

Computational Finance Program Review

June 8, 2010

The following document outlines the process and findings for the five-year Computational Finance Graduate Certificate Program review. The report is divided into distinct sections with the aim of addressing the charges of the graduate school to evaluate the program and to assess whether it should be continued.

Executive Summary

The extensive discussions engaged in by the review committee suggest that *the computational finance graduate certificate program (CFGCP) has been successful and should indeed be continued*. The program co-directors, Doug Martin and Eric Zivot, should be commended for developing an interdisciplinary program that has had a broad base of appeal to graduate students on the University of Washington campus. However, as will be outlined further in this document, the committee also found that the program was in a very fragile state in that it depended critically on the continued contributions of Martin and Zivot and was not supported by any department. Realistically, for the program to be continued, its foundation must be strengthened. Specifically, the certificate program needs to (i) find a UW departmental home that would take responsibility for the CFGCP and work with Martin and Zivot to further develop it, and (ii) develop a revenue stream, most likely from a fee-based masters program, to support both the CFGCP and the masters program on a self-sustaining basis. It is imperative that these two issues be addressed and resolved in the next five-year period of the program.

Current CFGCP Program

The CFGCP is run largely by the initiative and effort put forward by its co-directors: Doug Martin (Statistics) and Eric Zivot (Economics). Working in collaboration with various faculty in other departments, such as James Burke (Mathematics) and Krzysztof Burdzy (Mathematics) and faculty from the finance department (courses such as FIN 561, 562, 590, 591, and 592, many of which are electives in the current program), the co-directors are able to supplement their own course offerings with material that is highly relevant to the computational finance certificate. Thus the CFGCP leverages a wealth of intellectual talent at the University of Washington. The co-directors should be commended for their effort to develop a strong interdisciplinary program that brings together interested faculty from across the UW campus. Moreover, current certificate students and one program graduate were all uniformly positive in their assessment of the program. Enthusiastic support was also given by representatives of the UW Treasury, where an alumnus of the program has been placed and collaborative projects have been undertaken. The overall impact of the CFGCP is quite remarkable given that it has been managed by just two faculty from different UW departments. These findings alone would warrant support for the continuation of the program into the next five-year cycle.

One criticism from the students concerned the lack of breadth of courses in computational finance. In particular, the students felt improvements could be made by offering courses in

a broader range of subjects, most notably in derivative pricing models, and by reinstating a seminar series featuring presentations from both academic and finance professionals. Given the limited number of faculty (primarily Martin and Zivot), it is not surprising that such gaps in the educational structure exist. A directed effort should be made to broaden the breadth of the program to ensure that the most critical aspects of computational finance are covered.

Sustainability of the CFGCP is a critical question for the program. As has already been pointed out, the co-directors share the brunt of the burden of running the program, and this is largely done on their own initiative without the support of a home department. Unfortunately, this is unsustainable since if either Martin or Zivot were to become unavailable, there is no UW faculty member prepared to step in and teach their specialized courses or take on their administrative duties. Indeed, the program does not generate any income at all, so there are no funds that could be drawn upon to bring in adequate substitutes.

The sustainability question is quite acute because (i) Doug Martin will be retiring within the next 3-5 years, (ii) An attempt was recently made to recruit Eric Zivot away from the UW and (iii) Currently no department has either an intellectual or financial interest in the survival of the CFGCP. Thus the program is in a very fragile state given its exclusive dependence on two key people, one of whom is guaranteed to leave in the foreseeable future, and another whose reputation may make him a constant target for recruitment away from the UW. Given the important contribution the certificate program is making to Ph.D. students at UW, it is very important to solve this sustainability problem.

The sustainability problem has two important parts: (1) finding a departmental home for the program and (2) generating a revenue stream that would allow for improvements in the program. The most obvious potential sources of revenue would be a fee-based masters program in computational finance. The program could also seek support from financial institutions in the Pacific Northwest.

Potential Departmental Homes for the CFGCP

The committee was continually faced with the notion that the CFGCP, first and foremost, needs to be housed in a home department that will support the mission and vision of the computational finance program. There were six possible UW academic homes considered by the committee: Statistics, Economics, the Foster Business School, Industrial Engineering, Mathematics, and Applied Mathematics. The first three seemed to be the most obvious choices as Martin is a member of the Statistics Department, Zivot is a member of the Economics Department, and the Foster Business School has finance as one of its core departments. We next summarize the results for all six possible homes.

- **Statistics:** The Statistics department would seem to be a natural home for the program given that Doug Martin is the creator of the CFGCP and Statistics is his home department. On closer inspection, however, it appears that Doug Martin is the only member of the department interested in the intellectual area of computational finance. This view was supported by more extensive conversations with both Werner Stuetzle and Jon Wakefield, a former and current chair of Statistics respectively. It is clear that the Statistics department, even if given

multiple positions in the foreseeable future would not hire in the area of computational finance. Indeed, they see themselves moving in a very different intellectual direction from finance. Thus it would be hard to imagine that Statistics would ultimately house a certificate program for which the only interested faculty member is near retirement. It was made clear that the department would not hire a faculty member with research interests in finance just in order to support the program. Ultimately, the computational finance program was viewed as a program peripheral to the intellectual interests of the department. Furthermore, the viability of a program supported by only two faculty members was called into question. This diminished the department's confidence that the program would continue to be successful and reduced any interest the department may have in becoming a home for the program.

- **Economics:** The Economics department initially appeared to be a good choice to house the CFGCP. Given that Economics is Eric Zivot's home department and this department recently developed a large retention package (including a Chaired Professorship) to retain him, this would suggest that the department highly values Zivot and his role in the department. But like the Statistics department, Robert Halverson, Economics department chair, made it clear that the current academic directions of the Economics department are inconsistent with supporting, through hiring, a faculty member in the computational finance arena. Much like Martin in Statistics, Zivot's research in computational finance seems to be orthogonal to the general interests and direction of the Economics department. It was also unclear to Professor Halverson how the department would or could support Eric Zivot in developing a program. They have neither extra resources nor FTE support for the certificate program.
- **Foster School of Business:** The Foster School of Business was represented by Professors Tom Lee and Lawrence Schall. Although the Business school is aware of the computational finance program, they clearly had no interest in the program or its future. This was despite Professor Schall's statement that he felt there was a great need to develop more analytic and quantitative methods in the arena of finance. The business school clearly has a set of objectives that they are actively pursuing, and computational finance would not be one of those objectives in any foreseeable future. Thus the business school also effectively removed themselves from consideration as a home department, since they are fully committed to their own intellectual research areas and their own educational programs. The Foster school is in the process of developing two new programs including an information science degree and a global eMBA program. They stated categorically that they would not be interested in a computational finance program even if the participating students generated the same revenue level as MBA students.
- **Engineering (Industrial and Systems Engineering (ISE)):** Matthew O'Donnell, Dean of Engineering, had heard of the computational finance program, but none of his faculty had expressed any interest in taking on the program, most likely in the industrial and systems engineering program. O'Donnell's primary concern was that there was: (i) no pro-active efforts toward developing a computational finance program from the ISE faculty, (ii) there was no mention by key faculty concerning the possibility of hosting the program in engineering, and (iii) there was essentially no measurable support or leadership from engineering regarding the program. Although he was supportive of the idea of the computational finance program in general, his ultimate concern was for the quality, sustainability and leadership of the program. He felt there must be strong internal support and commitment from

faculty in engineering before he would entertain any consideration of housing a computational finance program. Given the lack of such support, Engineering clearly is not a possible home for the CFGCP program

- **Mathematics:** Several Mathematics Departments around the country host computational finance programs. In discussing the CFGCP with Professor James Burke, it was clear that Mathematics is stretched exceptionally thin by its broad base of course offerings at the undergraduate and graduate level. The key professors who would be involved in the program, James Burke and Krzysztof Burdzy, are both being moved away from teaching their standard upper division optimization courses in order to teach broader service requirements. Professor Burke's perspective was that the CFGCP program was limping along but that no real traction had been gained towards building a sustainable, well-supported program. Like Statistics and Economics, the intellectual direction of the department is clearly focused in other areas of academic interest, making the department an unlikely home. Indeed, the Mathematics department was not even considered as a potential home by Martin or Zivot.
- **Applied Mathematics:** Applied Mathematics offered to investigate the possibility of running the program through its own infrastructure. Doug Martin and Eric Zivot had on two or three previous occasions broached the subject about Applied Mathematics taking on the CFGCP program. Applied Mathematics has several critical features in its favor (i) the department runs a highly successful on-line program that could easily integrate portions of the computational finance program, (ii) the department currently offers a number of graduate level courses that would be suitable, under slight modification, to supplement the scope of the CFGCP and contribute to a possible masters degree program in computational finance, and (iii) there is faculty interest in the intellectual area of computational finance. Indeed, under the aegis of Applied Mathematics, computational finance could find an intellectual and administrative home to support and grow the program in a revenue generating, self-sustaining manner. This was the only department that seems enthusiastic about working with Martin and Zivot towards building a world-class computational finance program.

The choices for potential home departments resulted in two conclusions: First, aside from applied mathematics, none of the other candidate departments would support the program by committing resources and future faculty lines to the program. Second, only by establishing a home department would the long term sustainability goals of the CFGCP be met. Despite the negative or indifferent responses from the potential home departments of Statistics, Economics, Business, Industrial Engineering, and Mathematics, the exercise proved useful by identifying Applied Mathematics as a potential home for the certificate program, one in which the program would be supported and encouraged to grow. In interest of full disclosure, the CFGCP review committee Chair is also the Chair of Applied Mathematics. Thus a full conflict of interest statement was given to the other committee members. However, given the lack of enthusiasm for the program shared by the five other potential academic homes, there is no conflict of interest with the interests of any of the other departments.

Funding the CFGCP

The CFGCP currently does not bring in any resources. It continues to be successful because of the efforts of Martin and Zivot who teach courses designed for the program and invest their time in running the program. To reach a sustainable state, the program needs to generate revenue. The most obvious source would be the creation of a fee-based masters program, either on-line or on-site or both. A masters program in computational finance would require more course offerings and an administrative infrastructure to provide student services (such as advising and placement), admission, etc. Fortunately, the Applied Mathematics department already administers a very successful on-line masters program, which would provide some of the needed infrastructure. Furthermore, the department offers courses which, with some modification, could be included in a computational finance masters curriculum. More courses would be needed, but the revenues generated by the program would more than cover these costs. It should be noted that the CFGCP would be distinct from a computational finance masters program. The former is a short certificate program designed for Ph.D. students, many with research interests in computational finance. The masters degree would be a terminal professional degree consisting of course work. If a full-fledged masters degree program were developed, it would not only provide revenues to sustain the certificate program, but it would provide additional courses that could be taken by certificate students to enrich their own program. Thus both the CFGCP and a professional masters degree program could both exist and be very synergistic.

Committee Recommendation and Future Outlook

There is clear interest in computational finance from the student perspective. Further, computational finance is a field of growing importance and demand. The lack of support for the current program at the University of Washington is surprising given that many universities have turned such programs into strong revenue sources for academic departments. The committee therefore recommends that the CFGCP be allowed to continue. However, in continuing the program, several high priority goals must be pursued in order to justify the long-term existence of the program. The committee would like to make the following specific recommendations:

1. **Continuation:** The CFGCP has been successful and should be allowed to continue provided key aspects are put in place to make it a long-term, self-sustaining program. Furthermore, the curriculum should be enhanced to provide a broader academic program on computational finance for the certificate students. If a parallel fee-based professional masters degree program is developed to generate revenue necessary to sustain the program, this masters program could contribute both revenue and new courses that would broaden the certificate program. Consequently both the CFGCP and a professional masters program could co-exist and be synergistic.
2. **Home department:** A home department needs to be identified for the computational finance program. At the present time Statistics, Economics, the Foster Business School, Engineering and Mathematics will not provide suitable homes for the CFGCP. On the other hand, Applied Mathematics is a very strong candidate as a possible home. Martin and Zivot will need to have detailed discussions with the faculty of the Applied Mathematics department to work out all the details. It would appear that the research interests of some of the Applied

Mathematics faculty coupled with that department's experience with fee-based masters programs makes them a very appropriate choice. The review committee hopes that all the parties will see that it is in their best interests to come to a mutual agreement. No other options seem to be available at this point.

3. **Sustainability:** The sustainability of the CFGCP hinges on the development of revenue, and the most obvious source of revenue is a fee-based professional masters program. Applied Mathematics would be interested in developing such a Professional Masters Degree Program in Computational Finance. This program could have both an on-site and on-line presence much like the current, and highly successful, masters degree in applied mathematics.

If a supportive home department is found and a revenue generating fee-based masters degree is developed, then the committee feels fairly confident that the CFGCP can not only flourish but its scope can be slightly expanded. The revenue can also be used to add faculty lines to further advance computational finance both as a research area and as an area of graduate education. Replacing Doug Martin's teaching and research contribution in the program is also a critical issue for the immediate future and the steps above give the program the best chance of success.

It should also be noted that in building a sustainable and interdisciplinary infrastructure, the committee felt that it should not be necessary to move faculty lines into the home department of the computational finance program. This issue will clearly have to be resolved in developing a future framework for the program. However, it would also seem that within the infrastructure of a sustainable computational finance program, many departments could benefit financially from the success of the program as the fee-based program would provide some form of buy-out money for faculty from various departments. This would be the approach that Applied Mathematics would take, sharing the wealth with different departments rather than moving appointments into Applied Mathematics.

Logistic Details of the Review Process

The following are the specific details of the review committee's meetings. They are included here for completeness.

Location and Date:

Meetings were held in Savery Hall on Friday, May 7, home of the Department of Economics. Specifically, the morning meetings were held in Savery Hall 410 and the afternoon meetings were held in Savery Hall 311. The interviews conducted included members of various departments and students, including Robert Halverson (Chair of Economics); Jon Wakefield (Chair of Statistics); Werner Stuetzle (Divisions Dean, Natural Sciences); Matthew O'Donnell (Dean of Engineering); Tom Lee and Lawrence Schall (Foster School of Business); James Burke (Mathematics); Doug Martin and Eric Zivot (Co-directors of the program); Keith Ferguson, Garth Reistad, and Yinden Jiang (UW Treasury); and a group of computational finance graduate certificate students.

Committee members:

The following were the committee members:

J. Nathan Kutz, Professor and Chair, UW Department of Applied Mathematics (Committee Chair)

Mark Damborg, Professor, UW Department of Electrical Engineering, filling in for Les Atlas, Professor, UW Department of Electrical Engineering, who had an unavoidable conflict with a trip to NSF on Friday, May 7

John Lehoczky, Thomas Lord Professor of Statistics and Dean,
College of Humanities and Social Sciences, Carnegie Mellon University

George Zinn, Corporate Vice President and Treasurer, Microsoft