**In what direction is economics heading?**

In the aftermath of the recent financial crisis the status of economics has come under attack. A central critique is that economics is dogmatic in its adherence to its orthodox insights. The literature on current developments in economics, however, argues that mainstream economics has moved beyond the previous orthodoxy. To show empirically which view is correct, a computational text analysis of PhD dissertations is performed. The text analysis shows that a large majority of the dissertations explicitly engage with orthodox economics, while about a quarter does so with nonorthodox mainstream economics. The findings thus support the view that orthodox economics is still dominant, although it coexists with some nonorthodox mainstream approaches. There is very little change over time in the ratios of dissertations which mention any of the approaches. This runs counter to the idea that the dominance of the current orthodoxy is fading.

*Key words:* Mainstream economics, Pluralism, Quantitative history of economic thought

*JEL classifications:* B20, A23, B40

**1. Introduction**

Economics is a highly influential social science (Fourcade, Ollion and Algan 2015, Backhouse and Fontaine 2010). The recent financial crisis, however, damaged its status. Economists were criticized for being taken by surprise and the picture of economics as an orthodox, scholastic, and mathematical religion with tremendous political influence began to spread (Nelson 2014, Colander et al. 2009, Hodgson 2009, Lawson 2009, Spiegler and Milberg 2013, Rapley 2017, Levinovitz 2016, Harvey 2016, Bouchaud 2008, Earle, Moral and Ward-Perkins 2016). Students, the media, the public, and even the Queen of the United Kingdom questioned whether the authority often bestowed on economists was justified.

This was, however, not a new phenomenon; before the crisis there were similar critiques of economics, mainly voiced by heterodox economists and other social scientists, but also by some student groups and social movements (Fullbrook 2003, Fisher and Ponniah 2003, Bourdieu 2005, Keen 2001, Lee 2009). What changed since the crisis was the magnitude of the group voicing this critique.

 This raises the question whether these critiques had any effect. Did economics change? Or was this just an embarrassing moment for economists to be forgotten quickly so that they could get back to what they were doing?

Interestingly, a few academics studying recent developments within economics were arguing in the years just before the crisis, that economics had actually become more pluralistic (Davis 2006b, Colander, Holt and Rosser 2004a). They claimed that the research frontier was developing some unconventional ideas that began to spread within the mainstream profession.

The apparent contradiction between a growing critique of economics as being too orthodox and academics arguing that economics had become more pluralistic, can be explained by differentiating between education and research; and between full-blown and limited pluralism. First, while research, and the research frontier in particular, may have become pluralistic, economics education had not (PEPS-Economie 2014, Neilson 2010, Wigstrom 2016, Fauser and Kaskel 2016, Tieleman et al. In Progress). This explains especially why the number of student groups arguing for pluralism in economics education is still growing (Earle et al. 2016). Besides this, many have pointed out that the so-called pluralism within research is not full-blown pluralism, as only some approaches, such as behavioral economics, have become accepted while many are still not (Davis 2007b, Cedrini and Fontana 2017, Dequech 2007, Dow 2008a, Dobusch and Kapeller 2012, Dutt 2014).

Now, can this be shown with systematic empirical investigation? The literature on recent developments within economics is, perhaps inevitably, to some extent speculative in nature and would benefit from quantitative research. The purpose of this paper is, therefore, to show quantitatively whether economics is changing, whether it is becoming more pluralistic or continues to be orthodox. The method is however only able to identify if there is explicit engagement with an approach, but not in what way this approach is engaged with. Therefore, the quantitative method should be complemented by more traditional qualitative history of economic thought to come to definitive conclusions.

In the literature review section, three categories of economics — orthodox, nonorthodox mainstream, and heterodox economics — are defined and their current state is discussed. The literature review also elaborates the sub-questions and the quantitative approach to history of economics used in this paper. In the data and methodology section, an overview of the data is given and the specific method — computational text analysis — used in this research is discussed. In the results section, it is shown what approaches are dominant within economics. The concluding section elaborates the implications and limitations of this research as well as suggestions for further research.

**2. Literature review**

The conceptual core of this paper consists of the three categories: orthodox, nonorthodox mainstream, and heterodox economics. Firstly, these categories are defined and secondly the literature on recent developments within these categories is discussed.

To see in what direction economics is heading, this paper studies developments within mainstream economics. This is defined as a sociological category instead of an intellectual one (Colander, Holt and Rosser 2004b). This means it is not a fixed set of ideas but the set of ideas that are, at a particular time in history, acceptable in the elite institutions of the discipline and are thus professionally successful. It can, however, be the case that at a particular time and place, only one set of ideas is mainstream and thus making mainstream also an intellectual category for that case (Dequech 2007).

Orthodox economics is also defined as sociological category following Davis (2006a). Orthodox economics is the type of economics that is considered conventional by economists at one moment and place in time. Orthodox economics is not the same as mainstream economics, although they may overlap. Mainstream economics is the kind of economics practiced at top graduate schools and that is published in top journals, regardless of whether those ideas are conventional or not. There is thus both orthodox mainstream economics which is conventional and professionally successful, and nonorthodox mainstream economics which is unconventional but still professionally successful.

Heterodox economics is often defined as intellectual category in opposition to orthodox economics. There have, however, been various criticisms of this dualist definition for being too restrictive, ahistorical, and simple (Backhouse 2004, Mearman 2012). Therefore, the definition of Davis (2006a) of heterodox economics as a sociological category, which comprises approaches that are both unconventional and professionally unsuccessful, is followed. Engaging with ideas considered heterodox will generally be punished, while conforming to the mainstream will be rewarded (Dequech 2017).

This, thus, means that there are three categories of economics: (1) orthodox mainstream economics, those approaches that are part of the mainstream and are conventional; (2) nonorthodox mainstream economics, those ideas that are professionally successful but are unconventional; and (3) heterodox economics, those ideas that are non-mainstream and also unconventional.

It could be argued that there is one additional category, namely orthodox non-mainstream economics. This kind of economics would have to be conventional but professionally unsuccessful. For example, it could be argued that Neo-Keynesian Economics is no longer part of mainstream research, but is still conventional since it is important position within education. In this paper this category will, however, not be included because there is very little literature on what approaches would be part of this category. Therefore, orthodox economics, mainstream or not, will be treated as one category.

While defining these three categories is fairly straightforward, determining what approaches actually belong to these categories is more of a challenge. First, what belongs to these groups of approaches is historically specific, that is to say what was orthodox 100 years ago, could no longer be so today. Second, it is specific to place. As Davis (2006a) explains, for instance, from 1950 to 1990 Marxian economics was orthodox in socialist economies while it was heterodox in capitalist economies and vice versa for neoclassical economics. And third, most importantly, these categories should be thought of as continuous rather than discrete. Certain approaches can be more or less conventional or mainstream. They can thus also be partially in one category and partially in another.

Based on literature about recent developments, approaches in economics at top institutions in the Anglo-Saxon world in the last decade are categorized.

Current orthodox economics is generally conceived as neoclassical economics. Important neoclassical approaches are general equilibrium theory (Blaug 2003, Mirowski and Hands 1998), Walrasian economics (Walker 2008, Rizvi 2008, De Vroey 2004), Marshallian economics (Groenewegen 2008, De Vroey 2004), Chicago school (Emmett 2010, Leeson 2000), environmental economics (Turner 2002, Van den Bergh 2002)[[1]](#footnote-1), new classical and new Keynesian macroeconomics (Hoover 2008). It has been argued that the dominance of neoclassical economics is declining, especially in research (Colander 2000). Others have, however, doubted whether this is actually the case (Lee 2012, Spiegler and Milberg 2013) and most argue that neoclassical economics is still dominant within education (PEPS-Economie 2014, Wigstrom 2016, Neilson 2010, Fauser and Kaskel 2016, Tieleman et al. In Progress).

Various authors claim that mainstream economics currently consists of not only orthodox approaches but also nonorthodox approaches such as game theory, behavioral, experimental, evolutionary, and complexity economics (Colander, Holt and Rosser 2011, Dow 2008a, Cedrini and Fontana 2017, Davis 2007a, Dequech 2007). There has been discussion about whether these approaches will together form a new paradigm in the future that will dominate economics (Davis 2007a, Colander et al. 2011) or whether the current fragmentation will be a permanent feature of the discipline (Cedrini and Fontana 2017).

Finally, heterodox economics consists of many approaches, such as Austrian (Boettke and Leeson 2008), ecological (Røpke 2004, Spash 2017, Asara and Spash 2017), feminist (Seiz 2008), Marxian (Howard and King 2014), old institutional (Hodgson 1993, Rutherford 2001)[[2]](#footnote-2), post-Keynesian (Dequech 2012, Dow 2008b), and radical political economy (Pietrykowski 2008). While mainstream economics seems to become pluralistic, many have noted that it still excludes heterodox economics (Davis 2007b, Lee 2009, Earle et al. 2016, Dequech 2007). Or as Schiffman (2004) puts it “modern economics embraces pluralism but in a limited sense”. This has also been shown by empirical research on publishing practices (Reardon 2008), rankings (Kapeller 2010), and the institutional structures of universities (Lee 2009, Lee, Pham and Gu 2013). See table 2 in the appendix for the entire list of approaches and their categorization. The list of approaches is meant to be exhaustive. But the results should therefore be interpreted carefully as some approaches are different in nature.

 To sum up, in the literature on recent developments in economics, radically opposing positions can be identified, as Cedrini and Fontana (2017) explain:

*“the one whereby mainstream economics is a synonym of neoclassical economics (1); and the one which holds that neoclassical economics is dead, and not just as a label (4). Intermediate positions are the one according to which other approaches coexist with dominant neoclassical economics (2), and the one which maintains that the mainstream is already a pluralistic environment which includes neoclassical economics as the formerly dominant, but now declining, research programme (3).”*

While there is a rich literature on the developments within the three categories discussed above, systematic empirical research into them is rare. This paper therefore investigates whether orthodox economics is becoming less dominant within mainstream economics as nonorthodox mainstream economics increases in importance and whether heterodox economics stays excluded.

Now that the three categories of economics are defined and the various approaches categorized, we turn to the sub-questions. By answering these questions, we hope to clarify what the current status of economics is and where it might be heading. First, in order to understand in what direction economics is heading, its dominant discourse is investigated. Economists, among which Backhouse, Dudley-Evans and Henderson (2017), McCloskey (1998), Samuels (2013), have shown that the words, language, rhetoric, and discourse economists use, is fundamental in understanding what they are doing. Second, explicit engagement with approaches is analysed to see what approaches are dominant within economics. Third, the relations among the approaches are identified. This shows whether economists tend to specialize in one approach or whether they explicitly engage in many, and if so it is also clear which ones are often mentioned together. Fourth, the frequency of explicit engagement with approaches within the texts is examined. By doing so it becomes clear how important explicit engagement with approaches is. And finally, developments over time in what approaches are dominant are investigated in order to assess whether it is possible to identify trends.

To address these questions, a quantitative text analysis of PhD dissertations at top graduate schools is performed. Quantitative studies of recent developments in economics should be seen as complementary to the more traditional qualitative research (De Vroey 2016, Claveau and Gingras 2016, Backhouse, Middleton and Tribe 1997). Quantitative research is done in order to arrive at more definitive answers and is able to do so by assessing large amounts of texts with fixed and strict categories (Starr 2014). Analysing large amounts of text creates the possibility to see what the average economist or different groups of economists are doing and how this might differ over place and time (Cherrier 2015). To see in what direction economics is heading this is especially important, since it indicates structural changes in the approaches economists engage with.

 Up to now, most quantitative research focused almost exclusively on journal articles. These are mostly studied by looking at JEL-Codes in order to show in what fields of research papers are being published (Guo et al. 2015, Kosnik 2017, Silva and Teixeira 2008, Kosnik 2014, Kelly and Bruestle 2011, Rath and Wohlrabe 2016, Card and DellaVigna 2013). In addition, analyses have been conducted of the content of the titles (Guo et al. 2015) and of citations to see what intellectual connections can be found (Silva and Teixeira 2008, Claveau and Gingras 2016). Only Kosnik (2014) has evaluated quantitatively what theoretical approaches are used. He looks at what paradigms within macroeconomics were addressed by counting keywords associated with these paradigms. This paper builds on this framework but extends it by looking not only at paradigms within macroeconomics but at all theoretical approaches within economics. In doing so, developments in the engagement with theoretical approaches can be analysed. By considering the explicit engagement with theoretical approaches, the spread or decline of approaches become visible in a quantitative way and thus can clarify what developments can be observed.

The other innovation of this paper is that it assesses PhD dissertations instead of journal articles. The reason is that dissertations, as opposed to journal articles which are more backward looking, indicate the specializations of the new generations of economists. Typically, they will stay in or close to this specialization for the rest of their academic careers (Cedrini and Fontana 2017, Fourcade 2009). This analysis focuses in particular on PhD dissertations at top ranking universities since these universities significantly impact in what direction economics is heading, or as Davis (2006b) argued:

 *“A test of this sort of change in the economics research frontier would then involve surveying changing shares of different identifiable research orientations in new doctoral degrees over distinct time periods, particularly in leading doctoral granting institutions, assuming, as seems reasonable, that these institutions tend to disproportionately influence change in research directions.”*

**3. Data & Methodology**

As elaborated in the previous section, this paper analyses PhD dissertations from top graduate schools, to provide systemic empirical foundations for the literature on recent developments in economics. It does so by conducting a quantitative text analysis of the names of approaches that are being mentioned. The analysis thus focuses on explicit engagement with theoretical approaches.

Studies of PhD dissertations are very rare and for a good reason, since it is difficult to collect them. The full texts of the PhD dissertations are available online for only five of the top fifteen universities (QS-World-University-Rankings 2017), namely Columbia University, London School of Economics, Massachusetts Institute of Technology, Princeton University, and Stanford University. Online available full texts of PhD dissertations from before 2010 are very scarce among these universities, hence the analysis starts from 2010. At these five universities, 702 PhD dissertations have been published since 2010 and 660 of them are available online. The five universities are represented quite evenly in the data set as the dissertations per university range from 120 to 146. Over the years there is, however, more difference, ranging from 49 to 109 dissertations a year, based on the years in which they were published. See table 3 in the appendix for an overview of the PhD dissertations by university and table 4 for an overview by year.

 The analysis is of the full texts of the PhD dissertations because this captures the maximum amount of information available. This means that when a name of an approach is measured it can be very central and important for the dissertation and for example even be in the title. But it can also be of only marginal importance and only in an appendix or in a title of a reference in the literature. To give an indication of how important the names of the approaches are in the dissertations, their average frequency is evaluated.

The computational text analysis is conducted based on a codebook which consists of an extensive list of approaches, as elaborated in the previous section (Appendix 1). To capture all the uses of the approaches, different versions of the same names are included and aggregated. For example, New Keynesian Economics can be written with a hyphen as in New-Keynesian Economics, behavioral economics can also be spelled as behavioural economics, Dynamic Stochastic General Equilibrium can be abbreviated as DSGE, Classical Political Economy can also be named Classical Economics, and Game Theory can also be called Game Theoretical or Game Theoretic.

The software program *ConText* (Diesner et al. 2015, Diesner 2014) is used for the computational text analysis since it is able to generate statistics on the explicit engagement with approaches. This is done by applying the codebook discussed above to the dissertations and generating statistics of the words used in the different corpuses. The semantic networks (Diesner 2013, van Atteveldt 2008) of explicit engagement with approaches are also assessed. Topic modelling (Blei 2012) is used on the full texts of the dissertations, to see which topics in general are central. *ConText* is used because it allows us to perform these different quantitative text analyses with the established algorithms which ensure maximum accuracy (Leydesdorff and Nerghes 2016).

The software program *AutoMap* (Azoulay, Carley and Columbus 2012) is applied to refine the dataset for the text analysis in *ConText,* in specifically by removing punctuation and extra spaces. And the software program *Gephi* (Bastian, Heymann and Jacomy 2009) is used for the exploration and visualization of the network analysis because it allows us to study and visualize many different aspects of networks (Cherven 2015).

**4. Results**

First, the dominant discourse within dissertations is assessed to get a better understanding of the direction in which economics is heading. After this the level of explicit engagement with approaches indicates what approaches might be important in the future. Third, a network of the approaches based on explicit engagement with more than one approach in a dissertation, shows how the approaches relate to each other. Fourth, the frequency of the mentioning of approaches is examined. Finally, the level of explicit engagement with approaches over time reveals trends and developments within economics in the last decade.

*4.1 What discourse is dominant?*

To get a general idea of what is discussed in PhD dissertations, the results of a topic modelling analysis are shown in Table 1. Topic modelling is a statistical method that clusters words that appear together frequently, so that topics within documents can be discovered. Stop words, such as “*the”* and “*and”,* are excluded from this analysis since they are not indicative of what topics are discussed in the documents.

The topic with the highest weight has *equilibrium* as most important word, followed by *information*. The second most central topic is centred on the word *model*, with other words being *rate, shocks, capital, consumption,* and *policy*. Looking at all the topics, a distinction between the substance and method of economics can be made. Four topics seem to be mainly about the quantitative method of economics since their most central words are: *equilibrium* and *information, model* and *rate, effects* and *results,* and *model* and *distribution.* The other five topics seem to be more about the substance of economics since their most central words are: *workers* and *income, firms* and *trade, credit* and *market, price* and *market,* and *school* and *students.*

Table 1: Topic Modelling

|  |  |  |
| --- | --- | --- |
| **Topic** | **Weight** | **Topic Members** |
| 1 | 0.198 | equilibrium - information - case - agents - type - model - optimal - agent - probability - proof -  |
| 2 | 0.167 | model - rate - shocks - capital - consumption - policy - price - debt - economy - shock -  |
| 3 | 0.153 | workers - income - tax - wage - labor - rate - earnings - employment - job - age -  |
| 4 | 0.127 | firms - trade - firm - data - industry - productivity - model - market - countries - level -  |
| 5 | 0.126 | credit - market - price - bank - table - loan - housing - banks - data - risk -  |
| 6 | 0.121 | political - effects - results - effect - table - data - level - government - state - economic -  |
| 7 | 0.118 | price - data - market - table - costs - health - effects - time - effect - number -  |
| 8 | 0.117 | school - students - effects - table - schools - education - year - effect - sample - children -  |
| 9 | 0.078 | model - distribution - models - function - estimation - assumption - data - estimator - test - results -  |

*4.2 What approaches dominate economics?*The analysis of the dominant discourse within the dissertations indicates what methods they use and what subjects they study, but it does not give much insight into what theoretical approaches are engaged with. Therefore, the mentioning of theoretical approaches is measured. Figure 1 presents how often a dissertation mentions any of the orthodox, nonorthodox mainstream, and heterodox approaches on average. The average dissertation thus mentions any of the orthodox approaches 6.7 times, nonorthodox mainstream 0.9 times, and heterodox 0.1 times. Orthodox approaches are thus mentioned a lot more on average than both nonorthodox mainstream and heterodox approaches.

Figure 1: Times mentioned on average

The analysis of this paper is about the use of the names of approaches. Nonetheless it is very relevant to first look at the non-use of names of approaches because it indicates the importance of the use of these names. 24.1% of the PhD dissertations do not use any of the names of the approaches. In other words, in almost a quarter of the PhD dissertations explicit engagement with any theoretical approach is entirely absent. This leads to the question whether these PhD dissertations do engage with theoretical approaches only implicitly or whether they do not engage with any theoretical approach and are for example purely empirical. The method used in this research is, however, not able to answer this question, so further research could investigate the content of these PhD dissertations.

 The other 75.9% of the dissertations do, however, explicitly engage with theoretical approaches. Figure 2 shows the ratio of texts in which any of the theoretical approaches of the three categories are mentioned. Please see table 2 in the appendix for how the approaches are categorized into orthodox, nonorthodox mainstream, and heterodox economics. 60% of the PhD dissertations mention at least one the orthodox approaches. Any of the approaches of nonorthodox mainstream and heterodox economics are named in respectively 28% and 10% of the dissertations. The differences between orthodox (M=0.60, SD=0.49), nonorthodox mainstream (M=0.28, SD=0.45) and heterodox economics (M=0.10, SD=0.30) are all highly significant (orthodox and nonorthodox mainstream economics: t(659)=17.72, p = 0.000; orthodox and heterodox economics: t(659)=25.91, p = 0.000; nonorthodox mainstream and heterodox economics: t(659)= 12.10, p = 0.000). This means that mainstream economics is still largely orthodox, while a large minority engages with nonorthodox economics. Furthermore, it shows that heterodox economics is not entirely excluded, although it is clearly engaged with the least.

Figure 2: Ratio of texts in which categories of approaches occur

To see whether the amount of explicit engagement with the categories of approaches differs substantially, the ratios by university are measured. In figure 3, the ratio of PhD dissertations that name any of the approaches of orthodox, nonorthodox mainstream, or heterodox economics are displayed by university. Although there are some differences among the universities, the results are very similar as orthodox is in all cases engaged with most and heterodox least. Orthodox economics ranges from 52% at Stanford to 67% at MIT, nonorthodox mainstream economics from 17% at Colombia to 34% at both Princeton and Stanford, and heterodox economics from 7% at Colombia to 13% at LSE.

Figure 3: Ratio of texts in which categories of approaches occur by University

To see in more detail what theoretical approaches are engaged with, an analysis of the mentioning of individual approaches is performed. Figure 4 shows how often the individual orthodox approaches are mentioned. These ratios of individual approaches do not add up to the categories, since one dissertation can mention more than one approach, which is also the reason the ratios of the categories cannot be aggregated. General equilibrium is mentioned the most by far, namely in 43% of the dissertations. General equilibrium, which is often held to be the core of orthodox economics, is thus explicitly engaged with by almost half the PhD students at these top graduate schools. At the same time, the second most mentioned approach, neoclassical economics, is mentioned only in 16%. It is followed by dynamic stochastic general equilibrium, environmental economics, new Keynesian economics, real business cycle, and Keynesian economics, which are named in respectively 12%, 11%, 11%, 10% and 8% of the dissertations. An interesting observation here is that dynamic stochastic general equilibrium, new Keynesian economics and real business cycle all belong to modern macroeconomics, which thus seems to be a subfield in of which the approaches are mentioned more often. A possible explanation for this can be that macroeconomics is characterized by intellectual battles, while microeconomics is characterized more by a consensus. In intellectual battles giving names to approaches can be useful for clear communication about ideas, while this is less necessary if there is a general agreement on what approaches to use.

Figure 4: Ratio of texts in which individual orthodox approaches occur

The overall explicit engagement with nonorthodox mainstream approaches is substantially lower than that with orthodox approaches. In figure 5 it can be seen that Game Theory is the most named nonorthodox mainstream approach, followed by Behavioral and Experimental Economics. The other approaches are mentioned in 2.6% of the dissertations or less, which indicates they occupy a relatively marginal position within top graduate schools. Another possibility could, however, be that the other approaches are often engaged with implicitly or that they do not yet have a commonly used name.

Figure 5: Ratio of texts in which individual nonorthodox mainstream approaches occur

All the individual heterodox approaches are only marginally engaged with in the dissertations — 2.4% at most — as can be seen in figure 6. Besides the fact that these heterodox approaches are rarely mentioned, a lot of the heterodox approaches included in the list measured were not even mentioned once. This is in contrast to nonorthodox mainstream and especially orthodox approaches. Only 12 of the 22 individual heterodox approaches were mentioned in the dissertations, while 17 of the 25 nonorthodox mainstream and 17 of the 20 orthodox approaches were.

Figure 6: Ratio of texts in which individual heterodox approaches occur

 To conclude, orthodox approaches are dominant within the dissertations as measured by explicit engagement. This is the case at all of the five top graduate schools and is also reflected in the mentioning of the individual approaches. General equilibrium theory is by far the most engaged with approach, followed by neoclassical economics but also game theory. This indicates that while orthodox approaches are dominant, it coexists with some nonorthodox mainstream approaches. Individual heterodox approaches are in a very marginal position as they are engaged with in a maximum of 2.4% dissertations.

*4.3 What are the relations among approaches?*

To investigate whether the categories of approaches have close connections with each other or whether they are isolated from each other, a network analysis of the mentioning of the approaches is performed. In figure 7, a network analysis of the use of the names of approaches of orthodox, nonorthodox mainstream, and heterodox economics is presented. The nodes are ranked in size, based on their weighted degree, which is based on the number and weight of the edges the node has. An edge indicates that the names of the approaches are used in the same dissertation and these are also ranked in size to their weight. This shows that orthodox economics has by far the most connections, almost all of them with itself. The connections of nonorthodox mainstream economics are also somewhat present although substantially smaller than that of orthodox economics. The connections of heterodox economics are however negligible.

Figure 7: Network analysis of the categories of approaches



To give more insight into what approaches are engaged with in the dissertations, below the results of the individual approaches are shown. First, to have a better understanding of the connections among the approaches, a network analysis of the individual approaches is shown in figure 8. The nodes and edges are again ranked in size on their weights and approaches in the colour of their category. The orthodox approaches are blue, nonorthodox mainstream approaches are green, and the heterodox approaches are yellow. The orthodox approaches are clearly the most important in the network as they have the most central positions and highest weights. At least some nonorthodox mainstream approaches occupy fairly central positions while basically all heterodox approaches are at the periphery of the network.

The most central approach in the network is Real Business Cycle, followed by General Equilibrium Theory, Dynamic Stochastic General Equilibrium, and New Keynesian. Besides these four approaches, Game Theory, Neoclassical, Walrasian, and Keynesian economics also have a somewhat central position in the network. The fact that all these approaches, except one (Game Theory), is an orthodox approach explains why orthodox economics dominates the aggregate network analysis in figure 7. Largely the same approaches also have a high betweenness centrality, which indicates gatekeepers as they occupy central positions in terms of shortest paths. In particular General Equilibrium Theory, Game Theory, Environmental Economics, and Neoclassical Economics, with respectively a betweenness centrality of 198, 114, 86, and 83.

The network diameter is 3, which is the shortest path between two most distant approaches. In other words, all approaches are connected to each other by a maximum of 3 edges. This means that even the approaches at the periphery of the network are not entirely marginal as the paths to the other approaches are relatively short. The average path length is 1.85, which means that on average the approaches are connected to each other by 1.85 edges. The network has a low density of 0.25, which means a lot of approaches are unconnected. The community detection is 0.063, which is very low and thus means that there are no distinct communities of approaches found in the network analysis.

Figure 8: Network analysis of individual approaches



 The analysis of the relations among the approaches shows that orthodox economics again occupies a dominant position. The vast majority of the connections among approaches are within orthodox approaches, in particular Real Business Cycle Theory, followed by General Equilibrium Theory and Dynamic Stochastic General Equilibrium. Even though most connections between approaches are within their categories, the network analysis of the individual approaches detected no communities. This can be explained by the fact that the network is fairly centralized, as its network density and average path length are somewhat low.

*4.4 How frequent is explicit engagement with approaches?*

To understand how important the theoretical approaches are in the dissertations, the frequency of their mentioning is analysed. In Figure 1, it was shown how often the categories of approaches are mentioned on average, but here the analysis focuses only on those 76.1% of the dissertations that do at least mention one approach. Figure 9 shows how often any of the approaches of each category are mentioned in the dissertations in which at least one of them is mentioned. In the 60% of the dissertations in which at least one of the orthodox approaches is mentioned, on average 11.2 times an orthodox approach is mentioned. For the 28% engaging with nonorthodox mainstream economics, it is on average 3.3 times. And in the 10% which engage with heterodox approach, it is on average 1.5 times.

 This shows that besides the fact that more dissertations engage with orthodox approaches, dissertations also engage more intensively with orthodox approaches. If a nonorthodox mainstream or heterodox approach is mentioned in a dissertation, it has on average a marginal position as it is only mentioned 3.3 times while dissertations on average contain about 45,000 words. It should however be noted that the orthodox approaches are also not mentioned very often, only ones in about every 4,000 words.

Figure 9: Average times mentioned in the dissertations that do engage with it

To understand how important the approaches are within the dissertations, their frequency is also measured at the individual level. By doing this, it possible to see whether an individual approach is generally very important or unimportant within dissertations, if it is mentioned at all. Figure 10 shows how often an orthodox approach is mentioned on average, if it is mentioned at all. For example, the 10% of the dissertations that explicitly engage with real business cycle theory, mention it on average 10.2 times. While the 11% of the dissertations that mention environmental economics, do this on average only 1.9 times. This also explains the central position of real business cycle theory and relatively marginal position of environmental economics in the network in figure 8.

Figure 10: Average times mentioned in the dissertations that do engage with it

The difference between the frequency of mentioning orthodox and nonorthodox mainstream approaches is very similar to the difference between the ratios of orthodox and nonorthodox mainstream approaches. In both cases, engagement with orthodox approaches is substantially higher. Figure 11 shows the frequency of the mentioning of nonorthodox mainstream approaches. The nonorthodox mainstream approaches are mentioned much less on average than the orthodox approaches as the most frequent — game theory and behavioral economics — are mentioned only 2.7 times on average. This indicates that if these approaches are engaged with, it is done so only marginally or at least not explicitly.

Figure 11: Average times mentioned in the dissertations that do engage with it

The difference between the frequency of mentioning nonorthodox mainstream and heterodox approaches is interesting because if some heterodox approaches are engaged with, they are mentioned more often than nonorthodox approaches. Figure 12 shows that if a dissertation explicitly engages with some heterodox approaches, namely Schumpeterian or ecological economics, it does so more frequently than with any nonorthodox mainstream approaches on average. While this is the case for these two heterodox approaches, in general heterodox approaches occupy very marginal positions in the dissertation in which they are mentioned.

Figure 12: Average times mentioned in the dissertations that do engage with it

The average frequency of mentioning the approaches is thus low, although it is substantially higher for orthodox approaches than for nonorthodox mainstream and heterodox approaches. This indicates that explicit engagement is a relatively unimportant aspect in the dissertations.

*4.5 How has explicit engagement with approaches developed over time?*

Finally, developments over time are analysed. In doing so, it is possible to see whether the dominance of orthodox approaches is fading. Figure 13 shows the ratio of PhD dissertations that explicitly engages with orthodox, nonorthodox mainstream, and heterodox economics by year. All the three categories are fairly stable over time and show no clear decline or growth, as orthodox economics fluctuates from between 51% and 65%, nonorthodox mainstream economics between 20% and 41%, and heterodox economics between 4% and 18%. The idea that orthodox approaches are declining while nonorthodox mainstream approaches are growing, which is often put forward in the literature is thus not supported by these results. It does, however, support that heterodox economics stays in a marginal position.

Figure 13: Ratio of texts in which categories of approaches occur by year

The ratio of the individual orthodox approaches over time is presented in figure 14. There is much more fluctuation at the level of individual approaches than at the level the categories. General equilibrium is again clearly mentioned much more often than the other approaches and it shows a slight growth over time, starting at 43% and ending at 48%. Neoclassical economics has a decline from 22% to 13%, while DSGE stays fairly stable starting at 10% and ending at 9%. Environmental economics starts at 12% in 2010, rises to 23% in 2012, and then declines to 4% in 2017. New Keynesian Economics, Real Business Cycle and Keynesian Economics fluctuate all three around 8% to 11% although sometimes being as low as 0%. Walrasian economics fluctuates around 4% to 5% and Marshallian economics around 2% to 3%. All the other approaches are generally at 0%, while sometimes rising as high as 4%.

Figure 14: Ratio of texts in which individual orthodox approaches occur by year

The developments of the nonorthodox mainstream approaches over time shows that three approaches are mentioned more often than the others: Game Theory, Behavioral, and Experimental Economics. Game Theory has one peak in 2011 but in the other years fluctuates between 8% and 18%. Behavioral and Experimental Economics are more stable and fluctuate both between 3% and 13%. All three approaches do not, however, show a clear decline or rise over time. The other approaches seem to occupy a marginal position in the dissertations as they fluctuate between 0% and 5%.

Figure 15: Ratio of texts in which individual nonorthodox mainstream approaches occur by year

Finally, the developments of the individual heterodox approaches are presented. Figure 16 shows that there is very little stability in the mentioning of individual heterodox approaches in the dissertations. It also shows that no approach is at any year mentioned in more than 5% of the dissertations. No individual approach is relatively stable as they all fluctuate heavily between 0% and 5% or less.

Figure 16: Ratio of texts in which individual heterodox approaches occur by year

 While the fluctuations in the ratios of individual approaches are quite substantial, the ratios of the categories of approaches are very stable. Orthodox economics stays dominant, nonorthodox mainstream and heterodox economics are not becoming more important over time.

**5. Conclusion**

The legitimacy and authority of economics is increasingly challenged and questioned, especially since the recent financial crisis. A core element of the debate is whether economics is dominated by an orthodoxy or whether it is pluralistic. In the literature on recent developments within economics, it has been argued that both perspectives could be valid as mainstream economic research has been incorporating some nonorthodox approaches while excluding heterodox approaches.

To investigate in what direction economics is heading, a computational text analysis of PhD dissertation at top graduate schools is performed.

Topic modelling shows that the most central word in the dissertations is *equilibrium*, followed by *model*, *effects, firms, and workers*.

About a quarter of the dissertations does not mention any theoretical approach. A significant majority of the dissertations explicitly engages with at least one of the orthodox approaches, while only a bit more than a quarter does so with nonorthodox mainstream approaches and one tenth with heterodox approaches. This supports the view that neoclassical economics is still dominant but that it coexists with other nonorthodox approaches within mainstream economics. Within orthodox economics, general equilibrium theory plays a very important role, followed at a distance by neoclassical economics and dynamic stochastic general equilibrium theory. The main nonorthodox mainstream approach is game theory, followed by behavioral and experimental economics. All the heterodox approaches occupy a very marginal position as not one is mentioned in more than 2.4% of the dissertations.

The network of the approaches is dominated by connections among orthodox approaches, with real business cycle theory occupying the most central position.

On average, approaches are mentioned very little in the dissertations. Orthodox approaches are, however, still mentioned substantially more than nonorthodox mainstream or heterodox approaches.

The dominance of neoclassical economics does not seem to go away as the ratios of texts in which the approaches are mentioned are fairly stable over time. The ratios of the individual approaches vary, however, much more over time than the categories.

The results thus show that the future leading economists are engaging mostly with orthodox economics and thus supports the claim by critics of mainstream economics that it is largely orthodox, although not entirely as there is some engagement with unconventional ideas.

The findings of this paper should, however, be interpreted very carefully as measuring what names of approaches are used in PhD dissertations is a crude way of measuring with what approaches they are engaged. This method is not able to identify in what way the names of approaches are used, what they are meant to communicate, and how this differs over time and place. Traditional qualitative history of economic thought is, however, able to this and can thus give more meaningful interpretations of texts. The names can be used in an inconsistent way, but more fundamentally, there is generally not a very precise consensus on what the approaches actually are (Colander 1998). So, it might be possible for two PhD dissertations to mention the same approach but to be very dissimilar theoretically. And just the other way around, it can be the case that dissertations not mentioning the same approach are very similar theoretically. Nonetheless, the mentioning of a name of an approach is an indication of engaging with certain ideas. Therefore, the names measured in this research should not be seen as definite intellectual categories to which the PhD students who use them devote themselves entirely, but just an indicator that they are engaging with that set of ideas.

Besides this, names of approaches can be used in the following different ways: (1) positively and self-identifying, in this case they are used for promoting a specific approach or trying to combine different researches into an approach in a programmatic way; (2) negatively, here the approach is criticized and thus is engaged with, although not in an embracing way; and finally (3) more or less neutrally, it is used to identify and describe a certain approach without judging whether it is a “good” approach or not. Examples of these are (1) the new institutional economics used by Williamson (2000); (2) neoclassical economics when it was coined by Veblen (1900); and (3) the German historical school by Tribe (2003). A computational text analysis is not able to distinguish among these three categories, so the results only show the aggregate uses of the terms. But even though it does not directly measure who uses or self-identifies with specific approaches, it does measure who engages with a specific approach, be it positively, negatively, or more neutrally.

Characteristics of approaches, however, also influence the use of names. A dominant or orthodox approach often goes unnamed since it is perceived to be “just economics”. Because these implicit uses cannot be measured, it is reasonable to expect that the orthodox approaches are underrepresented in the results. Besides this, general approaches such as neoclassical economics, which incorporate many different kinds of theories, also often go unnamed since the names of the specific theories are enough to communicate clearly to the reader what approach is used in the dissertation. Therefore, these general approaches are probably also underrepresented in the results. And, it is also likely that very new approaches are underrepresented in the results as they often do not yet have a commonly used name.

Finally, another limitation is the exclusive focus on five Anglo-Saxon top graduate schools (four in the United States and one in the United Kingdom).

Further research could try to address some of these limitations mainly by looking in more detail at dissertations so that not only explicit engagement can be measured, but also implicit engagement. This is especially relevant since about a quarter of the dissertations does not name any approach. A more detailed analysis of dissertations could also show how often the names of approaches are used in an inconsistent manner and whether they are often used in a positive, negative, or more neutral way. This can be done by using the more traditional qualitative method within history of economic thought or by using more extensive and advanced text analysis methods. Further research could investigate whether the cohesion within orthodox, nonorthodox mainstream, and heterodox economics is really as low as measured here or whether this cohesion manifests itself in a different way. It can be useful to investigate which graduate schools do differ from the pattern found at these five graduate schools, since these may have a disproportionate influence on nonorthodox mainstream or heterodox economics. Further research could also apply a similar measurement to journal papers to compare these results with those in this paper based on analysing dissertations. And finally, it can be useful to do interviews and/or surveys of students or economists (similar to what Colander (2007), Colander et al. (2004a) have already done).

Despite the limitations of the method used in this research, it can give an indication of in what direction economics is heading. In that sense, it is meant to contribute to more systematic empirical research into the future of economics.

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**Appendix**

Table 2: Names of Approaches in categories

|  |  |  |
| --- | --- | --- |
| **Orthodox Economics** | **Nonorthodox Mainstream Economics** | **Heterodox Economics** |
| Agency Theory | Agent Based Modelling | Austrian School |
| Chicago School of Economics | Behavioral Economics | Classical Political Economy |
| Decision Theory | Behavioral Game Theory | Ecological Economics |
| Dynamic Stochastic General Equilibrium | Capability Approach | Feminist Economics |
| Environmental Economics | Classical Game Theory | Fundamentalist Keynesian Economics |
| General Equilibrium Theory | Cognitive Economics | Hayekian |
| Keynesian Economics | Complexity Economics | Heterodox Economics |
| Marshallian | Computational Behavioral Economics | Historical School of Economics |
| Monetarism | Computational Economics | Kaldorian |
| Neoclassical Economics | Computer Simulations | Kaleckian |
| Neo Keynesian Economics | Econophysics | Marxian Economics |
| New Classical Economics | Evolutionary Economics | Misesian |
| New Keynesian Economics | Evolutionary Game Theory | Neo Ricardian |
| Orthodox Economics | Experimental Economics | Old Institutional Economics |
| Rational Choice Theory | Game Theory | Post Keynesian Economics |
| Real Business Cycle | Happiness Economics | Radical Political Economy |
| Robinsonian | Institutional Economics | Schumpeterian |
| Samuelsonian | Mainstream Economics | Social Economics |
| Walrasian | Network Economics | Socioeconomics |
|  | Neuroeconomics | Sraffian |
|  | New Institutional Economics | Stockholm School |
|  | Non-Linear Complexity Economics |  |
|  | Psychological Economics |  |
|  | Transaction Cost Economics |  |

Table 3: Overview of the PhD dissertations by university

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **University** | **Years** | **Available** | **Total** | **Ratio** | **Source** |
| Columbia University | 2011-2017 | 120 | 125 | 0.960 | <https://academiccommons.columbia.edu/> |
| London School of Economics | 2010-2017 | 134 | 137 | 0.978 | <http://etheses.lse.ac.uk/> |
| Massachusetts Institute of Technology | 2010-2017 | 146 | 147 | 0.993 | <https://dspace.mit.edu/> |
| Princeton University | 2012-2017 | 129 | 129 | 1 | <http://dataspace.princeton.edu/> |
| Stanford University | 2010-2017 | 131 | 164 | 0.799 | <https://searchworks.stanford.edu/> |
| *Total* | *2010-2017* | *660* | *702* | *0.940* |  |

Table 4: Overview of the PhD dissertations by year

|  |  |
| --- | --- |
| **Year** | **Available** |
| 2010 | 49 |
| 2011 | 51 |
| 2012 | 105 |
| 2013 | 102 |
| 2014 | 84 |
| 2015 | 109 |
| 2016 | 80 |
| 2017 | 80 |

1. While environmental and ecological economics share their focus on the environment, they are different in their approach. Environmental economics uses a formalistic individualistic approach to analyse the efficiency of resource allocation, giving specific attention to physical resources. Ecological economics is an inter- or rather transdisciplinary research field that understands the economic system as a subsystem of the natural system and sees the relations between these systems as dynamic and complex (Asara and Spash 2017). [↑](#footnote-ref-1)
2. New institutional economics is categorized as a nonorthodox mainstream approach. The distinction between old and new institutional economics is, however, often not made explicitly. Since the dissertations analysed in this research are published fairly recently and mainstream approaches often feel less need to contrast themselves with non-mainstream approaches than vice versa, it is reasonable to assume that it is more likely that they engage with new institutional economics if they mention only institutional economics. The same logic applies to Keynesian economics. When Post Keynesian economics is meant it is probably explicitly called so, while the orthodox versions of Keynesian economics often go unspecified. [↑](#footnote-ref-2)