Financial Microeconometrics as Research Methodology in Corporate Finance and Accounting

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Abstract This paper presents the main issues of financial microeconometrics. This field can be considered as a part of financial econometrics, while usually not exposed as such. Typical domains of the methodology of financial microeconometrics include research in empirical corporate finance and applied accounting. This survey-like paper argues that financial microeconometrics research shall be also rooted in wider fields like corporate law, management and finance. Various types of research in financial microeconometrics as well as several methodological issues are examined. A major emphasis is placed on questions of endogeneity, sample selection and treatment effects. Observations on financial microeconometrics literature both in Poland and worldwide are also included.

Keywords Financial microeconometrics • Applied corporate finance • Applied accounting • Endogeneity • Sample selection

1 Introduction

This article presents issues of methodology as applied to research in finance, law, management and economics and—moreover—when it comes to considering a sample of cases instead of a single case. This is the domain of financial microeconometrics.

Financial microeconometrics emerges as a natural consequence of applying statistical and econometric methods to corporate finance, accounting and other fields of finance. The *applied* edge of research in accounting and corporate finance is inevitably linked with the use of notions like statistical sample, population, and the operation on sets of microdata.

In such research the sets of microdata on companies substitute for a single company, microdata on transactions substitute for a single transaction, events substitute for event etc. Obviously, this message is not novel in 2017. What might be novel is the structured view on how the domains of finance and the research methodology

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interact, as well as the exposition of how the statistical-econometric methods may help or hurt the results of research in those areas.

The structural view of applied corporate finance and applied accounting is presented in Sect. 2. Section 3 comments on financial microeconometrics literature. Section 4 introduces major methodological issues: sample selection and endogeneity.

2 Financial Microeconometrics and Empirical Corporate Finance

The field of financial microeconometrics emerges on the crossroads of research in finance, mostly corporate finance and statistical-econometric methodology. It is the tools of microeconometrics which are commonly applied in the research on corporate finance, accounting, as well as the research on non-financial managerial subjects, e.g. corporate governance etc.

This is depicted in the diagram shown as Fig. 1.

To sum up—the application of microeconometric methods in corporate finance and accounting research is named financial microeconometrics (FM). This methodology constitutes a major foundation of empirical corporate finance (ECF). For verifying its research questions ECF uses large datasets on companies, their financials, decisions etc. This is where the methods of FM are usually indispensable.

ECF and FM, i.e. the lower right-hand side corner of Fig. 1 are therefore of major interest in this exposition. However, in order to properly execute research in corporate finance and accounting, it is inevitable to simultaneously consider questions relating to law and management, corporate law, corporate governance and,
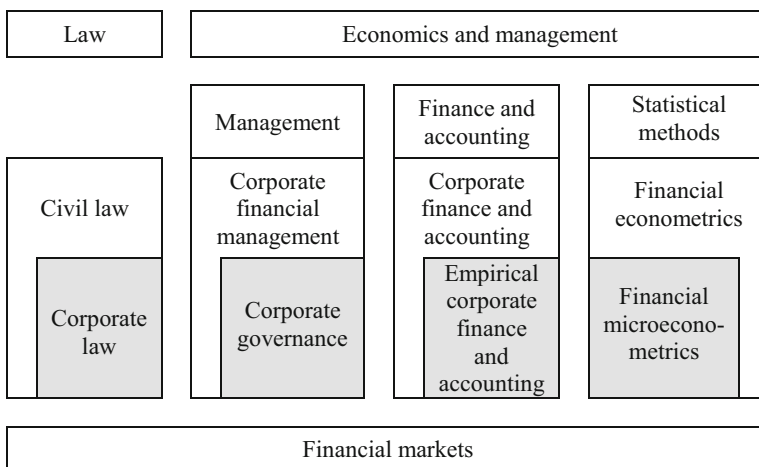

Fig. 1 Empirical corporate finance and financial microeconometrics

finally, financial markets. It is the synergy of expertise from all of those fields which seems to be necessary for meaningful research in corporate finance and accounting.

Thus, a contribution of this paper might be an attempt to coin the term "financial microeconometrics" for labelling the large part of empirical research in corporate finance and accounting. Obviously, it is not that important to give some label to a research field. Rather, the motivation here is exposing econometricians to new areas to use their methodology. "Financial econometrics" is regularly in use elsewhere, therefore "financial microeconometrics" might well be recognized as part of it.

3   Literature on Financial Microeconometrics

The term "financial microeconometrics" has been introduced in the literature by the author (Gruszczyński 2008, 2012). Although some textbooks on financial econometrics rightfully recognize the necessity of including topics on financial microdata analysis (e.g. Wang 2009), the major methodological stream in financial econometrics is devoted to time series, like in recent textbooks by Bofetti and Urga (2016) or Fan and Yao (2017). Also, the latest handbooks on financial econometrics published by Elsevier (Ait-Sahalia and Hansen 2010a, b) or by Springer (Lee and Lee 2015) contain sets of papers with a major edge on time series methodology.

On the other hand, microeconometrics tools are justifiably included in modern classes on empirical corporate finance (e.g. Ph.D. class of prof. Da Rin at Bocconi, 2016–2017) and in some basic textbooks, like Damodaran (2014) or Berk and DeMarzo (2014, chapter "Financial Distress, Managerial Incentives, and Information").

Although not specifically named like this, the literature on financial econometrics in abundant. The numerous papers can be found in multiple journals. To name a few: "Abacus", "Advances in International Accounting", "Accounting and Finance", "Accounting Review", "Corporate Governance: An International Review", "Financial Analysts Journal", "International Journal of Accounting", "International Review of Financial Analysis", "Journal of Accounting and Economics", "Journal of Accounting and Public Policy", "Journal of Accounting Research", "Journal of Applied Corporate Finance", "Journal of Banking and Finance", "Journal of Business, Finance and Accounting", "Journal of Corporate Finance", "Journal of Economics and Business", "Journal of Empirical Finance", "Journal of Finance", "Journal of Financial Economics", "Journal of Financial and Quantitative Analysis", "Journal of Law and Economics", "Quarterly Journal of Finance and Accounting", "Review of Economic Studies", "Review of Financial Economics", "Review of Financial Studies".

This subjective list contains 25 journal names and does not include many other good quality journals with financial microeconometrics articles pertaining to financial law, corporate law, management etc. Moreover, financial microeconometrics papers are also available in many serious internet journals, like those from SSRN

sub-networks: Accounting Research Network eJournals, Corporate Governance eJournals and Econometrics and Financial Economics eJournals.

It should also be noted that sets of articles on those topics have been topically grouped and included into "handbooks on empirical corporate finance", e.g. Eckbo (2007, 2008, 2010) or Brennan (2001).

In addition to the above remarks, Sect. 5 provides the selected evidence on financial microeconometrics research in Poland.

4   Major Methodological Concerns

4.1   Models of Financial Microeconometrics

Methodological maturity of research in corporate finance and applied accounting is growing. Understandably, the highest level of research quality is attained by top journals.

Financial microeconometrics encompasses topics of both methodological and applied nature. The examples, with the list that is far from comprehensive, are as follows:

1. Financial management and corporate strategy:

   – diversification and the company value,
   – choice of financing and owners of the equity,
   – financial distress and bankruptcy models,
   – firm survival.

2. Valuation:

   – regression models for comparative valuation,
   – event studies: market reaction to companies' announcements,
   – event studies for IPO,
   – earnings forecasts,
   – analysts following.

3. Financial decisions of companies:

   – choice models: debt financing, bonds,
   – dividend policy: vs. company valuation, vs. equity owners.

4. Corporate governance (owners' decisions):

   – association of corporate governance items with earnings (ownership structure, institutional investors, board structure, CEO change),
   – managerial incentives,
   – corporate governance indices.

5. Applied accounting:

   – auditor: change, independence, pay,
   – accounting standards: influence of changes,
   – disclosure and performance, disclosure indices,
   – value relevance of financial statements.

The journals, books and repositories cited above in Sect. 3 contain specific examples of research results covering all of those topics and many more. There are also several survey articles that are concentrated either on specific topics from empirical corporate finance and applied accounting or on methodological issues.

Modelling microdata in corporate finance and accounting calls for all possible approaches of microeconometrics and advanced data analysis. As mentioned earlier, good applications should utilize not only methodological knowledge but also lessons from wider fields like corporate law, management and finance. This broader view may sometimes result in proposing novel methodologies.

Some methodological problems recently gained more attention. They are explained in the next two subsections.

4.2   Endogeneity

Mostly discussed by researchers, the problem of endogeneity is present in almost all research in corporate finance. In their survey paper entitled "Endogeneity in empirical corporate finance" Roberts and Whited (2011) present some structured view on the topic which will be covered below in two paragraphs.

Endogeneity means a situation when explanatory variables correlate with an error term in a regression-like equation. A typical situation is the omitted variable—not included in the set of explanatory ones. If the omitted variable is correlated with any explanatory variable then we have endogeneity (error term is correlated with explanatory variable). The sign of the bias of parameter estimate for the variable in question might somehow be guessed, but the estimator itself remains inconsistent.

Roberts and Whited (2011) mention the CEO compensation studies for which the firm size is a common explanatory variable. The CEOs in larger companies are supposedly more skilled because larger firms are more difficult to manage than smaller ones (Gabaix and Landier 2008). Managerial ability, as unobservable, is included in error term. Therefore, we have an endogeneity situation: the firm size as the explanatory variable is correlated with the error term (the firm size appears to be endogenous). In this situation, the bias in the estimated firm size coefficient will likely be positive [if we assume that regression coefficient of compensation on ability is positive and also regression coefficient of ability on firm size is positive].

According to a presentation by Roberts and Whited (2011), the techniques addressing the endogeneity in empirical corporate finance might be classified into two groups. One includes techniques that use the known source of exogenous variation for identifying the coefficients of interest: instrumental variables,

difference–in–differences estimators and regression discontinuity design. The second group includes techniques that rely on modelling assumptions: panel data, matching methods and measurement methods.

The techniques quoted and presented by Roberts and Whited (2011) are in growing use in applied finance today. This trend follows the turn toward "quasi-experimental" methods in applied microeconomics as shown in Angrist and Pischke (2010). Similarly, Panhans and Singleton (2016), show how quickly the "quasi-experimental terms" grow bibliometrically in top economics journals. In 1990 there were no articles including such terms—as compared with 7–8% of articles in 2014. Those terms are: difference-in-differences, regression discontinuity, natural experiment, and randomized control trial (data was drawn from the Web of Science).

Thus, the "new" approaches gain importance in empirical corporate finance. On the warning side, one should agree with the conclusion of Roberts and Whited (2011) survey paper where they state that the statistical technique itself is not the blessed remedy for all shortcomings of traditional approaches. It should be carefully placed within the composite world of good empirical design, high-quality data, thorough testing in various settings and also well researched arguments e.g. for a specific solution to the problem of endogeneity etc. In their final advice the authors say that the very first step towards ultimately finding the causal relationship is the simple analysis of correlation coefficients and the descriptive analysis of data. This message will obviously encourage methodological newcomers to the field.

4.3   Selection Bias and Treatment Effects

The experimental or quasi-experimental mood gaining attention in economics and financial research is inevitably associated with questions of selection bias and treatment effects. These are also issues connected with endogeneity problems in research.

Suppose that a single company, at a particular point of time, contemplates whether or not to decide on an IPO (initial public offering). In the language of "treatments" there are two treatment levels, deciding on an IPO or not deciding on an IPO. If company decides on an IPO then its financial result (say, ROE), after a while, attains the level Y_1. If a company does not decide on an IPO, then the ROE level reaches Y_0. Question: does IPO influence ROE?

Our single company (i-th company in a sample) may be observed only after it takes the decision on an IPO, i.e. either the decision is "yes" or "no". Therefore we observe only one result from the possible two: Y_0 or Y_1. This second result is called *counterfactual* (hypothetical, potential). Thus, what we observe is:

$$Y_i = D_i Y_{1i} + (1 - D_i) Y_{0i} \tag{1}$$

where $D_i = 1$ if IPO and $D_i = 0$ if not-IPO.

The average observed difference in ROE values (between companies with and without an IPO) is called ATE (*average treatment effect*) and is equal:

$$ATE = E(Y_i|D_i = 1) - E(Y_i|D_i = 0) = E(Y_{1i}|D_i = 1) - E(Y_{0i}|D_i = 0) \qquad (2)$$

Thus, the value of *ATE* may be quickly calculated. But what we would like to know is the treatment effect "on the treated" (*ATT*), i.e. change in ROE for companies deciding on an IPO as compared to the same companies not deciding on an IPO. It may be shown that:

$$ATE = ATT + E(Y_{0i}|D_i = 1) - E(Y_{0i}|D_i = 0) = ATT + selection\ bias \qquad (3)$$

So, the question is: when can the selection bias be equal to zero? Firstly, it happens when the variables D_i and Y_i are independent. This is only possible for randomized experiments or simple random sample. In our case this would mean that companies are randomly selected and administered the IPO or not. Obviously, such a scenario is not valid here.

Another possibility to significantly lower the selection bias occurs when one can adopt the assumption of conditional independence (CIA) i.e. independence of variables D_i and Y_i, conditionally on explanatory variables ("covariates") X_i. Such X_i's are like "control variables" in relationship between D_i and Y_i. The CIA is also called the assumption of "selecting on observables". This means that if, conditionally X_i's, both groups of companies (IPO and not-IPO) choose an IPO then their results (ROE) have the same distribution. Rosenbaum and Rubin (1983) have shown that in such case the treatment effect is equal to ATE, i.e. the difference between results of companies "with the treatment" and companies "without the treatment" provided that they have the same probability of treatment. This probability is called propensity score.

The method of propensity score matching (PSM) creates the comparison group by matching observations (companies) with IPO to not-IPO observations for similar values of propensity scores. The general idea is matching "treated" to "non-treated" companies that are as similar as possible. Instead of matching on all X_i variables, the match is performed with a single measure called propensity score.

Matched-comparison evaluation, like PSM, belongs to quasi-experimental design techniques and becomes more and more standard, not only in labour economics but also in corporate finance and applied accounting.

PSM is the method for diminishing selection bias in Eq. (3). In the survey entitled "Selection bias and econometric remedies in accounting and finance research" Tucker (2010) presents the division of selection bias into two types: (A) due to observables and (B) due to unobservables. The remedies she describes are: PSM for case (A) and Heckman inverse Mills ratio (IMR) for case (B). The latter case i.e. "selection bias due to unobservables" results from a "failure to control for the differences researchers cannot observe", usually due to smaller information sets accessible to researchers than to managers and market participants.

Tucker (2010) interestingly exposes different uses of the popular notion "selection bias". Selection bias has the meaning in both cases (A) and (B), like in Eq. (3) for case (A) but originally and more frequently this term is used for problems of selection on observables, i.e. case (B). The author's advice for researchers using PSM in finance and accounting are as follows:

– PSM does not address selection bias due to unobservables,
– PSM does not guarantee that treated and non-treated companies are well matched by X variables (companies' characteristics); thus, it is advisable to test the differences in distributions of explanatory variables between treated and non-treated companies matched by propensity scores and to restrict the inference to companies whose characteristics can be found in both groups of companies.

The author's survey presented in her paper shows a growing number of articles addressing selection bias in two leading journals: "Journal of Accounting and Economics" and "Journal of Financial Economics". Unfortunately, most articles using this methodology have various flaws. This creates a risk of drawing improper conclusions from otherwise interesting research.

A rising number of accounting research with the use of PSM has also been confirmed in recent article by Shipman et al. (2017).

5   Financial Microeconometrics Research in Poland

Modern research in empirical corporate finance in Poland has been present since the 1990s. Published papers and books appear regularly, with growing numbers and, perhaps, with rising methodological maturity. There are many periodic conferences held all over Poland, conferences dedicated either to financial/accounting topics or to applied methodology. The examples of such conferences are: WROFIN (Wrocław University of Economics), FindEcon (University of Łódź), Financial Management (University of Szczecin). Papers presented at these conferences are usually published in the proceedings monographs.

Publications belonging to the stream of financial microeconometrics in Poland appear in journals specializing in economics, management and finance. According to recent ministerial list, there are more than 200 journals attached to those disciplines in Poland. The most important journals are ranked highly in ministerial ranking.

The subjective choice for the purpose of this paper includes five top journals: "Ekonomista", "Finanse", Bank i Kredyt", "Przegląd Statystyczny", "Gospodarka Narodowa". According to the Bazekon repository, in 2011–2016 there were following numbers of articles published with main topics connected to the field of financial microeconometrics:

– "Ekonomista": four articles,
– "Finanse" (Polish Academy of Sciences): zero articles,
– "Bank i Kredyt": eight articles,

– "Przegląd Statystyczny" (Polish Academy of Sciences): one article,
– "Gospodarka Narodowa": five articles.

Hence, the good reports from financial microeconometrics projects still wait for publication in leading journals in Poland. A closer, subjective closer look into the sample of other journals shows much larger numbers of publications in this area. Most of them are of applied nature and of variable methodological quality.

6   Conclusion

Financial microeconometrics represents the methodology dedicated to research in (empirical) corporate finance. It encompasses knowledge from many scientific fields surrounding the corporation, its purpose, its management and its finances.

The framework for financial microeconometrics is composed by corporate law, corporate governance, accounting principles and corporate finance. Financial microeconometrics is also a part of financial econometrics which nowadays is mostly associated with time series methodologies.

This paper indicates this structural understanding of financial microeconometrics, shows its underpinning for models of empirical corporate finance, presents some methodological constraints and describes the literature streams, both worldwide and in Poland.

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