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City Size and Financial Development

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Abstract. Stock markets tend to be few in each country, often unique, and located in the largest cities. Typically, much of the economic activity relating to the stock market takes places in this large city. These facts suggest that agglomeration economies are important. In other words, productivity is enhanced for stock market-workers and -firms located in a large city. After discussing this prima facie evidence of agglomeration economies, we consider the cross-country implications. Countries with larger cities will have better developed stock markets because they can benefit from stronger agglomeration economies surrounding the stock market. This provides an economic theory of financial development which is complementary to the standard legal and political theories of financial development. We establish that city size is a robust determinant of stock market size and activity, but not of other types of financial development (banks). We show that this is not driven by reverse causality and that it is not driven by small or new stock markets. Finally, we show that alternative measures of a country's geography, such as urbanization and the population of the second largest city, do not predict stock market development, implying that we do not capture some alternative geographic effect. We conclude that there is a significant positive effect of city size on stock market development, that this reflects agglomeration economies. This explains why countries with large cities have better developed stock markets. (*JEL* G10; G20; O16; R10)

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1. Introduction

Financial development varies dramatically across countries, with large possible effects on economic performance and welfare. Explanations for this variation have mainly fallen into one of two categories: legal (e.g. La Porta, Lopez-de-Silanes, Shleifer and Vishny, (1997, 1998)), or political (e.g. Rajan and Zingales (2003), Braun and Raddatz (2004), Ashoka and Mody (2005), Perotti and von Thadden (2006) and Benmelech and Moskowitz (2006)). These two strands of the literature have made a forceful case that politics, regulation and legal systems influence financial development. What has not been emphasized in the literature is the extent to which economic factors influence financial development.[1]

It must be considered a striking fact that almost every country has a single (important) stock market. Similarly, that city is usually where most activity takes place (i.e. where work is done).[2] Also, the city with the stock market tends to be each country's largest city. With three exceptions, we identify every country's largest city as the main stock market city in our sample of 71 countries.[3] The largest city is not necessarily the capital. For example, Italy, Morocco, Germany, India, Canada and Israel all have the stock market in a city different from the capital. In each case, this city is larger than the capital.[4]

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[1] Greenwood and Jovanovic (1990) is an early exception.

[2] The smaller US stock exchanges were relatively more important in the nineteenth century. Werner and Smith (1991) report that Philadelphia had 13.9% of the volume of New York in 1837-40 compared to much less now, whereas Glaeser (2005) describes Philadelphia and New York as close rivals as centers for trading stocks and bonds. The reasons for a possible trend toward increasing concentration are beyond the scope of this paper.

[3] In Ecuador, the stock market is in the capital Quito, 1.4 million inhabitants, but Guayaquil is the largest city, 2.1 million. In Poland, Warsaw is the stock market city and has a population of 2.2 million whereas Katowice 3.1 million. In Germany, Rhein-Main (containing Frankfurt) is the stock market city and has a population of 3.7 million, but Rhein-Ruhr North is larger with a population of 6.5 million.

[4] The measure of city size is important. This can be seen clearly from the example of Italy. Our variable, measuring total population of an urbanized agglomeration, puts Rome (capital) at 2.7 million in 2000, and Milan (stock market city) at 4.2 million. However, official Italian sources gives population in the cities proper as 2.55 for Rome and 1.31 million (2004) for Milan.

All these facts imply that brokers, traders and market participants are concentrated in a single location with large population. In theory, there are several reasons that trade will tend to concentrate, for example because buyers prefer to have more local variety (Stahl (1982)) or more local competition (Gehrig (1988)).[5] That agglomeration economies are important in practice for the financial sector is also emphasized by Glaeser (2005): *"there are two major agglomeration economies at work. First, the role of the dense city as a center for idea flows... The high value of knowledge meant that being in the city was particularly valuable. It may even be that New York's high density levels… helped New York finance continue to thrive because those high density levels are particularly conducive to chance meetings, regular exchanges of new ideas and the general flow of information…. (Second,) The costs of delivering manufactured goods depends only on transportation technology, but the cost of delivering services depends both on technology and on the value of the time involved by the participants in the transaction. Because services are by definition face-to-face, during an era of rising wages, there is an increased incentive to agglomerate these activities."* These agglomeration economies imply a positive effect of city size on stock market development. This paper explores the implications of this across countries, what we might call an agglomeration theory of financial development.

We show that the size of a country's largest city exerts a positive effect on measures of stock market development, but not on other forms of financial development. The result holds when we include controls reflecting real income levels and legal origin. Our base line estimates suggest that a one standard deviation increase in the log of city population (0.98) corresponds to a quarter of a standard deviation increase in the log of market capitalization (a 41% increase). While fairly large, the effect explains less of the cross-country variation than legal variables or living standards (in the sense that city size contributes less to R-squared). Hence, we find that there is support in the data for our "agglomeration theory of stock marked development", but that this seems to be quantitatively less important than the legal system in explaining the international cross-section.

We also show that our findings are robust to variation in the timing of variables, the inclusion of geographical controls and to changes in the sample composition. At this point, we have not been able to contrast the agglomeration theory with political alternatives. We hope to add this in future versions of the paper.

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[5] See also Ellison, Fudenberg and Möbius (2004) for a recent paper on the unlikely coexistence of multiple markets.

The rest of this paper is organized as follows. Section two discusses existing literature briefly, section three presents data and sources, section four presents basic cross-sectional results, and section five robustness tests. Section size concludes.

2. Theory, literature

Few papers have addressed the relationship between finance and agglomeration economies. Helsley and Strange (1991) suggest that local capital markets may be more liquid in large cities where the secondary market for collateral assets is deeper. This is a theory of local capital markets, and is perhaps naturally thought of as regarding local bank markets.

More closely related to the current research, Glaeser (2005) assigns credit for New York City's performance over the last few decades in large part to growth in the financial sector, and argues that strong agglomeration economies explain why this growth took place in New York. Such agglomeration economies may operate between within the financial sector since much of the financial sector chose to locate in the same city. They presumably also operate between finance and other sectors, since New York is the city with the largest non-finance population.

To get a sense of the magnitude of these economies of agglomeration, we construct a simple calibration. Of our 70 countries with stock market data as well as city size data, 67 countries have the stock market in the largest city according to our UNPD city size data (see the next section for details), and three in the second largest. For the 38 countries with data on city size for at least two cities in 2000, the median log difference of populations is 0.69 (the largest city is twice the size of the second largest city).

Consider the following example of cities and worker productivities. Assume each city has a specific productivity level and that this productivity is the sum of a city-specific normal shock with mean zero and standard deviation 0.05 and a city size effect. The city size effect is given by some factor α times the log of city population. A high α corresponds to strong agglomeration economies. For simplicity, disregard heterogeneity across countries and assume that all countries have a second city which has log population 0.69 less than the largest city. Note that the productivity shock difference between two cities is normal and has a standard deviation of 0.1. Finally, assume that the stock market is located in the city where productivity of workers is higher. We can now calibrate α to match the empirical fact that 96% of stock exchanges are located in the largest city (i.e. the cumulative normal for α times 0.69 should be equal to 0.96). The estimate of α turns out to be 0.25. This implies that doubling city size

increases productivity by 19%. We disregarded heterogeneity and locational dynamics in estimating this, and abstracted completely from the micro foundations of agglomeration economies, so the number should only be seen as a rough estimate. The estimate of α can now be compared to agglomeration economies estimated across all sectors. For example, Rosenthal and Strange (2003) suggest that the average productivity increase for doubling city size is in the 3-8% range, based on a literature survey. Hence, our calibration suggests that agglomeration economies are large for stock markets, but of the same order of magnitude as overall agglomeration economies.

We take this to suggest that countries with larger cities are likely to have better developed stock markets. This is the agglomeration economies theory of stock market development. To test the theory, we relate stock market development to city size, which is simply the log of population. We follow the literature in using market capitalization and trading volume as measures of stock market development. It should be noted that the micro foundations of the relevant agglomeration economies are not explored at all. This remains for future work. The theory assumes that city size is exogenous, an assumption which is examined in the robustness section.

3. Data

To maximize our sample size, we start from all the countries from Beck et al (2001) for which we have financial development variables, and then exclude those for which we cannot get city size data. Below, each variable is described in detail.

City data

We identified the stock market city of each country by searching the web for country name and the words "stock market", and letting the location of the first linked domestic stock market be the stock market city of that country. In most cases, this provides anticipated result (e.g. New York in the US, London for the UK, Shanghai for China, Paris for France, and Frankfurt for Germany). The location of each stock exchange was taken to be its legal address as reported on its web page. The results of this process were checked against the city listings for each country in World Federation of Stock Exchanges publications, and no discrepancies were found.

Measuring city size is complicated. Conceptually, what constitutes the borders of a city is not obvious. Political definitions of cities can be used, of course. Political entities are normally the units of national statistics and hence provide for good data availability. However, political boundaries are determined by historical accident, political forces, etc. Therefore, political units may not correspond to economically meaningful entities. An alternative, economic definition could be based on the propensity of people in an area to interact with each other. The US Census uses Metropolitan Statistical Areas, defined as urban areas that either has a core city of at least 50,000 inhabitants within its corporate limits, or contain an urbanized area of at least 50,000 inhabitants and have a total population of at least 100,000, or multiple such areas if sufficient commuting takes place between them.

Unfortunately, such an economic definition of a city, while conceptually attractive, is difficult to apply across countries.[6] The United Nations Population Division provides population data for urban agglomerations, based on a consistent definition. An urban agglomeration is defined as containing "the population within the contours of contiguous territory inhabited at urban levels of residential density without regard to administrative boundaries. Whenever possible, data classified according to the concept of urban agglomeration are used. However, some countries do not produce data according to the concept of urban agglomeration but use instead that of metropolitan area or city proper. If possible, such data are adjusted to conform to the concept urban agglomeration." Population size data is available for all capitals and cities with more than 750,000 inhabitants (in 2000) for every five years starting in 1950. We use this measure of city size throughout the paper. Table 1 presents some summary statistics.

The size of each country's largest city apart from the city where the stock market is located is also used. In 35 cases this is simply a country's second largest city. In three cases it is the largest city (Ecuador, Germany and Poland). In the remaining cases, there is no other agglomeration with data on population for 2000, or there is no agglomeration of sufficient size to be included in the UN data.

Older city size data is collected from Chandler (1987) for the years 1850, 1900 and 1925 to the extent possible.

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[6] Improved data on agglomerations across the globe is a topic of current research. See e.g. Balk et al (2004).

Other variables

We use several measures of financial development – stock market capitalization over GDP, stock market value traded of GDP and private credit over GDP (used by e.g. Rajan Zingales (1998), Beck and Levine (2002)). All measures are from Beck et al (2001). Educational attainment data is from Barro and Lee (2001). Financial employment data for OECD countries is taken from the STAN database for Industrial Analysis. Two sectors are used. First, we use the fraction of national employment in "Finance, Insurance and Real Estate" (FIRE) for OECD members for 2000. Finer categories, such as "Financial intermediation except insurance and pension funding" exist in the database but contain very few observations. We therefore focus on the wider measure of the fraction of total employment in the FIRE sector.

We also use the variable urbanization – the fraction of a country's population living in urban locations – is reported by the United Nations Population Division, Department of Economic and Social Affairs.

4. Cross-sectional results

This section tests the main hypothesis of the paper, that stock markets are more developed when a country's stock market city is larger. Table 3 presents results of cross-sectional regressions for 2000. The effect of a large city on our two measures of stock market development, total market capitalization over GDP and total value trade over GDP, is shown in columns one to six. We then contrast this with the dependent variable private credit over GDP.

Columns one and four show that without controls, city size exerts a strong positive (and significant) effect on stock market development. The magnitudes are important both for market capitalization and turnover. For market capitalization, a change in city size from the 25th percentile of our sample to the 75th percentile, meaning approximately from 1.3 million to 6.8 million inhabitants, corresponds to a change in the log of market capitalization of 0.61, or an 84% increase. This corresponds to approximately a third of the 25-to-75 percentile difference in market capitalization. Alternatively, a one standard deviation increase in the log of city size (0.99) corresponds to a quarter of a standard deviation increase in the log of market capitalization. The effect of city size is larger for turnover by any measure. Despite the economically important estimated effects, the explanatory power of city size is limited, and R-squared is only 0.05 and 0.07 in the two regressions. This can be compared to legal system

dummies which have an R-squared of 0.22 and 0.16 (without further controls) for the two dependent variables.

Given the data limitations, i.e. the approximately 70 countries included in our sample, the number of controls we can include in cross-sectional regressions is limited. However, columns two and five introduce a key control variable, the level real GDP per capita. This variable adds considerable explanatory power, and is itself highly significant. As expected, economic development exerts a strong positive force on stock market development. In addition to controlling for the effect of wealth itself, GDP per capita may capture the effect of many variables related to wealth. Columns three and six also add legal origin dummies as control variables (socialist legal origin is excluded). These dummies are jointly significant for market capitalization (F-test significance 0.001), and line up as usual (see e.g. La Porta et al (1998)) – English legal origin has the largest positive effect. They are not significant either jointly or individually in the turnover regression. Including these controls reduces the magnitude (from 0.35 to 0.28) and significance (from 0.6% to 5%) of the city size coefficient for market capitalization. The estimated coefficient still implies an economically large effect. For example, a one standard deviation increase in city size implies 32% higher market cap. The magnitude and significance of the turnover variable is barely affected by including controls.[7]

Columns seven, eight and nine present the effect of city size on private credit, used here for a "placebo test". The variable private credit reflects financial intermediation, but is unrelated to the stock market. If the relation between city size and stock market development was caused by an omitted variable, we might expect private credit to be affected by city size as well. If agglomeration economies affecting the stock market are the cause of a city size-stock market development link, we expect private credit to be unaffected (or marginally affected at most).[8] The effect of city size on private credit is consistently small and insignificant, and of inconsistent sign. It seems fair to conclude that there is no relation between city size and private credit. If city size captured something besides agglomeration economies, we would expect private credit to be affected by city size as well. The fact that private credit is not

[7] Including the squared value of (the log of) GDP per capita in order to allow for non-linearities does not affect the estimated coefficient on city size.

[8] There might for example be a small negative effect if stock markets and institutional credit are substitutes (or a positive effect if there are some agglomeration benefits for private credit too). These effects should be insignificant compared to the direct effect on stock markets.

affected therefore constitutes indirect confirmation of our theory, since it rules out many alternative explanations for our findings.[9]

The results in Table 3 demonstrate the main implication of the agglomeration economy theory of stock market development. The next sub-section considers data on stock market inputs.

Outputs vs. inputs

If agglomeration economies operate on stock market development, productivity of workers is higher in countries with larger cities. For almost any market structure, this can be expected to lower prices of output. This is a prediction that might well be testable with appropriate data. Comparable cross-country data on prices of stock market-related services, is not currently available, and collecting it is beyond the scope of this paper. We test instead the effect of city size on aggregate inputs. The prediction here is not clear unless we can assign a price elasticity of stock market-related services. For a broad category of goods, with few close substitutes, it is quite possible that price elasticity is low. If output demand rises slowly with productivity, inputs required may in fact drop. For example, consider a representative individual with a fixed amount of savings and a fixed demand for financial intermediation (stock market services). As productivity goes up, output remains the same, so inputs must be falling.

For input measures, we focus on employment, which is available by sector from the OECD. Employment in Finance, Insurance and Real Estate (FIRE) is available for 23 countries. We use aggregate national employment, which is the quantity of interest.[10]

Table 4 presents regressions of the fraction of national employment in each sector on city size and controls. We find a significant negative effect for FIRE, with an elasticity of 2.1% to 2.5%. This implies that a one standard deviation in city size reduces sector employment by 2%

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[9] The combination of a positive effect on stock market development and the insignificant effect on bank development (private credit) implies that countries with larger cities naturally tend to have more market-based financial systems.

[10] No comparable data on capital or other inputs has been found, so we restrict attention to employment. Ideally, we would use the narrower measure employment in Financial intermediation except insurance and pension funding (FIN). While FIN more accurately corresponds to stock market-related activity, it is available for many fewer observations (seven), so we do not use it for regressions.

to 2.5%. The coefficient for FIN, the narrower sector, is much higher, but estimated with little precision. Without taking the estimate too seriously (there are only seven observations) we note that again, employment seems to be decreasing with city size.

These results imply that the productivity gains associated with larger cities result in reduced employment. This is what we expect if there is low price-elasticity for the output of stock market related services, which to our knowledge has never been directly tested. Low price elasticity seems plausible, however, mainly because the amount of intermediated capital in an economy is possibly fairly fixed regardless of the productivity of workers associated with its intermediation.[11]

5. Robustness and extensions

We now turn to the robustness of the main results. This section considers, in turn, several potential concerns with our main basic results.[12]

Timing

Do our main results hold for years apart from 2000? While city size is very slow moving, market capitalization and trade volume vary from year to year. In Table 5, we examine the effect of city size on averages for 1990 to 1999. The averages are straight averages of the values for all available years during the period. The effects on market cap and volume trade are positive and significant except in one specification, where the t-stat falls just outside the 10% limits and the coefficient estimate is very similar to other specifications. In other words, 2000 does not appear to be a special year for our purposes. However, the effect is lower for the averages than for the 2000 cross-section, perhaps reflecting overall growth in market values and trade volumes.

Rajan and Zingales (2003) point out that financial development has not advanced in tandem in the world and that the explanatory power of standard variables such as legal system

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[11] If this sounds counter-intuitive, this may be because rich countries have more stock market-related workers than poor countries. This fact most likely reflects the income elasticity of output, not its price elasticity, however.

[12] We have also experimented with various weights for regressions, including based on country GDP and country GDP/capita. The results, not reported, are consistent with the unweighted results reported in Table 3.

varies with timing. It may therefore be interesting to examine the performance of city size in earlier times. City size data is available far back (although probably not as precise), but historical data on stock market development is more difficult. A small sample is provided by Rajan and Zingales (2003), however, for 1913 (and some later years). The data is too limited for real tests, but Graph 1 plots city size in 1900 vs. market capitalization in 1913 for the countries of the main sample for which Rajan and Zingales provide data on market capitalization (twenty one countries). The correlation is positive but just not significant. This provides very weak evidence that city size was a predictor of stock market development in an earlier era as well as today. Of course, no controls were used, and no trade-based measure of stock market development has been examined. Also, stock market locations have changed in some cases (Berlin was the seat of the main German exchange in the early 20th century), which has not been taken into account.

Robustness in subsamples

To investigate robustness to potentially influential groups of observations, we now vary the sample in various ways. The small overall sample size limits the extent to which it is possible to exclude data points without losing statistical power. However, it is feasible to exclude small groups of observation to investigate if they have influenced the results.

Table 6 presents regression in varying samples. Column one reprises column two of Table 3, and is included to simplify comparisons. Column two and three exclude single city countries and very young stock markets (less than eight years in 2000). In both cases, the significance of city size drops somewhat, but the variable remains significant and the coefficient magnitude is unaffected. Hence, the effect of city size is not driven by city-states like Kuwait and Singapore or smaller countries with only a single agglomeration such as Uruguay. Similarly, the city size effect is not due to very young stock markets.

In column four and five, the sample is divided into large and small countries, based on a cut-off of 20 million inhabitants.[13] The effect of city size is more pronounced in the smaller countries, and may not be present at all in the larger sub-sample (the coefficient is similar to other specifications, but is not significant). Taking this large country-small country difference at face value, agglomeration economies must be more important for small countries. Why this

[13] Any cut-off between 19.6 and 20.7 million makes the two sub-samples similar in size.

might be the case is left for future work. An important caveat is that the sub-samples are small, so that the difference results should be taken with a grain of salt.

Reverse causality

A potential concern with our results is that city size may be endogenous to financial development. In fact, Glaeser (2005) does emphasize the role of the financial sector in New York's resurgence over the last few decades. If this explained our findings, it would not reject the influence of agglomeration economies in stock markets. Glaeser (2005) argues that agglomeration economies drive New York's prominence in finance, so reverse causality would *also* reflect agglomeration economies. However, in cross-sectional regressions, countries with a bigger stock market would have larger cities because the stock market was more developed. This would reflect agglomeration economies, but would not explain why a certain country has more developed markets. To address this issue we exploit a suggestion from Glaeser (2005): that the financial sector was much smaller historically. We can therefore substitute lagged city size for current city size, and get a measure of city size much less likely to be affected by recent growth in finance.

We use 1950 city size, the oldest available from the same source, in place of contemporaneous city population. As expected, lagged city size is correlated with current size, even at the 50 years horizon. The raw correlation between 2000 and 1950 city sizes (in logs) is 0.76 and the rank correlation is 0.77 (both correlations are highly significant). Table 7 reproduces the specifications of table three, regressing stock market capitalization and trade on city population with and without controls for real GDP/capita and legal origin. Of six specifications, city size always enters positively and significantly five times. The magnitude is consistently a little bit less than for contemporaneous city size. These results imply that reverse causality (*from* stock market development *to* city size) is unlikely to be the cause of our results.

Population density, geography

So far, we have not controlled for country size. Table 8 includes country population as a control variable. Country population is strongly related to city size (the correlation in logs is 0.7). Columns one and two show that country population by itself is not significant either in the largest possible sample or in the sample where data on city size is available. The third and fourth column include city size and, in column four, real GDP per capita. Country population is not significant in any specification. These results suggest that city size is not a proxy for the

size of a country, despite the correlation with city size. The result in column four is less comforting. The joint significance is very high for city and country size, so this specification indicates that they jointly predict market development in a robust way. The general result seems to be that country size never adds explanatory power to speak off, and never enters significantly on its own. We conclude that if anything, city size is the driver of market capitalization.[14]

We now attempt to address more general omitted geographical variables. For example, could it be that city size proxies for population density, urbanization or some other country-wide characteristic, and that this factor in turn affects stock market development? We use four alternative geographical measures to show that this does not seem to be the case. The first measure, relative size, is the fraction of a country's population in the main stock market city, ranging from 1.2% (Mumbai, India) to 85% (Hong Kong, Hong Kong). City population (second city) is the population of a country's largest city except for the stock market city itself. This city size ranges from 755 thousand in Kumasi, Ghana to 13 million in Calcutta, India. In most cases, the city is the second largest city of the country. Finally, we use urban population, the fraction of a country's population living in cities in 2000, ranging from 23.2% in Bangladesh to 91.5% in Israel and 100% in Hong Kong and Singapore. All of these measures capture aspects of a country's geography that are plausibly linked to city size. Since neither measure is directly related to the extent of agglomeration economies in the city where the stock market is located, they offer a way of ruling out alternative explanations of the city size-stock market development link.

Table 9 presents regression results with alternative geographic measures. Column one recapitulates the basic specification from Table three, column two for comparison. As can be seen from columns two to four, neither of the alternative variables has a significant relation with market capitalization (column one is repeated from Table three, and included for comparison purposes only). When both size of the stock market city and one of the three alternative variables are included, the alternatives remain insignificant, whereas stock market city size remains significant in two of three specifications. The one case where significance

[14] Country population is probably a better measured variable than city size, since there is less ambiguity about borders of countries than of city borders. Including two correlated variables with different degrees of measurement error is generally problematic of course, and may bias any comparison (to the advantage of the variable with less measurement error).

drops is the second city regressions, which sees a substantial reduction in sample size (many countries have no second city).[15] The general conclusion of this must be that city size provides a better statistical fit than the alternatives. This suggests that city size is not just capturing some general geographic factor, but that city size itself indeed the driving force behind the results.

6. Conclusions

We note two facts about stock markets: there are few in each country and they tend to be located in the largest cities. Both facts suggest that there are strong agglomeration economies affecting stock markets. Our back of the envelope calculation suggests that a doubling of city size implies a 19% increase in productivity. Whether this is the true number or something lower, we have reason to suspect that having a large city benefits a country's stock market development. In this paper, we examine this hypothesis, which we call an agglomeration theory of financial development. Indeed, we find a positive effect of city size on stock market development. The effect is robust to variations in sample composition, controls included, and the timing of variables. It is of economically highly meaningful magnitude, but explains less of the cross-country variation than legal origin variables.

We have not yet contrasted the agglomeration theory with political theories of financial development, such as Rajan and Zingales (2003), Ashoka and Mody (2005) and Perotti and von Thadden (2006). We hope to extend the paper in this direction in the future.

Are there other implications of the agglomeration theory? Some are easy to spot. If cross-country frictions diminish in the future, stock markets are likely to concentrate to some cities. In the European Union, for example, London (7.7 million) and Paris (9.7 million) are poised to gain at the expense of smaller cities if cross-listings and cross-border trade become easier.

Are there agglomeration economies in other areas of finance? Perhaps, but it seems less likely. Only stock markets present the strong concentration we take as prima facie evidence of agglomeration economies. Notably, banks are spread out in comparison, and hence likely less affected by agglomeration.

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[15] If the original sample is used (with a zero value for size and a dummy set to one for countries with no second city) the estimated coefficient is 0.40, significant at the 5% level (t-stat 2.38).

As for policy implications, they are perhaps less obvious. In the short run, city size is outside the influence of policy makers. Perhaps we can conclude tentatively that aiming to create a financial center, in third world countries for example, is less plausible for small than for large cities.

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Graph 1 – City size and market capitalization in 1913

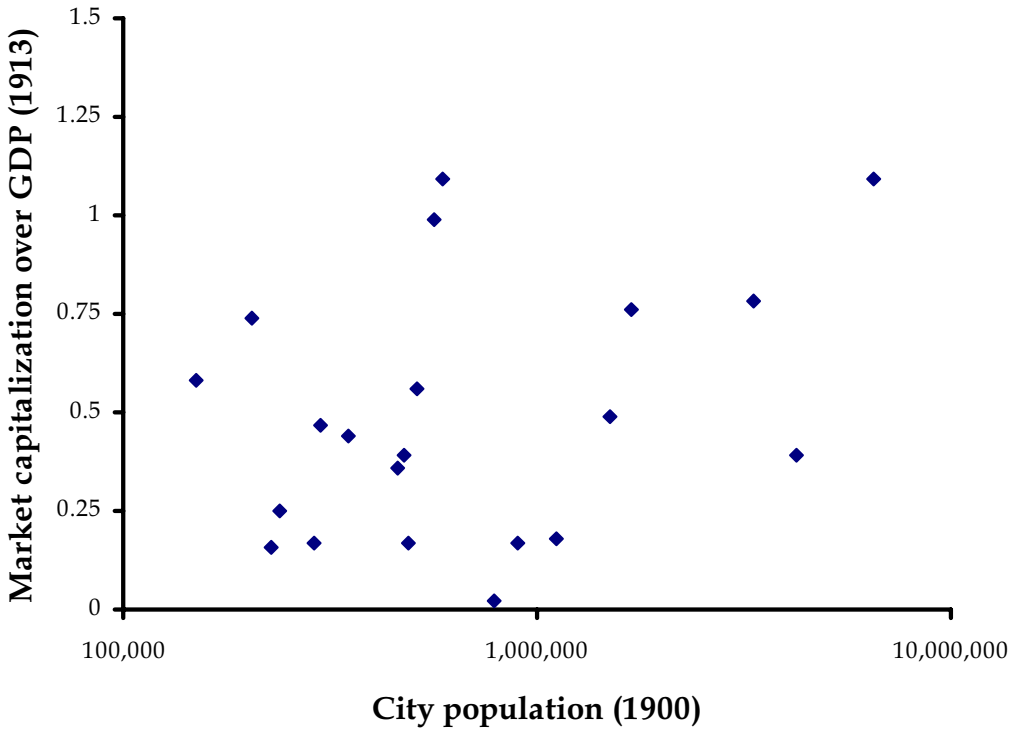

Table 1 – City sizes

Summary of city size data from UN. A city is defined as an urban agglomeration: "an agglomeration contains the population within the contours of contiguous territory inhabited at urban levels of residential density without regard to administrative boundaries".

	City (population, million)			
	1950	**1975**	**1995**	**2000**
Largest city	New York-Newark (12.3)	Tokyo (26.6)	Tokyo (33.6)	Tokyo (34.5)
Second largest city	Tokyo (11.3)	New York-Newark (15.9)	New York-Newark (16.9)	Mexico City (18.1)
Third largest city	London (8.4)	Shanghai (11.4)	Mexico City (16.8)	New York-Newark (17.9)
Fourth largest city	Paris (5.4)	Mexico City (10.7)	Sao Paulo (15.9)	Sao Paulo (17.1)
Number of cities >1M	86	195	347	387
Total population of top 10 cities, million	67.9	119	157	166

Table 2A – Summary statistics

Summary statistics of key variables. Population is measured in thousands. Market capitalization, value traded and private credit are divided by GDP and are taken from Beck et al (2001). All variables refer to 2000.

Variable	Observations	Average	Minimum	25th percentile	Median	75th percentile	Max
Population	72	5,110	761	1,316	2,669	7,541	34,450
Market capitalization	75	0.61	0.00	0.13	0.35	0.81	3.75
Value traded	72	0.50	0.00	0.01	0.11	0.66	3.27
Private credit	69	0.54	0.04	0.21	0.50	0.82	1.62

Table 2B – Correlations

Pair-wise correlations between selected variables. All data is for 2000. City size is log of city population in 2000. Common Law and Civil Law (French) are dummies for legal origin. Population, real GDP/capita, market capitalization over GDP and private credit over GDP are in logs. One star (*) represents significance at the 10% level, two stars at the 5% level, three stars at the 1% level.

	City size	GDP	Common Law	Civil Law	Market cap	Value traded	Private credit
City population	1						
Real GDP/capita	0.03	1					
Common Law (English)	0.17	-0.15	1				
Civil Law (French)	0.06	0.06	-0.55***	1			
Market capitalization	0.21*	0.66***	0.11	0.03	1		
Value traded	0.26**	0.64***	-0.03	-0.08	0.75***	1	
Private credit	0.07	0.69***	0.05	0.04	0.70***	0.67***	1

Table 3 – Financial development and city size

Regression of financial development measures on population of main stock market city and control variables. All dependent variables are in logs. All variables refer to 2000 values. Legal origin variables represent dummies for legal origin (socialist origin is omitted). Robust standard errors are reported under coefficients. One star (*) represents significance at the 10% level, two stars at the 5% level, three stars at the 1% level.

	Market capitalization over GDP			Value trade over GDP			Private credit over GDP		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
City population (log)	**0.32***	**0.35*****	**0.28****	**0.60*****	**0.67*****	**0.76*****	**0.06**	**0.10**	**-0.02**
	0.17	0.12	0.14	0.20	0.20	0.22	0.11	0.08	0.12
Real GDP per capita (log)		**1.48*****	**1.37*****		**2.27*****	**2.25*****		**0.91*****	**0.80*****
		0.20	0.17		0.26	0.29		0.11	0.10
English legal origin			**1.68****			**0.737**			**1.10*****
			0.365			0.502			0.224
French legal origin			**1.08****			**-0.304**			**0.819*****
			0.362			0.498			0.244
German legal origin			**0.819**			**0.043**			**1.22*****
			0.56			0.911			0.240
Scandinavian legal origin			**1.34****			**1.04**			**0.392**
			0.55			0.64			0.250
R-squared	0.05	0.50	0.60	0.07	0.54	0.60	0.00	0.45	0.53
N	72	71	71	69	68	68	66	66	66

Table 4 – Inputs: finance employment

Regression of employment in the finance, insurance and real estate (FIRE) sector, as a fraction of total employment, on population of main stock market city and control variables. All variables refer to 2000 values. Legal origin variables represent dummies for legal origin (socialist origin is omitted). Robust standard errors are reported under coefficients. One star (*) represents significance at the 10% level, two stars at the 5% level, three stars at the 1% level.

	FIRE employment, fraction of total		
	(1)	(2)	(3)
City population (log)	**-0.021*** **	**-0.022*** **	**-0.025*** **
	0.003	0.003	0.005
Real GDP per capita (log)		**0.036*** **	**0.05**
		0.011	0.03
English Legal Origin			**-0.00**
			0.03
French Legal Origin			**-0.00**
			0.02
German Legal Origin			**0.00**
			0.02
Scandinavian Legal Origin			**-0.01**
			0.02
R-squared	0.51	0.63	0.64
N	23	23	23

Table 5 – Lagged dependent variables

Regression of stock market measures on population of main stock market city and real GDP per capita. Dependent variables refer to 2000 values. The dependent variables are averages for the 1990-99 period. Robust standard errors are reported under coefficients. One star (*) represents significance at the 10% level, two stars at the 5% level, three stars at the 1% level.

	Market capitalization over GDP, 1990-99 average		Value trade over GDP, 1990-99 average	
	(1)	(2)	(3)	(4)
City population (log)	**0.204**	**0.258****	**0.646****	**0.700*****
	0.14	0.102		0.171
Real GDP per capita (log)		**1.08*****		**2.08*****
		0.17		0.254
R-squared	0.03	0.38	0.09	0.55
N	71	70	72	71

Table 6 – Sub-samples

Regression of stock market capitalization over GDP on population of main stock market city and control variables. All variables refer to 2000 values. Robust standard errors are reported under coefficients. Single city countries are those where there is UN population data for only one city. Newest stock markets the 10% of countries in the sample with the youngest stock markets (started in 1992 or later). Large countries have 20 million inhabitants or more, small have less than that. One star (*) represents significance at the 10% level, two stars at the 5% level, three stars at the 1% level.

Sample:	Full sample	Excluding single city countries	Excluding newest stock markets	Large countries	Small countries
	(1)	(2)	(3)	(4)	(5)
City population (log)	**0.35***** 0.12	**0.22**** 0.10	**0.19*** 0.11	**0.21** 0.31	**0.64***** 0.75
Real GDP per capita (log)	**1.48***** 0.20	**1.04***** 0.213	**0.98***** 0.15	**0.98***** 0.19	**1.10***** 0.23
R-squared	0.50	0.38	0.34	0.33	0.46
N	71	66	62	35	35

Table 7 – Lagged city size

Regression of financial development measures on population of main stock market city and control variables. All variables except city population refer to 2000 values. City population refers to 1950. Robust standard errors are reported under coefficients. One star (*) represents significance at the 10% level, two stars at the 5% level, three stars at the 1% level.

	Market capitalization over GDP			Value trade over GDP		
	(1)	(2)	(3)	(4)	(5)	(6)
City population (log), 1950	**0.43*** **	**0.08**	**0.148***	**0.93*** **	**0.47** **	**0.58*** **
	0.11	0.10	0.088	0.15	0.17	0.17
Real GDP per capita (log)		**1.47*** **	**1.28*** **		**1.93*** **	**1.69*** **
		0.22	0.20		0.35	0.37
English Legal Origin			**1.82*** **			**1.54** **
			0.35			0.52
French Legal Origin			**1.10*** **			**0.13**
			0.37			0.55
German Legal Origin			**0.94***			**0.81**
			0.54			1.01
Scandinavian Legal Origin			**1.33** **			**1.56** **
			0.56			0.75
R-squared	0.12	0.45	0.60	0.24	0.54	0.59
N	71	70	70	68	67	67

Table 8 – Country vs. city size

Regression of stock market capitalization over GDP on population of main stock market city and control variables. Column two excludes observations where data on city size is not available. All variables refer to 2000 values. Robust standard errors are reported under coefficients. One star (*) represents significance at the 10% level, two stars at the 5% level, three stars at the 1% level.

	Market capitalization over GDP			
	(1)	(2)	(3)	(4)
City population (log)			**0.67****	**0.05**
			0.32	0.24
Country population (log)	**0.07**	**0.24**	**-0.66**	**0.57**
	0.16	0.26	0.52	0.41
Real GDP per capita (log)				**1.59*****
				0.20
R-squared	0.00	0.01	0.07	0.52
N	98	71	71	71

Table 9 – Alternative geographical measures

Regression of stock market capitalization over GDP on population of main stock market city and control variables. All variables refer to 2000 values. Relative size is the fraction of a country's population in the main stock market city. City population (second city) is the population of a country's largest city except for the stock market city. Urban population is the fraction of a country's population living in cities. Robust standard errors are reported under coefficients. One star (*) represents significance at the 10% level, two stars at the 5% level, three stars at the 1% level.

	Market capitalization over GDP							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
City population (log)	**0.35****				**0.33****	**0.22**	**0.35*****	**0.45***
	0.12				0.12	0.24	0.12	0.24
Relative size		**-0.70**			**-0.48**			**-3.54**
		1.30			1.11			2.51
City population (log), second city			**0.05**			**-0.11**		**-0.51***
			0.14			0.22		0.29
Urban population				**-0.00**			**-0.01**	**-0.018***
				0.01			0.01	0.010
Real GDP per capita (log)	**1.48*****	**1.55*****	**1.26*****	**1.50*****	**1.54*****	**1.27*****	**1.76*****	**1.89*****
	0.19	0.21	0.18	0.25	0.20	0.18	0.27	0.24
R-squared	0.50	0.46	0.55	0.43	0.51	0.56	0.52	0.65
N	71	70	38	96	70	38	71	37

Appendix Table A1 – City list

Tabulation of city size (population in millions) for 1950 and 2000 from UN data and for approximately 1850 from Chandler (1987). Data from the United Nations Population Division refers to the urban agglomeration containing the city where the stock market is located, whereas 1850 data from Chandler refers to a city. Countries with stock market capitalization data in Beck et al (2001) but no population data for the stock market city in 2000 are: Abu Dhabi (United Arab Emirates), Blatyre (Malawi), Bratislava (Slovak Republic), Bridgetown (Barbados), Colombo (Sri Lanka), Doha (Qatar), Gaborone (Botswana), Suva (Fiji), Guatemala (Guatemala), Kathmandu (Nepal), Kingston (Jamaica), Kishinev/Chisnau (Moldova), Ljubljana (Slovenia), Luxembourg-Ville (Luxemburg), Manama (Bahrain), Mbabane (Swaziland), Muscat (Oman), Nicosia (Cyprus), Port Louis (Mauritius), Port-of-Spain (Trinidad and Tobago), Reykjavik (Iceland), Tallinn (Estonia), Valletta (Malta), Vilnius (Lithuania), Wellington (New Zealand), Windhoek (Namibia), Zagreb (Croatia).

Country	Stock market city	1850	1950	2000
Argentina	Buenos Aires	74	5,041	12,583
Australia	Sydney	48	1,696	4,099
Austria	Vienna	426	1,787	2,158
Bangladesh	Dhaka		417	10,159
Belgium	Brussels	210	806	962
Bolivia	La Paz		319	1,394
Brazil	Sao Paulo		2,313	17,099
Bulgaria	Sofia	19	547	1,133
Canada	Toronto	27	1,068	4,607
Chile	Santiago	84	1,330	5,266
Colombia	Santa Fé de Bogotá	53	676	6,771
Costa Rica	San José		148	998
Cote d'Ivoire	Abidjan			3,057
Czech Republic	Prague	117	1,002	1,181
Denmark	Copenhagen	135	1,216	1,079
Ecuador	Quito	36	206	1,357
Egypt, Arab Rep.	Cairo	256	2,436	10,398
El Salvador	San Salvador		194	1,339
Finland	Helsinki		365	1,019
France	Paris	1,314	5,424	9,693
Germany	Rhein-Main		2,295	3,688
Ghana	Accra		167	1,674
Greece	Athens	30	1,783	3,179
Guatemala	Guatemala City	40	428	908
Hong Kong, China	Hong Kong	33	1,631	6,807
Hungary	Budapest	156	1,618	1,787
India	Mumbai (Bombay)	575	2,981	16,086
Indonesia	Jakarta	60	1,452	11,018
Ireland	Dublin	263	626	989
Israel	Tel Aviv-Jaffa		418	2,752
Italy	Milan	182	3,633	4,183
Japan	Tokyo	780	11,275	34,450

Country	Stock market city	1850	1950	2000
Jordan	Amman		90	1,147
Kenya	Nairobi		87	2,233
Korea, Rep.	Seoul	183	1,021	9,917
Kuwait	Kuwait City		81	1,175
Kyrgyz Republic	Bishkek		130	769
Latvia	Riga	61	490	761
Lebanon	Beirut	20	335	1,639
Malaysia	Kuala Lumpur		208	1,297
Mexico	Mexico City	170	2,883	18,066
Mongolia	Ulaanbaatar		70	764
Morocco	Casablanca		625	3,344
Netherlands	Amsterdam	225	855	1,127
Nigeria	Lagos		288	8,665
Norway	Oslo	29	492	774
Pakistan	Lahore	22	826	5,452
Panama	Panama City		171	905
Peru	Lima	70	973	7,454
Philippines	Manila	114	1,544	9,950
Poland	Warsaw	163	1,014	2,194
Portugal	Lisbon	262	778	1,942
Romania	Bucharest	95	1,111	2,009
Russian Federation	Moscow	373	5,356	10,103
Saudi Arabia	Riyadh		111	4,519
Singapore	Singapore	25	1,022	4,016
South Africa	Johannesburg		900	2,732
Spain	Madrid		1,550	5,036
Sweden	Stockholm	93	741	1,641
Switzerland	Zürich		494	955
Taiwan, China	Taipei		604	2,550
Thailand	Bangkok	158	1,360	6,332
Tunisia	Tunis	90	472	1,891
Turkey	Istanbul	785	967	8,744
Ukraine	Kiev	52	815	2,606
United Kingdom	London	2,320	8,361	7,628
United States	New York-Newark	645	12,338	17,846
Uruguay	Montevideo	33	1,140	1,324
Uzbekistan	Tashkent	50	659	2,148
Venezuela, RB	Caracas	43	676	3,153
Zambia	Lusaka		26	1,307
Zimbabwe	Harare		84	1,386

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