***MathCamp Report 2016[[1]](#footnote-1)\****

*September 2016*

1. **INTRODUCTION**

This year MathCamp followed the same structure from last year. The mandatory final exam, which was introduced in 2013, counts for five percent points of the final grade of the graduate courses Microeconomics (Econ 8301) and Macroeconomics (Econ 8305). Important changes were introduced in terms of the evaluation for business school students. We made a policy that students from business school should pass the exam to enroll Econ 8301 and Econ 8305. Unlike the last year, final exam was taken right before the semester starts (8/28/2016). Final exam was more challenging than the last year. This report not only analyzes the performance of the students and instructors, but also summarize suggestions made by students who took the course.

1. **MATHCAMP 2016 Teaching Schedule**

***Table.1 Math Camp 2016: Teaching Schedule***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Monday Aug 15** | **MON 353** | Real Analysis | James Foster | 9:00-11:30am |
| **MON 353** | Real Analysis / Mathematical Proof | Jin | 2:00pm – 4:00pm |
| **Tuesday Aug 16** | **MON 353** | Differential Calculous I | Jin | 9:00-11:30am |
| PS Real Analysis | Jin | 2:00-4:00pm |
| **Wednesday Aug 17** | **MON 353** | Differential Calculus Part II | Jin | 9:00-11:30am |
| PS Differential Calculus Part I | Jin | 2:00-4:00pm |
| **Thursday Aug 18** | **MON 353** | Differential Calculus Part III | Jin | 9:00-11:30am |
| PS Differential Calculus Part II | Jin | 2:00-4:00pm |
| **Friday Aug 19** | **MON 353** | Linear Algebra | Amjad | 9:00-11:30am |
| PS Differential Calculus Part III | Jin | 2:00-4:00pm |
| **Saturday Aug 20** | **MON 353** | Probability and Statistics | Amjad | 9:00-11:30am |
| PS Linear Algebra | Amjad | 2:00-4:00pm |
| **Sunday Aug 21** | **FREE** | | | |
| **Monday Aug 22** | **MON 251** | Optimization Part I | Amjad | 9:00-11:30am |
| PS Probability and Statistics | Amjad | 2:00-4:00pm |
| **Tuesday Aug 23** | **MON 251** | Optimization Part II | Amjad | 9:00-11:30am |
| PS Optimization Part I | Amjad | 2:00-4:00pm |
| **Wednesday Aug 24** | **ISO orientation** | | | |
| **Tuesday Aug 25** | **MON 251** | Comparative Statics | Amjad | 9:00-11:30am |
| PS Optimization Part II | Amjad | 2:00-4:00pm |
| **Friday Aug 26** | **MON 251** | Introduction to Dynamic Programming | Jin | 9:00-11:30am |
| Comparative Statics | Jin | 2:00-4:00pm |
| **Saturday Aug 27** | **MON 251** | Office Hour | Amjad | 9:00-noon |
| Office Hour | Jin | 2:00-5:00pm |

1. **GENERAL ORGANIZATIONAL ISSUES AND ATTENDANCE**

Following the last year, we added a paragraph to the offer letter for all incoming Economics PhD and MA students establishing that MathCamp will be held in the last two weeks before term starts and final exam will be counted 5 percent of their first year microeconomics and macroeconomics courses.

The initial direct contact was made via email by Jin Ho Kim on June 17nd 2016 based on the roster of incoming Economics PhD/MA students and PhD in Business students in order to distribute the preliminary syllabus and sample questions to let them know about the content of the course. In total, 46 students attended. (26 Ph.D. in Economics/ 6 Masters in Economics / 7 Ph.D. in Business)

1. **STUDENT EVALUATIONS**

The Course Evaluation sheets were distributed to all students attending the last lecture of MathCamp on Friday 28th. A total of 26 students answered the survey. In order to do comparative analysis, the structure and content of the Evaluation Survey this year was the same as the last years.

In general, a similar result in the evaluation of the course was registered with respect to 2015 (see Table.2). The course as whole was evaluated on average with a 4.96 score out of 6, which is a higher score than the 2015 (4.90). Majority of students (73%) think that the course was either Excellent or Very Good. Evaluation on materials covered were lower than the last year in overall, and instructors’ performance were evaluated higher than the last year.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *Number of students =21* | **Weighted Avg 2015** | **Weighted Avg 2016** | **Excellent** | **Very Good** | **Good** | **Fair** | **Poor** | **Very Poor** |
| **(6)** | **(5)** | **(4)** | **(3)** | **(2)** | **(1)** |
| **1** | The course as a whole was | **4.90** | **4.96** | 6 | 13 | 7 | 0 | 0 | 0 |
| **2** | Amount you learned in the course was | **4.76** | **4.65** | 5 | 13 | 6 | 2 | 0 | 0 |
| **3** | Relevance and usefulness of course content was | **5.24** | **5.23** | 10 | 12 | 4 | 0 | 0 | 0 |
| **4** | Quality of questions and problems assigned was | **5.14** | **4.58** | 8 | 5 | 11 | 2 | 0 | 0 |
| **5** | Effectiveness of the instructors in teaching the subject matter was | **4.86** | **5** | 9 | 11 | 5 | 1 | 0 | 0 |
| **6** | Explanations by instructors were | **4.71** | **4.92** | 8 | 11 | 6 | 1 | 0 | 0 |
| **7** | Answers to participant questions were | **4.86** | **5.08** | 11 | 9 | 5 | 1 | 0 | 0 |
| **8** | Enthusiasm of the Instructors was | **5.62** | **5.81** | 21 | 5 | 0 | 0 | 0 | 0 |

***Table.2 Evaluation results for the Math Camp 2016***

SOURCE: Own elaboration based on the MathCamp Evaluations 2015 and 2016.

At the same time, students still perceive that topics covered in the course are relevant, 85% of them think that the content was either excellent or very good. Though we covered the same materials as last year, 50% of students think that the quality of questions and problem sets were excellent or very good; a clear devaluation compare to the last year (76% students answered either excellent or very good in 2015).

In general, MathCamp instructors were well evaluated, with a small overall improvement with respect to 2015; their enthusiasm were qualified as excellent or very good by 100% of students. In terms of clarity of explanations for questions and materials, 77 % of students evaluated as excellent or very good. Effectiveness of the instructors was evaluated better than the last year as well.

The survey has a space for the student to make additional comments and suggestions. In this report, comments were grouped by student as in the 2015 report. The first point lists what students would like to add, subtract or change about MathCamp, or other suggestions and the second point lists comments about the instructor:

*Student\_1:*

* I would add one more week for the course. It was too much material for only two weeks. Sometimes, we need more time to process all the new material.
* 1. Jin was an amazing TA. He carefully helped us with the questions and problem sets.

2. I would suggest that each TA comes to class prepared. Specifically in the second week, it seems that the TA did not prepared the exercises and he made a lot of mistakes.

3. Both TA understood the topic.

*Student\_2:*

* More implications for economics should be introduced.. The intuition behind the mathematics should be more emphasized.
* Very passionate in the course and try best to respond to the questions in the class.

*Student\_3:*

* When the math camp begins, many students have just arrived to DC. Thus besides preparing for the class and doing homework, we also move our apartments and go to orientation and try to complete all documentation issues. Therefore, instead of two sections in one day, it would be better to have one each day. Most of the days we finished morning classes early. We could use remaining time from morning classes for problem solving. This also provide students with sufficient time to work on the following day’s problem.
* They were both helpful and tried to answer all of the questions.

*Student\_4*

* Math camp is too heavy, for non-math-major. We are squeezing too much material in 2 weeks. We could extend the length of math camp to 3 weeks.
* The handout is not very clear. If one barely learned the stuff, one cannot follow it.

*Student\_5:*

* Some of the more remedial topics has too much emphasis in the problem sets. More focus on applications in economics and less on theory? Maybe?

*Student\_6:*

* I think it could have been beneficial to have more time to absorb the material.
* Keep it up, Jin!

*Student\_7:*

* Excellent!

*Student\_8:*

* It would have been better to send the answers of the problem sets. Also, the first assignment that was used to form the groups was too easy for the camp compared to problem set questions.
* Jin Ho Kim was the best instructor ever. He was so enthusiastic and well prepared. He did his best to explain the topics and the solutions.

*Student\_9:*

* No
* Make the materials more detailed like more examples.

*Student\_10:*

* Add Game Theory, Time Series

*Student\_11:*

* Fast-paced for students who have not learned the materials. Hope to get answers.
* Very nice. ^.^ ! Surprised by the enthusiasm of the instructor. Thank you, Jin!

*Student\_12:*

* (1) Arrange lectures so that subjects are arranged in the order of difficulty. For example, put linear algebra earlier in the lecture.

(2) More detailed handouts.

(3) More examples in handouts.

*Student\_13:*

* I would add more statistics and fundamentals of econometric analysis and statistical anomalies. I think there was too much emphasis on basic optimization. I would add more set theory and explore more thoroughly the delta definition for real analysis II of continuity and the existence of limits.
* Clearer hand writing and more formalized proof.

*Student\_14:*

* The number of days is very small compared to the amount of covered materials, especially considering the fact that there is almost no breaks or weekends in between.
* I know that Jin thinks that shouting while teaching is somehow helpful, but it REALLY is not. PLEASE try to keep your voice down, it is very very VERY disturbing when you shout.

*Student\_15:*

* 1. It would be good to add more contents about real analysis, which I find very useful in higher level of icroeconomics.

2. And subtract some pure calculation part.

3. The supplying material could be more detailed. For example, for the comparative statics slides, more details explaining why we are studying that content would be very helpful.

* The instructors are very enthusiastic and full of passion.

*Student\_16:*

* The course is useful and closely relevant to contents in econ courses in general. It will be better if there’s more exercises and the instructors would go through some of examples instead of explaining theory in the course material.
* Enthusiastic, explanations are helpful.

*Student\_17:*

* Although the course was very beneficial, there were many topics to be covered in few days. It might be better if some material was taught in micro and macro and the rest in Math Camp. My suggestion would be that, the instructor should be coming to the class with the answers to the problem sets, so that it would be him who is checking the solutions, not the students. Moreover, it would be better if the instructor considers using the board more frequently, rather than just showing the material from the projector.
* Jin was a great instructor who tried his best to explain even a very simple topic in many different ways. It was really nice that he was available via email so that we could get answers to our questions that are asked through emails.

*Student\_18:*

* The lengths of the homework assignments were overwhelming at times. If they were a bit shorter, I could spend more time studying the material being taught.
* Both were great!

*Student\_19:*

* Some of the problem sets were quite long so it may not be a bad idea to make them a bit shorter.
* I thought Jin and Amjad did a great job of running the course.

*Student\_20:*

* Too many materials covered sometimes so may lose of concentrations.
* Very Enthusiastic.

*Student\_21:*

* The content is just right, but the materials can be improved by showing full steps.
* 1. Jin: Very Enthusiastic and good at explaining.

2. Amjad: Good at explaining, can develop higher familiarity with the material.

*Student\_22:*

* Very helpful

*Student\_20:*

* Very helpful

*Student\_23:*

* 1. I think if the math camp can start from Mid-July or Early August will be better since we have a lot of materials are going to be reviewed.

2. The textbook recommended on the syllabus wasn’t used. I bought it beforehand, but I think the textbook could be an optional.

3. Not every group members are very responsible. Sometimes, I feel prefer to discuss with people outside of group.

* 1. Jin is very passionate to answer our questions and also lecturing and give us very helpful information with regards to courses, lifes and the living for the first year.

2. Amjad taught clearly also. I like his linear alebra and constrain problem solving the most.

1. **MATH & STAT EXAM: General Comments**

This year the exam was prepared by Amjad Khan and Jin Ho Kim with the supervision of Professor Arun Malik. The exam was taken on Sunday, August 28th, from 3:00pm to 6:00pm, which is just one day after the last MathCamp lecture on Friday, August 26nd. Since the exam counted for five percent points of Micro and Macro courses in Fall 2016, the exam proposal was sent on August 27th to Professors Arun Malik, Pamela Labadie, Paul Carrillo, Summit Joshi, Tara Sinclair, and Constantin Burgi for their comments and final approval. They approved the proposal by email by August 28th with no substantive comments.

The goal of the exam was to be challenging but fair. While incorporating problems from the last year and from problems set discussed during the afternoon session, there are some challenging problems that weaves several topics. The questions were much longer than the last year. (see the complete exam in *Appendix B*).

Students had three hours to complete the task, the same time given last year. The exam had 11 questions with several sub-questions adding up 100 points distributed as follows:

* Three questions of *Differential Calculous* (12 points)
* Two sub-question of *Comparative statics* (9 points)
* Two questions on *Homogeneous Functions and Real Analysis* (10 points).
* Two questions of *Real Analysis* (10 points).
* Six questions of *Constrained/Unconstrained* *Optimization* (28 points).
* Two questions on *Difference and Differential Equation* (13 points)
* Four questions of *Probability and Statistics* (18 points)

As can be seen in Table 3, the general results of the Math&Stat exam were again quite disappointing but marginally better than in 2014. The cutoff to pass the test was 65 points out of 100. Therefore, **20 out of 34 students passed the test (59%)**, the average score was 68 (median of 71) with a high standard deviation (17 points) reflecting the heterogeneity within this group.

***Table.3 Math & Stat Exam Results***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| # | First | Last | Major | Level | Attended MC | Score(100) | Pass |
| 1 | Josiah | Mark Drewry | Business | Ph.D. | Yes | 25 | Fail |
| 2 | Edgerton | Brett | Business | Ph.D. | Yes | 35 | Fail |
| 3 | Khalid | Alotaibi | Economics | Ph.D. | Yes | 45 | Fail |
| 4 | Michael | Arango | Economics | Master | Yes | 46 | Fail |
| 5 | Robin | Merse | Economics | Master | Yes | 47.5 | Fail |
| 6 | Michael | Rand | Business | Ph.D. | Yes | 48 | Fail |
| 7 | Megan | Bishop | Economics | Master | Yes | 51 | Fail |
| 8 | Priyanka Devarakonda | Kanth | Economics | Ph.D. | Yes | 55 | Fail |
| 9 | Jinhee | Park | Economics | Ph.D. | Yes | 56.5 | Fail |
| 10 | Qi | Chen | Economics | Ph.D. | Yes | 56.5 | Fail |
| 11 | young | Mkandawire | Economics | Master | Yes | 57 | Fail |
| 12 | Irmak | Cankatan | Economics | Ph.D. | Yes | 60 | Fail |
| 13 | Zidong | Pan | Economics | Master | Yes | 61 | Fail |
| 14 | Atilla | AY | Business | Ph.D. | Yes | 62 | Fail |
| 15 | Naixin | Zhu | Economics | Ph.D. | Yes | 67 | Pass |
| 16 | Scot | Remick | Economics | Ph.D. | Yes | 69.5 | Pass |
| 17 | Ivette | Contreras Gonzalez | Economics | Ph.D. | Yes | 71 | Pass |
| 18 | Ruoyu | Chen | Economics | Ph.D. | Yes | 71 | Pass |
| 19 | Connor | Meneough | Economics | Ph.D. | Yes | 73 | Pass |
| 20 | Behdad | Kian | Business | Ph.D. | Yes | 74 | Pass |
| 21 | Urbashe | Paul | Economics | Ph.D. | Yes | 74 | Pass |
| 22 | Charles | Eason | Economics | Ph.D. | Yes | 75 | Pass |
| 23 | Nisan | Gorgulu | Economics | Ph.D. | Yes | 76 | Pass |
| 24 | Patrick | Bauer | Economics | Ph.D. | Yes | 78 | Pass |
| 25 | Yuliya | Sivay | Business | Ph.D. | Yes | 78.5 | Pass |
| 26 | Bozhen | Liu | Economics | Ph.D. | Yes | 82 | Pass |
| 27 | Yoon Jung | Lee | Economics | Ph.D. | Yes | 82 | Pass |
| 28 | Jiang | Bo | Economics | Ph.D. | Yes | 84.5 | Pass |
| 29 | Xiaoying | Yang | Economics | Ph.D. | Yes | 84.5 | Pass |
| 30 | Chen | Xiangpei | Business | Ph.D. | Yes | 91 | Pass |
| 31 | Zheyu | Yang | Economics | Ph.D. | Yes | 91 | Pass |
| 32 | Je-Uei | Kuo | Economics | Ph.D. | Yes | 92 | Pass |
| 33 | Xinxin | Cao | Economics | Ph.D. | Yes | 93 | Pass |
| 34 | Liu | Yijun | Business | Ph.D. | Yes | 94 | Pass |
| 35 | Aastha | Malhotra | Economics | Ph.D. |  |  |  |
| 36 | Anuraag | Gupta | Economics | Master |  |  |  |
| 37 | Hanadi | Alabaad | Economics | Ph.D. |  |  |  |
| 38 | Hector | Tzavellas | Economics | Ph.D. |  |  |  |
| 39 | Jie | Li | Economics | Master |  |  |  |
| 40 | Matthew | Farrell | Economics | Ph.D. |  |  |  |
| 41 | Mohammed | Alshowaikhat | Economics | Ph.D. |  |  |  |
| 42 | Ning | Song | Economics | Ph.D. |  |  |  |
| 43 | Shoola | Dzhumaeva | Economics | Master |  |  |  |
| 44 | Zhang | Yue | Economics | Ph.D. |  |  |  |
| 45 | Zhengqing | Bao | Economics | Master |  |  |  |

|  |  |
| --- | --- |
| *Bin* | *Frequency* |
| 20 | 0 |
| 30 | 1 |
| 40 | 1 |
| 50 | 4 |
| 60 | 6 |
| 70 | 4 |
| 80 | 9 |
| 90 | 4 |
| 100 | 5 |
| More | 0 |
| mean | 67.83824 |
| sd | 17.21479 |
| median | 71 |
| 25th pctile | 56.5 |
| 75th pctile | 81.125 |

1. **SUGGESTIONS FOR THE MATH CAMP 2016**

Given the cumulative experience over the last two Math Camps, some suggestions might be important to consider for future courses:

* *Organizational Issues*:
* For those students who enrolled 1st year ph.d. sequences and who do not have a sufficient math background, it would be helpful if we provide the power point slides with syllabus in advance. We can provide the material in May

* For those students coming from other Department/s, a formal notification has to be submitted during the spring term to the authorities and Professors in charge of the graduate Programs in those Department/s. In addition, a kindly reminder might be sent in May and during summer.
* For those students who directly contact the Professors of Macro and Micro to ask for an authorization to join their courses, it would be very important that these potential students were immediately informed about the MathCamp and the exam, providing at the same time the contact information of the Instructor in charge of coordinating the MathCamp.
* Many students responded that the math camp is too intense, and they do not have a time to digest the material. Given these comments, we need to either send more detailed information (lecture note and slides) in advance or cover the same material over 3 weeks and finish the final exam before the semester starts.
* *Course Content and Material provided*:
* Since the Professors of Macro and Micro are ultimately responsible for a fair treatment of the students and content of their courses, they could discuss with the MathCamp Team about the content of the course and the scope of the topics covered. A meeting during the spring term is suggested to better prepare the MathCamp syllabus based on their recommendations.
* Though several students suggested that we provide a written solution to them, providing answer keys for problems sets does not help the purpose of the math camp. When students prepare for the comprehensive exam, they will not have an answer key for the previous comprehensive exam. They have to find out the solution on their own, or depend on other classmates. This whole process of math camp is microcosm of the first year Ph.D. study.

**APPENDIX A**

## *Course outline:*

# 1) Basic Concepts:

Set, set operations, real and complex numbers, positive and negative number, function.

# 2) Real Analysis:

Sequences in R, convergence (epsilon-N definition), sequences in Rn (mapping from N to Rn), subsequences, convergence, limit of subsequence, closed set, the unit ball is closed, an orthant is closed, preservation of weak inequality in limit, infinite intersection of closed sets is closed, applications to orthants and budget sets, union of finite number of closed sets is closed, infinite union need not be closed, budget set example, closure, closure and set inclusion, “smallest closed set containing a set”, complement of a set, open set as complement of closed set, DeMorgan’s law, digression on norms and distance (metric), properties of norms, Euclidean norm, properties of distance, triangle inequality, Taxicab norm, sup norm, open epsilon ball, another definition of open, neighborhood, interior point, exterior point, boundary point, interior, boundary, link between interior and closure, closed relative to a set, open relative to a set, compact set, bounded set, convergent subsequence definition of compact, intersections of compact sets, finite unions of compact sets, compact sets in economics, continuous functions achieve max and min on compact set (Weierstrass Theorem), application to consumer theory (existence of a utility maximizing bundle), application to producer theory (existence of a cost minimizing input bundle), convex set, strictly convex set, convex combination, intersection of convex sets, convex hull as smallest convex set containing a set.

# 3) Linear Algebra:

Vector, column, row, matrix, matrix addition, matrix subtraction, vector addition, vector subtraction, geometric interpretation, scalar multiplication, matrix multiplication, vector multiplication or inner product, properties of inner product, Euclidean norm, properties, orthogonal, perpendicular, orthonormal, properties of matrix operations, commutative, associative, distributive, transpose, linear dependence, linear independence, linear combination, basis, matrix as vector of vectors, space generated by matrix, determinant, row interchanges and determinant, combination of rows and determinant, scalar multiplication of row and determinant, minor, cofactor, singular, nonsingular, singularity and solution of system, rank, Gaussian elimination, rank as number of basis vectors, cofactor matrix, adjoint, inverse matrix, properties, derivation through Gaussian elimination, system of linear equations, solution via inverse, Cramer’s rule, diagonal matrix, block diagonal, symmetric, idempotent. Eigenvalues and Eigenvectors

# 4) Differential Calculus:

*Part 1:*

Continuity at a point, continuous functions, right and left continuity, Intermediate Value Theorem. Differentiability on ℝ, the Mean Value Theorem. Derivatives and Limits: L’ Hopital’s rule, Composite functions, Inverse functions, the Inverse Function Theorem. Higher order derivatives, interpretation of the first and second derivative. Functions on ℝ, the Hessian matrix, the Young’s Theorem.

*Part 2:*

Total Differential. Taylor and McLaurin approximations. Taylor series. Integration: indefinite integrals, integration by parts, definite integrals, First Fundamental Theorem of Calculus, Second Fundamental Theorem of Calculus, properties of integrals. Differentiation under the integral sign, the Leibniz’s formula. Multiple integrals: the Fubini’s theorem.

# 5) Difference and Differential Equations:

Differential equations. First order linear difference equation FOLDE: the general solution, initial value problem, the particular solution, a cookbook to solve FOLDE. System of FOLDE: general solution, homogeneous system. Phase diagrams: construction, interpretation, and different solutions. Difference equations: an introduction to first order difference equations, convergence.

# 6) Static Optimization:

Principal submatrix, principal minor, kth order principal minor, leading principal submatrix, leading principal minor, positive definite (PD), negative definite (ND), positive semidefinite (PSD), negative semidefinite (NSD), indefinite, tests via minors, unconstrained optimization, constrained optimization, objective function, equality constraints, global and local solutions, example from consumer theory, budget set, well-behaved preferences, tangency condition, MRS, MU per dollar, first order conditions, second order conditions, global maximum and convexity, problems with nonconvexities, problems with kinks, problems with corners, general solution procedure, Lagrangian function.

# 7) Comparative Statics with Application:

Endogenous and exogenous variables, Linear model, Cramer’s Rule, stability and comparative statics results, second order conditions and comparative statics results, solution procedure, system of equations, Implicit Function Theorem, Jacobian, Jacobian matrix, differentials vs. partial derivatives, application in microeconomics and macroeconomics (IS-LM models).

**8) Probability and Statistics:**

*Part 1:*

Set theory, properties of probability, conditional probability, Bayes’ rule, independence, random variables, cdf, pdf, joint distribution, marginal distribution, conditional distribution, mean, properties of expectation, variance, covariance, correlation, moment generating function, uniform distribution, normal distribution, Bernouli distribution, Binomial distribution, exponential distribution.

*Part 2:*

Markov chains, law of large numbers, central limit theorem, t-test, Wald test, confidence interval, p-value, power of a test.

**9) An introduction to discrete-time Dynamic Programming:**

The typical infinite-horizon optimization problem, state and control variables. The nature of the problem, from a sequential problem to a recursive one: the Bellman’s Principle of Optimality, assumptions required. Computational methods to solve for the Value function. Some examples with the Guess and Verify method: guessing the policy function versus the Value function. A brief comment on finite-horizon optimization problems.

1. \* This report was prepared by Jin Ho Kim and Amjad Khan to be presented to the Math Camp Supervisor, Professor Arun Malik , as well as to other Professors and the Chair of the Department of Economics. [↑](#footnote-ref-1)