Feasibility of international comparisons of PhD program times-to-degree and completion rates

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Abstract

Can one usefully compare doctoral times-to-completion and completion rates for institutions in different countries, or are there too many confounders in the national contexts of the universities for such a comparison to be useful? Based on an attempt to compare three institutions, we find that issues of definitions and data availability are the major stumbling blocks. National and institutional contexts also complicate matters. Because of these complications, comparisons are difficult to make, but it might be possible to account for those confounding issues to gain some insights from such comparisons.

Introduction

For a number of good reasons, there is an increasing interest in comparing doctoral programs across national boundaries. There are expanding flows of students internationally, and those students would like to have better information about the choices open to them. Governments in a number of jurisdictions are interested in more 'efficient' production of doctoral graduates, and often look outside their borders for examples to make their points in this regard. With EU universities moving toward a common framework as a result of the Bologna Process, comparisons with other countries' doctoral education processes and outcomes are likely to increase. Finally, institutions themselves wish to 'benchmark' their own performance with good performance elsewhere in the world, to see if there are ways they can improve.

In this context, it is reasonable to ask if it is possible to make legitimate comparisons of doctoral programs that operate within different national and historic contexts. The three authors of this paper each have extensive experience in working in doctoral education in a different country. Our purpose in this paper is to attempt a comparison of some doctoral program outcomes, in an effort to identify the pitfalls and possibilities of making cross-national comparisons.

The first issue to be addressed is what topics it is plausible to consider in such a comparison. Certainly the underlying concern in any such effort is the overall quality of the graduate program taken as a whole. That, however, is a difficult concept to address even within a single country, as is described in the recent methodology report for a new survey of research doctorate programs in the US (Ostriker, 2003). That report identified several shortcomings in the previous such NRC-supported survey (Goldberger, 1995). The one that is particularly important for this discussion is that the survey was based on a "flawed measurement of educational quality", in which the "reputational measure of program effectiveness in graduate education … confounded research reputation and educational quality." Even if it were possible to assess the reputation of graduate programs, to attempt to do so cross-nationally would

introduce unavoidable national, cultural, or linguistic biases for those doing the rating.

The one measure from the 1995 survey that appears to make sense cross-nationally is the median time to completion of the degree. Surprisingly, the 1995 study did not include a related objective measure that is probably equally important, namely the percentage of students who complete the degree. One might think that these two items, completion rates and times to completion, are relatively easily measured in any country, and therefore could potentially serve as a basis for cross-national comparisons. However, as the following pages will show, undertaking this type of measurement and comparison proved to be quite complicated. There are many variations and complexities hidden within the definitions of their measurement that make institutional comparisons far from obvious, and would make generic cross-national comparisons nearly impossible at present. As a result, we focused on trying to compare our own three institutions, so far as that was possible.

One earlier cross-institutional and cross-national study worked in terms of survival and hazard models to address completion rates and times (Bergman, 1994). That study focused on specific disciplines, and noted that in general "similarities in doctoral degree completion patterns may be predominantly attributed to disciplinary effects rather than to the attributes of an institution or a nation" (abstract). We have attempted to control for disciplinary effects in our study by classifying the results into four or five broad fields of study.

One word of caution before proceeding: often the same word is used with different meanings in the different countries, or different words are used to describe the same concept. With two of the three authors from North America, there is a bias toward that terminology here, although we try to make note of it when we are aware of a difference in language. The next section of this paper addresses the issue of feasible ways to measure completion rates and times. Following that, some quantitative comparisons are provided, drawing on numbers from our own institutions when possible. To understand or explain the numerical results, we then turn to a discussion of salient issues about the national context within which (post)graduate education occurs, including the educational systems prior to the PhD. The concluding section returns to the original question: are such international comparisons feasible or helpful?

Potential ways to measure time-to-degree and completion rates

A number of methods have been used to measure the two indicators of interest, but several can be eliminated for purposes of a cross-national comparison. This section discusses the set that has been used, and offers a rationale for focussing on only one for each indicator.

Consider time-to-degree (TTD) first. Four measures are in common use. The US Survey of Earned Doctorates (SED) (Hoffer, 2003) uses three (p. 20): "(1) the total time elapsed from completion of the baccalaureate to completion of the doctorate, (2) the total time elapsed while in graduate school [anywhere] to completion of the doctorate, and (3) the age of the doctorate recipients at the time the doctorate is

awarded." A fourth measure used in earlier SEDs and elsewhere is the total registered time for the degree.

Of these four measures, only the total elapsed time is appropriate for an international comparison of graduate programs. Age at PhD completion, and time from baccalaureate to completion, are important for labour force planning, but that is not the focus of our paper. In addition, these two measures are culturally dependent. For example, Australian PhD students are older at the time they begin study than are US students (Holbrook, 2004), with the result that both of these measures would be distorted in a cross-national comparison. Similarly, there are disciplinary differences, with Humanities and Social Science students in the US tending to stop out of school between bachelor's and graduate work, unlike students in the Science and Engineering disciplines. Registered time, the fourth potential measure, reflects the policies and regulations of each institution, and/or funding regimes in the different countries, and is therefore also not a useful measure of how much of the student's time the degree actually takes.

Elimination of these three measures leaves as the measure potentially useful for international comparisons the total time elapsed from first registration to the date that the degree is completed. Even this definition, however, leads to two issues of detail. The first issue is whether that first registration should be in graduate school anywhere, as in the SED; at the school at which they received the doctorate; or specifically in the doctoral program that was completed. The SED approach is not feasible here, as most institutions do not have detailed information on previous universities attended. Either of the other two definitions has both advantages and drawbacks. We three authors ourselves do not agree on which is better, and that disagreement reflects in large measure the nature of the graduate system we each work in. Ultimately, the abstract debate must yield to the data that are available for the comparison, and it is in that context that we will return to this definitional issue.

The second issue in the definition is when the degree is deemed to be completed. We have used the date when all requirements for the degree are completed, including external examination, revisions, and final submission of the revised copies. One reviewer suggested that the appropriate time is when the thesis is submitted for external examination, since the examination process, revisions, and the time to produce the library copies can together take as much as six months. It is our view that it is the fulfilment of *all* requirements that finally allows the student to get out from under the shadow of the doctoral degree requirements. Submission for the external examination still leaves the student with concerns, and usually work to do. In this regard, it is useful to note that HEFCE's recent study of PhD completions uses the completion of all degree requirements, and not submission date (HEFCE, 2005).

There is also the issue of whether TTD should be measured for entering cohorts, or for exiting cohorts (i.e. those who graduate in a given year). Bowen and Rudenstine (1992) conclude that the only correct way is to measure on the basis of entering cohorts, which is therefore what we propose for the comparisons, again depending on data availability.

With regard to completion rates, entering cohorts must clearly be the basis for calculation, since these rates are defined as the percentage of entering students who complete the degree. The issue is when they should be measured. Ideally, one would prefer to use a number of years from entry such that all, or at least almost all of the students have completed the program (or dropped out of it). As with times-to-degree, however, the nature of the data that are available will take precedence over any *a priori* definition. It therefore becomes important to be clear about the definition of completion rates that one is using, and to take that into account in the comparison. It is also important to be aware that completion rates can be strongly skewed by differences in enrolment patterns in different disciplines. Humanities, social sciences and education for example have high rates of part-time enrolments at some of our institutions, and thus inevitably lower completion rates and times within any specified period, unless analyses can be restricted to full-time students.

Quantitative comparisons

Our initial effort was to compare national numbers on these two measures, but that proved impossible for two reasons: either the data do not seem to exist, or the definitions underlying them differ too much across countries. For Australia, the closest to any kind of national numbers on degree completion are in a federal government study done in 1999 on the 1992 entering doctoral cohort of domestic students (i.e. excluding overseas students) (Martin, 1999). In that seven year period, only 53% of the doctoral students had completed their degree, and 18% were still studying. Although the US SED has numbers on times-to-degree, there seem not to be any national numbers on completion rates. Canadian time-to-degree and completion rate data are available publicly only for the 1992 cohort (nine years later), and only for about 2/3 of the national doctoral enrolment (CAGS, 2004).

For both of these reasons, we gave up on looking at national data, and turned instead to data from our own institutions, to see if at that level, where we could have better control of definitional issues, a comparison is feasible and meaningful. We recognized that at the institutional level, and wishing to break numbers out into four or so broad disciplinary fields, it would be necessary to combine the data for several entering cohorts in order to have a large enough sample for meaningful analysis. Unfortunately, the University of Washington publishes time-to-degree information only for exiting cohorts (http://www.grad.washington.edu/stats/TTD/index.htm), and does not report completion rates; hence we were not able to use UW data for this comparison. Fortunately, there are US data recently published about Duke University (Siegel, 2005), and we have been able to use those instead. Table 1 shows the results across the three institutions for times to completion in four broad fields of study. We have been able to ensure a close match of departments within these broad fields for Melbourne and McMaster, but for the Duke numbers have simply taken the published values, listing Humanities and Social Sciences both under the Arts category, resulting in two lines of data for that category under Duke.[1]

[1]For Melbourne, the analysis was done as of 14 May 2003 for entering cohorts for calendar years 1992 through 1996. That is, students had between 6.37 and 11.37 years to complete their degrees. The McMaster study was done as of August 31, 2004, for entering cohorts from September 1993 through August 1998, providing between 6 and 11 years for the students to complete. The Duke study considered Ph.D. cohorts matriculating from Fall 1991 through Fall 1995 as of Fall 2004, providing

Table 1. Doctoral outcomes for three specific institutions

	Melbourne			McMaster			Duke		
	N	% compl	median TTD	N	% compl	median TTD	N	% compl	median TTD
Arts	413	54%	5.7	219	53%	5.0	344 450	61% 60%	6.7 6.0
Eng'g	323	69%	5.0	153	76%	4.3	259	60%	4.9
Life Sci	703	76%	4.7	142	77%	4.0	471	73%	5.5
Phys Sci	386	74%	4.7	158	75%	4.0	379	60%	5.0

In all three cases the data refer only to students who commenced their doctoral studies on a full-time basis. One reviewer suggested that this is an inadequate control of differing proportions of Full-time (FT) and Part-time (PT) candidature, and suggested that FT-equivalent (FTE) candidature should be used instead. There are two practical problems with this suggestion. First, it is not obvious what rate of equivalence should be used for PT. Australia treats it as equal to half of full-time, but Ontario treats it as 30% of FT. Which is correct? Second, to move to FTE as the basis would require going into the term by term details of every student's record. That in turn would make doing such comparisons as this one even more difficult than they already are, and would reduce the likelihood that they would be done at all. Restricting the analysis to students who began their programs on a FT basis at least removes the most obvious inequities from the comparison. In addition, it seems plausible that a student who began full-time had initial intentions of finishing on that basis, or at least more quickly than had they started part-time. It might be interesting to do a similar study for students who began a program on a PT basis.

The same reviewer argued that time on leave should be omitted from the calculation. We are of mixed opinion. While we have some sympathy for this view, there are three reasons for including leave time. First, it is often the case that work continues on the degree even while a student is on leave, whether the leave be for family reasons, for illness, or for employment issues. Second, the requirement to complete the degree remains with the student while she is on leave. Using calendar time to completion does not reflect the demands made on the university's resources, but may reflect the impact that the doctoral work has on the student's life. Third, and most important for the present study, is the practical point that the calendar time data were available from analyses already done at Melbourne and Duke. Omitting leave time would have entailed a complete re-analysis, by other people who have access to the individual-level student data.

TTD in all three cases is measured as total calendar time between start of program and date of completion, but there is an important discrepancy in the data with regard

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between 9 and 13 years for the students to complete. Although this is somewhat longer than for the other two institutions, given the median TTD it should not affect the comparison too much.

to the start date. Melbourne and Duke admit students directly to the PhD, but have calculated the start date from the time of first entry to graduate studies at their university. For those few students who first enrolled in a Master's program, but then upgraded to a PhD program, the start date was the date of entry into the Master's. At McMaster on the other hand, most departments require a Master's degree prior to entry into the PhD, and TTD for the PhD is generally calculated from time of entry into the PhD. A special analysis was run, to count the time from start of the Master's for those who transferred to PhD status without completing the Master's, in order to match the Melbourne analysis. But the time spent in Master's work has not been counted for those who completed the Master's before beginning PhD work. This is consistent with standard Canadian practice, as reflected also in the data in the report by the Canadian Association for Graduate Studies (CAGS, 2004).

Even recognizing that inconsistency in definitions, the first thing one notes in these numbers is that not only is the general pattern of completion rates consistent at Melbourne and McMaster, lower in the Arts than in the Sciences, but the rates themselves are almost identical in all but Engineering. At Duke, completion rates follow a different pattern, with essentially the same completion rate across all areas except Life Sciences. It is only in Life Sciences that the completion rates at all three institutions are similar. In the Arts, Duke's completion rates are noticeably better than at the other two schools, which may relate to the presence of their Center for the Humanities, and the fact that Duke has focused resources on the Arts disciplines, at least relative to the other two schools.

These completion rates are lower bounds, not final numbers. At both Melbourne and McMaster, for which we have more detailed data as well, there is a small percentage of students still in program at the time these numbers were tallied. The highest percentages are not surprisingly in Arts. At Melbourne, 24 of 413 entrants, or less than 6%, still remained enrolled or expected to return. For McMaster Arts, the corresponding numbers are 7 out of 219, or just over 3%. While the final completion rates may be higher than the ones reported in Table 1, they will not be markedly higher. There is also the question of how long one must wait to perform such calculations. Two of Melbourne's students who began in 1992 were still enrolled or expected to be as of May 2003. It should not be necessary to wait until every student has either completed or dropped out of a program before one can calculate useful statistics such as are discussed here.

For times-to-degree, McMaster generally has the lowest numbers (but this is affected by the treatment in the Table of prior Master's degrees); Duke and Melbourne have similar times in Engineering and Physical Sciences. Duke is almost a full year longer in Arts and in Life Sciences.

The conclusion from this table is that these two primary measure of doctoral outcomes, completion rates and times, differ in identifiable ways across the three institutions. The next section discusses some of the reasons for these differences, drawing on aspects of the national system more than on the individual universities.

Potential reasons for the differences

We have identified eight potential reasons for the differences:

- the nature of undergraduate education;
- the structure of the PhD program;
- the proportion of students completing a Masters degree prior to the PhD;
- the presence or absence of a requirement for continuous registration, and its relationship to the financial support provided to students;
- the governmental context including funding of the universities;
- the definition of full-time study, and its consequences for tuition fees and student employment;
- the proportion of students studying part-time; and
- the national job market as reflected in employment prospects for graduates.

Nature of undergraduate education

Undergraduate education in the US is less specialized than that in the other two countries. The Australian undergraduate degree is the most specialized, and builds on a secondary school education that is also more specialized than in the US or Canada. As is often the case, the Canadian university system falls somewhere between the US and the UK systems. In this case, since the Australian is largely modelled on the UK, the Canadian ends up part way between the US and the Australian. A Canadian student does not enter university with very much previous specialization, as one would in Australia, but more specialization is encouraged (and often required) within an honours undergraduate program than in the US.

As examples, we looked at Physics and English undergraduate programs in each of the authors' own institutions. The minimum course requirements, expressed as a percentage of the total course load over four years, are shown in Table 2. The differences among the three institutions are not as great in English as in Physics, where Melbourne's requirement is for twice as much physics as at Washington, and more math as well.

Table 2. Percentage of total four-year program required in specific disciplines

PHYSICS

	McMaster	Melbourne	Washington
total physics reqd	55	63	31
math	17	19	12
other science	10	3	5
elective	17	16	50

ENGLISH

	McMaster	Melbourne	Washington
total English reqd	50	53	42
other languages	0	0	8
other Humanities/Arts	0	0	0
elective	50	47	50

At Washington, "the College limits to 90 the number of credits from a single department that the student may elect to count in the 180 credits required for the baccalaureate degree." (http://www.washington.edu/students/gencat/ 20 April 2005). Hence no more than 50% of the work over the four years is *permitted* to be in physics, which is a lower proportion than is *required* in physics at the other two universities. This type of limit to specialization has historical roots. Clark, for example, describes the way in which the American undergraduate college developed as generalist education. In the late 18th century and into the 19th, "the four-year uniform college program was defined as the right place for the broad preparation of the educated person." (Clark, 1995). When research and doctoral education began to occur in American universities in the late 1800s, "the general undergraduate program was the immovable object" (both quotes from p. 121), which was maintained even as the research imperative led to the addition of new structures within the university. Because the undergraduate preparation is not specialized, graduate education in the US may have to fill in some of the gaps in the specialities of a discipline before a student can begin to consider undertaking advanced research for the PhD. This may explain some of the differences in times-to-degree.

Structure of the PhD program

The doctoral program structure reflects assumptions about the undergraduate background (but note that each of the three countries admits doctoral students from the other two). Australia has in the past had no required coursework for the doctorate, although formal coursework is increasingly being required in some programs (e.g. Economics and Commerce). Canada requires about one year of coursework, although that is often after graduate coursework as part of a Master's degree. Two years of coursework tends to be the norm in a US doctorate. If these differences in coursework requirements were the explanation for difference in TTD, one might expect time to completion to be shortest in Australia, roughly a year longer in Canada, and roughly two years longer in the US. This is not consistent with the order of the data in Table 1 (keeping in mind still the difference in the start time for the TTD measures). While the structures of the programs are perhaps a contributor to the differences in time to completion, they are clearly not the main cause.

Proportion of students completing a Masters degree prior to PhD study

The current official view of the Ontario Council on Graduate Studies is that an Honours Bachelor's degree alone is not sufficient for admission to PhD: a Masters degree is also needed. As a consequence of this restriction, over half of the PhD students at McMaster had completed a Masters degree prior to starting their PhD. In some disciplines, it is common practice to admit a student to a Masters program, and then if they are progressing well to promote them to PhD without finishing the Masters. (When this happened, the start date for the PhD was backdated to the start of the Masters for calculation of Table 1.) This happened to roughly three-quarters of the Health Sciences PhD students, about half of those in Science and Engineering, and few if any in the Arts disciplines. By contrast, most Melbourne students go directly from the Honours program into the PhD. Similarly, at Duke most students are admitted directly to the PhD following the four-year bachelors degree. It seems reasonable to expect that the advanced coursework of the Masters degree, plus the

prior experience of doing a graduate level thesis should give the student an advantage in completing the PhD, if the Master's required a research thesis. However, data from the University of California system showed quite the opposite result: students without a Master's degree completed both their graduate study and their PhD itself in less time than those with a Master's degree, whether the Master's was from the same institution as the PhD or a different one (Nerad, 1991).

Continuous registration, and student support

One major difference among the institutions is the expectation regarding student registration during the summer term. Melbourne and McMaster (indeed Australia and Canada generally) expect students to remain fully registered (enrolled) throughout the year. They also generally try to provide financial support that is consistent with that expectation. In contrast at Duke (as at many US schools), it appears that enrolment for the summer term is required and expected only of those who have financial support from the university, whether scholarship or research assistantship. Unsupported students are free to allow their enrolment to lapse for the summer while they earn money outside the university, and then return to enrol again in the fall. This is likely to have a larger effect on calendar time to completion than many of the previous potential explanations.

This explanation also relates to the differences across the broad fields of study. In the US and Canada, science and engineering (including health sciences) receive from various sources larger funding for their doctoral students (Nerad, 1991). Social science and humanities fields have the lowest institutional and national funding other than TAs. This discrepancy is compounded by the fact that in science and engineering the research assistantships often permit students to be working on research closely related to their dissertation, which is not often the case in social science or the humanities. Thus the nature and source of financial support is a major explanation of the differential time to degree among broad fields.

Governmental context including funding

The fifth potential explanation of outcome differences is government policy, and particularly policies related to funding of universities. Although often less of a driver of PhD structure and outcomes than the governments would like, both of these are nonetheless significant constraints on the programs. In Australia, the funding to universities by the government has since 2001 been limited to four years of study for each doctoral student. (DEST, 2004) Section 8.2. (It was previously five years)

The governmental situation in the other two countries varies by province or state. In Ontario as in Australia, universities are funded on the basis of student enrolments, up to a maximum number of students. The funding to a university on behalf of graduate student enrolment is also time-limited. A university can receive funding for an enrolled doctoral student for anywhere from three and one-third years to four and a half years depending on whether the student did a Masters degree and how long that took. In a number of US states there is no limit on the number of years for which the university is funded for a student. However, for a private school like Duke, this is a non-issue, as there is no direct government funding per student. The direction of the

differences in TTD is consistent with this explanation, but the average times exceed governmental funding limits, so this is not a complete, or even a major explanation.

Definition of full-time study

One might expect 'full-time student' to mean the same thing in all countries, but it does not, and the conditions that attach to it are different. Melbourne limits full-time students to 6 or 8 hours of employment per week, and if a student is not full-time, he or she loses the federal scholarship most have. McMaster (and Ontario generally) limits full-time students to ten hours of employment per week "on average in any one term". The US has the most decentralized system, with different regulations in each state, university, and sometimes department. Full-time status is usually based on the number of units being taken; treatment of thesis-only registration is handled differently by each institution. Full-time students are often allowed up to 20 hours per week of employment at the university as a research or teaching assistant; there is no limit on off-campus work. As a consequence of these differences, the amount of time that a full-time student has available to devote to their studies (and specifically their thesis) may vary considerably across the three countries.

This item alone may be one of the largest contributors to differences in time to completion. Assume for sake of argument a 40-hour work week (although 60 may be closer to the mark for a student heavily involved in thesis research). Then a Melbourne student has 80% of their time available for research; a McMaster student has 75%; and a US student 50%. All else being equal, one could expect completion times to be in the ratio of the inverse of these, e.g. 3.75, 4, and 6 years respectively. These are relatively close to the actual numbers in Table 1, so this potential contributor to the differences may well be a major one. Note that it implies nothing about the relative merits of the different programs or structures, nor about the 'efficiency' of the various systems or universities.

Proportion of students studying part-time

A further distinction among the three countries' doctoral programs relates to the proportion of students who undertake doctoral work on a part-time basis. Unfortunately, there seem to be no consistent national data on this variable. The SED survey does not even ask about this question. Similarly, the Canadian study does not report on this variable, although the data were collected. Australian data suggest that part-time doctoral students are 45-47% of the total (Terry Evans, personal communication, December 2005). Nevertheless, anecdotal material suggests that the proportion of students studying part-time for a PhD is higher in Australia than in the other two countries. There is also considerable variation in this across disciplines. Obviously it will affect total time-to-degree, so it is a confounder that should be kept in mind, as was discussed above.

National job market, and employment outlook

If students know that there are jobs available in their field, they are more likely to complete the degree, and to do so more quickly. Hence the employment market by field of study is also an important determinant of completion rates and times. To the

extent that the market for PhDs is a national rather than international one, this factor will have a differential effect on institutions in different countries.

Conclusions

Given all that has been discussed, we come back to the initial question: Are such international comparisons feasible, or meaningful? The first answer to that is that the lack of necessary and appropriate data is probably the greatest stumbling block at the moment, whether for cross-national comparisons or simply for cross-university comparisons within a single country. That problem is starting to be overcome, however, as more institutions recognize the need for such data. If the necessary data are available from several universities in several countries, what can be learned by comparing the numbers from institutions in different countries?

Probably the first thing to be learned is that one needs to look beyond the numbers themselves to know what they mean. In the three comparisons made here, we would say that the differences between the US context and that of the other two countries are probably too great to allow for a meaningful comparison. This includes differences in undergraduate and graduate program requirements, in the hours of employment permitted for full-time students, in the absence of a requirement for continuous registration, and in the proportion of students' time spent in part-time status (even for those who started full-time).

On the other hand, in the comparison between Melbourne and McMaster the differences in those same factors are not so large. Hence when various potential confounders can be shown to be of little effect, a comparison between universities in different countries can be valid or useful. In this case, the fact that times to completion tend to be a bit shorter at McMaster despite the presence of roughly a year of course work may suggest that the coursework does not slow down time to completion, or may in fact expedite it – except that there remains the confounder of the prior Master's degrees done by many McMaster students.

All of the preceding discussion has been implicitly about time to degree, and the reasons it may be different in the different countries. The longer it takes to complete a degree, the greater the chance that other life events will affect the probability of successful completion for an individual, and hence the percentage of students successfully completing. Particularly given the similarities in contexts between Canada and Australia, and the similarities in percentage completing successfully in three of the fields of study, the difference in Engineering in Table 1should flag a search for potential causes. The very different pattern of completion rates at Duke suggests that they are doing something right in Arts that the other two institutions could learn from. They, on the other hand, could potentially gain from practices at the other two institutions in physical sciences and engineering.

In short, there are benefits to be gained from cross-university comparisons, even when the institutions are in different countries, but the numbers cannot simply be taken at face value.

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