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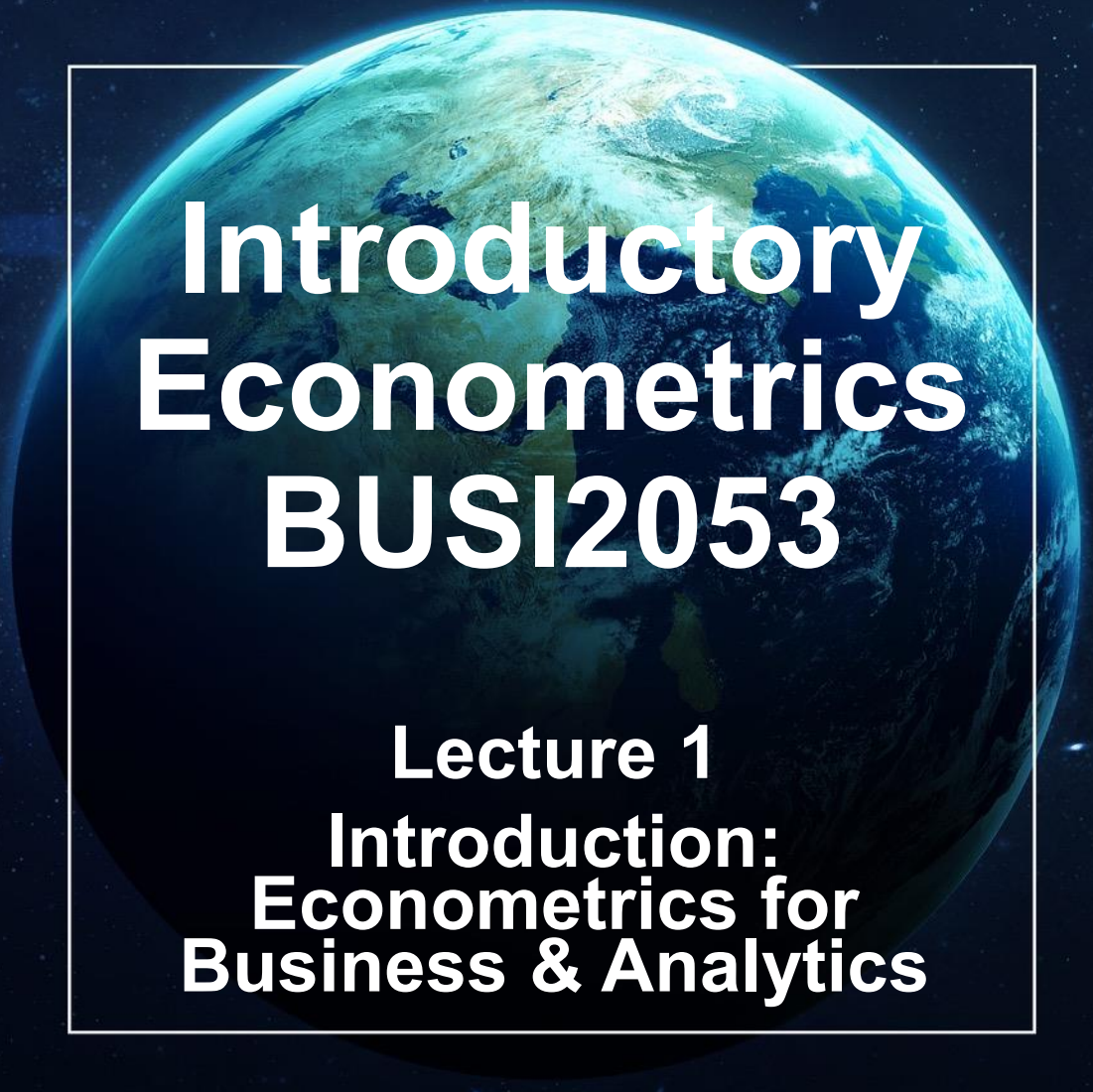

Introductory Econometrics BUSI2053

Lecture 1

Introduction: Econometrics for Business & Analytics

Module Convenor Particulars

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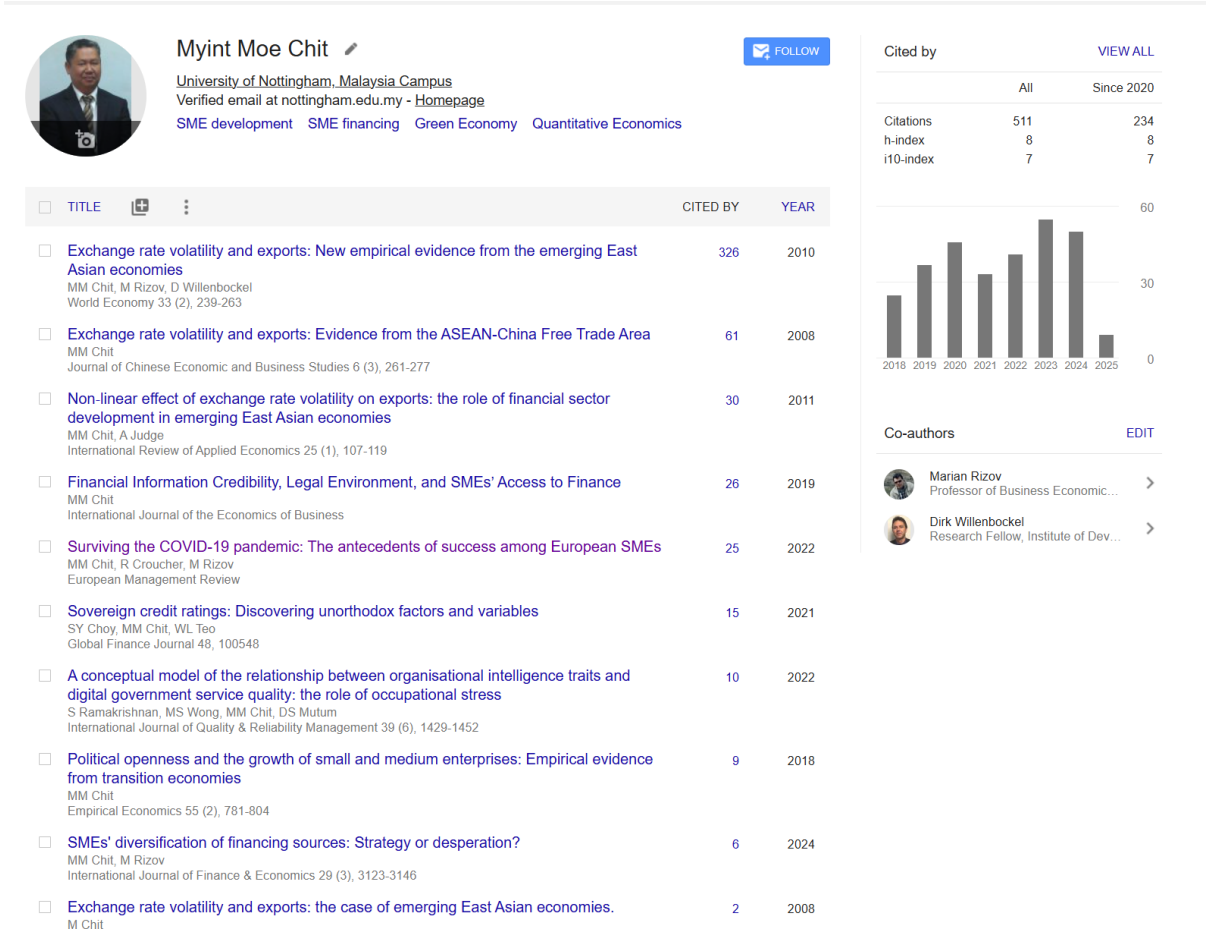
Consultation hours

- Wednesday: 2pm-4pm;
- Thursday: 10am-1pm;

Teaching: BUSI1037, BUSI1125, BUSI2053, BUSI4279

Research: SME Development, Green Economy, Digital Transformation, Financial Structure, Fintech



Myint Moe Chit

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SME development SME financing Green Economy Quantitative Economics

TITLE	CITED BY	YEAR
Exchange rate volatility and exports: New empirical evidence from the emerging East Asian economies MM Chit, M Rizov, D Willenbockel World Economy 33 (2), 239-263	326	2010
Exchange rate volatility and exports: Evidence from the ASEAN-China Free Trade Area MM Chit Journal of Chinese Economic and Business Studies 6 (3), 261-277	61	2008
Non-linear effect of exchange rate volatility on exports: the role of financial sector development in emerging East Asian economies MM Chit, A Judge International Review of Applied Economics 25 (1), 107-119	30	2011
Financial Information Credibility, Legal Environment, and SMEs' Access to Finance MM Chit International Journal of the Economics of Business	26	2019
Surviving the COVID-19 pandemic: The antecedents of success among European SMEs MM Chit, R Croucher, M Rizov European Management Review	25	2022
Sovereign credit ratings: Discovering unorthodox factors and variables SY Choy, MM Chit, WL Teo Global Finance Journal 48, 100548	15	2021
A conceptual model of the relationship between organisational intelligence traits and digital government service quality: the role of occupational stress S Ramakrishnan, MS Wong, MM Chit, DS Mutum International Journal of Quality & Reliability Management 39 (6), 1429-1452	10	2022
Political openness and the growth of small and medium enterprises: Empirical evidence from transition economies MM Chit Empirical Economics 55 (2), 781-804	9	2018
SMEs' diversification of financing sources: Strategy or desperation? MM Chit, M Rizov International Journal of Finance & Economics 29 (3), 3123-3146	6	2024
Exchange rate volatility and exports: the case of emerging East Asian economies. M Chit	2	2008

Cited by VIEW ALL

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Citations	511	234
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Co-authors EDIT

Marian Rizov
Professor of Business Economic...

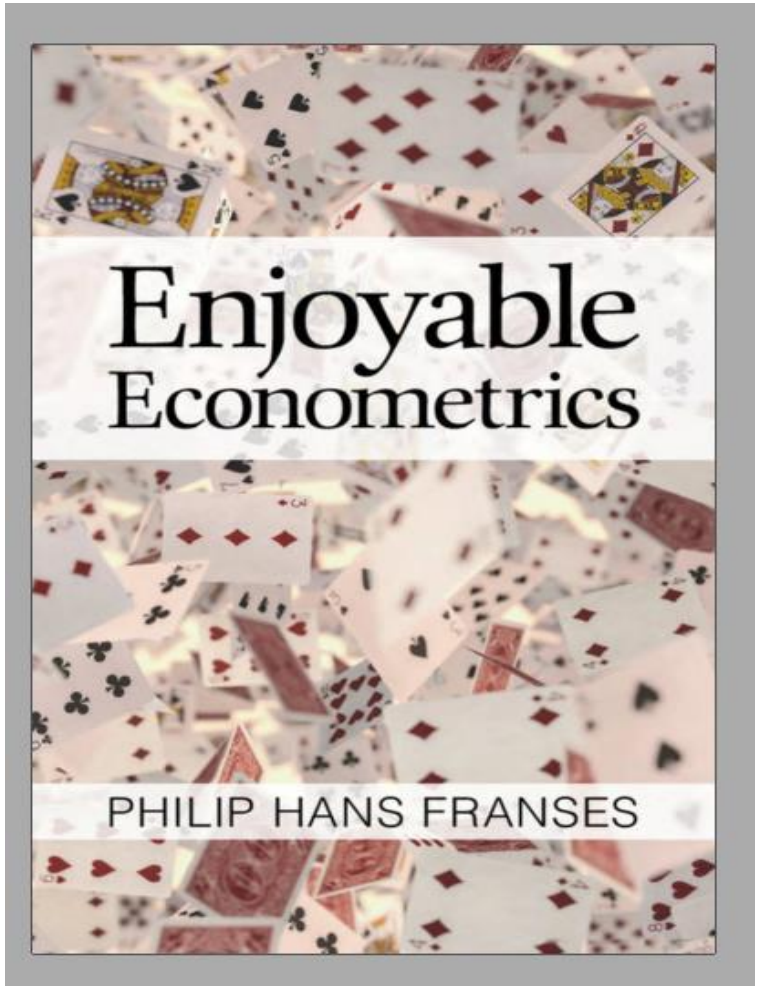
Dirk Willenbockel
Research Fellow, Institute of Dev...

What is Econometrics About?

What do you think Econometrics is?

Econometrics means “measurement in economics”.

Econometrics is about how we can use theory and data from economics, business, finance and the social sciences, along with tools from statistics and mathematics, to answer ‘‘how much’’ questions. (POE)



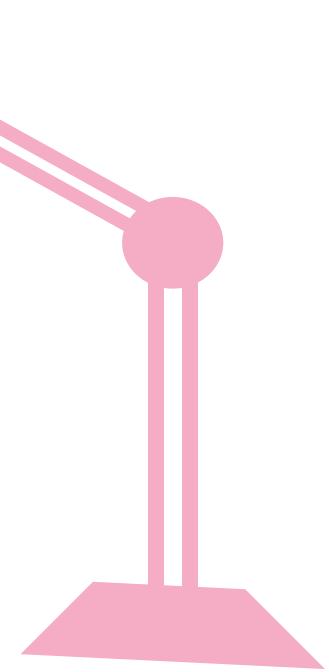
What is Econometrics About?

In economics the ideas about relationships between economic variables are expressed using the mathematical concept of a function.

$$Consumption = f(Income)$$
$$Q_d = f(P, P_S, P_C, INC)$$
$$Q_S = f(P, P_S, P_f)$$

Mathematical function that expressed the determinants of demand can be transformed into an Econometric Model

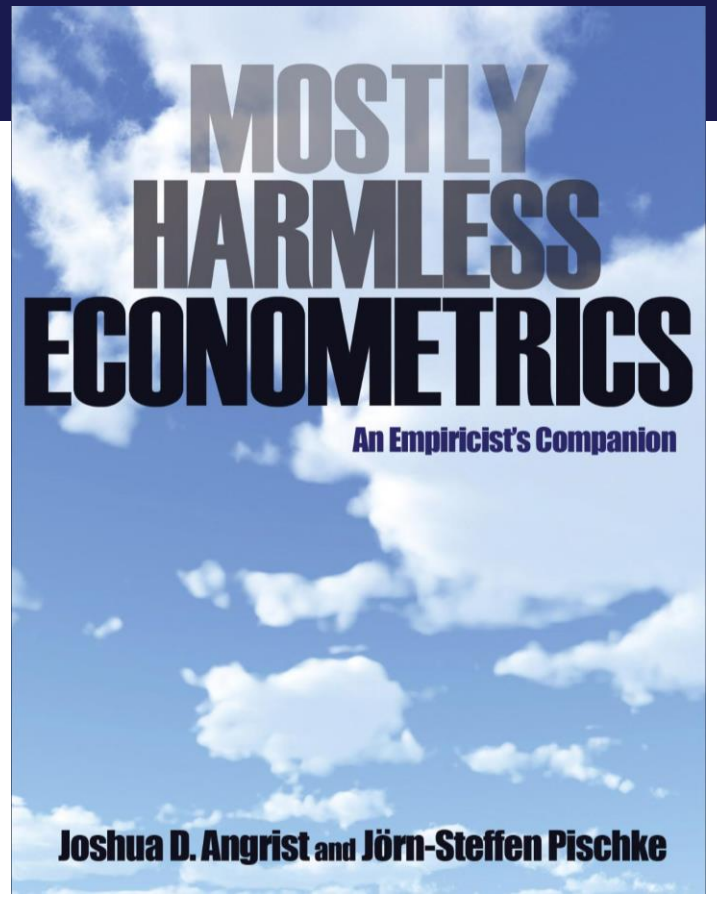
$$Q_d = \beta_1 + \beta_2 P + \beta_3 P_S + \beta_4 P_C + \beta_5 INC + e$$



- The functional form represents a hypothesis about the relationship between the variables
- The systematic portion is the part we obtain from economic theory, and includes an assumption about the functional form
- The random component represents a "**noise**" component, which we represent using the random variable ***e***

A Brief History of Econometrics

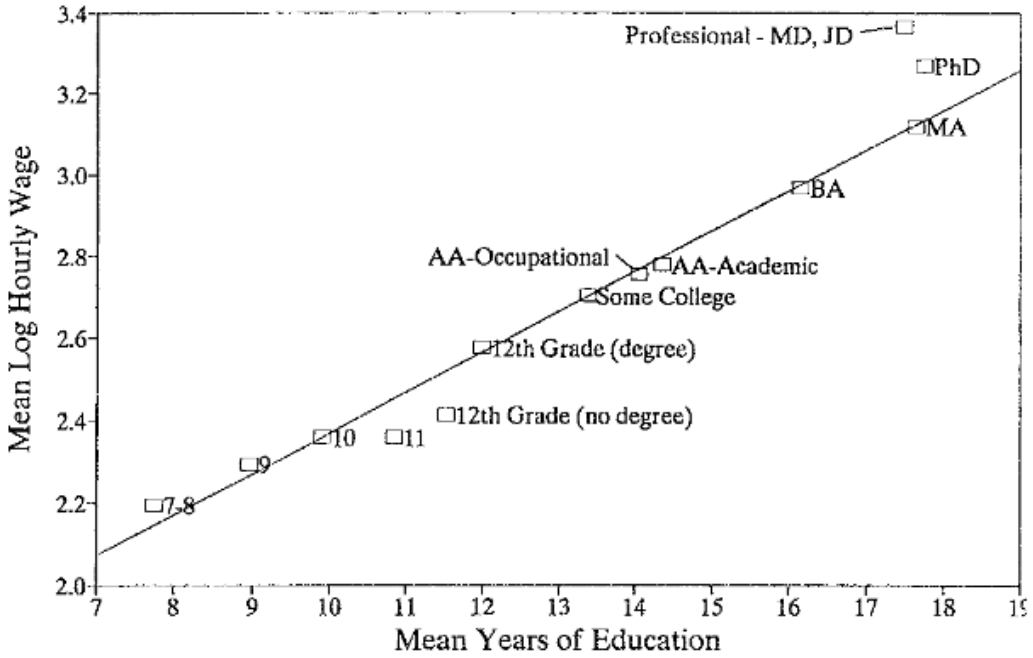
- Development of the econometric approach (1870s-1920s) relied heavily on statistical regularities (without probability theory)
- 1930: Founding of the Econometric Society by Ragnar Frisch, Irving Fisher, and Charles F. Roos.
- 1933: Publication of Econometrica
- 1938: Introducing probability theory in Econometrics (Applications of the Theory of Probability to Economic Problems (Econometrics Society meeting, 1937)



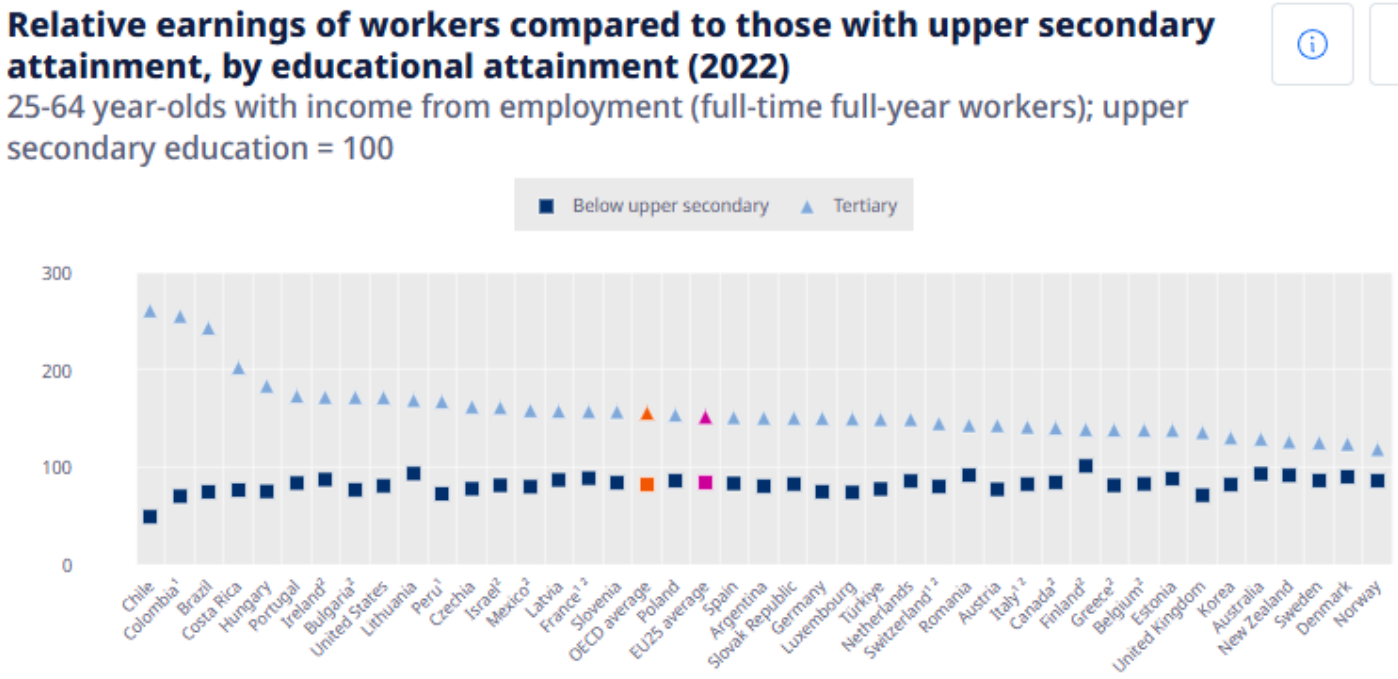
Who are the winners of the 2021 Nobel Prize of Economic Science?

How many Nobel Prize winners are connected to the University of Nottingham?

Why Study (Econometrics)?



https://davidcard.berkeley.edu/papers/causal_educ_earnings.pdf



https://blogs.worldbank.org/en/education/strong-link-between-education-and-earnings

- **Human capital hypothesis**: Schooling imparts skills that enhance productivity.
- **Screening hypothesis**: Employers select workers with higher qualifications to reduce their risk of hiring someone with a lower capacity to learn.

Some studies of identical twins suggest10%. A consistent finding among studies using instrumental variables the estimated returns to schooling are 20-40%.

Why Study Econometrics?

- Econometrics makes use of economic and business theory, mathematics, and statistics to quantify economic reality and bridge the gap between the abstract world of theory and the real world of human activity.
- It lets you (as a Business Analyst?) tell your employer:
  - "I can predict the sales of your product" (Predictive Analytics)
  - "I can estimate how much to spend on ad campaign to increase $1 million in your sales" (Prescriptive Analytics)
- Through rigorous analysis, econometrics helps in optimising resource allocation and evaluating potential strategies. This is crucial for achieving competitive advantage in dynamic markets.

Why Study Econometrics?

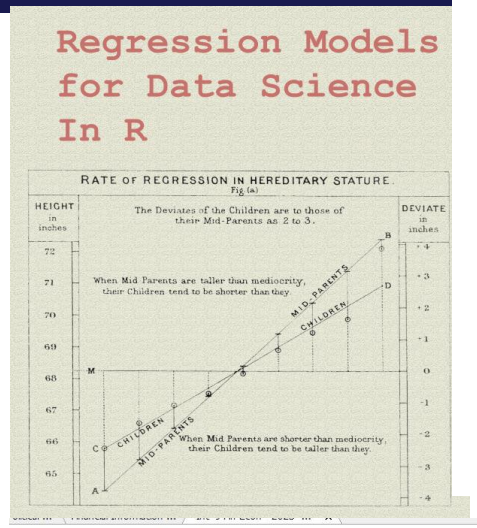
- Econometrics informs business strategies by providing data-driven insights. It helps quantify relationships between variables, guide investments, and forecast outcomes. This leads to more informed decisions based on empirical evidence.
- Everyday, decision-makers (managers) face question of "how much":
  - The owner of a local Pizza Hut must decide **how much** advertising space to purchase in the local newspaper, and thus must estimate the relationship between advertising and sales
  - The University of Nottingham must estimate **how much** enrollment will fall if tuition is raised by RM1000 per annum, and thus whether its revenue from tuition fees will rise or fall
  - The CEO of Proctor & Gamble must estimate **how much** demand there will be in ten years for the detergent Tide, and how much to invest in new plant and equipment

Why Study Econometrics?

- Econometrics (regression analysis) is one of the methods used for predictive and prescriptive analytics. Least square method is one of the algorithms used in Machine Learning to identify actionable insights.

- Econometrics is the most widely used quantitative research method in academic research and financial forecasting.

- Helps you develop “intuition” about how things work and is invaluable if you go for further studies



DOI: 10.1111/emre.12525

ORIGINAL ARTICLE

EMR European Management Review

Surviving the COVID-19 pandemic: The antecedents of success among European SMEs

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Abstract
We research the antecedents of relative success among small and medium enterprises (SMEs) in avoiding temporary or permanent closure during the COVID-19 pandemic. We investigate the roles of firm-specific resources and state support policies in influencing SME fortunes, in a sizeable group of European countries covered in the World Bank Enterprise Survey. Using resource dependency, Varieties of Capitalism and Systems theories, we find that innovative capacities, institutional connectedness, governance, and management experience were major antecedents of success across all SMEs. Significant differences in outcomes were found between SMEs operating in old and new EU member states, and non-EU countries.

KEYWORDS
COVID-19, enterprise survival, government support, innovativeness, SMEs, World Bank Enterprise Survey

RESEARCH ARTICLE

WILEY

SMEs' diversification of financing sources: Strategy or desperation?

Myint Moe Chit[1] | Marian Rizov[2,3]

[1]Nottingham University Business School, University of Nottingham Malaysia, Semenyih, Malaysia
[2]Faculty of Business Administration and Social Sciences, Molde University College, Molde, Norway
[3]Lincoln International Business School, University of Lincoln, Lincoln, UK

Abstract
The paper's objective is to provide a large sample evidence on small and medium enterprises' (SMEs) financing source diversification patterns. We use the large World Bank Enterprise Survey (WBES) sample of SMEs from 135 developing and emerging economies. We find that the extent of financing source diversification is significantly affected by firm-specific and country-

$$DI_{it} = \varphi(\alpha + \beta FSV_{it} + \gamma CSV_{it} + \delta IND_i + \theta YEAR_t + \varepsilon_{it}), \quad (2)$$

Why Study Econometrics? (For Business Analysts)

- **Foundation of Business Analytics**: Econometric models use statistical methods to test hypotheses, forecast trends, and uncover causal relationships in economic data.

- **Informed Decision-Making**: They integrate theory with observation, enabling precise predictions and prescriptive analytics.

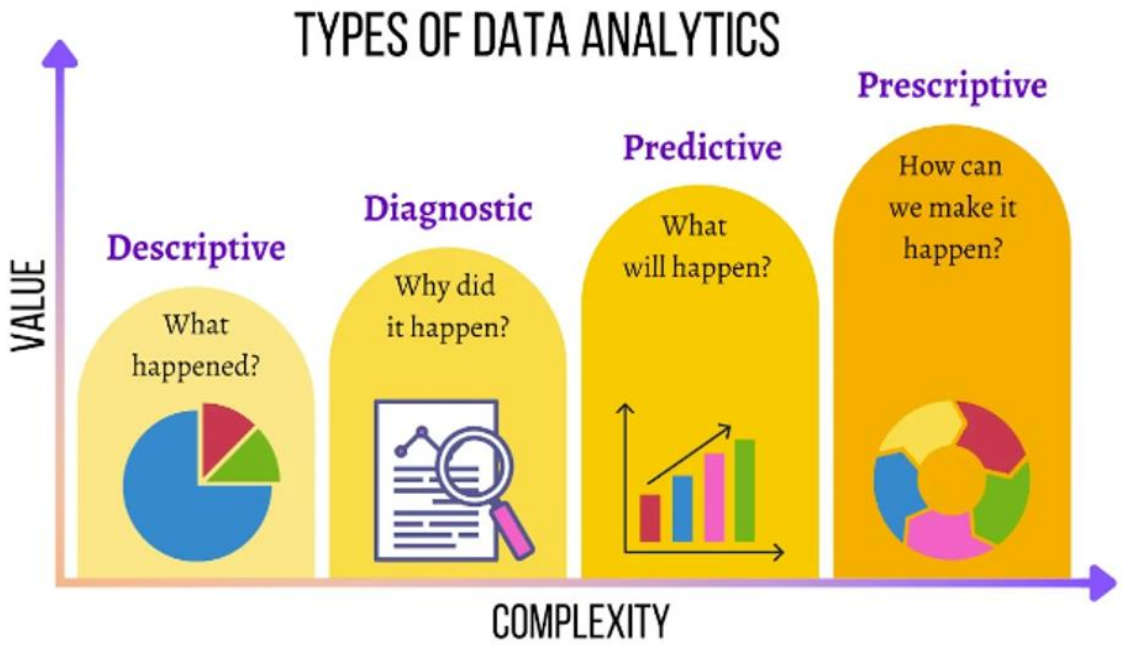


Image source: https://bookdown.org/cuborican/RE_STAT/

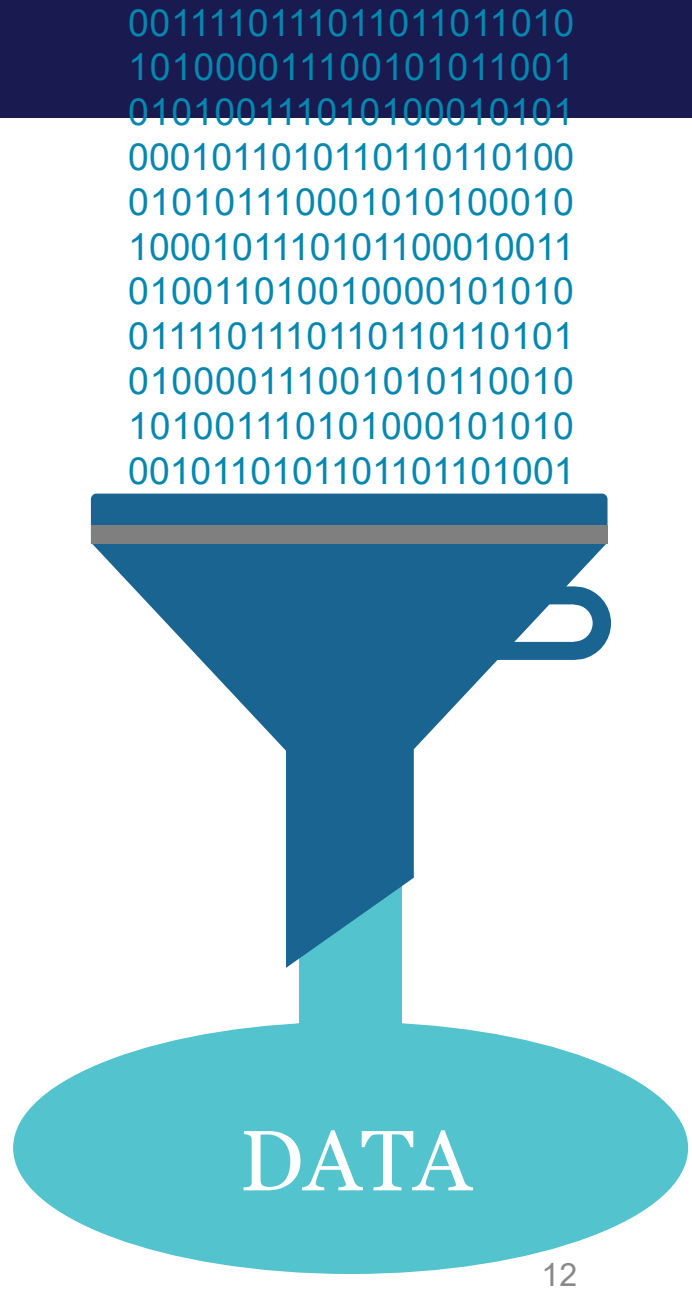
- **Key Tool - Regression Analysis**: Establishes causal inference when assumptions are met, and the model is correctly specified. For example, assessing how advertising spend impacts sales, while accounting for price changes or seasonality—critical for prescriptive analytics.

Econometrics For Business Analytics

Steps in Econometrics	Steps in Business Analytics
Statement of theory or hypothesis: Develop a theoretical framework or hypothesis to be tested.	**Defining the business problem:** Clearly state the problem or decision that needs to be addressed.
Specification of mathematical model of the theory: Translate the theory into a mathematical equation describing relationships.	**Developing an analytical framework:** Define measurable KPIs and relationships to be analysed.
Specification of econometric model: Introduce error terms to reflect real-world variability.	**Specifying an analytical model:** Choose suitable techniques (e.g., regression, machine learning).
Obtaining data: Collect structured data relevant to the variables in the model.	**Data collection:** Gather business-relevant structured and unstructured data.
Estimation of the parameters of the econometric model: Use techniques like OLS to estimate model coefficients.	**Model building and parameter estimation:** Train the model using methods like supervised learning or regression.
Hypothesis testing: Test statistical significance of coefficients to validate the theory.	**Validation of the model:** Assess the accuracy and performance of the model (e.g., R^2, RMSE).
Forecasting or prediction: Use the model to predict future outcomes.	**Prediction and Prescriptive analysis:** Generate actionable predictions (Predictive) or recommend optimal decisions based on predictive insights and constraints (Prescriptive).
Using the outcome of the model for business / policy applications: Apply insights to guide decisions or policy formulation.	**Application of insights:** Use results to optimize strategies, improve operations, or inform decisions.

Economic Data Types

- Economic data comes in a variety of “flavours.”
  - Data may be collected at various levels of aggregation: Micro (individual)or Macro (aggregate)
  - Data may also represent a flow or a stock:
    - Flow: measured over a period (e.g., Income)
    - Stock: measured at a particular point in time (e.g., Wealth)
  - Data may be quantitative or qualitative:
    - Quantitative: expressed as numbers
    - Qualitative: expressed as an “either-or” situation



Economic Data Types

Cross-sectional data

- A cross-section of data is collected across sample units in a particular time period
- The "sample units" are individual entities and may be firms, persons, households, states, or countries

	Variables					
Individual	*RACE*	*EDUCATION*	*MARITAL_STATUS*	*SEX*	*HOURS*	*WAGE*
1	White	10th Grade	Never Married	Male	2	8.00
2	White	Assoc Degree	Married	Male	40	10.81
3	Other	Some College No Degree	Divorced	Male	38	10.23
4	White	High School Grad or GED	Married	Female	32	11.50
5	White	Some College No Degree	Never Married	Male	50	12.50
6	White	High School Grad or GED	Divorced	Female	20	7.00
7	White	High School Grad or GED	Married	Female	10	8.00
8	White	5th or 6th Grade	Never Married	Female	15	9.30
9	White	High School Grad or GED	Married	Female	40	20.00

Economic Data Types

Time-series data

- A time-series is data collected over discrete intervals of time for an individual
- The key feature of time-series data is that the same economic quantity is recorded at a regular time interval

Year	GDP
2001	11347.2
2002	11553.0
2003	11840.7
2004	12263.8
2005	12638.4
2006	12976.2
2007	13254.1
2008	13312.2

GDP of the United States (in US$ Billion)

Economic Data Types

Panel data

- A “panel” of data, also known as “longitudinal” data, has observations on individual units which are followed over time

FIRM	*YEAR*	*PROD*	*AREA*	*LABOR*	*FERT*
1	1990	7.87	2.50	160	207.5
1	1991	7.18	2.50	138	295.5
1	1992	8.92	2.50	140	362.5
1	1993	7.31	2.50	127	338.0
1	1994	7.54	2.50	145	337.5
1	1995	4.51	2.50	123	207.2
1	1996	4.37	2.25	123	345.0
1	1997	7.27	2.15	87	222.8
2	1990	10.35	3.80	184	303.5
2	1991	10.21	3.80	151	206.0
2	1992	13.29	3.80	185	374.5
2	1993	18.58	3.80	262	421.0
2	1994	17.07	3.80	174	595.7
2	1995	16.61	4.25	244	234.8
2	1996	12.28	4.25	159	479.0
2	1997	14.20	3.75	133	170.0

Indexing Conventions

- Subscript "*i*" for data on individuals (so called **"cross section"** data)

$$Wage_i = f(Education_i, Working\ hours_i)$$

- Subscript "*t*" for **time series** data (e.g., series of years, months, or days—daily exchange rates, for example)

$$GDP_t = f(Exchange\ Rate_t, FDI_t)$$

- Subscript "*it*" when we have **both** (for example, **"panel data"**)

$$PROD_{it} = f(LABOUR_{it}, FERT_{it})$$

Lecture Topics

Week	Date	Lecture Topics	Workshop Topics
23	05/02/2025	Introduction: Econometrics for Business & Analytics	
24	12/02/2025	Probability for Econometrics	
25	19/02/2025	Statistics for Econometrics (via MS Teams)	
26	26/02/2025	Statistics for Econometrics	
27	05/03/2025	The Simple Linear Regression Model (I)	
28	12/03/2025	The Simple Linear Regression Model (II)	Workshop 1: Introduction, Probability and Statistics for Econometrics
29	19/03/2025	Multiple regression (I)	
30	26/03/2025	Multiple regression (II)	Workshop 2: Simple Regression Analysis
31	Hari Raya Puasa		
32	09/04/2025	Further Topics in the Multiple Regression Model	Workshop 3: Multiple Regression Analysis
33	16/04/2025	Dummy (Indicator) Variables	Workshop 4: Model Specification and Further topics in regression
34	23/04/2025	Heteroscedasticity & Autocorrelation	Workshop 5: Dummy variables, heteroscedasticity and Autocorrelation
35	30/04/2025	Revision	

Textbooks and Materials (details on Moodle)

Core Textbook:

- Hill, R.C., Griffiths W.E. and Lim, G.C. Principles of Econometrics, fourth edition, Wiley, 2012.

Recommended Textbooks

- Vivek B. Ajmani. Applied econometrics using the SAS system, Wiley, 2008,
- Hill, R.C., Griffiths W.E. and Lim, G.C. Using SAS for Principles of Econometrics, 4th Edition, Wiley, 2012.

Supplementary Textbooks:

- Westhoff, F. An introduction to econometrics: a self-contained approach, MIT Press, 2013
- Alan C. Elliott and Wayne A. Woodward., SAS essentials: Mastering SAS for data analytics, Wiley 2016
- Gujarati, D.N. Econometrics by Example, 2nd ed., Bloomsbury Publishing Plc, 2014.
- Gujarati, D.N. and Porter D.C. Basic econometrics, 5th ed., McGraw-Hill, 2009
- Gujarati, D.N. and Porter D.C. Essentials of econometrics. 4th ed., McGraw-Hill, 2010

For FMBA students:

- Econometrics for Business Analytics by Jose Fernandez.

The materials (based on R programming) might be of an interest to FMBA students. We will cover a few relevant topics in our lectures as and when appropriate.

Note: There are plenty of alternative econometric textbooks which will also cover most of the module topics. You can use any basic or introductory econometric textbooks as a reference for this module.

Modes of Assessment

- **2 hours (120 minutes) exam (80% of overall assessment):**
  There are two sections in the exam paper – Sections A and B. All 3 questions in Section A (30% of the Exam) are compulsory. There are 3 questions in Section B (70% of the exam), of which you can choose to answer any two (35% each).
  [You may obtain the past exam paper from Moodle.]

- **5 Workshop assessments (20% of overall assessment):**
  During each workshop session, you will have to complete lab exercises and submit your worksheet via ExamSys (ROGO). Your answer sheet will be marked and returned in the next week. The Lab exercises you complete (average of the best 4 out of 5) comprise the coursework element of this module (20%).

  Default Reassessment Method: 2 hours (120 minutes) Exam

Workshops

In each of the workshop sessions:

- you will learn how to conduct econometric analysis using GRETL and SAS (except workshop 1).
- you will work on a ExamSys (ROGO) worksheet, and your task is to attempt to answer the questions thereon within the timeframe (45 minutes for Workshop 1 and 30 minutes for the rest.
- You have to work individually. Make sure you bring your lecture notes as well as stationery and a calculator to the workshops.
- The workshop discussion questions will be made available prior to the workshop sessions. Please attempt the questions before the workshop.
- you will have to complete lab exercises and submit your worksheet via ExamSys (ROGO) at the end of your workshop session.
- Once you have started your ROGO session, the timer will start counting and you must complete it within the time period allowed. Your answer sheet will be marked and returned in the next week.
- If you fail to submit your worksheet, **attempt the workshop outside the workshop venue**, do not show up for the test or **turn up at the workshop venue 30 minutes late**, you will receive a zero mark for that particular workshop assessment.
- All workshop tests on ExamSys platform are password protected. Sharing the password with other students is an academic offence.

Workshop Group Registration

Students must sign up for one workshop group via Moodle. Each workshop group is limited to **only 30 students**. You can sign up for workshop group (first-come-first-served) anytime between 2pm February 12 and 11pm February 25, 2025. If you failed to sign up for a particular workshop group, you would be registered in a group with available slot.

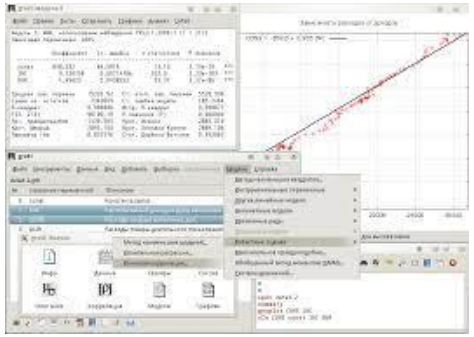
You should sign up for only ONE workshop group. The workshop groups available are:

- Group 1: Fridays 03:00-03:50PM (Week 28, 30, 32, 33, 34 at TCR3)
- Group 3: Thursdays 02:00-02:50PM (Week 28 at TCR2, 30, 32, 33, 34 at TCR3)
- Group 4: Thursdays 03:00-03:50PM (Week 28 at TCR2, 30, 32, 33, 34 at TCR3)
- Group 5: Fridays 04:00-04:50PM (Week 28, 30, 32, 33, 34 at TCR3)

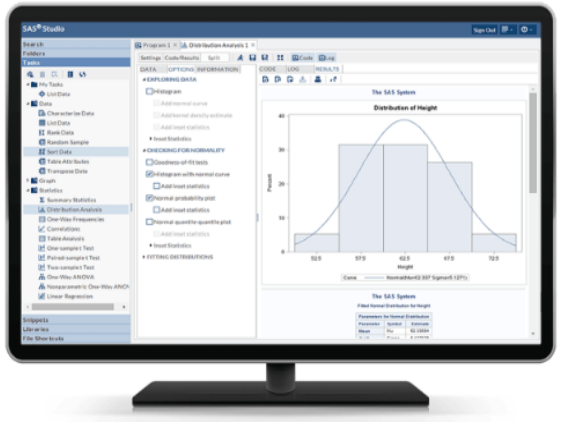
- **You must attend the group for which you are registered. Attending a different group without prior approval will lead to receiving a zero mark for that particular workshop**
- **In exceptional circumstances (e.g. illness) and with appropriate documentation, you may attend another group subject to space availability and approval of the lecturer.**
- **Note that transportation related issues (such carpooling) or non-academic related travel booked after timetable released are not considered as exceptional circumstances**

Softwares

- **gretl:** an open-source statistical package, mainly for econometrics. The name is an acronym for **G**nu **R**egression, **E**conometrics and **T**ime-series **L**ibrary.



- **SAS® Studio:** SAS is an advanced analytics and business intelligence software. SAS Studio provides users with the ability to:
  - use data processing, graphing, and analysis
  - interact with a point-and-click interface that writes SAS programs automatically
  - write SAS programs, which consist of commands in the form of DATA steps and PROC (or procedure) steps.



- See the course Moodle page for installation and registration guidelines.

Feedback of students on the Module (see on Moodle)

I think this module really complements other modules, such as computational finance. I realized that without taking introductory econometrics in the first place, I would not have been able to appreciate the things that I am learning in Computational Finance which uses models from econometrics (Ex: coefficients of independent variables are actually betas of stocks in Computational Finance). Besides that, this module allowed me to get to know the reason that there are so many econometrics models out there, because information is just not perfect and there are too many constraints out there to allow a perfect model. In a way, this module enlightened me.

I don't usually like subjects that are quantitative based but this module was really interesting. The blend of mathematical calculations and making interpretation makes it all the more interesting, and therefore manageable (looking at corporate reporting and audit). Overall I'm very happy and thankful with the way Dr myint delivers the module. Cheers!

The module is organised in a reasonably progressive manner, where the arrangement of the five workshops help students to do timely follow-up to be prepared for the final exam. And the resources provided by the lecturer are helpful and adequate for students to have good practice and build more solid understanding.

Thank you for teaching us this year!💔 Enjoyed classes a lot as the topic was new and informative. Would appreciate it if more practice questions are made available along with guided solutions (I find it difficult to get them from the book). Once again thank you for teaching us!💔

I love this module!! Its very fun and the ROGO quizzes are amazing! Lecturer also very sweet and approachable and takes the time to help out students. 10/10

Overall satisfied , just a tough module in general 👍

Feedback of students on the Module (see on Moodle)

hopefully there are more and different examples shown in the lecture slides ;D

It is a very confusing module.

Thank you for always replying my emails regarding any questions for this module so swiftly. It was a hard module but the explanations and the swiftness for email response helped a lot

Too difficult to understand

Hardest subject and not interested in this subject.

I encourage sir to utilize the google whiteboard platform to increase the interaction with the students so that it will be not too awkward for the students to interact back with the lecturers on MS TEAMS. Anyways, pandemic will soon become a norm for us to blend in already, we might not need the google whiteboard to increase the interaction when things go back to physical but sir can definitely consider to continue to use slido to interact with the students whichever is more convenient for the lecturer.

Most of the time I do not understand the class he taught and I think it might be good if he can teach more example and more details in term of explaining

This is the worst module this semester. The lecturer always want us to give our answer instead of his but the thing is I study math by answers and workings and due to that he doesn't provide lots of workings. I lose interest in this subject zzzz

Is this Module very difficult?

Well, it depends on you ☺

Previous 3 cohorts' performance comparison

	2021-22 (online)	2022-23	2023-24
Average	49.8	53.4	62.8
Standard Deviation	15.5	21	17.8
Maximum	90	97	91
Minimum	0	2	19
Above 69.5 (%)	17 (12%)	23 (23%)	28 (36.4%)
Below 40 (%)	35 (25%)	26 (26%)	9 (11.7%)
Number of students	142	101 (96)	77

Pre-requisites

- This module requires the understandings of the following topics covered in QM1b and QM2a:
  - Linear and Quadratic Functions
  - Logarithm, percentage, and elasticity
  - Differentiations and Integrations
  - Partial Derivatives and Multi-variate Optimisation
  - Measures of central tendency and variation
  - Probability Distributions and Sampling Distributions
  - Interval estimations
  - Hypothesis testing

To get the most out of this module

- Read suggested readings before each lecture
- Attempt the practice questions and past exam questions
- Do ask questions (in Moodle forum or via email)
- Participate in class-room activities: Socrative and Slido
- Use data set from gretl/SAS to run regressions, interpret the results and check the validity of results.
- The lecture topics are arranged progressively. Failure to attend classes and workshops may seriously affect your ability to keep abreast of the course and hence impact on your final grade.
- After successfully completed this module, you should be able to:
  - run regressions (conduct business analytics) using econometrics softwares and interpret the results correctly.
  - well prepared to study advanced topics in Econometrics and Data Science

Lecture Summary

- After this lecture, you should be able to:
  - define what is econometrics and the role of econometrics in business and economic decision makings
  - differentiate between economic model and econometric model
  - identify the different types of economic data
- In Lecture 2, we will be looking at Probability for Econometrics
  - Review Probability and Probability Distribution notes from QM1B

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Thank you and any question?