The Historical Dynamics of Financial Exchanges

Bjorn N. Jorgensen, Kenneth A. Kavajecz, and Scott N. Swisher IV*

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Abstract

The historical dynamics of entry and exit in the financial exchange industry are analyzed for a panel of 741 exchanges in 52 countries from 1855 through 2012. We focus on economic, technological, and regulatory factors. Using novel panel data evidence, we empirically test whether these factors are consistent with existing financial theories. We find that US exchanges are 4.6% more likely to exit per year after the passage of the Securities Exchange Act. The telephone, literacy, and regulation are robust predictors of financial exchange dynamics. The upward trend in literacy is an important driver of exchange entry.

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*Bjorn N. Jorgensen, London School of Economics; Kenneth A. Kavajecz, University of Wisconsin-Madison; Scott N. Swisher IV, University of Wisconsin-Madison. Correspondence should be directed to Kenneth A. Kavajecz, University of Wisconsin-Madison, 975 University Ave., Madison, WI 53706. Phone: 608-265-3494; fax: 608-265-4195; e-mail: kkavajecz@bus.wisc.edu. We gratefully acknowledge helpful comments from Steven Durlauf and Jason Zweig, and excellent research assistance from Zachary Ferrara, Anthea Lai, Ivy Lun, Damien Chu Matthews, and Kathleen Rogers. We also thank seminar participants at the University of Wisconsin macroeconomics working group and 2012 Financial Management Association Annual Meeting. All remaining errors are our own.

1 Introduction

The past two decades have witnessed dramatic change in the number, location, and structure of global financial exchanges. The number of new financial exchanges has surged worldwide in countries such as Russia and China,[1] as well as in countries with many competing established exchanges and mature domestic financial markets.[2] The number of cross-border and trans-Atlantic exchange mergers has increased in recent years. Additionally, new liquidity providers have emerged since 2000 as the Internet provides a low-cost open platform for alternative trading systems to compete with more traditional exchanges.[3]

This proliferation of newly formed financial exchanges and alternative trading systems runs counter to predictions that economies of scale will, in the long run, force exchanges to consolidate through exit; specifically, exchanges that attract more trading volume will lower their average costs and generate more liquid markets relative to their competitors. Indeed, the recent acceleration of exchange mergers provides some support for theories of consolidation in the industry.[4] However, the literature on market fragmentation offers no *ex-ante* reason to believe that the number of exchanges will decline monotonically over time due to new entrants. In support of this view, we have seen the rise of a number of specialized exchanges that operate exclusively on the Internet. Given the mixed empirical evidence and contradictory motives faced by financial exchanges, their desire to expand into new markets on one hand and their quest for efficiency and economies of scale on the other, it is natural to question how exchanges have responded in the past, and will adapt going forward, to changing market conditions. Any assessment of the future of exchanges must be made based on the available historical evidence.

In this paper, we construct a novel panel dataset for financial exchanges and provide new long-run historical evidence on the exchange industry. We investigate the historical dynamics of 741 financial exchanges in a sample of 52 countries to quantify the economic forces driving entry and exit. Specifically, we document the evolutionary pattern of the number of exchanges as well as entry and exit events across sample countries.[5] We test the dual hypotheses that after controlling for the relevant exogenous factors, (1) exchange entry is concentrated in periods of elevated uncertainty and broadening capital investment, and (2) exit occurs

[1] For recent Chinese examples, see the China Financial Futures Exchange (opened 2006) and the Hong Kong Mercantile Exchange (2008). Excluding Hong Kong, securities markets did not exist in China thirty years ago; see Weber, Davis and Lounsbury (2009) for additional insight.

[2] For example, the BATS Exchange in the United States and Chi-X in the United Kingdom.

[3] Examples of alternative trading systems include: electronic communication networks (ECNs) such as Archipelago (opened 1997), Instinet (1969), and Island/INET (1996), and crossing networks such as the Arizona Stock Exchange (1992), OptiMark (1999), and WIT Capital (1997).

[4] For example, American Stock Exchange - NYSE Euronext and Philadelphia Stock Exchange - NASDAQ OMX mergers in the US. For additional details, see Arnold, Hersch, Mulherin, and Netter (1999), which studies the effect of US regional stock exchange mergers on order flow.

[5] Throughout the paper, the term "exit" is defined as the sum of exchange shutdowns and mergers. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; that is, the exchange halts trading and its assets are liquidated.

during periods of increased regulation and emerging communications technology. In testing the validity of these conjectures, the goal is to better understand the patterns and commonalities in exchange dynamics across countries. Our hope is that this knowledge will provide historical perspective and context, which will aid interpretation of recent developments in global financial markets.[6]

The historical record is not consistent with convergence to a single financial exchange in each country, or steady growth in the number of exchanges over time. We document periods of exchange entry and exit in many of the 52 countries that we investigate. We consider two classes of models: one class includes binary controls in models across regional cuts of the data, while the other uses continuous controls to look exclusively at US data. In regional samples, periods of entry are negatively associated with US Blue Sky laws, but positively associated with communications advances and literacy. Periods of exit coincide with the US Silver Rush, communications advances, and UK securities regulation. The results suggest waves of entry and exit primarily driven by underlying structural change and regulation, not business cycle fluctuations. For the US data with binary controls, we find that entry is driven positively by Blue Sky laws, the Internet, and literacy; negatively by national securities regulation. Exit is positively related to the Silver Rush and communications advances, but negatively related to national securities regulation.

With continuous controls for US data, we find that entry is affected positively by output growth and literacy, negatively by regulation. Exit is driven by gold mining and telephone lines. We employ the proportional hazard model of Cox (1972) and the competing hazard model of Fine and Gray (1999) to study the exit of financial exchanges, where the competing hazard is going missing from the data. This is one way to address the salient data incompleteness problem that we face in using expansive historical data. In a proportional hazard setting, we find that US exchanges are 4.6% more likely to exit per year after the passage of the Securities Exchange Act, but a one percent increase in the growth of telephone lines leads to a 0.171% reduction in the likelihood of exit. When going missing from the data is allowed as a competing hazard to exit, our competing hazard model results suggest that the risk of exchange exit is increased by national securities regulation and decreased by telephone lines. In summary, we find that the telephone, literacy, and regulation are robust predictors of financial exchange dynamics in both US and regional datasets. It now appears that the literacy rate was an important source of demand for exchanges since a better educated populace would be more likely to purchase securities as a savings vehicle for retirement.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature. Section 3 provides theoretical background and justifies our hypotheses. Section 4 describes the data collection methodology and the resulting dataset on exchanges used throughout the paper. Sections 5 and 6 discuss

[6] Regulators in the United States express concern that US capital markets are falling on a number of dimensions, including IPO activity and trade volume; see Doige, Karolyi, and Stulz (2011), among others.

the results with binary and continuous control variables, respectively. Our proportional and competing hazard models are presented in Section 7. Section 8 concludes. Sections 9 and 10 contain figures and tables, respectively. The appendix provides a list of the exchanges in our dataset by country, as well as a list of additional sources by country.

2 Literature Review

One strand of financial theory predicts consolidation within the market to provide liquidity. Macey and O'Hara (1999), Pirrong (1999), and Hasan and Malkamaki (2001) argue that technology places an emphasis on cost minimization, which forces financial exchanges to consolidate through exit to exploit economies of scale. Exchanges that can attract incremental order flow will lower their costs at the margin, thus reducing trading costs for market participants and in turn further attracting even more order flow. According to these arguments, fragmentation of order flow among competing exchanges should be a temporary phenomenon associated with newly-developed financial markets or emerging economies. A separate literature in finance, including Stoll (2001, 2008), argues for market fragmentation due to entry by low-cost startup Internet-based exchanges. Therefore, on balance, the existing literature does not make decisive theoretical claims about how the number of exchanges should change over time. Thus the answer to this question must be found in the data.

While a natural starting point for our analysis is the literature on the history of financial exchanges in various countries around the world, the existing literature does not explicitly address the economic factors that drive exchange entry and exit.[7] Prior research most closely related to our analysis includes (1) Cole (1944), on the number of regional stock exchanges prior to the Securities Exchange Act of 1934; (2) Angel (1998), on the lifespan of a number of US regional exchanges since the Securities Exchange Act; (3) Arnold, Hersch, Mulherin, and Netter (1999), on the distribution of trading volume surrounding exit events and mergers among nine US regional exchanges from the 1930s through the 1990s; (4) Chabot (1999), on the extent of market integration from 1865 to 1885 for major stock exchanges of the United Kingdom and United States; and (5) Jorion and Goetzmann (1999), on the equity premium in the context of international equity markets from 1920 to 1996.[8] When comparing our analysis to the literature, we find substantially more local and regional exchanges than previously acknowledged.

The hazard models that we estimate are related to a literature on firm failure as a hazard. Bhattacharjee

[7] For example, see Salsbury and Sweeney (1988), Australia; Armstrong (1997), Canada; Michie (1981), UK; Sears (1973), US.

[8] A substantial literature reconstructs and analyzes historical stock market indices in various countries; see Jorion and Goetzmann (1999) for references. This line of research focuses on stocks traded and recorded on the major exchanges in a country and does not provide information on smaller competing exchanges.

et al. (2009) employ a competing hazard model to study firm exit in the UK over a 38 year period, where bankruptcy and acquisition serve as competing risks. Although they have many firm-specific variables that we do not due to the historical nature of our data, they find that the US rather than UK business cycle matters for these UK firms. High output growth in the US reduces the risk of firm bankruptcy while increasing the risk of being acquired by a competitor.

Wheelock and Wilson (2000) study bank failure and acquisition using panel data on US banks. Using bank-specific covariates only, they find that banks that are less well capitalized or have high loan to asset ratios are more likely to fail. Again, we lack the firm-specific information necessary to implement their empirical strategy and they do not employ any macroeconomic control variables. Dinc and Brown (2011) use panel data on banks in 21 emerging market countries from 1994 to 2000 to estimate a competing hazard model with failure and acquisition as competing risks. They include country-specific macroeconomic variables as controls. Regarding those variables, they find that the risk of a government takeover increases with output growth. We conclude that the literature has not established a definitive link between macroeconomic variables and exit in this type of model, especially for exchanges.

3 Theoretical Framework

The life cycle of a financial exchange, from entry to exit, is a dynamic process which is potentially influenced by many factors. In this section, we develop hypotheses regarding specific factors that affect growth in the number of exchanges as well as exchange entry and exit events: macroeconomic fluctuations and the need for efficient capital allocation, periods of resource exploration and discovery associated with heightened uncertainty, advances in communications technology, and shifts in regulatory regimes. We discuss each in turn.

As discussed in Greenwood and Jovanovic (1990) and King and Levine (1993), economic growth and financial market development are positively correlated. Financial exchanges facilitate the flow of capital into high-growth sectors by redirecting funds from other less productive sectors of the economy. We conjecture that economic expansion is associated with increased entry as firms demand more capital for their operations, which in turn increases the demand for trading services; the reverse applies for exit. While the potential linkage of exchange entry with economic expansion is intuitive, the timing, or more specifically the frequency of business cycle fluctuations, is likely to be important.

We consider two possible time horizons for the link between financial exchange entry and economic growth. At the highest frequency is the set of business cycles which identify periods of expansion and contraction within a country's economy. Within our framework, expansions are associated with entry, while recessions are associated with exit. Since entry and exit are costly long-term decisions made in a dynamic setting, business cycle fluctuations may pass too quickly to influence the underlying decision rules. Nevertheless, it is likely that, controlling for other factors, we observe some correlation between output fluctuations and exchange entry in the data.

Consequently, we would also like to investigate the relationship between the start of the Industrial Revolution and the evolution of exchanges, but given the data it is not feasible. The transition from a predominantly agrarian economy to a predominantly industrial one creates an ever-expanding need for the capital and transaction services supplied by exchanges. We hypothesize that the Industrial Revolution is positively correlated with entry as the entrant exchanges help growing companies obtain capital and enable firm expansion; again, the reverse applies for exit. Investors, searching for opportunities to diversify away from agriculture and shipping, are a primary driver of demand for shares in newly-formed manufacturing firms under this hypothesis. Conventional historical dating of the Industrial Revolution places its start between 1780 and 1830, with the onset differing across countries, and thus ahead of the majority of our sample; most of the exchanges that we have documented opened after 1855. As a result, we can conjecture as to the importance of the Industrial Revolution in driving exchange entry, but this paper cannot provide empirical evidence beyond the correlation observed in the data.

Financial exchanges did exist before the start of the Industrial Revolution. Despite the fact that exchanges were in place to facilitate the raising of capital, many new exchanges were formed during the era of the Industrial Revolution. The timing of this proliferation suggests that existing exchanges could not, or would not, facilitate the level of trade associated with the industrial expansion. If financial exchanges were solely anonymous providers of transaction services in a perfectly competitive industry without reputation effects in this period, then such an observation would be logically inconsistent; it is unlikely that existing exchanges were operating near maximum capacity at the start of the Industrial Revolution. With non-binding capacity constraints, incumbent exchanges should have been able to expand transaction services to meet the new demand of entrant industrial firms. This empirical puzzle motivates our next hypothesis concerning the entry of exchanges during periods of heightened uncertainty.

We argue that financial exchanges provide more than transaction services; specifically, they supply implicit certification of actively traded securities. The reputation of an exchange provides the basis for market participants to trust the information, trades, and counterparties they deal with on the exchange; this concept is similar to the reputation effects discussed in Edelen and Gervais (2003). While existing exchanges would always like to trade more securities to exploit economies of scale in trading volume, an exchange may refrain from doing so, absent further information about the security, because the cost of trading a fraudulent security is primarily borne by all other securities traded on the exchange. In this case, the benefit of additional trading volume is more than offset by the potential long-run reputational cost due to the negative externality of fraud.

When existing financial exchanges choose not to trade new securities, an opportunity arises for entrant exchanges. An entrant can step in to provide liquidity and transaction services for market participants willing to trade the new risky securities. By facilitating trade in the new securities, an entrant can help to identify viable securities for incumbent exchanges to trade without the older exchanges having to risk paying a reputational cost due to fraud.[9] We argue that the role of entrant exchanges is particularly critical during periods of extreme uncertainty that often accompany dramatic changes in the set of investment opportunities. Specific historical examples include periods such as the California Gold Rush (1848–1855) and the US Internet boom (1995–2000), which saw the entry of many new firms whose profitability was particularly uncertain. Therefore, we conjecture that exchange entry is likely to increase during periods characterized by heightened uncertainty in the valuation of firms, with the opposite true for exit.

One of the fundamental tasks of any financial exchange is to match the trading interests of buyers and sellers. Operationally, this involves both the buyer and seller communicating their trading intent to the exchange and the exchange matching the purchase and sell orders. Thus, the ease with which market participants and the exchange can communicate, both in terms of time and cost, is likely to impact the productivity and overall efficiency of an exchange's trading operations. Indeed, before the development of mass near-instant communication, new exchanges were typically located at or near the site of the risky asset being priced, due to transportation and communication costs. One example is an entrant exchange located adjacent to a newly-discovered panning stream that trades claims to the uncertain amount of gold embedded in the stream.[10] New communications technologies allow trade to occur from more remote locations, and thus the need for specialized local exchanges to facilitate trade wanes. With lower variable costs, large incumbent exchanges can increase their market share, driving out small local competitors. However, improvements in communications technology also lower entry costs for startup exchanges, increasing startups and the number of exchanges; an example of this is online-only exchanges enabled by the development of the Internet. Therefore, we hypothesize that advances in communications technology should have an ambiguous effect on both entry and exit; which effect dominates is again an empirical question.[11]

For example, consider the Hartford Stock Exchange in Connecticut, which closed within two weeks of the telegraph starting to operate between Hartford and New York City. Swedish and Norwegian historians have also noted that the emergence of the telegraph removed local demand for specialized financial exchanges.

[9] In other words, the purpose of startup exchanges is to separate fraudulent securities from legitimate ones. Therefore, it is not surprising to observe that most securities fraud takes place on newer exchanges (relative to trading volume).

[10] We observe this type of behavior anecdotally in the data, especially in Colorado and Nevada.

[11] Since in a theoretical model, the answer would depend on relative parameter values (the reduction in incumbent variable costs relative to the decrease in entry costs for startups).

These exchanges disappeared first from smaller towns with less trading volume, and later from larger towns until a single exchange remained in the capital city of those countries. Furthermore, prior to the introduction of efficient long-distance communication, exchange mergers and alliances were only feasible if the exchanges were close to each other. Therefore, advances in communications are likely to increase the probability of exchanges merging or forming alliances independent of distance. As evidence, note the acceleration in exchange merger activity over the past decade, including the combination of NASDAQ and OMX in 2008.

The regulatory environment is another factor to consider when discussing the dynamics of financial exchanges. At first glance, the direction of the net effect is indeterminant. On one hand, regulation may ultimately increase the viability of exchanges that can comply with the increased regulatory burden by creating a stable environment for them to operate in. On the other hand, regulation, at least in the implementation phase, may force some exchanges to close or merge if they cannot or will not comply with the imposed requirements. For example, after the implementation of the Securities Exchange Act of 1934, which gave jurisdiction of exchange oversight to the US Securities and Exchange Commission (SEC), many exchanges voluntarily closed rather than submit to a review by the newly-formed regulator. Similarly, regulation may inhibit market entry by startups as the compliance hurdle rises in a regulated environment relative to *laissez-faire*. We hypothesize that regulatory oversight is associated with a decrease in entry, with an ambiguous effect on exit (an increase in exit events at the beginning of the regulatory period, but a decrease after implementation and enforcement).[12]

We believe that macroeconomic fluctuations, periods of heightened uncertainty, communication advances, and enhanced regulation summarize the primary factors that affect exchange dynamics. However, major military conflicts such as World War II halted exchange entry and led to temporary suspensions of trading and exit.[13] During such conflicts, centralized war planning can lead to a reduced need for capital reallocation within an economy, thus demand for the associated trading services provided by exchanges abates. In the empirical work, we account for this by adding war dummies as control variables.

4 Data

Our financial exchange data consist of the entry, exit, missing, and merger dates that we could confirm for the exchanges identified in our sample of 52 countries. If its exit is unobserved, an exchange goes missing

[12]Note that we are not asking research questions about the quality (or trading volume) of exchanges, only their quantity. Regulation is likely to increase exchange quality among the survivors, but for our purposes, this is unobservable in historical data; going back to 1855, trading volume data is not available across all of the exchanges that we have identified. The assertion that regulation increases exchange quality is empirically untestable given the data incompleteness problem that we face.

[13]Unfortunately, data are often unavailable or of poor quality during military conflicts. In compiling our dataset, we occasionally observe temporary exit due to local or global wars, i.e. World War II, so there is strong anecdotal evidence that wars matter for entry and exit in the financial exchange industry.

on the last date after entry that it is observed (provided that it is observed as operational after entry). The appendix contains a comprehensive list of exchanges in the sample and their respective entry, exit, missing, and merger dates, if known, as well as our sources. Due to data incompleteness and limited information going back to 1855, trading volume data on the exchange level, although it would be our dependent variable of choice in the empirical work, is unavailable. We define an exchange as any formal organization whose objective is to facilitate trade and economic activity through the pricing and trading of uncertain, inherently risky claims.[14] Although this definition is sufficiently broad as to be non-binding in almost all cases, we do not possess enough observables at the exchange level to be able to apply a more stringent definition.[15]

Our data on financial exchanges are collected from various historical sources. To start, we identify currently-operating exchanges based on the list in Clayton, Jorgensen, and Kavajecz (2005) as well as the *Handbook of World Stock, Derivative and Commodity Exchanges* (2001). When possible, we verify operational status by viewing the exchange's website.[16] Typically, contemporary exchanges make their historical information publicly available, which provides us with entry and merger dates along with merger partners. This is our first option for identifying defunct exchanges; these sources, however, provide only merger dates and not entry dates for absorbed merger partners.

After exhausting the available information derived from active financial exchanges, we then searched for inactive and defunct exchanges. Multiple data sources provide historical information on exchanges. Some sources yield direct positive (entry) or negative (exit) outcomes, while others provide indirect evidence of operational status at a particular date without explicitly listed entry or exit dates. While these sources identify a large number of defunct exchanges, the information they provide on entry and exit dates is often incomplete. In some cases, a source makes reference to an exchange, so we know that the exchange existed, but provides no entry or exit dates. We began with the strongest sources that confirm the entry or exit of an exchange. Country-specific historical records are particularly helpful in gathering this information, for example, Armstrong (1997) for Canada, Michie (1986) for the United Kingdom, Salsbury and Sweeney (1988) for Australia, and Sears (1973) for the United States. These sources, however, suffer from a common bias: exchange entry dates are reported much more frequently than exit dates because the popular press typically covers celebratory exchange entry and overlooks unceremonious exit events.[17]

[14]This definition of an exchange, although arbitrary, is a key part of the paper because our sample is only going to include "exchanges" as we define them. Under the current definition, the government or any public service provided by it is classified as an exchange, but our data excludes such organizations. Many of our exchanges might have existed and operated informally prior to incorporation, but in the interest of objectivity and preciseness we begin to follow an exchange after the formal organization is created. Additionally, the incorporation date is often the only available object of interest in the data.

[15]We are not committed to this definition and will not exert any additional effort in defending it here because, due to data incompleteness, it is infeasible to apply a binding definition that would eliminate some exchanges we have discovered from the dataset; we do not have enough exchange-level information to do so.

[16]In this context, operational status for an exchange's online presence is defined as a publicly available (i.e. indexed by a search engine) open-access website that is updated regularly to indicate that the exchange continues to trade actively.

[17]This bias is similar to the tendency mentioned previously with exchange websites: the history of the survivors is more

To further address data incompleteness, we next examine historical print media. Specifically, we searched the electronic versions of *The New York Times*, *The Wall Street Journal*, and *The Washington Post* as far back as 1850 for any reference of a financial exchange. The procedure involved database queries with keywords such as "exchange", "trading" and so on. The results add a number of entries to our dataset; however, as would be expected from mainstream and financial press sources, newly-discovered entry dates far exceeded exit dates due to the selection issue mentioned previously.

Our next approach was to search legal and regulatory documents pertaining to financial exchanges. The information contained in these documents is very detailed and unambiguous, thus serving as an excellent source. Unfortunately, these documents are a relatively recent phenomenon (latter half of the 20th century), typically commissioned on an *ad hoc* basis. As a result, relatively few of these documents are available, limiting their widespread use in constructing the dataset. They are, however, are our most reliable source of information on exit events. The SEC, for example, has published the "Annual Report of the Securities and Exchange Commission" each fiscal year ending June 30 since 1935. This report contains, among other data, a list of all registered exchanges and exempt exchanges. For other countries, we used similar legal texts to verify the existence or exit of financial exchanges. For example, the UK Securities Contract (Regulation) Act of 1956 and the Stock Transfer Act of 1963 state that only stock exchanges recognized by the Minister for Finance shall be permitted. This allows us to establish that the number of registered exchanges in the United Kingdom and Ireland dropped from 22 in 1964 to 11 in 1965 to 7 in 1966.[18]

Having exhausted the availability of regulatory and exchange-specific data, we next look to sources that solely provide evidence of operational status without revealing entry or exit dates. The Moody's securities manuals, published annually since 1900, list many publicly traded and privately held US companies. Included in a company's description is often a listing of the exchanges where its shares traded. While originally intended to be a general guide for investors, today Moody's is probably best known for providing credit ratings for some, but not all, of the securities listed in the manuals. The Moody's manuals allow us to infer the existence of, and active trading on, exchanges that need not exist today or have been closed in the interim. Specifically, any particular Moody's manual indicates for each security issued by a company (stock, preferred stock, or bond) the domestic and foreign exchanges on which the security is traded for most, but not all, companies included in the manual. However, the usefulness of this information is limited because the manuals can only provide dates over which a particular exchange was operating; entry and exit dates are not explicitly provided for each exchange. Nevertheless, we utilize the Moody's data to put bounds on

complete than that of the assimilated or non-operational firms.

[18] Such an event, directly observable in the data and difficult to attribute to slower-moving trends towards consolidation and exit, provides strong circumstantial evidence for the proposition that securities regulation induces the exit of firms from the financial exchange industry.

the set of feasible years for an exchange's entry and exit dates.

The Moody's 1903 manual, for example, states that Chatham Bank was traded on the Savannah (Ga.) Cotton Exchange, that Chrystal Consolidated was traded on the Oregon Mining Exchange, and that Orange (NJ) Mutual Trust Co. was traded on the Newark (NJ) Market. The Moody's manuals also include foreign companies, mainly registered in Canada or the United Kingdom. As an aside, cross listing of securities on multiple exchanges is not a recent phenomenon. Armour & Co., to cite one example, was quoted in Louisville (Ky.), Omaha (Neb.), Philadelphia (Pa.), and St. Louis (Mo.) in 1932. Similarly, Sony was simultaneously trading on the Osaka and Tokyo stock exchanges in 1961.

The Moody's manuals were parsed by reading through all of the early years (1900, 1901, and 1903) and 1932. In addition, we read through the international sections of the Moody's manuals for the following years: 1925, 1927, 1947, 1955, 1961, and 1966.[19] We created a list of exchanges whose starting date could not be verified from other sources. For each of these exchanges, we listed all currently-traded companies and then tracked them to see whether they were included in prior or subsequent years of the Moody's manuals.

The Moody's 1903 manual, for example, lists three companies traded on the Albany (NY) Market: Consolidated Car Heating Co., Hudson River Telephone Co., and Rathbone Sard & Co. Tracking these companies through subsequent manuals, we verified that trading continued for at least one of them in Albany until 1908. Similarly, Russell & Erwin Manufacturing and Torrington Co. traded on the Hartford Market from 1903 through 1907 and 1910, respectively. Furthermore, Buffalo & Niagara Falls Electric Light & Power Co., Niagara Falls Power Co., and Taylor Signal were trading in Buffalo (NY) in 1903, and this was verified from 1901 to 1907.

If an exchange previously reported as a listing venue for all previously listed stocks and bonds disappears from the manuals, we consider the exchange closed. To illustrate this, consider the case of the Fall River Market in Massachusetts. We know that trading took place at least as early as the beginning of the 20th century since 38 (31) companies were listed in Moody's Industrial Manual 1900 (1903); the listed firms were mostly mills or related manufacturing companies. According to the Moody's manuals from 1929 and 1937, each listed company had its stock transferred and registered at the company's office. Occasionally, stock price ranges (high/low) are provided for the year, and often the number of shareholders is recorded (around 100 to 300). The stocks of some companies were reported in Moody's as "quoted in Fall River" in previous years, but by 1940 no companies are listed in Moody's under Fall River Market and we deem the exchange closed.[20]

[19] The selected years may seem arbitrary, but they were chosen to initially look through Moody's manuals that are in the best readable paper format. For some years, the manuals are in such poor condition that reading is difficult without using the microfiche version.

[20] Fall River Market is not mentioned in the SEC manuals as an exchange starting in 1935 because the definition of an exchange applied by Moody's differs from that of the SEC. Alternatively, the Moody's manuals might not have been completely

As a source for data on financial exchanges, the Moody's manuals have limitations. First, the criteria for inclusion of a company have undoubtedly changed over time; the coverage of Moody's increased in the first years of the publication of the manuals. Four Oil Co., for example, was trading on the California Stock and Oil Exchange (San Francisco, Calif.), according to Moody's Industrial Manual 1903, but the company is not listed in 1901 or 1913. Second, the manuals are probably geographically biased towards exchanges on the East Coast of the United States. They fail, for example, to report many of the local Western mining exchanges mentioned in Sears (1969, 1973). We do not claim that the Moody's manuals constitute a comprehensive list of financial exchanges; we view inclusion in the manuals as indirect evidence of the existence of an exchange.

The current sample consists of 741 exchanges, less than half of which (327) are in the United States. Clearly, missing data is a salient problem: some entry dates and especially exit dates are missing. Tables 1–3 summarize the available data on entry and exit dates for our sample of exchanges, partitioned by country and region. Note that, consistent with asymmetric media coverage of exchange entry and exit, the United States subsample includes substantially more entry (91%) than exit events (39%); this bias is reversed for some countries in the sample. However, we have complete coverage of exit dates for all identified exchanges in many of our sample countries.

The financial exchange data are supplemented with information on the timing of significant historical events as well as country-specific business cycle data (i.e. growth in real GDP per capita). The historical data include major advances in communications, regulatory events, country and region-specific output growth, and periods of elevated uncertainty during commodity rushes and the Internet boom. See Table 4 for a full list of historical events and their respective dating used in the paper. As mentioned previously, we are confident that structural expansion due to industrialization spurred exchange entry. The post-Industrial Revolution era coincides with the entry of over 95% of the exchanges in our sample. Thus the Industrial Revolution occurs too early relative to the vast majority of recorded exchange entry events to be able to empirically test our conjecture. Therefore, the Industrial Revolution is dropped completely from the model as an explanatory variable.

4.1 Binary Controls

To identify historical periods with high uncertainty, we define dummy variable *Silver Rush* for the 1859–1873 Silver Rush in the United States. We do not attempt to disentangle the speculative Internet boom of 1995–2000 from the 1995–2012 period of the Internet as the dominant state-of-the-art communications technology.

A number of discontinuous events have advanced and shaped the evolution of communications technol-

updated each year; if true, our exchange lifetime estimates would be biased upwards. We have no direct evidence to support or disprove this claim.

ogy as it pertains to financial markets: the invention of the telegraph in 1837, the ticker tape in 1867, the telephone in 1876, the trans-Atlantic cable connecting Europe and the United States in 1886, the personal computer in 1974, and the commercialization of the Internet in 1995.[21] We consider three binary communications variables: the first is a dummy variable equal to one when the telephone was the state-of-the-art communications technology (1876–1976), the second is an analogous dummy variable for the personal computer pre-Internet (1977–1994), and the third is for the Internet (1995–2012). These variables are denoted by *D_Telephone*, *D_Computer*, and *D_Internet* in the empirical work.

Finally, our country-specific regulation variables mark periods when financial exchanges were directly monitored by a new governmental authority to prevent securities fraud and abuse. Specifically, these periods are after the Securities Exchange Act of 1934 for the United States (1934–2012) and after the Stock Transfer Act of 1963 for the United Kingdom (1965–2012); denote these by *US Reg* and *UK Reg*, respectively.

4.2 Continuous controls

From the *Historical Statistics of the United States, Millennial Edition* online database, we take the annual time series listed in Table 5. The data can be divided into two categories: supply and demand shocks. Supply-side variables include: thousands of miles of Western Union telegraph wire (*Telegraph*), thousands of miles of Bell (AT&T) telephone wire (*Telephone*), number of computers (*Computer*), and number of Internet hosts (*Internet*). On the demand side, we have: income as measured by real GDP in 1996 US dollars (*GDP*), silver and gold mining in metric tons (*Silver Mining* and *Gold Mining*),[22] and the literacy rate as a percentage of persons above age 14 (*Literacy*).[23] Since the continuous control variables contain more information than their binary counterparts, as long as you believe that the underlying variables are well approximated by their empirical counterparts, models including these variables should be able to tell us more about the factors driving exchange entry and exit (i.e. explain more of the observed variation). All continuous control variables used in the empirical work are in per-capita growth rates. Because we do not have strong priors as to which variables among these are most important for exchange dynamics, all variables listed here are included in the models we estimate with continuous controls.

5 Results: Binary Controls

The life cycle of an exchange is as follows. First the exchange enters, then it operates for some period of

[21] Greenwood and Jovanovic (1999) argue that the technological innovation associated with the IT Revolution of the 1990s favored smaller firms that had recently entered the market. Generalizing this story for all of the communications advances we mention, new entrant exchanges without reputational capital are needed to price risky entrant firms that do business based on the new technology.

[22] Included to capture commodity rushes.

[23] Included as a proxy for education and financial literacy, which is related to the ability of the public to identify fraudulent securities.

time. The only thing we know about exchange operational history is the timing and duration. Exchanges can leave the dataset in three ways: exit, going missing, and surviving to the end of the sample (2012). In exit, the exchange is explicitly noted as going out of business and ceasing operations. Going missing is more ambiguous: in this case, we note the last recorded mention of the exchange in the press after entry in cases where the exchange does not have an exit date. Thus an exchange can only go missing if its exit was not directly observed. Survival to the end of the sample is straightforward and easy to detect since these exchanges are currently operating as of 2012.

Due to the historical nature of the data collected, data incompleteness is a salient problem. Many of the exchanges we discovered lack entry or exit dates. See Tables 1–3 for a complete summary of this data fact. Data incompleteness is worst for the US and Norwegian datasets. Therefore, as a response to this problem, throughout the rest of the paper we will work with three alternative specifications of the data: restricted (R), unrestricted A (UR-A), and unrestricted B (UR-B). The restricted, R, dataset only includes exchanges when complete information is available: entry date as well as an explicit exit date, if the exchange is not currently operating. The unrestricted A, UR-A, dataset consists of all exchanges with at least an entry date and an exit or missing date. We assume that an exchange exits immediately upon going missing from the dataset. Consequently, more exchanges are included in the unrestricted A dataset since many exchanges have missing dates instead of exit dates (see appendix). This means that the set of R exchanges is a subset of the set of UR-A exchanges. Finally, the unrestricted B, UR-B, dataset, consists of all exchanges with an entry date. For UR-B, if an exchange does not have an exit date or a missing date, we assume that the exchange exited the sample three years after entry (i.e. the exchange is "short lived" in our appendix tables). Thus R is a subset of UR-A, which is in turn a subset of UR-B. We do not have a preference for one dataset specification over another, and leave it up to the reader to decide which selection rule is best.[24]

To gain a sense of the data, we provide some summary measures. Figure 1 reports the total number of financial exchanges (for R, UR-A, and UR-B datasets), while Figure 2 breaks the R dataset down by region. The regions are Africa, Asia, Europe, Middle East (ME), North America (NA), and South America (SA). Tables 1–3 provide a list of countries for each region. Figures 3 and 4 report cumulative entry and exit events in each year, 1850 through 2012, aggregated for all 52 sample countries. In Figure 1, we observe an extended upward trend in the number of exchanges through the second half of the 19th century, followed by 112 years of comparatively little to no change. Apart from the long-term trend, the diagram shows periods with relatively violent fluctuations in the number of exchanges, especially when viewed at the regional level

[24] All three specifications have their own unique flaws which one could criticize. Dataset R tends to undersample exchanges for which we have limited information, and thus are more obscure. UR-B makes strong assumptions about when exchanges exit after entry if they do not have exit or missing dates (always three years). UR-A is a balance between the two which requires the assumption that exchanges exit immediately when they go missing.

in Figure 2. If consolidation towards a limited number of exchanges is indeed occurring through exit, this convergence did not begin on a global level until after the 1930s. Due to growth in emerging markets, particularly Asia, convergence is not at all apparent. Figures 3 and 4 reveal a similar long-run accumulation of entry and exit events, suggesting a fairly steady net number of operating exchanges throughout the 20th century.

Figures 5 through 8 plot the number of confirmed financial exchange entry, exit, shutdown, and merger events in all 52 sample countries from 1850 through 2012. Looking at the number of exchange entry events from 1850 to the present, we see distinct fluctuations in the rate of entry around its long-run trend, particularly from 1865 through 1905. For Canada and the United States, many of these exchanges were mining exchanges formed during the late 19th century, though smaller clusters of new exchanges emerged during the stock market rallies of the 1920s and 1990s. Many of the newly formed exchanges from the 1920s disappeared following the stock market crash of 1929. This pattern is consistent among many of our sample countries. Despite having fewer confirmed exit dates, Figures 6 and 7 suggest distinct periods of exit via shutdowns. Both entry and exit are highly volatile and exhibit substantial co-movement. Mergers follow a similar pattern in Figure 8; consistent with advances in communications technology, they are much more prevalent since the 1980s.

Figures 9–14 provide similar summary measures for the number of exchanges, entry, and exit events for three samples: the Americas (North and South America), Asia, and Europe. In the Americas data (Figure 9), dominated numerically by US exchanges, an increase in the number of exchanges during the Industrial Revolution and the California Gold Rush (and Silver Rush) was followed by a rapid decline after the 1929 crash, subsequent Great Depression of 1929 to 1939, and the introduction of the Securities Exchange Act of 1934.[25] Looking at cumulative entry and exit events in Figure 10 yields the same conclusion. A similar pattern emerges for Europe (Figure 13) due to large bilateral trade with the Americas and synchronization of international business cycles via globalization. The increase in exit is much more dramatic during the mid-1960s, largely due to the UK Stock Transfer Act of 1963. The trend for Asia in Figure 11 is markedly different, where we see a steady increase in the number of exchanges over time: both entry and exit are on the rise in Figure 12.

Given the incompleteness of the dataset, we execute a number of different data partitions with multiple specifications. We consider as the dependent variable, the number of financial exchanges, entry, and exit events separately for a total of five alternative cuts of the data: the full sample of 52 countries, the Americas, Asia, Europe, and the US. We use linear regression, Poisson regression, Cox (proportional) hazard,

[25]These two events, the Great Depression and the advent of the SEC, are confounded in the data. This makes it difficult to attribute the resulting decline in exchanges observed in the data entirely to the Securities Exchange Act.

and competing hazard models to analyze the dynamics of financial exchanges on three exchange datasets: restricted (R), unrestricted A (UR-A), and unrestricted B (UR-B). These datasets were defined previously at the start of this section.[26]

The covariates used as independent variables in the model were discussed in the theory section. They are the growth rate in real output per capita, the US Silver Rush, advances in communications technology, and regulation. The growth rate of output (*GDP*) is measured by country-specific historical GDP series over the period 1855 to 2012. *Silver Rush* is an indicator for silver rush period of 1859 to 1873. *Literacy* is the US literacy rate as a percentage of persons above age 14. For telecommunications variables, *D_Telephone* is equal to one from 1876 to 1976 and zero otherwise, and is equivalent to an indicator for the telephone as state-of-the-art; *D_Computer* is analogous for computers over the period 1977 to 1994; finally, *D_Internet* takes a value of one only over 1995–2012 and is equivalent to an indicator for the Internet as the state-of-the-art telecommunications technology. The variable *US Reg* accounts for the 1934 to 2012 period after the introduction of the Securities Exchange Act of 1934 in the United States; *UK Reg* is similar for the United Kingdom's 1963 Stock Transfer Act. Define *F_BlueSky* as the fraction of US states with a Blue Sky law, a particular type of state-specific securities regulation in the US case which will be discussed later. Finally, *USCW*, *WWI*, and *WWII* are dummy variables for the US Civil War, World War I, and World War II, respectively; they are included when appropriate as controls, although the coefficients are not of interest for us. For a complete list of variables and their definitions, see Table 6.

5.1 Exchange Growth

Let t index time in years. Consider per-capita growth in the aggregate number of exchanges (denoted *Exchanges*, although specified as a rate, not in levels) as the dependent variable in the following annual time-series linear regression within a country or region (or full sample)

$$\begin{aligned} Exchanges_t \quad = \quad & \beta_1 GDP_t + \mathbf{1}\{US \in S\}\beta_2 Silver\ Rush_t + \beta_3 D\_Telephone_t + \beta_4 D\_Computer_t \\ & +\beta_5 D\_Internet_t + \beta_6 Literacy_t + \mathbf{1}\{US \in S\}\left[\beta_7 F\_BlueSky_t + \beta_8 US\ Reg_t\right] \\ & +\mathbf{1}\{UK \in S\}\beta_9 UK\ Reg_t + \beta_W \mathbf{W}_t + \varepsilon_t \end{aligned}$$

with forecast error ε_t, where $\mathbf{W}_t \equiv [USCW_t,\ WWI_t,\ WWII_t]'$ includes war dummies $USCW_t$ for the US Civil War (excluded when the US is not in the sample), WWI_t for World War I, and $WWII_t$ for World War

[26] We also ran linear regressions with log(1 + *Exchanges*) as the dependent variable, as a robustness check against the inappropriateness of the linear model due to the nature of *Exchanges* as a nonnegative count outcome. The results are both qualitatively and quantitatively similar to those reported below and are available upon request.

II; $\beta_W \equiv [\beta_{USCW},\ \beta_{WWI},\ \beta_{WWII}]$ a 1×3 vector of coefficients; $\mathbf{1}\{US \in S\}$ and $\mathbf{1}\{UK \in S\}$ are indicator functions for the inclusion of the United States and United Kingdom in the sample.[27] The results, estimated coefficients $\hat{\beta}_1, \hat{\beta}_2, \ldots, \hat{\beta}_9$ and robust standard errors for each dataset are shown in Tables 8 (full sample and Americas) and 9 (Asia and Europe). Separate restricted (R), unrestricted A (UR-A), and unrestricted B (UR-B) results are shown as successive columns across the table for each dataset.

Given the varying sign of the estimated coefficient and insufficient magnitude to deliver significance, output growth has a negligible impact on per-capita growth in the number of exchanges. Across models, the sign on output growth is almost always negative and only significant at $\alpha = 0.10$ (t-test) in the European UR-A case. We conjecture that growth periods in the business cycle contain much more noise and occur at a higher frequency than is useful for explaining variation in *Exchanges* as an aggregate quantity which depends on both entry and exit events. The commodity rush variable *Silver Rush*, delineating a period of high uncertainty in US asset markets, exhibits a negative and significant ($\alpha = 0.05$) coefficient ranging from -0.034 (world, UR-B) to -0.108 (Americas, UR-B), implying a decrease in the growth rate of the number of exchanges of up to 10.8% per year for the Americas, but as little as 3.4% per year in the full sample. The result here relies on using the UR-B data selection methodology since it does not go through for the R and UR-A datasets. This is a counterintuitive result since we conjectured that a commodity rush would lead to increased exchange entry and more exchanges due to a need for mine securities trading.

The estimated coefficient on *D_Telephone* ranges from -0.019 (world, R) to -0.101 (Americas, UR-B) when significant ($\alpha = 0.01$), so at most the telephone as state-of-the-art reduces exchange growth by 10.1%. It appears that the introduction of the telephone accelerated consolidation in the exchange industry. Note that *D_Telephone* is only significant in the world and Americas datasets, and the estimated coefficient becomes more negative when going from R to UR-A to UR-B datasets. From this finding we conclude that the introduction of the telephone was particularly pivotal for the exit of more obscure, and thus smaller, exchanges. With an estimated coefficient ranging from -0.106 (Asia, R) to 0.032 (Europe), *D_Computer* has an ambiguous effect on exchange growth across regions ($\alpha = 0.05$). Holding all else equal, computerization increases exchange growth by 3.2% for Europe; alternatively, it decreases growth by roughly 10% for Asia. No consistent effect is found for the world and Americas datasets, although the advent of the computer decreased exchange growth by about 6 to 7% in the Americas for unrestricted samples ($\alpha = 0.05$). We conclude that computerization shifted exchange growth from the young American and Asian periphery to the old European core.

D_Internet performs best in the Americas and Asia samples. We find that, in unrestricted American datasets, the advent of the Internet decreased the rate of exchange growth by 5.8 to 6.7% per year ($\alpha = 0.05$).

[27]Constant term suppressed throughout.

Along similar lines, Asia saw its growth slow by 11% after the Internet was introduced ($\alpha = 0.05$); this finding holds up across, R, UR-A, and UR-B datasets. There is no detectable effect on Europe and the full sample. We conclude that the Internet is associated with additional consolidation, but only in the Americas and Asia, with the effect particularly pronounced in Asia. This is potentially because of the young age of emerging Asian economies, since their financial exchanges do not benefit as much from incumbency compared to European competitors.

The US literacy rate, *Literacy*, performs very well ($\alpha = 0.01$) in the world and Americas datasets. We find that a one percentage point increase in the US literacy rate is associated with an increase in the rate of exchange growth of between 5.4% and 21.4%. Therefore, we find that the spread of basic education captured by *Literacy* was a powerful driver of the growth of financial exchanges, primarily in the second half of the 19th century. In terms of relative magnitudes, the importance of *Literacy* swamps all other variables that we considered in an unexpected way since we conjectured that a more literate population would be less prone to fly-by-night exchange operations. It now appears that the literacy rate was an important source of demand for exchanges since a better educated populace would be more likely to purchase securities as a savings vehicle for retirement.

Recall that *F_BlueSky* is the fraction of US states having adopted a Blue Sky securities regulation law. We find that, outside of restricted samples, adoption of Blue Sky laws at the state level has a negative effect on exchange growth ($\alpha = 0.05$). The estimated coefficient ranges from -0.039 (world, UR-A) to -0.13 (Americas, UR-B). Therefore, a one percentage point increase in the fraction of US states with an active Blue Sky law leads to at most a 0.13% reduction in exchange growth. This provides additional evidence for the negative effect of securities regulation on financial exchange growth.

Country-level regulation is surprisingly unimportant, with a negative estimated coefficient on $UK\ Reg$ of -0.025 for European data only, but the regulation variables are generally not significant across datasets ($\alpha = 0.05$). Thus we find that the UK 1963 Stock Transfer Act decreased the rate of exchange growth by 2.5% per year for Europe after its implementation. Regulation does not show up as important for determining the annual growth rate of the number of exchanges in the other datasets. The results in Tables 8 and 9 are consistent with some of our hypotheses, such that the communication and regulation variables are significant and almost always have the predicted sign. Considering the resources (time, capital, reputation, etc.) necessary to start up or close an exchange, these results present support for our hypotheses that is also economically relevant in terms of the size of the estimated coefficients. However, we also find that output growth, the US Silver Rush, and the US literacy rate have effects inconsistent with our expectations: output growth has no detectable effect, the Silver Rush slowed exchange growth by as much as 10.8% (Americas, UR-B), and *Literacy* increased growth by as much as 21.4% (Americas, UR-B). It is generally true that the size of estimated coefficients increases when going from restricted (R) to unrestricted (UR-A, UR-B) datasets since the unrestricted samples are larger.

5.2 Exchange Entry

We next model the entry of financial exchanges using exchange entry events as the dependent variable. Given the nature of the data as a nonnegative count outcome, we estimate Poisson regression models of entry, where the dependent variable is the number of exchange entry events in a given year for a particular region or full sample. The covariates included as independent variables are identical to those used in our linear regression analysis of the number of exchanges. The annual time-series Poisson model for entry within a country or region (or full sample) is

$$\begin{aligned}\log(Entry_t) \quad = \quad & \beta_1 GDP_t + \mathbf{1}\{US \in S\}\beta_2 Silver\ Rush_t + \beta_3 D\_Telephone_t + \beta_4 D\_Computer_t \\ & + \beta_5 D\_Internet_t + \beta_6 Literacy_t + \mathbf{1}\{US \in S\}\left[\beta_7 F\_BlueSky_t + \beta_8 US\ Reg_t\right] \\ & + \mathbf{1}\{UK \in S\}\beta_9 UK\ Reg_t + \beta_W \mathbf{W}_t + \varepsilon_t\end{aligned}$$

with forecast error ε_t. Note that this is identical to our model for the number of exchanges with the outcome variable replaced by log entry events per year. Tables 10 and 11 present our results, estimated coefficients $\hat{\beta}_1, \hat{\beta}_2, \ldots, \hat{\beta}_9$ and robust standard errors for each model.

When we focus attention on entry in Table 10 (world and Americas), our results are generally stronger than the results for the number of exchanges, but output growth is still imprecisely estimated and thus insignificant ($\alpha = 0.10$) across all datasets for the full sample and Americas region. Again, our interpretation of this counterintuitive result is that business cycles as represented by output growth occur at too high a frequency to affect the long-term decision to start an exchange via entry. We find that *Silver Rush* and *D_Telephone* are also imprecisely estimated ($\alpha = 0.05$), with no detectable effect on exchange formation. However, the other communications variables *D_Computer* and *D_Internet* do very well in terms of explaining observed variation in entry ($\alpha = 0.01$). Thus *D_Computer* is strongly positively associated with entry, with an estimated average marginal effect ranging from 1.24 (Americas, R) to 6.061 (world, UR-B). To interpret this result for the Americas UR-B sample in terms of the average marginal effect, we find that computerization is associated with an increase in exchange entry of 3.543 exchanges per year.

The literacy rate is again a surprisingly strong performer in terms of explanatory power. When significant at the $\alpha = 0.05$ level, the estimated average marginal effect of a one percentage point increase in the literacy rate ranges from 5.125 (Americas, UR-A) to 13.166 (world, UR-B). We conclude that the literacy rate is an important predictor of exchange entry, with an increase in *Literacy* strongly tied to both exchange formation and growth in the number of exchanges.

There is also continued strong evidence for the negative effect of regulation on entry, particularly in the Americas UR-B sample, although this effect does not manifest itself as convincingly in the full sample. The *F_BlueSky* variable does best in UR-B datasets ($\alpha = 0.05$), with the largest estimated average marginal effect of -0.534 in the Americas UR-B sample; the average marginal effect is -0.412 in the world UR-B sample. Thus we find that, for the Americas UR-B dataset, a one percentage point increase in the fraction of US states implementing a Blue Sky law has an average marginal effect of decreasing the number of exchanges entering by roughly 0.5 per year. To interpret the result that the estimated coefficient on *US Reg* in the Americas UR-B sample is -2.277, the average marginal effect of US regulation on entry events per year is -5.059; in the restricted sample, the average marginal effect is -1.653. *UK Reg* does not have a detectable effect with our data. In summary, the results in Table 10 mostly reinforce our earlier results on the number of exchanges, with some change in the direction and precision of the estimated marginal effects for entry.

Turn now to Table 11, entry results for Asia and Europe. The results are qualitatively similar to those discussed previously for the Americas and full sample, with communications technology spurring exchange entry and regulation suppressing it. Communications variable *D_Telephone* now shows up as an important predictor ($\alpha = 0.05$) of exchange entry in the Asia sample, with an estimated marginal effect ranging from 0.593 (Asia, UR-B) to 0.658 (Asia, UR-A). Similarly, *D_Computer* and *D_Internet* are positively associated with entry in both Asian and European samples. The estimated marginal effect of computerization on exchange entry ranges from 1.309 (Asia, R) to 9.097 (Europe, R and UR-A). This means that at most 9 additional exchanges entered per year during the reign of computers without Internet access. UK securities regulation variable *UK Reg* has a negative effect on entry in all but the UR-B dataset. The estimated marginal effect is -8.641 in both the restricted and UR-A samples. As a consistent finding throughout this section, communications technology positively affects entry while regulation dampens it.

5.3 Exchange Exit

Our models of exchange exit parallel our entry models, with annual exit events as the dependent variable. We estimate Poisson models of exchange exit, where the dependent variable is equal to the number of exchange exit events in a given year for a region or full sample. The covariates as the same as those used in the analysis of exchange growth and entry. The annual time-series Poisson model for exit within a region (or full sample) is

$$\begin{aligned} \log(Exit_t) \quad = \quad & \beta_1 GDP_t + \mathbf{1}\{US \in S\}\beta_2 Silver\ Rush_t + \beta_3 D\_Telephone_t + \beta_4 D\_Computer_t \\ & +\beta_5 D\_Internet_t + \beta_6 Literacy_t + \mathbf{1}\{US \in S\}\left[\beta_7 F\_BlueSky_t + \beta_8 US\ Reg_t\right] \\ & +\mathbf{1}\{UK \in S\}\beta_9 UK\ Reg_t + \beta_W \mathbf{W}_t + \varepsilon_t \end{aligned}$$

with forecast error ε_t. Tables 12 and 13 provide the relevant results, estimated coefficients $\hat{\beta}_1, \hat{\beta}_2, \ldots, \hat{\beta}_9$ and robust standard errors for each model.[28]

In general, the exchange exit results resemble their entry counterparts, despite the fact that we observe fewer exit events. Turn first to the world and Americas results in Table 12. We find that output growth is insignificant across all datasets ($\alpha = 0.10$). However, in contrast to our previous results and against our initial expectations, we now find that *Silver Rush* performs very well ($\alpha = 0.01$) and is strongly positively associated with exit. The estimated average marginal effect of the commodity rush variable ranges from 12.963 (Americas, R) to 48.898 (world, UR-B). Therefore, at most the US Silver Rush is associated with an increase in approximately 49 exchange exit events per year.

Advances in telecommunications, as represented by *D_Telephone*, *D_Computer*, and *D_Internet*, sharply increase exit ($\alpha = 0.01$) as hypothesized across all samples examined in Table 12. The magnitude of the estimated average marginal effect is very similar across all three communications variables. After the introduction of the telephone as state-of-the-art, we find an average marginal effect ranging from 13.076 (Americas, R) to 49.923 (world, UR-B). The coefficient on *D_Computer* is positive, large, and precisely estimated across all exit models; its average marginal effect ranges from 12.332 (Americas, R) to 49.449 (world, UR-B) exit events per year. Finally, the estimated average marginal effect of *D_Internet* ranges from 13.438 (Americas, R) to 52.8 (world, UR-B). We infer that advances in communications technology have a strong positive effect on exchange exit in the Americas region and full sample, leading to consolidation.

The literacy rate has no detectable effect. Looking at *F_BlueSky*, it is only significant in restricted samples ($\alpha = 0.05$). In terms of the marginal effect when significant, it ranges from -0.26 to -0.553 per percentage point increase in the fraction of US states with a Blue Sky law. This small negative effect on exit is swamped in magnitude by the communications variables, and does not show up consistently across our samples.

Against our predictions, when significant at $\alpha = 0.05$, nationwide securities regulation in the United States has a very small negative effect on exit relative to commodity rush and communications covariates.

[28]We also ran negative binomial models with exit as the dependent variable. These additional results are available upon request.

UK regulation variable *UK Reg* has no detectable effect ($\alpha = 0.10$) on exit in the full sample using our data. To interpret the result that the estimated coefficient on *US Reg* in the unrestricted B sample is -1.326, the average marginal effect of US regulation on exit events per year is -2.592 (reduced in magnitude to -0.997 in the UR-A sample). Thus US securities regulation slows exit in the Americas region by at most 2.5 exchanges per year. Finally, to interpret the estimated coefficient of -0.816 on *US Reg* in the unrestricted B sample, the corresponding average marginal effect is -2.462; this is very close to its value in the Americas UR-B dataset. So, to summarize, the results suggest that the passage of a nationwide securities regulation law decreased the number of exchanges exiting per year by 1 to 2.5 exchanges, which is both statistically and economically meaningful ($\alpha = 0.05$).

Table 13 presents results on financial exchange exit for Asia and Europe. We find that the communications variables show up as significant ($\alpha = 0.05$) fairly consistently across our various datasets. The estimated average marginal effect of *D_Telephone* ranges from 4.541 (Asia, R) to 9.137 (Europe, UR-A) exchanges per year when significant ($\alpha = 0.05$). For *D_Computer*, the analogous object is between 1.093 (Asia, UR-B) and 8.725 (Europe, UR-A) when significant ($\alpha = 0.01$). Finally, when significant at $\alpha = 0.05$, the estimated average marginal effect of *D_Internet* ranges from 1.286 (Asia, UR-B) to 9.733 (Europe, UR-A); relative to the other European results, it falls precipitously to 1.65 in the UR-B dataset. To summarize, telecommunications advances have an important positive effect on exchange exit in Asian and European data.

The UK securities regulation variable *UK Reg* also has a strong positive effect on exit ($\alpha = 0.01$). We see that its estimated average marginal effect ranges from 1.025 (Europe, UR-A) to 1.074 (Europe, UR-B). The size of the marginal effect is extremely consistent, with variation across datasets only at the second decimal place. Thus the enactment of UK regulation is associated with one additional exchange exiting per year in Europe as a whole. However, note that the marginal effect of regulation is almost an order of magnitude smaller than that of communications advances. Thus we conclude that exchange exit in Europe was primarily driven by communications advances, not regulation.

We now extend our prior results in three important ways. First, we investigate the state-level effect of Blue Sky laws on US financial exchanges. We then provide a brief discussion of how the formation of the European Union has affected exchanges located within its borders. Finally, we model going missing from the data as a competing hazard to exit for US exchanges.

5.4 US State-Level Effect of Regulation

The previous results showed that regulation has a significant ($\alpha = 0.05$) and economically meaningful negative impact on exchange entry. The effect on exit is ambiguous, positive in the European case but negative for the Americas region and full sample. We now provide further support for these results by investigating the passage of Blue Sky laws within each US state. The name "Blue Sky" law stems from one of the pioneering legal cases on the issue (Hall v. Geiger-Jones Co., US 539, 1917) in which the judge ruled to prevent "speculative schemes which have no more basis than so many feet of blue sky." Table 7 reproduces Table 1 from Mahoney (2003) and shows the timing of Blue Sky law passage by state. We re-estimate the binary covariates model for United States alone at the state level in Tables 14–16, now including dummy variables by state which mark periods that the state-level Blue Sky laws were in effect. Tables 14–16 present the results, estimated coefficients $\hat{\beta}_1, \hat{\beta}_2, \ldots, \hat{\beta}_8$ and robust standard errors for each model, using only US data for the outcome variable and output growth. A state is included in the sample if we recorded at least five exchanges for that state historically. Applying this procedure to the US data results in a sample of 14 states which is used throughout this section.

Let i index US states included in the sample. In the state-year panel with 14 states, we estimate exchange growth model

$$\begin{aligned} Exchanges_{it} &= \beta_1 GDP_t + \beta_2 Silver\ Rush_t + \beta_3 D\_Telephone_t + \beta_4 D\_Computer_t \\ &\quad + \beta_5 D\_Internet_t + \beta_6 Literacy_t + \beta_7 Blue\ Sky_{it} + \beta_8 US\ Reg_t \\ &\quad + \beta_W \mathbf{W}_t + \varepsilon_t \\ &\equiv \mathbf{B}\mathbf{X}_t + \beta Blue\ Sky_{it} + \varepsilon_{it} \end{aligned}$$

with results reported in Table 14, where $\mathbf{X}_t$ is the vector of 10 national controls defined above (binary controls, national regulation dummy, and war dummies). The only variables that perform acceptably well at $\alpha = 0.05$ are *Literacy* and *US Reg*. When significant ($\alpha = 0.01$), the estimated coefficient on the US literacy rate is 15.398 for UR-A and 22.823 for UR-B. To interpret, a one percentage point increase in the literacy rate leads to at most a 23% increase in the annual exchange growth rate in the UR-B sample. This is consistent with our findings on literacy in the Americas regional sample, of which the majority is US data. To repeat the exercise, when significant at $\alpha = 0.05$, US nationwide securities regulation has an estimated coefficient ranging from -0.032 (R) to -0.022 (UR-A). The interpretation is that the passage of such legislation slows exchange growth by at most 3% per year. Again we find that, in terms of relative magnitudes, the effect of regulation is overwhelmed by structural change in the economy, in this case the rise in literacy. However, note that most of the movement upward in the literacy rate occurred before nationwide securities regulation was implemented, so the two variables were not changing much contemporaneously.

For entry, our specification is

$$\log(Entry_{it}) = \mathbf{BX}_t + \beta Blue\ Sky_{it} + \varepsilon_{it}$$

with results given in Table 15. The model is specified at the state level, with marginal effects at the mean read directly off of the table. This is the first set of results in which the effect of output growth is estimated precisely; *GDP* is significant at $\alpha = 0.01$. We find that the estimated coefficient ranges from 5.047 (UR-B) to 6.343 (UR-A). Thus a one percent increase in the rate of national output growth is associated with at most 0.063 additional entry events per year at the state level, in a particular set of 14 states with 5 or more exchanges at the end of the sample period, 2012. Both *D_Internet* and *Literacy* are significant at $\alpha = 0.01$ across all samples. The coefficient on *D_Internet* ranges from 2.249 (R) to 3.082 (UR-B), so the advent of the Internet results in at most three additional entry events per year. The literacy rate has an estimated coefficient in the range 396.832 (UR-A) to 437.469 (UR-B), so the maximum marginal effect is 4.3 additional entry events per year in response to a one percentage point increase in the national literacy rate.

Our state-level policy variable of interest *Blue Sky* shows up as significant ($\alpha = 0.01$) only in the restricted dataset, with an estimated coefficient of 1.102. The interpretation is as follows, that the advent of a Blue Sky law for a particular state leads to an increase in entry of 1.1 exchanges per year for that state. This result is contrary to our expectation that Blue Sky regulation would drive exchanges out of business in a given state; instead we find that such regulation encourages exchanges to enter the state's market. However, the national regulation variable *US Reg* is always significant ($\alpha = 0.01$) and yields the expected negative sign, with a coefficient between -2.333 (R) and -2.772 (UR-B). Therefore, when all states have passed Blue Sky laws in the late 1930s and Federal regulation is passed, the net effect of regulation on the exchange industry is unambiguously negative. The minimum effect of roughly -1.2 entry events per year occurs in the restricted sample, and the maximum effect of -2.6 is present in the UR-B dataset. We conclude that, although the Blue Sky laws have a poor showing here ($\alpha = 0.10$), the net effect of state and Federal regulation is negative.

Finally, for exit we specify

$$\log(Exit_{it}) = \mathbf{BX}_t + \beta Blue\ Sky_{it} + \varepsilon_{it}$$

with results presented in Table 16. Again, marginal effects are read directly off of the table. Now the commodity rush and communications variables have a strong showing: they are always significant at $\alpha = 0.01$. Additionally, their estimated coefficients lie in a very tight range, bounded between 14.273 (computer, R) and 17.139 (Internet, UR-B). This set of variables is positively associated with exit at the state level, with the rise of the Internet associated with roughly 17 additional exit events per year. National output growth, the national literacy rate, and state-level Blue Sky laws have no discernible effect at $\alpha = 0.05$. Federal regulation is significant only in the UR-A and UR-B samples. The passage of national securities legislation is associated with a reduction of at most 1.515 exchange exit events per year, which runs counter to our theory. Regulation appears to suppress both entry and exit in the US exchange industry, but entry falls by more than exit so the net effect remains negative. For example, in the unrestricted B sample, net exchange formation (the difference between annual entry and exit) falls by about 1.2 per year as a result of Federal securities law.

In summary, even with no measurable effect of Blue Sky laws and the counterintuitive effect of Federal regulation reducing exit, on net securities regulation hurts the exchange industry (in terms of net exchange formation and the number of exchanges) in all US datasets. This provides further evidence on the power of regulation to curtail both entry and exit, which is represented in the subsequent negative effect on the number of exchanges through net exchange formation. These results imply that regulation, either state or federal, is an important driver of exchange dynamics in historical data.

5.5 Comment: Exchanges in the European Union

As with US blue sky laws, the European Union (EU) provides another setting in which to study the historical dynamics of exchanges. The US experience of regulation, first at the state level, and next at the federal level, bears some resemblance to the experience within the European Union with regulation at the member country level followed by regulation at the EU level, most notably the 4th and 7th directives. Nevertheless, there are differences. For one, unlike the United States, the European Union left unlinked its members' fiscal policies. The members also joined the Union at different times, which provides an interesting counterpoint and a time-series aspect to the analysis. The formation of the European Union meant the breakdown of economic and financial barriers and strengthening of economic ties among member countries. Prior to the formation of the European Union, each member country had its own stock exchange(s) within its own regulatory framework. Over time, the European Union added a new layer of regulatory framework and policies. On the one hand, we would expect more consolidation through exit in the common EU regulatory framework due to a new layer of regulation, despite calls by EU officials for greater competition among exchanges. The exchange mergers that resulted in Euronext and NASDAQ OMX lend support for this view. Interestingly, results are decidedly different for the United Kingdom, which is a member of the union but opted out of participating in the common currency, the euro. The United Kingdom has witnessed an increase in exchange entry in recent years.

Our results also suggest that if the recent turmoil in peripheral member countries (Cyprus, Greece, Portugal, Italy, Ireland, etc.) continues, and causes increased uncertainty about the viability of the European Union, then we may see a reversal of the recent trend of consolidation through exchange exit, and possibly even an increase in entry. Consistent with this conjecture, we note that currently within the European Union, exchange mergers are much more prevalent than shutdowns, as a consolidation strategy that leads to exit. This strategy leaves open the option of an exchange being able to break up if the European Union itself begins to unravel.

6 Results: Continuous Controls

First, we estimate models at the national level for the US with $F\_BlueSky$, the fraction of states having passed a Blue Sky securities regulation law, included as the state-level policy variable. We are interested in the effect of regulation on the financial exchange industry when continuous control variables from the *Historical Statistics of the United States, Millennial Edition* replace the binary ones used previously. The results are presented in Tables 17–19. First we estimate

$$\begin{aligned} Exchanges_t &= \beta_1 GDP_t + \beta_2 Silver\ Mining_t + \beta_3 Gold\ Mining_t + \beta_4 Telegraph_t \\ &\quad + \beta_5 Telephone_t + \beta_6 Computer_t + \beta_7 Internet_t + \beta_8 Literacy_t \\ &\quad + \beta_9 F\_BlueSky_t + \beta_{10} US\ Reg_t + \beta_W \mathbf{W}_t + \varepsilon_t \\ &\equiv \mathbf{BZ}_t + \beta F\_BlueSky_t + \varepsilon_t \end{aligned}$$

with exchange growth as the dependent variable, where $\mathbf{Z}_t$ is the vector of 12 national controls defined above (continuous controls, national regulation dummy, and war dummies). The findings in Table 17 are weak: with $\alpha = 0.05$, only silver mining and telegraph wire are significant in the unrestricted B sample. To interpret, a one percent increase in the growth of silver mining is associated with a 0.01% decrease in the rate of growth in the number of exchanges at the national level for the US. Similarly, a one percent increase in the growth rate of total US telegraph wire mileage leads to a 0.2% increase in exchange growth. Regulation at the state or Federal level has no detectable effect. We conclude that the result here is a negative one, and thus make no attempt to supply intuition.

Table 18 provides the results of estimating

$$\log(Entry_t) = \mathbf{BZ}_t + \beta F\_BlueSky_t + \varepsilon_t$$

with entry as the dependent variable and continuous controls. Output growth, when significant at $\alpha = 0.01$, has an estimated average marginal effect ranging from 4.852 (UR-A) to 6.396 (UR-B). The interpretation is that a one percent increase in output growth leads to at most an increase of 0.063 exchange entry events per year at the national level. The next control variable of note ($\alpha = 0.01$) is the literacy rate, with a marginal effect between 293.096 (UR-A) and 600.379 (UR-B). To interpret, a one percentage point increase in the US literacy rate is associated with at most six additional entry events per year.

The fraction of states with a Blue Sky law shows up as significant at $\alpha = 0.05$ in unrestricted samples only. The marginal effect ranges from -24.41 (UR-A) to -39.129 (UR-B), so a one percentage point increase in the Blue Sky fraction leads to at most a -0.391 annual reduction in entry events. Finally, national securities regulation is significant throughout at $\alpha = 0.05$; the marginal effect lies between -0.499 (R) and -2.545 (UR-B). Thus the maximum effect of the passage of nationwide securities law is a decrease of 2.5 entry events per year. In summary, with continuous controls, we find compelling evidence for the negative effect of securities regulation on exchange entry.

Table 19 lists our results using the model

$$\log(Exit_t) = \mathbf{BZ}_t + \beta F\_BlueSky_t + \varepsilon_t$$

with exit as the dependent variable and continuous covariates. We find evidence that growth in mining, telephone lines, and Internet hosts has a detectable effect on exchange exit. Silver mining growth is significant only in the unrestricted B dataset at $\alpha = 0.05$, with an estimated average marginal effect of -1.56. This implies 0.015 fewer exit events annually given a one percent increase in silver mining. For gold mining at $\alpha = 0.05$, the marginal effect ranges from 1.404 in the UR-A sample to 3.85 in UR-B. Thus a one percent increase in gold mining activity is associated with at most an increase of 0.038 exit events per year. Growth in miles of telephone lines is interpreted in a similar way; the marginal effect is 0.895 (UR-A) or 1.202 (UR-B) when significant at $\alpha = 0.01$. Lastly, Internet host growth is always significant at $\alpha = 0.05$. The marginal effect ranges from -0.681 (R) to -1.82 (UR-B); the interpretation is identical. Thus we conclude that while growth in gold mining and telephone lines accelerates exit, it is slowed by growth in Internet hosts.

The regulation policy variables are not very compelling here. The only variable significant at $\alpha = 0.05$ is nationwide securities regulation in the UR-B dataset: the estimated coefficient is -0.954 with marginal effect -1.654. To interpret, passage of the Securities Exchange Act is associated with 1.6 fewer exit events per year. Again we have the result that regulation slows both entry and exit, with entry falling by more than exit, leading to a decline in net exchange formation and the number of exchanges over time. However, the evidence on the fall in exit is very weak and does not manifest itself consistently across our datasets.

We now estimate, in the state-year panel of 14 states with continuous controls, for exchange growth,

$$Exchanges_{it} = \mathbf{BZ}_t + \beta Blue\ Sky_{it} + \varepsilon_{it}$$

where all continuous variables are in per-capita growth rates, with results reported in Table 20. At $\alpha = 0.05$, silver mining and telegraph lines are only significant in the unrestricted B dataset; number of computers is significant throughout. To interpret, a one percent increase in the control variable leads to a 0.016% decrease in exchange growth for silver mining and a 0.626% increase for telegraph lines. The effect for computers is at most a 0.009% increase in the unrestricted A sample. In terms of relative magnitudes, growth in telegraph lines is swamping everything else, but only in the UR-B case. Internet hosts and the literacy rate are significant at $\alpha = 0.05$ in the unrestricted samples. Growth in Internet hosts has at most a 0.01% positive effect per year on exchange growth given a one percent increase in the independent variable (UR-A). The literacy rate obtains its maximum marginal effect of 0.165 in the UR-B sample. Regulation is again underperforming in terms of an identifiable marginal effect given controls. Our only finding is that nationwide regulation is significant at $\alpha = 0.05$ in the restricted sample, with a marginal effect of slowing exchange growth by 0.026% once enacted. We conclude that computers, Internet hosts, and literacy positively affect exchange growth in a consistently detectable way across datasets.

For *Entry*, our specification is

$$\log(Entry_{it}) = \mathbf{BZ}_t + \beta Blue\ Sky_{it} + \varepsilon_{it}$$

with results given in Table 21. Recall that entries in the table are marginal effects at the mean for a Poisson regression specified at the state level. Output growth is always significant at $\alpha = 0.01$, with the largest marginal effect of 0.06 additional exchange entry events per year (in response to a one percent increase in output growth) occurring in the restricted sample. Growth in silver mining shows up as significant at $\alpha = 0.05$ in the restricted and unrestricted B datasets. Telephone lines and computers are always significant at $\alpha = 0.05$. The maximum effect of growth in telephone lines occurs in the restricted sample, with a marginal effect of 0.006 entry events. Growth in the number of computers also has its largest marginal effect of -0.008 in the restricted sample. Finally, the literacy rate has a detectable marginal effect ranging from 2.998 to 3.907 in the UR-A and UR-B samples, respectively, at $\alpha = 0.01$. To summarize: output growth, telephone lines, and literacy are positively related to entry, while the relationship is negative for silver mining and computers.

State-level Blue Sky regulation is significant at $\alpha = 0.05$ in the restricted sample only, with a marginal effect of 0.909 entry events per year. Our national policy variable *US Reg* has a detectable effect across all datasets here at $\alpha = 0.01$. The marginal effect of the nationwide law ranges from -1.168 (UR-A) to -1.48 (UR-B) entry events per year. Thus we conclude that the Blue Sky laws encouraged entry while the Securities Exchange Act discouraged it, but the evidence on the Blue Sky laws is limited to the restricted sample. The net effect of regulation when both dummies are active is negative across all datasets.

For *Exit*, we estimate

$$\log(Exit_{it}) = \mathbf{B}\mathbf{Z}_t + \beta Blue\ Sky_{it} + \varepsilon_{it}$$

with results presented in Table 22. The strong predictors here are mining, telephone lines, and computers. Growth in silver mining is always significant at $\alpha = 0.01$. The marginal effect ranges from -0.012 (R) to -0.013 (UR-A). Gold mining shows up as significant at $\alpha = 0.05$ in the unrestricted samples: the marginal effect is 0.013 in UR-A and 0.023 in UR-B. Lastly, growth in computers is also always significant at $\alpha = 0.01$. Its marginal effect ranges from -0.011 (UR-B) to -0.014 (UR-A). The literacy rate is significant at $\alpha = 0.05$ only in the restricted sample, with a marginal effect of -1.238. There is no detectable effect of regulation on exit whatsoever in our datasets with continuous controls. To conclude, gold mining and telephone lines encourage exit, while silver mining and computers discourage it; securities regulation policy has no detectable effect on exit with our data.

7 Results: Hazard Model

Finally, we model going missing from the data as a competing hazard to exit. We start with the full US sample of financial exchanges. The first data scenario to consider is when all exchanges without an explicit exit date are dropped from the sample *ex-ante*, the restricted sample, so by construction no exchanges are allowed to go missing. In this case, it is sufficient to estimate the Cox proportional hazard model with time-varying covariates given by hazard function (exchange in state i, year t)

$$\lambda\left(t|\mathbf{Z}(t), Blue\ Sky(i,t)\right) = \lambda_0(t)\exp\left(\mathbf{B}\mathbf{Z}(t) + \beta Blue\ Sky(i,t)\right)$$

because the competing hazard event is never observed in the restricted sample. Turn attention first to the Cox hazard model results in Table 23, column 3 (R), which reports estimated hazard ratios and robust standard errors. At $\alpha = 0.05$, the only significant predictors of exit as the sole hazard are telephone lines, Internet hosts, and nationwide regulation. The hazard ratio is interpretable as a marginal effect. For a binary variable like *US Reg* with an estimated hazard ratio of 1.046 in the proportional hazard model, we find that exchanges are 4.6% more likely to exit per year after the passage of the Securities Exchange Act. For a continuous variable like *Telephone* with a hazard ratio of 0.829, we find that a one percent increase in the growth of telephone lines leads to a 0.171% reduction in the likelihood of exit. Similarly, a one percent increase in the growth of Internet hosts is associated with a 0.007% decrease in the odds of exit. To summarize, telecommunications advances like telephone lines and Internet hosts decrease the chance of exchange exit; however, the risk of exit is attenuated by national securities regulation.

We can model the competing hazard directly when some subset of the unrestricted data is included in the sample used for analysis. Exchanges will now go missing and the competing hazard is observed. Results for the competing hazard model, adapted from Fine and Gray (1999), given by hazard function for the subdistribution (going missing, failure type 1; exit, failure type 2)

$$\bar{\lambda}_1 \left(t|\mathbf{Z}(t), Blue\ Sky(i,t)\right) = \bar{\lambda}_{1,0}(t) \exp\left(\mathbf{BZ}(t) + \beta Blue\ Sky(i,t)\right)$$

are presented in Table 23. Column 1 provides estimated subhazard ratios and robust standard errors when the full US sample is used; column 2 excludes the unrestricted B dataset. Subhazard ratios are interpretable like hazard ratios from the proportional hazard model, but they cannot be interpreted directly as marginal effects. Looking at the full sample in column 1, at $\alpha = 0.05$ the following covariates are significant: silver mining, telephone lines, Blue Sky laws, and the Securities Exchange Act. We cannot interpret the relevant subhazard ratios directly in an economically meaningful way, only the magnitude of the ratio being greater or less than one. Thus growth in silver mining and telephone lines decreases the hazard of exit, while the application of state-level or national securities regulation increases that risk. Column 2 drops exchanges only in the UR-B dataset. The results are similar, with silver mining no longer significant at $\alpha = 0.05$.

To conclude across all three hazard models, we find that growth in communications technology, particularly telephone lines, diminishes the risk of exit. Both state and Federal securities regulation increase the odds of exit. The two most robust predictors of exchange exit in the US data are growth in telephone lines and national securities regulation.

8 Conclusion

We investigate the historical dynamics of 741 financial exchanges in a sample of 52 countries to quantify the economic forces driving entry and exit. The historical record is not consistent with convergence to a single financial exchange in each country, or steady growth in the number of exchanges over time. We document periods of exchange entry and exit in many of the countries that we investigate. We consider two classes of models: one class includes binary controls in models across regional cuts of the data, while the other uses continuous controls to look exclusively at US data. In regional samples, periods of entry are negatively associated with US Blue Sky laws, but positively associated with communications advances and literacy. Periods of exit coincide with the US Silver Rush, communications advances, and UK securities regulation. The results suggest waves of entry and exit primarily driven by underlying structural change and regulation, not business cycle fluctuations. For the US data with binary controls, we find that entry is driven positively by Blue Sky laws, the Internet, and literacy; negatively by national securities regulation. Exit is positively related to the Silver Rush and communications advances, but negatively related to national securities regulation.

With continuous controls for US data, we find that entry is affected positively by output growth and literacy, negatively by regulation. Exit is driven by gold mining and telephone lines. We employ the proportional hazard model of Cox (1972) and the competing hazard model of Fine and Gray (1999) to study the exit of financial exchanges, where the competing hazard is going missing from the data. In a proportional hazard setting, we find that US exchanges are 4.6% more likely to exit per year after the passage of the Securities Exchange Act, but a one percent increase in the growth of telephone lines leads to a 0.171% reduction in the likelihood of exit. When going missing from the data is allowed as a competing hazard to exit, our competing hazard model results suggest that the risk of exchange exit is increased by national securities regulation and decreased by telephone lines. In summary, we find that the telephone, literacy, and regulation are robust predictors of financial exchange dynamics in both US and regional datasets. It now appears that the literacy rate was an important source of demand for exchanges since a better educated populace would be more likely to purchase securities as a savings vehicle for retirement.

These results suggest that the predicted long-run consolidation or fragmentation of exchanges, through sustained exit or entry, respectively, may only be a transitory phenomenon. We predict that, as long as some demand for liquidity provision services goes unmet by incumbent exchanges, new exchanges will enter to meet that demand. Advances in telecommunications technology may render consolidation through shutdowns and mergers more attractive to firms in the financial exchange industry. However, we predict that such technological advances will not eliminate the role for competing entrant exchanges to resolve uncertainty about the viability of risky claims. This suggests that the economic role for competition among exchanges, including the dynamics of entry and exit, is not yet fully understood by the existing literature and could be explored further in future work.

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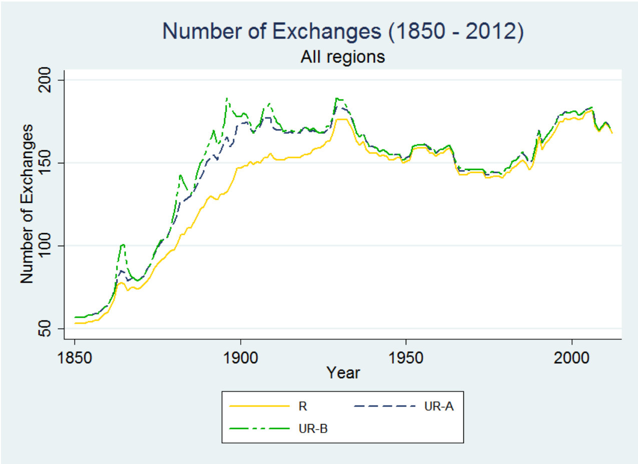
9 Figures

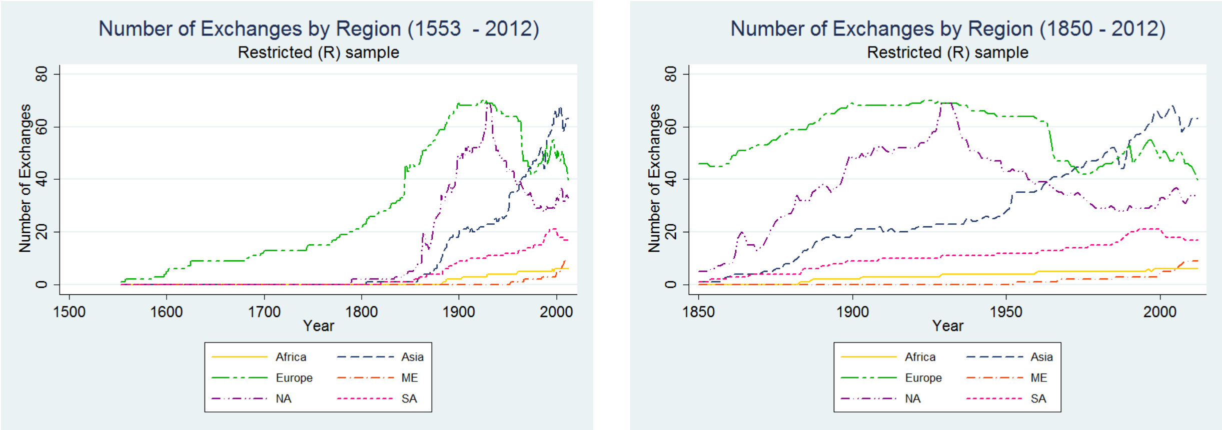
9.1 All Countries

Figure 1: All Countries, Number of Exchanges, 1850–2012



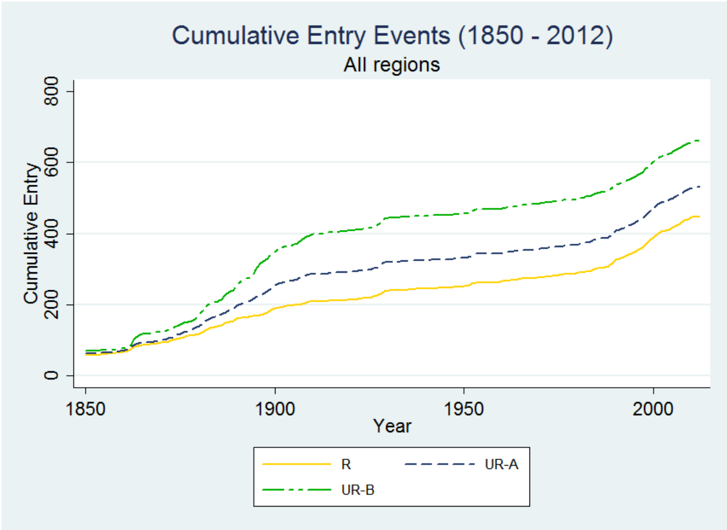
Notes: The phrase "all countries" or "all regions" refers to the complete sample, as detailed in Section A.1 "List of Exchanges by Country" in the Appendix. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided.

Figure 2: Number of Exchanges by Region, 1553–2012



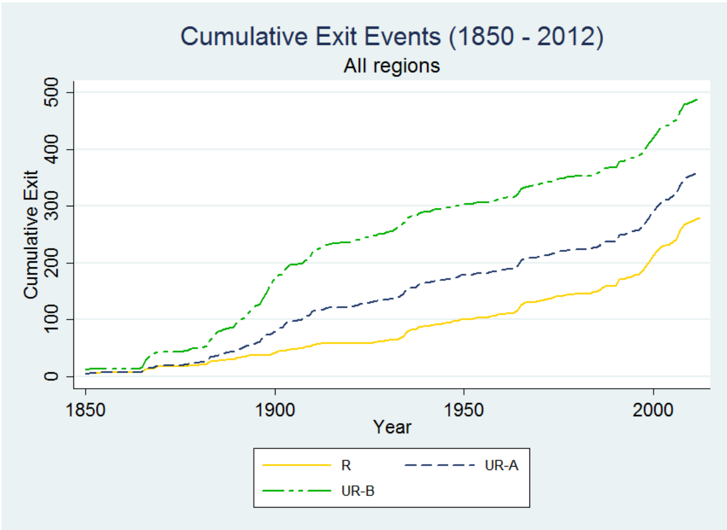
Notes: Regions defined in Section A.1 "List of Exchanges by Country" in the Appendix. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. ME: Middle East; NA: North America; SA: South America.

Figure 3: All Countries, Cumulative Entry Events, 1850–2012



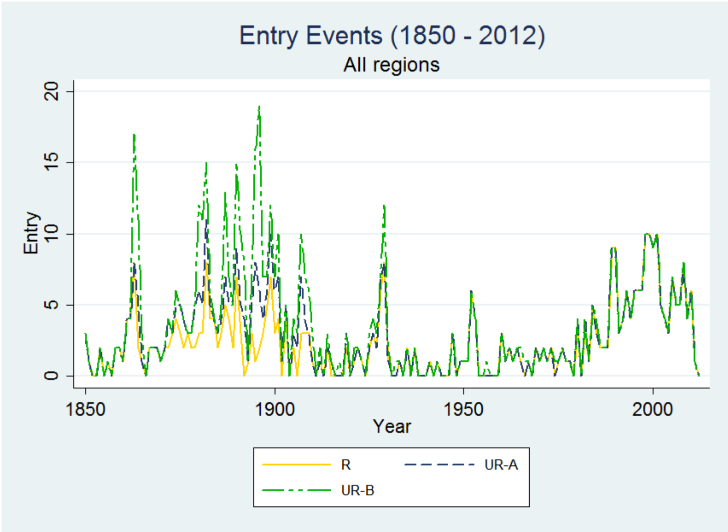
Notes: The phrase "all countries" or "all regions" refers to the complete sample, as detailed in Section A.1 "List of Exchanges by Country" in the Appendix. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided.

Figure 4: All Countries, Cumulative Exit Events, 1850–2012



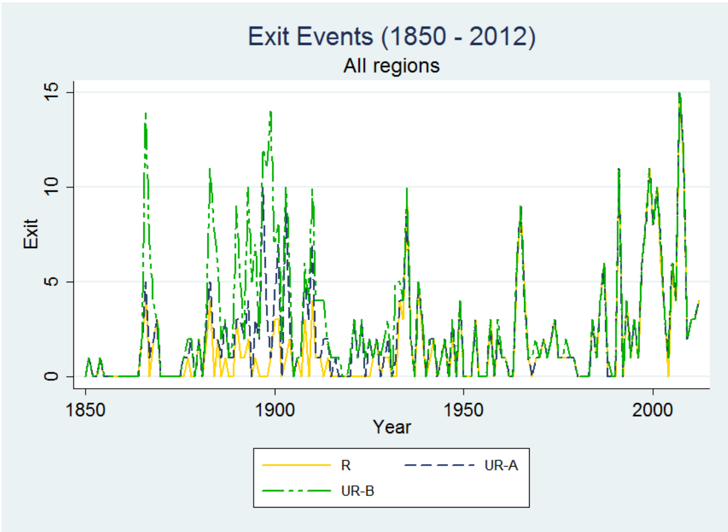
Notes: The phrase "all countries" or "all regions" refers to the complete sample, as detailed in Section A.1 "List of Exchanges by Country" in the Appendix. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable "exit" is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated.

Figure 5: All Countries, Exchange Entry Events, 1850–2012



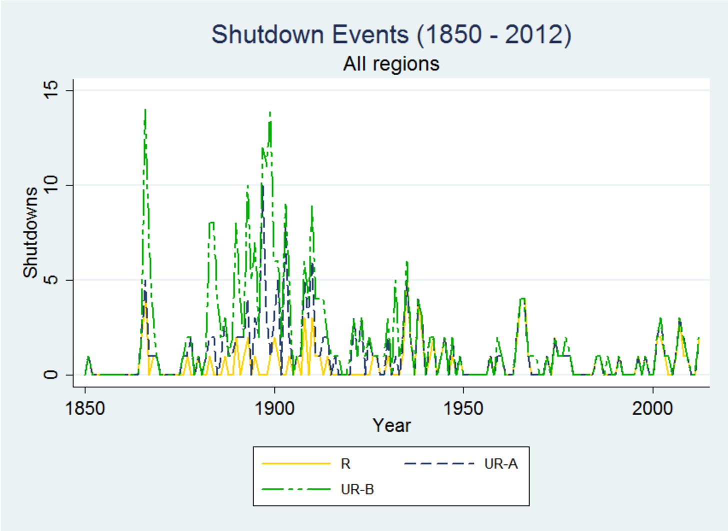
Notes: The phrase "all countries" or "all regions" refers to the complete sample, as detailed in Section A.1 "List of Exchanges by Country" in the Appendix. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided.

Figure 6: All Countries, Exchange Exit Events, 1850–2012



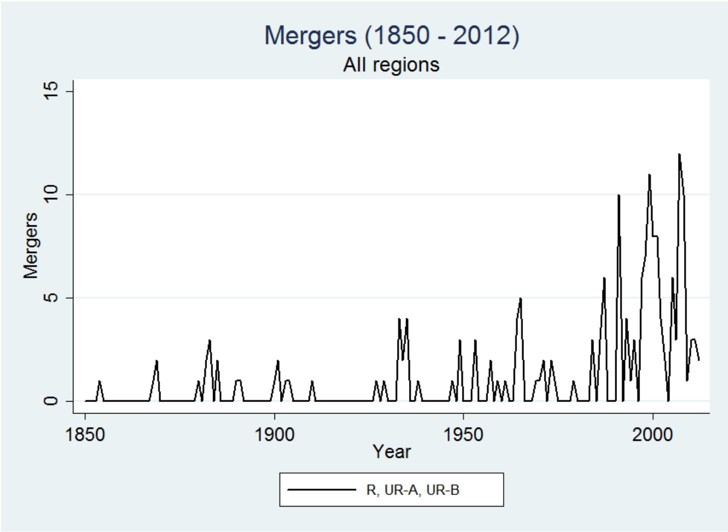
Notes: The phrase "all countries" or "all regions" refers to the complete sample, as detailed in Section A.1 "List of Exchanges by Country" in the Appendix. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable "exit" is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated.

Figure 7: All Countries, Exchange Shutdowns, 1850–2012



*Notes:*The phrase "all countries" or "all regions" refers to the complete sample, as detailed in Section A.1 "List of Exchanges by Country" in the Appendix. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated.

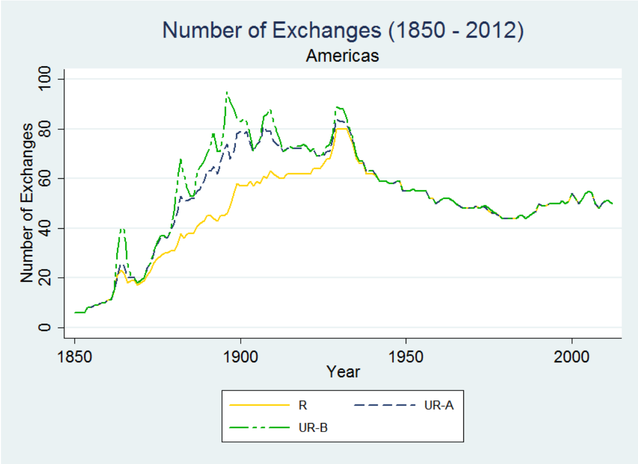
Figure 8: All Countries, Exchange Mergers, 1850–2012



Notes: The phrase "all countries" or "all regions" refers to the complete sample, as detailed in Section A.1 "List of Exchanges by Country" in the Appendix. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided.

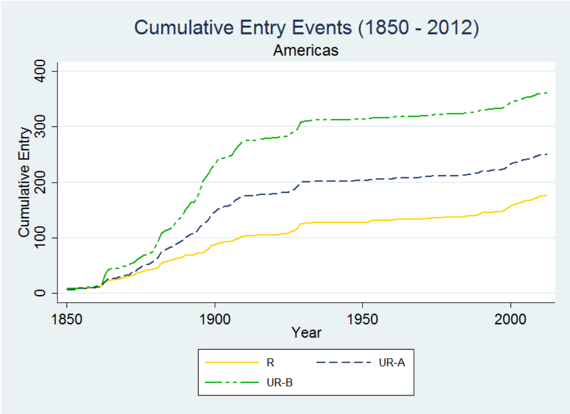
9.2 Americas (North and South America)

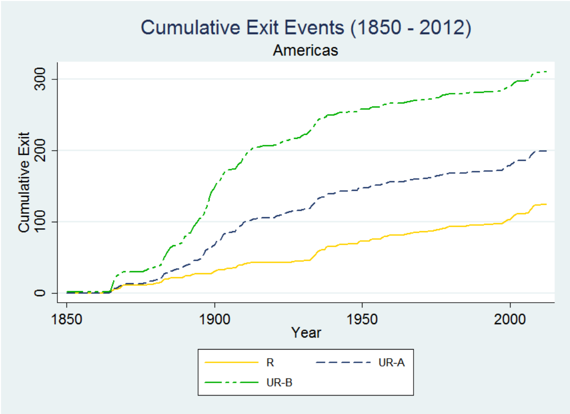
Figure 9: Americas, Number of Exchanges, 1850–2012



Notes: "Americas" defined as union of North and South America regions. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided.

Figure 10: Americas, Cumulative Entry and Exit Events, 1850–2012

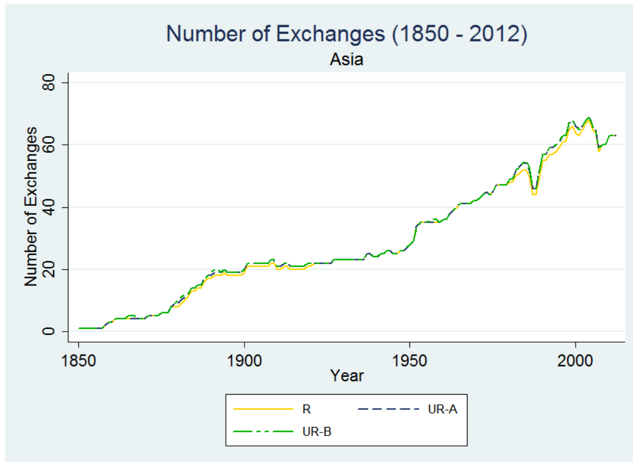




Notes: "Americas" defined as union of North and South America regions. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable "exit" is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated.

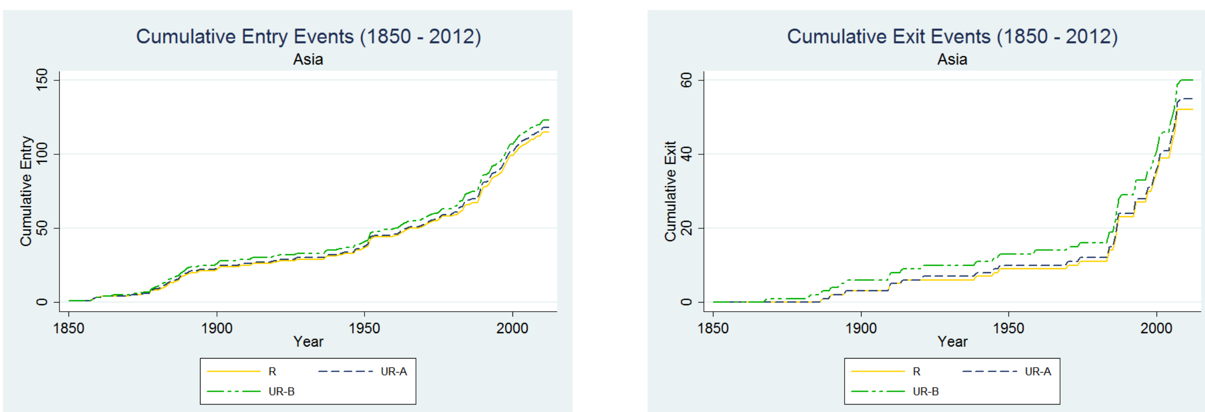
9.3 Asia

Figure 11: Asia, Number of Exchanges, 1850–2012



Notes: Asia region only. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided.

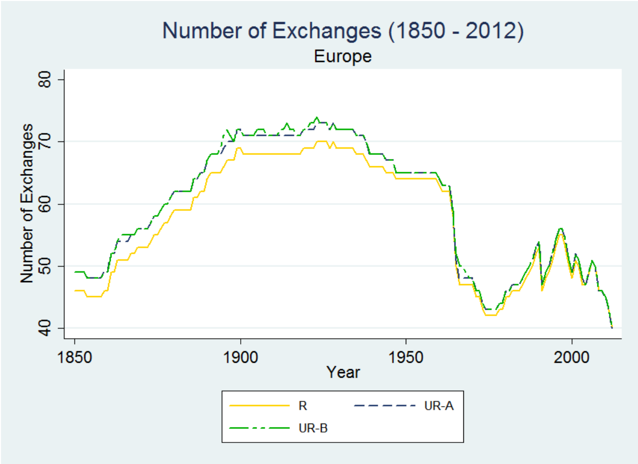
Figure 12: Asia, Cumulative Entry and Exit Events, 1850–2012



Notes: Asia region only. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable "exit" is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated.

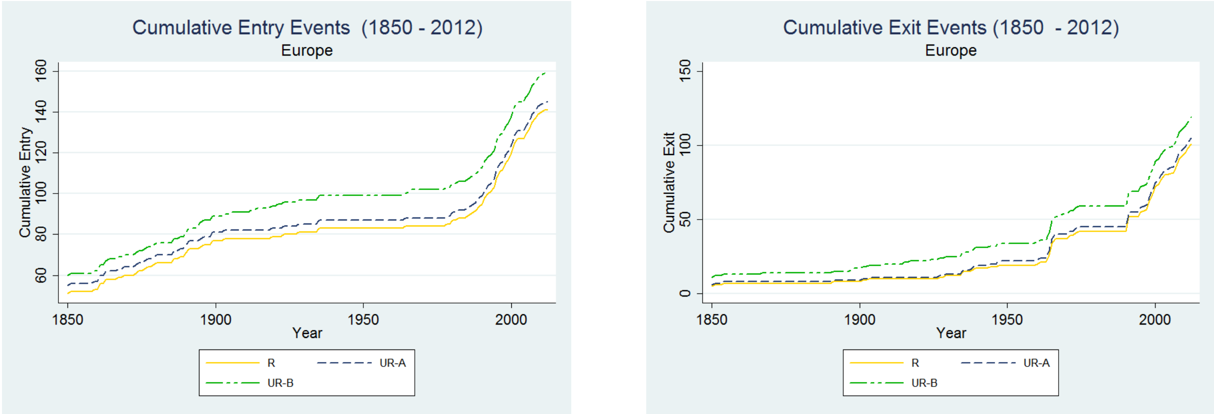
9.4 Europe

Figure 13: Europe, Number of Exchanges, 1850–2012



Notes: Europe region only. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided.

Figure 14: Europe, Cumulative Entry and Exit Events, 1850–2012



Notes: Europe region only. R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable "exit" is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated.

10 Results (Tables)

10.1 Summary

Table 1: Data Completeness: Exchange Entry and Exit Dates by Country, Africa and Asia

			Percentage Complete		
Region	Country	Number of Exchanges	Entry (%)	Exit, R (%)	Exit, UR-A (%)
Africa	Egypt	3	100	100	100
	Morocco	1	100	100	100
	Nigeria	2	100	100	100
	South Africa	2	100	100	100
	Regional Total	8			
Asia	Australia	29	83	72	79
	China	15	100	100	100
	India	31	94	87	94
	Indonesia	4	100	100	100
	Japan	42	59	90	93
	Malaysia	4	100	100	100
	Pakistan	3	100	100	100
	Philippines	4	100	100	100
	Singapore	4	100	100	100
	South Korea	4	100	100	100
	Taiwan	3	100	100	100
	Thailand	4	100	100	100
	Regional Total	147			

Notes: The variable "exit" is defined as the sum of exchange shutdowns and mergers year-by-year: "Exit, R" column uses the restricted definition (counted as missing unless an explicit exit date is provided) and "Exit, UR-A" uses the unrestricted A definition (counted as missing unless an explicit exit or missing date is provided). The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. China: defined here as the People's Republic of China plus the Hong Kong SAR (Special Administrative Region). Taiwan: defined as the Republic of China.

Table 2: Data Completeness: Exchange Entry and Exit Dates by Country, Europe and ME

			Percentage Complete		
Region	Country	Number of Exchanges	Entry (%)	Exit, R (%)	Exit, UR-A (%)
Europe	Belgium	6	100	100	100
	Denmark	2	100	100	100
	France	14	50	50	57
	Germany	23	83	83	91
	Ireland	7	86	71	71
	Italy	13	100	100	100
	Luxembourg	1	100	100	100
	Netherlands	5	100	100	100
	Norway	16	100	31	37
	Poland	1	100	100	100
	Portugal	3	100	100	100
	Romania	3	100	100	100
	Russia	4	100	100	100
	Spain	7	86	100	100
	Sweden	9	67	67	67
	Switzerland	9	67	100	100
	Ukraine	2	100	100	100
	UK	56	95	93	93
	Regional Total	181			
Middle East	Iran	3	100	100	100
	Israel	1	100	100	100
	Saudi Arabia	1	100	100	100
	Turkey	1	100	100	100
	UAE	3	100	100	100
	Regional Total	9			

Notes: The variable "exit" is defined as the sum of exchange shutdowns and mergers year-by-year: "Exit, R" column uses the restricted definition (counted as missing unless an explicit exit date is provided) and "Exit, UR-A" uses the unrestricted A definition (counted as missing unless an explicit exit or missing date is provided). The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated.

Table 3: Data Completeness: Exchange Entry and Exit Dates by Country, Americas

Region	Country	Number of Exchanges	Percentage Complete		
			Entry (%)	Exit, R (%)	Exit, UR-A (%)
North America	Canada	44	84	59	61
	Mexico	2	100	100	100
	US	327	91	39	61
	Regional Total	373			
South America	Argentina	4	100	100	100
	Bolivia	1	100	100	100
	Brazil	5	100	80	80
	Chile	3	100	100	100
	Columbia	4	100	100	100
	Ecuador	2	100	100	100
	Paraguay	1	100	100	100
	Peru	1	100	100	100
	Uruguay	2	100	100	100
	Venezuela	1	100	100	100
	Regional Total	23			
	Grand Total	741			

Notes: The variable "exit" is defined as the sum of exchange shutdowns and mergers year-by-year: "Exit, R" column uses the restricted definition (counted as missing unless an explicit exit date is provided) and "Exit, UR-A" uses the unrestricted A definition (counted as missing unless an explicit exit or missing date is provided). The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated.

10.2 Data

10.2.1 Timing of Historical Events

Table 4: Data on the Timing of Historical Events (Binary Controls)

Event	Date(s)	Rationale
Silver rush (duration)†	1859–1873	Comstock Lode discovery made public to Coinage Act of 1873
Telegraph (introduction)	1845	First commercial telegraph line in the US
Telephone (introduction)	1876	Alexander Graham Bell awarded patent for electric telephone
Personal computer (introduction)	1977	Apple II, PET, and TRS-80 personal computers introduced
Internet (introduction)	1995	Commercial restrictions on the use of the Internet lifted
Telephone (state-of-the-art)†	1876–1976	Introduced in 1876; replaced by the personal computer
Personal computer (state-of-the-art)†	1977–1994	Introduced in 1977; replaced by the Internet
Internet (state-of-the-art)†	1995–2012	Introduced in 1995; current state-of-the-art technology
UK financial regulation (duration)†	1965–2012	Introduction of the Stock Transfer Act of 1963 in the UK
US financial regulation (duration)†	1934–2012	Introduction of the Securities Exchange Act in the US (1934)

Notes: The term "duration" refers to the set of dates for which the event in question was active or ongoing. The term "introduction" refers to the technological development and large-scale introduction of the communications innovation in question into mainstream (non-academic) US/UK society for business use. The term "state-of-the-art" is used to denote the period of a particular communications technology's dominance over all other forms of high-speed mass communication in industrialized societies (e.g. the US and Europe). A dagger (†) denotes a variable used in our empirical work (see Section 9.3 "Results").

10.2.2 Historical Time Series

Table 5: Data on Historical Time Series (Continuous Controls)

Variable	HSUS Code	Description
Telegraph	Dg11	Western Union telegraph wire (thousands of miles)
Telephone	Dg39	Bell (AT&T) telephone wire (thousands of miles)
Computer	Cg241	Computers (number of computers)
Internet	Dg110	Internet hosts, total (number of hosts)
GDP	Ca9	Real Gross Domestic Product, "Millennial Edition series" (1996 $US)
Silver Mining	Db95	Silver mining, annual yield (metric tons)
Gold Mining	Db94	Gold mining, annual yield (metric tons)
Literacy	Bc793	Literacy rate (percentage of persons above age 14)

Notes: All series are specific to the United States, sourced from the *Historical Statistics of the United States, Millennial Edition*. The column "HSUS Code" corresponds to the series code used in the *Historical Statistics of the United States, Millennial Edition* online database. All variables listed here are available from 1855–1995 on an annual basis (*Computer* and *Internet* extended to 2012 using external data source).

10.2.3 Variable Definitions

Table 6: Variable Definitions

Variable	Definition
	Dependent (Outcomes)
$Entry$	Number of exchange entry events
$Exit$	Sum of exchange mergers and shutdowns (exchange exit events)
$Exchanges$	Growth rate in number of exchanges actively operating, per capita
	Independent (Controls)
GDP	GDP (Gross Domestic Product) growth rate in a country or region, in real per-capita terms
$Blue\ Sky_{it}$	Indicator function; $Blue\ Sky_{it} = 1$ if US state i has a Blue Sky law in effect in year t, 0 otherwise
$F\_BlueSky$	Fraction of US states with a Blue Sky law
$Silver\ Rush_t$	Indicator function for year $1859 \leq t \leq 1873$ (US silver rush period)
$Silver\ Mining$	Silver mining, annual yield (metric tons), per-capita growth rate (US)
$Gold\ Mining$	Gold mining, annual yield (metric tons), per-capita growth rate (US)
$Literacy$	Literacy rate, percentage of persons above age 14 (US)
$D\_Telephone_t$	Indicator function for year $1876 \leq t \leq 1976$ (telephone as state-of-the-art)
$D\_Computer_t$	Indicator function for year $1977 \leq t \leq 1994$ (computer as state-of-the-art)
$D\_Internet_t$	Indicator function for year $1995 \leq t \leq 2012$ (Internet as state-of-the-art)
$Telegraph$	Western Union telegraph wire (thousands of miles), per-capita growth rate (US)
$Telephone$	Bell (AT&T) telephone wire (thousands of miles), per-capita growth rate (US)
$Computer$	Computers (number of computers), per-capita growth rate (US)
$Internet$	Internet hosts, total (number of hosts), per-capita growth rate (US)
$US\ Reg_t$	Indicator function for year $1934 \leq t \leq 2012$ (US Securities Exchange Act of 1934)
$UK\ Reg_t$	Indicator function for year $1965 \leq t \leq 2012$ (UK 1963 Stock Transfer Act)
$USCW_t$	Indicator function for year $1861 \leq t \leq 1865$ (US Civil War)
WWI_t	Indicator function for year $1914 \leq t \leq 1918$ (First World War)
$WWII_t$	Indicator function for year $1938 \leq t \leq 1945$ (Second World War)

Notes: The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. Time subscript t stands for year. All variables listed here are available from 1855–2012 on an annual basis. Suppress state/time subscripts on these variables from this point forward.

10.2.4 Timing of US Blue Sky Laws

Table 7: Dates of Adoption of Blue Sky Laws

Year	Merit Review	Ex-Ante Fraud	Ex-Post Fraud
1911	Kansas		
1912	Arizona		Louisiana
1913	Arkansas, Idaho, Michigan, Montana, North Dakota, Ohio, South Dakota, Tennessee, Vermont, West Virginia	California, Florida, Georgia, Iowa, Missouri, Nebraska, North Carolina, Texas, Wisconsin	Maine, Oregon
1915		South Carolina	
1916		Mississippi, Virginia	
1917		Minnesota	New Hampshire
1919		Alabama, Illinois, Oklahoma, Utah, Wyoming	
1920		Indiana, Kentucky	Maryland, New Jersey
1921		Massachusetts, New Mexico, Rhode Island	New York
1923		Colorado, Washington	Pennsylvania
1929			Connecticut
1931			Delaware

Source: Mahoney (2003), Table 1.

10.3 Results

Notes for this section: Numbers reported to the third decimal place, except terminal zeroes which are dropped for coefficients and standard errors. Marginal (or average) effect is not necessary read off of the table; see text of paper for details.

Table 8: Linear Time Series Regression Analysis of the Number of Exchanges, Binary Controls: World and Americas (1855–2012)

Dependent Variable: *Exchanges*

	World			Americas		
	R	UR-A	UR-B	R	UR-A	UR-B
GDP	-0.096	-0.118	-0.109	-0.038	-0.054	0.017
	(0.114)	(0.11)	(0.112)	(0.093)	(0.103)	(0.159)
Silver Rush	-0.011	-0.015	-0.034**	-0.051	-0.063	-0.108**
	(0.01)	(0.01)	(0.017)	(0.036)	(0.039)	(0.052)
D_Telephone	-0.019***	-0.027***	-0.031***	-0.065***	-0.088***	-0.101***
	(0.007)	(0.007)	(0.009)	(0.022)	(0.024)	(0.027)
D_Computer	0.000	-0.005	-0.009	-0.04*	-0.06**	-0.07**
	(0.01)	(0.011)	(0.011)	(0.023)	(0.024)	(0.027)
D_Internet	-0.006	-0.013	-0.017	-0.039	-0.058**	-0.067**
	(0.009)	(0.01)	(0.01)	(0.024)	(0.025)	(0.028)
Literacy	5.428***	7.038***	9.319***	11.256**	16.421***	21.464***
	(1.73)	(1.872)	(2.866)	(4.591)	(5.639)	(7.886)
F_BlueSky	-0.016	-0.039***	-0.057***	-0.041	-0.083**	-0.13***
	(0.01)	(0.014)	(0.019)	(0.027)	(0.032)	(0.043)
US Reg	-0.003	0.001	0.004	-0.012	0.000	0.006
	(0.006)	(0.006)	(0.007)	(0.011)	(0.013)	(0.017)
UK Reg	-0.006	-0.005	-0.004			
	(0.006)	(0.006)	(0.006)			
Also included: constant, *USCW*, *WWI*, *WWII*						
Pr. > F	0.000	0.000	0.000	0.000	0.000	0.000
R^2	0.301	0.319	0.314	0.303	0.354	0.341
RMSE	0.019	0.021	0.031	0.051	0.055	0.092
Sample size: 158						

Notes: In all six regressions listed above, the dependent variable is *Exchanges* (cumulative entry minus exit events). Robust standard errors are reported in parentheses. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. The phrase "World" refers to the complete sample, as detailed in Section A.1 "List of Exchanges by Country" in the Appendix. The phrase "Americas" refers to the union of North America and South America regions. See data section of the paper for variable definitions. Variables *USCW*, *WWI*, and *WWII* are dummy variables for the US Civil War (1861–1865), World War I (1914–1918), and World War II (1938–1945), respectively; *Exchanges* and *GDP* are in growth rates, in per-capita terms; *GDP* was computed based on data from Maddison (2003) using regional countries only; "World" model uses world GDP.

Table 9: Linear Time Series Regression Analysis of the Number of Exchanges, Binary Controls: Asia and Europe (1855–2012)

Dependent Variable: *Exchanges*

	Asia			Europe		
	R	UR-A	UR-B	R	UR-A	UR-B
GDP	-0.202	-0.211	-0.281	-0.102	-0.125*	-0.134
	(0.549)	(0.548)	(0.549)	(0.066)	(0.068)	(0.07)
D_Telephone	-0.09*	-0.09*	-0.092*	-0.006	-0.006	-0.005
	(0.053)	(0.053)	(0.055)	(0.004)	(0.004)	(0.004)
D_Computer	-0.106**	-0.104**	-0.104**	0.032**	0.032**	0.032**
	(0.05)	(0.05)	(0.052)	(0.016)	(0.015)	(0.014)
D_Internet	-0.112**	-0.114**	-0.115**	0.011	0.009	0.01
	(0.051)	(0.051)	(0.053)	(0.016)	(0.016)	(0.015)
UK Reg				-0.026**	-0.025**	-0.025**
				(0.012)	(0.012)	(0.01)
Also included: constant, *WWI*, *WWII*						
$Pr. > F$	0.006	0.004	0.004	0.021	0.019	0.007
R^2	0.114	0.115	0.115	0.132	0.136	0.143
RMSE	0.101	0.101	0.104	0.025	0.024	0.024
Sample size: 158						

Notes: In all six regressions listed above, the dependent variable is *Exchanges* (cumulative entry minus exit events). Robust standard errors are reported in parentheses. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. The phrases "Asia" and "Europe" refer to regional samples, as detailed in Section A.1 "List of Exchanges by Country" in the Appendix. See data section of the paper for variable definitions. Variables *WWI* and *WWII* are dummy variables for World War I (1914–1918) and World War II (1938–1945), respectively; *Exchanges* and *GDP* are in growth rates, in per-capita terms; *GDP* was computed based on data from Maddison (2003) using regional countries only.

Table 10: Poisson Time Series Regression Analysis of Exchange Entry, Binary Controls: World and Americas (1855–2012)

Dependent Variable: *Entry*

	World			Americas		
	R	UR-A	UR-B	R	UR-A	UR-B
GDP	-0.931	-1.577	-2.16	-0.783	0.433	0.887
	(2.147)	(2.163)	(2.243)	(3.332)	(2.731)	(2.705)
Silver Rush	0.051	-0.094	-0.169	-0.01	-0.229	-0.343
	(0.265)	(0.242)	(0.251)	(0.333)	(0.324)	(0.339)
D_Telephone	0.047	0.127	0.458*	0.155	0.171	0.531*
	(0.268)	(0.232)	(0.252)	(0.337)	(0.272)	(0.303)
D_Computer	1.336***	1.493***	1.629***	1.173**	1.33***	1.595***
	(0.383)	(0.363)	(0.336)	(0.532)	(0.503)	(0.502)
D_Internet	1.968***	2.107***	2.236***	2.131***	2.283***	2.543***
	(0.352)	(0.332)	(0.305)	(0.478)	(0.452)	(0.453)
Literacy	292.871***	356.046***	353.783***	207.647*	334.629***	338.166***
	(87.678)	(77.585)	(82.593)	(113.653)	(94.277)	(100.785)
F_BlueSky	-7.665*	-9.554*	-11.073**	-27.437	-22.823*	-24.065**
	(4.249)	(5.711)	(5.154)	(19.407)	(11.993)	(11.407)
US Reg	-0.219	-0.527*	-0.892***	-1.565***	-1.912***	-2.277***
	(0.316)	(0.287)	(0.285)	(0.433)	(0.383)	(0.372)
UK Reg	-0.088	-0.058	0.113			
	(0.313)	(0.315)	(0.263)			
Also included: constant, *USCW*, *WWI*, *WWII*						
$Pr. > \chi^2$	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo-R^2	0.225	0.252	0.294	0.206	0.316	0.403
Sample size: 158						

Notes: In all six regressions listed above, the dependent variable is *Entry*. Robust standard errors are reported in parentheses. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. The phrase "World" refers to the complete sample, as detailed in Section A.1 "List of Exchanges by Country" in the Appendix. The phrase "Americas" refers to the union of North America and South America regions. See data section of the paper for variable definitions. Variables *USCW*, *WWI*, and *WWII* are dummy variables for the US Civil War (1861–1865), World War I (1914–1918), and World War II (1938–1945), respectively; *Exchanges* and *GDP* are in growth rates, in per-capita terms; *GDP* was computed based on data from Maddison (2003) using regional countries only; "World" model uses world GDP.

Table 11: Poisson Time Series Regression Analysis of Exchange Entry, Binary Controls: Asia and Europe (1855–2012)

Dependent Variable: *Entry*

	Asia			Europe		
	R	UR-A	UR-B	R	UR-A	UR-B
GDP	1.102	0.314	-1.01	-4.072	-4.072	-5.882
	(4.174)	(4.125)	(3.883)	(4.808)	(4.808)	(4.354)
D_Telephone	0.867**	0.889**	0.768**	-0.47	-0.47	-0.349
	(0.418)	(0.42)	(0.378)	(0.427)	(0.427)	(0.381)
D_Computer	1.815***	1.905***	1.788***	16.151***	16.151***	1.417*
	(0.495)	(0.491)	(0.446)	(0.565)	(0.565)	(0.777)
D_Internet	1.931***	1.941***	1.779***	16.829***	16.829***	2.085***
	(0.444)	(0.447)	(0.406)	(0.538)	(0.538)	(0.775)
UK Reg				-15.341***	-15.341***	-0.695
				(0.374)	(0.374)	(0.678)
Also included: constant, *WWI*, *WWII*						
$Pr. > \chi^2$	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo-R^2	0.129	0.133	0.127	0.266	0.266	0.205
Sample size: 158						

Notes: In all six regressions listed above, the dependent variable is *Entry*. Robust standard errors are reported in parentheses. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. The phrases "Asia" and "Europe" refer to regional samples, as detailed in Section A.1 "List of Exchanges by Country" in the Appendix. See data section of the paper for variable definitions. Variables *WWI* and *WWII* are dummy variables for World War I (1914–1918) and World War II (1938–1945), respectively; *Exchanges* and *GDP* are in growth rates, in per-capita terms; *GDP* was computed based on data from Maddison (2003) using regional countries only.

Table 12: Poisson Time Series Regression Analysis of Exchange Exit, Binary Controls: World and Americas (1855–2012)

Dependent Variable: *Exit*

	World			Americas		
	R	UR-A	UR-B	R	UR-A	UR-B
GDP	1.969	1.66	0.472	-1.465	1.397	-1.121
	(4.374)	(4.172)	(4.281)	(4.361)	(3.035)	(2.88)
Silver Rush	13.755***	14.971***	16.197***	16.386***	15.208***	14.824***
	(0.647)	(0.641)	(0.642)	(0.818)	(0.655)	(0.672)
D_Telephone	13.947***	15.596***	16.537***	16.528***	15.835***	15.176***
	(0.508)	(0.448)	(0.555)	(0.742)	(0.47)	(0.464)
D_Computer	13.779***	15.479***	16.38***	15.589***	14.974***	14.392***
	(0.691)	(0.631)	(0.648)	(0.825)	(0.607)	(0.609)
D_Internet	14.883***	16.623***	17.49***	16.986***	16.343***	15.66***
	(0.596)	(0.558)	(0.508)	(0.759)	(0.6)	(0.587)
Literacy	-9.982	67.127	35.696	-107.658	9.709	18.367
	(140.48)	(108.915)	(109.169)	(169.336)	(120.543)	(118.938)
F_BlueSky	-32.058***	-1.267	-1.272	-32.938**	-1.254	-1.202
	(11.775)	(1.612)	(1.7)	(15.595)	(1.742)	(1.795)
US Reg	0.338	-0.226	-0.816**	-0.125	-0.788**	-1.326***
	(0.488)	(0.4)	(0.393)	(0.467)	(0.357)	(0.366)
UK Reg	0.329	0.279	0.296			
	(0.432)	(0.425)	(0.404)			
Also included: constant, *USCW*, *WWI*, *WWII*						
$Pr. > \chi^2$	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo-R^2	0.248	0.173	0.161	0.099	0.117	0.217
Sample size: 158						

Notes: In all six regressions listed above, the dependent variable is *Exit*. Robust standard errors are reported in parentheses. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. The phrase "World" refers to the complete sample, as detailed in Section A.1 "List of Exchanges by Country" in the Appendix. The phrase "Americas" refers to the union of North America and South America regions. See data section of the paper for variable definitions. Variables *USCW*, *WWI*, and *WWII* are dummy variables for the US Civil War (1861–1865), World War I (1914–1918), and World War II (1938–1945), respectively; *Exchanges* and *GDP* are in growth rates, in per-capita terms; *GDP* was computed based on data from Maddison (2003) using regional countries only; "World" model uses world GDP.

Table 13: Poisson Time Series Regression Analysis of Exchange Exit, Binary Controls: Asia and Europe (1855–2012)

Dependent Variable: *Exit*

	Asia			Europe		
	R	UR-A	UR-B	R	UR-A	UR-B
GDP	7.642	6.201	5.428	10.027	13.886	10.357
	(10.494)	(9.591)	(8.316)	(8.26)	(8.726)	(7.403)
D_Telephone	13.797***	15.156***	1.048	14.941***	14.884***	1.665
	(0.454)	(0.23)	(1.028)	(0.453)	(0.369)	(1.021)
D_Computer	15.937***	17.202***	2.88***	14.211***	14.214***	0.823
	(0.498)	(0.436)	(1.061)	(1.182)	(1.167)	(1.49)
D_Internet	16.444***	17.777***	3.389***	15.827***	15.857***	2.46**
	(0.397)	(0.113)	(1.022)	(0.681)	(0.646)	(1.147)
UK Reg				1.758***	1.67***	1.601***
				(0.644)	(0.633)	(0.538)
Also included: constant, WWI, $WWII$						
$Pr. > \chi^2$	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo-R^2	0.288	0.292	0.246	0.328	0.33	0.28
Sample size: 158						

Notes: In all six regressions listed above, the dependent variable is *Exit*. Robust standard errors are reported in parentheses. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. The phrases "Asia" and "Europe" refer to regional samples, as detailed in Section A.1 "List of Exchanges by Country" in the Appendix. See data section of the paper for variable definitions. Variables WWI and $WWII$ are dummy variables for World War I (1914–1918) and World War II (1938–1945), respectively; *Exchanges* and *GDP* are in growth rates, in per-capita terms; *GDP* was computed based on data from Maddison (2003) using regional countries only.

Table 14: Linear State-level Panel Regression Analysis of the Number of Exchanges, Binary Controls: US (1855–2012)

Dependent Variable: *Exchanges*

	US		
	R	UR-A	UR-B
GDP	0.1	0.216	0.28
	(0.118)	(0.147)	(0.178)
Silver Rush	-0.009	-0.025	-0.057*
	(0.018)	(0.021)	(0.03)
D_Telephone	-0.004	-0.017	-0.035
	(0.02)	(0.023)	(0.033)
D_Computer	0.009	0.003	-0.008
	(0.019)	(0.021)	(0.03)
D_Internet	0.026	0.021	0.007
	(0.017)	(0.021)	(0.03)
Literacy	6.629	15.398***	22.823***
	(3.87)	(4.651)	(5.191)
Blue Sky	0.011	-0.001	0.002
	(0.012)	(0.014)	(0.014)
US Reg	-0.032***	-0.022**	-0.018
	(0.01)	(0.009)	(0.011)
Also included: constant, *USCW*, *WWI*, *WWII*			
$Pr. > F$	0.000	0.000	0.000
R^2 Within	0.018	0.024	0.027
R^2 Between	0.112	0.092	0.011
R^2 Overall	0.018	0.024	0.027
Sample size: 2212 (14 groups)			

Notes: In all six regressions listed above, the dependent variable is *Exchanges* (cumulative entry minus exit events). Robust standard errors are reported in parentheses, clustered at the state level for 14 US states with 5 or more exchanges at the end of the sample: California, Colorado, Illinois, Massachusetts, Minnesota, Missouri, Nevada, New York, Ohio, Oregon, Pennsylvania, Texas, Utah, and Washington. Nevada is counted as passing a blue sky law in 1933 when Federal legislation was enacted (Securities Act of 1933). State-level fixed effects are included. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. See data section of the paper for variable definitions. Variables *USCW*, *WWI*, and *WWII* are dummy variables for the US Civil War (1861–1865), World War I (1914–1918), and World War II (1938–1945), respectively; *Exchanges* and *GDP* are in growth rates, in per-capita terms.

Table 15: Poisson State-level Panel Regression Analysis of Exchange Entry, Binary Controls: US (1855–2012)

Dependent Variable: *Entry*

	US		
	R	UR-A	UR-B
GDP	6.083***	6.343***	5.047***
	(2.055)	(1.919)	(1.386)
Silver Rush	-0.179	-0.555	-0.638
	(0.683)	(0.377)	(0.454)
D_Telephone	-0.384	0.065	0.432
	(0.532)	(0.307)	(0.399)
D_Computer	-0.656	-0.212	0.181
	(0.789)	(0.476)	(0.513)
D_Internet	2.249***	2.693***	3.082***
	(0.424)	(0.423)	(0.466)
Literacy	406.196***	396.832***	437.469***
	(91.836)	(86.103)	(118.471)
Blue Sky	1.102***	0.256	0.106
	(0.359)	(0.426)	(0.463)
US Reg	-2.333***	-2.466***	-2.772***
	(0.424)	(0.475)	(0.551)
Also included: constant, $USCW$, WWI, $WWII$			
$Pr. > \chi^2$	0.000	0.000	0.000
Sample size: 2212 (14 groups)			

Notes: In all six regressions listed above, the dependent variable is *Entry*. Robust standard errors are reported in parentheses, clustered at the state level for 14 US states with 5 or more exchanges at the end of the sample: California, Colorado, Illinois, Massachusetts, Minnesota, Missouri, Nevada, New York, Ohio, Oregon, Pennsylvania, Texas, Utah, and Washington. Nevada is counted as passing a blue sky law in 1933 when Federal legislation was enacted (Securities Act of 1933). State-level fixed effects are included. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. See data section of the paper for variable definitions. Variables $USCW$, WWI, and $WWII$ are dummy variables for the US Civil War (1861–1865), World War I (1914–1918), and World War II (1938–1945), respectively; *Exchanges* and GDP are in growth rates, in per-capita terms.

Table 16: Poisson State-level Panel Regression Analysis of Exchange Exit, Binary Controls: US (1855–2012)

Dependent Variable: *Exit*

	US		
	R	UR-A	UR-B
GDP	-1.953	0.125	-0.353
	(3.049)	(1.791)	(1.37)
Silver Rush	15.383***	14.645***	16.072***
	(0.775)	(0.677)	(0.58)
D_Telephone	15.256***	15.535***	16.711***
	(0.545)	(0.449)	(0.427)
D_Computer	14.273***	14.506***	15.543***
	(0.642)	(0.477)	(0.634)
D_Internet	15.574***	15.82***	17.139***
	(0.71)	(0.587)	(0.503)
Literacy	-141.33	-141.533	-165.566
	(154.15)	(142.258)	(122.877)
Blue Sky	-0.476	-0.746	-0.891*
	(0.775)	(0.461)	(0.456)
US Reg	0.205	-0.756**	-1.515***
	(0.655)	(0.308)	(0.454)
Also included: constant, *USCW*, *WWI*, *WWII*			
$Pr. > \chi^2$	0.000	0.000	0.000
Sample size: 2212 (14 groups)			

Notes: In all six regressions listed above, the dependent variable is *Exit*. Robust standard errors are reported in parentheses, clustered at the state level for 14 US states with 5 or more exchanges at the end of the sample: California, Colorado, Illinois, Massachusetts, Minnesota, Missouri, Nevada, New York, Ohio, Oregon, Pennsylvania, Texas, Utah, and Washington. Nevada is counted as passing a blue sky law in 1933 when Federal legislation was enacted (Securities Act of 1933). State-level fixed effects are included. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. Variables *USCW*, *WWI*, and *WWII* are dummy variables for the US Civil War (1861–1865), World War I (1914–1918), and World War II (1938–1945), respectively; *Exchanges* and *GDP* are in growth rates, in per-capita terms.

Table 17: Linear Time Series Regression Analysis of the Number of Exchanges, Continuous Controls: US (1855–2012)

Dependent Variable: *Exchanges*

	US		
	R	UR-A	UR-B
GDP	0.045	0.075*	0.115*
	(0.033)	(0.039)	(0.061)
Silver Mining	-0.004*	-0.005*	-0.009**
	(0.002)	(0.002)	(0.004)
Gold Mining	-0.006	-0.007	-0.01
	(0.014)	(0.016)	(0.026)
Telegraph	0.01	0.087	0.209**
	(0.05)	(0.058)	(0.092)
Telephone	0.014	-0.012	-0.011
	(0.011)	(0.013)	(0.02)
Computer	0.002	0.002	0.003
	(0.005)	(0.005)	(0.008)
Internet	0.006	0.006	0.007
	(0.004)	(0.004)	(0.007)
Literacy	1.582	3.229	5.401
	(1.903)	(2.204)	(3.462)
F_BlueSky	-0.007	-0.047	-0.03
	(0.045)	(0.052)	(0.082)
US Reg	-0.001	0.001	0.01
	(0.005)	(0.006)	(0.01)
Also included: constant, *USCW*, *WWI*, *WWII*			
Pr. > *F*	0.041	0.009	0.000
R^2	0.142	0.169	0.232
Adj. R^2	0.065	0.094	0.162
RMSE	0.021	0.024	0.038
Sample size: 158			

Notes: In all six regressions listed above, the dependent variable is *Exchanges* (cumulative entry minus exit events). Robust standard errors are reported in parentheses. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. See data section of the paper for variable definitions. Variables *USCW*, *WWI*, and *WWII* are dummy variables for the US Civil War (1861–1865), World War I (1914–1918), and World War II (1938–1945), respectively; continuous variables are in growth rates, in per-capita terms.

Table 18: Poisson Time Series Regression Analysis of Exchange Entry, Continuous Controls: US (1855–2012)

Dependent Variable: *Entry*

	US		
	R	UR-A	UR-B
GDP	2.92*	4.014***	3.435***
	(1.729)	(1.239)	(0.97)
Silver Mining	-0.268	-0.347	-0.339*
	(0.187)	(0.24)	(0.181)
Gold Mining	-1.82*	-0.457	0.72
	(1.071)	(0.816)	(0.671)
Telegraph	1.732	0.747	1.633
	(1.704)	(1.364)	(1.006)
Telephone	0.465	0.39	0.354*
	(0.319)	(0.239)	(0.201)
Computer	-1.028	-0.865	-0.753
	(0.702)	(0.65)	(0.601)
Internet	0.125	0.102	0.039
	(0.289)	(0.271)	(0.265)
Literacy	41.959	242.465***	323.761***
	(95.689)	(82.399)	(71.764)
F_BlueSky	-23.57*	-20.193**	-21.101***
	(12.908)	(9.115)	(8.069)
US Reg	-0.675**	-1.054***	-1.372***
	(0.315)	(0.286)	(0.271)
Also included: constant, *USCW*, *WWI*, *WWII*			
$Pr. > \chi^2$	0.000	0.000	0.000
Pseudo-R^2	0.196	0.32	0.415
Sample size: 158			

Notes: In all six regressions listed above, the dependent variable is *Entry*. Robust standard errors are reported in parentheses. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. See data section of the paper for variable definitions. Variables *USCW*, *WWI*, and *WWII* are dummy variables for the US Civil War (1861–1865), World War I (1914–1918), and World War II (1938–1945), respectively; continuous variables are in growth rates, in per-capita terms.

Table 19: Poisson Time Series Regression Analysis of Exchange Exit, Continuous Controls: US (1855–2012)

Dependent Variable: *Exit*

	US		
	R	UR-A	UR-B
GDP	0.287	1.308	0.611
	(2.087)	(1.427)	(1.06)
Silver Mining	-1.02	-0.969*	-0.9**
	(0.664)	(0.531)	(0.419)
Gold Mining	0.768	1.404**	2.22***
	(0.774)	(0.63)	(0.515)
Telegraph	2.572	-3.109	-3.13*
	(3)	(2.345)	(1.736)
Telephone	-0.906	0.895***	0.694***
	(0.91)	(0.236)	(0.201)
Computer	-0.787*	-0.784*	-0.73*
	(0.447)	(0.437)	(0.408)
Internet	-1.098**	-0.989**	-1.05***
	(0.44)	(0.413)	(0.398)
Literacy	-71.881	95.189	99.822
	(102.423)	(84.815)	(66.369)
F_BlueSky	-32.988	0.141	-1.97
	(24.102)	(1.754)	(1.895)
US Reg	0.449	-0.209	-0.954***
	(0.307)	(0.246)	(0.217)
Also included: constant, *USCW*, *WWI*, *WWII*			
$Pr. > \chi^2$	0.001	0.000	0.000
Pseudo-R^2	0.091	0.132	0.242
Sample size: 158			

Notes: In all six regressions listed above, the dependent variable is *Exit*. Robust standard errors are reported in parentheses. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. Variables *USCW*, *WWI*, and *WWII* are dummy variables for the US Civil War (1861–1865), World War I (1914–1918), and World War II (1938–1945), respectively; continuous variables are in growth rates, in per-capita terms.

Table 20: Linear State-level Panel Regression Analysis of the Number of Exchanges, Continuous Controls: US (1855–2012)

Dependent Variable: *Exchanges*

	US		
	R	UR-A	UR-B
GDP	0.087	0.206	0.291
	(0.118)	(0.157)	(0.189)
Silver Mining	-0.007	-0.01*	-0.016**
	(0.004)	(0.005)	(0.007)
Gold Mining	-0.009	-0.027	-0.014
	(0.023)	(0.026)	(0.029)
Telegraph	-0.012	0.077	0.626**
	(0.119)	(0.18)	(0.265)
Telephone	0.017	-0.05*	-0.033
	(0.02)	(0.028)	(0.034)
Computer	0.006**	0.009***	0.008**
	(0.003)	(0.003)	(0.003)
Internet	0.006*	0.01**	0.009**
	(0.003)	(0.003)	(0.004)
Literacy	4.638	14.582***	16.569***
	(2.924)	(3.933)	(4.799)
Blue Sky	0.01	-0.004	0.015
	(0.01)	(0.012)	(0.011)
US Reg	-0.026**	-0.014	-0.01
	(0.009)	(0.01)	(0.011)
Also included: constant, *USCW*, *WWI*, *WWII*			
Pr. > *F*	0.000	0.000	0.000
R^2 Within	0.018	0.025	0.034
R^2 Between	0.112	0.092	0.011
R^2 Overall	0.018	0.025	0.034
Sample size: 2212 (14 groups)			

Notes: In all six regressions listed above, the dependent variable is *Exchanges* (cumulative entry minus exit events). Robust standard errors are reported in parentheses, clustered at the state level for 14 US states with 5 or more exchanges at the end of the sample: California, Colorado, Illinois, Massachusetts, Minnesota, Missouri, Nevada, New York, Ohio, Oregon, Pennsylvania, Texas, Utah, and Washington. Nevada is counted as passing a blue sky law in 1933 when Federal legislation was enacted (Securities Act of 1933). State-level fixed effects are included. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term “shutdown” is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. See data section of the paper for variable definitions. Variables *USCW*, *WWI*, and *WWII* are dummy variables for the US Civil War (1861–1865), World War I (1914–1918), and World War II (1938–1945), respectively; continuous variables are in growth rates, in per-capita terms.

Table 21: Poisson State-level Panel Regression Analysis of Exchange Entry, Continuous Controls: US (1855–2012)

Dependent Variable: *Entry*

	US		
	R	UR-A	UR-B
GDP	6.061***	5.87***	4.702***
	(2.244)	(1.935)	(1.416)
Silver Mining	-0.225***	-0.324*	-0.311**
	(0.074)	(0.176)	(0.126)
Gold Mining	-1.664	-0.521	1.15
	(1.822)	(1.33)	(1.621)
Telegraph	3.116	-0.342	1.319
	(1.893)	(2.433)	(1.799)
Telephone	0.683***	0.488**	0.464**
	(0.25)	(0.232)	(0.196)
Computer	-0.801***	-0.659***	-0.551***
	(0.141)	(0.145)	(0.126)
Internet	0.104	0.108	0.008
	(0.254)	(0.196)	(0.218)
Literacy	78.433	299.879***	390.767***
	(104.617)	(103.258)	(81.878)
Blue Sky	0.909***	0.202	0.241
	(0.326)	(0.333)	(0.335)
US Reg	-1.19***	-1.168***	-1.48***
	(0.291)	(0.323)	(0.406)
Also included: constant, *USCW*, *WWI*, *WWII*			
$Pr. > \chi^2$	0.000	0.000	0.000
Sample size: 2212 (14 groups)			

Notes: In all six regressions listed above, the dependent variable is *Entry*. Robust standard errors are reported in parentheses, clustered at the state level for 14 US states with 5 or more exchanges at the end of the sample: California, Colorado, Illinois, Massachusetts, Minnesota, Missouri, Nevada, New York, Ohio, Oregon, Pennsylvania, Texas, Utah, and Washington. Nevada is counted as passing a blue sky law in 1933 when Federal legislation was enacted (Securities Act of 1933). State-level fixed effects are included. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. See data section of the paper for variable definitions. Variables *USCW*, *WWI*, and *WWII* are dummy variables for the US Civil War (1861–1865), World War I (1914–1918), and World War II (1938–1945), respectively; continuous variables are in growth rates, in per-capita terms.

Table 22: Poisson State-level Panel Regression Analysis of Exchange Exit, Continuous Controls: US (1855–2012)

Dependent Variable: *Exit*

	US		
	R	UR-A	UR-B
GDP	0.554	1.356	0.969
	(2.532)	(1.774)	(1.25)
Silver Mining	-1.251***	-1.38***	-1.346***
	(0.347)	(0.456)	(0.406)
Gold Mining	0.934	1.385***	2.397**
	(0.73)	(0.532)	(1.048)
Telegraph	4.285	-2.939	-3.067
	(2.977)	(4.048)	(2.802)
Telephone	-1.13	0.721***	0.497***
	(1.363)	(0.24)	(0.181)
Computer	-1.414***	-1.448***	-1.181***
	(0.504)	(0.463)	(0.42)
Internet	-0.963*	-0.893*	-0.953*
	(0.521)	(0.464)	(0.499)
Literacy	-123.863**	32.904	4.615
	(54.897)	(58.679)	(123.643)
Blue Sky	-0.295	-0.481	-0.678*
	(0.72)	(0.396)	(0.347)
US Reg	0.631	-0.043	-0.868
	(0.59)	(0.264)	(0.555)
Also included: constant, $USCW$, WWI, $WWII$			
$Pr. > \chi^2$	0.000	0.000	0.000
Sample size: 2212 (14 groups)			

Notes: In all six regressions listed above, the dependent variable is *Exit*. Robust standard errors are reported in parentheses, clustered at the state level for 14 US states with 5 or more exchanges at the end of the sample: California, Colorado, Illinois, Massachusetts, Minnesota, Missouri, Nevada, New York, Ohio, Oregon, Pennsylvania, Texas, Utah, and Washington. Nevada is counted as passing a blue sky law in 1933 when Federal legislation was enacted (Securities Act of 1933). State-level fixed effects are included. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. Variables $USCW$, WWI, and $WWII$ are dummy variables for the US Civil War (1861–1865), World War I (1914–1918), and World War II (1938–1945), respectively; continuous variables are in growth rates, in per-capita terms.

Table 23: Hazard Model of Exchange Exit, Continuous Controls: US (1855–2012)

	Hazard Variable: *Exit*		
	Competing Hazard: *Missing*		Cox Hazard
	R, UR-A, UR-B	R, UR-A	R
GDP	1.051	1.037	1.084
	(0.087)	(0.081)	(0.079)
Silver Mining	0.959**	0.966*	0.975
	(0.017)	(0.018)	(0.016)
Gold Mining	1	0.999	1.007
	(0.014)	(0.014)	(0.008)
Telegraph	1.525	1.372	1.186
	(0.786)	(0.62)	(0.42)
Telephone	0.805***	0.809***	0.829***
	(0.052)	(0.045)	(0.046)
Computer	0.999	0.998	0.997
	(0.004)	(0.004)	(0.004)
Internet	0.995*	0.994*	0.993**
	(0.003)	(0.003)	(0.003)
Literacy	0.047	0.065	0.187
	(0.097)	(0.13)	(0.344)
Blue Sky	1.143***	1.108***	1.055*
	(0.054)	(0.043)	(0.033)
US Reg	1.07***	1.059***	1.046**
	(0.025)	(0.022)	(0.021)
Also included: constant, *USCW*, *WWI*, *WWII*			
$Pr. > \chi^2$	0.000	0.000	0.000
Observations	5802	5496	4757
Subjects	296	194	120
Failed	96	96	96
Competing	176	74	
Censored	24	24	

Notes: In all six regressions listed above, the hazard variable is *Exit*; competing hazard variable is *Missing*. Subhazard ratios are reported, not estimated coefficients. All covariates are allowed to vary over time. Robust standard errors are reported in parentheses, clustered at the exchange level. Significance levels: α =0.10 (*), 0.05 (**), 0.01 (***). R (restricted): counted as missing unless an explicit exit date is provided (or survived to the end of the sample period, 2012). UR-A (unrestricted A): counted as missing unless an explicit exit or missing date is provided. UR-B (unrestricted B): counted as missing unless an entry date is provided. The variable *Exit* is defined as the sum of exchange shutdowns and mergers year-by-year. The term "shutdown" is defined as the permanent shutdown of an exchange due to prevailing market conditions, not a merger or buyout; the exchange halts trading and its assets are liquidated. Variables *USCW*, *WWI*, and *WWII* are dummy variables for the US Civil War (1861–1865), World War I (1914–1918), and World War II (1938–1945), respectively; continuous variables are in growth rates, in per-capita terms.