

Referee report: *Structure and temporal change of credit network between banks and large firms in Japan* by Yoshi Fujiwara, Hideaki Aoyama, Yuichi Ikeda, Hiroshi Iyetomi and Wataru Souma.

I have read the manuscript *Structure and temporal change of credit network between banks and large firms in Japan* by Yoshi Fujiwara, Hideaki Aoyama, Yuichi Ikeda, Hiroshi Iyetomi and Wataru Souma. The authors propose an innovative approach to studying the credit structure of a banking system and use it to examine the evolution of the Japanese banking system from 1980 to 2005. The manuscript contains an interesting analysis of credit dynamics that should be published after the authors consider the recommendations and make the needed typographical corrections discussed below.

Recommendations:

The recommendations are presented in two groups. First, those concerning the substance of the paper and, second, those of a largely editorial nature.

Recommendations concerning the substance of the paper:

1. In footnote 4 on page 4 the authors note that interbank lending was not considered. Why not? Perhaps a small additional comment in the footnote as to why this was not included given the rather serious problem the world currently faces with the failure of inter-bank lending would be in order.
2. The discussion of Figure 4 in the paragraph ending Section III.A on page 5 is too brief. Please walk the reader through each of the panels with a few sentences of explanation for each describing that the message of each panel is.
3. In the second paragraph of Section III.B on page 5 the authors observe:

“Suppose that bank μ shrinks the amount of its supplied credit, firm i would be influenced to a certain extent that might be quantified by $B_{i\mu}$. Similarly, if firm i fails or delays its repayment, then its effect to bank μ would propagate to an extent being measurable by $A_{\mu i}$.”

I see how the reduction of extended credit from bank μ to firm i would be measured by $B_{i\mu}$ (assuming, of course that there was no similar reduction in the credit extended by other banks to firm i). The impact on $A_{\mu i}$ of the failure of firm i to make a payment to bank μ , however, is less clear. Is the change in $A_{\mu i}$ the increased credit from bank μ to firm i as a result of the missed payment? Perhaps an extra sentence providing an example of this would help.

4. In the paragraph preceding Equation 7 the authors introduce the score. Is there a financial-economic interpretation of the score? It would greatly enhance the appreciation of the paper if the authors could add a few sentences explaining what the score is from a financial or economic perspective. Perhaps an example?
5. At the top of page 7 the authors introduce the modifier of “fragility” and “dependency” to the scores. It would be helpful if they added a sentence or two explaining why they chose these names. What is it, for example, about α that suggests it is a measure of fragility?

6. The authors should consider moving page 7 (beginning with the sentence “Let us first prove mathematical properties ...”), all of page 8 and the first three lines on page 9 to an Appendix. First, there is a lot of math here that, while interesting to some, is not needed to appreciate the authors’ central message concerning the measurement of changes in the structure of the credit network. Second, while the observation that “eigenvector \mathbf{u} can be calculated directly from eigenvector \mathbf{x} ” is of some interest, \mathbf{u} does not seem to be used much in the discussion on the pages that follow and so the details of the relationship between \mathbf{u} and \mathbf{x} appear to be unnecessary for appreciating the credit message of the paper. Finally, locating this in an Appendix keeps the information available for those readers who would like to understand the deeper mathematical aspects of this credit analysis.
7. On page 11 the authors begin their discussion of the results of their new methodology on the Japanese credit network. They observe “There are a strong peak in the late 80s and a drop in 1990; also two peaks around 1992 and in 1997.” First, the sentence should begin “There is a strong peak ...”. Second, please tell the reader what was happening in the Japanese credit market that correlates with these observations. Walk the reader through the time-series: are these peaks and troughs reasonable? Of so why and if not why not?
8. At the bottom of page 11 the authors show the average modulus of the second and third eigenvectors. Why should the average modulus be informative? A sentence or two motivating the use of this average would be helpful.

Recommendations of an editorial nature:

1. On page 1 in the listing of the authors’ names:
 - (a) The font for the final two authors’ names is not italics like that of the first three authors.
 - (b) A comma should not appear after “Souma¹” in the author list.
2. On page 1 please consider the following rewording in the Abstract:
 - (a) The first sentence understates what the paper is about. Please consider something like “We present a new approach to understanding credit relationships between commercial banks and quoted firms and with this approach examine the temporal change in the structure of the Japanese credit network from 1980 to 2005.”
 - (b) Consider replacing “... we propose to define a set of scores ...” with “... we propose a set of scores ...”
 - (c) Consider replacing “... eigenvalue problem determined the weight ...” with “... eigenvalue problem based on the weight ...”
3. The term “Banks-firms” in the Keywords list is not likely to be used in a search. Terms like banking, systemic risk, or credit score might generate more computer-search hits.
4. Beginning on page 2, and then throughout the paper, the width of the main text is narrower than the width of other text such as footnotes and Figure captions. An example of this is seen at the bottom of page 2. It is as if the main text is in the “quote” environment in L^AT_EX. Is this what the authors intended?

5. In the 1st sentence of the 1st paragraph on page 2 consider replacing “Credit-debt relation between banks and firms ...” with “The credit-debt relationship between banks and firms ...”.
6. In the 2nd sentence of the 1st paragraph on page 2 consider replacing “... a fuel for a firm to make growth.” with “... fuel for growth of a firm.”
7. In the 1st sentence of the 2nd paragraph on page 2 consider replacing “... system had undergone a considerable deterioration in its financial conditions for a decade in 90s.” with “... system suffered a considerable deterioration in its financial condition during the 1990s.”
8. In the 3rd sentence of the 2nd paragraph on page 2 consider replacing “... decrease the supply of credit immediately even by reducing existing loans to firms.” with “... decreased the supply of credit immediately; even by reducing existing loans to firms.”
9. In the final sentence of the 2nd paragraph on page 2 consider replacing “... medium-sized firms, had eventually suffered the loss of funding.” with “... medium-sized firms, eventually suffered loss of funding.”
10. In the 2nd sentence of the 3rd paragraph on page 2 consider replacing “This perspective has been recognized extensively in economics; ...” with “This perspective has been recognized increasingly in economics; ...”. I’m not sure that *extensively* is how I would characterize the recognition of this perspective in economics at this time. Indeed, one of the goals of reconstructing macroeconomics is to get this perspective *extensively* recognized.
11. In the sentence that runs from the bottom of page 2 to the top of page 3 consider replacing “Thus, only a fractional part of firms dominants a half of the entire loans.” with “Thus, only a small fraction of firms account for half of all loans.”
12. Midway down the 2nd paragraph on page 3 consider replacing “Recent development of complex network analysis ...” with “Recently, complex network analysis ...”
13. In the 1st sentence of the 3rd paragraph on page 3 consider replacing “... we describe our dataset of credit network.” with “... we describe our credit network dataset.”
14. In the 2nd sentence of the 3rd paragraph on page 3 consider replacing “... we propose to define a set of scores ...” with “... we propose a set of scores ...”.
15. In the 2nd sentence of the 4th paragraph on page 3 consider replacing “... from financial institutions, the amounts of borrowing, classified into short-term and long-term borrowings.” with “.. from financial institutions such as the amounts of borrowing and their classification into short-term and long-term borrowings.”
16. In the 1st sentence of the 1st paragraph on page 4 consider replacing “Each snapshot of credit network ...” with “Each yearly statement, or snapshot, of the credit network ...”.
17. Consider changing the sentence that follows Equation 6 from “Degree k_μ of bank ... and degree k_i of firm ...” to “The *degree* k_μ of bank ... and the degree k_i of firm ...”
18. In the first paragraph of Section III.B on page 5 consider replacing “A pair of bank and firm establish ... and a firm demands for credit as an important source ... on the other in twofold

ways.” with “A bank and a firm establish ... and a firm uses credit as an important source ... on the other in two ways.”

19. In the first sentence on page 7 a comma should replace the period that appears immediately after the definition of \mathbf{P} .
20. In the sentence immediately following Equation 28 the authors instruct the reader to “[i]gnore the subspace spanned by the trivial eigenvector $\mathbf{x}^{(1)}$ ”, but the authors then wait until the end of the paragraph following Equation 29 to point out why that makes sense from a credit perspective. Perhaps the final sentence in the paragraph following Equation 29 could be moved up and integrated into the sentence that follows Equation 28 to justify ignoring the subspace.
21. In the 1st sentence of Section III.C consider replacing “To determine significance ... bipartite graphs from the real data ...” with “To determine the significance ... bipartite graphs for comparison from the real data ...”.
22. In the 1st sentence following the enumeration of the steps in generating the random bipartite graphs consider replacing “The procedure 3 is done ...” with “The 3rd procedure is done ...”.
23. In the final sentence of the 1st paragraph of the Discussion on page 12 consider replacing “Yet it would be possible ...” with “With this it would be possible ...”.
24. In the 3rd sentence of the 2nd paragraph of the Discussion on page 12 consider replacing “In the late 80s, the profile is observed to be unstable, and ... are known to go financially deteriorated during the period.” with “In the late 80s, the profile changes dramatically, and ... are known to have deteriorated financially during the period.”
25. The sentence that begins the 4th paragraph of the Discussion on page 12 “Also we note that the peaks and spikes are present in same geographical regions as mentioned above.” seems out of place. What peaks and spikes are being referred to here?
26. In the 2nd sentence of the 1st paragraph of the conclusion consider replacing “Each snapshot of credit network ...” with “Each snapshot of the credit network ...”.
27. Consider rewording the final sentence of the paper “... our results based on the complex network analysis ... our approach has a potential quantification in the structure and its development of credit relationships.” with “... our results based on complex network analysis ... our approach is a potentially valuable quantification of the structure and development of credit relationships.”
28. In the References:
 - (a) There should not be a period at the end of the title of the paper by Brewer *et al.*
 - (b) The last name of the 1st author of 4th reference appears as “Gatti” instead of “Delli Gatti”. If the authors are using BibTeX this is likely due to the way BibTeX parses names. Try putting brackets around “Delli Gatti” (i.e. {Delli Gatti}) in the BibTeX file to get the parser to treat both words as a single last name.

- (c) There are two problems with the reference to the work by Imakubo and Soejima. First, the word “mony” in the title is spelled “money”. Second, I was not able to find this paper on the Bank of Japan website. Please ensure that it can be found by the interested reader. A URL would be helpful.
- (d) The title of the paper by Inaoka *et al.* is incorrect. It is “Self-similarity of banking network”.
- (e) There are two problems with the reference to the work by De Masi and Gallegati. First, the 1st authors last name appears as “Masi” instead of “De Masi”. As mentioned above, try typing {De Masi} in the BibTeX file to get the parser to treat both words as a single last name. Second, I was unable to find this in preprint form on the Web. This makes it difficult for the reader to use this reference. Since Dr. Fujiwara has a working relationship with Prof. De Masi and since other work by her does appear in preprint form on the Web (cf. next item) perhaps Dr. Fujiwara could ask her to put this paper up on a preprint site.
- (f) A preprint of the paper *An analysis of the Japanese credit network* by De Masi *et al.* is on the Web with citation “arXiv:0901.2384v1 [q-fin.ST]”. Please add this to the citation in your reference list.