Appendix to

Systemic Risk in the Consumer Credit Network across Financial Institutions

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Appendix

A The Financial Network by Groups

The connectivity of financial institutions may vary along with specific groups, such as borrowers with bad credit scores or those who use loan corporation loans. In this sense, we construct a network of financial institutions for specified groups to identify which groups have more fragile networks than others. Figures A.1 and A.2 depict the linkages among financial institutions by the balance of loans shared depending on gender. As shown in Table 1, male borrower comprise 61% of the sample and the connections for male borrowers are denser than for females borrowers. This indicates that female borrowers tend to take out loans from multiple sources, whereas male borrowers usually borrow from the first vendor, a commercial bank.

Figure A.3 shows the network of borrowers who are overdue, that is, who are late in paying their interest or principle by more than 90 days. According to the figure, this type of borrowers still has a large amount of loans from banks and their connections with other institutions have been strong since well before 2016. However, these connections have faded over time. This means that those who are in default cannot take out a loan at other institution, which makes the contagion effect weaker.

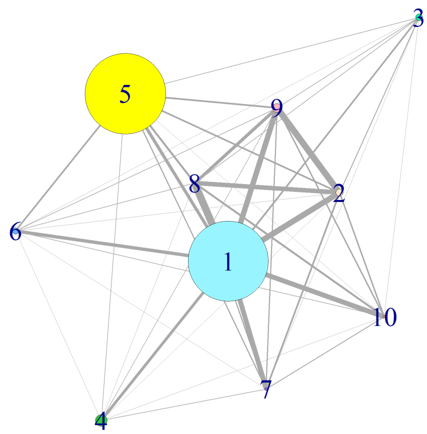
Figure A.4 shows the network according to credit scores. For brevity, we introduced only a select number of the credit score groups in the given period (2017Q2), but the rest of the results can be provided at the reader's request. In the better credit score group (1 and 3), we can see the influence of saving banks, which is bigger than commercial banks. However, the size of the circle means solely indicates the effect of the particular institution, whereas the width of the branch indicates the effect of contagion. That is, a weak connection between circles indicates that borrowers from two institutions are distinctive, even though they have homogeneous credit scores. In Panels C and D, for lower credit group (4 and 6), the connection are not as strong as in others because these borrowers are less eligible to borrow from financial institutions. At a credit score of 7∼10 it is almost impossible to engage in financial activity, so these individuals are excluded from this figure.

If borrowers are not eligible to borrow from the conventional financial institutions listed herein, they can still borrow from loan corporations, of course, at higher interest rates. Since these institutions are not registered as official financial institutions, they are also called “private loans”. If people borrow from those institutions, they are often extremely desperate and are believed to have a high probability of default. Figure A.5 constructs the financial network with only these borrowers. These individuals still have a large amount of loans from commercial banks and the connection is strong with non-banking financial institutions such as credit card companies, financing companies, and guarantee corporations (Group 8∽10)

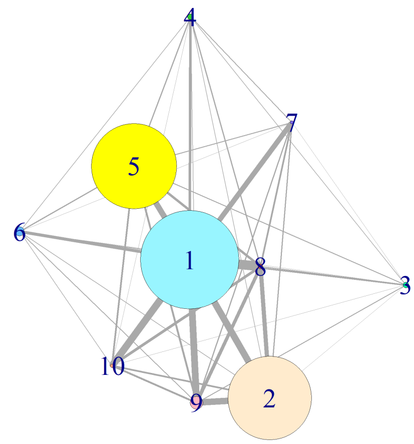
Figure A.6 depicts the network of financial institutions for borrowers who run their own businesses, or self-employed borrowers. This type of borrower take out personal loans and pays them back as a corporate unit. They have multiple kinds of loans, so they are often considered to be more vulnerable than others. In 2012, their contagion effect was not that strong but, in 2014, more loans were made to them by savings banks and the network contracted. This means that the connectivity between financial institutions has increased over time, while more loans have been made from savings banks to self-employed borrowers.

Self-employed borrowers may have a different strategy in borrowing, too, which can cause different effects on the network. In this sense, we depict the network according to the the borrower’s business type, as shown in Figure A.7.

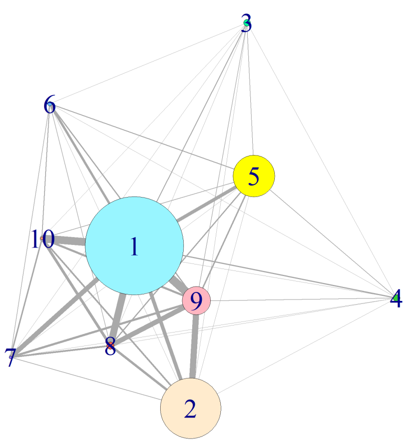
Figure A.1: Networks of financial institutions by expected exposure in selected quarters [male borrowers]*



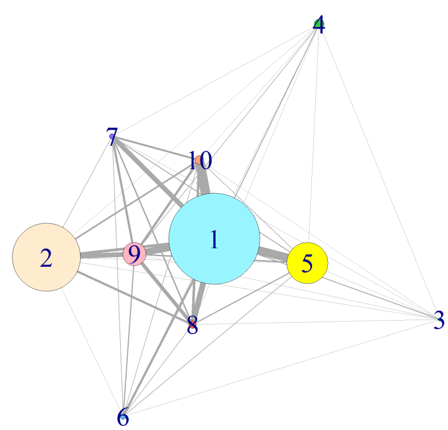
(a) 2012 Q1



(b) 2014 Q1



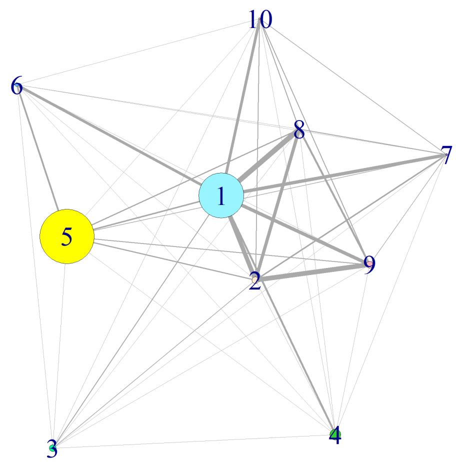
(c) 2016 Q1



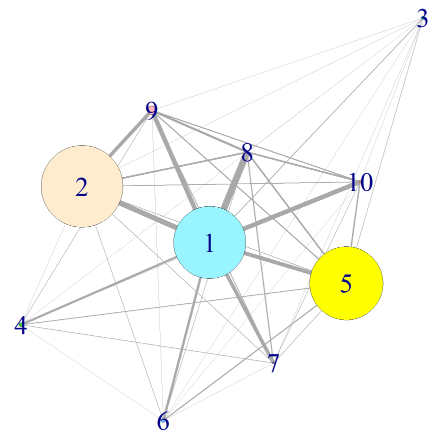
(d) 2017 Q2

* Note: Numbers in circle represents the financial institution listed in Table 1 in the main text. The size of the circle indicates exposures to default of institution i, and the width of branch stands for the exposure to default shared by two institutions i and j. See notes to Figure 3 and 5 in the main text.

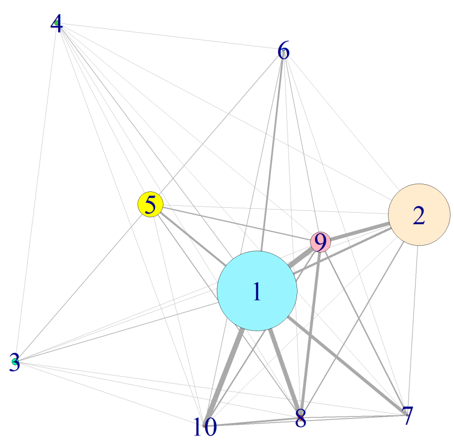
Figure A.2: Networks of financial institutions by expected exposure in selected quarters [female borrowers]*



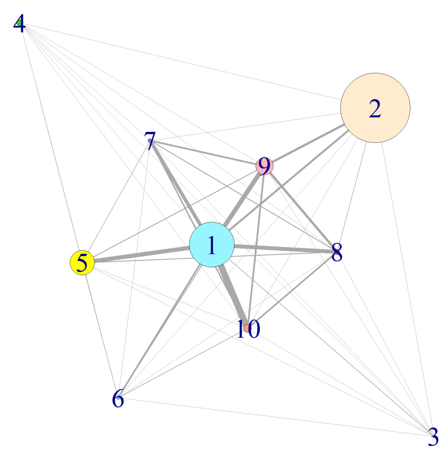
(a) 2012 Q1



(b) 2014 Q1



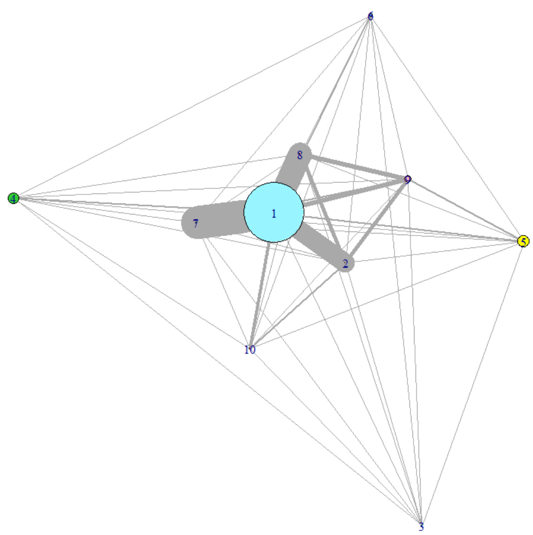
(c) 2016 Q1



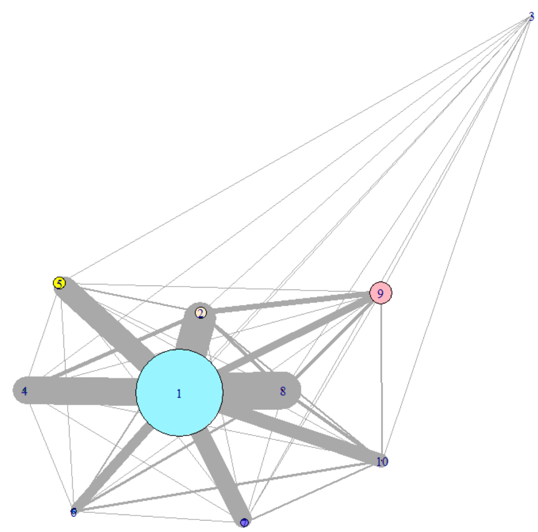
(d) 2017 Q2

* Note: See notes to Figure A.1

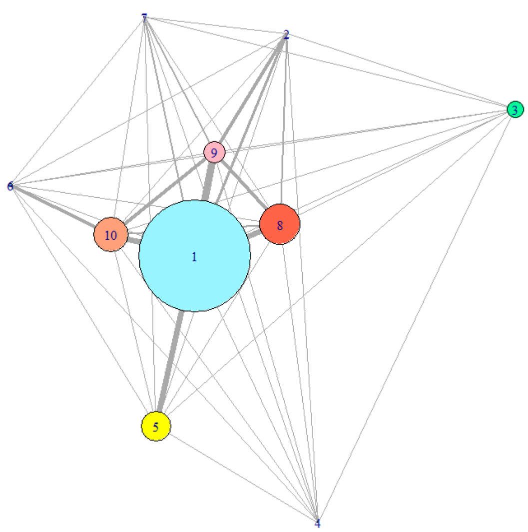
Figure A.3: Networks of financial institutions by expected exposure in selected quarters [overdue]*



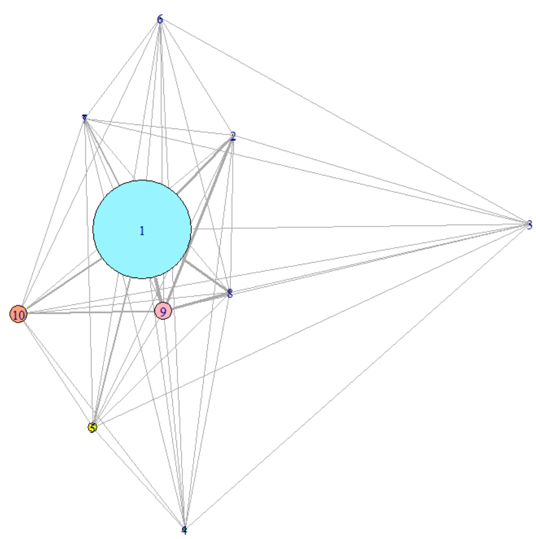
(a) 2012 Q1



(b) 2014 Q1



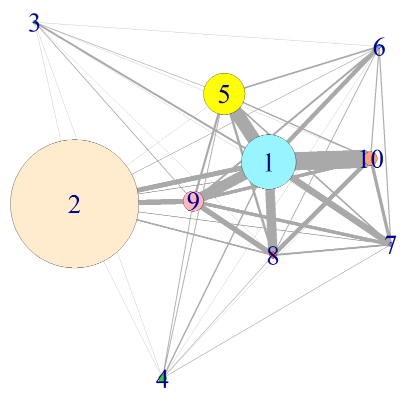
(c) 2016 Q1



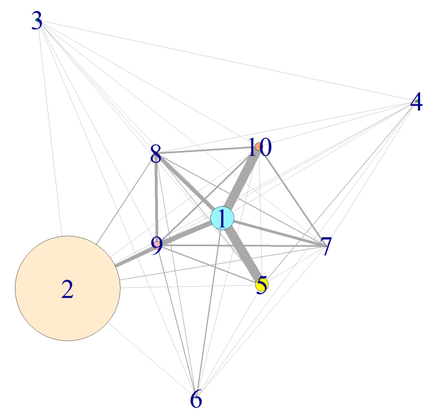
(d) 2017 Q2

* Note: See notes to Figure A.1

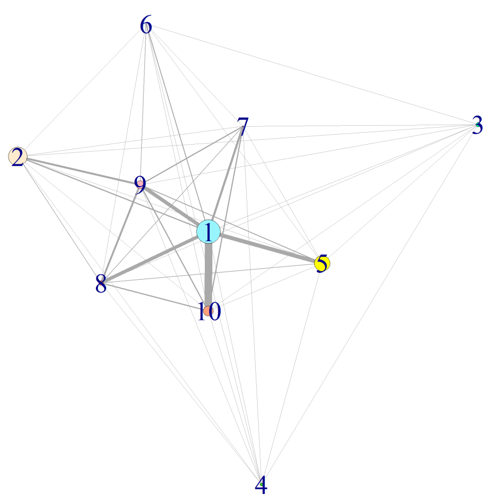
Figure A.4: Networks of financial institutions by expected exposure in 2017Q2 [credit score]*



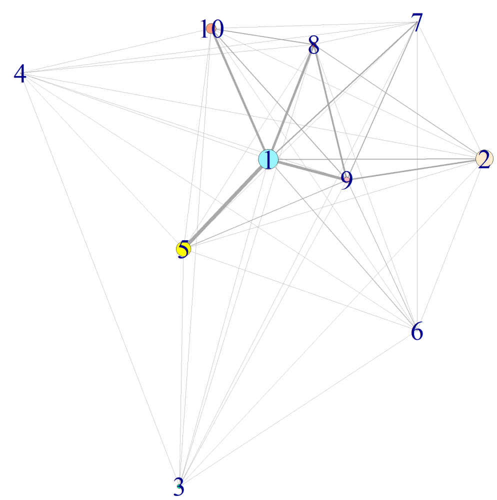
(a) Credit 1, 2017 Q2



(b) Credit 3, 2017 Q2



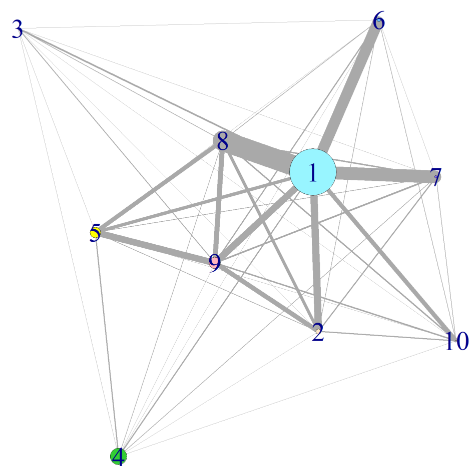
(c) Credit 5, 2017 Q2



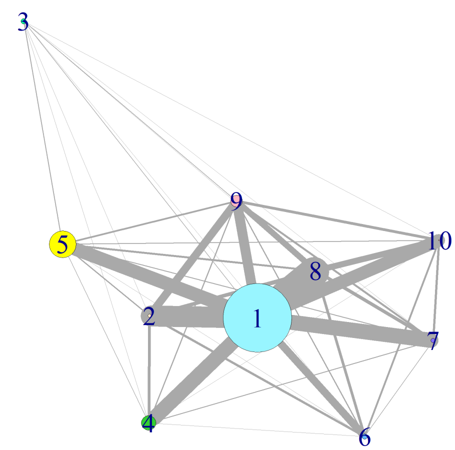
(d) Credit 6, 2017 Q2

* Note: See notes to Figure A.1

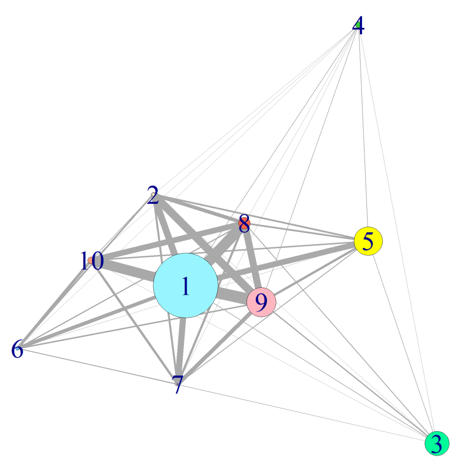
Figure A.5: Networks of financial institutions by expected exposure in selected quarters [use of loan corp.'s loan]*



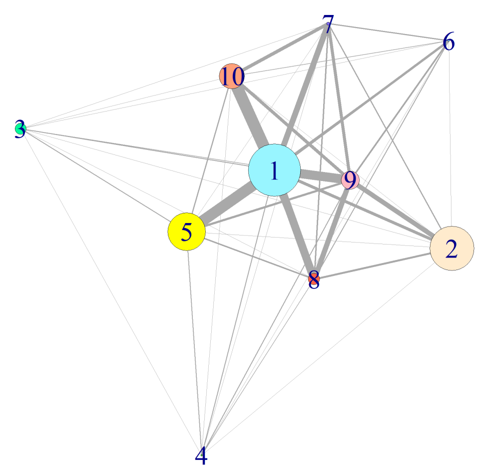
(a) 2012 Q1



(b) 2014 Q1



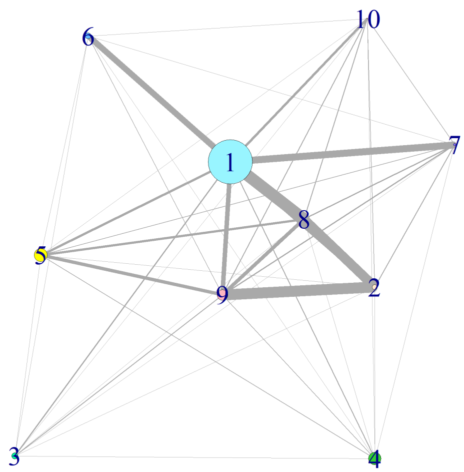
(c) 2016 Q1



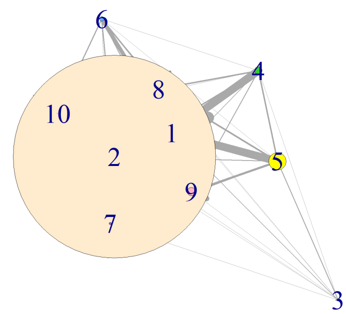
(d) 2017 Q2

* Note: See notes to Figure A.1

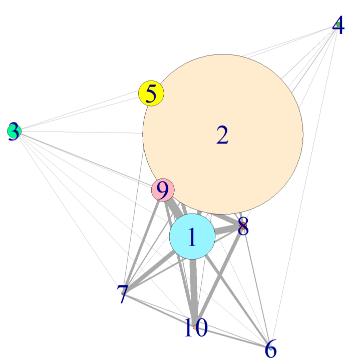
Figure A.6: Networks of financial institutions by expected exposure in selected quarters [self-employed borrowers]*



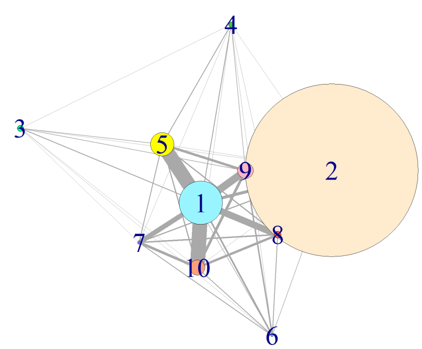
(a) 2012 Q1



(b) 2014 Q1



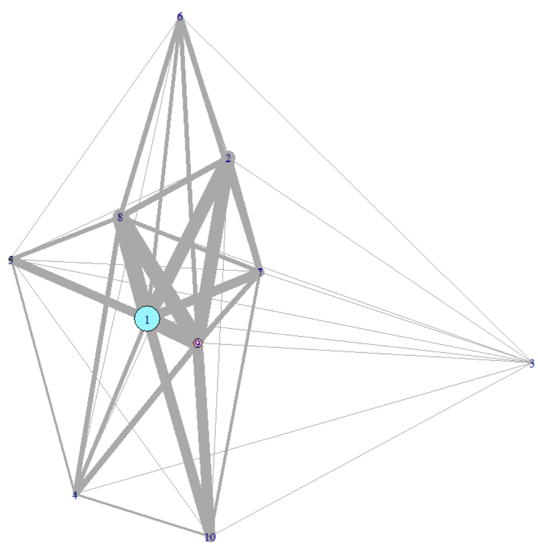
(c) 2016 Q1



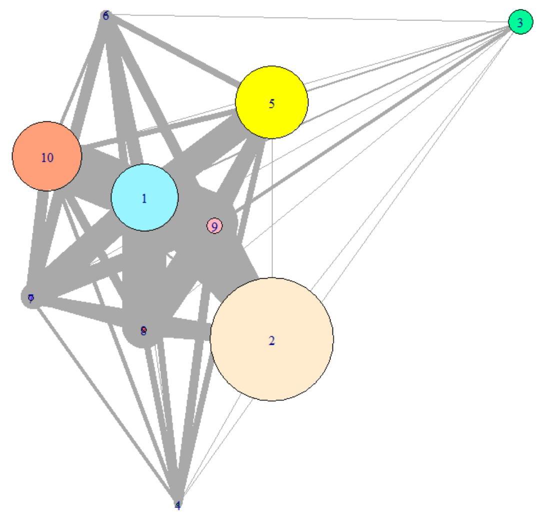
(d) 2017 Q2

* Note: See notes to Figure A.1

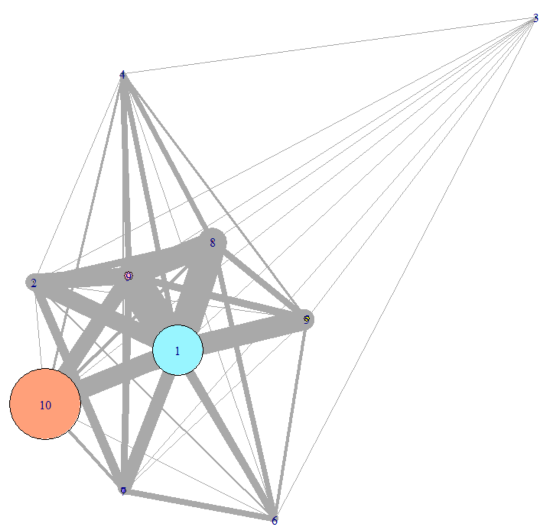
Figure A.7: Networks of financial institutions by expected exposure in 2017Q2 [self-employed borrowers' business type]*



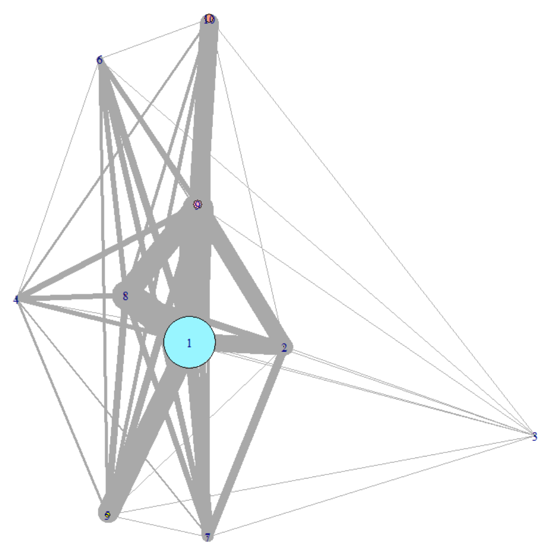
(a) Manufacturing 2017 Q2



(b) Whoelsale and retails, 2017 Q2



(c) Hotels and Restaurant, 2017 Q2



(d) Real estates, 2017 Q2

* Note: See notes to Figure A.1

Figure A.8: Kendall's Tau*