

# **What Does a Software Engineer Need to Know About Economics and Finance and Why**

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## **Introduction**

The need for software engineers to truly understand and appreciate the economic context within which their products are developed and sold does not appear to be well accepted. A predominant view among “traditional” software engineers is that we should concern ourselves with technical details and leave decisions regarding business and economics to the “suits”.

On the other hand, it is arguable that many “suits” start out as software engineers and then make their way to a point where they must deal the best they can with these issues. Some make use of a combination of additional education (perhaps an MBA) and “on-the-job training”. Others either are not given or do not take the opportunity to avail themselves to formal education in these areas and quickly find themselves overwhelmed. It is also true that many normal software engineers (“non-suits”) bitterly resent seemingly illogical decisions and actions by senior management.

The Oregon Master of Software Engineering program (<http://www.omse.org>) is a collaborative program hosted by the four Oregon Universities (Portland State University, Oregon State University, University of Oregon and the Oregon Graduate Institute). The program offers the Master of Software Engineering degree which is awarded by whichever institution an individual chooses. The program is tailored to the needs of Oregon’s software industry and is targeted at working, mid-level software engineers.

For the most part, the curriculum is fairly typical of a contemporary Master of Software Engineering degree:

- OMSE 500 -- Principles of Software Engineering
- OMSE 511 -- Managing Software Development
- OMSE 512 -- Understanding the Software Business
- OMSE 513 -- Professional Communication Skills for Software Engineers

- OMSE 521 -- Using Metrics and Models to Support Quantitative Decision Making
- OMSE 522 -- Modeling and Analysis of Software Systems
- OMSE 525 -- Software Quality Analysis
- OMSE 531 -- Software Requirements Engineering
- OMSE 532 -- Software Architecture and Domain Analysis
- OMSE 533 -- Software Design Techniques
- OMSE 535 -- Software Implementation and Testing
- OMSE 551 -- Strategic Software Engineering
- OMSE 555/556 -- Software Development Practicum I & II

However, it includes one course that is seldom seen in most other programs. OMSE 512, “Understanding the Software Business” focuses on the marketing, financial and legal aspects of the software industry. This course establishes a core set of financial and economic topics that we believe Software Engineers need to know. These topics are spread over a six hour series of lectures that are delivered over a two week period (out of a ten week course).

- Basic macro economics concepts – especially with respect to its affect on pricing decisions
  - Supply-and-Demand
  - Substitutes/Complements
  - Producer and Consumer surplus
  - Elasticity (of various sorts: price, cross-price, income, etc.)
- General pricing strategies, especially
  - “Price-to-Cost”
  - “Price-to-Value”
  - Variable vs. Fixed Costs
  - Breakeven analysis
  - Cost allocation of indirect and fixed costs
  - Marginal revenue
- Capital Budgeting Issues
  - Time Value of Money
  - Discounted Cash Flow Analysis
  - Revenue Recognition
  - (Financial) Risk and Uncertainty
    - risk-adjusted discounting
    - portfolios

To date, we have taught this class six times since 1998 (one to two times a year under a three quarter, plus summer annual schedule) to between 50 and 60 students. These students are primarily composed of mid-level practicing software engineers, mostly employed by local “high tech” software companies. They view the MSE as an opportunity to grow professionally as a software engineer. Consequently, we feel that this class represents an “optimistic view” of practicing industrial software engineers.

From this experience, there are a number of issues that we believe can be generalized to the broader practitioner community. Upon entering the program, most students exhibited the following characteristics:

1. lack of prior exposure to economic and/or financial topics
2. misunderstanding of the concepts of time value of money and financial quantification of risk
3. misunderstanding of cost allocation methods, especially with respect to indirect and fixed costs
4. lack of awareness of methods for quantifying the impact of substitutions and complements on demand and pricing, especially with respect to elasticities

The issue at hand of course, is if this lack of knowledge represents a significant shortcoming for the average software engineer. It is, after all, hard enough to be educated and keep up with the technology of developing software, much less also having to become acquainted with aspects of economics and finance that many business majors may not fully understand.

It is our position that a lack of awareness of the financial and economic aspects of the business is in fact a serious problem. This is not due to an expectation that software engineers will necessarily have to compute cross-product elasticities or determine risk premiums for discounted cash flow analysis. Rather, we are concerned that this lack of awareness will foster a lack of appreciation for these issues, so when these techniques are used, their results will be devalued or ignored. Our fear is that consequently, sub-optimal decisions will be made because a large portion of the available information and analysis is not brought to bear on the problem.

By exposing mid-level software engineers to financial and economic issues as part of a mandatory core course within the Master of Software Engineering program, we hope to raise awareness, and foster more business-like outcomes.