Banks and the World's Major Banking Centers, 2010

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Abstract

We update three earlier articles on the determinants of interpenetration of financial centers by banks by adding the year 2010 to our analyses for 1970 and 1980, 1990, and 2000. In addition, we also re-estimate our model to include data for Beijing/Shanghai, and add those emerging centers for 2010.

First, the number of banks in our data and the number of their offices in other centers has fallen by 46% and 24% since peaking in 1990. Second, even so our matrix saw less turbulence than in the prior two decades as density and number of presences in other centers per bank increased. Third, London had regained the first place from New York. Tokyo remains in fifth place after Hong Kong and Singapore. Once one includes Beijing/Shanghai, the Chinese centers now rank first and Tokyo sixth. Fourth, Paris and Frankfurt/Hamburg have regained some centrality. Fifth, our gravity model approach continues to model the data well, with distance between centers continuing to depress interpenetration between centers as it did in 2000. Lastly, the primary effect of introducing Beijing/Shanghai as a center has increased the importance of interpenetration as banks from Beijing and Shanghai are going to centers from which banks are coming to Beijing and Shanghai.

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Contents: I. Introduction. - II. Data and the Degree of Interpenetration. - III. The Determinants of Interpenetration. - V. Gravity Model Estimation Results. - VI. Discursive Summary.

I. Introduction

This paper updates the research in Choi *et al*., (1986), Choi *et al*., (1996), and Choi *et al*., (2003) on the determinants of interpenetration of financial centers by banks. Adding an analysis of the data for the year 2010 to the analyses for 1970, 1980, 1990, and 2000 enables us to continue to track the evolution of the centers and the behavior of the banks that come from these centers. Replicating our earlier work using the same methods and models enables us to attribute the changes that we see to changes in the phenomenon, rather than possibly to changes in approach. The exercise is worthwhile because scholarly interest in financial centers continues, particularly with respect to the emergence of China as an important participant in international capital markets, and with respect to the question of competition among centers in Asia to be the center for the region and the time zone.

II. Data and the Degree of Interpenetration

We define interpenetration as the exchange of organizational presence. We begin by updating the matrices in Choi *et al.,* (1986, 1996, and 2003) for the year 2010. Initially we use the same fourteen centers: London (LO), New York (NY), Paris (PA), Frankfurt/Hamburg (FH), Tokyo (TO), Singapore (SI), Hong Kong (HK), Los Angeles/San Francisco (LS), Zurich/Geneva (ZG), Amsterdam (AM), Brussels (BR), Panama (PN), Milan/Rome (MR) and Toronto/Montreal

(TM). These centers then are the basis for a To/From matrix (Table 1). The diagonal elements (Y_{ii}; i = 1...14) are the number of banks in the world's Top 300 (The Banker) with headquarters in the respective centers. Panama has no bank in the Top 300 so we used the largest bank. The off-diagonal elements (Y_{ij}; $i \neq j$) enumerate the number of banks from one center (center i) that have a presence (representative office, agency, branch, subsidiary or Edge Act subsidiary) in the other center (center j). As before, we treat representative offices, agencies, branches or subsidiaries equally in the sense that the presence of one establishes a sending bank's presence in the center.

In our last paper we alluded to the increasing importance of the People's Republic of China (PRC) and the possibility that Shanghai might return to the primacy over Hong Kong that it enjoyed prior to World War II. To start to address this question, we have expanded our matrix for 2010 to include the composite Beijing/Shanghai (BS) financial center. To assist in comparability, we present all our analyses below without and with this center.

The number of banks in the Top 300 headquartered in our centers peaked in 1980 and has fallen thereafter in terms of our data (Table 2). Increasingly, more of the world's largest banks have their headquarters outside the centers we focus on. This reflects the rise of large banks in such countries as Brazil, Russia, India, and China (the BRICs), and others such as Korea, Malaysia, and Spain. When we include China in our matrix the number of banks headquartered in our centers jumps. However, even when we include Beijing/Shanghai the total remains below that of 1980.

The number of presences in other centers by the banks headquartered in our centers too peaked in 1990. However, this is due to the decline in the number of banks headquartered in our centers. When we include banks headquartered in Beijing or Shanghai, the number of presences abroad rises.

Furthermore, the density of our matrices has risen almost continuously since 1970. Density did fall in the 1990-2000 decade, due in large part to a 50 percent fall in the number of presences in other financial centers by Japanese banks. In our most recent data, density has increased to a new high.

This is due to the surviving banks headquartered in our centers having an increased number of presences in other centers. We do not know whether this is due to expansion, or to some combination of the surviving banks being the banks with the more extensive international networks and gains in the number of presences due to mergers. The ratio of the number of presences in other centers per bank headquartered in one of our centers has continued to rise whether or not we include China. Including China only damps the trend; this will probably change in the future as more of the large banks in China increase their presence abroad.

The percentage of one-way links between centers appears to have peaked in 1990 and 2000, with and without China. The percentage of two-way links peaked in 1990 and by 2010 has fallen to below the level pertaining in 1970. The ratio of actual to potential links also peaked in 1990, has recovered slightly from the level in 2000, and is at about the same level as in 1980. What appears to be happening is a decreasing interpenetration between lower-ranked centers, though banks from those lower-ranked centers still have a presence in higher-ranked centers. Panama is not a source for any other center, though banks from other centers do have a presence there.

Lastly, the 2010 To/From matrix shows relatively little change from the 2000 matrix at the level of individual cells. The sum of the squared cell-by-cell differences between the 1970 and 1980 matrices is 1365. The sum of the squared differences between the 1980 and the 1990 matrices is 613. The sum of the squared differences between the 1990 and the 2000 matrices is 1280. The turbulence in the 1970-80 period derived from expansion. In the 1990-2000 period the turbulence derived from contraction, most of which came from the banks in Tokyo and NY. The sum of squared differences between the 2000 and 2010 matrices is 356, making this, despite the world-wide banking crisis, the most stable decade yet, at least in terms of changes in interpenetration.

As in the decade from 1990 to 2000, much of the change comes from banks headquartered in Tokyo and New York as sources of interpenetration. The FROM Tokyo row of the matrix accounts for 26% of the sum of squared differences and the FROM NY row accounts for 21%. In the case of Tokyo the differences originate in the decline in the number of banks headquartered there from 14 to 10, and an ongoing consolidation of presence abroad. However, for New York the number of headquarters rose from four to six with the post-crisis reclassification of the investment banks Goldman Sachs and Morgan Stanley as commercial banks.

Lastly, we rank centers using the sum of the columns in Table 1, that is, by the number of banks from our centers either headquartered in the center in question or with a presence there if headquartered elsewhere (Table 3). We also measure what we call the centrality of each center, which we calculate by the proportion of centers that have at least one of their banks with representation in the center in question. Centrality takes on a value of 1 (i.e., 13/13 or 14/14 with Beijing/Shanghai) if all other centers have representation in the center in question, and 0 if none do (i.e., 0/13 or 0/14).

We may see that for 2010, London ties with New York for first place when we omit Beijing/Shanghai, and pulls ahead when we include it. Although Hong Kong and Singapore continue to climb in rank, now ranking third and fourth (without Beijing/Shanghai), all four top centers are equally central. None are completely central because Panama's largest bank is no longer Banco Nacional de Panama but rather Banco General, which does not have a presence in any other of our centers. Tokyo remains in fifth place, the same rank as it held in in 2000, and 1970.

When we add in Beijing/Shanghai, it appears in first place, moving all other centers down in rank. Tokyo drops to sixth place. Beijing/Shanghai is also more central than Tokyo. Were we to separate Shanghai and Beijing Tokyo would probably rank fifth, though we would not be surprised if Shanghai alone would rank fifth in 2020 as the number of foreign banks that are establishing themselves in the Shanghai Free Trade Zone, which the PRC established in August 2013, continues to climb. For now, however, approximately three-fifths of the foreign banks in one or the other city are in Beijing.

Paris regained some centrality, and Frankfurt/Hamburg regained both a rank and some centrality, so that both are now more central than they were in 1970. Among the lowest-ranked centers, Toronto/Montreal has gained a rank, but has continued to lose centrality to the point where it is no more central than Panama, our lowest ranked and otherwise least central center.

It is a little surprising that Panama has not gained any ground. Since the terror attack on New York in 2001, the United States has increased its scrutiny of visitors to such a degree that executives from Latin America are facing difficulties in getting visas to the U.S. Consequently, some firms that had situated their Latin American regional headquarters in Miami are now moving them to Panama.

Seven centers saw declines in the number of presences of foreign banks, and five saw increases. London, New York, Tokyo, Hong Kong, Singapore, Zurich/Geneva, and Brussels saw declines, with New York at -17%, seeing the largest. Frankfurt/Hamburg, Paris, Milan/Rome, Toronto/Montreal, and Amsterdam saw an increase in the number of presences, with Paris being the largest gainer both absolutely (plus nine presences to 29), and relatively (+45%). The variance across the centers has shrunk in the decade, with a large source of that shrinkage being the behavior of the Japanese banks. As the number of Japanese banks in our data fell from 14 to 10, the survivors had fewer presences in New York and Singapore, and more presences in Paris and Milan/Rome.

III. The Determinants of Interpenetration

We continue to use the gravity model of international trade as the basis for our estimations. Gravity has long been one of the most successful empirical models in economics (Anderson 2011). It is much used in modeling goods trade (Campbell 2010) and is coming increasingly to be used to model services trade as well (Okawa and van Wincoop 2012). There is also now some literature that uses gravity models, including frictions, to cross-border financial flows. Recent examples include Eichengreen and Luengnaruemitchai (2008), and Park and Shin (2013).

Our models are also consistent with micro-economic approaches to foreign direct investment in banking. There the underlying model is a profit function with banks maintaining themselves in foreign locations when they expect it will be profitable to do so. Lastly, our models incorporate considerations of rivalry between and collusion among firms as factors in the foreign direct investment decision.

Statistical techniques and the dependent variable

We again use both ordinary least squares (OLS) and non-linear weighted least squares (NLWLS). For the OLS regressions the dependent variable is the two-parameter Box-Cox (1964) transform of Y_{ij} with $\lambda_1 = 0$ and $\lambda_2 = 0.5$. Using two techniques (OLS and NLWLS) with different assumptions and estimation methods enables us to check that our results are robust to our choice of method. For fuller descriptions of the models, variables and estimation techniques we refer the reader to the earlier articles.

Centers as destinations

The variables $\underline{TO}$ and CGNP operationalize the notion of the attractiveness of the destination centers, and we use them as alternatives. $\underline{TO}_j = \underline{Y}_{.j} - \underline{Y}_{ij}$; the variable measures the number of banks from centers *other than i* that are in *j*. In the estimation of Model III, the elements of $\underline{TO}$ are the fitted values based on a first pass regression of Y_{ij} on the exogenous variables. We used this two-stage approach to reduce any simultaneity problems. We calculate $CGNP_i$, the GNP of center *i*, by multiplying the population of the city or city-pair by the national GNP per capita in US dollars. Only four of our centers (in population order, Tokyo, Shanghai, New York, and Beijing) rank among the ten most populous cities in the world (Palmberg 2013), suggesting that the attractiveness of the center as a destination rests on more than its size.

Centers as sources

FROM represents the capacity of the banks headquartered in a source center to establish offices abroad. $FROM_i = Y_{ii}$; that is, we draw the elements of the variable from the main diagonal of our To/From matrix. Given our measures, a center cannot establish more offices in another center than the source center has banks.

Obstacles or costs, and strategic considerations

The major potential obstacle in the models is the distance between centers. We measure this by $DIST_{ij}$, the airline distance between the centers. Airline distance correlates, arguably, with interconnectedness between cities, and cultural distance, both of which matter to FDI (Bel and Fageda 2008; Goldberg *et al*., 2005). Furthermore, physical distance may have an indirect effect on interconnectedness in banking through its (negative) effect on trade volumes and hence on the demand for trade financing (Heinkel and Levi 1992).

JPN is a (0,1) dummy variable for those cases where Tokyo is the source center. Prior to 1982 the Ministry of Finance discouraged or at least slowed the international expansion of Japan's banks. After 1982, the Ministry of Finance progressively reduced its restrictions. Since the collapse of the bubble economy at the end of 1989, Japanese banks have been consolidating and curtailing their international activities.

The first variable representing strategic behavior is $\underline{Y}_{ji}$, the reverse of the flow to $\underline{Y}_{ij}$. We use the variable to attempt to capture whether mutual forbearance outweighs potential retaliation, or vice-versa. In the estimations the elements of $\underline{Y}_{ji}$ are fitted values from a first pass regression of Y_{ij} on the exogenous variables. That is, the variable captures whether the number of banks in Center *i* from Center *j* is a function of the number of banks from *j* in *i*.

The second variable for strategic behavior is a nationality dummy for Swiss banks. SWISS is a (0,1) dummy variable that takes on a value of 1 when Y_{ij} represents a flow from Zurich or Geneva to any one of the following five centers: Paris, Brussels, Amsterdam, Frankfurt/Hamburg, or Milan/Rome. Swiss banks have historically had few foreign branches and subsidiaries in Europe despite the extent of their international involvement overall.

The third variable representing strategic behavior is a (0,1) dummy for intra-European pairs of centers. EURO takes on a value of 1 when Y_{ij} represents a flow between any two of the following five centers: Paris, Brussels, Amsterdam, Frankfurt/Hamburg, or Milan/Rome. The variable reflects two opposing influences, liberalization of cross-border establishment due to the European Union on the one hand, and cross-border alliances to limit competition on the other.

The last of our variables for strategic behavior is FHZG. This is a (0,1) dummy variable that takes on a value of 1 whenever Y_{ij} represents a flow between Zurich/Geneva on the one hand and Frankfurt/Hamburg on the other. The Swiss banks did not join the European banking clubs, but there is anecdotal evidence that they at one time engaged in mutual forbearance pacts with the major German banks. We do not include the variable in the NLWLS regressions because including it frequently prevented convergence in the estimating algorithms in the earlier studies.

IV. Gravity Model Estimation Results

We begin by replicating our earlier analyses, i.e., without Beijing/Shanghai. The OLS and NLWLS results for Model I (the simple gravity model) for 1970, 1980, 1990, 2000, and 2010 appear in Table 4. The coefficients on TO and FROM are quite consistent across the years and within an estimation method, and of a similar magnitude to each other. The symmetry between the coefficients of the two variables is what one would expect as the symmetry assumption is inherent in gravity models (Theil 1979). The coefficient of the DISTance variable is consistent between 2000 and 2010, though not with earlier decades. The earlier decades were an era of enthusiastic globalization among banks; the last two decades may be reflecting a victory for theory as banks trimmed over-enthusiastic expansion. Clare et al., (2013) found that the likelihood of a bank continuing to maintain a presence in London was negatively related to the distance of the home-country from London.

Models II and III augment Model I with the explanatory variables we discussed in Section IV. The difference between the models is that Model II uses CGNP as the variable representing the attractiveness of a center and Model III uses TO.

In Models II and III for the OLS (Table 4) and the NLWLS (Table 5) estimations, the coefficients for CGNP are the same for 1990, 2000, and 2010. Both methods show the magnitude of the coefficient of TO clearly having peaked in 1990 and declined since, with the magnitude in 2010 being about at the same level as in 1970. One may recall from Table 2 that 1990 saw the peak in our data in the number of presences abroad.

Across models and methods, the coefficient on FROM appears to have peaked in 2000. Compared with the results for Model I, there is also noticeably less symmetry between the coefficients on TO and FROM. As in Model I, the coefficient of DIST in 2010 is roughly the same magnitude as in 2000, and negative.

Next we come to the variables that represent strategic factors. The coefficient for JPN, the dummy for Japanese origin, shows that before the relaxation in 1982 of what Engwall (1992) has called emigration restrictions, Japanese banks opened fewer offices abroad than what one would otherwise expect. By 1990, the year in which the “bubble economy” began to burst, the Japanese banks had disproportionately more presences abroad than banks from other origins. In 2000 and 2010 the overseas presence of Japanese banks came back in line with expectations.

The coefficients of $\underline{Y}_{ji}$ (the backflow variable), show a dramatic change in behavior between 1970 and 1980 on the one hand, and 1990, 2000, and 2010 on the other. The coefficients for 1970 and 1980 were generally positive and large across both estimation methods. Thereafter, the coefficients are generally small, whether positive or negative. This suggests that the variable may be capturing history rather than strategic behavior. In 1970 and 1980 London and New York were both major destinations and major sources, with a number of other centers being much less important as either. By 1990, centers such as Singapore and Hong Kong had risen in importance as destinations rather than as sources. Furthermore, after 1990 Tokyo's importance as a source had declined, as had its importance as a destination.

The coefficients for SWISS origin are negative across time and methods. The results are consistent with the Swiss reluctance to establish offices in continental Europe that we noted in the earlier articles. The magnitude of the effect of SWISS origin now appears closer to zero than in 1970. The behavior of the Swiss banks may no longer be standing out as dramatically now that other banks elsewhere have scaled back their presences abroad.

The coefficients for EURO, the variable for the links between the (non-Swiss) continental European banks remain negative, but the absolute value of the magnitude is becoming quite small. Some implicit mutual forbearance is probably still occurring, but decreasingly so.

The coefficients of FHZG, the variable for mutual forbearance between Swiss and German banks, has returned to being negative but the absolute magnitude in 2010 is the smallest for our series of years. As our earlier papers forecast, the détente of earlier years, if any, has broken down.

When we extend the analysis for 2010 to Beijing/Shanghai (Table 7), little changes. The coefficient of FROM gets dramatically smaller, especially in comparison with the results for 2000 and 2010 for the models without Beijing/Shanghai, perhaps because although 13 banks have their headquarters in these cities, most of them have no or few presences in our other financial centers. More interestingly, the coefficient on $\underline{Y}_{ji}$ becomes larger, doubling or almost tripling in magnitude. Banks from Beijing and Shanghai are going to centers from which foreign banks are coming to Beijing or Shanghai.

VI. Discursive Summary

The behavior of international banks continues to evolve, with consequences for financial centers. Our update of Choi *et al*., (1986, 1996, and 2003) has enabled us to support some of the earlier findings and to identify some changes both in the evolution of financial centers and in the behavior of the international banks. Our results parallel, where our concerns overlap, with the results in Buch *et al*., (2014). They found a decline in the number of foreign subsidiaries of German banks in response to the recent financial crisis, but that this decline began well in advance of the crisis and that the crisis has not accelerated any the retrenchment.

First, in our data aggregate interconnectedness has at most decreased slightly between 2000 and 2010 although we had 29% fewer parent banks in our population in 2010 than in 2000. The decline in the number of banks is a function of mergers among banks and the consolidation of their networks, and the concomitant rise in importance of banks with headquarters outside the centers we follow. Even if the number of foreign banks represented in each center has fallen, the extent of each bank's network has generally increased.

Second, between 2000 and 2010, the tiering of centers that had developed earlier has become more ambiguous. London has regained the first place, sharing it with New York. London benefits from its location near Europe, and between the Far East and North America, a location that is particularly useful for currency trading, which is important to banks and is a market that London dominates (Pooler 2014). If the United Kingdom were to leave the European Union this would probably weaken London's position both vis-à-vis New York and the European centers. New York is arguably the center of the overall world financial system because of the role of the U.S dollar and the Federal Reserve (Pooler 2014). The United States' heavy hand in regulation, excessive litigation, and post-9/11 immigration and visa rules are problematic for New York as a location for financial service business (Pooler 2014. Although Frankfurt/Hamburg and Paris have regained some rank or centrality, the European centers in general form a third tier.

Still, as Fratianni (2009) and Spufford (2006) point out, although great financial centers are subject to decline and eventual eclipse, they may well persist in importance for some time after industry and trade have moved elsewhere. Spufford (2006, pp.173-4) makes the point that one factor in the durability of centers is the increasing difficulty of moving the many people that make the center, especially once they have invested in homes there.

Despite the growing importance of Asia, there is no sign yet that one center will emerge there as the dominant center for that region. Asia is now split between four centers, in order: Hong Kong, Singapore, Beijing/Shanghai, and Tokyo.

The emergence of China as the world's second largest economy (on a Purchasing Power Parity basis) has resulted in our combined Beijing/Shanghai center assuming the first place among our centers. However this is a little deceptive in that if we were to split the combined center the individual ranks would be less. It is not clear which city will come to dominate the pair. Beijing is home to ten banks, and Shanghai is home to three, but Shanghai is the commercial capital of the PRC, and Beijing is the political.

In the absence of a primate city such as London, Paris, or Tokyo, the commercial capital tends to win out over the political capital, see for instance New York vs. Washington, DC, Toronto vs. Ottawa, Sydney vs. Canberra, and so on. All of these cases though are ones where the banks are not government-owned, and where the government is not as dominant as in the PRC.

In an early article Zhao *et al*. (2004), look at the location of the regional headquarters of multinational companies (MNCs), and argue that "Beijing, as the prime source of policy information, is more likely than other Chinese cities to be the national pre-eminent financial center when the Chinese financial markets become more open to foreign firms in the near future." By contrast, Du *et al*., (2013), a later paper, examine 23 Chinese cities and argue from their results that although Shanghai is not yet an international financial center, it has the greatest chance of becoming a national financial centre in China. Beijing, because it is a major source of financial policy and regulation and home to supervisory institutions, state-owned banks, and securities and insurance companies will remain important in China's financial development. As of 2010, in our data there are approximately one-and-a-half times as many foreign banks in Beijing as in Shanghai. The Du *et al*., (2013) paper does note that some institutions are migrating from Beijing to Shanghai.

Still, this means that the three-way competition between Hong Kong, Beijing, and Shanghai may persist for some time. Leung and Unteroberdoerster (2008) make a case for Hong Kong having a first-mover advantage but that it will need to benefit from links with China and be able to transition into a truly international center. There is another consideration as well.

Murphy (2005) points out the importance of jurisdictional competition and its effect on regulatory advantage. Though he is writing more generally, the point is particularly germane to the rivalry between Hong Kong on the one hand and Beijing and Shanghai on the other in the context of the "One country, two systems" policy of the PRC. Hong Kong has an advantage in its use of British common law, and more importantly, the rule of law, but the durability of that advantage is not certain.

There are two possibilities. Political considerations may erode the rule of law in Hong Kong, pulling it back to the level of Shanghai or Beijing. Alternatively, China may democratize its political system, liberalize its economy, and internationalize its currency. If it does so, Shanghai will improve its competitive position (Du *et al*., 2013).

Third, the gravity model continues to work well. The number of banks in a center remains a major indicator of the attractiveness of a center. As the economic size of center works equally well as an explanatory variable, the number of banks in a center reflects the size of the market facing each bank independently of the presence or absence of other banks. Distance continues, as in 2000, to be a major obstacle to interpenetration. Buch *et al*., (2014) too found that financial frictions, proxied for by gravity-type variables such as distance, matter for international banking and that the frictions' impact remained relatively stable throughout the recent crisis.

The gravity models show that Japanese banks have gone from being under-represented abroad in 1970 and 1980 due to Japanese government restrictions on their international expansion to pattern of presence in line with those of banks from elsewhere, after having been over-represented in 1990. Some explicit or implicit agreements between banks from different countries not to compete in each other's markets have continued to wane though intra-European interpenetration remains a little low. Lastly, the primary effect of introducing Beijing/Shanghai as a center has been to increase the importance of our interpenetration measure as banks from Beijing and Shanghai are going to centers from which banks are coming to Beijing and Shanghai.

The story of financial centers is a story of cities, but cities are embedded in countries and regions. Centers emerge as the result of a process of spontaneous order and urban economics (Palmberg 2013). Florida (2012) has produced a ranking of the most powerful cities in the world. In order, these are New York, London, Tokyo, Hong Kong and Paris, Chicago, Singapore, Shanghai, Los Angeles, and Zurich. Not surprisingly, this list correlates well with our centers, and their ranking. As Gulamhussen (2007) points out, when banks establish large operations in centers they do so not to service domestic customers or get a foothold, but rather to create hubs. Our results, especially after the inclusion of Beijing and Shanghai among our centers, point to the importance of the national context to the fortunes of a center. Only Singapore is a true city-state. In all the other cases, city exists in a national system in which national politics exert a strong influence on the attractiveness of the city as a hub through their role in national economic performance, regional and international relations between countries, and the degree to which they foster the city as a central marketplace for financial transactions.

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Table 1 — Head-offices of major banks and their representation in other centers
2010

To: / From:	LO	NY	TO	HK	SI	FH	PA	ZG	MR	LS	TM	BR	AM	PN	Σ	BS	Σ
LO	**4**	4	4	4	4	4	4	4	4	2	3	3	2	2	48	4	52
NY	5	**6**	5	5	5	5	5	5	5	5	5	3	5	2	66	5	71
TO	8	7	**10**	8	6	3	5	4	4	4	4	3	4	0	70	8	78
HK	1	1	0	**1**	1	0	0	0	0	1	0	0	0	0	5	1	6
SI	3	2	3	3	**3**	0	1	0	0	3	0	0	0	0	18	3	21
FH	4	5	3	4	4	**7**	3	3	3	1	0	2	2	1	42	4	46
PA	4	4	3	3	3	4	**4**	4	4	1	3	4	2	1	44	4	48
ZG	3	2	2	3	4	3	3	**4**	2	2	2	1	2	3	36	4	40
MR	2	3	2	2	2	2	2	1	**3**	1	0	1	1	0	22	2	24
LS	1	1	1	1	1	1	1	0	1	**1**	0	0	0	0	9	0	9
TM	6	6	3	6	4	1	1	1	0	4	**6**	0	0	1	39	5	44
BR	2	2	0	1	1	1	3	1	1	0	1	**3**	1	0	17	2	19
AM	1	1	1	1	1	1	1	1	1	1	0	1	**1**	0	12	1	13
PN	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	1	0	1
Σ	44	44	37	42	39	32	33	28	28	26	24	21	20	11	429		
Rank	1	1	5	3	4	7	6	8	8	10	11	12	13	14			
BS	5	4	5	5	5	4	1	1	1	1	1	0	0	1		**13**	47
Σ	49	48	42	47	44	36	34	29	29	27	25	21	20	12		56	519
Rank	2	3	6	4	5	7	8	9	9	11	12	13	14	15		1	

Source: *Bankers Almanac* (2010)

Table 2 — Number of head offices, presences per bank, and links between centers, 1970, 1980, 1990, 2000, and 2010

	Number of presences				Percentage of links		
	Main diagonal	Off-diagonal	Density[1] (%)	Ratio: Off/Main	One-way[2]	Two-way[3]	Actual to potential[4]
1970	102	289	1.6	1.8	78	59	60
1980	105	549	2.9	4.2	91	64	77
1990	100	591	3.2	4.9	93	65	79
2000	76	381	2.8	5.0	93	54	74
2010	54	375	3.8	6.9	90	52	76
2010*	67	439	3.7	6.6	89	49	75

* The data in this row is with respect to the inclusion of Beijing/Shanghai.

1)The density is the ratio of the number of off-diagonal presences to the product of 182 or 210 (the number of off-diagonal cells, with the 210 reflecting the inclusion of Beijing/Shanghai) and the number of banks (i.e., the sum of the main diagonal). It can range in value from 0 (no bank has any off-diagonal presence) to 1 (every bank has a presence in every center).

2) One-way links is the percentage of off-diagonal cells where at least in one direction there is a non-zero cell. That is, at least one bank from center *i* has a presence in center *j* OR at least one bank from center *j* has a presence in *i*.

3) Two-way links is the percentage of off-diagonal cells in which there is a reciprocal presence. That is, at least one bank from center *i* has a presence in *j* AND at least one bank from *j* has a presence in *i*.

4) Actual to potential is the proportion of non-zero off-diagonal cells.

Source: Choi *et al.*, (1986, 1996, and 2003), and Table 1.

Table 3 — The ranking and centrality of the 14 or 15 centers

Center	1970		1980		1990		2000		2010			
	Rank	Cent.	Rank	Cent.	Rank	Cent.	Rank	Cent.	Rank	Cent.	Rank	Cent.
Beijing/Shanghai											1	0.86
London (LO)	1	0.77	3	0.92	1	0.92	2	0.92	1	0.92	2	0.93
New York (NY)	2	0.85	1	1.00	2	1.00	1	1.00	1	0.92	3	0.93
Hong Kong (HK)	8	0.69	5	0.92	4	0.92	3	0.85	3	0.92	4	0.93
Singapore (SI)	11	0.69	6	0.92	5	0.92	4	0.85	4	0.92	5	0.93
Tokyo (TO)	3	0.69	2	0.92	3	0.92	5	0.77	5	0.77	6	0.79
Paris (PA)	3	0.69	7	0.77	7	0.77	8	0.69	6	0.85	8	0.86
Frankfurt/Hamburg (FH)	4	0.69	4	0.69	6	0.69	7	0.62	7	0.77	7	0.79
Zurich/Geneva (ZG)	11	0.54	12	0.62	8	0.77	6	0.62	8	0.69	9	0.71
Milan/Rome (MR)	6	0.54	9	0.69	9	0.77	10	0.69	8	0.69	9	0.71
Los Angeles/San Francisco (LS)	7	0.69	8	0.77	10	0.77	8	0.92	10	0.85	11	0.86
Toronto/ Montreal (TM)	13	0.31	10	0.69	11	0.69	12	0.54	11	0.46	12	0.50
Brussels (BR)	10	0.54	11	0.69	12	0.62	11	0.62	12	0.62	13	0.57
Amsterdam (AM)	9	0.54	13	0.62	13	0.69	13	0.62	13	0.62	14	0.57
Panama (PN)	14	0.23	14	0.62	14	0.62	14	0.62	14	0.46	15	0.50

Source: Choi *et al.*, (1986, 1996, and 2003), and Table 1.
Note: Cent. is Centrality, the proportion of centers that have at least one of their banks with representation in the center in question.

Table 4 — OLS and NLWLS estimation of Model I

	OLS					NLWLS				
	1970	1980	1990	2000	2010	1970	1980	1990	2000	2010
Constant	-2.60	-4.28	-3.60	-1.78	-1.55	-4.10	-4.73	-4.87	-3.48	-2.73
	(-5.21)*	(-8.68)*	(-7.17)*	(-3.68)*	(-3.22)*	(-6.69)*	(-9.49)*	(-9.77)*	(-5.88)*	(-5.16)*
ln TO	0.51	0.76	0.77	0.74	0.73	0.91	0.88	0.89	1.05	0.87
	(6.28)*	(7.86)*	(7.69)*	(6.65)*	(6.24)*	(9.63)*	(14.7)*	(8.62)*	(6.93)*	(6.26)*
ln FROM	0.57	0.76	0.85	0.88	0.80	0.91	0.99	1.14	1.15	1.08
	(10.5)*	(5.06)*	(16.3)*	(11.8)*	(13.85)*	(7.80)*	(9.61)*	(17.9)*	(11.2)*	(14.30)*
ln DIST	0.05	014	0.02	-0.17	-0.13	-0.01	0.05	0.05	-0.16	-0.11
	1.15	(3.41)*	(0.69)	(-4.80)*	(-4.02)*	(-0.29)	(1.41)	(1.65)*	(-4.23)*	(-3.46)*
R^2	0.43	0.60	0.63	0.53	0.57					
F	45.4	67.1	99.2	66.7	78.3					
SER	0.71	0.64	0.61	0.61	0.58					
LR Statistic						684	726	616	273	197

Note: The number of observations is 182; t-statistics are in parentheses; R^2 is the coefficient of determination; F is the F-statistic; SER is the standard error of the regression; * indicates significance at the 5% level on a one-tailed test. The LR statistic is -2ln(likelihood ratio) and is distributed as chi-square with 179 degrees of freedom.

Table 5 — OLS estimation of Models II and III

	Model II					Model III				
	1970	1980	1990	2000	2010	1970	1980	1990	2000	2010
Constant	-0.11	-1.30	-2.75	-2.33	-2.28	-1.42	-3.20	-3.35	-1.01	-0.52
	(-0.19)	(-2.54)*	(-3.69)*	(-2.97)*	(-2.69)*	(-1.10)	(-3.94)*	(-4.73)*	(-1.31)*	(-0.76)
ln TO						0.38	0.62	0.97	0.57	0.42
						(0.93)	(3.36)*	(6.49)*	(2.88)*	(2.48)*
ln CGNP	-0.12	0.12	0.19	0.19	0.18					
	(-1.02)	(2.28)*	(5.11)*	(4.87)*	(4.22)*					
ln FROM	0.40	0.76	0.75	0.84	0.72	0.50	0.78	0.77	0.88	0.76
	(5.43)*	(12.8)*	(12.1)*	(9.23)*	(10.86)*	(5.84)*	(13.3)*	(13.0)*	(9.05)*	(10.70)*
ln DIST	-0.01	0.06	-0.10	-0.22	-0.16	-0.04	0.06	-0.07	-0.18	-0.13
	(-0.15)	(0.96)	(-2.05)*	(-4.21)*	(-3.01)*	(-1.64)	(1.09)	(-1.51)	(-3.34)*	(-2.40)*
JPN	-0.22	-0.38	0.49	-0.02	0.11	-0.15	-0.31	0.61	-0.11	0.07
	(-0.95)	(-1.74)*	(2.35)*	(-0.09)	(0.54)	(-0.65)	(-1.44)	(3.04)*	(-0.48)	(0.33)
ln Y_{ji}	0.74	0.22	-0.06	-0.08	0.07	-0.29	0.18	0.02	-0.09	0.10
	(3.12)*	(2.59)*	(-0.75)	(-0.82)	(0.89)	(-1.07)	(2.34)*	(0.36)	(-0.77)	(1.06)
SWISS	-0.36	-0.72	-0.80	-0.63	-0.22	-0.27	-0.65	-0.66	-0.60	-0.22
	(-0.96)	(-2.18)*	(-2.56)*	(-1.98)*	(-0.71)	(-0.72)	(-2.00)*	(-2.17)*	(-1.82)*	(-0.69)
EURO	-0.21	-0.51	-0.45	-0.18	-0.13	-0.35	-0.46	-0.25	-0.19	-0.14
	(-0.92)	(-2.60)*	(-2.46)*	(-1.96)*	(-0.67)	(-1.46)	(-2.34)*	(-1.42)	(-0.99)	(-0.68)
FHZG	-0.24	-1.11	-0.39	0.35	-0.04	-0.83	-1.17	-0.55	0.24	-0.10
	(-0.39)	(-2.19)*	(-0.81)	(0.72)	(-0.08)	(-1.27)	(-2.35)*	(-1.19)	(0.47)	(-0.21)
R^2	0.44	0.60	0.62	0.50	0.55	0.44	0.61	0.65	0.46	0.52
F	16.7	32.3	35.6	22.0	26.5	16.7	34.2	40.2	18.5	23.6
SER	0.72	0.65	0.63	0.64	0.60	0.72	0.64	0.60	0.66	0.63

Note: The number of observations is 182; the t-statistics are in parentheses; R^2 is the coefficient of determination; F is the F-statistic; SER is the standard error of the regression; * indicates significance at the 5% level on a one-tailed test; underlining (__) of a variable's name indicates a fitted value from a first-pass regression.

Table 6 — NLWLS estimation of Models II and III

	Model II					Model III				
	1970	1980	1990	2000	2010	1970	1980	1990	2000	2010
Constant	-1.79	-1.05	-3.46	-3.34	-3.24	-1.62	-3.30	-4.80	-2.12	-1.56
	(-2.29)*	(-2.25)*	(-4.92)*	(-3.83)*	(-3.13)*	(-2.01)*	(-4.12)*	(-6.95)*	(-2.44)*	(-1.93)*
*ln*TO						0.55	0.70	1.08	0.53	0.53
						(1.05)	(3.83)*	(7.39)*	(2.22)*	(2.27)*
ln CGNP	-0.03	0.14	0.18	0.18	0.19					
	(-0.20)	(2.77)*	(4.93)*	(4.02)*	(3.46)*					
ln FROM	0.70	0.83	0.93	1.14	1.05	0.79	0.86	0.98	1.18	1.09
	(4.81)*	(9.91)*	(11.2)*	(7.88)*	(9.56)*	(4.85)*	(10.6)*	(12.5)*	(7.88)*	(9.73)*
ln DIST	0.04	-0.01	-0.06	-0.16	-0.14	-0.02	0.00	0.00	-0.11	-0.11
	(0.46)	(-0.24)	(-1.35)	(-2.93)*	(-2.46)*	(-0.17)	(0.06)	(0.01)	(-2.05)*	(-1.95)*
JPN	-0.35	-0.28	0.29	-0.16	-0.11	-0.24	-0.15	0.40	-0.26	-0.14
	(-1.36)	(-1.67)*	(2.10)*	(-0.78)	(-0.61)	(-0.91)	(-0.96)	(3.12)*	(-1.21)	(-0.81)
ln Y_{ji}	1.26	0.24	-0.03	0.07	0.10	0.91	0.15	0.06	0.05	0.11
	(4.02)*	(3.20)*	(-0.36)	(0.64)	(1.00)	(2.47)*	(1.94)*	(1.15)	(0.37)	(0.84)
SWISS	-0.72	-1.24	-1.18	-0.17	-0.28	-0.72	-1.17	-0.98	-0.17	-0.25
	(-0.56)	(-2.05)*	(-2.03)*	(-0.94)	(-0.83)	(-0.68)	(-1.99)*	(-1.80)*	(-0.93)	(-1.18)
EURO	0.31	-0.34	-0.43	-0.50	-0.23	0.16	-0.28	-0.13	-0.47	-0.29
	(0.94)	(-1.81)*	(-2.54)*	(-1.36)*	(-1.13)	(0.46)	(-1.54)	(-0.78)	(-1.25)	(-0.80)
LR Statistic	679	774	637	286	190	677	766	612	292	183

Note: The number of observations is 182; asymptotic t-statistics are in parentheses; * indicates significance at the 5% level on a one-tailed test; underlining (__) of a variable's name indicates a fitted value from a first-pass regression. The LR statistic is -2ln(likelihood ratio) and is distributed as Chi-square with 175 degrees of freedom.

Table 7: OLS & NLWLS re- estimation of Models I, II and III with Beijing/Shanghai						
	Model I		**Model II**		**Model III**	
	OLS	**NLWLS**	**OLS**	**NLWLS**	**OLS**	**NLWLS**
Constant	-1.40	-2.29	-1.71	-2.05	-0.28	-0.95
	(-3.06)*	(-4.41)*	(-2.01)*	(-2.14)*	(-0.41)	(-1.24)
ln $\underline{\underline{TO}}$	0.78	0.89			0.37	0.44
	(7.17)*	(6.71)*			(2.18)*	(1.93)*
ln CGNP			0.14	0.13		
			(3.50)*	(2.72)*		
ln FROM	0.68	0.82	0.59	0.72	0.61	0.74
	(13.25)*	(13.11)*	(10.37)*	(9.74)*	(10.30)*	(9.94)*
ln DIST	-0.17	-0.14	-0.15	-0.12	-0.14	-0.12
	(-4.97)*	(-4.18)*	(-2.83)*	(-2.39)*	(-2.59)*	(-2.31)*
JPN			0.27	0.23	0.27	0.23
			(1.40)*	(1.54)*	(1.36)*	(1.54)*
ln $\underline{\underline{Y}}_{ji}$			0.24	0.29	0.23	0.26
			(2.81)*	(3.02)*	(2.42)*	(2.37)*
SWISS			-0.20	-0.26	-0.21	-0.29
			(-0.61)	(-0.79)	(-0.63)	(-0.87)
EURO			-0.12	-0.18	-0.14	-0.21
			(-0.59)	(-0.88)	(-0.67)	(-1.03)
FHZG			-0.04		-0.09	
			(-0.08)		(-0.19)	
R^2	0.52		0.50		0.49	
F	76.80		25.50		23.70	
SER	0.61		0.63		0.65	
LR Statistic		197		191		187

Note: The number of observations is 210; the t-statistics are in parentheses; R^2 is the coefficient of determination; F is the F-statistic; SER is the standard error of the regression; * indicates significance at the 5% level on a one-tailed test; underlining (__) of a variable's name indicates a fitted value from a first-pass regression; Model I uses lnTO instead of ln$\underline{TO}$; the LR statistic is distributed as chi-square with 203 degrees of freedom.