# Earnings Management and Investor Protection: Accounting Reading Group - Assignment III

Melisa Mazaeva

Aug 9, 2024

**Abstract**

This project uses the TRR 266 Template for Reproducible Empirical Accounting Research (TREAT) to provide an infrastructure for open science-oriented empirical projects. Leveraging external Worldscope data sets on financial data, the repository showcases a reproducible workflow that integrates Python scripts for data analysis. The project's output demonstrates a comprehensive application of skills to replicate and extend the findings from the seminal paper by Leuz, Nanda, and Wysocki (2003), particularly in providing descriptive statistics for the four individual earnings management measures as well as the aggregate earnings management score across various countries. In doing so, it documents and discusses the research design choices made and the variations between the original and reproduced results. This code base, adapted from TREAT, should give you an overview on how the template is supposed to be used for this specific project and how to structure a reproducible empirical project.

# 1 List of Abbreviations

**EM**: Earnings Management **IDE**: Integrated Development Environment **UK**: United Kingdom **US**: United States **WRDS**: Wharton Research Data Services

# 2 Introduction

The following paper illustrates how to use open science tools in empirical accounting research.

The original study by Leuz, Nanda, and Wysocki (2003) examines systematic differences in earnings management (EM) across 31 countries and proposes that these differences are influenced by the level of investor protection. Specifically, they argue that stronger investor protection reduces earnings management by limiting insiders' ability to acquire private control benefits.

This paper presents details on a replication of Table 2 Panel A from the seminal paper by Leuz, Nanda, and Wysocki (2003). The original table provides descriptive statistics for four individual earnings management measures and the aggregate earnings management score across various countries, highlighting significant differences in EM practices between Continental Europe, Asia, and Anglo-American countries.

The project uses data from the Worldscope Database through Wharton Research Data Services (WRDS), focusing on the fiscal years 1990 to 1999 and covering multiple countries. The replication aims to follow the research design by Leuz, Nanda, and Wysocki (2003) as closely as possible with the available data. It employs four individual earnings management measures: earnings smoothing using accruals (EM1), the correlation between changes in accruals and cash flows (EM2), the magnitude of accruals (EM3), and the ratio of small profits to small losses (EM4). These measures are combined to create an aggregate earnings management score, providing a comprehensive overview of EM practices.

The analysis includes pulling and filtering the relevant financial data, identifying relevant companies and countries based on the authors' requirements, calculating the earnings management measures for each country, and examining the relationship between each country's aggregate earnings management score and its ranking based on made explicit assumptions whenever the paper is not clear on how to proceed.

## 2.1 delete. from mine

Note that intermediate check steps have been omitted for brevity. The full code, including intermediate print steps to verify outputs, is presented in `code/python/Assignment1_analyze_residual_income.`

The replicated table is shown below, followed by replication steps documentation, a detailed comparison, and discussion of the results.

## 3 Research Design Choices and Assumptions

The aim of Assignment III is to replicate a specific empirical table (Table 2 Panel A) from the seminal paper by Leuz, Nanda, and Wysocki (2003). This table involves calculating the EM measures for firms across various countries over a defined period and examining the relationship between these measures and investor protection. The replication process includes data loading, preparation, cleaning, and normalization, followed by the application of statistical methods to compute and interpret financial metrics. For Assignment III, I pulled data from the Worldscope database through WRDS and used the Python programming language to carry out the empirical analysis. Visual Studio Code was used as the Integrated Development Environment (IDE) for writing, debugging, and optimizing the Python code.

The replication is based on data pulled from the Worldscope database, specifically from the `wrds_ws_company` and `wrds_ws_funda` tables, which were merged for the analysis. The first table provides company profile information, including items such as ISIN, Worldscope Identifiers, company name, and the country where the company is domiciled Wharton Research Data Services (2024a). The latter table contains Fundamentals Annual data at the company-year level, including items such total assets, net income, and other relevant financial variables Wharton Research Data Services (2024b).

Following Leuz, Nanda, and Wysocki (2003), I focus the analysis on companies across various countries, ensuring that the data accurately reflects the fiscal years 1990 to 1999 as specified in the original study. The replication aims to mirror the research design as closely as possible with the available data.

In addition, I impose the following assumptions to ensure clarity and consistency where the paper by Leuz, Nanda, and Wysocki (2003) does not provide explicit guidance:

1. The original paper references the November 2000 version of the Worldscope Database. However, the data used for this analysis represents the latest available version, updated in July 2024, with quarterly frequency updates (Wharton Research Data Services 2024c). Due to

potential adjustments and updates made to the database since November 2000, there may be differences between the databases that could affect the results. For example, companies may restate financials after the original reporting period, so that these restatements are reflected in the later database version rather than the historical one. Moreover, the data vendor Refinitiv regularly updates its databases to correct errors and add new information, which may be included in the later data but not in the November 2000 snapshot.

2. The original paper outlines key terms that will be used in this project to ensure consistency and accuracy in the replication. Leuz, Nanda, and Wysocki (2003) define earnings management as the manipulation of a firm's reported economic performance by insiders to deceive certain stakeholders or to affect contractual results. Authors describe investor protection as a key institutional factor that limits insiders' acquisition of private control benefits, thereby reducing their incentives to manage accounting earnings by ensuring strong and well-enforced rights for outside investors. Finally, private control benefits are the benefits that insiders can gain from controlling a firm, which can include financial gains or other advantages that are not shared with other stakeholders Leuz, Nanda, and Wysocki (2003).
3. While pulling the data for analysis, I encountered negative values for some key financial metrics such as operating income (`item1250`), or net income before preferred dividends (`item1651`). The paper by Leuz, Nanda, and Wysocki (2003) does not explicitly specify how to handle negative values in key financial metrics. For the purpose of this replication study, I will include negative values in the analysis. Including these values ensures that the analysis captures the full spectrum of earnings management activities across different countries.
4. Another potential source of discrepancies between the original and replicated tables may be the choice of variables pulled from Worldscope. For example, in the `wrds_ws_funda table`, both `item1151` and `item4051` are named "DEPRECIATION, DEPLETION AND AMORTIZATION" Wharton Research Data Services (2024b). I chose `item1151` from the Income Statement rather than `item4051` from the Cash Flow Statement, based on the Excel Industrials Template by Wharton Research Data Services (2024d). Since the authors do not specify the choice of variables used from the database, this could cause differences in the results.
5. The EM measures are based on scaled variables (e.g., operating cash flow scaled by lagged total

assets). As such, the currency of the relevant data items should not affect the results as long as the same currency is used consistently for both the numerator and the denominator. This approach ensures comparability across different countries, regardless of their local currencies. Additionally, according to a document by (Thomson Financial 2007, 20), all Worldscope data is consistently reported in the local currency of each firm's country of domicile, eliminating the need for currency conversions in this project.

6.

### 3.1 delete. mine

7. It is assumed that Penman (2013) restricted the possible P/B values to a range of 0 to 7 to exclude outliers. Hence, extreme P/B values that are negative and very high (greater than 7) are excluded to focus the analysis on firms with more stable and reasonable valuations, reducing the impact of outliers.

By following the steps provided in Section 4 and adhering to the assumptions made, I successfully replicated the analysis and produced the required table. A thorough step-by-step approach, with each step clearly documented, helped to understand and verify the outputs.

## 4 Replication Steps

### 4.1 Step 1: Pulling the Data and Managing the Databases

In contrast to Assignment I, where the data was provided externally, Assignment III involves additionally pulling data directly from the Worldscope database, merging relevant tables, and preparing the data for further analysis from raw data to final output.

To ensure the integrity of the data, I filtered out rows with empty `item6105` (Worldscope Permanent ID) values, as this identifier is critical for firm/year level filtering in the data preparation step. In total, 125 observations from the dynamic data and 10,306 observations from the static data were removed. To compile the dataset, the dynamic and static datasets were merged on the `item6105` identifier, representing the unique Worldscope Permanent ID. WRDS advises using this identifier consistently within Worldscope data since it remains stable over time (Wharton Research Data Services 2024e). An inner join was used for this merge, because this approach ensures that only the complete and consistent data from both tables is retained.

Moreover, an additional filter is applied to retain only company rows. This is achieved by selecting rows where the `item6100` field equals 'C', indicating that the Worldscope Identifier represents a company. This step ensures that the analysis includes only company data, excluding averages, exchange rates, securities, or stock indices, as indicated by (Wharton Research Data Services 2024e).

As required by Leuz, Nanda, and Wysocki (2003), financial institutions are removed from the analysis based on their SIC codes. This is done by filtering out rows where the `item7021` identifier, representing the SIC code, falls within the range of 6000 to 6999. Hence, the dataset focuses only on non-financial companies, aligning with the methodology of the original paper.

Finally, additional filtering ensures that only data from the 31 countries, as given in the paper, is included. These filtering steps were applied to reduce the dataset size and improve the workflow.

Notably, the configuration file utilizes additional refinement as proposed by (Wharton Research Data Services 2024e). Using `A` (Annual) in `freq` variable ensures that the data represents the financial information reported on an annual basis, which is consistent with the paper's methodology. This excludes data reported on a current, daily, or quarterly basis.

After retaining only relevant company data, filtering out financial institutions, and focusing on specified countries, the processed data was then saved to a CSV file at the path `data/pulled` specified in the configuration file `config/pull_data_cfg`.

## 4.2 Step 2: Data Preparation

In order to verify the pulle data, I checked the dataset for duplicate firm-year observations based on the combination of the Worldscope Permanent ID (`item6105`) and the fiscal year (`year_`) and confirmed that there were no duplicates present, ensuring the accuracy of the data for further analysis. As the original study does not specify the net income measure, `item1651` (Net Income before Preferred Dividends) was used as the variable for net income. This choice aligns with the final net income figure reported in the income statement, based on the Excel Industrials Template by Wharton Research Data Services (2024d).

To prepare the data sample in line with the methodology outlined in the paper, it is essential to follow the requirements, as instructed by Leuz, Nanda, and Wysocki (2003). Firstly, countries with sufficient firm-year observations must be filtered. Each country should have at least 300 firm-year observations for certain key accounting variables, including total assets, sales, net income, and operating income. In this step, no countries were eliminated as all countries met the requirement, which aligns with the paper's overview of countries.

In the second filtration step firms with adequate consecutive data must be identified. Each firm must have income statement and balance sheet information for at least three consecutive years, with all key accounting variables mentioned above present. If a firm had at least three consecutive years of complete data at any point, all its data entries were retained in the final dataset. Therefore, only those countries and firms that meet these criteria for all specified variables are retained in the dataset.

During the preparation step, 8,265 firms and 20,521 firm-year observations (all due to second filtration step) were dropped, resulting in a final dataset with 18,040 firms and 123,469 firm-year observations. The differences in the numbers between the prepared dataset and the figures mentioned in the paper (70,955 firm-year observations and 8,616 non-financial firms) could be due to the assumptions such as variations in initial datasets, data updates, and filtering criteria listed in Section 3. However, the original study might have included additional data cleaning steps not explicitly mentioned, such as handling outliers, specific industry exclusions, or other criteria, which could affect the final counts.

Now that it is clear that the number of observations for this project is significantly higher than that in Leuz, Nanda, and Wysocki (2003) study, in order to illustrate the differences and compare the firm-year observations, Table 1 from Leuz, Nanda, and Wysocki (2003) was partially replicated (only columns on countries and firm/year observations) to distinguish specific discrepancies that could arise for certain countries.

The results in Table 2 show a higher number of firm-year observations for almost all countries compared to the paper by Leuz, Nanda, and Wysocki (2003), likely due to database updates leading to a more comprehensive dataset. The trend in the number of firm-year observations across countries is consistent with the paper, with larger capital markets like Japan, the United Kingdom, and the United States having the highest numbers. The distribution of observations in my dataset shows higher mean and median values compared to the paper by Leuz, Nanda, and

Wysocki (2003), indicating a greater overall number of firm-year observations, while the minimum values are relatively close, suggesting that the overall distribution of observations across countries remains broadly similar.

However, there are significant discrepancies, particularly for the United States, which has 41,585 observations compared to 3,792 in the original study, possibly due to more comprehensive data or changes in dataset scope. Leuz, Nanda, and Wysocki (2003) focuse only on S&P 500 companies for the U.S., while this analysis uses a more comprehensive dataset from the Worldscope database, which includes detailed financial statement data and profile data on public companies globally. This broader scope results in a higher number of firm-year observations for the United States. Despite the differences in absolute numbers, the relative trends across countries align with the paper.

[Table 1 about here.]

### 4.3 Step 3: Analysis Implementation and Table Reproduction

In this replication step, implement the calculations for the EM measures as described in the methodology of the paper, ensuring that all statistical methods and groupings are accurately replicated.

This project demonstrates the effectiveness of using an open science and collaborative workflow for analyzing earnings management measures across various countries. By following a step-by-step approach and using the TRR 266 Template for Reproducible Empirical Accounting Research, I was able to replicate an empirical table from Leuz, Nanda, and Wysocki (2003) and provide insights into the trends of earnings management practices, which vary significantly across countries, similar to Leuz, Nanda, and Wysocki (2003).

The study by Leuz, Nanda, and Wysocki (2003) documents systematic differences in the level of earnings management across 31 countries. It suggests that insiders use EM to conceal firm performance and protect their private control benefits and that stronger investor protection reduces earnings management by limiting insiders' ability to gain private benefits. By conducting a descriptive cluster analysis after descriptive statistics that was replicated in this project, the paper identifies groupings of countries with similar institutional characteristics and demonstrates that earnings management varies systematically across these institutional clusters.

The analysis revealed that

The replication yields mixed results. While

This final assignment has required the comprehensive application of all skills learned and feedback received from previous assignments, making it a more complex project workflow. In the future, this repository can be cloned or forked (if made public) to kickstart further projects on earnings management measures analysis. Thanks for reading!

## References


Leuz, Christian, Dhananjay Nanda, and Peter D. Wysocki. 2003. "Earnings Management and Investor Protection: An International Comparison." *Journal of Financial Economics* 69 (3): 505–27. https://doi.org/10.1016/S0304-405X(03)00121-1.

Thomson Financial. 2007. "Worldscope Database: Datatype Definitions Guide." Issue 6. https://www.tilburguniversity.edu/sites/default/files/download/WorldScopeDatatypeDefinitionsGuide_2.pdf.

Wharton Research Data Services. 2024a. "Table: WRDS - Worldscope - Company Information (Wrds_ws_company)." https://wrds-www.wharton.upenn.edu/data-dictionary/tr_worldscope/wrds_ws_company/.

———. 2024b. "Table: WRDS - Worldscope - Fundamentals Annual (Wrds_ws_funda)." https://wrds-www.wharton.upenn.edu/data-dictionary/tr_worldscope/wrds_ws_funda/.

———. 2024c. "Thomson Reuters - Worldscope." https://wrds-www.wharton.upenn.edu/data-dictionary/tr_worldscope/.

———. 2024d. "Worldscope Balancing Model - Industrials." https://wrds-www.wharton.upenn.edu/documents/526/Worldscope_Balancing_Model_-_Industrials.xls.

———. 2024e. "WRDS Overview of Worldscope Data." https://wrds-www.wharton.upenn.edu/pages/support/manuals-and-overviews/thomson-reuters/worldscope/wrds-overview-worldscope-data/.

| index | Country | # Firm-years |
|---|---|---|
| 1 | AUSTRALIA | 2099 |
| 2 | AUSTRIA | 686 |
| 3 | BELGIUM | 932 |
| 4 | CANADA | 4215 |
| 5 | DENMARK | 1326 |
| 6 | FINLAND | 1058 |
| 7 | FRANCE | 5515 |
| 8 | GERMANY | 5307 |
| 9 | GREECE | 1034 |
| 10 | HONG KONG | 1862 |
| 11 | INDIA | 2068 |
| 12 | INDONESIA | 978 |
| 13 | IRELAND | 625 |
| 14 | ITALY | 1591 |
| 15 | JAPAN | 20528 |
| 16 | KOREA (SOUTH) | 2038 |
| 17 | MALAYSIA | 2283 |
| 18 | NETHERLANDS | 1782 |
| 19 | NORWAY | 1210 |
| 20 | PAKISTAN | 598 |
| 21 | PHILIPPINES | 574 |
| 22 | PORTUGAL | 577 |
| 23 | SINGAPORE | 1291 |
| 24 | SOUTH AFRICA | 1334 |
| 25 | SPAIN | 1221 |
| 26 | SWEDEN | 1766 |
| 27 | SWITZERLAND | 1553 |
| 28 | TAIWAN | 1259 |
| 29 | THAILAND | 1664 |
| 30 | UNITED KINGDOM | 12910 |
| 31 | UNITED STATES | 41585 |
| 32 | Mean | 3983 |
| 33 | Median | 1553 |
| 34 | Min | 574 |
| 35 | Max | 41585 |

**Table 1: Replicated table - Number of Firm-Year Observations per Country**