



Paper to be presented at the DRUID 2011

on

INNOVATION, STRATEGY, and STRUCTURE -
Organizations, Institutions, Systems and Regions

at

Copenhagen Business School, Denmark, June 15-17, 2011

The Contextual Dependence of Social Network Activation

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Abstract. Social networks are ubiquitous in social and economic life. Networks act as conduits of resources such as status and information. While our knowledge about the kinds of network ties used for carrying different types of resources, especially information, has grown considerably, we know very little about when actors choose to rely on the information carried by network ties. Here we outline a theory and empirically study how context affects the choice of actors to rely on the information from their social networks. Using data from the English East India Company's shipping network, we find that the captains were more likely to rely on information carried by social network ties early in their careers but less so later as their own experience grew. Likewise, the level of autonomy enjoyed by the actors has a positive effect on their reliance on network information. Environmental uncertainty also increases the importance of the timely information carried by networks. When the diversity of information carried by networks increases, we find that personal experience becomes increasingly important in deciding what course to take. Our theory and results contribute to our understanding of the role of networks economic and social life.

Introduction

Social networks are ubiquitous in social and economic life. Their effects have been shown to extend from being conduits of information to creating trust to giving actors an advantage over others. Network position, or structural social capital, has been linked to better ideas, more promotions, and higher returns. Information for instance about job opportunities seems to diffuse through diverse kinds of network contacts.

However, our understanding of when actors choose to rely on their networks still remains rudimentary. Few, if any, studies have looked at the context in which actors turn to their contacts. The existing literature has mainly looked at personal characteristics of either the actor or the network contacts or characteristics of the network (e.g., Smith 2005; Renzulli & Aldrich 2005). Here we outline a theory and empirically study how context affects the choice of actors to rely on the information from their social networks.

Using data from the English East India Company's shipping network, we find that the captains were more likely to rely on information carried by social network ties early in their careers but less so later as their own experience grew. Likewise, the level of autonomy enjoyed by the actors has a positive effect on their reliance on network information. Environmental uncertainty also increases the importance of the timely information carried by networks. When the diversity of information carried by networks increases, we find that personal experience becomes increasingly important in deciding what course to take. Our theory and results contribute to our understanding of the role of networks economic and social life.

Activation of Social Networks

We investigate four types of factors that are likely to affect the activation of social network ties: factors about the actor, about the network position, about the organizational context, and about the environmental context.

First, the level of experience an actor has is likely to make the actor more reliant on personal experience and less reliant on both his or her superiors and peers. Thus actors with greater experience are less likely to activate their network ties for new information.

Hypothesis 1: Tenure in organization reduces the effect of both formal orders and social network while increasing the effect of personal experience.

Second, the diversity of the information coming through the social networks makes it harder to decide which piece of information to act on. In these cases, it is personal experience that is likely to be decisive.

Hypothesis 2: The diversity of information from social networks increases the importance of personal experience as a deciding factor.

Third, the level of autonomy the actor has is likely to affect the activation of network ties. When autonomy is high, the activation is likely to be higher as well.

Hypothesis 3: Organizational structure affects the importance of formal orders and social networks.

Fourth, the level of uncertainty in the environment is likely to be a critical factor in the importance of network ties. In times of greater uncertainty, the timely information through local contacts is likely to be important.

Hypothesis 4: Environmental uncertainty reduces the impact of formal orders and increases the impact of social networks.

Data

The data for this research came from the print volume, *The Catalogue of the East India Company's Ships' Journals and Logs, 1600-1834* (Farrington 1999). This volume integrates information from the journals, logs, ledgers, imprest books, pay books, receipt books, absence books, company papers, and voluminous correspondence of the Company. The initial stage of the project involved the electronic transcription of the information pertaining to all voyages of the EIC, supplemented by the collection of geographic data for the 272 East-Indies ports visited (Milburne 1813, Stevens 1775). The result includes a complete list of the 1,480 ships (4,725 voyages) that were engaged in official EIC trade from 1601 to 1835 and geographic coordinates for all 272 ports. All ships list the trading season in which they were active and 99% percent include the intended destination. The captain of the ship is systematically listed and present in

95% present of the voyages with ports recorded. 85% of the entries for voyages contain a complete set of ports visited with dates of arrival and departure.¹

This list of ports is the key piece of information used for analysis, since it forms the basis of the evolution of the trade network – each trip between ports constitutes the creation of an edge in the network and travel to a new port adds a node. Since this is a crucial piece of evidence, it was important to confirm that the data available in the Farrington volume faithfully recorded the actual passage of the ships. The British Library holds the original ships’ logs in the India Office Records Collection. A stratified sample of 107 logs confirmed that the ports listed as destinations in Farrington (1999) were those recorded in the original logs: dates and ports were correct in all cases.

One may also question whether the purser and captain (the two officers usually responsible for maintaining the log and journal) recorded the actual passage of the ship. As described by the historian Miles Ogborn, the journals...

“were to guarantee to the adventurers in London of the performance of what they had ordered to be done, or at least that decisions made on the voyage did not contradict those orders. Where possible, they were to provide the foundation of succeeding voyages by providing knowledge of winds and shoals, useful ports and places of refreshment, good routes to take, supposedly friendly or treacherous peoples, good commodities and markets, and the extent of Portuguese and Dutch power as well as the orientations of Asian politics. These journals were collated, archived, and used by

¹ Of the missing 724 voyages, 188 were terminated due to rotting, wreck, acts of aggression, and other misadventures.

the Company in increasingly systematic ways in order to provide ‘navigational’ knowledge for subsequent voyages” (2007: 49).

This guarantee raises the possibility that the captains and purser might omit ports from the logs that weren’t consistent with official orders and regulations – in order to hide transgressions from company officials. There is no evidence of such omissions. Instead, Portuguese and Dutch ports, legitimately off limits to EIC traders, are recorded in abundance. The practical reason for this honesty is that the log served as a navigational tool during the course of the voyage. The log tracked weather conditions as well as position. Without an accurate record, the ship would be lost, and therefore at risk -- good reason to keep an accurate record.

The level of detail included in the data set allows a day-to-day recreation of the location of ships (through reference to arrival and destination ports), which spans 85,838 days – or 234 years -- from the granting of the royal charter, December 31, 1600, to the return of the last ship, the *General Palmer*, on March 3, 1835. The data captures both ‘networks,’ patterned interactions between individuals in different ports, and ‘flows,’ the movement of commodities, capital, people, and information (Castells 1966, Gotham 2006). It is the patterns of interactions between individuals that determine the subsequent ‘flow’ of goods, currency, news, and people. Unlike today, the passage of information, goods, and capital were consolidated along a small number of available channels. Today, multiple information networks, cellular, telephone, email, internet, personal, commercial, overlap and feed into each other. The number of potential channels for communication makes the analysis of network growth difficult. In the early modern period, this complexity was reduced. The large commodity-carrying ships were also principal conduits in the

transmission of information throughout the region. Therefore, the records of the shipping network of the English capture a flow of goods, capital, persons, and information that can be transformed into an analytically tractable network that captures a large proportion of English interactions.²

Statistical Model

Throughout the history of the English Company, Captains were contracted by the firm and expected to follow orders. However, once aboard ship, captains had command of the vessel and were in practice relatively autonomous actors. As each captain pulled up anchor, unfurled the ship's sails, and drifted into tropical waters, they had several considerations to weigh. They were about to pilot a 1,000 ton wooden ship into uncertain waters with a crew of 100 or more men, half of whom may have been suffering from scurvy, malaria, or a host of other illnesses and parasites that drastically lowered the life expectancy of Europeans in the East (Cotton 1949).³ The crew and the captain were interested in making their own fortunes. However, in order to continue to pursue their own private trade in the East, they needed the permission and employment offered by the EIC.⁴ Given this, the captain had to decide where he might find a safe haven and good prospects for trade. It is reasonable to assume that captains were acting on some sort of information about viable commercial opportunities at ports. They had three potential sources of information: organizational knowledge, social networks, and personal experience.

² By this we mean English-English interactions. Systematic data on Asian and Middle Eastern trading voyages is not available. There were also country voyages made by English traders that are not captured in any extant data. The lack of these data sources indicates that, if anything, we are underestimating the effect of social networks in the English trade.

³ 61% of the men serving within the EIC in the East died while employed (Hejeebu 2005).

⁴ Hejeebu also shows that profits from the private trade are likely to have increased with time – as individuals gained more experience and local knowledge (2005), giving employees an larger stake in future employment.

We treat the decision of a captain to travel from one port to another in the East as the unit of analysis. The captain's decision is operationalized in the data as the creation of a directed tie between 2 ports. A tie occurs in the trade network when a captain travels from one port to another.⁵

We began by assuming that when deciding his next port, a captain could in principle travel to any other of the 272 ports visited by EIC in the East. We then used a fixed-effects logit model to estimate how the probability of choosing a particular port deviates from a baseline probability as a function of formal orders, social networks, and personal experience. If having information about a particular port through social networks makes captains more likely than the baseline expectation that that port will be chosen, then we would expect the coefficient for social networks to be positive and statistically significant.

The baseline probability, i.e., the fixed effect, includes components for the directed dyad, season, and time period. Including the directed dyad component controls for such time-invariant factors as the relative geographic locations of the two ports, in particular the distance between them, the popularity of certain routes, and also prevailing winds and currents which might make the voyage in one direction easier than the other. As an example, due to the winds in the Atlantic, sailing from England to Cape Town generally included stop in Brazil while the reverse route followed the African coast and stopped over at St. Helena's. For many commodities, the source locations are very stable and hence are effectively controlled for as well. The season component,

⁵ The creation of a tie is, of course, a fundamental issue in network dynamics because the types of ties that are created determine the evolutionary pattern of the network as well as its structure at any given point in time.

defined as three-month periods, allows for regular variations in weather patterns, primarily monsoons and hurricanes. Finally, the period component allows the baseline to vary over time as the popularity of the ports grows and declines. We use periods of forty years, which roughly corresponds to the pace of change in terms of shifts in the major commodities traded and hence to the factors for which we want to control. Shorter periods run the risk of controlling for exactly the short-term changes in port popularity that arise from formal orders, personal experience, and social networks. To be sure, we also estimated the models with baseline probabilities based on periods of twenty, sixty, or eighty years and obtained broadly similar results.

It should be noted that if the baseline probability of a particular choice of next port is zero, i.e., the port is never chosen as the next port from the current port in the current season and period, it effectively drops out of the estimation. The true choice sets thus include only those choices that actually occur. This means for instance that ports established after 1700 do not appear as viable alternatives in 1640. Ports thus appear in the choice sets only in time periods when they are actually visited. We also estimated models where ports entered the choice sets five or ten years prior to first visit or first formal order to visit and exited the choice sets five or ten years after the last visit or last formal order to visit. The results were very similar, suggesting that the period component of the baseline probability is sufficient to control for the appearance and disappearance of ports.

Variables

Peer-to-Peer Networks within the Firm

Though ships were often dispersed across Asia, they came into contact with each other regularly at frequent ports-of-call. If informal relationships between employees were used to transfer information, the opportunity to communicate came when English captains and crews shared the same harbor. English Company employees came into close personal contact with each other when sharing a common port. If the port held an English factory, that factory would hold the living quarters for all Company employees while stationed abroad. In most ports, English access to social and residential life was restricted by the local government. The English, as well as most other foreign merchants, were consigned to merchant ghettos, called *nattios*. As a result, these factories became the center of English social life overseas (Cotton 1949), facilitating the collection and transfer of information. Therefore, each captain should have been able to access information about the ports visited by each of the other captains anchored or recently anchored at the same port. Constructing this “reference group” allows for the identification of network effects (Manski 1995).

Unfortunately, the data systematically reports only arrival dates, so the exact overlap is unknown in most cases. The total number of completed trips over the history of the organization was 14,065. In 1,012 voyages additional notes in the data recorded the departure date of ships from one or more of the ports visited in the East Indies.⁶ Out of a sample of 200 of these voyages, 72 trips had complete information. We used this information to estimate the time it took to travel between ports and the average stay in ports, which became the basis for our calculation of departure times from ports.

⁶ Port departure often replaced port arrival information.

If the factories provided a home away from home for the English overseas, residents of the factories should have been able to store information which could then be transferred from ship to ship without direct overlap. However, the information would have to be timely to be useful. We estimated that information stayed in port four months after the departure of a ship. The model results are robust to variations of this estimate.⁷ A small number of voyages originated in Asia. In these cases we estimated that they gathered in the port four months prior to departure to make preparations.

Using the supplied arrival times and the imputed departure times, we can then assess which captains had an opportunity to get information from other captains. If two captains were in a position to communicate information, we assumed that the captains received information about the most recent port the other ship had visited.⁸ We coded the variable *SN* as 1 for a dyad if a captain had just received information about the possible destination port and as 0 otherwise.

Captain's personal travel experience

Captains also had access to the store of information they had accumulated through their own travels in the East. The disadvantage of personal experience is that it is limited when compared to the information available through social networks and also more likely to be out of date. On the other hand, personal experience may reflect trusting relationships across firm boundaries or a deep cultural knowledge of sites that cannot be transmitted to others. In this sense, personal experience could reflect a different set of social networks, those networks spanning outside of

⁷ There was almost no change in results based on 3 and 5 months storage periods. Additional models available on request from authors.

⁸ We also tested the models with the assumption that the captains shared information about all prior ports on the current voyage. The results were very similar, which suggests that timeliness of information was very important.

the firm's boundaries. In other words, personal experience could also be conceived of as the accumulation of past relationships created outside of the firm boundaries.

It is also possible to see personal experience in an individualistic light. It is reasonable to expect that in competitive circumstances, individuals will prefer to rely upon their own experiences, rather than trust others for reliable information. Up-to-date information about prices and goods was invaluable for making the fortunes of foreign traders: there was a tremendous difference in profits for the first ship to port and the second. Therefore it is possible that commercial information would have been hoarded by firm employees. The expectation that captains would rely solely upon personal experience is most in line with classical assumptions about decentralized actors in market situations. Following Adam Smith, it is the self-interested actions of individuals that create the greatest value for the whole. Narrowly conceived, this would lead to the expectation that captains relied upon personal experience to pursue their own interests; social networks did not drive the trade.

In either case, personal experience is a potentially crucial source of information for captains that must be disentangled from information transmitted through peer networks. In a trade network such as this, information is not only transmitted through the network, *it traverses the network* as actors move from location to location.⁹ The personal experience variable *PE* captures the movement of information as it is carried and accumulated by the individual that traverse the network. It is recorded in the data as a binary variable: 1 if the destination port is part of a captain's past repertoire from past voyages, 0 otherwise. Since captains rarely return to a port

⁹ This dual movement, transmission and traversing, occurs in many real-world networks, i.e. transportation, migration, and trade networks.

during one voyage (Erikson and Bearman, 2006), we exclude prior ports on the current voyage from personal experience.

Formal Orders

The captains were also presented with formal voyage targets, which they may or may not have used to direct the passage of their ships. If they were to abide by the terms of their contract, captains were obligated at some point in their voyage to journey to the destinations indicated by the board of directors.¹⁰

These destination ports were systematically recorded in the catalogue of ships' voyages (Farrington 1999). Destinations were occasionally vague. When an area was listed rather than a port, we supplied the site of the major English factory in that region. For example, if Bengal was listed, we supplied Calcutta as the formal destination of the voyage. Our reasoning was that imprecise directions are only possible when general knowledge is high; therefore, vague directions are only given if the most obvious answer is the correct one. If the listed destination was too imprecise, i.e. the East Indies, we did not replace it. We did, however, supplement the recorded destinations with the list of major factories and ports known as intermediate docks for those factories (Surat, Benkulen, Hugli, Vizagapatam, Masulipatam, Diamond Harbour, Saugor, Second Bar, New Anchorage, Whampoa, Penang, Singapore, Johanna, Madras, Bombay, Calcutta). These were the centers of EIC administrative power in the East. Captains pursuing their own trade were unlikely to make undirected stops at these official ports, even when private trade had limited legitimacy during the late-17th to early 18th centuries. Drawing from a sample

¹⁰ Directions to captains are often listed in the first pages of ships logs and appear scattered through the paperwork associated with each voyage, bound in separate volumes in the India Office Records division of the British Library in London.

of ships' logs, we found that, again, if a destination was uncommon, it was likely to be noted in the first pages of the logs.¹¹ More common destinations, i.e. *Mumbai* and *Chennai*, could go unnoted although they were part of the official route intended for the ship by the board of directors. We use the variable *FO* to indicate formal destinations, 1 is a formal destination (i.e. organizational target), and 0 is not. Since additional information about a formal destination would be beside the point – and captains would be more likely to have information about formal destinations because they were heavily trafficked -- this is an important control.

Tenure

While the above personal experience variable measures whether a captain had visited a particular port before, we measure the level of personal experience through tenure in the organization, operationalized in the variable *tenure* as the number of complete voyages from England to the East and back the captain had done prior to the current one.

Diversity of Information

Given our operationalization of network ties, the natural measure of the diversity of information is the number of other captains who overlapped with the focal captain in port 1, recorded in our variable *plcrowding*.

Organizational Structure and Autonomy

There were also key organizational shifts that were likely to have affected the use or prevalence of social networks. We broke the life of the organization into three periods: The first phase

¹¹ This is almost certainly the case because exploratory voyages were prestigious appointments.

(1600-1673), the country trade period (1674-1756), and the colonial era (1757-1835).¹² Although various concessions were granted prior to that year, in 1674 country trade was fully legitimized in the regulatory structure of the EIC. The period ends with the 1757 Battle of Plassey, in which the EIC forces defeated the Mughal Empire and began to establish the Raj, British colonial dominion in India. The regulatory structure lagged behind the organizational shift, as shown by the 1776 Act outlawing route deviations. We use the date of 1757 because it was the Battle of Plassey that definitively changed organizational goals and incentives. These periods are relatively standard in the historical literature on the English Company (Basset 1960, Chaudhuri 1965 1978, Stern 2009).

Environmental Uncertainty

We operationalized environmental uncertainty as a time of war. During times of war, timely information is at a premium. Running into Dutch or French ships at sea or arriving at a port that had fallen into Dutch or French hands during periods of war could be highly dangerous. Conditions shifted suddenly, making information from London, via the formal orders, less useful. Meanwhile, timely information through social networks was likely to carry more weight. Thus, we coded the variable *war_br_fr_hl* as 1 whenever Britain was at war with France and/or Holland and 0 otherwise. The variable *war_br_asia* we coded as 1 whenever Britain was at war with an Asian power and 0 otherwise.¹³ Wars with Asian powers were generally fought on land and would be expected to affect the trade less than wars with the major European powers. We expected that wars would reduce the importance of formal orders and increase reliance on social

¹²

¹³ The war data came from ICPSR studies Great Power Wars and Major-Minor Power Wars (Levy 1989, Midlarsky & Park, 1991).

networks, with wars fought against the major European powers having a greater impact than wars against Asian powers.

Control Variables

The initiation of trade in a new commodity is also likely to affect patterns of information use. Attempts at quickly finding the best sources for valuable new commodities are likely to increase reliance on timely information from social networks at the expense of formal orders. We looked for periods when there was a rapid expansion in the trade of a particular commodity. The variable *cotton* was coded as 1 for 1660 to 1685 and 0 otherwise. The variable *tea* was coded as 1 for 1717 to 1722 and 0 otherwise. The variable *coffee* was coded as 1 for 1700 to 1710 and 0 otherwise. Although the East Indies trade included hundreds, if not thousands, of specific exotic items of trade, these commodities cover the majority of traded goods and all the major shifts in trade.

We also included a control for the time period when there were two competing English companies claiming the rights to the monopoly of trade in the East (1694-1712), as this could have reduced the power of the principals and hence reliance on formal orders.

Results

Tables 1 presents tests of Hypotheses 1 & 2. In Model 1, we have the baseline model showing that formal orders, personal experience, and social networks were all active in the choice of ports. The effect sizes differ considerably though, with the formal orders being considerably

more important than the other two. This is understandable as a captain had to go to the ports he was ordered to visit at some point during the voyage if he wished to do another voyage.

In Model 2, we present test of Hypothesis 1 and find that the level of experience measured as tenure indeed does reduce the importance of both formal orders and social networks while increasing the importance of personal experience. The more experienced captains are less likely to pay attention to other captains, but also are willing to take more liberties from the orders of the principals in London. In Model 3, we present a test of Hypothesis 2 and find that the diversity of information carried by social networks increases the importance of personal experience as the deciding factor.

Table 2 and 3 present tests of Hypotheses 3 & 4. In Model 1, we break the entire time to the three periods indicated earlier and find that there are clear differences in the coefficients across the time periods. The changes in the importance of formal orders and social networks as autonomy decreases when we move from the first phase to the country trade and then further decreases as we move from country trade to the colonial era are inline with Hypothesis 3.

In Model 2, we add the environmental uncertainty variables and find that war of any kind reduces the importance of formal orders while wars especially with France or Holland increase the importance of formal orders, supporting Hypothesis 4.

Models 3 & 4, add the variables from Table 1 to show that these results are robust to the variables introduced here. Table 3 presents evidence that the differences in the magnitudes of the

formal order and social network coefficients are statistically significant especially when we move from the country trade period to the colonial era, supporting Hypothesis 3.

Discussion

We outlined a theory on how social network activation is likely to depend on contextual factors and tested the theory on data from the English East India Company's shipping network. The results support the theory.

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Table 1

	(1)	(2)	(3)
fo	2.269 ^{***}	2.492 ^{***}	2.195 ^{***}
	(17.92)	(18.73)	(13.42)
pe	0.316 ^{***}	0.383 ^{***}	0.109 [*]
	(5.88)	(7.00)	(1.85)
snl	0.144 ^{**}	0.255 ^{***}	0.112
	(2.44)	(3.28)	(1.45)
fo x tenure		-0.113 ^{***}	
		(-4.84)	
pe x tenure		0.0397 ^{**}	
		(2.20)	
sn x tenure		-0.0817 ^{***}	
		(-2.84)	
fo x p1crowding			0.0000293
			(0.74)
pe x p1crowding			0.0000557 ^{***}
			(3.52)
sn x p1crowding			0.00000817
			(0.46)
Clusters	3241	3241	3241
<i>N</i>	127959	127959	127959

t statistics in parentheses, fixed-effects logit estimates using directed-dyad-season-period fixed effects, standard errors robust to clustering on the fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2

	(1)	(2)	(3)	(4)
fo x per_firstphase	1.815*** (9.85)	2.015*** (10.16)	2.192*** (10.97)	2.166*** (10.63)
fo x per_countrytrade	2.145*** (12.92)	2.264*** (13.18)	2.529*** (14.34)	2.483*** (12.59)
fo x per_colonialera	2.488*** (13.29)	2.720*** (13.24)	3.067*** (14.40)	3.020*** (11.92)
fo x per_twocompanies	-0.750* (-1.75)	-0.820* (-1.92)	-0.882** (-2.07)	-0.873** (-2.05)
fo x imp_cotton	0.0647 (0.17)	-0.0414 (-0.11)	-0.0717 (-0.19)	-0.0603 (-0.16)
fo x imp_tea	-0.264 (-0.99)	-0.380 (-1.40)	-0.437 (-1.59)	-0.431 (-1.58)
fo x imp_coffee	0.425 (1.00)	0.565 (1.33)	0.575 (1.36)	0.567 (1.34)
pe x per_firstphase	0.0833 (0.37)	0.0309 (0.13)	0.0987 (0.42)	0.0753 (0.32)
pe x per_countrytrade	0.250*** (3.49)	0.232*** (2.95)	0.300*** (3.89)	0.152* (1.68)
pe x per_colonialera	0.339*** (4.89)	0.305*** (3.19)	0.382*** (4.04)	0.186* (1.92)
pe x per_twocompanies	0.281 (0.48)	0.291 (0.50)	0.278 (0.49)	0.262 (0.46)
pe x imp_cotton	-0.163 (-0.23)	-0.184 (-0.26)	-0.244 (-0.34)	-0.205 (-0.28)
pe x imp_tea	0.189 (0.70)	0.205 (0.75)	0.180 (0.67)	0.192 (0.74)
pe x imp_coffee	-0.0878 (-0.19)	-0.137 (-0.29)	-0.162 (-0.35)	-0.0839 (-0.18)
sn x per_firstphase	0.581*** (4.14)	0.444*** (2.72)	0.480*** (2.90)	0.467*** (2.83)
sn x per_countrytrade	0.242*** (2.77)	0.164* (1.69)	0.229** (2.07)	0.150 (1.27)
sn x per_colonialera	0.0456 (0.53)	-0.0985 (-0.87)	-0.0184 (-0.14)	-0.129 (-0.95)
sn x per_twocompanies	0.196 (0.38)	0.246 (0.47)	0.224 (0.43)	0.248 (0.48)
sn x imp_cotton	0.343 (0.59)	0.425 (0.74)	0.422 (0.74)	0.415 (0.70)
sn x imp_tea	-0.452 (-1.31)	-0.376 (-1.08)	-0.398 (-1.13)	-0.389 (-1.13)
sn x imp_coffee	-0.427 (-0.90)	-0.548 (-1.14)	-0.547 (-1.15)	-0.552 (-1.16)
fo x war_br_fr_hl		-0.251*** (-2.60)	-0.280*** (-2.95)	-0.274*** (-2.89)
fo x war_br_asia		-0.249** (-2.13)	-0.263** (-2.27)	-0.273** (-2.36)
pe x war_br_fr_hl		0.0662 (0.65)	0.0676 (0.69)	0.0559 (0.58)
pe x war_br_asia		-0.0333	-0.0360	-0.0107

		(-0.31)	(-0.34)	(-0.11)
sn x war_br_fr_hl		0.174*	0.174*	0.168*
		(1.70)	(1.72)	(1.66)
sn x war_br_asia		0.132	0.129	0.147
		(0.93)	(0.90)	(1.04)
fo x tenure			-0.140***	-0.128***
			(-5.90)	(-5.47)
pe x tenure			0.0421**	0.0401**
			(2.35)	(2.26)
sn x tenure			-0.0636**	-0.0660**
			(-2.14)	(-2.23)
fo x plcrowding				0.00000814
				(0.20)
pe x plcrowding				0.0000476***
				(3.19)
sn x plcrowding				0.0000266
				(1.42)
Clusters	3241	3241	3241	3241
N	127959	127959	127959	127959

t statistics in parentheses, fixed-effects logit estimates using directed-dyad-season-period fixed effects, standard errors robust to clustering on the fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3

<i>Test for coefficients of Table 2</i>	(1)	(2)	(3)	(4)
fo x firstphase - fo x countrytrade = 0	p > .15	p > .15	p > .15	p > .15
fo x countrytrade - fo x colonialera = 0	p < .15	p < 0.05**	p < 0.05**	p < 0.05**
pe x firstphase - pe x countrytrade = 0	p > .15	p > .15	p > .15	p > .15
pe x countrytrade - pe x colonialera = 0	p > .15	p > .15	p > .15	p > .15
sn x firstphase - sn x countrytrade = 0	p < 0.05**	p < 0.10*	p < .15	p < 0.05**
sn x countrytrade - sn x colonialera = 0	p < .15	p < 0.05**	p < 0.05**	p < 0.05**

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$