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THE GEOGRAPHY OF STOCK EXCHANGES IN IMPERIAL GERMANY

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The geography of stock exchanges in Imperial Germany*

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The geography of stock exchanges in Imperial Germany

Abstract:

23 Stock Exchanges were in operation in Germany in 1913. We provide new data about the number of listed firms, their market value, and the number of IPOs between 1897 and 1913 for all exchanges. We assess reasons why a firm opts to be listed at a certain exchange. Large firms tend to be listed and tend to go public at the Berlin Stock Exchange, while the regional stock exchanges were important hosts for small and medium-sized firms. Borders and distance affect listing decisions, suggesting that a patriotic home bias and asymmetric information between issuer and investors affected listing decisions.

JEL-Classification:

N 23, G 23, R 12

Keywords:

Financial development; Regional stock exchanges; IPOs; Germany; Economic history

I. INTRODUCTION

A few days before the outbreak of the Great War, all 23 German stock exchanges were closed. Why do we observe so many stock exchanges within one country? In principle, bundling stock trading in one place increases liquidity and thereby prices (Ahmihud and Mendelssohn, 1986). Thus, issuers and investors have an incentive to concentrate activities in one place. This did not happen in Germany. In this article, we describe the geography of stock markets in Germany and explore various theories explaining the existence of multiple stock exchanges.

After the political and monetary unification of Germany during the 1870s, one would expect geography to become less relevant for the allocation of capital inside the new Reich (Holtfrerich, 1993). In general, the German Empire was a relatively homogenous area, with similar institutions and a well-developed capital market. Moreover, the major German stock market, the Berlin Stock Exchange, was already closely integrated with international stock markets during the 1870s (Baltzer, 2006). In addition, the Reichsbank, the German central bank which has been established in 1876, operated several hundred branches all over Germany and some of the larger universal banks, e.g. Deutsche Bank and Dresdner Bank, operated branches in the largest cities (Riesser, 1911). Furthermore, price differentials for identical stocks traded at different exchanges was close to zero already before World War I, indicating an integrated national market (Weigt, 2005: 199). If share prices are identical at all stock exchanges, it is difficult to understand why not all issuers and investors use the same stock exchange.

In general, several motives for listing decisions of firms exist (Pagano et al., 2001; 2002: 2654). Raising new capital for the firm or improving the liquidity for existing shareholders is easier in large and liquid stock markets. In turn, liquidity is higher if transaction costs are low and trading volume high. In addition, financial theory provides three kinds of arguments for spatially fragmented financial markets: regulatory arbitrage, asymmetric information due to spatial distance, and a home bias of issuers or investors. Turning first to costs and regulation, Shleifer and Wolfenzon (2002), Huddart et al. (1999), and Foucault and Parlour (2004) theoretically demonstrate that the quality of corporate governance and disclosure, the costs of listing, and the trading costs on the secondary market affect the listing decision. Firms tend to be listed at stock exchanges with relatively high legal standards protecting outside investors. However, the legal rules underpinning joint-stock companies and stock exchanges were identical all over Germany from 1897 onwards and regulatory arbitrage should not be a major force supporting fragmented financial markets (Baltzer, 2013). With respect to trading and listing costs it is an established fact that high expected trading costs induces investors to demand higher rates of return, i.e., high trading costs depress the current market price – and thus the issuing price – of securities (Amihud and Mendelson, 1986). Consequently, issuers should have a preference for listing on markets with low transaction costs. Yet, the stock exchange operator maximizes his income from transaction and listing

fees and he may charge high listing fees if the expected transaction volume of a share is low. Indeed, Foucault and Parlour (2004) show, first, that companies listed on exchanges with relatively high trading costs have a relatively low market valuation. Second, they demonstrate that listing fees are lower on such stock exchanges since the stock exchange operator mainly generates his income from transaction fees. Consequently, stock exchanges with high trading costs and low listing fees should attract relatively small issues with low liquidity needs, whereas other stock exchanges should attract large issues with high liquidity needs.[1]

The existence of a home bias for international (French and Poterba, 1991) and within-country portfolio allocation (Coval and Moskowitz, 1999) is a well established fact: Investors prefer shares from their home country and home region. Thus, listing shares at multiple stock exchanges may attract additional investors. In particular, Coval and Moskowitz (1999) show in a seminal paper that investors tend to buy shares of firms located in geographic proximity to the investor. More specifically, geographic distance explains about one-third of the border effect detected in studies of an international home bias. In addition, Baltzer et al. (2013) demonstrate that geographic proximity is also important for international portfolio allocation. In particular, investors located close to an international border invest relatively strongly in firms located just on the other side of the border. Thus both, geographic distance and state borders should be considered to explore home biases. Portes and Rey (2001, 2005) demonstrate too that geographic distance negatively affected cross-border equity flows during the 1990s. They also provide an explanation for this finding. In particular, they show that the effect of distance becomes smaller once they control for indicators of information flows, e.g. international phone calls. Thus, geographic distance is a proxy for asymmetric information between issuer and investor. From the investors' point of view, buying shares of local firms may increase returns. For example, Coval and Moskowitz (2001) show that U.S. mutual funds with a local investment bias earn higher returns than funds without such a bias. Moreover, Hau (2001) demonstrates that German-speaking traders earn higher returns than non-German-speaking traders on the German stock exchange. Thus, having access to and understanding of local information may pay out for investors. Consequently, asymmetric information between local and non-local equity investors can be put forward as an explanation of the home bias in international capital allocation.

Another explanation of the tyranny of distance has been put forward by Klagge and Martin (2005: 414), who compare the - still existing - decentralised German system of stock exchanges and the centralised system in the UK. They argue that regionally decentralised systems are more effective in matching demand and supply for small firms. This would be caused by a home bias of local investors, who are

[1] Indeed, Corwin and Harris (2001) empirically show that listing fees and trading costs affect listing decision: larger firms are more likely to list on the NYSE, whereas smaller firms tend to be listed on the Nasdaq, a market with relatively high trading and low listing cost.

interested in their region's firms. Furthermore, this home bias keeps capital within regions, as local investors rather invest in their regional firms instead of investing in a central market. They also argue that regional exchanges may increase the efficiency of allocation of investment between the centre and the periphery. Regional markets could fulfil an information and network function between local firms and national markets by collecting, evaluating and concentrating information about local firms and providing them to potential national investors. This argument goes into the direction of an infant industry argument. Local markets may help small local firms to attract capital and grow bigger, and make their shares available to the national market in the moment of take-off.[2]

By and large, our results suggest that differences in market microstructure fit not well with theoretical predictions and they were most likely too small to play a major role for listing decisions. In contrast, firm-specific and geographic factors correlate as expected with listing decisions. In particular, small firms tend to list on regional stock exchanges, whereas larger firms tend to list at the Berlin Stock Exchange. Moreover, the distance between the stock exchange and the corporate headquarter are negatively associated in a cross-section of firms. Furthermore, intra-German state borders have a strong negative impact on listing decisions, indicating a patriotic bias. This finding of an intra-German border effect also supports similar results regarding the weak integration of the intra-German goods and intra-German patent market (Wolf, 2009; Burhop and Wolf, 2013). Thus, Germany around 1900 was a fragmented economy in many respects.

II. REGIONAL STOCK MARKETS: HISTORY AND DESCRIPTIVE STATISTICS

A. Historical background

Modern stock exchanges (i.e., exchanges, where the shares of corporations were traded) emerged in Germany during the 19th century. They were set-up at three different kinds of places: in traditional commercial centres (e.g., Frankfurt and Hamburg), at seats of state governments (e.g., Berlin, Munich, and Dresden) or in new industrial towns (e.g., Essen and Hannover). A decisive impact on the development of stock exchanges had the emergence of railroad stocks from the 1840s onwards. Frankfurt – Germany's traditional financial centre with internationally well-connected private bankers like Rothschild and Bethmann located in the city – attracted international railroad stocks and bonds, whereas the other stock exchanges mainly attracted local railroad shares (Marx, 1913: 36; Gömmel, 1992: 183).

Berlin became the leading financial city after the take-over of the formerly independent city of Frankfurt by Prussia following a war in 1866 and after the foundation of the German Reich in 1871. In particular,

[2] Another explanation has been put forward by Anderson et al. (2011), who argue that investors prefer shares from issuers located in culturally similar countries.

Berlin became host of the new Reichsbank and consequently of the central money market (Marx, 1913: 38; Gömmel, 1992: 191-192). Moreover, Berlin attracted many stock issues from industrial firms, whereas Frankfurt lacked engagement in this line of business. This was due to the rise of Berlin as the leading industrial city in Germany and to the traditional focus of Frankfurt's financial establishment on government bonds. Only during the second half of the 1880s became stocks of industrial firms regularly listed at the Frankfurt Stock Exchange. However, at this point in time, the exchange turnover in Berlin had been about seven times the turnover in Frankfurt (Gömmel, 1992: 183-184, 191-192). Over time, the differences between the leading market – Berlin – and the various provincial markets became stronger. In particular, a liquid spot and a liquid derivative market existed in Berlin, whereas spot trading dominated at the provincial markets. The only provincial stock exchanges with a significant derivative market were the Frankfurt Stock Exchange and the Hamburg Stock Exchange (Marx, 1913: 45). Moreover, since the largest joint-stock universal banks were either headquartered in Berlin (like Discontogesellschaft, Deutsche Bank, and Berliner Handelsgesellschaft) or moved their business to Berlin (like Dresdner Bank and Darmstädter Bank für Handel und Industrie), they issued most securities at the Berlin market (Marx, 1913: 39-40).

Nevertheless, some provincial markets remained important for certain types of firms. For example, many coal mines had their shares listed in Essen and Düsseldorf, while the Augsburg Stock Exchange was an important hub for Bavarian industrial firms (Marx, 1913: 47, 50; Gömmel, 1992: 187-188). In general, the securities markets in Munich, Stuttgart, and Dresden were mainly created to issue bonds of the Bavarian, Wurttemberg, and Saxon state governments, respectively (Marx, 1913: 48). Nonetheless, the Dresden Stock Exchange became – like the nearby Leipzig Stock Exchange – important for financing industrial firms from Saxony (Marx, 1913: 49; Gömmel, 1992: 193-194). The same happened in Munich, where many Bavarian firms listed their shares since the 1870s (Gömmel, 1992: 187-188). The Hamburg Stock Exchange grew relatively fast during the second half of the century, mainly by attracting securities from nearby firms and countries. During the 1880s, the Hamburg exchange was already as important as the market in Frankfurt. Frankfurt was now the most important provincial market for South-Germany, whereas Hamburg was the most important market for Northwest-Germany. In addition, Frankfurt and Hamburg attracted a substantial number of foreign issues – Frankfurt mainly from Austria-Hungary and Hamburg mainly from Scandinavia (Gömmel, 1992: 197-198).

B. Data Sources

From 1897 onwards, the Imperial Statistical Office published information about all securities admitted to German stock exchanges in its quarterly journal (Vierteljahrshefte zur Statistik des Deutschen Reichs). The register contains the name of the issuer, the nominal amount of the issue, the offering price, the

date of admission, the names of the underwriters, and the stock exchange, where the admission took place. These data have been recently used to collect information about initial public offerings (IPOs) at the Berlin Stock Exchange between 1897 and 1913 (Lehmann, 2014). We complement the Berlin data with the data for all provincial stock markets. Thus, we present a unique time series of IPO activity at all German stock exchange for the period 1897 to 1913. Moreover, we provide a point estimate of all firms listed at German stock exchanges in 1913 (31 December 1913). These data have been collected from Saling's Börsenpapiere, a stock market manual. This stock market manual is available for the Berlin Stock Exchange for each year from 1880 onwards; a volume covering the provincial markets is available from 1900 onwards.

C. Descriptive Statistics

Table 1 provides an overview over the number of listed firms at end of 1913 and their main characteristics. The table contains only firms listed and incorporated in Germany and the table refers to the primary stock exchange only. We discuss cross-listings and listing of foreign firms below.

TABLE 1: PRIMARY LISTING OF FIRMS INCORPOARTED AND LISTED IN GERMANY IN 1913

	All German stock exchanges	Berlin	Dresden	Frankfurt	Leipzig	Hamburg	Munich	Augsburg
Number of listed firms	1,579	865	136	112	74	71	62	31
Average age (in years)	29.2	28.1	25.9	27.3	32.3	27.8	30.1	40.9
Average market value (in million marks)	12.9	18.4	3.2	13.4	4.0	4.1	12.0	6.3
Average distance between headquarter and stock exchange (in kilometres)		267	124	102	85	22	65	59
State border between headquarter and stock exchange		23%	32%	54%	24%	14%	2%	0%
Finance & Insurance	13%	16%	2%	17%	7%	11%	11%	0%
Construction & real estate	10%	11%	12%	8%	9%	1%	21%	3%
Mining, metal production & processing	16%	22%	7%	10%	23%	1%	3%	0%
Mechanical & electrical engineering, chemical industry	15%	14%	17%	22%	11%	20%	8%	19%
Food, drink, tobacco	17%	10%	24%	20%	15%	35%	31%	19%
Transportation & utilities	11%	12%	10%	6%	7%	20%	2%	7%
Textiles	9%	7%	10%	11%	18%	4%	8%	48%
Other branches	10%	8%	18%	6%	11%	7%	16%	3%

TABLE 1: DESCRIPTIVE STATISTICS - FIRMS INCORPOARTED AND LISTED IN GERMANY IN 1913 (cont.)

	Mannheim	Bremen	Stuttgart	Cologne	Zwickau	Strasbourg	Hannover	Breslau
Number of listed firms	31	30	26	21	21	19	14	14
Average age (in years)	30.2	24.9	25.1	45.8	26.7	31.0	37.9	28.2
Average market value (in million marks)	3.9	4.5	4.9	5.1	1.4	5.2	7.3	5.4
Average distance between headquarter and stock exchange (in kilometres)	39	9	38	89	21	85	64	71
State border between headquarter and stock exchange	45%	13%	25%	0%	5%	0%	7%	14%
Finance & Insurance	19%	3%	4%	24%	10%	21%	0%	14%
Construction & real estate	6%	3%	15%	10%	0%	5%	7%	29%
Mining, metal production & processing	3%	10%	8%	5%	19%	5%	14%	0%
Mechanical & electrical engineering, chemical industry	13%	10%	12%	5%	24%	11%	21%	14%
Food, drink, tobacco	42%	13%	27%	14%	24%	21%	36%	21%
Transportation & utilities	13%	27%	4%	14%	10%	11%	7%	0%
Textiles	0%	13%	23%	24%	14%	5%	7%	7%
Other branches	3%	20%	12%	5%	10%	21%	7%	14%

TABLE 1: DESCRIPTIVE STATISTICS - FIRMS INCORPOARTED AND LISTED IN GERMANY IN 1913 (cont.)

	Halle	Königsberg	Stettin	Magdeburg	Dusseldorf	Mainz	Brunswick	Essen
Number of listed firms	13	13	11	11	4	4	4	2
Average age (in years)	29.1	31.7	50.9	36.0	40.5	35.5	33.5	29.0
Average market value (in million marks)	4.2	1.2	3.0	2.0	5.0	1.8	1.2	4.9
Average distance between headquarter and stock exchange (in kilometres)	242	36	0	44	6	5	35	68
State border between headquarter and stock exchange	31%	0%	0%	27%	0%	50%	0%	0%
Finance & Insurance	15%	8%	18%	0%	25%	0%	0%	0%
Construction & real estate	0%	8%	0%	0%	25%	0%	0%	0%
Mining, metal production & processing	8%	8%	0%	27%	0%	0%	0%	0%
Mechanical & electrical engineering, chemical industry	31%	8%	18%	9%	0%	25%	25%	50%
Food, drink, tobacco	39%	46%	36%	27%	0%	25%	25%	50%
Transportation & utilities	0%	0%	18%	18%	50%	0%	0%	0%
Textiles	0%	15%	0%	9%	0%	0%	0%	0%
Other branches	8%	8%	9%	9%	0%	50%	50%	0%

Source: Own calcualations based on Saling's Börsenpapiere, Vol. 38, 1914/15, Issues 2 and 3.

1,579 firms with a total market value of 20.37 billion Mark were listed when the year 1913 closed. Thus, the total market value equaled 38 percent of the German net national product.[3] Per million inhabitants, 23.6 firms were listed in Germany. Therefore, the German stock market was slightly less developed than suggested by Rajan and Zingales (2003: 15, 17) who estimated a market capitalization of 44 percent of GDP and 28.0 listed firms per million inhabitants.[4] Nevertheless, the German stock market was quite developed, especially in view of the relatively large number of listed firms. In the United States, for example, the number of listed firms per million inhabitants has been 13.9 in 1910/11 and 15.8 in 1915.[5] Therefore, the number of listed firms per million inhabitants was about 50 percent higher in Germany than in the United States.

More than half of all listed firms had their primary listing at the Berlin Stock Exchange. These firms represented close to 80 percent of the market capitalization of all listed firms. Thus, the Berlin Stock Exchange was by far the dominant market. Taking the number of listed firms (primary listings only) as an indicator of importance, Dresden, Frankfurt, Leipzig, Hamburg and Munich were the most important regional stock exchanges. 136 firms had their primary listing in Dresden, 112 in Frankfurt, 74 in Leipzig, 71 in Hamburg, and 62 in Munich. The five leading regional markets are followed by a group of three stock exchanges with 31 or 30 listed firms (Augsburg, Mannheim, and Bremen). The remaining 14 regional stock exchanges are all very small and the average number of firms having their primary listing on one those markets is about 13. When we use the market value as an indicator of size, we get the following ranking: Frankfurt, Munich, Dresden, Leipzig, and Hamburg.

The typical firm having its primary listing on a regional stock exchange is quite small and with the corporate headquarter located close to the stock exchange. The average market value of a regionally listed firm is 6.2 million Mark, whereas the average market value of a Berlin-listed firm is 18.3 million Mark. Furthermore, the branch distribution of firms differs between center and periphery. At the Berlin Stock Exchange, we observe a relatively large number of firms from the financial sector and from heavy industry (mining, metal production and processing), whereas provincial markets are often hosts for firms from the light industry (textiles, food, drink, and tobacco). In some cases, the regional stock exchange displays local economic characteristics. For example, the north-German port cities Hamburg and Bremen are host for many firms from the food, drink, and tobacco industry (processing of imported coffee, tobacco etc.) and for many firms from the transportation (shipping) sector. At the Munich stock exchange, we observe a large number of listed breweries, in Cologne many insurance companies, and

[3] We use the compromise estimate made by Burhop and Wolff (2005: 652).

[4] A similar revision of the Rajan and Zingales (2003) data have been made for the U.S. and the U.K. (see Musacchio and Turner, 2013: 528)

[5] According to Rajan and Zingales (2003: 17) only 4.75 firms were listed per million inhabitants. This seems to refer to the New York Stock Exchange only. O'Sullivan (2007: 449, 507, 512) present data for the New York Stock Exchange, the New York curb market, and the (major) provincial markets.

in Augsburg quite a few textiles firms. Mainz, the birthplace of book printing was dominated by paper industry.

For firms listed in Berlin, the geographic distance between the corporate headquarter and the stock exchange is about 267 kilometer. For half of the regional markets, the geographic distance between corporate headquarter and the stock exchange is less than 50 kilometer. In case of the five leading regional markets, the average distance ranges between 22 kilometer (Hamburg) and 124 kilometer (Dresden). Thus, the provincial stock exchanges mainly serve regional firms. This result stays more or less unchanged once we control for cross-listings. In Figure 1, we display for each stock exchange the share of regional firms (i.e., those with the corporate headquarter up to 100 kilometers away from the stock exchange), which were only listed at this stock exchange; the share of regional firms which were cross-listed, and the share of non-regional firms. Berlin has been the only stock exchange of nationwide importance. Other markets with a reach beyond the region were Frankfurt, Munich, Dresden, and Leipzig. The Hamburg stock exchange was relatively large, but of only local importance. To take the point home, we display the regional distribution of firms in several maps (see Figures 2a to 2e).

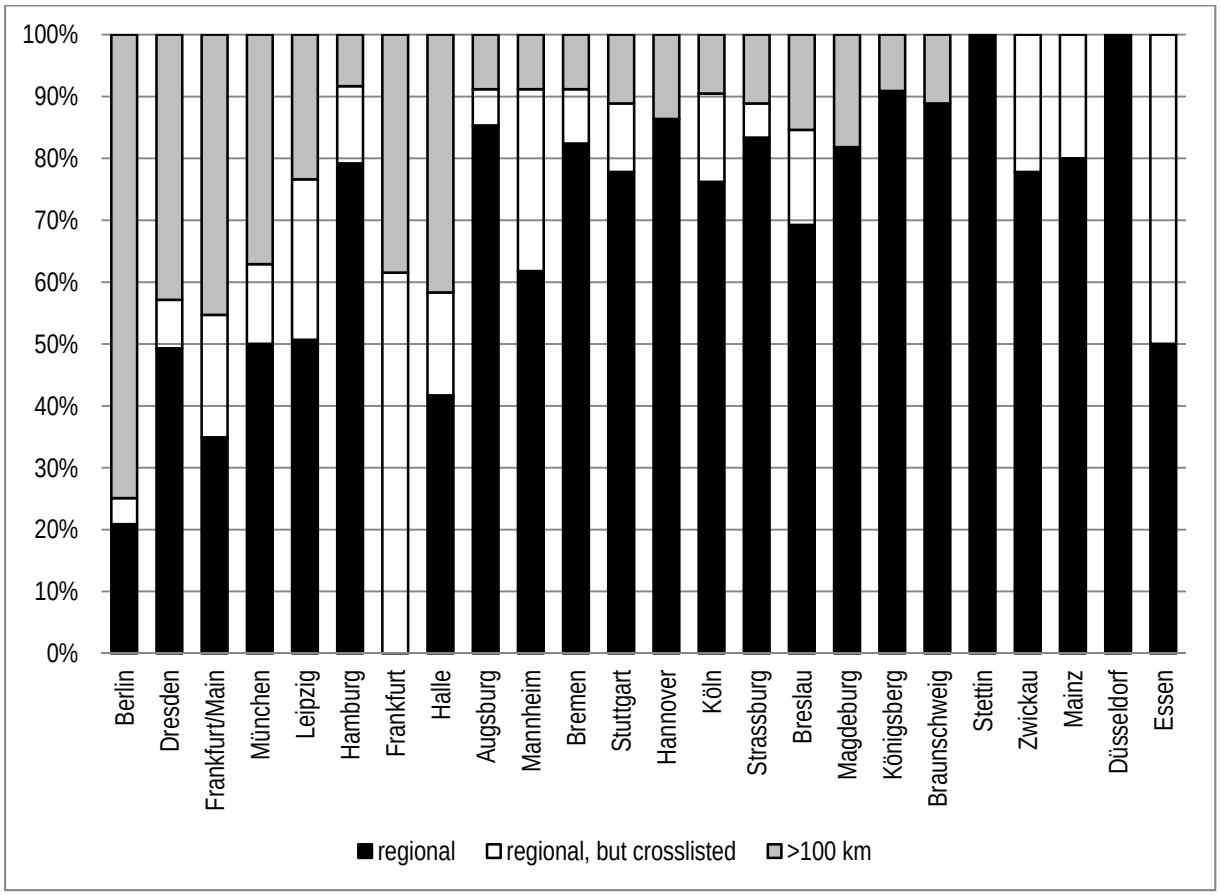

Figure 1

Distance between corporate headquarter and stock exchange

Figure 2: Regional importance of the largest stock exchanges

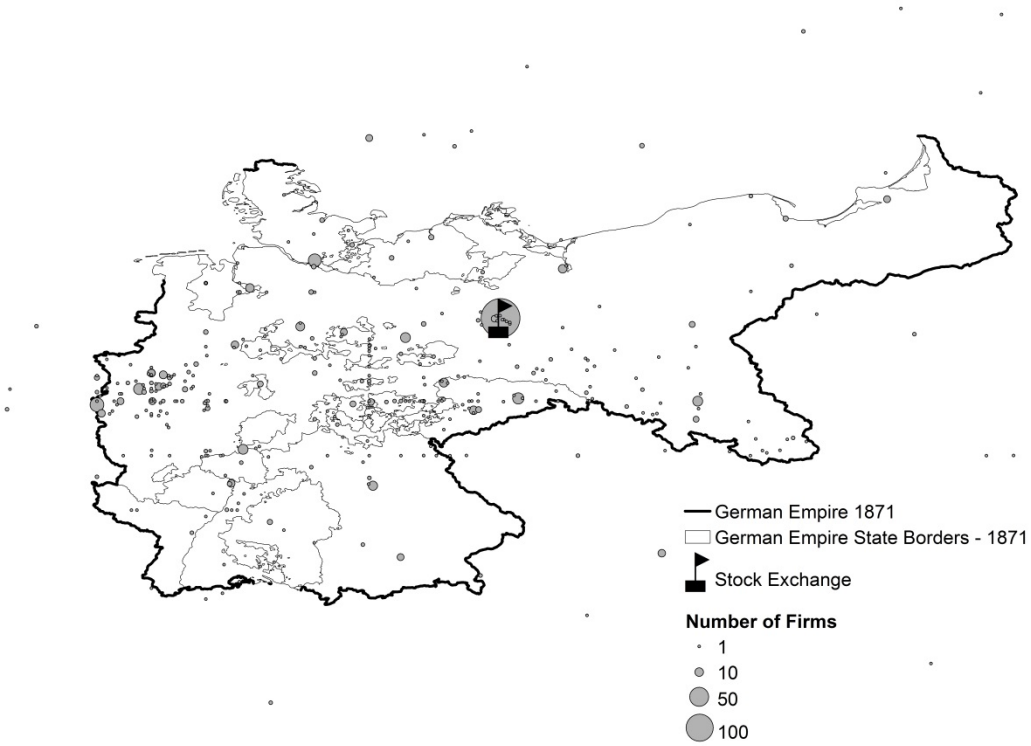

Figure 2a: Berlin stock exchange

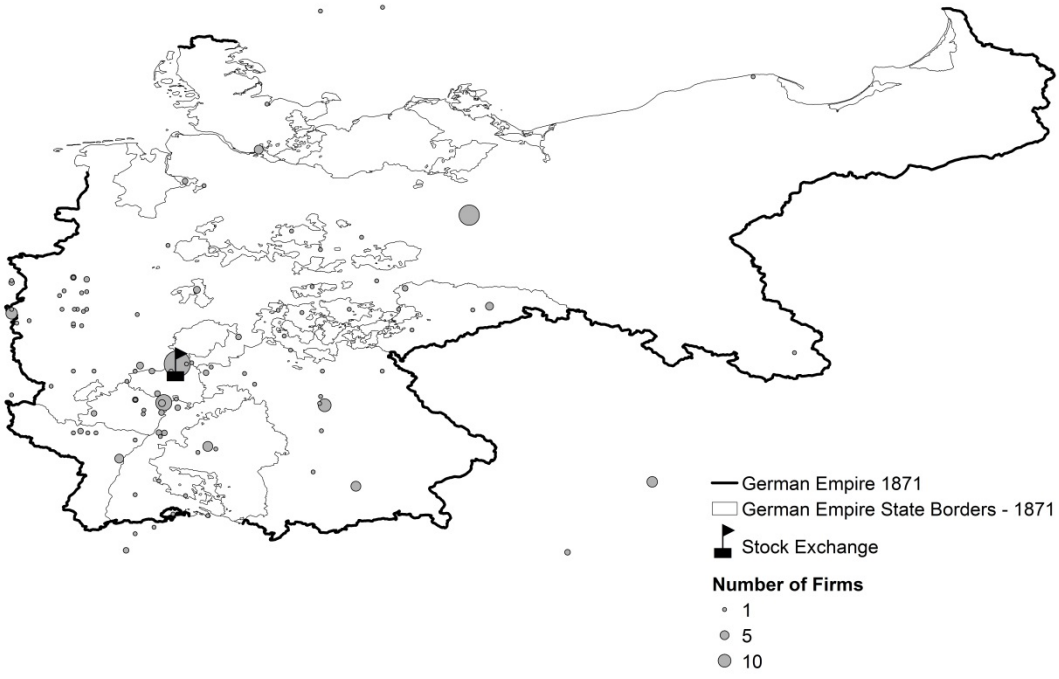

Figure 2b: Frankfurt (Main) stock exchange

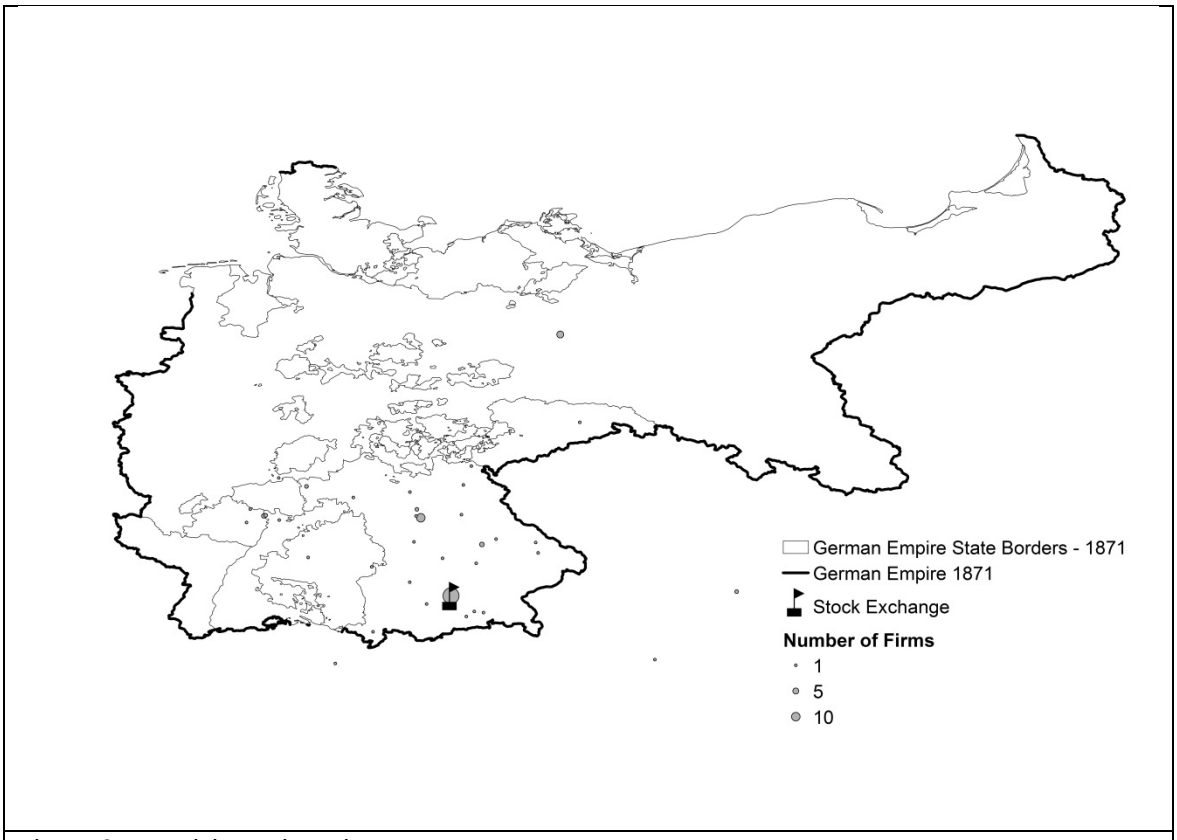

Figure 2c: Munich stock exchange

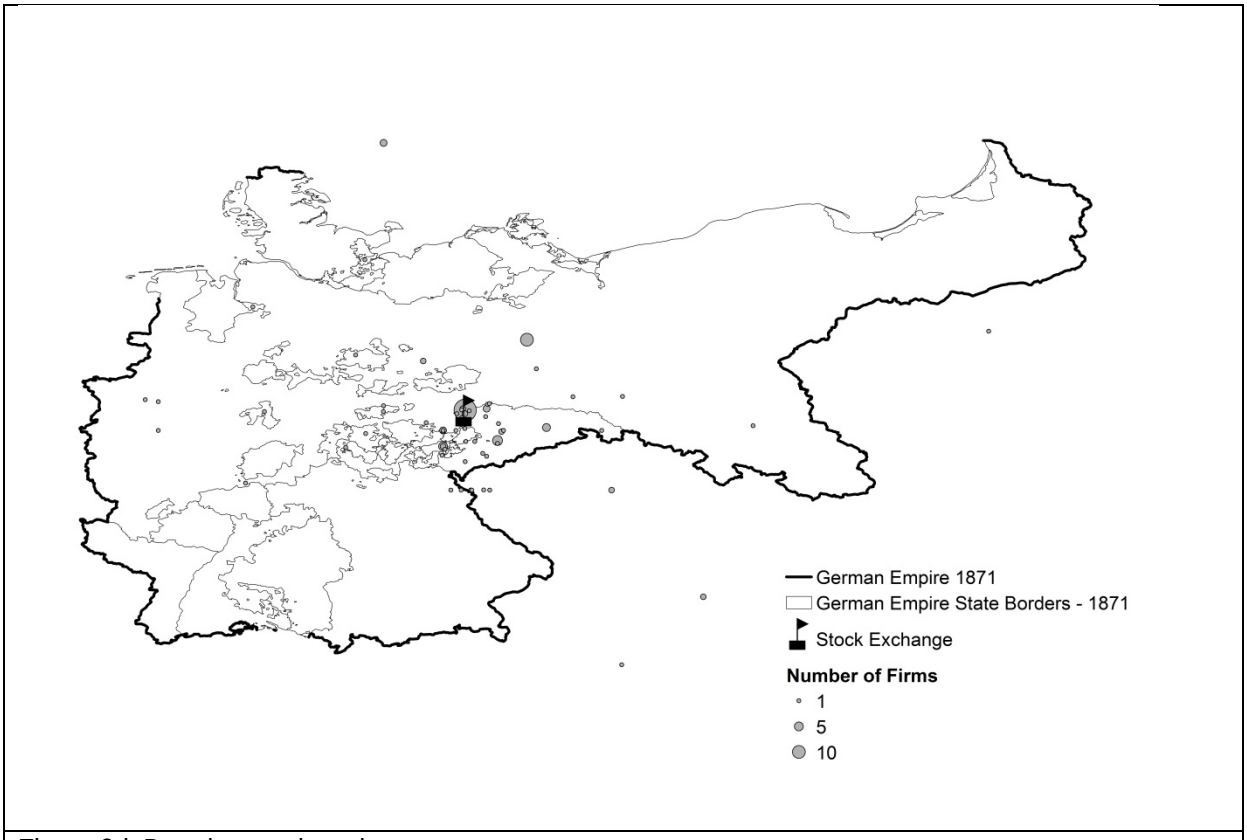

Figure 2d: Dresden stock exchange

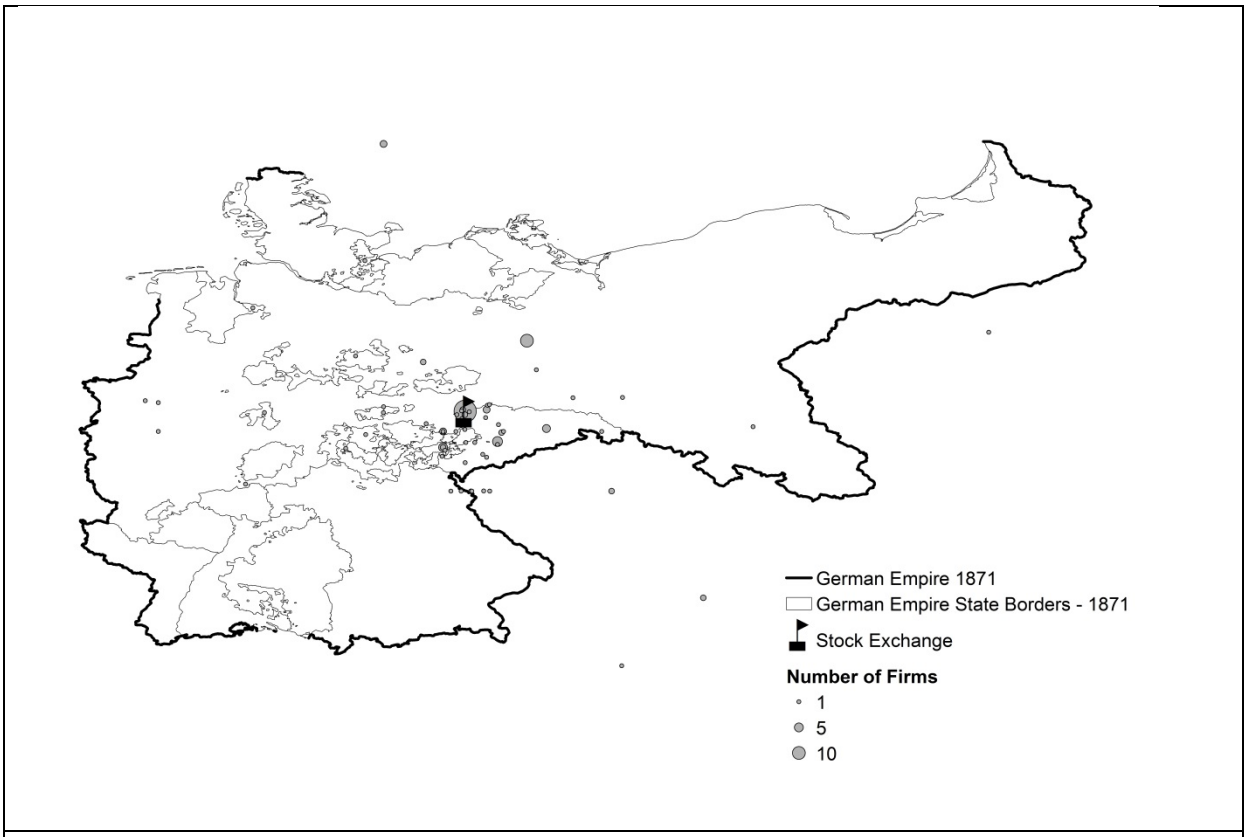

Figure 2e: Leipzig stock exchange

A substantial number of firms were listed at several German stock exchanges. In Table 2, we list the number of firms having their primary listing at this exchange (the number in grey fields) for the ten largest stock exchanges (measured by number of listings). In addition, we show for each stock exchange how many firms were primarily listed at this stock exchange and cross listed at other exchanges. For example, 104 firms were primarily listed in Berlin and cross-listed in Frankfurt; 15 firms were primarily listed in Frankfurt and cross-listed in Berlin. In total, 428 German firms were listed at more than one German stock exchange. Noteworthy is perhaps that not all firms listed in Berlin had their primary listing there: The Berlin Stock Exchange attracted 67 German firms which were primarily listed at one of the provincial exchanges. In general, only the Berlin and the Frankfurt Stock Exchange were closely connected to many other exchanges. The other regional stock exchanges were at best related to nearby markets. This structure of cross-listing is also reflected in direct telegraph lines among the major markets. Direct telegraph lines connected the Berlin Stock Exchange with the stock exchanges in Frankfurt and Munich. In addition, the Frankfurt and the Munich Stock Exchange had a direct connection via telegraph (Marx, 1913: 55).

TABLE 2: LISTINGS AND CROSS-LISTING OF GERMAN FIRMS AT THE 10 LARGEST STOCK EXCHANGES IN 1913

		Primary listing									
		Berlin	Frankfurt	Dresden	Leipzig	Hamburg	Munich	Augsburg	Mannheim	Bremen	Stuttgart
other listing	Berlin	865	15	17	8	7	6	1	3	2	0
	Frankfurt	104	112	2	0	2	8	0	10	0	2
	Dresden	40	4	136	9	0	0	0	0	0	0
	Leipzig	38	1	6	74	0	0	0	0	0	0
	Hamburg	45	0	1	0	71	0	0	0	0	0
	Munich	21	4	3	0	0	62	1	1	0	1
	Augsburg	6	0	0	0	0	6	31	0	1	0
	Mannheim	6	18	0	0	0	0	0	31	0	0
	Bremen	19	0	0	0	0	0	0	0	30	0
	Stuttgart	5	8	0	0	0	1	0	1	0	26

Looking at the type of firms opting for multiple listings, banks lead the table: Direction der Discontogesellschaft (listed at ten stock exchanges), Reichsbank (8), Deutsche Bank (8), and Dresdner Bank (8). Four firms were listed at seven (Harpener Bergbau, Hiberia, Gelsenkirchener Bergwerks AG, Bank für Handel und Industrie) and six (Schuckert & Co., Nationalbank für Deutschland, Mitteldeutsche Privatbank, Vereinigte Königs- und Laurahütte) stock exchanges, respectively.

Beyond German firms, we observe a relatively small number of foreign firms listed at one or several of the German stock exchanges. In total, 77 foreign firms were listed in Germany: 32 from Austria-Hungary, 13 from Russia, five from Britain, each four from Italy and Denmark, each three from Switzerland, Turkey, and Belgium, each two from the U.S., the Netherlands, Luxemburg, and China (both representing German investment in China), and each one from Sweden and Canada. Most of the foreign firms were listed in Berlin (60) and Frankfurt (30) and few of them in Hamburg (ten), Cologne (six), Dresden (five), Bremen (four), Leipzig (four), Munich (three), and Breslau (one). Thus, the German stock markets mainly served the German economy.

Taking the total number of primary listings, cross-listings, and foreign listings, as an indicator of stock market size, the Berlin Stock Exchange (992 listed firms) comes first, followed by Frankfurt (270), Dresden (194), Hamburg (127), Leipzig (125), and Munich (96). Taking the market value of the listed German firms (primary and cross-listed) as an indicator of size, the ranking is: Berlin (17,548 million Mark), Frankfurt (9,991 million Mark), Hamburg (5,486 million Mark), Leipzig (4,045 million Mark), Munich (3,254 million Mark), and Dresden (2,362 million Mark). Information about the trading volume has not been published and an estimation using stamp tax receipts can only serve as a rough guide since the stamp has been raised for all kinds of exchange transactions (stocks, bonds, and commodities) and since only aggregate (i.e., Imperial) stamp tax receipts have been published. A slightly more detailed look is possible for 1909/10. During these two years, 42.38 million Mark has been raised as a stamp tax on securities (stocks and bonds) transactions.[6] Out of this amount 64.8 percent have been raised in Berlin, 5.5 percent in Hamburg, 4.9 percent in Frankfurt, and 24.9 percent at the other exchanges.[7] In 1907/8, 57.5 percent of the tax receipts have been raised in Berlin. Between 1900 and 1908, Hamburg accounted for 5.8 percent of the receipts. This suggests that most trading took place in Berlin. Nevertheless, a substantial part of trading took also place at the regional exchanges.

The tax receipt data suggest that the relevance of the Berlin Stock Exchange for securities trading increased over time. We look at IPO data for the period 1897 to 1913 to assess if the relevance of provincial markets became indeed weaker over time when one looks at the primary market for shares.

[6] Federal Archive (Bundesarchiv Berlin-Lichterfelde, BAL) files 3103/102 and files 3103/103 provide monthly data for the period January 1897 to December 1910. Own calculations.

[7] Wormser (1919: 229) provides data for Berlin (1907-1913), Frankfurt (1909-13), and Hamburg (1900-1913).

Between 1897 and 1913, 670 IPOs took place at 16 different stock exchanges, raising about 3.4 billion Mark. 377 IPOs (55 percent of all) took place in Berlin. The issuing firms were valued at circa 2.4 billion Mark (70 percent of the total) in Berlin. Beyond Berlin, six provincial stock markets were frequently the place where an IPO took place: Dresden, Frankfurt, Leipzig, Munich, Bremen, and Hamburg. Significant amounts of money were raised at three provincial markets: Frankfurt, Munich, and Dresden.

TABLE 3: IPOs AT GERMAN STOCK EXCHANGES, 1897-1913

	Number of IPOs	Market value at offering price (in million Mark)	Average market value at offering price (in million Mark)
Berlin	377	2,358.5	6.3
Dresden	82	153.3	1.9
Frankfurt	58	284.8	4.9
Leipzig	28	61.1	2.2
Munich	28	263.2	9.4
Bremen	27	60.9	2.3
Hamburg	25	80.4	3.2
Augsburg	13	21.2	1.6
Mannheim	11	25.5	2.3
Breslau	10	20.8	2.1
Stuttgart	9	12.4	1.4
Köln	7	11.0	1.6
Königsberg	6	8.9	1.5
Hannover	4	5.8	1.5
Zwickau	3	6.0	2.0
Stettin	2	1.3	0.6
Total	690	3,375.1	4.9

Source: IPO database, own calculation.

Figures 3 and 4 illustrate the time path of IPO activity in Berlin, Frankfurt, and at the other provincial markets, using the number of IPOs (Figure 3) and the value of IPOs (Figure 4) as an indicator. In general, the number of IPOs as well as the amount of money firms raised by way of IPO declined over time. Moreover, one can clearly see that Berlin has been more dominant regarding the value than regarding the number of IPOs. Furthermore, the number of IPOs fluctuated more strongly at the provincial markets. In addition, we clearly see the effects of the business cycle downturns in 1901 and 1907 in both time series. Of special importance for the current paper is the distribution of IPOs between Berlin and the provincial markets. One may expect an ongoing integration of the German economy and of the German financial markets in particular. However, this seems not to be the case. The relative importance of the Berlin Stock Exchange declined over time. Between 1897 and 1902, the Berlin Stock

Exchange accounted for 65 percent of the number of issues (73 percent of the money raised). Between 1903 and 1908, the share declines to 55 percent (71 percent). Between 1909 and 1913, Berlin accounted for only 38 percent (50 percent). Thus, the importance of the Berlin Stock Exchange as the place to go public declined over time and instead of the expected increase of centralization, we observe the opposite.

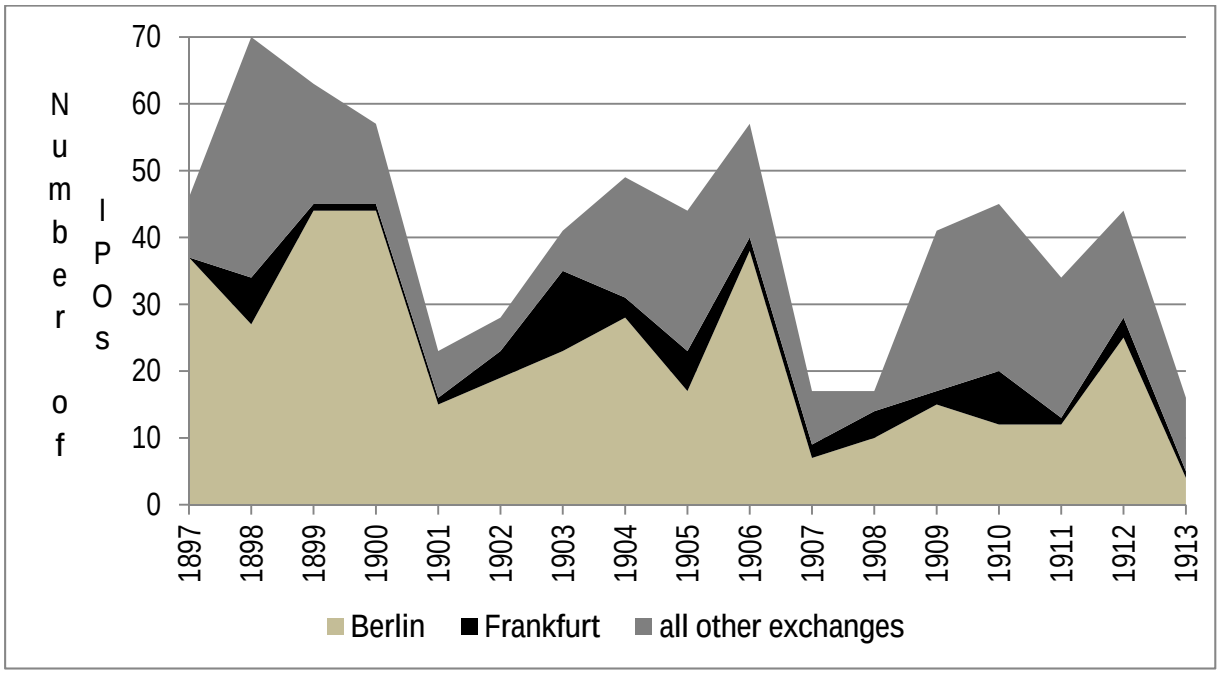

Figure 3
Number of IPOs in Germany, 1897-1913

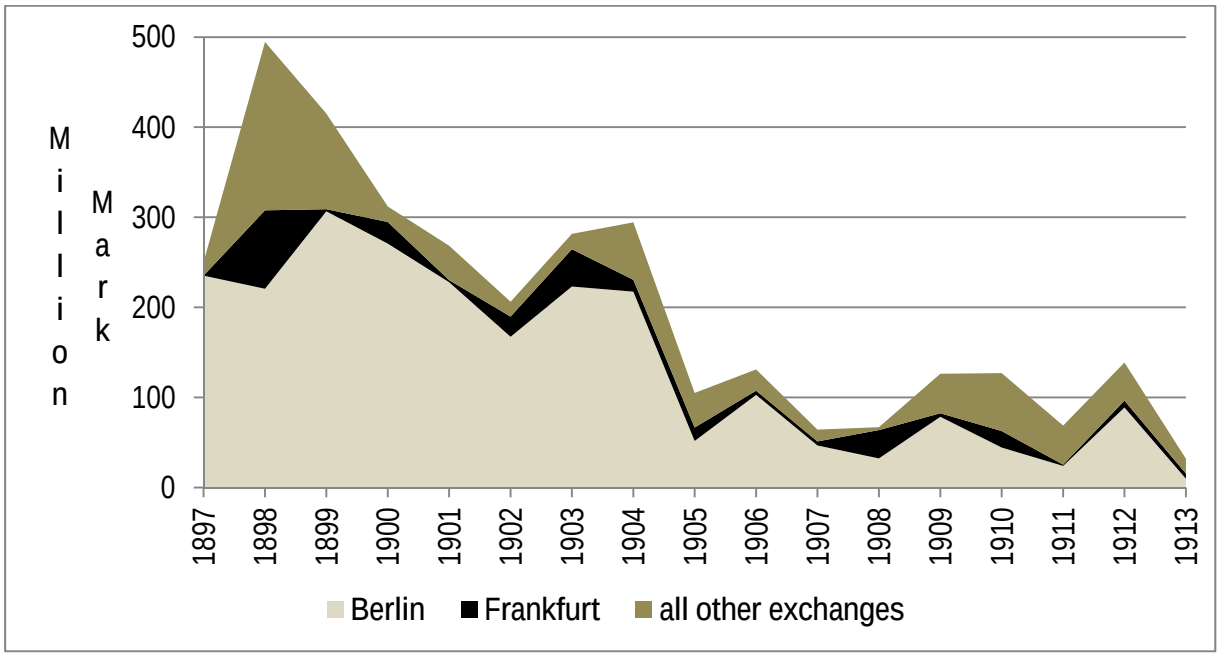

Figure 4
Value of German IPOs, 1897-1913

III. MARKET MICROSTRUCTURE

Regulatory arbitrage was most likely not a major reason for the existence of multiple stock exchanges. The 1884 corporate law unified corporate governance and publicity rules for all joint-stock companies incorporated in Germany. From 1884 onwards, every firm had to publish an annual balance sheet and a profit and loss statement, every shareholder had the right to attend the annual meeting and every shareholder had voting rights. Moreover, the two-tier board system with strictly separated executive non-executive supervisory boards became compulsory. Furthermore, the rules of incorporation have been standardized with the 1884 corporate law (Gareis, 1888). Thus, every potential investor had, in principle, the same set of information. Nevertheless, local investors may have had some advantages compared to distant investors. For example, travelling costs to attend the annual meeting are much lower when you live in the area where the meeting takes places (usually the seat of the corporate headquarter, sometimes the financial capital, Berlin).

Beyond corporate law, Germany was the first major country enacting a securities market law. The 1896 Stock Exchange Act (in force from 1 January 1897) regulated the admission rules in force at all German stock exchanges, the organization of the stock exchange, and the price formation at the stock exchange. For example, every firm has to publish a standardized prospectus when issuing shares and the admission rules were standardized (§§ 36-49 Stock Exchange Act). Moreover, the organisation of the exchange (§§ 1-28 Stock Exchange Act) and the formation of fair prices has been regulated (§§ 29-35 Stock Exchange Act). Thus, the scope for regulatory arbitrage was substantially reduced by these two acts.

However, some scope for regulatory arbitrage remained in place. For example, the admission board of each stock exchange was composed of local bankers and business men, the government agency monitoring each stock exchange (Staatskommissar) has been appointed by the state government, and local banks were needed as underwriters. Moreover, the minimum size of issues differed. It was fixed at a nominal share capital of one million Mark in Berlin, Frankfurt, and Hamburg, but only at 500,000 Mark at all other stock exchanges (Obst, 1921: 384). The stock exchange admission boards in Berlin, Frankfurt, and Hamburg could, however, decide to list smaller firms with a size of 500,000 Marks if the firms were of special importance for the regional economy (Swoboda, 1913: 182), but this did not happen very often. In Berlin, less than two percent of all firms had a share capital below one million Mark and less than 15 percent in Frankfurt and Hamburg.

Beyond size regulation, differences with respect to listing fees can be observed (see Figure 5). In general, listing fees were raised as a percentage share of the nominal capital to be listed and at rates below 0.1 percent of the face value of shares issued. The average IPO listed a share capital of about 3

million Mark. Thus, the listing fees for a firm of the typical size were 1,200 Mark in Berlin, 450 Mark in Frankfurt, and 2,500 Mark in Leipzig. In Hamburg, the admission committee determined the fee without any regulation, but the fee was not allowed to exceed 500 Mark (Jürgens, 1898: 37). Furthermore, some stock exchanges (e.g., Munich and Dresden) raised higher fees for firms from other Germany states. In general, listing fees were quite low in Hamburg and Frankfurt and quite high in Saxony (Leipzig, Dresden). The Berlin Stock Exchange raised the highest fee for very large issues (of more than 8 million Mark), but it can be expected that issues of this size could only be sold in Berlin. In general, we do not observe a clear-cut relationship between market size and listing fees: some provincial markets requested higher fees than the Berlin Stock Exchange, while other provincial stock exchanges demanded lower fees. In particular, the relatively large markets in Frankfurt and Hamburg raised comparatively low listing fees.

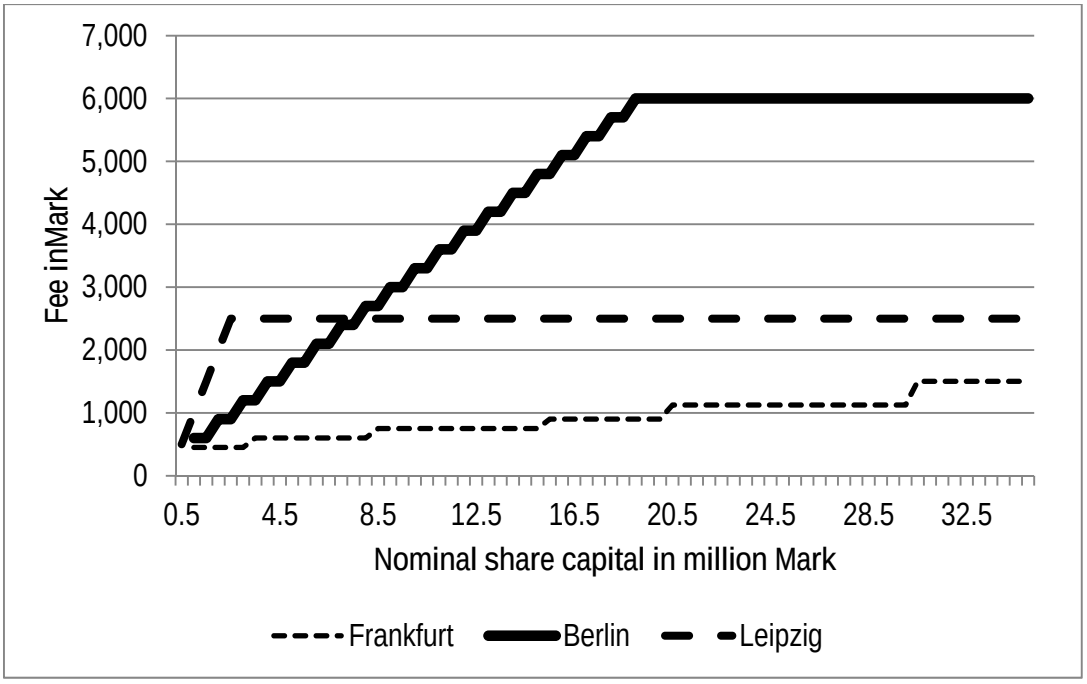

Figure 5: Listing fees in percent of face value of shares listed.

Own calculation based on data from Swoboda (1913: 139, 183-184, 226)

Transaction costs also varied from stock exchange to stock exchange. Most of the transaction costs (taxes, bank fees) were not under the control of the stock exchange operator, whereas some of them were. First of all, an Imperial stock market turnover tax of 0.03 percent of the market value of each transaction was raised (Gelman and Burhop, 2008: 43). Moreover, most investors had to pay a commission to a bank acting as an intermediary between investor and broker. In Berlin, this commission varied between 0.1 and 0.33 percent of the market value. In Frankfurt and Hamburg, bank commissions varied between 0.1 and 0.125 percent of the market value. In Leipzig, bank commissions varied

between 0.125 and 0.25 percent (Weigt, 2005: 192). It seems that bank commissions were slightly lower outside of Berlin.

Furthermore, a broker's fee has to be paid. This fee was set by the stock exchange operator and it varied among stock exchanges. The roundtrip fee in Berlin was 0.1 percent of the market value. At those provincial markets where the fee was also raised as a percentage share of the market value, the fee varied between 0.1 (Augsburg, Breslau) and 0.2 percent (Düsseldorf, Essen). Other stock exchanges used the face value of shares, which was usually below the market value, as a basis to calculate the fee. In these cases, the fee has been in the range of 0.1 percent (Frankfurt, Hamburg, Dresden, Hannover, Königsberg, Leipzig, and Munich) and 0.2 percent (Bremen) percent of the face value. The Zwickau Stock Exchange raised no fee at all (Swoboda, 1913). Thus, the major provincial markets – Frankfurt and Hamburg – raised lower broker fees than the Berlin Stock Exchange. In general, our results do not lend much support to the model proposed by Foucault and Parlour (2004). According to the model, listing fees and turnover fees should be negatively related. We provide evidence that smaller stock exchanges (Frankfurt, Hamburg) charged lower transaction and lower listing fees than the major market, the Berlin Stock Exchange.

Moreover, the stock exchange operator usually raised a fee from people who wanted to trade. This fee has been quite low in Hamburg: market participants who were not members of the chamber of commerce had to pay a daily fee of 0.30 Mark. There was no fee for members of the chamber of commerce (Jürgens, 1898: 33). Fees were substantially higher at the Frankfurt Stock Exchange – they were in a range between 60 and 3,300 Mark per year, depending on expected turnover (Schütze, 1911: 318). Fees at the Berlin Stock Exchange were of a similar size. Nominal fees were between 30 and 5,000 Mark per year (depending on expected turnover). The actual fee was calculated to balance the books of the stock exchange operator. In 1910, for example, only 60 percent of the nominal fee was actually raised. Thus, market participants paid between 18 and 3,000 Mark. Moreover, short-term visitors could buy a six-week-stock-exchange card at a price of 20 Mark (Schütze, 1911: 293-294).

Another dimension of competition among markets is the trading time (hours and days).[8] Typically, markets were open from Monday to Saturday and trading times were similar at a given stock exchange from Monday to Friday, with shorter hours on Saturday. Some of the smaller markets reduced the number of trading days. For example, the Cologne stock exchange has been closed on Saturday; the stock exchanges in Düsseldorf and Essen were only open three days a week, the stock exchange in Zwickau only two days per week. The benchmark market in Berlin opened the floor at noon at closed at 3 in the afternoon. Some markets opened up to one hour earlier (Breslau, Zwickau, Cologne, Augsburg, and Munich), but no market closed later than Berlin. Frankfurt opened 15 minutes after Berlin and

[8] A unified time zone has been introduced in Germany in 1893.

closed 15 minutes earlier, whereas Munich opened 15 minutes earlier and closed simultaneously. Noteworthy is the evening trading in Frankfurt, where the stock exchange has been open from 5:15 to 6:30 in the afternoon (see Wormser, 1919: 76-81 on this point). Thus, two of the provincial markets used opening hours to compete with Berlin: Munich by opening earlier and Frankfurt by offering an evening exchange.

Putting the pieces together yields the impression that especially the Frankfurt Stock Exchange competed with the Berlin Stock Exchange. The Frankfurt Stock exchange asked for lower listing fees, it raised lower broker fees, and it had advantageous opening hours.

IV. EMPIRICAL INVESTIGATION OF LISTING DECISIONS

The standard econometric technique used in empirical investigations of listing decisions is the probit model (e.g. Saudagaran and Biddle, 1995; Claessens and Schmukler, 2007). More technically speaking, the dependent variable 'firm is listed at a certain stock exchange' ($L_{i,i}$) takes the value 1, when a firm i is listed at stock exchange j. Our set of explanatory variables includes firm fundamentals (size, age, and branch), geographic characteristics (distance between corporate headquarter and the stock exchange), and political indicators (state border between firm headquarter and stock exchange). All explanatory variables are included into the vector X. We then estimate:

$$\text{Prob}\,(L_{i,j}=1|X) = \Phi\,(\beta X')$$

with Φ denoting the cumulative density function of the normal distribution, β the vector of estimated coeffients, and X' the vector of explanatory variables.

The theoretical literature (see Section I) offers several hypothesizes regarding the relationship between explanatory variables and the listing decision:

> Hypothesis 1: If the financing needs of a firm are large, it is more likely to list its shares on a large market. We thus expect that firm size (measured by market value at offering price in case of IPOs and measured by the market value at the end of 1913 in case of the cross-section) is positively related to the decision to list at the Berlin Stock Exchange.

> Hypothesis 2: Asymmetric information between issuer and investors is expected to increase with geographic distance between corporate headquarter (where firm specific information is produced) and the stock exchange (where trading specific information is produced). Thus we expect distance to be negatively correlated with the listing decision.

Hypothesis 3: A state border is significantly negative, if issuers and investors identify themselves with their home states (patriotic home bias).

We start with an investigation of the factors driving a firm to choose the Berlin Stock Exchange as the venue for the primary listing (see Table 4). First, we apply a simple model, using only one explanatory variable: firm size. In the following models 2 to 7, additional variables are one by one included in the model. According to models 1 to 7, firm size is positively related to the probability of being listed in Berlin. This supports hypothesis 1. In model 2, we add geographic distance between the corporate headquarter and the Berlin Stock Exchange as a proxy variable grasping the effect of asymmetric information on listing decisions. In turns out (in models 2 to 7) that geographic distance has a negative impact on the listing decision. The farther a firm is away from the Berlin Stock Exchange, the less likely is the firm to have the primary listing of its shares at this stock exchange. This supports our hypothesis 2. In model 3, we put a state border dummy into the model. This dummy variable takes the value 1 when at least one German state border (e.g., the border between Prussia and Saxony) lies between the corporate headquarter and the stock exchange. The border effect is significantly negative in models 3 to 7. We take this as evidence in favor of hypothesis 3 (patriotic home bias). In the following models, several control variables are added to the model: firm age, a dummy variable indicating if the firm has been incorporated before the German unification in 1871, and sector dummies. Some of the control variables are significant, but they never affect our conclusions. Of more interest is perhaps the dummy variable taking the value of one when the nominal share capital of a firm is at least one million Mark. Only if this is the case, the firm can be listed without additional administrative difficulties at the stock exchanges in Berlin, Frankfurt, and Hamburg. If the capital is below one million Mark, a listing at the main stock markets is – in general – not possible. Indeed, firms having a nominal share capital of one million Mark or more are more likely to be listed in Berlin. One should note that the size variable is still significant, indicating that the quest for capital is still an important factor for the listing decision. Putting the findings together yields a clear picture: large, Prussian firms tend to be listed at the Berlin Stock Exchange.

Table 5 presents the results for five major provincial markets: Frankfurt, Hamburg, Leipzig, Munich, and Dresden (the order reflects the aggregate market value of listed firms). In general, the probit model does not work well (as indicated by the Hosmer-Lemenshow-statistics). Listing decisions at provincial stock markets are mainly driven by “random” decisions not by structural “facts”. The only exception is the Frankfurt Stock Exchange. In Frankfurt, size does not play a role. This supports hypothesis 1, stating that large firms seek finance in Berlin. Asymmetric information (Hypothesis 2) plays a similar role for

Frankfurt than it does for Berlin – firms which are farther away from the stock exchange are less likely to be listed. Moreover, the minimum size regulation is also at work in Frankfurt. Firms with a share capital of less than one million Mark are less likely to be listed in Frankfurt. Surprisingly, the border effect is positive in case of Frankfurt. This implies that firms having their headquarter outside Prussia are more likely to be listed in Frankfurt. This may have historical reasons (Holtfrerich, 1999: 148-167, 200-216). Frankfurt has been an independent city until 1866 and it acted as a financial hub for many south-German states (like Bavaria, Baden, and Württemberg) and it may have continued this role until the Great War. Thus, tradition affected financial decision making. This finding also supports the idea that the border effect did not reflect institutional differences. If institutions play a role, the border dummy should have the same sign in case of Frankfurt and Berlin since both stock exchanges are located in Prussia.

For the other regional stock exchanges, the model does not explain much. However, the border effect is often negative indicating that firms form the Kingdom of Saxony tend to be listed in Dresden or Leipzig and that firms from the Kingdom of Bavaria tend to be listed in Munich. Thus, we observe a patriotic home bias in most cases and one exception – the Frankfurt Stock Exchange.

TABLE 4:THE DECISION TO HAVE PRIMARY LISTING IN BERLIN

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Firm size (Log of market value in million Mark)	0.087***	0.086***	0.068***	0.070***	0.071***	0.047***	0.035***
Distance (Log of distance between headquarter and Berlin in kilometre)		-0.108***	-0.075***	-0.075***	-0.074***	-0.075***	-0.071***
State border between headquarter and Berlin			-0.387***	-0.383***	-0.383***	-0.357***	-0.337***
Firm age (Log of years since incorporation)				-0.059***	-0.051*	-0.036	-0.028
Incorporated before 1870					-0.023	-0.015	-0.052
Minimum size regulation fulfilled						0.307***	0.309***
Finance & Insurance							0.110***
Construction & real estate							0.036
Mining, metal production & processing							0.149***
Mechanical & electrical engineering, chemical							0.054
Food, drink, tobacco							-0.063
Transportation & utilities							0.031
Textiles							0.034
Number of observations	1,575	1,575	1,575	1,575	1,575	1,575	1,575
p-value Chi^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hosmer-Lemenshow (p-value)	0.063	0.166	0.004	0.003	0.003	0.000	0.000
Share correctly predicted	0.546	0.604	0.681	0.684	0.684	0.697	0.707
McFadden-Pseudo R^2	0.066	0.174	0.302	0.308	0.308	0.335	0.354

Probit regression. Dependent variable takes the value 1 when a firm is listed in Berlin and 0 otherwise.

****, **, * indicates significance on 0.1, 1, and 5% level. Average partial effects.*

TABLE 5:THE DECISION TO HAVE PRIMARY LISTING AT PROVINCAL STOCK EXCHANGE

	Frankfurt	Hamburg	Leipzig	Munich	Dresden	Berlin
Firm size (Log of market value in million Mark)	-0.002	-0.004***	-0.000	0.000	-0.001	0.047***
Distance (Log of distance between headquarter and Berlin in kilometre)	-0.054***	-0.021***	-0.000	-0.000	-0.000	-0.075***
State border between headquarter and Berlin	0.053***	0.013	-0.150***	-0.051***	-0.211***	-0.357***
Firm age (Log of years since incorporation)	-0.014	-0.001	0.018	0.010	-0.019	-0.036
Incorporated before 1870	-0.007	-0.005	-0.015	-0.014	-0.048***	-0.015
Minimum size regulation fulfilled	0.056***	-0.005	-0.027	-0.014	-0.139***	0.307***
Number of observations	1,575	1,575	1,575	1,575	1,575	1,575
p-value Chi^2	0.000	0.000	0.000	0.000	0.000	0.000
Hosmer-Lemenshow (p-value)	0.088	0.990	0.306	0.999	0.303	0.000
Share correctly predicted	0.916	0.970	0.934	0.936	0.897	0.697
McFadden-Pseudo R^2	0.381	0.707	0.329	0.655	0.362	0.335

Probit regression. Dependent variable takes the value 1 when a firm is listed in Berlin and 0 otherwise.
****, **, * indicates significance on 0.1, 1, and 5% level. Average partial effects.*

We now turn to the listing decisions of firms going public between 1897 and 1913. The results for the three major IPO markets Berlin, Frankfurt, and Dresden (accounting for 517 out of 690 IPOs) are displayed in Table 6. Large firms tend to go public at the Berlin Stock Exchange, whereas smaller firms opted for the Dresden Stock Exchange. About half of the issues taking place in Dresden represent firms with a nominal share capital of less than one million Mark, i.e., firms which could not go public in Berlin or Frankfurt due to minimum size regulations. Moreover, we observe a negative state border dummy in case of Berlin and a positive state border dummy in case of Frankfurt and Dresden. Thus, a patriotic home bias works in Berlin, whereas Dresden manages to attract issues from other states, in particular from Prussia and Bavaria, and Frankfurt acted as a hub for going publics from south German states (e.g., 13 firms from Baden and 11 from Bavaria). Distance has basically no effect for IPOs taking place in Frankfurt and Dresden between 1897 and 1913, while it has a positive effect in Berlin: when your corporate headquarter is far away from the Berlin Stock Exchange, you are more likely to list your shares there. This could indicate that problems of asymmetric information became less important over time. Distance used to play a role for listing decisions in the past, leading to a negative association

between distance and listing probability in case of the 1913 cross-section. If we just consider the latest IPOs (1897 to 1913), firms coming from distant regions make it directly to the Berlin Stock Exchange – the German financial market overcame the tyranny of distance.

TABLE 6: DETERMINANTS OF IPO STOCK EXCHNAGE

	Berlin	Berlin	Frankfurt	Dresden
Firm size (Log of market value in million)	0.073***	0.083***	-0.004	-0.024
Distance (Log of distance between headquarter and regional stock exchange in kilometer)	0.064***	0.062***	-0.009*	-0.008
State border between headquarter and regional stock exchange	-0.324***	-0.327***	0.124***	0.236***
Minimum size regulation fulfilled	0.001***	0.001***	0.000***	0.000***
Sector dummies	Y	N	N	N
Number of observations	692	692	692	692
p-value Chi^2	0.000	0.000	0.000	0.000
Hosmer-Lemenshow (p-value)	0.021	0.000	0.084	0.062
Share correctly predicted	0.702	0.694	0.853	0.850
McFadden-Pseudo R^2	0.356	0.340	0.082	0.306

Probit regression. Dependent variable takes the value 1 when a firm goes public at a certain stock exchange.
****, **, * indicates significance on 0.1%,1%, and 5% percent level.*

V. CONCLUSION

In the German Reich we observe 23 stock exchanges out of which six still exist today, although issuers and investors have economic incentives to concentrate activities in one place. We provide new data about stock market listings at all German exchanges in 1913 and we provide IPO statistics for all markets for the period 1897 to 1913. Stock and flow data show that the Berlin Stock Exchanges has been the leading financial market in Germany. However, instead of a rising financial integration and concentration of activity in one place, we observe that Berlin seems to become less important over time, indicating a trend towards further decentralisation. In this paper we explore listing decisions of firms on different stock exchanges in order to understand the existence and persistence of the decentralised stock market system.

Raising new capital for firms is easier in large and liquid markets, which would lead to a rather centralised system. And indeed, we find evidence that if financial needs of a firm are large it is more likely to list on a larger market, i.e., in Berlin. In contrast, small firms tend to list on regional stock exchanges. Differences in market microstructure are unlikely to explain this observation. Corporate and stock exchange legislation were national laws since 1897. Moreover, differences with respect to trading

fees and listing costs were quite small. Asymmetric information between issuer and investors and a patriotic home bias are more likely candidates to explain market fragmentation. We show in a cross-section of firms in 1913 that intra-German state borders and distance between headquarter and stock exchange have a strong negative impact on listing decisions – although this seems to become less relevant over time, as indicated by our IPO data for the period 1897 to 1913. Nonetheless, a patriotic home bias plays a role for listing decisions of German joint-stock companies during the early 20th century. This can be driven by preferences of local investors to invest in their home market. Regional stock exchanges seem to persist, since they were more efficient in matching supply and demand of local firms and investors, thereby keeping capital within the regions and fostering economic development.

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