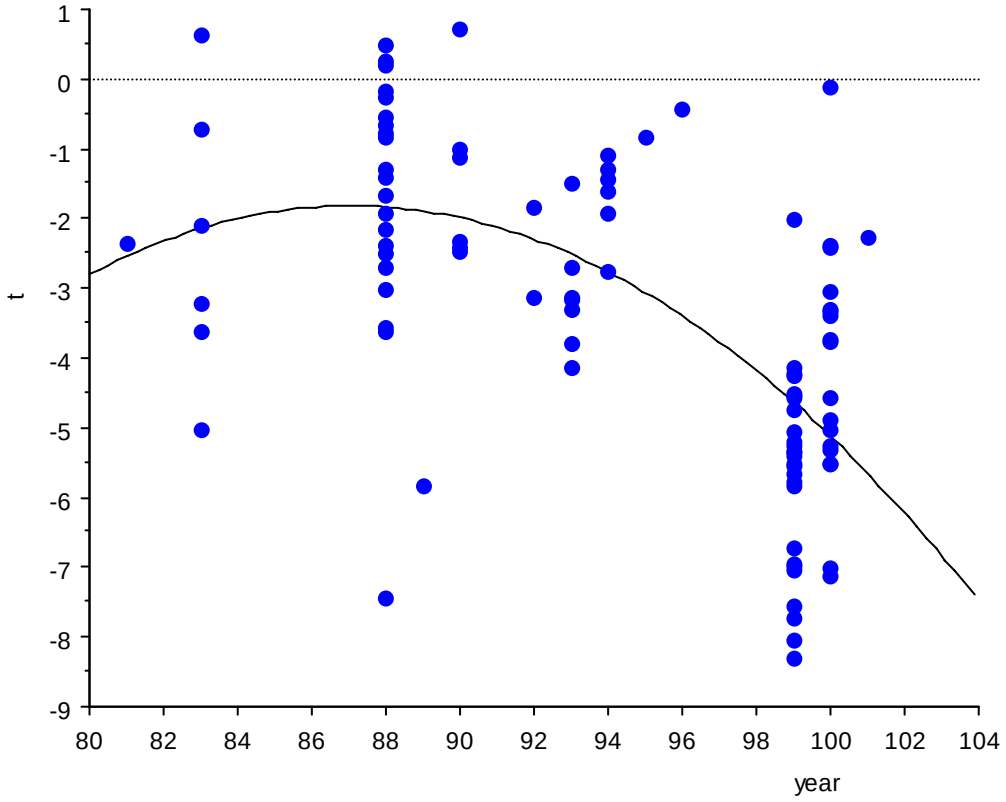
[11] Recall that the test for a unit root has a non-standard t-distribution. Critical values of this t-test are -3.5 or so depending on the exact model used.

[12] Actually, as discussed in a previous note, this pattern of research results is consistent with our generalization of Goldfarb's conjecture but not with his original statement.

[13] Because this process necessarily data-mines unemployment's time pattern, it almost guarantees the rejection of unemployment's unit root (Mitchell, 1993, p.1499).

above, allowing multiple break points, defined through data-mining, in the time series of the unemployment rate increases the publication bias against UH.

Figure 2: Tests of Unemployment Hysteresis



In contrast, the countries of UK, France, Germany and Greece all exhibit evidence of a genuinely higher unemployment persistence by about 1%, which is sufficient to make the unemployment persistence in these EU countries indistinguishable from full hysteresis (recall Table 2). Note that the dummy variables representing these countries are all divided by Se_j. Thus, the research on unemployment hysteresis serves as a useful illustration of a more complex MRA that allows socio-economic factors to affect both the actual phenomenon in question (nationality of the data) and the publication selection of research results (research fashion and novelty).

Secondly, we find no discernable time pattern among tests of the natural rate hypothesis (*NRH*). Including a quadratic time trend in a well-specified MRA model (*i.e.*, one that passes a whole battery of auxiliary specification tests and explains all the excess

variation among NRH test results) adds no further explanatory power ($F_{(2,22)}$= 1.38; p>0.05)—Stanley(2005b).

Third and lastly, Doucouliagos, Laroche and Stanley (2005) have investigated the time pattern found in the research on labor union productivity. They find a surprising pattern. When research results are ordered by year published, they exhibit a significantly negative, AR(1) dynamic (t=-2.70; p<.05). That is, there is a tendency for research findings presented in one year to be reversed in the following year.[14] The magnitude of this negative autocorrelation is not of much practical significance; however, the fact that such a time pattern can be distinguished from background is curious.

Union-productivity research is unusual in that there has been a long history of widely accepted theory that supports both positive and negative productivity effects from union membership—the 'two-faces' view (Doucouliagos and Laroche, 2003). Driven by a literature replete with theoretical and empirical support for both sides of this issue, Doucouliagos, Laroche and Stanley (2005) interpret this negative autoregression as a measure of the contentiousness of labor research. In any case, union-productivity research contains a clear rejection of the 'Goldfarb conjecture.' Perhaps, this is the exception that proves the rule. In union-productivity research, novelty and 'balance' dominates fashion.

Meta-regression analysis permits additional validation of its findings that is simply not possible for conventional literature reviews or summaries. First, there are the usual battery of econometric specification tests that should be routinely used in MRA—Stanley (2001). Furthermore, the adequacy of the specific MRA model employed can be tested by investigating whether excess variation remains. If a research literature contains a wider variation in its findings than consistent with the known magnitude of random sampling errors, then there is 'excess variation.' Such wide study-to-study research variation is ubiquitous in economic research. The central purpose of MRA, of course, is to explain this 'excess' variation and render it harmless. When MRA model (4) or (5) is used and if a specific MRA succeeds in its purpose, then its error variance will be equal to one (Stanley, 2005a). Recall that equations (4) and (5) investigate empirical effects that have first been standardized by

[14] The astute reader will note that the pattern in which this paper unfolds is roughly in the expected way—*i.e.*, the Goldfarb conjecture. A novel hypothesis is offered, at first it is confirmed, and finally it is rejected. Thus, we give homage to Hegel. Perhaps the observed pattern of economic research reflects a Socratic dialogue or Hegel's dialectic.

dividing each estimate by its standard error. Testing whether the MRA error variance is one becomes an additional test of the specific MRA's adequacy.

More formally, the alternative hypothesis for this MRA specification test is H_1: $\sigma^2_v>1$.[15] When found, such 'excess' remaining variation signals the existence of omitted factors that are responsible for the wide study-to-study variation of research results in the investigated area of economic research. Such omission is widely recognized to be an important cause of bias in conventional econometric research; MRA is no different. Omitting relevant explanatory variables may also bias the reported MRA results. Fortunately, we can find no excess variation for the MRAs presented in Table 2 (accept H_0: $\sigma^2_v=1$; $\chi^2_{(86)}=128.8$; $p>.05$); thus, we have no reason to suspect our previous socio-economic explanations of unemployment hysteresis research.

In contrast, conventional narrative literature reviews have no ability to validate their more impressionistic explanatory stories. Worse still, all conventional reviews are tainted by publication bias. Although not entirely universal, publication selection bias must be regarded as the 'rule' in empirical economics. Conventional reviews simply have no way to identify or correct likely publication bias. Compounding likely selection and omitted-variable biases, conventional reviewers typically make idiosyncratic choices about which studies to omit (or to discount by giving small weight) on purported methodological grounds (Stanley, 2001). "Hence, conclusions are influenced by prejudice and stereotyping to a degree that would be unforgivable in primary research itself" (Glass, McGaw and Smith, 1981, p.18).

V. Conclusions

In this paper, we offer an empirical model, with an accompanying statistical methodology, for studying the socio-economics of economic research. Our meta-regression model of research is illustrated by examining three separate areas of economic research. In the course of this exercise, several interesting findings are uncovered.

1. Publication selection bias greatly exaggerates the estimates of the elasticity of water demand.
2. Some, but not all, areas of economic research exhibit the pattern of economic fashion and novelty suggested by Goldfarb (1995).

[15] Recall that simulations show that PET is valid as long as this variance is not found to be larger than 2 (α=.001) (Stanley, 2005b).

3. Meta-regression analysis can identify time patterns in the magnitude of publication selection bias (*e.g.*, unemployment hysteresis).

Meta-regression analysis is superior to all other approaches to understanding and interpreting economic research because only it uses objective and replicable methods for delineating which empirical results to survey, for identifying and removing publication bias, and for validating the specific interpretive model used. We make two strong claims. First, the MRA model of the socio-economics of economic research advanced and illustrated here can explain the excess variation routinely found in economics—recall Table 2 and see Stanley (2005b). Secondly, all other types of empirical literature reviews must be regarded as biased. Aside from their subjective and unscientific choices and methods, conventional reviews have no way to correct likely publication and omitted-variable biases. Thus, conventional narrative reviews cannot be trusted.

We view 'empirical reality' as an emergent statistical property (Lawson, 2003). Because the traces of statistical power that MRA seeks are not observable to an individual (original) conventional econometric study, researchers cannot select their results to create artificially the appearance of a genuine empirical effect (i.e., to pass the PET test). Thus, meta-regression analysis is not as vulnerable to selection and misspecification biases as are the original econometric studies themselves. The serious weaknesses of conventional narrative reviews only broaden the wide gulf between economic theory and reality. Meta-analysis permits and encourages a closer, more transforming contact.

Research is more than a random process of discovery, punctuated by occasional serendipity; it is a deliberate socio-economic activity. Consequently, reported empirical results cannot be assumed to be unbiased because they are vulnerable to biases inherent in the process of qualitative literature reviewing: (a) subjective interpretation of the reported results, (b) reviewer selection bias (Stanley, 2001) and (c) publication selection bias. Furthermore, these vulnerabilities are likely to be compounded by the socio-economics of the research endeavor. Meta-analysis permits an objective quantification of the socio-economic biases contained in economic research. No more objective (nor comprehensive, nor rigorous) method exists to assess a research literature or to draw policy inferences from the available research information.

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