The decline of merchant guilds in Europe: Role of trade and information shocks in market development

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Abstract

In this paper, I theorize that trade and information shocks were necessary for developing modern impersonal markets. I develop a dataset on the decline of merchant guilds in Europe and find that merchant guilds declined in the sixteenth century in cities on the Atlantic coast that adopted printing early. These cities were exposed to simultaneous trade and information shocks of Atlantic trade and the Gutenberg printing press in the late fifteenth century, making market opportunities outside of guilds lucrative, triggering market development. These cities also had greater printing of bourgeois content in the late sixteenth century.

Keywords: Europe, Printing, Information Technology, Atlantic Trade, Guilds, Markets
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I Introduction

The widespread dominance of markets is a modern phenomenon, and markets remain less developed in many regions (Rajan and Zingales, 1998). What conditions enable the development of impersonal markets, where business is done at arm's length, supported by impartial, impersonal institutions? Scholars are divided over the topic, and multiple theories exist on how factors such as contractual infrastructure (Rajan and Zingales, 1998), non-extractive institutions (North, 1990; Acemoglu et al., 2005), rationality (Weber, 1905), trust (Guiso et al., 2004), bourgeois culture (McCloskey, 2016), technology (Malone et al., 1987) and intergroup networks (Padgett and Powell, 2012; Yenkey, 2015) are needed to develop and support impersonal markets and their institutions. The above factors do not emerge spontaneously, and there exists less clarity over how different factors align to trigger market development. In this paper, I offer such an explanation.

Until the end of the fifteenth century, impartial institutions like courts and the police that serve all parties generally - so ubiquitous today in the developed world - were not well developed in Europe (Ogilvie (2011), p. 187). In such a world without a developed contractual infrastructure, trade often was (is) relationship-based, customary (Kadens, 2011), and conducted through networks like merchant guilds (Greif, Milgrom, and Weingast, 1994). However, in the sixteenth century, merchant guilds began to decline as impersonal markets supported by evolving local contractual infrastructure began to develop in cities like Amsterdam, Antwerp, and London (Puttevils, 2015; Gelderblom, 2013) in northwest Europe. Across social science disciplines, early modern northwest Europe has been a popular setting to propose and debate theories of transformation and change (Weber, 1905; North, 1990; Cook, 2007; Harris, 2009; Padgett and Powell, 2012; McCloskey, 2016; Mokyr, 2016; Rubin, 2017; De la Croix et al., 2017). In this paper, I study the puzzle: why did relationship-based institutions of merchant guilds decline in the sixteenth century in northwest Europe and make way for impersonal markets, but persisted elsewhere in Europe.

Several institutional and cultural factors helped in supporting impersonal markets in the Northwest European region. The *inclusive political institutions* of the region limited coercive powers of the rulers (North (1990), p. 130; Acemoglu, Johnson, and Robinson (2005)), and the *impartial market-based institutions* of its cities began to serve the interests of all merchants instead of a particular few (Ogilvie (2011), p. 33; Gelderblom (2013)). The *bourgeois intellectual culture* of the region promoted discovery, entrepreneurship, and innovation (McCloskey (2016), Chapter 58; Mokyr (2016), p. 17), and due to its cosmopolitan *business friendly popular culture*, profit-making ceased to be a taboo (McCloskey (2016), Chapter 58). Yet, why did these characteristics develop in the region?

I propose that the traditional relationship-based institutions like merchant guilds per-

sist unless a combination of disruptively positive trade and information shocks enable the rise of impersonal markets. Impersonal markets are defined as markets where exchange between parties at arm's length supported by a developed contractual infrastructure can occur (Rajan and Zingales, 1998). Impersonal markets expand the circle of exchange of traders, promising more lucrative opportunities (De la Croix et al., 2017) but have greater uncertainty in comparison to relationship-based modes of business. I develop a stylized model, where I embed a modified investment game in a global games setting. I theorize that market development and development of its supporting contractual infrastructure is a coordination problem, where lucrative market opportunities (due to a positive trade shock) and precise private information about these opportunities (reduced uncertainty due to positive information shock) improve the ability of traders to coordinate and trigger market development.

I exhibit the plausibility of my hypothesis by curating a dataset of economic institutions of Europe's largest fourteenth, fifteenth, and sixteenth century cities. Cities are classified as relationship-based, undergoing reform and impersonal depending upon whether the city allowed trade only to certain groups of traders (by usually offering guild privileges), or else it opened trade for a wider demographic by establishing impersonal institutions facilitating impersonal exchange. The variation in economic institutions across cities of Europe emerged after the sixteenth century, and this emerging distinction was noted by Ogilvie (2011) who wrote:

> [In the sixteenth century,] the guild-dominated societies of Italy, Iberia, and German-speaking central Europe were unable to adjust to rapid institutional, commercial and demographic changes of the sixteenth century. They lost out to the market-oriented civic culture of the Low Countries and England with their increasingly impersonal markets and impartial states, which encouraged forms of generalized trust that favoured adaptation and growth. The weakening of the particularized trust generated by associative institutions such as merchant guilds created interstices in English and Dutch society within which people could experiment with generalized trust in strangers mediated by impersonal markets and impartial states. This cannot be regarded as an accident.

To verify the plausibility of the codified dataset on economic institutions, I use extensive data on printing content in Europe acquired from the Universal Short Title Catalogue (USTC). I show that the cities where impersonal markets emerged in the sixteenth century were similar to other European cities in the penetration of trade-related books (on the topics of economics, science and mathematics, news, and travel) in the fifteenth and early sixteenth century. But these cities progressively became distinct after the mid-sixteenth century, especially in the 1580s and 1590s, with greater penetration of such trade-related

"bourgeois" content (McCloskey, 2016). The result suggests that a distinct bourgeois culture of growth (McCloskey, 2016; Mokyr, 2016) developed in such market-oriented cities as the sixteenth century progressed.

Using this data on economic institutions, I argue that the trade shock of Atlantic trade and the Gutenberg printing press's information shock were instrumental in the rise of modern impersonal markets and the decline of the traditional merchant guild system in early modern Europe. I find that

- among cities within a 150km distance from the sea, the cities where merchant guilds declined or reformed in the sixteenth century had more than twice the number of diffused books per capita in the fifteenth century than cities where merchant guilds continued to dominate.

- a city at the Atlantic coast with about four times more per capita printing penetration in the fifteenth century was one degree higher in the level of market development[1]0 in the sixteenth century[2].

The paper contributes at two levels. Firstly, it provides a historical pan-European account of the decline of the merchant guilds system, which dominated trade in Europe for most of the second millennium (Ogilvie, 2011). It looks at a transformational period in world history - the late fifteenth and sixteenth century when several institutional innovations, like the stock market or the joint stock company, emerged in northwest Europe. The rise of the region in early modern Europe has been a significant research theme. Looking at this period through the lens of changes in information technology and its interaction with trade incentives can bring a new perspective. Secondly, the paper helps economists and policymakers understand the conditions under which relationship-based modes of business may transform and impersonal markets and the supporting institutions develop. For societies that are still dominated by traditional modes of business, the paper offers a history-informed discussion on the factors that trigger market development.

II Economics of merchant guilds

Merchant guilds were city based associations of merchants, and were the traditional and historically dominant form of organizing business. Merchant guilds helped in the close monitoring of partners through repeated interaction, and by the collective assertion of

[1]Market development: 0=Relationship-based, 1=Undergoing Reform, 2=Impersonal.

[2]*Atlantic coast and Printing:* There were four impersonal cities- Hamburg, London, Antwerp and Amsterdam, while there were four relationship-based cities- Lisbon, Seville, Rouen and Bordeaux as the major Atlantic ports in the sixteenth century. The fifteenth century per capita printing penetration of these cities would stack as- Lisbon (0.81 books per 1000 population (bptp)), Bordeaux (1.44 bptp), *Hamburg* (3.69 bptp), Seville (4.57 bptp), Rouen (8.11 bptp), *London* (9.33 bptp), *Amsterdam* (14.29 bptp) and *Antwerp* (24.92 bptp).

their rights (Greif, Milgrom, and Weingast, 1994; Gelderblom and Grafe, 2010). A wide range of relationship-based mechanisms (private, third party and community-based) could be applied by guild members to reduce cheating by traders.

- Individual merchants could *privately* constrain a partner from cheating using reputation and repetition-based mechanisms.
- Alternatively, a *third party* (like guild court) could identify and punish cheaters by improving contract enforcement (or law and order) (North, 1990; Milgrom, North, and Weingast, 1990).
- Moreover, entire communities could enable impersonal exchange through the *community mechanism* of community responsibility system (Greif, 2006), as long as their community identities were known[3].

Moreover, guild networks were valuable conduits of information for guild members, and merchants would use their "guild mysteries" to maintain competitive advantage (Greif, Milgrom, and Weingast (1994); Ogilvie (2011), Chapter 9). Merchant guilds also helped in the development of public goods such as warehousing and protective convoys that helped in trade (Gelderblom and Grafe, 2010).

Before the fourteenth-century merchant guilds were probably non-hierarchical, voluntary and inclusive. However, with time merchant guilds started to become exclusive monopolies, placing high barriers of entry for outsiders (Ogilvie (2011), Chapter 5). By the fifteenth-century, merchant guilds were no longer voluntary institutions, and they began to resemble almost like cartels (Gelderblom and Grafe, 2010). The potential to obtain rents through monopoly privileges obtained with a nexus with local authorities (Ogilvie, 2011) was one reason why the individual members were interested in delegating more control to the merchant guilds (Gelderblom and Grafe, 2010). Given the dominance of guilds in the market, merchant guilds were also a favored channel for local authorities to raise taxes (Dessí and Ogilvie, 2004). However, such exclusionary guild monopolies meant that a large fraction of potential traders were left out. European cities, over time, got divided into the prosperous merchant guild members and the non-members (Ogilvie (2011), Chapter 3, 4).

The merchant guild system started to decline from the sixteenth century in the Low Countries and England. The direct reason for the decline was the change in preferences of the local authorities. Local authorities of cities like Amsterdam or London in the sixteenth century would no longer approve requests for monopolies by local or overseas merchant guilds (Ogilvie (2011), p. 187). As monopolies of guilds were removed, trade opened up for other individuals interested in trading. What motivated local authorities to

[3]In the community responsibility system, cheating behavior by one member of a community was followed by sanctions on the entire community by the members of the community of the cheated partner.

stop favoring merchant guilds remains a puzzle (Ogilvie (2011), p. 187). Moreover, why did the shift happen only in the sixteenth century and especially in the Low Countries and England? A new theory can give some answers.

III Theory

I develop a principal agent model, where the investor faces the "*fundamental problem of exchange (FPOE)*" where it is difficult for the agent to "*ex-ante commit to fulfil*" their "*contractual obligations ex-post.*" (Greif, 2006). To overcome the problems of FPOE transactions, two types of economic institutions are common.

1. Relationship-based institutions (like merchant guilds) where private (reputation, repetition (Greif, 1994), community (Greif, 2006), social network (Macy and Skvoretz, 1998), reciprocity (Kadens, 2014) based mechanisms - usually operating a web of particularized relationships - resolves the ex-ante commitment problem of FPOE transactions.

2. Impersonal institutions (supporting markets) where developed contractual infrastructure (North, 1990; Rajan and Zingales, 1998) enables generalized third party enforcement of contracts between parties at arm's length.

A Model: A modified investment game

Consider a classic investment game, where an investor decides whether to make an impersonal investment with an agent at arm's length. After the market realization of the investment, the agent earns m and decides whether to return an amount i to the investor. Both investor and agent have default payoff d_i and d_a, which is the income they earn from doing business through relationship-based institutions (like merchant guilds) that are traditionally embedded in relationships. In the classical game, agents cannot be punished if they do not return the amount i to the investor.

I modify the game such that each investor making impersonal investments pays a tax t, which contributes to the contractual infrastructure of the economy. The size of the tax base (i.e., fraction f of investors making impersonal investments and hence paying the tax) influences the efficiency of the contractual infrastructure to enforce contracts and punish (with a probability $L(t, f)$) the agents that renege on their ex-ante promise to ex-post return the amount i to the investor. If the reneger is detected and punished, they lose their earning (m). Hence the expected earning by a reneging agent in a regime with a contractual infrastructure of efficiency $L(t, f)$ is $m(1 - L(t, f))$.

The following conditions support impersonal investment as an equilibrium: If $m > \frac{i}{L(t,f)}$, if $m > i + d_a$, and if $i > d_i + t$. Some characteristics of $L(t, f)$ (which proxies for

quality of contractual infrastructure) I assume are: $L(.)$ is monotonically increasing in tax paid (t) and fraction of investors (f). If tax paid is high ($t \to \infty$) then contractual infrastructure is very efficient ($L(t, f) \to 1$); and if no tax is paid ($t = 0$ or $f = 0$) then contractual infrastructure is very inefficient ($L(t, f) = \delta \approx 0$). For $m < m_l = \frac{i}{L(t,1)}$, there exists no incentive for agents to return the investment, and hence for investors to make impersonal investments. Similarly, for $m > m_u = i/\delta$ agents always have incentive to return the investment, and hence for investors to make impersonal investments. For values $m_l < m < m_u$ willingness to make impersonal investments is increasing in f for the investors - if a fraction f of the investors are investing, then for a given i and t, an investor is indifferent to impersonal investments if

$$m = i/L(t, f) \tag{1}$$

The above condition presents a coordination problem for the investors: "*If none invest, I don't invest; if all invest, I invest.*", and two distinct equilibria exist, one where only relationship-based investments are made earning investors an amount d_i and the second where all investors make impersonal investments and earn $i - t$ for a market realization of $m_l < m < m_u$. Does a unique equilibrium exist where a threshold market realization m^* exists such that investors make impersonal investments if and only if $m > m^*$. The global games approach (Carlsson and Van Damme, 1993; Morris and Shin, 1998, 2003) provides a way to find such a unique equilibrium in settings where large-scale coordination is needed.

Let market realization m be imperfectly known to all investors, and m be drawn from a normally distributed function with mean y and variance $1/\alpha$. Let this distribution be public knowledge. Let investors have access to a private signal (from networks, letters, reports, etc.) x about market realization, where $x = m + e$ i.e. signal is accurate but not precise and e is normally distributed with mean 0 and variance $1/\beta$. Given this setup, the following proposition can be provided (proof in appendix).

Proposition 1 *If the market realization m can be precisely known through private signals ($\beta \to \infty$), then there exists a unique $m^* = \frac{i}{L(t,(1-\frac{d_i+t}{i}))}$ such that if $m > m^*$, then all investors make impersonal investments, and they do relationship-based investment otherwise.*

Hence, a combination of positive trade shock (= a high market realization m) and information shock (= a precise private signal $1/\beta \to 0$) can lead to the development of impersonal markets where impersonal investments supported by effective contractual infrastructure can occur. The rise of impersonal investments in impersonal markets is endogenous to the development of contractual infrastructure, and one supports the other.

B Hypotheses: Economic shocks and economic institutions

A high market realization (trade shock) and precise private signals about such market realization (information shock) can motivate a large mass of investors to make impersonal investments, hence creating the demand for contractual infrastructure supporting such impersonal investments. In the absence of conditions that create such a strong investor demand for contractual infrastructure, there exists little incentive for a local authority (providers of such infrastructure) to exogenously develop such impersonal institutions, as such a provision would disturb the traditional dominance of the competing relationship-based institutions (like merchant guilds[4]) that would resist such institutional development (Rajan and Zingales, 2003)[5] (e.g. early modern Lübeck (Dollinger, 1970)) So we can develop the following hypotheses as a corollary to Proposition 1.

Hypothesis 1 *In the absence of a positive trade or information shock, relationship-based institutions like merchant guilds are likelier to persist.*

Relationship-based institutions like merchant guilds also hold considerable bargaining power over their members (Gelderblom and Grafe, 2010; Ogilvie, 2011) and they can increase/decrease restrictions on activities of members and also influence who gets to be a part of the club. When an information shock exists, and it is complemented with a trade shock that offers a competing opportunity for impersonal investment (with a high m), the relationship-based institutions may respond by reforming themselves, by offering a higher steady utility d_i to the investors to make the relationship-based mode competitive.[6] This draws us towards the second hypothesis.

Hypothesis 2 *If an information shock accompanies a positive but not disruptive trade*

[4] *Craft vs. Merchant guilds:* Liberti and Petersen (2017) present a range of benefits of "hard" information, which they call "information reduced to numbers" when compared to "soft" information (see Uzzi and Lancaster (2003)). These benefits in contemporary finance include a lower cost in information processing due to automation, and standardization, expansion of the market due to lowering of entry barriers, and increased transparency of durable information. While the printing press could help diffuse such commercially useful hard information, its impact could only be indirect on the diffusion of softer and more tacit knowledge. Such transfer of soft or tacit knowledge required person-to-person transmission and was important for the effectiveness of craft guilds (De la Croix, Doepke, and Mokyr, 2017). So, the disruptive impact of the printing press on craft guilds could only be limited compared to its impact on merchant guilds. So, the introduction of the printing press in the late fifteenth century cannot be expected to cause a decline of craft guilds, unlike the decline of merchant guilds in the sixteenth century. Not surprisingly, craft guilds did not decline in the same period as the merchant guilds. They began to decline after the sixteenth century (Epstein, 2008).

[5] A relevant paper considering nexus between economic elites and politicians is Rajan and Zingales (2003) that discussed the political economy of financial development, and provided a mechanism for the opening of financial markets where financial and business elites resisted such development as they would lose their dominance.

[6] Note that in the absence of a positive information shock that resolves the uncertainty about market realization (m), relationship-based institutions may be exploitative (keep a low d_i), as regardless of the return from relationship-based investments (d_i) relationship-based investment is the only equilibrium (assuming $m < m_h$).

shock, relationship-based institutions like merchant guilds are likelier to undergo reform and persist.

There are limits to how much relationship-based institutions can reform and stay competitive as an alternative to impersonal institutions. If a trade shock is disruptively large ($m >> d_i$), relationship-based institutions may be replaced by impersonal institutions that support impersonal markets.

Hypothesis 3 *If an information shock accompanies positively disruptive trade shock, relationship-based institutions like merchant guilds become less efficient and likelier to be replaced by impersonal markets.*

Did trade and information shocks create the conditions in the sixteenth century that motivated the local authorities in northwest Europe to disband the merchant guilds and establish impersonal institutions supporting impersonal markets? I suggest that the combination of two unique shocks in Early modern Europe: trade shock due to the rise of Atlantic trade, and information shock due to the rise of the movable type printing press, led to the rise of modern markets supported by impersonal institutions.

IV Rise of impersonal markets

The medieval European merchant guilds traded in temporary fairs, of which the Champagne fairs of Northern France were the most prominent. In the thirteenth century, the Champagne fairs declined as a trading place when the local authorities began to exploit the visiting traders. After the decline, the neighboring regions of the Low Countries started to attract the international merchants who traded at Champagne (Gelderblom (2013), p. 14). The international merchants eventually began to cluster in the emerging cities of Low Countries like Bruges and Antwerp. The visiting traders began to trade with the help of local hostellers and brokers, who acted as intermediaries between unfamiliar traders (Gelderblom (2013), p. 43).

A Trade shock: Impact of trade at the Atlantic

In the late fifteenth century, the discovery of the new sea routes to Asia and the Americas during the commercial age opened up the Atlantic shores for beneficial long-distance trade (Davis (1973), Chapter 2). As the Low Countries shared a coastline with the Atlantic, the already booming inland trade of the region grew further with long-distance sea trade, bolstering the region's (including England) position as the leading cluster of international trade in Europe. One of the markets that soared in the early sixteenth century in Antwerp was the spice trade with Asia and Africa by Portuguese merchants who would trade through Antwerp with merchants from the Aachen area and South Germany (Tracy

(1993), p. 28). As the region began to emerge as a major center for trade of commodities such as spices, the footloose international merchants, who would previously visit the cities for short durations, began to settle in the cities (Gelderblom (2013), p. 58). This led to a significant increase in the city populations, as reflected in historical population estimates. The new population would like to enjoy greater freedom and not rely on local and increasingly influential brokers and hostellers as intermediaries for networking and trade (Gelderblom (2013), p. 58). Moreover, observing the newly found opportunities in long-distance trade, middle-class non-merchants in the Low Countries and England began to aspire to enter the profession. However, they found the guild monopolies enjoyed by some merchants to be restrictive for their aspirations to build new business networks (Ogilvie (2011), p. 188). If the non-guild members wanted to trade with long-distance traders, they needed alternative impersonal channels other than guilds.

The participation in impersonal markets was not only limited by the monopolized guild networks but also by market frictions like information access and moral hazard. The fifteenth century was a period of underdeveloped impartial legal systems and contract enforcement (Ogilvie (2011), p. 33). Economic information was opaquely available to aspirational traders, as it was tightly controlled by merchant guilds (Ogilvie (2011), Chapter 9). Moreover, there was uncertainty regarding the reliability of other traders, which was the prime reason why hostellers and other intermediaries were so dominant. The frictions of information and transparency made making a large shift to impersonal market-based institutions not feasible.

B Information shock: Impact of the movable type printing press

At the end of the fifteenth century, another significant breakthrough in information diffusion was the invention of the movable-type printing press. Printing diffused contagiously across Europe. High levels of diffusion of books in London, Antwerp, and other cities in the Low Countries, that got triggered in the fifteenth century, made best practices like the double-entry bookkeeping and new information regarding trade available with the availability of printed books (Puttevils, 2015; Chatfield and Vangermeersch, 2014). The unique aspect of the diffusion of information in the printing era was that the commercial information would mass-diffuse horizontally amongst peers, and not just vertically by parents, teachers, and other authorities.

Cities like London, Antwerp, and other cities in the Low Countries were some of the geographically closest non-German cities to Mainz, the city where Gutenberg invented the movable-type printing press (Dittmar, 2011). Dittmar (2011) argued that the movable-type printing press was heavy to transport and difficult to build without the small group of apprentices who knew how it was built. So, the cities closer to Mainz got the printing

press earlier than others in the first few decades of the introduction of printing (the 1450s to 1500s), and such cities were early to print books that appealed to merchants.

Trade-related information diffused through merchant manuals (Dittmar (2011)), and the new techniques in commerce and arithmetic[7] diffused through books. Such a horizontal diffusion of information and new techniques through the printing press had a profound effect on European businesses and culture in general (see Eisenstein (1980)). The effect of printing on the business culture of Antwerp was described by Puttevils (2015) as:

> ... Antwerp was one of the most important book production centres in sixteenth-century Europe - produced so-called *Ars Mercatoria* guides or 'Doing business for dummies'. So, merchants from the Low Countries could easily pick up information on Italian-style accounting, letter writing, mathematics, business techniques such as the bill of exchange and languages.

Increasing pressure from footloose merchants and the rising influence of a middle class that was not part of guilds, bolstered by (*i*) large benefits of trade at the Atlantic coast and (*ii*) learning of trade-related information and new business practices, provided the favorable conditions for impersonal exchange to emerge and be sustained. These favorable conditions motivated the local authorities to disfavor privileged guild monopolies, and they began to build institutions for supporting impersonal exchange, including the development of impartial legal institutions that significantly reduced the risks of such a trade. In London, the livery companies found it increasingly difficult to enforce their economic privileges as the sixteenth century progressed (Ogilvie (2011), pp. 32-33), while alternate forms of partnerships were emerging, like the joint stock company of *Merchant Adventurers to New Lands* was chartered in 1553 with 250 shareholders. Similarly, in Antwerp, merchant guilds began to decline right around 1500 (Ogilvie (2011), p. 32). In Bruges they persisted only until the mid-sixteenth century (Ogilvie (2011), p. 12). Amsterdam (as it was emerging as a major city only in the sixteenth century) never had merchant guilds barring in some specific areas of commerce (Ogilvie (2011), p. 32).

[7] Just as the commercial information and business techniques were diffusing across Europe through writers like Luca Pacioli and Jan Christoffels[8], another fundamental change was occurring across Europe due to printing at the end of the fifteenth and sixteenth century- the adoption of the Hindu-Arabic number system. With the advent of the printing press, the Hindu-Arabic number system began to get adopted in account books outside of Pisa and Italy and across Europe (Durham, 1992). Luca Pacioli's 1494 masterpiece, *Summa de arithmetica*, also played a role in the popularization of the Hindu-Arabic numbers (Devlin, 2011). Before the usage of Hindu-Arabic numbers, Roman numerals were the standard method of representing numbers, and such a non-positional system restricted the range of arithmetic operations that the merchants could perform. Even a simple operation like division was difficult and involved the use of the abacus. In other words, the usage of the Hindu Arabic numbers and arithmetic, especially in commercial settings, represented a significant (yet underappreciated) leap in commerce.

C Iberian Peninsula: Trade by Elites

Other regions of Europe did not have the conditions as favorable as in Low Countries and England. Spain and Portugal had a long Atlantic coast and commercially advanced cities with postal networks. Cities like Seville grew rapidly in the sixteenth century due to their position on the Atlantic coast. However, being distant from Mainz, the region was not an early adopter of printing. The first book on double-entry bookkeeping in Spanish was published in Madrid in 1590 by Seville based Bartolom Salvador (Edwards (2013), p. 68), when such accounting books in Dutch, French, and English were written much earlier by 1540s by Ympyn, and the original book by Pacioli in Latin in 1494.

Given the traditional information barriers, guilds continued to be an effective system. Many Spanish cities competed to receive guild privileges in the late medieval period (Smith, 1940), and cities like Sevilla further tightened their requirements (20 years residence) on who could undertake trade in the city (Ogilvie (2011), p. 54).

D Northern Italy and continental Europe: Absence of Disruption

Northern Italy provides another relevant case in contrast to Spain and Portugal. The region had a well-developed postal network (Schobesberger et al., 2016), and it also had a high penetration of printed books by the late fifteenth century. Several commercial books were being printed in its cities. Formal business practices like bookkeeping were well known, and these practices were being popularized elsewhere by printing books and sharing merchant letters. Revolutionary financial innovations like double-entry bookkeeping were developed in the region and diffused in Europe from there. For example, Luca Pacioli's 1494 book on bookkeeping was written in Venice and was adopted by Jan Ympyn Christoffels later in Antwerp.

The opportunity for impersonal exchange in Northern Italy was not disruptive enough (Hypothesis 2), as the region was already at the center of the Mediterranean trade and land trade to Asia. For the merchants in the Iberian cities, the Atlantic route to Asia (and to the Americas) was an alternative route to undercut the domination of the Venetians in the trade with Asia (Tracy (1993), pp. 26-28). Existing elites could initiate reform that made opportunities from the existing system more beneficial and averted the potential challenge of developing impersonal markets. In the North Italian region, especially in Venetian and Milanese clusters, reforms were going on during the sixteenth century (Epstein (2004), pp. 301, 308). Existing elites held onto their power in the regions (Ogilvie (2011), p. 53), but traders and producers from the countryside, like the silk producers of village areas of Milanese Lombardy, got more concessions from urban elites (Epstein (2004), p. 308).

Inland cities of Germany and France also continued to have dominant merchant guilds despite high levels of printing penetration, as these cities were distant to the beneficial long-distance sea trade, especially the Atlantic coast. Hamburg, being at the Atlantic coast, was a notable exception, where merchant guilds declined. Even Hanseatic cities like Cologne that were at the forefront of trade in previous centuries due to the presence of navigable rivers could not compete with cities like Antwerp or Amsterdam (and eventually Hamburg) which were better located geographically and acted as entrepôts for the whole North European region. In the city of Augsburg (a major center of printing and commerce), there was rising anti-monopoly dissent, which was decided in favor of the merchant companies, arguing that private interest and the common good were compatible (Häberlein, 2012).

[[Insert Figure I about here]]

Considering Figure I, in the sixteenth century; northwest Europe with a high printing penetration and an Atlantic coast fell in Region 1, which was favorable for the emergence of impersonal markets; Northern Italy with high printing penetration but no Atlantic coast fell in Region 2, which was favorable for relationship-based systems undergoing reform; and Spain and Portugal, and most of Europe, because of having either low rates of printing penetration or poorer opportunities for long-distance trade, fell in Region 3, which had persistent relationship-based systems. So, considering different regions of Europe, historical evidence suggests that different intensities of trade opportunity and printing penetration led to different outcomes in the different regions of Europe.

Can we observe such patterns in the data collected from medieval and early modern Europe?

V Data

In the sixteenth century, different regions of Europe developed different types of economic institutions. The theory developed in previous sections suggests that an area (a) was better placed to have impersonal markets or to undergo reform in the sixteenth century if the area enjoyed both large benefits from trade and access to high-quality information (Hypothesis 2 and 3). Otherwise, the area had relationship-based institutions (Hypothesis 1).

So, the basic hypothesis can be expressed as an OLS model:

$$Inst_a^{1600} = \alpha + \beta_1 Trade_a + \beta_2 Information_a + \beta_3 Trade_a X Information_a + \epsilon_a$$

where $Inst_a^{1600}$ is the nature of economic institutions in the sixteenth century in a given area a, $Trade_a$ is the size of the trade shock, $Information_a$ is the size of diffusion

of trade-related information. We expect the coefficient β_3 (the interaction) to be the only sizable and significantly positive coefficient. If in an area impersonal exchange was disruptively beneficial (code it as a dummy $dDisrupt_a = 1$), then we expect that area to be likelier to develop impersonal markets. So, we expect to observe a larger effect of $Information_a$ on $Inst_a^{1600}$ in areas with $dDisrupt = 1$ (Hypothesis 3).

To run the above test, we first need to identify the nature of economic institutions in the different parts of Europe in the sixteenth century. Secondly, we need to find good proxies that can measure the size of trade shock and the level of information access. We can then explore the relationship between the proxies and the nature of economic institutions.

A Nature of economic institutions

Merchant guilds in Europe were associated with particular cities. The German Hansa was an example of a regional association between merchants, but even the Hansa was a federation of different cities. What was the nature of economic institutions in the sixteenth century in the largest cities that dominated Europe between the fourteenth and sixteenth centuries? Did they allow for impersonal marketplaces? The largest cities of Europe provide a good snapshot of the commercial life of Europe, as the largest cities would also be the business or political centers. Tables I, II, and III in the Data Appendix list down the largest cities of Europe in the fourteenth, fifteenth, and sixteenth century as listed in Bairoch, Batou, and Chevre (1988), a historical data source on the city-level population of European cities.

Looking at secondary historical information on each of the 81 cities, I coded the nature of economic institutions of the cities, with cities coded as relationship-based (R), Undergoing Reform (U), and Impersonal (I) depending upon whether a city allowed trade only to particular groups. The coding criteria are detailed in Table I. I code a city as relationship-based (R) if it provided monopoly privileges to merchant guilds, or if guilds did not exist at all, and trade was restricted using other methods. I code a city as undergoing reform if a city was giving concessions to locals and other merchants who were not part of the restrictive group that enjoyed the monopoly privileges. Finally, I code a city as impersonal if it began to remove monopoly privileges in trade in the sixteenth century and opened up trade for a wider demographic.

[[Insert Table I and Figure II about here]]

Genoa (coded as I1) was an exceptional city, as since its foundation in the eleventh century, the city allowed all citizens to trade freely, with liberal requirements for citizenship (Ogilvie (2011), p. 53). All other cities restricted who could trade in the city, and just a handful of cities in northwest Europe were impersonal during the sixteenth century

period (coded as I2). The cities undergoing reform were found in North Italy and the Low Countries (coded as U1, U2, or U3), where guilds eased restrictions on trade for locals without losing their monopolies. In the rest of the cities (coded as R1, R2, and R3), guilds either enjoyed monopoly privileges or else the system of trade was feudal. Some special cases may be mentioned, for example, Nuremberg, which was called a "city without guilds", but was in practice an oligarchy that restricted the formation of new guilds (Soly, 2008) (thus not being an impersonal but rather a relationship-based city according to the coding in Table I). Another interesting city was Venice, which did not have guilds but imposed several restrictions on who could be a citizen and thus trade (Ogilvie (2011), p. 53). However, as Epstein (2004) (p. 301) recounts, Venice was giving concessions to rural representatives in trade (so, being coded as a reforming city in the sixteenth century). French cities continued to enjoy guild monopolies until the eighteenth century (Horn (2015), p. 224), and the partial abolition of guilds in cities of Rouen, Nancy, Metz, Roussillon, and Paris happened only in 1776, while other cities rebuffed these reforms. Based on the coding criteria in Table I, Table IV in Data Appendix details the nature of economic institutions in each of the 81 cities in the sample, based on secondary sources. Figure II maps the cities based on their coded type. Genoa was always an impersonal city, and so I do not include it in the dataset.

Variable $Inst_a^{1600}$ measures the level of market development in the sixteenth century in a given city. I code $Inst_a^{1600} = 2$ for all impersonal cities with coding I2, and cities undergoing reform with code U1, U2, and U3 have $Inst_a^{1600} = 1$. Other cities coded as relationship-based (R1, R2, and R3) have $Inst_a^{1600} = 0$.

B Trade condition: Closeness to sea

Cities closer to the sea, such as ports, have historically enjoyed natural advantages in long-distance trade. Large commercial cities usually formed either at the seacoast or else in river basins. Within large commercial cities (like the 81 largest European cities in our sample), cities closer to sea would be more likely to be exposed to new opportunities to trade and will be more likely to attract immigrants when compared to inland cities. So, European cities that were close to the sea were suitable for long-distance trade and can be expected to find a partnership with unfamiliar traders more beneficial. Acemoglu, Johnson, and Robinson (2005) listed down 166 cities that acted as the Atlantic and Mediterranean ports of Europe. I calculate the distance of each city a in the database to the nearest Atlantic or Mediterranean port ($PortDist_a$) (see Figure V). I also calculate the closest distance from the sea ($SeaDist_a$), and for cities that were closer to the Baltic Sea (Plovdiv, Poznan, Prague, and Wroclaw) or were Baltic Ports (Lübeck, Gdansk, and Copenhagen) I use the distance from the sea as a measure instead of the closest distance from an Atlantic Port. I square root transform the combined variable $SeaPortDist_a$

and invert to make it an increasing positive variable ($SeaPortCloseness_a = constant - \sqrt{SeaPortDist_a} \geq 0$) representing closeness to Atlantic or Mediterranean port or Baltic sea, to be used as a proxy for $Trade_a$.

The Mediterranean sea acted at the center of European long-distance trade until the discovery of new Atlantic routes to Asia and the Americas during the fifteenth century. For early modern Europe, the discovery was disruptive as it opened trade in newer lands and of newer commodities (Acemoglu, Johnson, and Robinson, 2005). Cities that were Atlantic ports can thus be expected to enjoy a disruptive opportunity for long-distance trade and be more likely to impersonalize (Hypothesis 3) compared to other cities close to the sea like Venice and Lübeck that were already dominant in their respective Mediterranean and Baltic trades. If a city was an Atlantic port or it was close to an Atlantic Port ($PortDist_a < 50km$), I label such a city as enjoying disruptive opportunity, and code $dNearAtlantic_a = dDisrupt_a = 1$.

I refrain from using actual historical figures on the volume of trade (unlike Acemoglu, Johnson, and Robinson (2005)), and rather focus on the geographic potential of the cities (closeness to sea, especially to the Atlantic), as trade potential itself is endogenous to market development. Cities like Amsterdam developed into leading ports of early modern Europe because of their market institutions that were attractive to traders (Gelderblom, 2013).

C Information condition: Printing penetration

A city that had higher printing penetration in the fifteenth century can be expected to have better availability of information regarding trading practices among its residents. To estimate the penetration of printed material in the 81 cities in the database, I use a database on early printing in Europe. There are several printing databases with minor differences. I rely on *Gesamtkatalog der wiegendrucke* (GW) database to build the database of early printing cities and the penetration of printing material as it has curated the exhaustive list of publications from the fifteenth century.

I characterize a city in the GW database as a printing city if it printed more than ten books until 1500 (see Figure VI). As books were not geographically bounded, books printed in one city b were being read in another. For example, the book called *Summa de arithmetica* by Luca Pacioli that gave the first printed description of double-entry bookkeeping was printed in Venice in 1494, but it quickly became popular across Europe. However, one can assume that more populous cities and closer cities would have better availability of books from a city b than others.

Could it be that some printing hubs were printing books with a target audience in a geographically distant region? Like German books being printed in Venice? USTC catalogue lists the language of printed books. I find that a negligent proportion of books

printed until 1500 were being printed in a language that was neither local nor Latin. For example, out of 3675 books printed in Paris until 1500 (according to USTC), only six were printed in Dutch, the maximum for a non-local language. Similarly, out of 3591 books printed in Venice until 1500 (according to USTC), fourteen were printed in German, the maximum for a non-local language.

I use a gravity model to estimate printing penetration in the 81 cities of interest. If one of the 81 cities a with population $Pop1500_a$ and one of the 121 printing cities b printing B_b books, were having a distance d_{ab}, then per capita printing penetration in the city a by books from city b, $PrintIndex_{ab} = \frac{B_b}{d_{ab}^2(\sum_{i=1}^{81}\frac{Pop1500_i}{d_{ib}^2})}$, where $\frac{Pop1500_c}{d_{cb}^2}/\sum_{i=1}^{81}\frac{Pop1500_i}{d_{ib}^2}$ represents the relative influence (mass) of a city a relative to b. When the printing city was the city itself (b=a), I normalise $d_{ab} = 1$. So, the total printing penetration in the city a because of all printing cities (121 in total) was $PrintIndex_a = \sum_{j=1}^{121}\frac{B_j}{d_{aj}^2(\sum_{i=1}^{81}\frac{Pop1500_i}{d_{ij}^2})}$ books per 10000 population (bptp). I log transform the variable to $PrintPentr_a = const + ln(PrintIndex_a) \geq 0$, to use it as a proxy for information access ($Information_a$) (see Figure VII). I also count the number of print cities in a 50km radius $PrintCity50km_a$, for a city a, and use it as an alternative measure of printing penetration.

D Bourgeois content: Content of printed material

The printing revolution led to a mushrooming of a variety of themes, with religious themes being highly popular. Books that were related to business occupied a small but numerically salient portion of printing. To understand the nature of printed content, I collect data on printed books from the USTC catalog, which classifies early printed books into 37 categories. I consider four categories of books that can be expected to include books with "useful" (Mokyr, 2016) "bourgeois" (McCloskey, 2016) content. The categories are science and mathematics, economics (treatises, regulation of guilds), news (sensational literature, events, wars), and travel (topography, maps, and navigational manuals). I call the categories- trade-related categories. Other categories are either related to religion, arts, politics, or are industry specific.

I collect data on all printed books and their categories from the USTC dataset in the fifteenth and sixteenth century and match the cities to their geographical coordinates[9]. To enable effective matching, I only focus on cities that printed at least ten books in total in a given year (229 such cities) and count the number of books that belonged to the trade-related categories. Once again, I apply the gravity model to estimate the yearly printing penetration of trade-related books in the 81 cities a of interest, in a given year y, and obtain two variables $YearlyPrintIndex_{ya}$ and $YearlyTradeIndex^U_{ya}$ measured as books per 10000 population (bptp). Log transforming these two vari-

[9]I use name-based matching with (Bosker et al., 2013) dataset, and if not with it then with Google

ables gives us two variables $YearlyPrintPentr_{ya} = ln(YearlyPrintIndex_{ya} + 1)$ and $YearlyTradePentr_{ya} = ln(YearlyTradeIndex_{ya} + 1)$, which gives us the yearly penetration of printing and of trade-related books in the city.

VI Preliminary Observations

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A Verifying the dataset

If cities that began to develop impersonal markets underwent a distinct change in the sixteenth century, we should observe a greater penetration of trade-related books (when compared to other cities) in that period and not before. Figure III plots the yearly penetration of trade-related books ($YearlyTradePentr_{ya}$) in impersonal, reforming and relationship-based cities. As is evident from the graph, the penetration of trade-related books was initially similar across types of cities, but impersonal cities began to consume more such books as the sixteenth century progressed.

[[Insert Figure III about here]]

B Verifying the theory

A two-way plot in Figure IV between printing penetration ($PrintPentr_a$) and closeness to the sea ($\sqrt{SeaPortDist_a}$), supports the basic arguments developed in the paper.

[[Insert Figure IV about here]]

Cities away from the sea: In cities that are away from the sea (closer to zero on the X-axis in Figure IV), guilds continued to be dominant in the sixteenth century. Cities close to the sea were the ones most likely to attract outsiders and become cosmopolitan hubs. So, in an inland city like Wroclaw, there was little benefit for traders to seek out impersonal relationships, and the merchant guild system was an effective system already. The only cities where traders could potentially have benefited from impersonal exchange were those close to the sea.

Cities with low printing penetration in the fifteenth-century : Among cities that were closer to the sea (on the right side of the X-axis in Figure IV), the cities that were having low levels of printing penetration in the fifteenth century (closer to zero on the Y-axis in Figure IV) continued to have dominant guilds in the sixteenth century. These cities primarily included major port cities of the Iberian peninsula like Lisbon.

Cities not on the Atlantic coast: Among cities that were close to the sea and had high levels of printing penetration in the fifteenth century (on the upper right corner of Figure IV), several cities loosened monopoly privileges (in the Low Countries and North Italy), but only a few actually saw the removal of guild monopolies. While both the Atlantic and non-Atlantic cities with high levels of printing could be argued to have the conditions that favored the decline of guilds, it was only the Atlantic coast where guilds actually declined as the opportunities found in these cities was disruptive.[10]. All impersonal cities (green squares in Figure IV), except Bruges, were Atlantic port cities, and Bruges was only 20km away from the Atlantic Port of Vlissingen (in previous centuries Bruges itself was a major port, but the port silted).

C Other fifteenth century factors

Postal system: As the postal system was an emerging means of accessing information (through letters), I code the cities based on whether they had a postal service as per Giovanni da L'Herba's travelogue in 1563 (the earliest compilation of such data), and find a small correlation of 0.0099 between the postal dummy and the type of institution, which is expected given that the postal network (formal and informal) had already developed extensively across Europe (not all of them listed in Giovanni's travelogue) by the middle of the sixteenth century and had especially reached most of the large cities (especially Western cities) that have been considered in the database.[11] I would focus on the printing penetration as the city-specific heterogeneous variable for horizontal information diffusion.

Urban Agglomeration and Population: North Italy, Belgium, and the Netherlands enjoyed high levels of urban agglomeration. It was argued by Gelderblom (2013) that the Low Countries were able to evolve institutionally because of competition between close competing cities. Is a high level of urban agglomeration a mediating factor that attracted higher rates of printing in regions close to the sea?

To measure the level of urban agglomeration, from Bairoch, Batou, and Chevre (1988) population dataset, I consider 335 cities that had a population greater than or equal to 10,000 in the fourteenth, fifteenth, and sixteenth century (including the 81 largest cities, see Figure VIII). I cluster the cities using the hierarchical clustering method based on

[10] *Growth of Mediterranean and Atlantic ports:* Mediterranean cities, especially of North Italy (where printing was high) were more established commercial centers and arguably enjoyed more powerful guilds. This meant that they were more likely to resist the opening of markets and instead undergo reforms when they faced the new commercial revolution at the Atlantic coast. One proxy that highlights the differences between the power of the Atlantic and Mediterranean cities is that Mediterranean cities in the sample were having an average population of around 48,000 on an average in 1400, while the Atlantic cities were having an average population of around 38,000 (See Data Appendix Figure IV). As guilds at the Atlantic coast held lower clout in previous centuries, they were more likely to decline than Mediterranean cities and give way to impersonal markets as these cities found the changes due to the commercial revolution more disruptive.

[11] Figure II in Data Appendix provides clear evidence that the network for postal communication in Europe existed already.

average city distance (UPGMA). The procedure produces a dendrogram (given in Figure I in Data Appendix) which can be cut off at a given threshold. For a given threshold, if a city a is part of a cluster made up of n cities, then the city has a clustering index $Clust_a = log(n)$. I cut the dendrogram at different thresholds for robustness and use the clustering in Table II in Data Appendix for the standard regressions.

I consider the log of population in the fifteenth century ($Log(Pop1500_a)$), and growth in population during the fifteenth century ($Growth1500_a = log(\frac{Pop1500_a}{Pop1400_a})$), as basic controls that may affect nature of economic institutions. Data related to population (total and growth) estimates not only demographic characteristics but also the economic characteristics at the city level, as historically, the largest cities were also the most prosperous ones. Large cities with a large population being economically dominant could attract more traders. Similarly, growing cities were attracting traders because of the greater availability of opportunities. I also consider the square root of elevation ($\sqrt{Elevation_a}$ for each city a), as cities at a higher altitude may be more difficult to reach in the medieval and early modern period, and thus they may be unsuitable as commercial towns, and more suitable as political and administrative centers. The three factors could affect the impersonal nature of cities.

Medieval Fairs: Medieval cities that hosted temporary fairs, where European traders (affiliated to guilds) would gather, could be good precursors for emerging impersonal markets. One of the most prominent medieval fairs in Europe was the Champagne fairs in Northern France. Gelderblom (2013) wrote how the decline of the medieval fairs gave rise to markets in the Low Countries, as footloose merchants trading in Champagne moved away to the North. It is noteworthy that cities in the Champagne region did not themselves impersonalize. So, it is possible that fair cities could themselves evolve into impersonal cities. It is also alternatively possible that the traditional institutions in established medieval fair cities resisted the evolution of impersonal economic institutions.

Regardless of the direction of causality, if any, medieval fairs reflected an important aspect of the medieval commercial system of Europe. I borrow data on the location of fairs during 1450-1500 in Europe from the University of Iowa Library's Atlas of Printing[12] which builds its data from a variety of sources. I label a city a as a fair city if the city is listed to host fairs in the Atlas of Printing, and I code $dFair_a = 1$. The following cities in the sample were fair cities in Europe according to the Atlas of Printing: Angers, Bordeaux, Caen, Lille, Lyon, Orleans, Paris, Rennes, Rouen, Toulouse and Tours in France; Antwerp, Bruges, and Ghent in Belgium; Bologna, Ferrara, Florence, Milan, Rome and Venice in Italy; Cordoba, Plasencia, Sevilla, and Valladolid in Spain, and London (Westminster) in England.

[[Insert Figures V, VI, VII, VIII about here]]

[12]The library's data can be accessed at http://atlas.lib.uiowa.edu

VII Results

A Empirical validity of the codified dataset

Table II provides descriptive statistics of the data, part of which has already been described in Figure IV where non-relationship-based cities have higher levels of printing and are closer to the sea. However, note that aggregate population growth in 1500 of the impersonal cities is higher than that of the reforming cities, whose growth is higher than that of the relationship-based cities. Such high levels of population growth in the medieval and early modern period highlights how impersonal (and relationship-based) cities were attracting people because of economic opportunities. Moreover, impersonal and reforming cities were more clustered and at a lower altitude from the sea on average than an average relationship-based city. Population-levels in the fourteenth and fifteen centuries do not show any distinct pattern. Cities undergoing reform were more populated than the general sample in the fifteenth century, while impersonal cities were less populated. More impersonal cities, on average, were holding medieval fairs than relationship-based cities. However, fewer cities undergoing reform, on average, were holding medieval fairs.

[[Insert Table II about here]]

Figure IX shows the estimates of yearly penetration of trade-related books ($YearlyTradePentr_{ya}$) controlling for the stated fifteenth century factors, yearly printing penetration ($YearlyPrintPentr_{ya}$) in the city, and additional controls of latitude, longitude, and growth of population in the sixteenth century. These additional factors do not significantly alter the graph presented in Figure III, and in the later periods of the sixteenth century, impersonal cities had a significantly larger penetration of trade-related books than in relationship-based cities. In the years 1551, 1555, 1568, 1576, 1580, 1582, 1583, 1585, 1587, 1588, 1589, 1590, 1591, 1594, 1595, 1596, and 1598 the penetration of trade-related books in impersonal cities was more than double than in cities where merchant guilds persisted[13]. Table III shows that since the 1550s, impersonal cities had a greater penetration of trade-related books than relationship-based cities, while they were similar in their trade-related book penetration before.

[[Insert Figure IX and Table III about here]]

The above observations show that cities that have been coded as impersonal in the sixteenth century began to show greater consumption of trade-related content as the sixteenth century progressed. Having established this pattern, we can now analyze the factors that led to the rise of such impersonal markets in cities.

[13] At 90 percent confidence or more.

B Antecedents to the Nature of economic institutions

Table IV reports the OLS regression of the dependent variable $Inst_a^{1600}$ with covariates for the whole sample.

$$Inst_a^{1600} = \alpha + \beta_1 SeaPortCloseness_a + \beta_2 PrintPentr_a + \beta_3 SeaPortCloseness_a X PrintPentr_a + \gamma X_a + \epsilon_a$$

where $Inst_a^{1600}$ measures the level of market development in the sixteenth century of a city and X_a is a vector of control variables.

[[Insert Table IV about here]]

Columns 3 and 4 of Table IV show that an interaction between the transformed variables Printing Penetration and Closeness to Port had a sizable and significant positive effect on the level of market development in the sixteenth century ($Inst_a^{1600}$). The individual effects of Printing Penetration and the Closeness to Port (Columns 1-3) lose significance when controls on clustering ($Clust_a$), population growth ($Growth1500_a$), population in 1500 ($log(Population1500)$), medieval fair and elevation are added (Column 4). As printing penetration and opportunities independently do not directly affect market development, the hypothesis passes a key test that it is the interaction of the two factors that mattered for market development.

Many cities had little or no printing, so any establishment of printing in and around the city increased the per capita printing penetration of the region several times. For example, London (with $PrintIndex_a = 9.33$ bptp) which with Westminster printed several hundred books in the fifteenth century, had ten times more printing penetration per capita than Lisbon (with $PrintIndex_a = 0.81$ bptp) where according to the GW database only 28 books were printed in the fifteenth century. If a relationship-based city was at the sea ($Trade_a = 21.29\sqrt{km}$), and its per capita printing penetration in the fifteenth century doubled, it was about 0.18 steps closer to undergo reform in the sixteenth century.

The fact that high printing penetration does not independently affect market development shows that a large shock in the number of printed books alone even in large commercial European cities did not make it easier for traders to trade in an impersonal manner, in the absence of clear incentives to initiate trade beyond familiar networks. If the interaction between printing and closeness to port is not considered (Columns 1, 2 & 2a), then both the factors appear individually significant, which further strengthens the argument that an interaction between the two sizable and significant factors was important to consider to understand the nature of the effect of these two factors. Clustering appears to have a large positive effect (Column 4) but only at a 10 percent

significance level, and it would have been attributed a larger and more significant positive effect (Columns 2a) had interaction between printing and closeness to port not been considered.

The regression results strengthen the argument that more cities close to a port and enjoying higher levels of printing activity in the fifteenth century, were reforming and turning impersonal in the sixteenth century, and cities that enjoyed none or only one of the two factors stayed relationship-based.

C Geography of economic institutions

Is it reasonable to assume that printing was exogenous? Maybe, cities like Antwerp that were already more commercially oriented attracted more printing. Such endogeneity may upward bias the results. However, many cities that were adopting printing, like Paris or Rome were traditional economic and political centers that might have been resistant to institutional change, which may downward bias the results. To allay endogeneity concerns, I use a geographic instrumental variable. One of the geographic reasons that determined the level of early printing adoption in Europe was its distance from Mainz, Germany. The printing press was invented in Mainz by Johannes Gutenberg, and most know-how regarding printing press technology was based in the city (held by Gutenberg and his apprentices) during the fifteenth century Europe. The printing press diffused slowly, with cities closer to Mainz getting the technology sooner (Dittmar, 2011), and distance from Mainz has been used an instrument by Dittmar (2011) for the level of print adoption. Mainz was not a distinct city in the fifteenth century, such that the distance from Mainz would affect cities in ways other than the adoption of printing. Figure X plots the logarithm of distance from Mainz on the X-axis, and $PrintPentr_a$ on the Y-axis.

[[Insert Figure X about here]]

Columns 2 and 4 of Panel A of Table V report the results of the second stage of the 2SLS regressions and the results of 2SLS regression seem to confirm that the interaction between printing and closeness to port were having a sizable and significant positive effect of level of market development ($Inst_a^{1600}$). Distance from Mainz and its interaction to the distance from a port is a strong instrument with large and highly significant relation to printing as shown in Panel B, with a large F statistic greater than 10. The 2SLS estimate of the effect of interaction between printing and closeness to port (Column 4), is around double the size of the OLS estimate (Column 3). While in the OLS specification, a two-fold increase in the fifteenth century per capita printing penetration led to 0.18 unit increase in the level of market development in the sixteenth century at cities close to the sea; in the 2SLS specification, a two times increase in the fifteenth century per capita printing penetration led to 0.39 unit increase in the level of market development

in the sixteenth century in cities at the sea. Alternatively, about a six-fold increase in the fifteenth century per capita printing penetration led to a unit increase in the level of market development in the sixteenth century in the cities at the sea[14].

As the distance from Mainz is a strong instrument, and it is argued that it is reasonable to assume that it followed the exclusivity restriction, the larger estimate can be interpreted as the effect of higher printing and its interaction for cities that adopted printing primarily because of closeness to Mainz. Other factors affected printing adoption, one of which is medieval fair in the city (Column 4a) which had a significant and positive effect on printing adoption, and the 2SLS estimate would exclude the impact of other covariates. Medieval fair in a city seems to negatively affect market development (Column 4), which hints towards the possibility that medieval traditional trade institutions, that must be more established in medieval fair cities, impeded reform and market development.

[[Insert Table V about here]]

As Figure IV showed and the OLS and 2SLS regressions in Tables IV and V confirmed, there is evidence for a strong relationship between the level of market development ($Inst_a^{1600}$) in the sixteenth century and the interaction between printing and closeness to the sea. I now turn our attention to cities close to the sea. The most distant non-relationship-based city from a port (Brescia, Italy) had a distance of 143km from the port (Table II). I thus now focus on cities that were within a distance of 150km from the sea.

Table VI reports the regression results for the limited sample. Among cities close to the sea, $PrintPentr_a$ continues to have a large and significant positive effect on market development in the sixteenth century. When the dummy variable $dNearAtlantic_a = dDisrupt_a$ is added to regression, to specifically account for the cities that were closer than 50km from an Atlantic Port, the variable also has a large and significant effect (Column 3). The addition also increases the R square of the regression from 0.268 to 0.444. When an interaction between printing and nearness to an Atlantic Port is considered (Column 4), the interaction has a sizable and significant positive effect, and the R square further increases to 0.503. Among cities close to the sea and on the Atlantic coast a two times increase in the fifteenth century per capita print penetration, increased the level of market development by 0.3 units in the sixteenth century.

The isolated effect of printing continues to be sizable and significantly positive in the limited sample, but cities near an Atlantic Port did not individually have higher levels of market development if not enjoying higher print penetration. Also, it is noteworthy that in the restricted sample of cities close to the sea, the effect of urban clustering

[14] $\Delta Inst_a^{1600} = (-0.111 + 0.0317 * (Trade_a = 21.29)) * ln(\#\ of\ X\ increase\ in\ PrintIndex_a)$ (Column 4 of Table V).

is insignificant. However, the dummy for a medieval fair in a city continues to have a significant negative effect (Column 4), further hinting that established trading institutions in cities with medieval fairs probably impeded the emergence of impersonal economic institutions.

[[Insert Table VI about here]]

Columns 2 and 4 of Panel A of Table VII report result of the 2SLS regressions with distance from Mainz acting as an instrument for printing penetration. The estimates for the limited sample like in the case of the whole sample (Table V) show a large and significant effect of printing. The interaction between closeness to Atlantic Port and printing is large but is significant only at 10 percent level. In the 2SLS specification, a two-fold increase in the fifteenth century per capita printing penetration among cities close to the sea and at the Atlantic coast led to a 0.48 unit increase in the level of market development in the sixteenth century (unlike the 0.3 unit increase in the OLS specification). In other words, about a four-fold increase in the fifteenth century per capita printing penetration among cities at the Atlantic coast led to a unit increase in the level of market development in the sixteenth century[15].

The instrument is strong (Panel B) and has a high F statistic. Once again like in Table V, the higher 2SLS in Table VII estimates can be interpreted as estimating the isolated effect of printing in cities that had high printing penetration primarily because of closeness to Mainz, excluding the effect of covariates like medieval fairs. Like in previous regressions, medieval fairs seem to have a large negative effect on the market development in the sixteenth century (Column 4).

[[Insert Table VII about here]]

As different factors may drive the rise of impersonal and reforming cities, I also run a multinomial logit regression, and the results are reported in Table VIII. There are two prominent observations to be made. Firstly Columns 2a and 2b show that an interaction between printing penetration and closeness to port is significant in predicting whether a city reforms or turned impersonal when considering the entire sample. If cities close to the sea (within 150km from the sea) are considered (Column 4a), printing increased the chances of a city reforming, while nearness to an Atlantic Port had no significant effect. The observation is in line with the expectation as the North Italian cities reformed, and enjoyed high printing penetration, but they were not close to the Atlantic. In contrast, closeness to the Atlantic exponentially increased the chances that a city impersonalized (Column 4b) (because there are no non-Atlantic cities that impersonal in the sixteenth

[15] $\Delta Inst_a^{1600} = (0.289 + 0.407 * (dNearAtlantic_a = 1)) * ln(\#\ of\ X\ increase\ in\ PrintIndex_a)$ (Column 4 of Table VII) .

century), and the effect of printing on market development of a city was large and positive (which is expected) but not statistically significant at 10 percent level in cities that were close to an Atlantic Port. The loss of significance may be attributed to the small sample of impersonal ($Inst_a^{1600} = 2$) cities. Secondly, urban clustering had a large and significant effect on increasing the chances of reform in a city (Column 2a and 4a), which is not surprising given that all reforming cities were parts of dense urban clusters of Belgium, Netherlands, and North Italy. However, noteworthily urban clustering had no significant effect on the chances of a city becoming impersonal (Column 2b and 4b). The observation is in line with expectation, as cities like London or Hamburg were not parts of urban clusters and turned impersonal nonetheless. The Medieval fair dummy holds large negative effect (statistically significant in column 2a and 4a, and not significant in column 2b) in all cases (as has been the trend in previous regressions) except Column 2b, where in Column 2b presence of medieval fairs increases the probability of a city became impersonal, which reflects the trends in the summary statistics (Table II) where impersonal cities were on an average more likely to hold medieval fairs. Given the mixed effects of medieval fairs in the results, I conclude it is better not to provide a definitive conjecture on the effect of medieval fairs on economic institutions, and this may be a topic of future research.

[[Insert Table VIII about here]]

Data Appendix Tables VI (considering number of printing cities within 50km from a city ($PrintCity50km_a$) as a proxy for printing), VII (considering different thresholds for distance from port and level of clustering), VIII and IX (considering a limited sample of 50 largest cities in the fifteenth century), X and XI (considering a limited sample of cities without code R3 or U3) report robustness checks, and the results remain principally unchanged.

[[Insert Figure XI about here]]

In Figure IX we observed that impersonal cities had a greater penetration of trade-related books than other cities especially in the later half of the sixteenth century. Given that these institutions developed in cities with high printing penetration (in the 15th century) at the Atlantic, would we observe a similar pattern if we regressed a city's yearly trade-related book penetration ($YearlyTradePentr_{ya}$) with the interaction between city's yearly printing penetration ($YearlyTradePentr_{ya}$) and its closeness to the Atlantic port ($dNearAtlantic_a$)? In Tables IX and X, we find that cities that were at the Atlantic and also had higher penetration of printing in a given year, had a higher penetration of trade-related books in that year, after the 1540s (Columns 10 to 15).

[[Insert Tables IX and X about here]]

VIII Conclusion

In this paper, I explored how markets develop in economies dominated by relationship-based forms of business. I collected and analyzed city-level data of early modern Europe to answer the following questions. Firstly, why did the relationship-based merchant guild system decline in the Low Countries and England, and why did impersonal markets emerge? I argued that the opportunity for beneficial long-distance trade with merchants, who were attracted to the growing Atlantic coast, motivated merchants to trade with relatively unfamiliar partners. Moreover, higher availability of printed books in the Low Countries and England, especially trade-related books, increased information access, accelerated diffusion of trade-related content. These trade and information shocks enabled a large mass of merchants to conduct business in impersonal markets, supported by co-developing contractual infrastructure.

Secondly, why did the transition happen only during the sixteenth century? I argued that because (*i*) trade on the Atlantic coast, and (*ii*) the movable-type printing press, were innovations of the late fifteenth century, the transition only began in the late fifteenth and the early sixteenth century. Thirdly, why did not other regions also transition to an impersonal system, even if they faced similar initial conditions? I argued that no other region other than northwest Europe won the double lottery of high printing penetration and booming trade at the Atlantic coast, and winning of both the lotteries was necessary for the emergence of impersonal exchange.

The paper showed that relationship-based institutions like guilds were dominant historically, in a world without formal and impartial legal institutions. The emergence of impersonal markets required a trade shock - good incentives to go beyond relationships - and information shock - precise information about these opportunities. While the study focused on the specific setting of sixteenth-century Europe, future studies on similar shocks of trade and information can provide further evidence whether the hypothesis developed in this paper about impersonal markets holds true across other geographical and historical settings.

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Proof of Proposition 1: If the actual market realization were m^*, and the agent observed a signal x^*, then the fraction of investors f^* who observe a signal $x > x^*$ is given as

$$f^* = 1((x^* - m^*)\sqrt{\beta}) \tag{2}$$

where (.) is the standard normal CDF function.

If an investor receives a signal x, based on the precision of public and private priors, and the mean y, the mean expected value of signal they calculate is $\frac{\alpha y+\beta x}{\alpha+\beta}$, and expected variance is $\frac{1}{\alpha+\beta}$. Hence, an investor who observes a signal x^*, calculates the probability that $m > m^*$, to be $Pr(m > m^*|\frac{\alpha y+\beta x^*}{\alpha+\beta}) = (1((m^* - \frac{\alpha y+\beta x^*}{\alpha+\beta})\sqrt{\alpha+\beta}))$. For an equilibrium with a threshold m^* to exist, at m^* an investor must be indifferent between investing $(i-t)$ and not investing (d_i) i.e. $(i-t)(1((m^* - \frac{\alpha y+\beta x^*}{\alpha+\beta})\sqrt{\alpha+\beta})) - t(((m^* - \frac{\alpha y+\beta x^*}{\alpha+\beta})\sqrt{\alpha+\beta})) = d_i,$. Hence,

$$((m^* - \frac{\alpha y + \beta x^*}{\alpha+\beta})\sqrt{\alpha+\beta})) = 1 - \frac{d_i + t}{i} \tag{3}$$

Combining equations 1, 2, and 3, we can solve for f^*, x^* and m^*. such that if actual m is m^*, investors are indifferent between investing and not investing at m^* and merchants are indifferent between returning and not returning at f^*. The solution to equations 1, 2 and 3 will be unique if and only if LHS of equation 3 is monotonically increasing in f^*. A sufficient condition for monotonicity (differentiating LHS of Eq. 3 w.r.t f^*) is $\beta \to \infty$, (precise private signal) or $\alpha \to 0$ (uniform prior of m which is unrealistic in our setting). At $\beta \to \infty$, $((m^* - \frac{\alpha y+\beta x^*}{\alpha+\beta})\sqrt{\alpha+\beta}) = (m^* - x^*)_\infty = 1 - (x^* - m^*)_\infty = f^* = 1 - \frac{d_i+t}{i}$ is a unique solution.

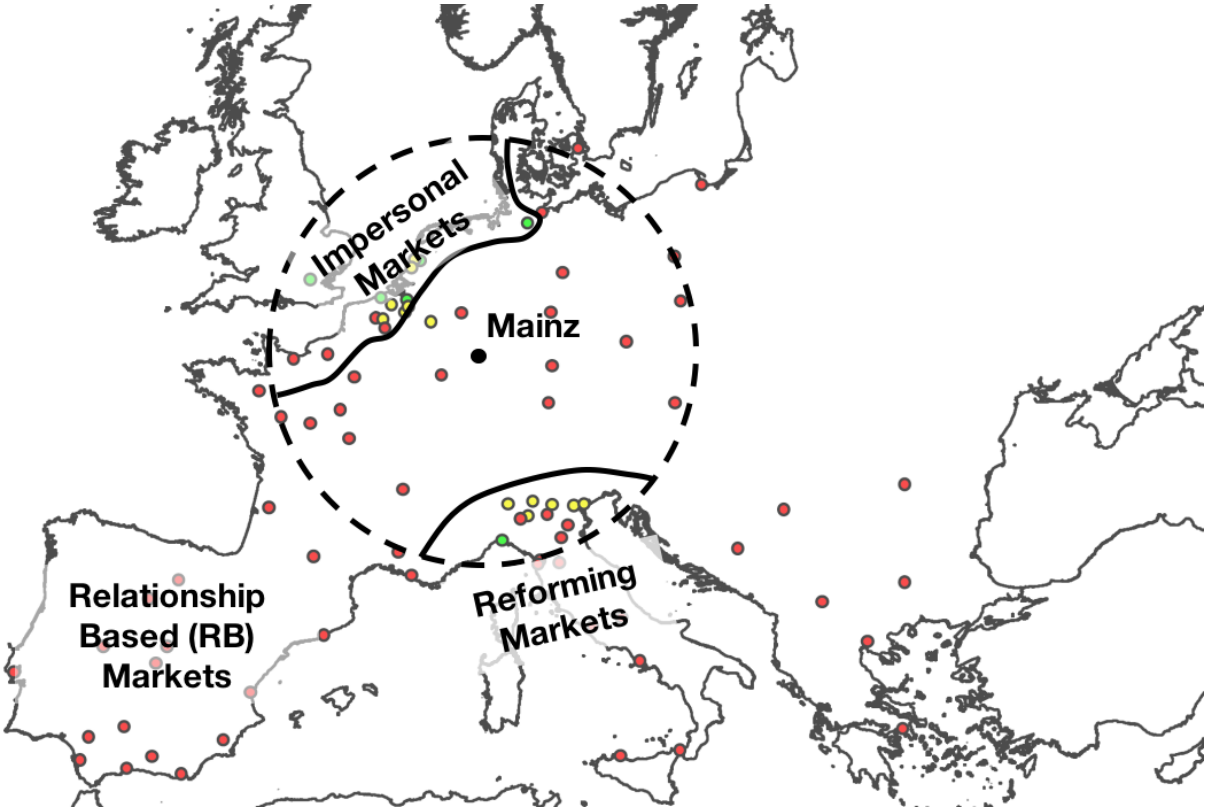

Figure I: Map of 50 largest cities of Europe in the fourteenth, fifteenth and sixteenth-century (Bairoch, Batou, and Chevre, 1988) based on the type of institutions. The figure describes the different conditions in the different regions in Europe. The Region 1 in northwest Europe is the area that is closer to Mainz and also close to the Atlantic Ports. Thus, it was uniquely situated at the heart of the commercial and communication revolutions. In Region 1, all the cities with emerging impersonal markets were found. No other region won the double lottery of high printing penetration and trade at the Atlantic coast like the Low Countries and England and winning of both the lotteries, we argue, was necessary for the transition to happen. The Region 2 in North Italy is the area that is closer to Mainz and also close to the sea. In Region 2, the cities undergoing reform were found where elites reformed to ensure impersonal markets would not develop. Rest of Europe (Region 3) is made up of Relationship-based cities.The Label- Green: I1 & I2 (impersonal), Yellow: U1, U2 & U3 (undergoing reforming), Red: R1, R2 & R3 (relationship-based). Table IV in Data Appendix details the nature of economic institutions in each city based on historical sources.

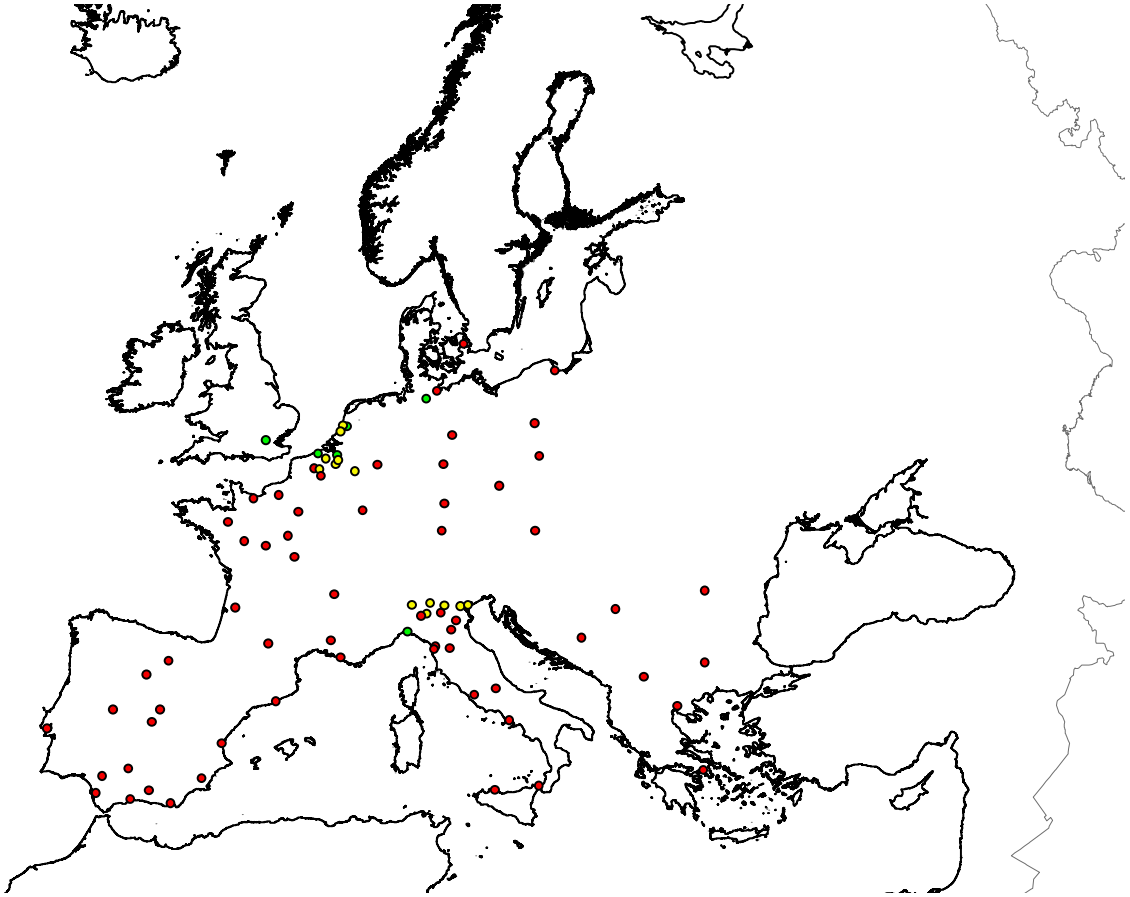

Figure II: Map of 50 largest cities of Europe during the fourteenth, fifteenth and sixteenth century (Bairoch, Batou, and Chevre, 1988) based on type of institutions. Label- Green: I1 & I2 (impersonal), Yellow: U1, U2 & U3 (undergoing reform), Red: R1, R2 & R3 (relationship-based).

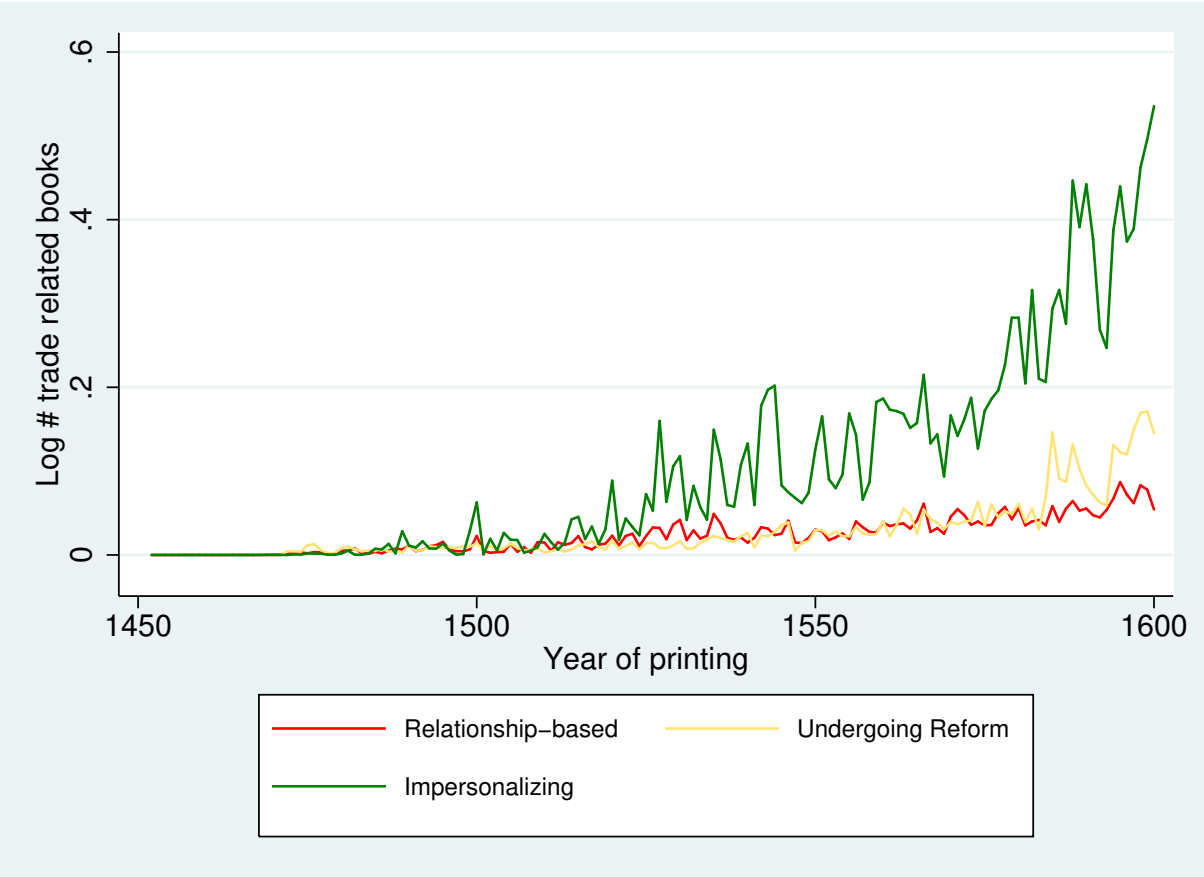

Figure III: The graph presents the yearly penetration of trade-related books ($YearlyTradePentr_{ya}$) in impersonal cities, cities undergoing reform, and relationship-based cities. Variable $YearlyTradePentr_{ya}$ is a measure of level of diffusion of trade-related books in a given year in a given city, from the 229 printing cities in the USTC database, adjusting for population. N = 80 cities X 149 years (1452-1600)

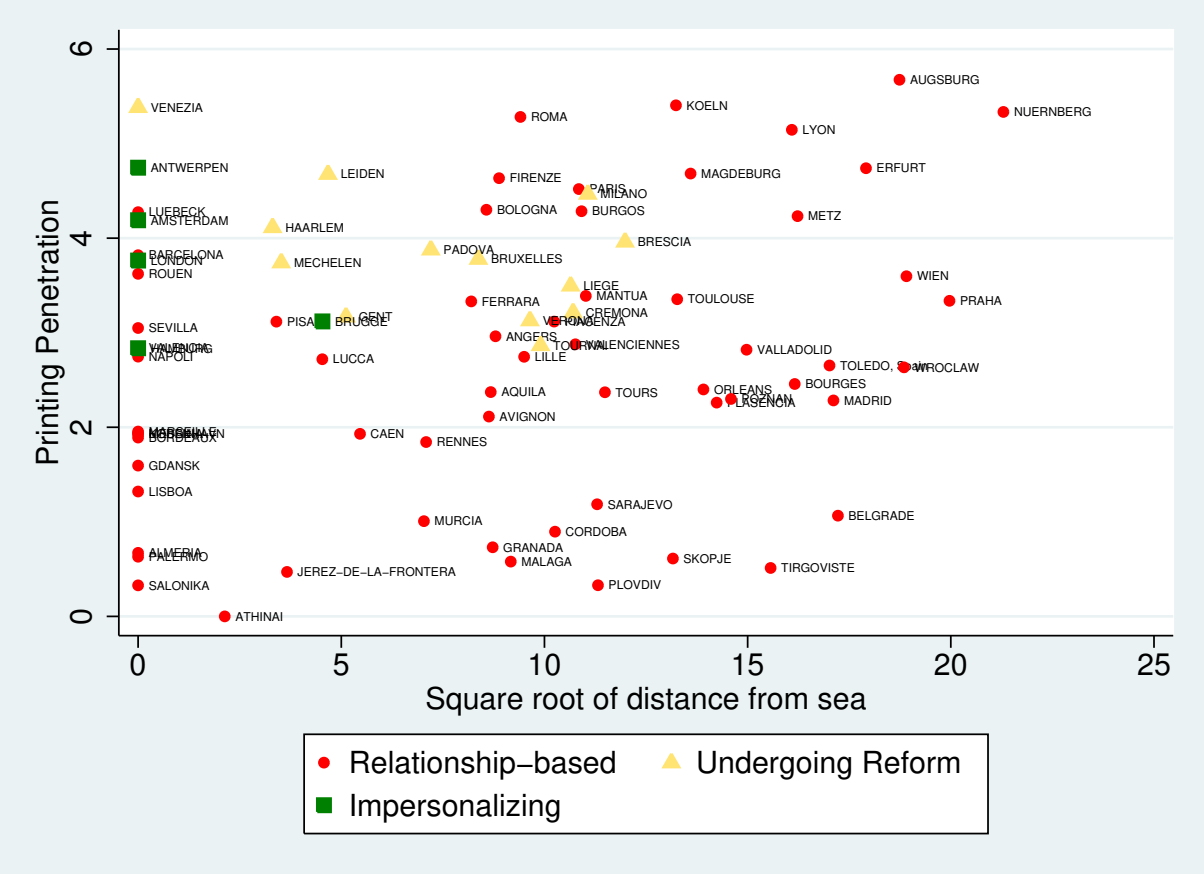

Figure IV: The two way plot of cities between variables $PrintPentr_a$ and $\sqrt{SeaPortDist_a}$ for different types of institutions. $PrintPentr_a$ is a measure of level of diffusion of printed books in the 15th century in a given city, from the 121 printing cities in the GW database, adjusting for population.

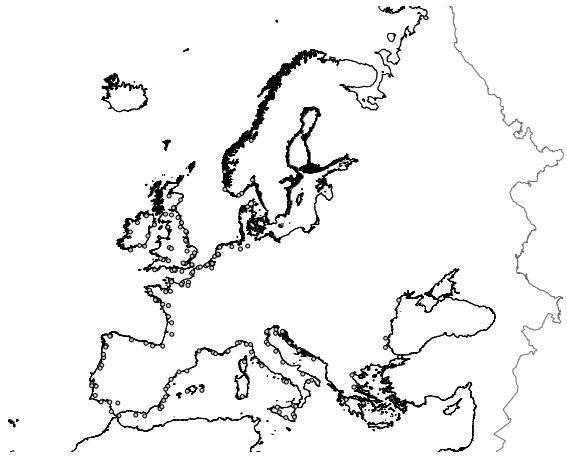

Figure V: Map of the 166 Atlantic and Mediterranean Ports of Early Modern Europe (Acemoglu, Johnson, and Robinson, 2005).

Figure VI: Map of the 121 cities that printed more than 10 books in the 15th century in the GW catalogue. Size of the circle represents the number of books being printed.

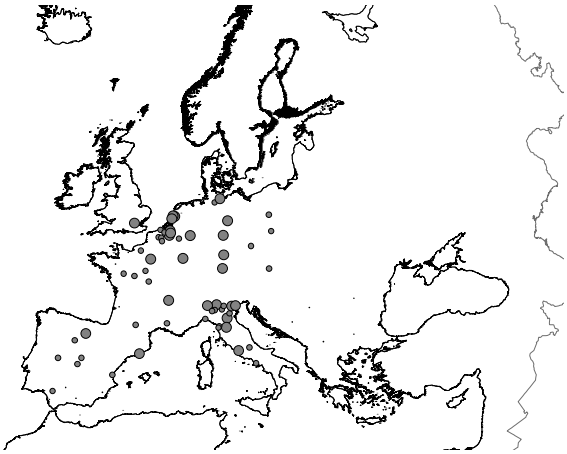

Figure VII: The $PrintPentr_a$ measure of the 81 largest cities in the sample. Size of the circle represents the degree of printing penetration.

Figure VIII: Map of 335 largest cities of Europe during the fourteenth, fifteenth and sixteenth century (Bairoch, Batou, and Chevre, 1988) with population greater than or equal to 10,000.

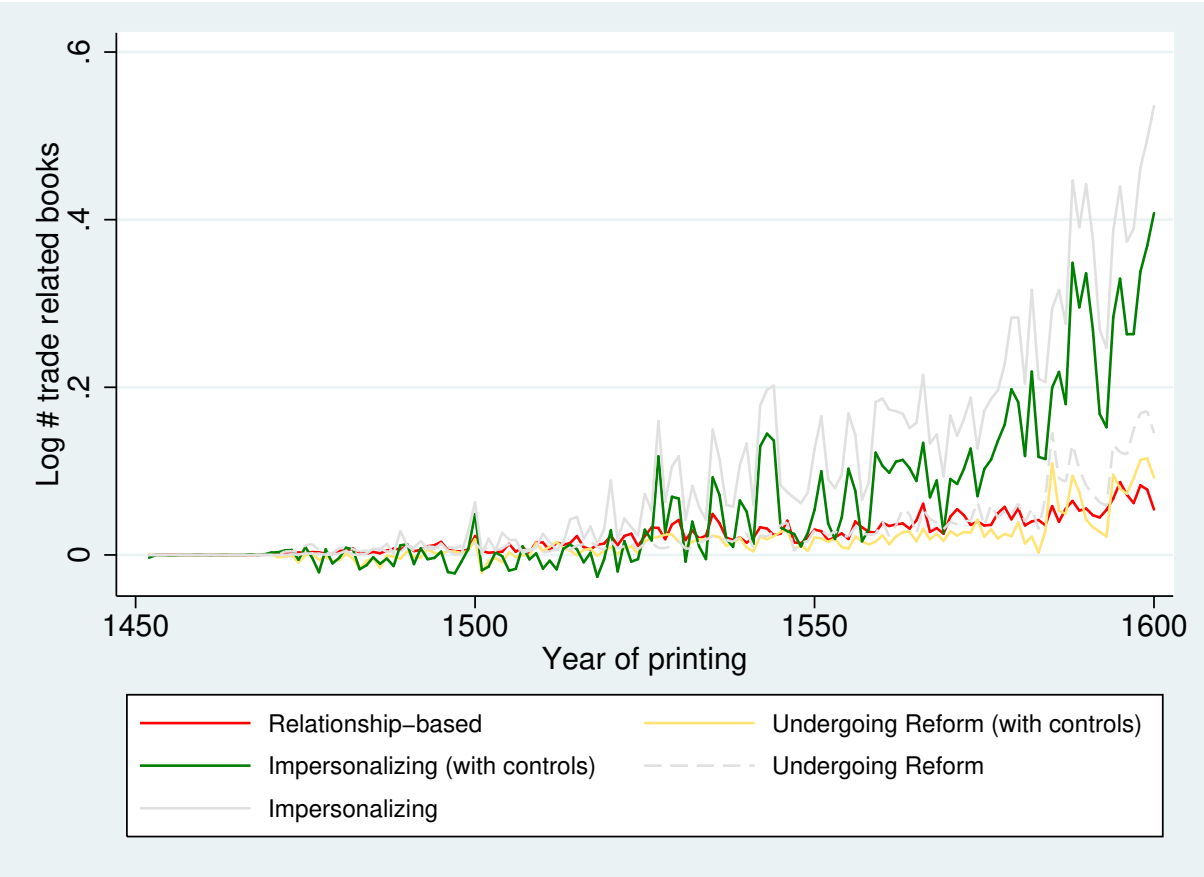

Figure IX: The graph presents the yearly penetration of trade-related books ($YearlyTradePentr_{ya}$) in impersonal cities, cities undergoing reform, and relationship-based cities, with additional city level controls on yearly printing penetration ($YearlyPrintPentr_{ya}$), size of urban agglomeration, log of population in 1400, 1500 and growth in population in the 16th century, square root of elevation, medieval fair, Atlantic port, distance from sea, latitude and longitude and closeness to port. Variable $YearlyTradePentr_{ya}$ is a measure of level of diffusion of trade-related books in a given year in a given city, from the 229 printing cities in the USTC database, adjusting for population. $YearlyPrintPentr_{ya}$ is a measure of level of diffusion of all books in a given year in a given city, from the 229 printing cities in the USTC database, adjusting for population. N = 80 cities X 149 years (1452-1600)

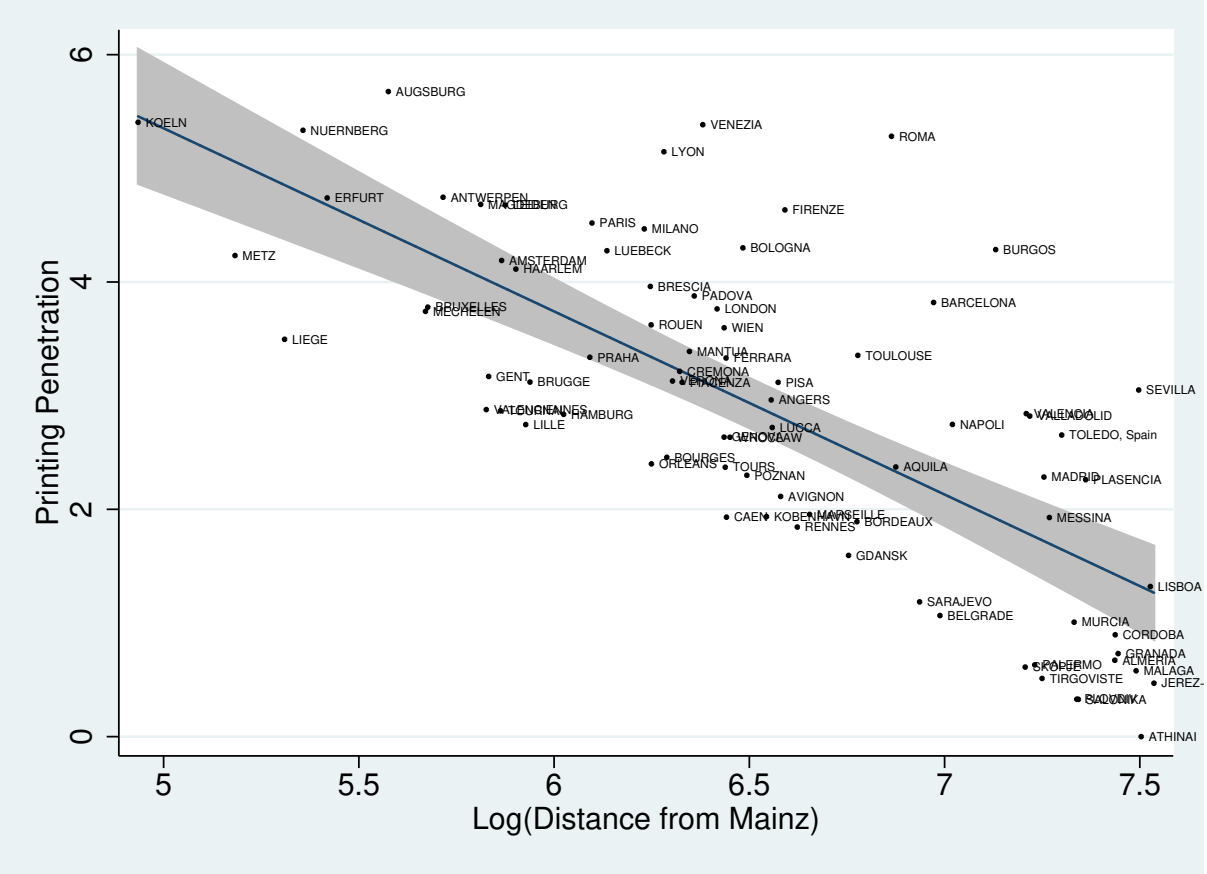

Figure X: The two way plot of cities between variables $PrintPentr_a$ and $log(DistancefromMainz)$ for different types of institutions. $PrintPentr_a$ is a measure of level of diffusion of printed books in the 15th century in a given city, from the 121 printing cities in the GW database, adjusting for population.

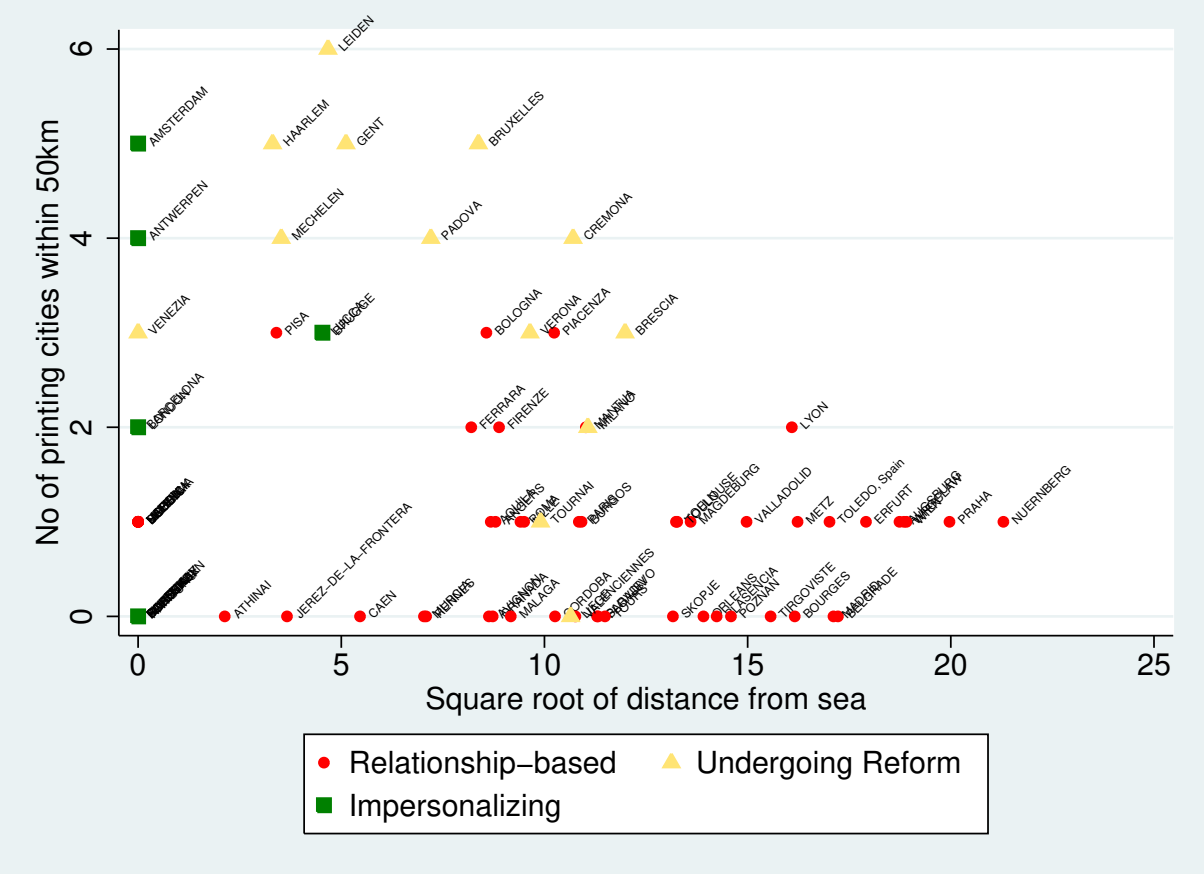

Figure XI: The two way plot of cities between variables $PrintCity50km_a$ and $\sqrt{SeaPortDist_a}$ for different types of institutions.

Table I: The table explains the scheme adopted for classifying cities as impersonal (I), undergoing reform (U), or relationship-based (R) in the 16th century.

Code	Description
I1	A city that never gave monopoly privilege to particular traders/-groups.
I2	Sixteenth-century impersonal city where monopolies over trade were removed at least partially.
U1	Sixteenth-century city undergoing reform where while urban elites enjoyed monopoly privileges, but they gave concessions to rural or non-guild producers/traders.
U2	Sixteenth-century auxiliary city close to an impersonal city, where rural or non-guild producers/traders were not coerced to trade through the auxiliary city.
U3	Sixteenth-century city undergoing reform where specific details regarding guild reforms are not documented at the city level, but region has been identified as undergoing reform.
R1	Sixteenth-century relationship-based city where merchant guilds have been documented to enjoy monopoly privileges.
R2	Sixteenth-century relationship-based city where merchant guilds were nonexistent as the social institution in the region was documented to be was feudal.
R3	Sixteenth-century relationship-based city where specific details regarding guild privileges are not documented at the city level, but their monopolistic nature can be inferred based on other descriptions.

Table II: The table presents the summary statistics of key variables for the whole sample of 81 cities, and further decomposes the statistics based on the type of the 16th century economic institution.

	(1)	(2)	(3)	(4)
		Whole Sample		
VARIABLES	N	mean	min	max
# cities in cluster	81	7.852	1	22
Print Index	81	9.250	0.217	63.14
# Print Cities in 50km	81	1.309	0	6
Population 1400	75	36.99	3	275
Population 1500	81	37.37	5	225
Population 1600	81	52.94	7	300
Population 1850	81	122.1	4	2,236
Distance from Port	81	106.4	0	453.4
Growth 1500	75	0.114	-1.273	2.079
Medieval Fair	81	0.309	0	1
Elevation from sea	81	127.1	1	862
Yearly Print Index	81 X 149	0.619	0	28.95
Yearly Trade Index	81 X 149	0.033	0	2.814
	(1)	(2)	(3)	(4)
		Inst = 0		
VARIABLES	N	mean	min	max
# cities in cluster	62	6.258	1	22
Print Index	62	8.381	0.217	63.14
# Print Cities in 50km	62	0.758	0	3
Population 1400	56	35.25	4	275
Population 1500	62	36.48	5	225
Population 1600	62	51.79	7	300
Population 1850	62	97.97	4	1,053
Distance from Port	62	124.5	0	453.4
Growth 1500	56	0.0828	-1.253	2.079
Medieval Fair	62	0.306	0	1
Elevation from sea	62	156.0	5	862
Yearly Print Index	62 X 149	0.536	0	13.01
Yearly Trade Index	62 X 149	0.025	0	1.510
	(1)	(2)	(3)	(4)
		Inst = 1		
VARIABLES	N	mean	min	max
# cities in cluster	13	13.54	4	22
Print Index	13	13.04	3.807	47.20
# Print Cities in 50km	13	3.462	0	6
Population 1400	13	38.46	6	100
Population 1500	13	43.23	12	100
Population 1600	13	49.69	11	151
Population 1850	13	72.62	26	209
Distance from Port	13	67.57	0	143.6
Growth 1500	13	0.202	-0.405	0.847
Medieval Fair	13	0.231	0	1
Elevation from sea	13	43.46	1	150
Yearly Print Index	13 X 149	0.675	0	28.95
Yearly Trade Index	13 X 149	0.031	0	1.783
	(1)	(2)	(3)	(4)
		Inst = 2		
VARIABLES	N	mean	min	max
# cities in cluster	5	12.40	2	22
Print Index	5	11.43	3.692	24.92
# Print Cities in 50km	5	2.800	0	5
Population 1400	5	40	3	125
Population 1500	5	29	15	50
Population 1600	5	73.60	27	200
Population 1850	5	549.6	50	2,236
Distance from Port	5	4.114	0	20.57
Growth 1500	5	0.370	-1.273	1.792
Medieval Fair	5	0.600	0	1
Elevation from sea	5	11	3	21
Yearly Print Index	5 X 149	1.498	0	11.239
Yearly Trade Index	5 X 149	0.132	0	2.814

Table III: Each row presents the mean difference between the yearly penetration of trade-related books ($YearlyTradePentr_{ya}$) in impersonal cities ($Inst = 2$) vs. relationship-based cities ($Inst = 0$), and cities undergoing reform ($Inst = 1$) vs. relationship-based cities, controlling for the yearly printing penetration ($YearlyPrintPentr_{ya}$), size of urban agglomeration, log of population in 1400, 1500 and growth in population in the 16th century, square root of elevation, medieval fair, Atlantic port, distance from sea, latitude and longitude, closeness to port and year fixed effects. Variable $YearlyTradePentr_{ya}$ is a measure of level of diffusion of trade-related books in a given year in a given city, from the 229 printing cities in the USTC database, adjusting for population. $YearlyPrintPentr_{ya}$ is a measure of level of diffusion of all books in a given year in a given city, from the 229 printing cities in the USTC database, adjusting for population. N=80 cites X 10 years in each decade. Standard errors clustered at the city level.

Decades	$Inst = 1$		$Inst = 2$		N	Year-FE	Controls
	coeff.	sd	coeff.	sd			
1470-79	0.00113	(0.00175)	-0.000830	(0.00130)	800	Yes	Yes
1480-89	0.000227	(0.00153)	0.00215	(0.00234)	800	Yes	Yes
1490-99	-0.00162	(0.00240)	-0.00304	(0.00505)	800	Yes	Yes
1500-09	-0.00118	(0.00236)	0.00685	(0.00594)	800	Yes	Yes
1510-19	-0.00467	(0.00312)	0.000196	(0.00780)	800	Yes	Yes
1520-29	-0.0119***	(0.00446)	0.00626	(0.0204)	800	Yes	Yes
1530-39	-0.0158**	(0.00740)	0.000907	(0.0178)	800	Yes	Yes
1540-49	-0.0167**	(0.00787)	0.0174	(0.0275)	800	Yes	Yes
1550-59	-0.00712	(0.00517)	0.0415**	(0.0199)	800	Yes	Yes
1560-69	-0.0110	(0.00937)	0.0599**	(0.0278)	800	Yes	Yes
1570-79	-0.0160	(0.0110)	0.0579	(0.0367)	800	Yes	Yes
1580-89	-0.00462	(0.0124)	0.118**	(0.0514)	800	Yes	Yes
1590-99	0.00181	(0.0181)	0.165*	(0.0840)	800	Yes	Yes
1452-1600	-0.00599	(0.00473)	0.0326**	(0.0124)	11920	Yes	Yes

Robust city-level clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table IV: The table reports results of regression between the 16th century economic institutions and the 15th century diffusion of printing with additional variables especially closeness to the sea. Dependent variable is the 16th century nature of economic institutions in a given city. Printing Penetration is a measure of level of diffusion of printed books in the 15th century in a given city, from the 121 printing cities in the GW database, adjusting for population. Closeness Port is a *constant* - the square root of Distance of the city from a sea port. The independent variables of interest are Print Penetration, Closeness to Port and their interaction. Columns 4 has additional controls described in the Other Factors subsection of the paper. Column 2a additionally reports the results without the interaction effect between Print Penetration and Closeness to Port.

	(1)	(2)	(3)	(4)	(2a)
VARIABLES	OLS	OLS	OLS	OLS	OLS
Print Penetration	0.127***	0.153***	-0.0762*	-0.0617	0.123***
	(0.0369)	(0.0356)	(0.0407)	(0.0427)	(0.0357)
Closeness Port		0.0336***	-0.0208**	-0.0119	0.0342**
		(0.0102)	(0.00967)	(0.0123)	(0.0130)
Print Pentr X Closeness Port			0.0179***	0.0151***	
			(0.00439)	(0.00469)	
log(# cities in cluster)				0.161*	0.195**
				(0.0825)	(0.0801)
Growth 1500				0.0651	0.0991
				(0.132)	(0.139)
log(Population 1500)				-0.0552	-0.0651
				(0.0838)	(0.0898)
$\sqrt{Elevation}$				0.00140	0.00160
				(0.00898)	(0.00942)
Medieval Fair				-0.0975	-0.0478
				(0.139)	(0.142)
Constant	-0.0799	-0.593***	0.133	0.0127	-0.630*
	(0.0749)	(0.171)	(0.108)	(0.352)	(0.354)
Observations	80	80	80	74	74
R-squared	0.099	0.228	0.312	0.360	0.307

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table V: Columns 2 and 4 of Panel A report results of second stage IV regression between the 16th century economic institutions and the 15th century diffusion of printing of cities at a given distance from the sea. The coefficients are contrasted with results of the OLS regressions reported in Columns 1 and 3. Dependent variable is the 16th century nature of economic institutions in a given city. Printing Penetration is a measure of level of diffusion of printed books in the 15th century in a given city, from the 121 printing cities in the GW database, adjusting for population. Closeness Port is a *constant* - the square root of Distance of the city from a sea port. Additional controls are described in the Other Factors subsection of the paper. Panel B reports the coefficients of the first stage regression between endogenous variable Printing Penetration and IV which is log (*constant* - Distance from Mainz). Columns 2a (4a) and 2b (4b) of Panel B, are the first stage of Column 2 (4) regression of Panel A.

Panel A: Dependent Variable: Institution

	(1)	(2)	(3)	(4)
VARIABLES	OLS	2SLS	OLS	2SLS
Print Penetration	-0.0762*	-0.0933	-0.0617	-0.111
	(0.0407)	(0.0748)	(0.0427)	(0.0770)
Closeness Port	-0.0208**	-0.0539**	-0.0119	-0.0522**
	(0.00967)	(0.0232)	(0.0123)	(0.0261)
Print Pentr X Closeness Port	0.0179***	0.0308***	0.0151***	0.0317***
	(0.00439)	(0.00797)	(0.00469)	(0.00971)
log(# cities in cluster)			0.161*	0.0717
			(0.0825)	(0.0906)
Growth 1500			0.0651	0.00859
			(0.132)	(0.132)
log(Population 1500)			-0.0552	-0.0294
			(0.0838)	(0.0940)
$\sqrt{Elevation}$			0.00140	0.00491
			(0.00898)	(0.0112)
Medieval Fair			-0.0975	-0.251*
			(0.139)	(0.150)
Constant	0.133	0.149	0.0127	0.157
	(0.108)	(0.240)	(0.352)	(0.455)
Observations	80	80	74	74
R-squared	0.312	0.138	0.360	0.175

Panel B: First Stage Regression

	(2a)	(2b)	(4a)	(4b)
Dependent Variable:	Print Penetration	Print Penetration X	Print Penetration	Print Penetration X
VARIABLES		Closeness Port		Closeness Port
Distance from Mainz	1.544***	-2.114	1.971***	1.065
	(0.373)	(5.389)	(0.418)	(6.206)
Mainz Dist X Closeness Port	0.00481	1.814***	-0.0101	1.739***
	(0.0271)	(0.391)	(0.0306)	(0.455)
Closeness Port	-0.00941	1.118**	0.0516	1.597**
	(0.0332)	(0.478)	(0.0436)	(0.648)
log(# cities in cluster)			0.0191	0.298
			(0.152)	(2.261)
Growth 1500			-0.0415	-1.229
			(0.207)	(3.075)
log(Population 1500)			0.241	5.177
			(0.217)	(3.221)
$\sqrt{Elevation}$			0.0583*	0.541
			(0.0292)	(0.434)
Medieval Fair			0.572**	6.331
			(0.281)	(4.176)
Constant	1.402***	1.468	-1.191	-31.87*
	(0.501)	(7.225)	(1.127)	(16.72)
Observations	80	80	74	74
R-squared	0.523	0.693	0.591	0.723
F stat	39.02	39.29	34.51	27.67

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table VI: The table reports results of regression between the 16th century economic institutions and the 15th century diffusion of printing for cities within 150km of sea port. Dependent variable is the 16th century nature of economic institutions in a given city. Printing Penetration is a measure of level of diffusion of printed books in the 15th century in a given city, from the 121 printing cities in the GW database, adjusting for population. Additional controls are described in the Other Factors subsection of the paper, and Near Atlantic is a dummy variable denoting whether the closest port to the observed city was an Atlantic Port.

	(1)	(2)	(3)	(4)
VARIABLES	OLS	OLS	OLS	OLS
Print Penetration	0.209***	0.182***	0.181***	0.123***
	(0.0473)	(0.0450)	(0.0438)	(0.0417)
log(# cities in cluster)		0.132	0.118	0.0731
		(0.105)	(0.0870)	(0.0825)
Growth 1500		0.105	0.0153	-0.0873
		(0.213)	(0.174)	(0.165)
log(Population 1500)		-0.104	0.0270	0.110
		(0.109)	(0.113)	(0.110)
$\sqrt{Elevation}$		-0.0139	-0.00187	-0.00267
		(0.0121)	(0.00858)	(0.00845)
Near Atlantic			0.688***	-0.235
			(0.227)	(0.318)
Near Atlantic X Print Penetration				0.318**
				(0.131)
Medieval Fair		-0.106	-0.292*	-0.289**
		(0.178)	(0.150)	(0.139)
Constant	-0.191**	0.121	-0.490	-0.531
	(0.0919)	(0.368)	(0.372)	(0.343)
Observations	59	56	56	56
R-squared	0.201	0.268	0.444	0.503

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table VII: Columns 2 and 4 of Panel A report results of second stage IV regression between the 16th century economic institutions and the 15th century diffusion of printing for cities within 150 km of sea port. The coefficients are contrasted with results of the OLS regressions reported in Columns 1 and 3. Dependent variable is the 16th century nature of economic institutions in a given city. Printing Penetration is a measure of level of diffusion of printed books in the 15th century in a given city, from the 121 printing cities in the GW database, adjusting for population. Additional controls are described in the Other Factors subsection of the paper, and Near Atlantic is a dummy variable denoting whether the closest port to the observed city was an Atlantic Port. Panel B reports the coefficients of the first stage regression between endogenous variable Printing Penetration and IV which is log (*constant* - Distance from Mainz). Column 2 (4a and 4b) of Panel B, is the first stage of Column 2 (4) regression of Panel A.

Panel A: Dependent Variable: Institutions in cities within 150km of port

	(1)	(2)	(3)	(4)
VARIABLES	OLS	2SLS	OLS	2SLS
Print Penetration	0.209***	0.424***	0.123***	0.289***
	(0.0473)	(0.0848)	(0.0417)	(0.0879)
Near Atlantic			-0.235	-0.494
			(0.318)	(0.648)
Print Penetration X Near Atlantic			0.318**	0.407*
			(0.131)	(0.222)
log(# cities in cluster)			0.0731	-0.00538
			(0.0825)	(0.0972)
Growth 1500			-0.0873	-0.153
			(0.165)	(0.173)
log(Population 1500)			0.110	0.136
			(0.110)	(0.124)
$\sqrt{Elevation}$			-0.00267	-0.00198
			(0.00845)	(0.0119)
Medieval Fair			-0.289**	-0.415**
			(0.139)	(0.167)
Constant	-0.191**	-0.790***	-0.531	-0.905**
	(0.0919)	(0.237)	(0.343)	(0.439)
Observations	59	59	56	56
R-squared	0.201		0.503	0.376

Panel B: First Stage Regression

		(2)	(4a)	(4b)
Dependent Variable:		Print Penetration	Print Penetration	Print Penetration X
VARIABLES				Near Atlantic
Distance from Mainz		1.583***	1.703***	-0.0721
		(0.230)	(0.340)	(0.134)
Distance from Mainz X Near Atlantic			-0.0762	1.344***
			(0.533)	(0.210)
Near Atlantic			0.0353	1.454***
			(0.668)	(0.264)
log(# cities in cluster)			-0.0975	0.0824
			(0.179)	(0.0705)
Growth 1500			0.00502	0.161
			(0.269)	(0.106)
log(Population 1500)			0.309	-0.0734
			(0.254)	(0.100)
$\sqrt{Elevation}$			0.0286	0.00197
			(0.0281)	(0.0111)
Medieval Fair			0.474	0.0618
			(0.337)	(0.133)
Constant		1.271***	-0.0389	0.141
		(0.258)	(0.930)	(0.367)
Observations		59	56	56
R-squared		0.453	0.510	0.938
F stat		47.17	16.39	25.39

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table VIII: Columns 2a and 2b report the log odds coefficients for multinomial logit regression between the 16th century economic institutions and the 15th century diffusion of printing with additional variables. Column 1 reports the OLS regression for reference. Column 4a and 4b report the log odds coefficients for multinomial logit regression for cities within 150 km. Column 4 reports the OLS regression for the limited sample for reference. Dependent variable is the 16th century nature of economic institutions in a given city. Printing Penetration is a measure of level of diffusion of printed books in the 15th century in a given city, from the 121 printing cities in the GW database, adjusting for population. Closeness Port is a *constant* - the square root of Distance of the city from a sea port. Additional controls are described in the Other Factors subsection of the paper.

VARIABLES Dependent Variable:	(1) OLS	(2a) Mlogit $Inst_a^{1600}=1$	(2b) Mlogit $Inst_a^{1600}=2$	(3) OLS	(4a) Mlogit $Inst_a^{1600}=1$	(4b) Mlogit $Inst_a^{1600}=2$
				$<150km$	$<150km$	$<150km$
Print Penetration	-0.0617	-1.558	-7.180	0.123***	4.657**	-1.411
	(0.0427)	(1.054)	(5.026)	(0.0417)	(1.816)	(2.302)
Closeness Port	-0.0119	-0.792**	-0.620			
	(0.0123)	(0.320)	(0.707)			
Print Penetration X Closeness Port	0.0151***	0.255**	0.426*			
	(0.00469)	(0.105)	(0.253)			
log(# cities in cluster)	0.161*	2.846**	0.554	0.0731	3.172**	0.832
	(0.0825)	(1.210)	(0.868)	(0.0825)	(1.511)	(1.469)
Growth 1500	0.0651	-0.669	-0.481	-0.0873	-2.595	-1.046
	(0.132)	(0.834)	(0.951)	(0.165)	(1.873)	(1.988)
log(Population 1500)	-0.0552	2.569**	-2.903**	0.110	4.883**	-2.161
	(0.0838)	(1.248)	(1.427)	(0.110)	(2.332)	(3.849)
$\sqrt{Elevation}$	0.00140	-0.0614	-0.851*	-0.00267	0.172	0.711
	(0.00898)	(0.118)	(0.444)	(0.00845)	(0.159)	(1.493)
Medieval Fair	-0.0975	-4.403***	4.088**	-0.289**	-12.85***	-4.313
	(0.139)	(1.585)	(1.862)	(0.139)	(4.468)	(3.761)
Near Atlantic				-0.235	0.850	20.71
				(0.318)	(10.62)	(27.36)
Near Atlantic X Print Penetration				0.318**	2.325	6.065
				(0.131)	(2.908)	(4.142)
Constant	0.0127	-10.65	16.39	-0.531	-40.25**	-28.81
	(0.352)	(7.366)	(14.71)	(0.343)	(16.43)	(33.26)
Observations	74	74	74	56	56	56
R-squared	0.360			0.503		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table IX: The table reports results of regression between the yearly penetration of trade-related books in a city and the yearly printing penetration in the city especially at the Atantic coast. EAch column (except column 1) represents a distinct decade. Dependent variable $YearlyTradePentr_{ya}$ is a measure of level of diffusion of trade-related books in a given year in a given city, from the 229 printing cities in the USTC database, adjusting for population. $YearlyPrintPentr_{ya}$ is a measure of level of diffusion of all books in a given year in a given city, from the 229 printing cities in the USTC database, adjusting for population. Additional 15th century controls are described in the Other Factors subsection of the paper, and Near Atlantic is a dummy variable denoting whether the closest port to the observed city was an Atlantic Port. Additional 16th century control includes growth of population in the 16th century. All regressions include year fixed effects.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	log (# trade-related books)						
VARIABLES	1452-1600	1460-1469	1470-1479	1480-1489	1490-1599	1500-1509	1510-1519
log(# books)	0.104***	0.0208	0.0370***	0.0442***	0.0418***	0.0624***	0.0662***
	(0.00784)	(0.0161)	(0.00465)	(0.00744)	(0.00724)	(0.0103)	(0.0149)
Near Atlantic	-0.0147**	9.87e-06	0.000434	-0.00220	0.000232	0.00137	0.00494
	(0.00596)	(1.92e-05)	(0.000444)	(0.00165)	(0.00260)	(0.00383)	(0.00572)
log(# books) X Near Atlantic	0.106***	-0.00755	-0.0312***	0.00922	-0.00619	-0.0176	-0.0120
	(0.0183)	(0.00911)	(0.00716)	(0.0116)	(0.0176)	(0.0255)	(0.0233)
log(# cities in cluster)	-0.00161	1.49e-05	0.000138	-0.00209*	4.87e-05	-0.000228	0.000579
	(0.00137)	(1.27e-05)	(0.000193)	(0.00115)	(0.00106)	(0.000911)	(0.00163)
log(Population 1400)	-0.00246	-9.17e-06	-5.13e-05	0.000264	-0.000790	-0.00209*	-0.00363**
	(0.00149)	(9.80e-06)	(0.000164)	(0.000552)	(0.00105)	(0.00105)	(0.00179)
log(Population 1500)	-0.000181	-6.93e-06	-0.000841*	-0.00105	0.00295	4.05e-05	0.00268
	(0.00206)	(1.24e-05)	(0.000468)	(0.00112)	(0.00178)	(0.00133)	(0.00212)
Growth 1600	0.000782	2.55e-05	-0.000637**	-0.000912	0.00203	-0.000917	-0.00118
	(0.00225)	(1.88e-05)	(0.000282)	(0.000941)	(0.00164)	(0.00104)	(0.00222)
$\sqrt{Elevation}$	-0.000259	-2.71e-07	1.49e-05	-0.000177	-0.000500*	-7.66e-05	0.000388
	(0.000267)	(1.25e-06)	(4.35e-05)	(0.000119)	(0.000290)	(0.000180)	(0.000348)
Medieval Fair	-0.00714**	9.25e-05	-0.000414	0.00310*	0.00658*	0.00251	-0.00331
	(0.00349)	(5.91e-05)	(0.000584)	(0.00164)	(0.00344)	(0.00261)	(0.00362)
Latitude	-0.000942***	-8.20e-06	1.58e-06	-0.000447***	-0.000466	-0.000436	-0.000317
	(0.000214)	(5.19e-06)	(3.75e-05)	(0.000143)	(0.000353)	(0.000314)	(0.000215)
Longitude	-4.54e-05	4.29e-06	2.28e-06	-3.82e-06	0.000299	0.000224*	0.000312**
	(0.000119)	(2.84e-06)	(1.78e-05)	(8.97e-05)	(0.000183)	(0.000133)	(0.000125)
Closeness Port	-0.000506*	2.93e-07	9.39e-05**	3.50e-05	-0.000263	0.000115	0.000151
	(0.000300)	(1.64e-06)	(4.71e-05)	(0.000168)	(0.000264)	(0.000168)	(0.000335)
Constant	0.0681***	0.000333	0.000779	0.0256**	0.0175	0.0234	0.00441
	(0.0159)	(0.000221)	(0.00315)	(0.0112)	(0.0179)	(0.0193)	(0.0166)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,069	810	810	810	810	810	810
R-squared	0.657	0.459	0.452	0.439	0.390	0.464	0.487

Robust standard errors clustered at city level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table X: The table reports results of regression between the yearly penetration of trade-related books in a city and the yearly printing penetration in the city especially at the Atantic coast. EAch column (except column 1) represents a distinct decade. Dependent variable $YearlyTradePentr_{ya}$ is a measure of level of diffusion of trade-related books in a given year in a given city, from the 229 printing cities in the USTC database, adjusting for population. $YearlyPrintPentr_{ya}$ is a measure of level of diffusion of all books in a given year in a given city, from the 229 printing cities in the USTC database, adjusting for population. Additional 15th century controls are described in the Other Factors subsection of the paper, and Near Atlantic is a dummy variable denoting whether the closest port to the observed city was an Atlantic Port. Additional 16th century control includes growth of population in the 16th century. All regressions include year fixed effects.

	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
				log (# trade-related books)				
VARIABLES	1520-1529	1530-39	1540-49	1550-59	1560-69	1570-79	1580-89	1590-99
log(# books)	0.0984***	0.123***	0.0967***	0.0947***	0.111***	0.127***	0.116***	0.129***
	(0.0116)	(0.0269)	(0.0170)	(0.00831)	(0.0167)	(0.0121)	(0.00998)	(0.0140)
Near Atlantic	-0.00785	0.00823	-0.0104	-0.00833	-0.00625	-0.0251*	-0.0365**	-0.0485**
	(0.0121)	(0.0114)	(0.0122)	(0.00791)	(0.0146)	(0.0130)	(0.0144)	(0.0239)
log(# books) X Near Atlantic	0.0677	0.0355	0.104**	0.0744***	0.0865***	0.113***	0.147***	0.137***
	(0.0472)	(0.0391)	(0.0437)	(0.0111)	(0.0209)	(0.0277)	(0.0171)	(0.0409)
log(# cities in cluster)	0.00251	0.00509	0.00409	-0.00239	-0.000390	-0.00882**	-0.00451	-0.0110
	(0.00354)	(0.00398)	(0.00411)	(0.00219)	(0.00331)	(0.00367)	(0.00432)	(0.00803)
log(Population 1400)	-0.00570**	-0.00588*	-0.00290	-0.000299	-0.00383	-0.000581	-0.00563	-0.00839
	(0.00245)	(0.00331)	(0.00238)	(0.00213)	(0.00374)	(0.00320)	(0.00668)	(0.0100)
log(Population 1500)	-0.000338	-0.00393	-0.00587	-0.00256	0.00379	-0.00223	0.00777	0.0144
	(0.00418)	(0.00538)	(0.00477)	(0.00319)	(0.00551)	(0.00374)	(0.00651)	(0.0105)
Growth 1600	-0.00228	-0.00281	-0.00407	-0.00158	0.00307	-0.00341	0.00424	0.0206**
	(0.00375)	(0.00512)	(0.00476)	(0.00383)	(0.00538)	(0.00542)	(0.00611)	(0.00997)
$\sqrt{Elevation}$	0.000192	0.000539	0.000223	-0.000340	0.000216	-0.000816	-0.000428	-0.000658
	(0.000438)	(0.000654)	(0.000417)	(0.000264)	(0.000862)	(0.000512)	(0.000815)	(0.000967)
Medieval Fair	-0.00874	-0.0113	-0.00647	-0.00116	-0.00587	-4.51e-05	-0.0211**	-0.0195
	(0.00534)	(0.00819)	(0.00569)	(0.00565)	(0.00854)	(0.00812)	(0.0105)	(0.0161)
Latitude	-0.00123**	-0.000855	-0.000508	-0.00129***	-0.00179***	-0.00178**	-0.00169*	-0.00108
	(0.000483)	(0.000629)	(0.000576)	(0.000395)	(0.000599)	(0.000741)	(0.000851)	(0.00170)
Longitude	0.000361	0.000646*	0.000448	0.000149	0.000426	-0.000309	-0.000673*	-0.00137*
	(0.000254)	(0.000339)	(0.000283)	(0.000181)	(0.000331)	(0.000359)	(0.000401)	(0.000705)
Closeness Port	-0.000409	-0.000814	-0.000206	-0.000702	-0.00134*	-0.00116*	-0.00137	-0.000377
	(0.000533)	(0.000611)	(0.000438)	(0.000470)	(0.000741)	(0.000643)	(0.000848)	(0.00161)
Constant	0.0527*	0.0623	0.0244	0.0645***	0.0732*	0.108**	0.0916*	0.0344
	(0.0315)	(0.0433)	(0.0389)	(0.0226)	(0.0397)	(0.0409)	(0.0492)	(0.0912)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	810	810	810	810	810	810	810	810
R-squared	0.589	0.644	0.661	0.697	0.603	0.729	0.704	0.676

Robust standard errors clustered at city level in parentheses
*** p<0.01, ** p<0.05, * p<0.1