

**Departments of Economics and Agricultural and Applied Economics**  
**Ph.D. Written Qualifying Examination**  
**August 2010**

*Purpose*

All Ph.D. students are required to take the written Qualifying Examination. The primary purpose of the Qualifying Exam is to provide each person both the opportunity and the responsibility to review and synthesize the material in economic theory and quantitative methods considered essential to successful performance in subsequent course work, dissertation research, and as a graduate of the Ph.D. program. As a requirement of all students for the Ph.D. degree, the Qualifying Exam also provides a level of cohesiveness among programs of graduate studies otherwise tailored to individual interests and objectives. Finally, the Qualifying Exam is evaluative. This exam must be passed in order for a student to proceed in the Ph.D. program.

*Program of Study*

Prior to taking the Qualifying Exam, students must have an approved program of study on file at the Graduate School. Exceptions to this rule, while unusual, may be considered if the student petitions the chairs of Graduate Program Committee (GPC) in writing not later than four weeks prior to the examination date. Students entering the Ph.D. program with a M.A. or M.S. degree must file a plan of study for their Ph.D. program. Students entering the Ph.D. program without a M.A. or M.S. must file a plan of study for a M.A. or M.S. program. Students that have not filed a plan of study **will not** be allowed to take the Qualifying Exam. As stated in the Student Planning Guide, a M.A. or M.S. program of study requires the signatures of a chair and two committee members, while a Ph.D. program of study requires the signatures of a chair and four committee members.

*Course Work and Subject Coverage*

The Qualifying Exam is a subject-matter exam, not an exam based on specific course work. It is the student's responsibility to decide what course work and other preparations will provide their background for taking the Qualifying Exam. First-year courses in microeconomics, macroeconomics and econometrics are generally considered essential. A file of previous exams is maintained by the president of the Graduate Student Association and by the Qualifying Examination Committee (see "Administration" below). They are also available online: <http://www.aaec.vt.edu/aaec/gradprelim.htm> Previous exams provide a useful guide to the types and difficulty of questions to be expected, but should not be construed as perfect predictors.

*Scheduling*

The Qualifying Exam will be given in January of the second year in the PhD program, the week before the Spring Term begins. All PhD students are **required** to take the Qualifying Exam at this time. Exceptions to this rule, while unusual, may be obtained on an individual basis. To be considered for an exception, a student must petition the chairs of the GPC in writing as early as possible and not later than four weeks before the examination date. Students who fail to take the Qualifying Exam without the required permission will be considered to have failed the exam, unless there are extraordinary extenuating circumstances.

It is anticipated that students taking the Qualifying Exam will devote considerable time to preparation and will make appropriate arrangements with their assistantship advisors and

concerning other summer plans. The chairs of the Qualifying Exam Committee (see "Administration" below) are available to serve as ombudsmen and discuss any individual problems that arise with students and other faculty. Members of the Qualifying Exam Committee are also happy to advise students on preparation for the exam.

A meeting is held for students planning to take the exam in November. Exact dates for the exam are provided at this meeting, and questions about the exam are addressed.

The Qualifying Exam may also be offered later in the spring semester for students who are required to retake the exam (see Grading below).

### *Structure of the Exam*

The Qualifying Exam is administered in two sessions on specific days during the scheduled week. Questions in each session are designed to be answered in a total of three hours, but up to four hours are allowed.

Questions from any of the exam topics may be included on either day. There are no guidelines as to the number of hours devoted to particular exam topics, but exam questions will be grouped into microeconomic, macroeconomics, and statistics/econometrics sections. Each section of the exam comprises a number of questions, often with subparts to each question.

### *Administration of the Exam*

The administration of the Qualifying Exam is the responsibility of the Qualifying Exam Committee. This committee is comprised of six faculty members appointed by the Department Heads, three from each department, two of whom serve as co-chairs. For 2010, the chairs of the committee are Amos Katz, Econ, and George Davis, AAEC/HNFE.

The Qualifying Exam committee solicits questions for the exam from faculty in Economics and Agricultural and Applied Economics. Faculty submitting questions are advised about the purpose and level of difficulty of the Qualifying Exam. Faculty asked to submit questions often include, but are not limited to, those teaching courses in microeconomics, macroeconomics, and econometrics during the preceding year. Final determination of the questions on the exam, and of the recommended time allotted for answering each question, are made by the Qualifying Exam Committee. The students will be informed of the relative weights (hours) associated with each section of the exam. Each question will be labeled with its weight and with which section of the exam it counts toward.

### *Grading the Exam*

Responsibility for grading of the Qualifying Exam and the determination of whether each student passes or fails the exam rests solely with the Qualifying Exam Committee. Students taking the exam are assigned an identification letter and the exams are graded anonymously. At least two graders evaluate each question: one of the graders is a member of the Qualifying Exam Committee and the other frequently is the question writer. For any given question, all answers are evaluated by the same two graders. Individual questions are graded as Superior Pass, Pass, Marginal Pass, Marginal Fail, or Fail.

Based on the individual grades, overall performance on the exam is then evaluated by the Qualifying Exam Committee to determine whether each student has passed the exam. At this time, additional evaluations of individual questions and/or exams may occur. There is no target or quota for the proportion of students who will pass or fail the Qualifying Exam and failure on one question does not necessarily preclude a person from passing the exam.

Each student is advised in writing on their performance on the Qualifying Exam. Every effort is made to have these evaluations available within four weeks of the examination. The exams are not returned, but students passing the exam are welcome to meet with the chairs of the Qualifying Exam Committee to discuss their performance on specific questions.

### *Successful Completion of the Exam*

The Qualifying Exam Committee will look at each paper (labeled only with an identifying letter) and award a pass to anyone who achieves at least a marginal pass for the exam as a whole. For students who do not achieve at least a marginal pass for the exam as a whole, the Qualifying Exam Committee will then determine a grade (on the same grading scale) for each of the three individual sections of the Qualifying Exam.

If a student does not achieve at least a marginal pass on at least one section, they will have failed the Qualifying Exam, with no option of a re-take unless their Department Head grants an exception. Absent such an exception, the student is dropped from the Program, as of the end of the Spring Term. In the case of such an exception, the student will need to wait until the following January to re-take the entire Qualifying Exam.

If a student achieves at least a marginal pass on two sections of the Qualifying Exam, then he/she will be eligible to re-take just the remaining section of the Qualifying Exam for which a marginal pass was not obtained. Any re-takes needed will be offered immediately after Spring Break of the Spring term, with a final decision made by the Qualifying Exam Committee as soon as possible thereafter. The length and format of the (single) re-take Qualifying Exam prepared for a particular section will be the same as for the corresponding section of the full Qualifying Exam and administered at the same time for all students re-taking this section of the Qualifying Exam. If a student does not achieve at least a marginal pass on this re-take section of the Qualifying Exam, he/she will have failed the Qualifying Exam, with no option of further re-takes, unless their Department Head grants an exception. Absent such an exception, the student is dropped from the Program, as of the end of that Spring Term. In the case of such an exception, the student will need to wait until the following January and re-take the entire Qualifying Exam.

If a student achieves at least a marginal pass on just one section of the exam, then the Qualifying Exam Committee will identify this student by name and combine their information on this student's performance across all three parts of the exam with their available information as to this student's performance in the core courses and with any other information appropriately relevant to a determination of the chance that this student will succeed in the Program. Based on this information, the Qualifying Exam Committee will decide whether or not to allow the student a re-take on the two failed parts of the exam. If this decision by the Qualifying Exam Committee is negative, then this student will have failed the Qualifying Exam, with no option of further re-takes, unless their Department Head, in consultation with the two Graduate Program Directors,

grants an exception. Absent such an exception, the student is dropped from the Program, as of the end of that Spring Term. If this decision by the Qualifying Exam Committee is positive, then this student will be eligible to re-take the two sections of the Qualifying Exam for which a grade of marginal pass was not obtained. Any re-takes needed will be offered immediately after Spring Break, with a final decision made by the Qualifying Exam Committee as soon as possible thereafter. If a student does not achieve at least a marginal pass on each (which is to say, both) of the two sections, then he/she will have failed the Qualifying Exam, with no option of further re-takes unless his/her Department Head grants an exception. In the case of such an exception, the student will need to wait until the following January and re-take the entire Qualifying Exam.

### **Study Areas for Qualifying Examination Preparation**

#### **I. Microeconomic Theory**

##### **A. Consumer Theory**

Preferences and utility functions  
Ordinary and compensated demand functions  
Substitution and income effects  
Expenditure function  
Indirect utility function  
Revealed preference  
Aggregate demand functions  
Expected utility  
Measures of risk aversion

##### **B. Production Economics**

Production functions/sets  
• Economies of size and scale  
• Law of Diminishing Returns  
• Elasticity of substitution  
Profit maximization and cost minimization  
Properties of supply, cost, and profit functions  
Hotelling's and Shepard's lemmas  
Average and marginal costs  
Long- and short-run cost curves

##### **C. Theory of Markets**

Competitive markets  
Non-competitive markets  
• Monopoly  
• Monopolistic competition  
• Oligopoly  
• Cournot and Bertrand competition

Effects of entry/exit  
Market failure and theory of second best  
Externalities

#### D. Non-cooperative and Cooperative Game Theory

Extensive forms  
Normal forms  
Mixed Strategies  
Dominance  
Rationalizability  
Nash equilibrium/Nash bargaining solution  
Perfection in normal forms  
Sub-game perfection  
Shapley value  
Arrow's Theorem

#### E. General Equilibrium

Edgeworth box  
Exchange economies  
Walrasian equilibrium  
Pareto optimality  
Theorems of Welfare economics  
Existence of equilibrium  
Limit theorems  
Public goods

### II. Macroeconomic Theory

#### A. General Equilibrium Models of Economy

Consumption and saving; forward-looking behavior  
Asset markets  
Aggregate output market  
Labor market  
Money, inflation and interest rates; neutrality and superneutrality  
Investment  
Productivity changes and technological change  
Business cycles  
Unemployment  
Open economy issues: balance of payments, exchange rates, international linkages  
Taxes, borrowing, government spending, Ricardian equivalence  
Analysis of disturbances  
Policy analysis

## B. Investment Theory

Neoclassical theory

q theory

Investment under uncertainty

## C. Other Topics

Basic macroeconomic empirical regularities

Keynesian model and its extensions (IS/LM plus Phillips curve)

Nominal and real rigidities and implications

Strategic complementarities and multiple equilibria

Consumption theory

Implications of imperfect competition

Simple search models of unemployment

Overlapping generations models

Neoclassical growth theory

## III. Quantitative Methods

### A. Mathematical Statistics

Probability theorems

Bayes theorem

Random variables

Probability distributions

- Normal distribution

- t distribution

- F distribution

- Chi-squared distribution

Mathematical expectations

Chebyshev's inequality

Methods of point estimation

- Maximum likelihood

- Least squares

Confidence interval estimation

Properties of estimators

Hypothesis testing

### B. Econometrics

Least squares estimation

- Results of Gauss-Markov Theorem

- Deriving least squares estimators and their variances

- Properties of least squares estimators

- Assumptions of the Classic Linear Regression (CLR) model

Consequences of violating CLR model

- Autocorrelation
- Violations of normality
- Heteroscedasticity
- Linearity
- Structural change and varying parameters

Misspecification testing

- Testing statistical assumptions of CLR model

#### Specification testing

- Testing regression equations
- Individual coefficients
- Subsets of coefficients

#### Other topics

- Dummy variables
- Multicollinearity
- Omitted Variables
- Forecasting
- Basic time series analysis

#### IV. Applied Economics

Most qualifying examinations include questions whose content is not specific to any one course, but which are deemed to be of the sort of question that an economist should be able to answer. These questions involve applying economic concepts, theories, and ideas to novel situations, and require the student to demonstrate competence in written communication. The topics below are simply *examples* of the sorts of topics which might be addressed.

Effects of subsidies and taxes

Market failure

Measuring gains and losses

- Consumer and producer surplus
- Compensating and equivalent variation

Tax incidence and equilibrium responses