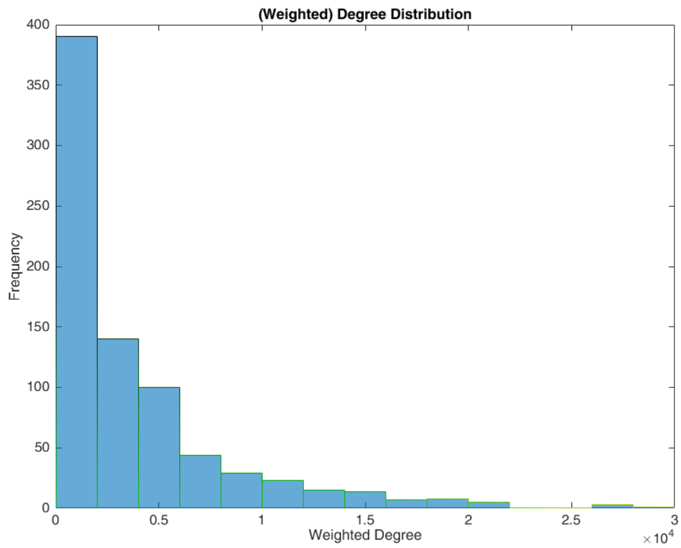
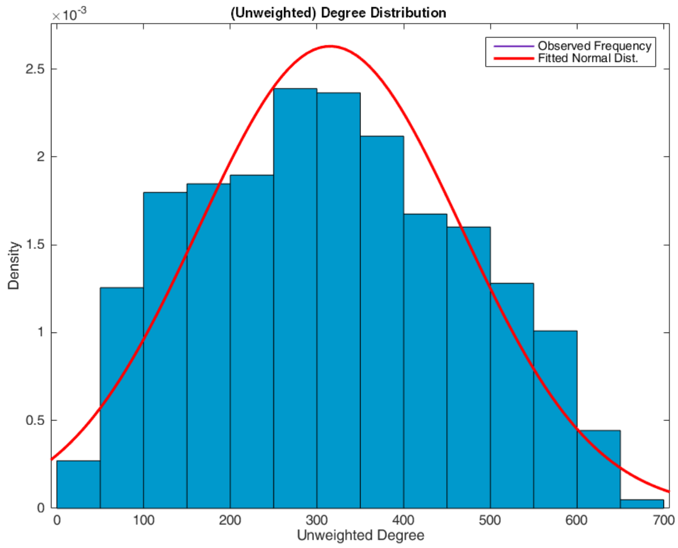
Research Fields in Economics Through the Years

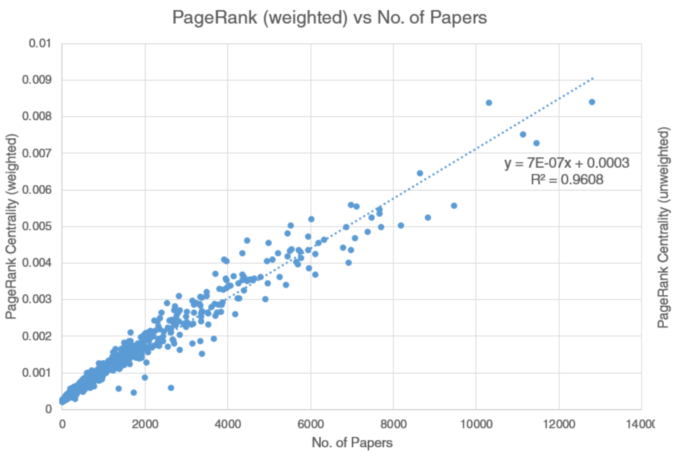
Degree distribution

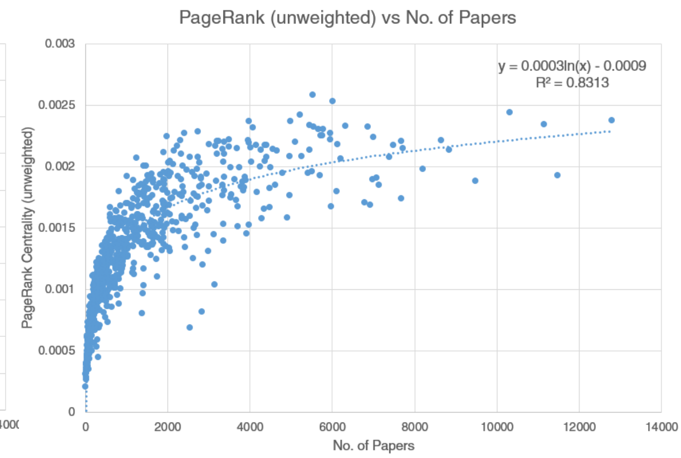




When we look at the degree distribution of the weighed network, we get a power law distribution as expected, since we have many of the papers citing the same JEL codes. But we get a more meaningful insight when we compare that with the degree distribution of the unweighted network (slide 10). We see that for the unweighted case, we get a degree distribution that is similar to a random network. This is very interesting, as it gives us an intuition that any two sub-fields in economics is randomly connected, if there are no prior connections made. As connections are made, many of the future papers would add to these same already established arcs, causing the power law to be exhibited in the weighted case.

Centrality





Looking at centrality, we can see that eigenvector centrality is very similar amongst the nodes (denoted by colour of nodes in slide 13). Specifically, we have red nodes being high in centrality while blue being low. This can be explained by the fact that in eigenvector centrality, each node retains its "importance", causing most nodes to reinforce their centrality. We can see an example of this where in slide 16 and 17, the top ranked nodes with eigenvalue centrality all have a similar general theme, environment. In fact the top 7 nodes in this field is a clique that retains its high centrality causing all of them to be in the top 10 nodes with high eigenvector centrality (slide 17).

As for page rank centrality, this property is not observed as we divide the centrality of each node amongst its neighbours, so we have a more meaningful list of what sub-fields are "central" in the field of economics. An unweighted plot of PageRank centrality against the number of papers tagged by that particular JEL code yields a logarithmic graph (slide 14). Which means that PageRank centrality increases very quickly when increase a small number of papers written on a subject (many of these new papers link this topic with new never-before-linked topics). But if we have a topic that already has a high unweighted centrality, writing more papers on this topic would not increase its unweighted centrality as these new papers likely link this topic to topics its already linked to.

Comparing this with an analysis of the page rank centrality of weighted version, we see a very linear pattern (slide 15) with an R-squared value of 0.9608. This is especially interesting because it shows that the weighted page rank centrality is dependent only on the number of papers written on it. Which further supports our analysis in the degree distribution analysis- that no topic is intrinsically important or related to other fields, but this importance arises because of the fact that many papers are written on it.

We also see specific insights like certain topics have a upward trend, such as *Financial Institutions & Mortgages* and *Financial Markets and the Macroeconomy* (slide 21).

Edge Normalisation and Analysis

We want to find a way to meaningfully compare arcs and their weights. We cannot compare the absolute weights of the arcs since the number of papers written on each topic, or the "node weight" is different. One way to do this is to normalise the arc weights with respect to the "node weights", and there are several ways to do this.

Method 1 (total edge weight over total node weight)
2 * (absolute edge weight)/sum of "node weights"

Method 2 (average of ratios with both JEL codes)
[(absolute edge weight/node 1 weight) + (abs. edge weight/node 2 weight)]/2

Method 3 (take the minimum of the two node weights)
absolute edge weight/[min{node 1 weight, node 2 weight}]

We finally chose Method 3 as we found out that it is the most meaningful. It does not dilute the arc weight when an unpopular field is tagged with a popular field. Using this formula, we cleaned up the network and made the following insights.

G01 (Financial crises) appears most relevant since we are able explore how it relates to its neighbours over time. Particularly in 2002, we see a large spike in *H12 (Crisis management)*. This is perhaps due to the end of dot-com bubble. Economists then were perhaps looking a to government intervention as a solution to managing financial crises (slide 25).

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