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Going public: evidence from stock and bond IPOs in Belgium, 1839–1935

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Abstract

We investigate firms' initial stock and bond issues in public capital markets and explain fluctuations in these IPOs over time. We study Belgium from 1839 to 1935, which provides a setting with poor investor protection, no tax distortions, and changing regulations. We find that economic growth induces stock and bond IPOs and that the issuers time offerings such that they coincide with favorable market conditions. Even though in 1873, regulation was abruptly relaxed, we find no evidence of increases in the number of IPOs. Finally, we show that stock and bond IPOs do not interact when controlling for the determinants of these IPOs.

Keywords Corporate finance · Going public · Initial public offering · Bond issues · Belgium

JEL Classification G32 · N23 · N24

1 Introduction

It is well-known that the number of initial public offerings (IPOs) varies over time in equity markets (Ibbotson and Jaffe 1975) and that similar fluctuations occur in bond issues (Becker and Ivashina 2014; Pour 2017). The development of public capital

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markets is an important area in finance (McDonald 2022). We aim to explain the changes in stock and bond IPOs over time. We also study how the two financing instruments interact and whether the motives and timing of stock and bond IPOs are affected by changes in the institutional setting. For this, we take the historical perspective of Belgium over the period 1839–1935, when stock and bond issues were the primary sources of financing for Belgian firms.

We contribute to the literature on stock and bond IPOs by simultaneously studying the determinants of stock and bond IPOs in a unique period covering almost a century. To the best of our knowledge, we are the first to study the effects of an institutional change on bond IPOs and simultaneously study the determinants of stock and bond IPOs to investigate their interaction. The period we investigate contains two well-defined sub-periods with specific characteristics that allow us to investigate the effects of institutional changes on the motives and timing of stock and bond IPOs by comparing results in sub-periods, mainly in terms of securities market development and Belgium's monetary situation.

The modern finance literature studies stock IPOs over short and recent periods, and these studies have a stable institutional setting (see Ibbotson and Jaffe 1975; Ritter and Welch 2002; Lowry 2003). Changes in economic and market conditions and stock market liquidity explain the fluctuations in the number of stock IPOs (Lowry 2003; Banerjee et al. 2013; Hanselaar et al. 2019). Few papers study fluctuations in the number of bond IPOs. Hale and Santos (2008) find that firms time bond IPOs to avoid recessionary periods, but that timing is not crucial outside these periods. Becker and Ivashina (2014) find that monetary policy and changes in bank-credit supply are also relevant because bank loans are an alternative for bond issues, and Pour (2017) finds effects of information asymmetry on the timing of bond IPOs.

Stock and bond issues are alternative financing instruments and can be each other's substitutes and complements. How firms choose between debt and equity is hotly debated. According to the so-called trade-off theory, firms will prefer debt issues as long as the tax advantage of debt outweighs the costs of financial distress. According to the alternative pecking-order theory, which builds on information asymmetries between issuers and investors, bond issues are preferred over equity due to the information premium investors require for new stock issues (Myers 1984). In addition, Baker and Wurgler (2002) argue that firms time their new issues to coincide with favorable market conditions. Because these conditions do not change synchronously for stocks and bonds, preferences for stock and bond issues vary over time. Glushkov et al. (2018) investigate how firms that go public through a bond IPO are different from those that go public through a stock IPO. The authors find that firms that go public through debt are larger, have less information asymmetry, and are backed by a venture-capital or private-equity firm.

Nowadays, the choice between debt and equity also depends on a firm's track record, especially at the IPO stage. For example, firms that issue bonds must be able to generate substantial positive cash flows to service the debt, unlike firms that issue equity (Shleifer and Vishny 1997). This makes the universe of firms that issue bonds substantially different from firms that issue equity. However, in the period of our study, Belgian stocks were more like bonds than they are today. Shareholders often had the right to a fixed minimum dividend insofar as a firm's profit was sufficient,

and this right was even guaranteed in the articles of association (Vermoesen et al. 2020). Also, the legal protection of shareholders in Belgium was similar to that of bondholders. For this reason, we argue that in the period we will investigate, stocks and bonds were more likely to be perceived as substitutes or complements than today.

Historians have studied IPOs in specific institutional settings and eras in the past years. Chambers and Dimson (2009) document the U.K. IPO market over the twentieth century. They find that underpricing has increased, from 3.8% in 1917–1945 to 9.2% in 1946–1986. Subsequent studies document market efficiency and the consequences of self-regulation by the London Stock Exchange, and have studied the Berlin Stock Exchange.[1] De Jong and Legierse (2022) study fluctuations in equity IPOs in the Netherlands from 1876 to 2015 and conclude that economic growth, investor sentiment, and the capital market's size are primary drivers of the number of IPOs. Research on the effect of institutional changes on stock IPOs focuses on IPO underpricing (Akyol et al. 2014; Chambers and Dimson 2009; Burhop 2010), post-IPO survival rates (Burhop et al. 2011; Espenlaub et al. 2016), long-term performance (Boubaker et al. 2017) and firm characteristics (Takahashi and Yamada 2015).

We are aware of only two papers investigating the effect of institutional changes on fluctuations in the number of stock IPOs. Gao et al. (2013) examine the impact of two regulatory changes to protect investors' interests better. Conventional wisdom blamed the Sarbanes-Oxley Act of 2002 and the Global Settlement of 2003 for the decline in IPO activity in the U.S. after 2000, especially among small firms, because of higher listing costs. Gao et al. (2013) find that these two changes cannot explain this decline. They argue that the reduction in the number of IPOs is due to the recent preference of small firms to be acquired rather than go public to grow (so-called 'economies of scope'). Cattaneo et al. (2015) examine the effect of changes in regulations related to protecting investor interests on the number of Italian IPOs between 1861 and 2011. The result of this study is not unequivocal. Cattaneo et al. (2015) find that a change in regulations in 1935 aimed at better protecting investors' interests led to a significant decrease in the number of IPOs. Still, a relaxation of regulation in 1973 did not significantly increase IPO activity. We are not aware of any recent paper that has studied the effect of regulatory changes on fluctuations in the number of bond IPOs. While macro-economic and financial market variables continuously fluctuate over time, institutional changes can occur at a specific time due to political and judicial decisions. Such abrupt and drastic change took place in Belgium in 1873, with a dramatic relaxation of the stock market regulations and for the establishment of limited liability firms. This offers an opportunity to investigate whether these changes affected the motives and timing of stock and bond IPOs.

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[1] For the London Stock Exchange, see Chambers (2009), Chambers (2010), and Burhop et al. (2014). In addition, Fjesme et al. (2019, 2021a, b) study the same exchange in an earlier period, from the late nineteenth century. For the early German market, Burhop (2010) finds that at the Berlin Stock Exchange between 1870 and 1896, the average underpricing was below 5% (Fohlin 2010; Lehmann-Hasemeyer and Streb 2016; Lehmann 2014; Burhop and Lehmann-Hasemeyer 2016).

At the start of the period we investigated, Belgium was the second most industrialized country after the U.K. (measured by industrial output per capita) and still ranked third in 1913, directly behind the U.S. and the U.K. (Bairoch 1982). The Brussels Stock Exchange (BSE) grew strongly, and by the end of the period, it belonged to the top ten stock markets in the world (Buelens 2001). Belgium had poor investor protection (Tienrien 1933), and up until the First World War, there were no tax advantages associated with debt financing. We end in 1935 when new regulations (prohibition of multiple voting rights, a forced split-up of universal banks, the introduction of supervision of security issues by a bank commission, and improved prospectus disclosure) significantly impacted IPOs. The number of IPOs dramatically decreased after 1935 and did not pick up again until the 1980s.[2]

We construct a dataset of 922 stock and 387 bond IPOs for 943 domestic firms with their main activities in Belgium. We start to explain the number of stock and bond IPOs separately. We use time-series regression models with macro-economic, market-timing, and institutional explanatory variables for 1839–1935. We also conduct analyses for two sub-periods, 1839–1872 and 1873–1935, before and after the deregulations of 1873. Next, we estimate a 3SLS model based on Zellner and Theil (1962) to allow interactions between stock and bond IPOs. This analysis aims to establish whether debt and equity IPOs are substitutes, complements, or unrelated.

Our analysis explains the time variation in the number of IPOs in a given year, over a long period of time. The purpose is to use aggregate annual data for the entire Belgian financial market and exploit the time-variation to measure how changes in financial and economic conditions affect IPO activity. An important limitation of our study is that we cannot account for the characteristics of individual firms, such as their profitability, size, or bank connections. These firm characteristics are influencing the choices of individual firms to go public or stay private, as has been widely documented (e.g., Pagano et al. 1998).

Our main findings are that stock and bond IPOs are timed to benefit from favorable market conditions and that their proceeds are mainly used to finance future growth. We find that these results are the strongest in the period after 1873, when the Belgian stock market reached a mature level of development. We also find that firms prefer to first issue stock, especially in expansionary phases of the business cycle. We find that easing regulation for the stock market and for the establishment of limited liability firms in 1873 did not immediately affect the number of IPOs. We also do not find evidence that stock and bond IPOs are complements or substitutes.

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[2] In analyses with recent data, stock IPOs have been compared with acquisitions of private firms as alternative funding opportunities for growth (for example, Smith et al. 2011). We have no indication that in our historical setting of the Belgian capital markets acquisitions were a dominant financing tool.

Table 1 Institutional setting per period

	1839–1872	1873–1913	1920–1935
Governmental interference	Coordinated	Liberal	Liberal
Protection investors	Poor	Poor	Poor
Tax advantage for debt	No	No	Minor
Securities market development	Start-up	Emerging	Mature
Leading in financing industries	Banks	Securities market	Securities market
Monetary situation	Stable	Stable	Highly unstable

This table presents the main institutional characteristics per period in Belgium

2 Institutional setting

Before the period that we investigate, some critical changes in the institutional setting paved the way for the rapid modernization of Belgium. The first is abolishing the craft guilds when Belgium was part of the French Republic (1795–1799). These craft guilds were founded in the Middle Ages, and the French government considered the lack of competition caused by these craft guilds the reason that the economic development of France was lagging that of the U.K. (Brouwer Ancher 1895). Another critical institutional change was the founding of the BSE in 1801 (De Clerq 1992). Finally, a significant change occurred when the Treaty of London was signed on April 19, 1839. With this treaty, the Netherlands recognized the independence of Belgium. The period that we study contains well-defined sub-periods described in detail hereafter. Table 1 gives an overview of their characteristics and highlights the importance of Belgium's securities market development and monetary situation.

2.1 Government control (1839–1872)

Belgium was one of the first nations on the European continent to industrialize (Van der Wee and Verbreyt 1999) based on natural resources like coal, ore, water, and wood (Buelens 2001). It was common for industrial firms to grant prolonged credit to their customers (Chlepner 1943). However, banks were dominant in financing industrial activity and two large banks dominated the sector: the Société Générale and the Banque de Belgique (Van Nieuwerburgh et al. 2006). These were mixed banks, which collected deposits and invested in industrial firms. In addition, they were authorized to issue banknotes until 1850 (Chlepner 1943). The financial crisis in the year 1848 demonstrated the risk of a mixed banking system when savers withdrew their deposits. Because these deposits were invested in industrial firms, many banks could not pay out their savers and almost went bankrupt. Banks could only continue with support from the government (Witte et al. 2005). Next to the BSE, there were other exchanges in Belgium, of which the most important one was located in Antwerp. However, the BSE became the primary exchange in Belgium for stocks and bonds. The overall monetary situation in Belgium was stable because of

the Gold Standard. The Belgian Franc (BEF) was a stable currency and there was little or no inflation (Ugolini 2012).

Until 1865, the government had a tight grip on the Belgian economy and the BSE. By law, interest rates were capped at 6% (Buelens 2001). Government approval was also needed to get a listing on the BSE (Annaert et al. 2011). Because of the tight governmental grip, the BSE could not keep up with the dynamics in the real economy. The number of listed firms was small, and the industry distribution of firms on the BSE did not reflect the economy (Annaert et al. 2012). It was also complicated to set up a limited liability firm as government approval was required, which was often refused (Annaert et al. 2012). For example, 25 of the 60 applications for setting up a limited liability corporations in 1838 were rejected (Frère 1951). The many opponents of limited liability in Belgium argued that these corporations would destroy existing businesses, create monopolies and enrich speculators (Chlepner 1930). In 1836, the news that two arms producers in Liège wanted to set up a limited liability corporation led to riots on such a scale that the Belgian army had to intervene and '*the city of Liège became like a place at war for several days*' (Chlepner 1930: p. 34). In 1841, the government published guidelines according to which a limited liability corporation could only be used for enterprises which, due to their capital needs or riskiness, could not be accommodated by firms with unlimited liability, and which would not hurt existing businesses whose usefulness had been certified.

Share prices tended to be very high, which made shares illiquid and limited the accessibility of the BSE for retail investors (Buelens 2001). The average price per share was between 500 and 1,000 BEF while the average salary for a worker was 1.5 BEF per day in the year 1846. In this period, there were no dividend taxes, almost no corporate taxes, and therefore no tax advantages for debt (Deloof and Van Overfelt 2008).[3] Investor protection was weak.[4] While limited liability firms were obliged to make an annual financial statement until 1841, this disclosure was only shared with shareholders at the general shareholders' meeting. To get access to this meeting, an investor needed to own at least five shares of 1,000 BEF, which at the time was a substantial investment (Moortgat et al. 2017). From 1841 onwards, firms were required to deposit the annual financial statement to the local court of commerce, but as there were no rules on the content of this statement, this requirement was not very helpful for investors (Moortgat et al. 2017). The Belgian economy was characterized by a liberalization between 1865 and 1873, as part of an economic movement across Europe. It was considered best that governments abstained from intervening in markets and let market forces work freely. From 1865 onwards, interest rates could be freely determined (Annaert et al. 2011). From 1867 anyone was allowed to conduct a brokerage business or establish a stock market or a bank without the need for governmental approval or supervision (Chlepner 1943).

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[3] Firms paid 2% tax on all revenues to the financiers (Belgian Law of 22 January 1849, Art. 3 and Belgian Law of 5 July 1871, Art. 12, referenced in Deloof and Van Overfelt 2008).

[4] Coyle and Turner (2013) find that in the U.K. investor protection did not influence bond markets in the nineteenth and twentieth century.

2.2 *Liberalization (1873–1913)*

The economic liberalization started in 1865 and was completed with the law of 1873 that freed up the founding of limited liability corporations (Annaert et al. 2011). This liberalization led to an enormous development of banking and financial operations (Chlepner 1943), and by 1913 Belgium had reached a level of financial development that in relative terms was higher than that of the U.S. (Rajan and Zingales 2003). With many new listings on the BSE, the industrial concentration of listed firms decreased. The downside of the liberalization was that investors had little protection against all kinds of abuse, and in the first decades of the liberalization many fraud cases occurred (Théate 1905; Buelens 2001).

Because neighboring countries of Belgium gradually introduced corporate taxes and dividend taxes, Belgium became a European tax haven attracting foreign investors that started to incorporate financing vehicles in Belgium that were listed on the BSE (Annaert et al. 2012). A first minor change in corporate taxation was introduced in 1913, but it took until 1919–1921 for major tax changes to become effectuated.[5]

After the changes in legislation in 1865 and 1873, the stock market became a more important source of financing. Belgian banks played a crucial role in stock market listings. They provided loans, which were reimbursed by the sale of new securities on the stock market, or they invested in shares of young firms that were sold once the firm became profitable, either directly to investors or via an IPO (Van der Valk 1932). Banks typically formed a syndicate with stockbrokers and other financiers, either acting as an intermediary and selling the securities directly to the public or buying the securities themselves and then selling them to the public. The banks and stockbrokers sold securities to their customers with 'unbridled' publicity (Théate 1905), where the Société Générale and the Banque de Bruxelles could use their extended network of local branches. The banks sometimes kept an equity stake in these firms, but the bank's main goal was generally to sell the shares at a profit and make the firm a regular customer of the bank (Chlepner 1943). Many firms were listed immediately after their foundation (Annaert et al. 2012). After the bankruptcy of the Banque de Belgique in 1885, the Société Générale was the only major bank left in Belgium before World War I, with about a dozen medium-sized banks and 50 small banks from which the most important banks owned substantial securities portfolios (Chlepner 1943).

From 1873 onwards, the annual financial statements from limited liability firms were required to be controlled and approved by supervising directors, and the general shareholders meeting became open for all shareholders (Moortgat et al. 2017). Although the financial statements were published in the Official Gazette of the Belgium government (Buelens 2001), this did not improve investor protection much since the control by the supervising director was often very weak (Théate 1905).

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[5] The initial 2 tax on all revenues to the financiers was raised in 1913 to 4 (Buelens 2001).

2.3 Interwar years (1920–1935)

The BSE was closed during World War I. After the war, one-third of the Belgian industry was destroyed and a large part of Belgian's foreign investments was lost in the 1917 Russian revolution. Belgium faced a tremendous loss of purchasing power for its currency, and it had a high governmental debt (Annaert et al. 2011). However, the BSE recovered relatively quickly (Buelens 2001). The BSE saw a wave of IPOs after the war, mainly from family and colonial firms, and the number of listed firms peaked at an all-time high in the 1920s (Buelens 2001). In the 1920s, fiscal legislation changed significantly due to the increasing need for finance of the Belgian government. A progressive corporate tax was introduced from 2 to 10% for profits above 48,000 BEF, and profits made with investments in bonds, stock, and savings were taxed at 10% (Buelens 2001).

In this period, the overall monetary situation in Belgium was unstable. After a suspension of the gold standard during the war, which was needed to allow governments to create deficits to finance war activities, countries began introducing the gold standard again in the 1920s. The Belgian Franc devaluated several times, first in 1926 and later in 1935. The currency stabilized after the devaluation in 1926, which introduced a short period in which exports flourished, and the Belgian industry expanded greatly (Chlepner 1943). The gold standard prevented governments from implementing counter-cyclical policies (Eichengreen 1995) and this became a problem during the depression that began in 1929. On March 31st, 1935 the gold weight of the Franc was again reduced by 28% (Chlepner 1943). However, the currency was linked to gold again and when other European countries left the gold standard in 1936, Belgium remained the only European country with a gold standard-based currency (Chlepner 1945; Van der Wee 2012). With the devaluation of the Franc in 1935, the monetary and banking upheaval that started in 1930 stopped. Capital that had fled the country began to be repatriated (Chlepner 1943). Triggered by the financial crisis of the late 1930s, new legislation was introduced in 1934 and 1935 that tightened regulation for the BSE and banks. This legislation started a period in which the role of the BSE in financing Belgian industries dramatically decreased (Buelens 2001). These measures included a ban on mixed banks, which were forced to split up. It was forbidden for any bank to own stocks or bonds issued by other firms for a more extended period than 6 months, and new group structures were set up in which the commercial banking activities were incorporated in the subsidiary of a holding company, that separately also held the banks' former industrial investments (Chlepner 1943). Remarkably, the split-up of the mixed banks was suggested to the government by Emile Francqui, who was the head of the largest Belgian mixed bank Société Générale de Belgique and as such was the most powerful man in Belgian finance (Chlepner 1943; Vanthemsche 1997). Chlepner argues that Francqui's move was intended to shield the banks' industrial investments from government control over the banks' activities, which by 1935 seemed inevitable. The banks were widely condemned for the economic difficulties in Belgium. Their holdings of illiquid industrial securities were believed to have been a major cause of the banking crisis in 1934–1935, individual bankers were

held responsible for bad investments and excesses on the stock exchange, and the financial support by the government for banks during the banking crisis was seen as a 'gift' to bankers (Chlepner 1943).

3 Determinants of stock and bond IPOs

3.1 Timing

The number of stock IPOs tends to increase in expansionary phases of the business cycle because there are more promising investment opportunities (Lowry 2003). We, therefore, expect that the number of stock IPOs is positively related to GDP growth, a proxy for the business cycle. GDP growth also correlates strongly with the sum of firm revenues, which is a key determinant of IPO activity. However, firms can finance promising investment opportunities by using either equity or debt. We therefore expect that the number of bond IPOs is also positively related to economic growth.

The market timing thesis of Baker and Wurgler (2002) posits that firms time their IPO to coincide with favorable market conditions. This theory assumes that markets are inefficient due to systematic biases from irrational investors and that rational managers use temporary mispricing to time their issues. The market value of equity is high when the profits investors expect are high, which causes stock prices to rise, and the market value of bonds is high when interest rates are low. Higher interest rates are expected to limit bond issues, because of higher financing costs. The empirical implication is that stock issues are expected to be positively related to the valuation of assets quoted on a stock market (Lucas and McDonald 1990; Lerner 1994; Pagano et al. 1998; Banerjee et al. 2013) and to stock market returns (Lucas and McDonald 1990; Pástor and Veronesi 2005; Banerjee et al. 2013). Also, firms avoid issues in periods with high volatility in stock market returns (Choe et al. 1993; Pástor and Veronesi 2005; Banerjee et al. 2013). The effects of bond prices, returns, and volatility also apply to bond issues. An additional empirical implication for bond issues is that a negative relationship is expected with the long-term interest rate (Graham and Harvey 2001).

Another timing variable for investors is the yield curve, the spread between the interest rates on bonds and their different maturities. Its slope is supposed to predict the development of future short-term interest rates (Estrella and Hardouvelis 1991). According to the expectations-theory, the yield curve presents investors' expectations of future interest rates. The current long-term interest rate (minus a liquidity premium) is the average of the successive expected short-term interest rates for the same period (see Omondi 2016). In case the long-term interest rate is higher (lower) than the short-term interest rate, investors expect that the future

short-term interest rate will rise (decline), causing future bond prices to decrease (increase). The implication is that we expect that the number of bond IPOs is negatively related to the yield spread.[6]

Moore (1983) confirms the positive relation between stock issues and profits for a sample of U.S. firms between 1946 and 1970, and the negative association between bond issues and interest rates, but indicates that this has implications for how these issues are related to the business cycle. When profits are expected to rise in an upswing, stock prices increase. At the same time, the interest rates rose, caused by an increasing restriction in the supply of money, which lowered the market value of bonds. The empirical result is that in the U.S. post-war economy, a shift toward stock issues and away from bond issues occurred during a business upswing. An opposite shift occurred during the contraction phase of the business cycle. Choe et al. (1993) finds for a more recent U.S. sample that firms issue relatively more equity than debt during expansionary phases of the business cycle because they are faced with lower adverse selections costs. Therefore, we introduce a nuance in how stock and bond IPOs are related to economic growth and expect that relatively more stock IPOs are issued than bond IPOs during periods of economic growth.

3.2 Institutional change

In this paper, we specifically focus on the role of the government as a regulator in securities markets. The necessity and effectiveness of regulation in securities markets is an ongoing discussion. Some economists state that in a perfectly efficient and well-developed market, regulation is superfluous, because such a market is self-regulating. Others state that some level of regulation is needed to correct market failures to have financial stability (e.g., Peltzman 1976), and a third group argues that the level of regulation and the role of the regulator depends on the stage of the development of the securities market (e.g., Stiglitz 1993). In reality, all securities markets in the Western world have some kind of regulation and according to Stigler (1964) this is "to increase the portion of truth in the world and to prevent or punish fraud".

Regulation of securities markets serves two goals. The first is to protect investors by decreasing the information asymmetry between investors, issuers and underwriters (Cattaneo et al. 2015), allowing investors to make confident and informed investment decisions for which correct and material information is fundamental (Latimer and Maume 2014). The second goal is to eliminate an unfortunate allocation due to a market failure (Peltzman 1976). Hall and Soskice (2001) identify two ideal types of governmental interference. The first ideal type is a liberal market economy. The government takes a *laissez faire* approach and only sets minimal rules and laws to ensure a fair and transparent market in which firms and investors coordinate their activities through markets. The second ideal type is an economy in which the government sets rules and laws and intervenes in coordination activities. In a liberal

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[6] The long-term interest rate and the yield could affect the maturity of a bond. However, we have no data on coupon rates and maturities so we were not able to investigate this.

market economy, firms rely less on long-term banking loans and more on public capital markets. In a coordinated market, based on strong relations with suppliers of finance, bank loans are used more (see also, De Jong et al. 2010).

In our study, the liberalization of the Belgian economy and the easing of regulations for the BSE between 1865 and 1873 are the most important institutional changes. We define the period before 1873 as a coordinated market and the period after 1873 as a liberal market economy and are especially interested in the effect of these quite abrupt changes on the number of IPOs.

4 Data and methodology

The purpose of our analysis is to determine the drivers of the fluctuations in the number of stock and bond IPOs and whether these drivers are affected by institutional changes. For this, we first aim to find the drivers of the initial public stock and bond offerings separately for the full period and for the periods before and after 1873. For this, we use OLS-regression models. Next, we investigate whether stock and bond IPOs are complements, substitutes or unrelated, and because of potential endogeneity issues between stock and bond IPOs we apply 3SLS-regression models for this investigation. In the final step, we measure whether firms issue relatively more equity than debt during expansionary business cycle phases.

The primary source for our data is a database from the Studie Centrum voor Onderneming en Beurs (SCOB) of the University of Antwerp, which holds all archives of the BSE.[7] This database contains data for all stock and bond issues of all listed firms. Firms are categorized into industries and a selection is made between domestic and foreign firms active in Belgium or abroad. In this paper, we focus on domestic firms, mainly active in Belgium. In the period covered in this study many non-Belgian firms were listed on the BSE, especially before World War 1. We chose not to include them in this study because the reasons for their listing in Brussels were often unrelated to underlying economic conditions, such as the comparative tax advantage of being listed in Belgium rather than in their home country. We have data on the number of IPOs for the full period. In World War I, the BSE was closed, and no new issues were placed. For the 1883–1935 period, we also observe the volume of money raised with equity IPOs.[8] All variables and sources are included in Table 2.

GDP is calculated based on the value added at current market prices in million BEF. GDP growth (*GDP Growth*) is the yearly increase in GDP. The yearly stock market level (*Stock Index*) is calculated with the monthly total returns, where the level for the 31st of December 1835 is set to 100. We correct the stock market level for inflation (Lerner 1994). The stock market return (*Stock Returns*) is the annual percentage change of the market index, before inflation correction. The stock market

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[7] See http://www.scob.be.

[8] We have no volume data for bond IPOs and only data for the period 1883–1935 for stock IPOs.

Table 2 Variables and sources

Variable	Abbreviation	Source
Number of stock initial public offerings from non-financial domestic firms	Stock IPOs	SCOB database
Number of stock initial public offerings, including financials	Stock IPOs Fin	SCOB database
Volume of initial public stock offerings, corrected for inflation (in Belgian Francs, 1883 values)	Stock IPOs Vol	SCOB database
Number of bond initial public offerings from non-financial domestic firms	Bond IPOs	SCOB database
Number of bond initial public offerings, including financials	Bond IPOs Fin	SCOB database
Annual inflation rate	Inflation	SCOB database
Number of equity securities quoted at the BSE per million of inhabitants of Belgium	Stock Securities	SCOB database
Number of bond securities quoted at the BSE per million of inhabitants of Belgium	Bond Securities	SCOB database
Number of inhabitants of Belgium	Population	Goossens (1993)
Growth in gross domestic product	GDP Growth	Historical National Accounts Database
Level of BSE stock market index based on total returns, where the level for the 31st of December 1835 is set to 100, corrected for inflation	Stock Index	SCOB database
Annual return in the level of BSE stock market index based on total returns, before correction of inflation	Stock Returns	SCOB database
Three-year volatility in annual returns of BSE stock market index based on total returns	Stock Volatility	SCOB database
Level of BSE bond market index based on total returns, where the level for the 31st of December 1837 is set to 100, corrected for inflation	Bond Index	SCOB database
Annual return in the level of BSE bond market index based on total returns, before corrected for inflation	Bond Returns	SCOB database
Three-year volatility in annual returns of BSE bond market index based on total returns	Bond Volatility	SCOB database
Annual yield-to-maturity for Belgian perpetual government bond	Interest	SCOB database
Spread between long and short interest rates	Yield	SCOB database, Price lists, Newspapers, and National bank Belgium
Number of newly founded firms in Belgium	Foundation	Frère (1951), Kruispuntbank van Ondernemingen
Number of newly founded firms in Belgium, financial firms included	Foundation Fin	Frère (1951), Kruispuntbank van Ondernemingen
Total amount of savings at Belgium banks	Deposits	Mitchell (2007)

This table presents variables, abbreviations and sources

volatility (*Stock Volatility*) is calculated as the variance in stock market return, using three years of data.[9] Both stock market return and volatility are proxies for changes in market conditions (Pástor and Veronesi 2005) and for this reason not corrected for inflation. The yearly bond market level (*Bond Index*) is calculated based on total returns, where the level for the 31st of December 1837 is set to 100. Like for stock we correct this level for inflation. The bond market return (*Bond Returns*) is the annual percentage change of the market index, before inflation correction, and the bond market volatility (*Bond Volatility*) is calculated as the variance in stock market return, using three years.

The long-term interest rate (*Interest*) is calculated as the annual yield of a perpetual government bond which was listed on the BSE from 1831 until 2013. The yield (*Yield*) is calculated as the spread between the long-term and short-term interest rate, where the short-term interest rate is calculated based on the commercial paper rate (1833–1940). The commercial paper rate for 1832–1918 is taken from the official quotation lists of the Antwerp Stock Exchange (published on a daily basis until 1883) as well as from the newspapers Journal du Commerce d'Anvers, L'Avenir, Moniteur des Intérêts Matériels and Het Handelsblad. For the period 1920–1935, we take data from the commercial paper rate from the National Bank of Belgium.[10] The data for the number of listed securities comes from the SCOB-database, and the data for the population comes from Goossens (1993).

Stock and bond market development may affect the allocation of financial resources and typically change incrementally. Since firms have several means to obtain finance, more firms are assumed to issue stock or bonds when equity or bond markets become more important in a country's capital market. The development of markets can be measured in several ways (see for an overview Van Nieuwerburgh et al. 2006). Rajan and Zingales (2003) measure stock market development by the ratio of the number of domestic firms whose equity is publicly traded in a domestic stock exchange to a country's population in millions. Our measures (*Stock Securities* and *Bond Securities*) are closely related to this. Instead of listed firms we use the number of listed securities, i.e., stocks or bonds. We expect that the number of stock (bond) IPOs is positively related to the ratio of the number of listed stocks (bonds) of Belgian domestic firms relative to the population of Belgium in millions of inhabitants.

To control for multicollinearity and autocorrelation, we measure correlations between our variables for the first 16 lags. Although variables with a high first-order autocorrelation are best suited to predict future values, these variables also make linear regression models less suitable. As expected, our variables that represent absolute levels have a high first-order autocorrelation and the variables that represent

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[9] Pástor and Versonesi (2005) defines market volatility as the monthly standard deviation of daily market returns within the month of the IPO and Choe et al. (1993) defines market volatility as the daily market return variance measured over the 60 trading days prior to the beginning of the month of the stock offering.

[10] Sources are: (1) National Bank of Belgium, 1929. Statistiques Economiques Belges 1919–1928. Bulletin d'Information et de Documentation. April, 1–85; and (2) National Bank of Belgium, 1950. De Nationale Bank van België 1850–1950. Tijdschrift voor Documentatie en Voorlichting. 25 (3), 63–178.

growth or decline rates do not. The IPO time series also have high first-order auto-correlations, and we therefore use Newey–West estimators (Newey and West 1987). When time series are non-stationary, there is a heightened risk of spurious regressions, and the regression estimators are likely to be adversely affected (Dougherty 2007). To overcome this problem, some papers detrend their time series. However, we see no need for detrending.[11] In addition, we performed Dickey-Fuller Generalized Least Squares tests (Elliot, Rothenberg and Stock 1996) to verify stationarity. The results show that the null hypothesis of a unit root in the time series of the natural log of one plus the number of stock IPOs is rejected for lags 1–3 at the 1% level and for the natural log of one plus the number of bond IPOs at a 10% level. Since the IPO process is time consuming, we assume that a firm's decision to go public is based on information available in the year prior to the listing.[12] We use the following model, or variations, for our regressions:

$$
\begin{aligned}
Ln\,(1 + Stock\,IPOs_t) = {} & Constant + \beta_1 GDP\,Growth_{t-1} + \beta_2 Ln(Stock\,Index_{t-1}) \\
& + \beta_3 Stock\,Returns_{t-1} + \beta_4 Stock\,Volatility_{t-1} + \beta_5 Interest\,Rate_{t-1} + \beta_6 Yield_{t-1} \\
& + \beta_7 Stock\,Securities_{t-1} + \beta_8 Post\,1873_t + \beta_9 Post\,1920_t + \varepsilon_t
\end{aligned}
$$

The dependent variable is the natural log of one plus $Stock\,IPOs_t$, i.e., the number of equity IPOs in year t. This variable is regressed on the growth of GDP ($GDP\,Growth_{t-1}$), the natural log of the stock or bond market level ($Stock\,Index_{t-1}$), stock or bond market return ($Stock\,Returns_{t-1}$), volatility in stock or bond market return ($Stock\,Volatility_{t-1}$), the long-term interest rate ($Interest\,Rate_{t-1}$), the spread between the long- and short-term interest rate ($Yield_{t-1}$) and the total number of publicly traded domestic equity or bond securities per million of inhabitants ($Stock\,Securities_{t-1}$). Finally, we include two dummy variables, one for the institutional change that was completed in 1873 ($Post\,1873_t$) and one that marks the start of a period with a highly unstable monetary situation ($Post\,1920_t$). Both dummy variables have the value of one in the mentioned year and onwards. We conduct our analysis for the entire period, but also for sub-periods to capture the influence of changes in the institutional setting. For bond IPOs we use a similar model.

We perform an additional analysis with this model for 1883–1935 using stock IPO proceeds as the dependent variable and compare the results with those from the number of stock IPOs.

For the three-stage-least-square (3SLS) regression (Zellner and Theil 1962), we first regress both dependent variables, stock and bond IPOs, to their specific independent variables based on the earlier mentioned model and then to each other.

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[11] Lowry (2003) and Pástor and Veronesi (2005) detrend their time series of IPOs by deflating the number of IPOs in a certain period by the number of publicly listed firms at the end of the previous period. Since we add a similar variable to our regression (the number of listed securities per million of inhabitants) we see no need for additional detrending.

[12] Today the IPO-process takes approximately twelve months (source: Public Listing on NYSE EuroNext, 2012).

5 Results

5.1 Descriptive statistics

From 1839 to 1935, 943 Belgian domestic non-financial firms issued 922 stock and 387 bond IPOs. From these firms, 556 firms only issued a stock IPO, 21 firms only issued a bond IPO and 366 firms issued both types during our investigation period. From the firms that issued both types, 197 firms issued first a stock IPO, 19 firms issued first a bond IPO and 150 firms issued both types simultaneously, i.e., within the same month. Figure 1 presents the time series of stock and bond IPOs and the 3-year moving average of the number of securities (stock plus bonds) per million of inhabitants. The descriptive statistics of the raw data are in Table 3.

The descriptive statistics in Panel A of Table 3 show an average of 9.51 firms per year seeking a quotation at the BSE with a stock IPO and 3.99 with a bond IPO. The average inflation rate is 3.1%, GDP growth is 4.4% and the long-term interest rate 4.1%. We observe in Fig. 1 that the 1873 changes are followed by a higher number of IPOs. Moreover, in periods with many stock IPOs we also observe more bond IPOs: the correlation between the two series is as high as 0.63. Panel B shows that the average number of IPOs in the period 1873–1935 is indeed much higher, both for stock and bonds, than in the period 1839–1872.

In Panel C we provide the distribution of the IPOs over sectors. In the first period until 1872 we find that the transportation sector is relatively large and bonds are the most importance source of funding in this sector. In 1873–1914 the number of IPOs is much larger and we do not observe strong sector patterns. Finally, after 1919 the industrial firms (not in iron and steel) become dominant and typically attract stock financing.

5.2 Determinants of initial stock offerings

We start with a regression analysis for stock IPOs. The results of the regression are presented in Table 4. The fit of the model is good, with the R-squared between 52 and 68%.

In the full period 1839–1935 we find that the log-scaled number of stock IPOs is positively influenced by the growth in GDP. The coefficient of 2.98 in column (1), significant at the 1% level, implies that in case the GDP growth changes from 0 to 1%, the log number of IPOs will increase by approximately 3%. We also find that the stock exchange index and stock returns have a positive and significant effect on the number of IPOs. These results imply that there were more IPOs in periods of economic growth and when the stock market performed well. Interestingly, while the 1873 dummy has a positive coefficient, this coefficient is not statistically significant. This suggests that the liberalization of 1873, which abolished the requirement of government permission to set up a limited liability firm, did not directly affect the number of IPOs. However, the 1873 reforms may have *indirectly* affected IPOs
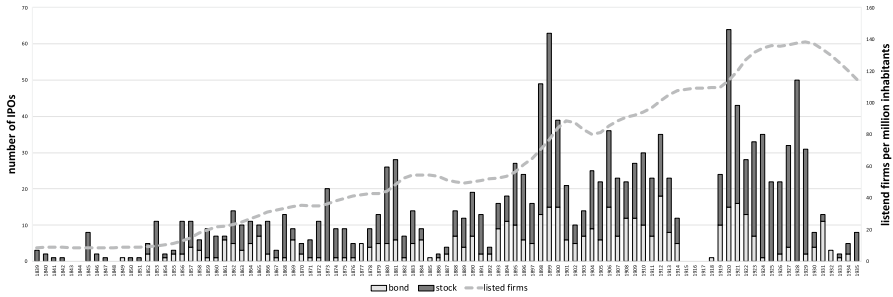
Fig. 1 Development of initial public offerings, 1839–1935. This figure presents the number of bond and stock initial public offerings from 1839 until 1935. The gray (black) bars are the number of bond (stock) offerings (left axis) and the dashed line is the 3-year moving average of the number of securities (stock plus bonds) per million inhabitants (right axis). Source: SCOB database

by stimulating economic development and facilitating future growth.[13] While GDP growth is not significantly related to the number of stock IPOs before 1873 (column (4)), it is strongly and positively related to the number of IPOs after 1873 (column (5)). The differences in the results between the two periods support Van Nieuwerburgh et al.'s (2006) finding that there was a stronger link between the BSE and the Belgian economy after 1873. We also find that the level of development of the BSE is significantly and negatively related to the number of IPOs before and after 1873, which indicates that more new equities are listed when the market is smaller relative to the number of inhabitants.

The dummy variable *Post 1920_t* that marks the beginning of the 'Roaring Twenties' is significant in every model. There are two explanations for this. First, the hunt for "real value" (Chlepner 1943) due to the depreciation of the BEF in the year 1919, triggered IPOs. Increasing wages, both in real and monetary terms, brought a new class of investors to the BSE and high inflation led to a shift from fixed income investments to stocks. Both banks and retail investors invested heavily in industrial securities and because of this the BSE was during the 1920s almost always in a state of excitement, usually bullish (Chlepner 1943). Second, the First World War casted its shadow in the media years before its outbreak in 1914. Coverage of an impending increase in war in the newspapers leads to the postponement of IPOs to mitigate war risks (Verdickt 2020).[14] As a result, the variable *Post 1920_t* marks the end a period with few to no IPOs since the early 1910s and the start of a period with many IPOs.

Our tests rely on the number of IPOs, but the size of IPO issues may vary over time. We have information about the issue size for equities for the period 1883–1935.

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[13] In this respect, it is also interesting to note that after the 1873 liberalizations, the number of limited liability companies set up each year in Belgium strongly increases (Frère 1951), and the correlation between IPOs and new limited liability companies becomes stronger. The correlation increases from 0.56 for the 1839–1872 period to 0.66 for the 1874–1914 period (own calculations with the number of new limited liability companies in each year based on Frère 1951).

[14] The reduction in stock IPOs, caused by this postponement, is larger than for bond IPOs.

Table 3 (a) Descriptive statistics, (b, c) data descriptives

	Average	SD	Number of observations	25th percentile	50th percentile	75th percentile
(a) Panel A: Full sample						
Stock IPOs	9.51	10.21	97	2	6	15
Stock IPOs Fin	10.51	11.48	97	2	6	16
Stock IPOs Vol (mln)	63.9	90.5	46	16.9	40.8	77.9
Bond IPOs	3.99	4.10	97	1	3	6
Bond IPOs Fin	4.15	4.24	97	1	3	7
GDP Growth	0.044	0.131	97	− 0.020	0.021	0.058
Stock Index	1076.712	894.900	97	328.329	681.938	1696.765
Stock Returns	0.063	0.168	97	− 0.009	0.034	0.128
Stock Volatility	0.021	0.038	97	0.002	0.005	0.218
Stock Securities	45.111	30.325	97	19.627	36.325	71.814
Bond Index	719.734	564.530	97	245.618	534.927	1077.854
Bond Returns	0.046	0.050	97	0.025	0.042	0.062
Bond Volatility	0.0024	0.0056	95	0.0001	0.0004	0.0022
Bond Securities	17.563	12.593	97	7.176	16.259	28.153
Interest Rate	0.041	0.009	97	0.033	0.041	0.047
Yield	− 0.004	0.011	97	− 0.010	− 0.004	0.001
Foundation	119.632	136.046	76	10	47	180
Foundation Fin	343.868	545.437	97	14	108	360
Deposits	2260.356	1329.771	61	1043.208	2199.53	3112.981
Inflation	0.031	0.154	97	− 0.041	0.010	0.061
Population	6,019,080	1,325,484	97	4,738,321	5,904,527	7,407,391

	1839–1872		1873–1935	
	Average	SD	Average	SD
(b) Panel B: Sub-periods				
Stock IPOs	3.059	2.881	12.984	11.048
Stock IPOs Fin	3.471	3.662	14.302	12.452
Stock IPOs Vol (mln)	–	–	63.9	90.5
Bond IPOs	1.529	1.846	5.317	4.369
Bond IPOs Fin	1.559	1.894	5.556	4.500
GDP Growth	0.036	0.066	0.049	0.156
Stock Index	246.747	119.662	1524.63	806.710
Stock Returns	0.055	0.132	0.068	0.186
Stock Volatility	0.016	0.031	0.024	0.042

Table 3 (continued)

	1839–1872		1873–1935	
	Average	SD	Average	SD
Stock Securities	14.676	6.163	61.537	24.931
Bond Index	196.067	84.676	1002.349	508.039
Bond Returns	0.046	0.050	0.046	0.051
Bond Volatility	0.003	0.004	0.002	0.006
Bond Securities	3.903	4.543	24.935	8.777
Interest Rate	0.046	0.004	0.038	0.010
Yield	− 0.004	0.0089	− 0.0065	0.0110
Foundation	9.059	4.572	192.857	135.494
Foundation Fin	10.676	5.068	523.686	605.720
Deposits	–	–	2260.356	1329.771
Inflation	0.012	0.0965	0.042	0.177
Population	4,554,096	293,399.5	6,809,707	928,679.8

	1839–1935	1839–1872	1873–1914	1919–1935
(c) Panel C: Sectors				
All IPOs				
Agriculture and Food	44 (5%)	0 (0%)	26 (5%)	18 (6%)
Mining and Extraction	161 (17%)	29 (25%)	112 (22%)	20 (6%)
Iron, Steel and other Metals	194 (21%)	17 (15%)	119 (24%)	58 (18%)
Other Industrials	303 (32%)	12 (10%)	122 (24%)	169 (52%)
Transportation	100 (11%)	52 (45%)	42 (8%)	6 (2%)
Utilities	58 (6%)	3 (3%)	40 (8%)	15 (5%)
Trade, Services and Other	83 (9%)	3 (3%)	41 (8%)	39 (12%)
All sectors	943 (100%)	116 (100%)	502 (100%)	325 (100%)
Only stock IPOs				
Agriculture and Food	34 (6%)	0 (0%)	19 (8%)	15 (6%)
Mining and Extraction	100 (18%)	21 (40%)	67 (28%)	12 (4%)
Iron, Steel and other Metals	98 (18%)	9 (17%)	43 (18%)	46 (17%)
Other Industrials	217 (39%)	9 (17%)	61 (26%)	147 (55%)
Transportation	25 (4%)	11 (21%)	11 (5%)	3 (1%)
Utilities	22 (4%)	1 (2%)	10 (4%)	11 (4%)
Trade, Services and Other	60 (11%)	1 (2%)	25 (11%)	34 (13%)
All sectors	556 (100%)	52 (100%)	236 (100%)	268 (100%)
Only bond IPOs				
Agriculture and Food	2 (10%)	0 (0%)	2 (25%)	0 (0%)
Mining and Extraction	2 (10%)	0 (0%)	1 (13%)	1 (33%)
Iron, Steel and other Metals	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Other Industrials	2 (10%)	0 (0%)	1 (13%)	1 (33%)
Transportation	12 (57%)	9 (90%)	3 (38%)	0 (0%)
Utilities	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Trade, Services and Other	3 (14%)	1 (10%)	1 (13%)	1 (33%)

Table 3 (continued)

	1839–1935	1839–1872	1873–1914	1919–1935
All sectors	21 (100%)	10 (100%)	8 (100%)	3 (100%)
Stock and bond IPOs				
Agriculture and Food	8 (2%)	0 (0%)	5 (2%)	3 (6%)
Mining and Extraction	59 (16%)	8 (15%)	44 (17%)	7 (13%)
Iron, Steel and other Metals	96 (26%)	8 (15%)	76 (29%)	12 (22%)
Other Industrials	84 (23%)	3 (6%)	60 (23%)	21 (39%)
Transportation	63 (17%)	32 (59%)	28 (11%)	3 (6%)
Utilities	36 (10%)	2 (4%)	30 (12%)	4 (7%)
Trade, Services and Other	20 (5%)	1 (2%)	15 (6%)	4 (7%)
All sectors	366 (100%)	54 (100%)	258 (100%)	54 (100%)

This table presents the descriptive statistics of the raw data for the full period (Panel A) and for 1839–1872 compared to 1873–1935 (Panel B). For each variable we present average, standard deviation and the 25th, 50th and 75th percentiles of the annual values in Panel A and average and standard deviation in Panel B. Panel C provide the distribution over time (three periods) and sector (seven sectors). All variables are defined in Table 2

Table 4 Determinants of initial public stock offerings

	(1)	(2)	(3)	(4) 1839–1872	(5) 1873–1935
GDP Growth	2.984***	3.182***	3.202***	0.207	3.342***
	(0.000)	(0.000)	(0.000)	(0.858)	(0.000)
Ln(Stock Index)	1.458***	1.484***	1.494***	3.246***	1.527***
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)
Stock Returns	1.226***	0.887**	1.010**	− 0.261	1.156***
	(0.001)	(0.030)	(0.015)	(0.795)	(0.003)
Stock Volatility	0.019	− 1.376			
	(0.996)	(0.549)			
Interest Rate	27.617	3.294			
	(0.173)	(0.895)			
Yield	− 0.712	− 9.173			
	(0.906)	(0.341)			
Post 1873		1.679	0.220		
		(0.650)	(0.481)		
Post 1920		1.742**	1.583***		1.563***
		(0.014)	(0.003)		(0.004)
Stock Securities	− 0.032***	− 0.050***	− 0.049***	− 0.189**	− 0.050***
	(0.000)	(0.000)	(0.000)	(0.018)	(0.000)
Constant	− 7.582***	− 6.362***	− 6.303**	− 13.551***	− 6.313***
	(0.000)	(0.001)	(0.000)	(0.002)	(0.000)
Observations	97	97	97	34	63
R^2	0.603	0.676	0.670	0.519	0.604

This table presents OLS regressions explaining the log value of one plus the number of stock initial offerings, with Newey–West-corrected $P > |t|$ values (in parentheses) and significance levels denoted with ***for 1%, **for 5% and *for 10%. All results are for 1839–1935, unless indicated. The explanatory variables are 1-year lagged. All variables are defined in Table 2

We thus conduct a test by replacing the number of equity IPOs by the natural log of the total volume in BEF, corrected for inflation. Because there is one extreme observation in 1928—the firm Union Chimique Belge – that represents 15% of the total volume, we report results with and without this issue in Table 5.

Again, we find in Table 5 that GDP growth and the stock market index and returns are main determinants. To allow a better comparison with the results for the number of IPOs we tested these models also for the 1883–1935 window. These results are also presented in Table 5. GDP growth, stock market level and returns and the post 1920 dummy are here significant at 1% level. Remarkably, although the number of IPOs increases significantly after 1920, the volume does not. In addition, the number of equity securities is statistically significant negatively related to the number of IPOs (at the 1% level), this is not the case for the volume.

5.3 Determinants of initial bond offerings

The results for bond IPOs are presented in Table 6. Again, the fit of the model is good, with the R-squared between 38 and 53%, but is less compared to stock IPOs.

A higher GDP growth has a significant positive impact on bond IPOs, indicating that there are more bond IPOs in expansionary phases of the economy. Also, bond IPOs seem to be timed. In times when the valuation of bonds is high and the volatility in the bond returns is low. As expected, a higher interest rate has a significant negative impact on bond IPOs over the full period, but only if the bond market variables are left out. This is because the correlation between the natural log of the bond market index and the long-term interest rate is high and negative. When the interest rate is high the valuation of bonds is low. In model (3) we include both the bond index and interest rate and conclude that the bond index effect dominates the interest rate effect.

When we distinguish between the subperiods 1839–1872 and 1873–1935 in columns (5) and (6), we find that GDP Growth is only significantly related to bond IPOs in the period after 1873. This is an indication that, as for stock, there was also a stronger link between the BSE and the Belgian economy after 1873 for bonds.

5.4 Interdependence of stock and bond IPOs

So far, we have regressed stock and bond IPOs separately. Of course, these two financing instruments may interact, either by being complements (positive relation) or as substitutes (negative relation). We have seen already that the correlation is large and positive.[15] However, this may be caused by factors that determine both stock and bond IPOs, and we thus have to control for these determinants in a 3SLS model. The outcome of our 3SLS-regression is presented in Table 7 (full period) and Table 8 (sub-periods).

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[15] Period 1839–1935: 0.6305, Period 1839–1872: 0.5069 an Period 1873–1935: 0.5302.

Table 5 Determinants of volume of initial public stock offerings (1883–1935)

	(1) Ln(Stock IPOs Vol)	(2) Ln(Stock IPOs Vol) (without outlier)	(3) Ln(1 + Stock IPOs)
GDP Growth	2.730**	2.726**	3.675***
	(0.016)	(0.016)	(0.000)
Ln(Stock Index)	1.580***	1.564***	1.759***
	(0.007)	(0.008)	(0.000)
Stock Returns	1.765**	1.592*	1.019***
	(0.043)	(0.066)	(0.003)
Stock Volatility	− 3.122	− 3.400	− 2.746
	(0.444)	(0.405)	(0.160)
Post 1920	0.899	0.895	1.720***
	(0.223)	(0.225)	(0.001)
Stock Securities	− 0.017	− 0.017	− 0.050***
	(0.361)	(0.364)	(0.000)
Constant	− 7.448**	− 7.327**	− 8.005***
	(0.028)	(0.031)	(0.000)
Observations	46	46	53
R^2	0.565	0.546	0.647

This table presents OLS regressions explaining the volume of initial offerings (1), the volume of initial offerings without an outlier (2) and the log value of one plus the number of initial offerings (3) in the period 1883–1935, with Newey–West-corrected $P > |t|$ values (in parentheses) and significance levels denoted with ***for 1%, **for 5% and *for 10%. The explanatory variables are 1-year lagged. All variables are defined in Table 1

With these models the R-squared for stock increase to 74% while the best model for bonds has an R-squared of 43%. The results confirm the earlier main findings for the determinants of stock and bond IPOs. There are more IPOs in expansionary phase of the business cycle (especially after 1873) and IPOs are timed to coincide with favorable market conditions. The results also show that the number of stock and bond IPOs are not significantly related. In other words, these two financing instruments are not interdependent although the correlation between the natural logs of the number of stock and bond IPOs is relatively high. This is also the case for the two sub-periods as presented in Table 8.

5.5 IPOs and the business cycle

Finally, we investigate in more detail how stock and bond IPOs are related to the business cycle. To be more precise, we investigate whether firms issue relatively more equity than debt during years with positive versus negative economic growth. We present our results in Table 9, which shows the proportion of stock IPOs in the total number of IPOs.

Over the full period, 70.4% of the IPOs is a stock IPO, and thus 29.6% are bond IPOs. The relative number of stock IPOs does not differ much between the early period (66.7% stock) and the later period from 1873 onwards (70.9% stock).

Table 6 Determinants of initial public bond offerings

	(1)	(2)	(3)	(4)	(5) 1839–1872	(6) 1873–1935
GDP Growth	2.482*** (0.001)	1.222* (0.085)	2.117*** (0.002)	2.255*** (0.001)	0.334 (0.811)	2.192*** (0.005)
Ln(Bond Index)	1.282*** (0.000)		0.841** (0.024)	0.925*** (0.006)	2.377*** (0.000)	0.655 (0.116)
Bond Return	0.665 (0.718)		0.285 (0.873)			
Bond Volatility	− 28.453** (0.035)		− 35.381** (0.018)	− 29.274*** (0.005)	− 34.737* (0.058)	− 23.242* (0.063)
Interest Rate		− 73.274*** (0.001)	− 33.561 (0.236)	− 30.038 (0.219)	− 8.896 (0.764)	− 47.726* (0.058)
Yield		− 9.697 0.328)	− 11.195 (0.305)			
Post 1873	− 0.574 (0.107)	− 0.525 (0.265)	− 0.725 (0.128)	− 0.647 (0.115)		
Post 1920	1.245* (0.053)	0.803 (0.349)	1.524** (0.048)	1.349* (0.059)		1.270 (0.110)
Bond Securities	− 0.049* (0070)	0.023 (0.291)	− 0.028 (0.302)	− 0.0312 (0.254)	− 0.145*** (0.007)	− 0.017 (0.630)
Constant	− 5.761*** (0.000)	3.951*** (0.000)	− 1.954 (0.508)	− 2.553 (0.311)	− 10.566*** (0.000)	− 1.039 (0.720)
Observations	94	97	94	94	31	63
R^2	0.472	0.432	0.495	0.483	0.531	0.375

This table presents OLS regressions explaining the log value of one plus the number of initial bond offerings, with Newey–West-corrected $P>|t|$ values (in parentheses) and significance levels denoted with ***for 1%, **for 5% and *for 10%. All results are for 1839–1935, unless indicated. The explanatory variables are 1-year lagged. All variables are defined in Table 2

However, in the eight contraction years in the period 1839–1872, firms issued much more equity (78.6%), compared to 64.1% in the expansion years. Clearly, in the early period, equity was relatively more attractive for firms in the years with economic decline. This effect reverts in the second period, after the deregulations. Now, in the 25 contraction years the fraction of equity issues is only 60.1%, compared to 73.8% in the expansion years. This implies that after 1873 stock issues have become less attractive in years of economic decline, compared to bond issues.

5.6 Robustness analyses

We conduct a number of additional analyses to check the robustness of our findings, which are presented in Tables 10, 11, 12 and 13.

Because the IPO-process is time consuming we so far have assumed that a firm's decision to go public is based on information that is available in the year prior to the year of the listing. A firm's sense of value could be based more on its internal

Table 7 3SLS for determinants of initial public stock and bond offerings

	(1)		(2)	
	Ln(1 + Stock IPOs)	Ln(1 + Bond IPOs)	Ln(1 + Stock IPOs)	Ln(1 + Bond IPOs)
Ln(1 + Stock IPOs)		− 1.143		− 0.111
		(0.372)		(0.451)
Ln(1 + Bond IPOs)	0.249		0.140	
	(0.371)		(0.485)	
GDP Growth	2.558***	2.763***	2.804***	2.781***
	(0.001)	(0.002)	(0.000)	(0.001)
Ln(Stock Index)	1.298***		1.319***	
	(0.000)		(0.000)	
Stock Returns	1.378**		1.351***	
	(0.012)		(0.004)	
Stock Volatility	− 1.563			
	(0.389)			
Ln(Bond Index)		1.136***		1.148***
		(0.004)		(0.002)
Bond Return		0.683		
		(0.653)		
Bond Volatility		− 30.279*		− 20.754
		(0.051)		(0.116)
Interest Rate	15.641	− 27.514		− 29.038
	(0.446)	(0.197)		(0.130)
Yield	− 6.762	− 13.145		
	(0.376)	(0.125)		
Post 1873	0.267	− 0.746**	0.222	− 0.650**
	(0.323)	(0.019)	(0.336)	(0.035)
Post 1920	1.441***	1.816***	1.485***	1.607***
	(0.003)	(0.001)	(0.000)	(0.000)
Stock Securities	− 0.045***		− 0.044***	
	(0.000)		(0.000)	
Bond Securities		− 0.0445*		− 0.045**
		(0.065)		(0.050)
Constant	− 6.204***	− 3.588	− 5.552***	− 3.611
	(0.0000	(0.179)	(0.000)	(0.145)
Observations	94	94	94	94
R^2	0.738	0.412	0.704	0.416
Chi^2	238.80	84.87	208.49	85.16
P value	0.0000	0.0000	0.0000	0.0000

This table presents 3SLS regressions explaining the log value of one plus the number of initial offerings, with $P > |t|$ values (in parentheses) and significance levels denoted with ***for 1%, **for 5% and *for 10%. All results are for 1839–1935. The explanatory variables are 1-year lagged. All variables are defined in Table 2

Table 8 Sub-period 3SLS for determinants of initial public stock and bond offerings

	(1) 1839–1872		(2) 1873–1935	
	Ln(1 + Stock IPOs)	Ln(1 + Bond IPOs)	Ln(1 + Stock IPOs)	Ln(1 + Bond IPOs)
Ln(1 + Stock IPOs)		− 0.234 (0.498)		− 0.037 (0.820)
Ln(1 + Bond IPOs)	− 0.211 (0.539)		0.224 (0.225)	
GDP Growth	− 0.045 (0.980)	0.952 (0.568)	2.745*** (0.000)	2.385** (0.012)
Ln(Stock Index)	3.521*** (0.001)		1.290*** (0.000)	
Stock Returns	0.094 (0.926)		1.544*** (0.002)	
Ln(Bond Index)		2.881*** (0.000)		0.724 (0.105)
Bond Volatility		− 33.055 (0.439)		− 16.755 (0.286)
Interest Rate		− 28.271 (0.637)		− 50.331** (0.036)
Post 1920			1.468*** (0.000)	1.411*** (0.004)
Stock Securities	− 0.198*** (0.007)		− 0.043*** (0.000)	
Bond Securities		− 0.182*** (0.006)		− 0.024 (0.394)
Constant	− 14.758*** (0.001)	− 11.903** (0.025)	− 5.321*** (0.000)	− 1.210 (0.696)
Observations	31	31	63	63
R^2	0.422	0.426	0.702	0.345
Chi^2	32.73	32.03	133.53	41.39
P value	0.0000	0.0000	0.0000	0.0000

This table presents 3SLS regressions explaining the log value of one plus the number of initial offerings, with $P > |t|$ values (in parentheses) and significance levels denoted with ***for 1%, **for 5% and *for 10%. The explanatory variables are 1-year lagged. All variables are defined in Table 2

Table 9 Economic growth and fraction of stock IPOs in total IPOs

Period	Expansion years	Contraction years	All years
1839–1935	72.6% (64)	62.0% (33)	70.4% (97)
1839–1872	64.1% (26)	78.6% (8)	66.7% (34)
1873–1935	73.8% (38)	60.1% (25)	70.9% (63)

This table presents the percentage of IPOs that are stock IPOs during years in which the economy expanded (positive GDP growth) or contracted (negative GDP growth) and overall. The number of years is mentioned in parentheses

perspective than on information from public markets (Ritter and Welch 2002). This means that sudden changes in the value of listed firms are not immediately absorbed and that firms therefore adjust their capital structure with a delay. As a robustness test, we therefore take the 3-year moving average of the values of the explanatory variables for the 2 years before the IPO and the year of the IPO. The results, which are reported in Table 10, confirm our main findings.

IPOs of domestic financial firms are excluded from our dataset because of intrinsic differences in the nature of their operations and accounting information with non-financial firms (see Pagano et al. 1998). However, in the SCOB data we also have a set of financial firms headquartered in Belgium. We find 97 additional stock IPOs, 16 bond IPOs from 99 different firms. We perform robustness tests by including these firms and again find our results to be robust. These results are presented in Table 11.

In addition to the aforementioned abrupt and drastic change in the institutional setting in 1873, the number of IPOs may also be affected by incremental changes that are not detected by our dummy variables. That is why we conduct additional robustness analysis that control for the number of newly founded firms and for the development of the banking sector. The more firms are founded, the more IPOs are to be expected. To control for the number of foundations we perform a robustness check in which we add the variable *Foundations*. The results are presented in Table 12. We only have data for the number of foundations of non-financial domestic firms until 1914, see columns (1), but a complete time series including financials, see column (20). The results again support our earlier main findings.

Bank loans are alternatives for public bonds. We therefore perform a final robustness check in which we add a variable to control for the importance of banking sector: *Deposits*. The data for deposits are available from 1876 onwards. The results are presented in Table 13. The results also support our main findings and show that the number of bond IPOs is not related to the importance of the banking sector.

6 Conclusion

New listings are important for investors, firms, and for a country's economic development. For investors who want to hold a diversified portfolio, it is important that new firms find their way to the securities market. For young, risky and innovative firms with a limited track record, it is often difficult to obtain sufficient bank finance or to finance their growth with retained earnings. Securities markets provide them with access to finance and in that way facilitate and drive economic growth (Van Nieuwerburgh et al. 2006).

We investigate the timing of stock and bond IPOs. We do this for a period with an institutional environment that is very different from today and was characterized by dramatic economic and regulatory changes. In addition, we examine whether stock and bond IPOs are complements or substitutes. Our findings for a setting in which the securities market is well developed, support the results from modern-day studies.

Table 10 3SLS for determinants of initial public stock and bond offerings, with 3-year averages

	(1) 1839–1935		(2) 1839–1872		(3) 1873–1935	
	Ln(1+Stock IPOs)	Ln(1+Bond IPOs)	Ln(1+Stock IPOs)	Ln(1+Bond IPOs)	Ln(1+Stock IPOs)	Ln(1+Bond IPOs)
Ln(1+Stock IPOs)		0.009 (0.949)		−0.366* (0.074)		0.035 (0.833)
Ln(1+Bond IPOs)	0.204 (0.403)		−0.403 (0.333)		0.140 (0.517)	
GDP Growth	3.396*** (0.004)	2.866** (0.032)	2.724 (0.321)	3.078 (0.237)	3.686*** (0.002)	2.406 (0.108)
Ln(Stock Index)	1.355*** (0.000)		4.551*** (0.003)		1.542*** (0.000)	
Stock Returns	2.921*** (0.000)		0.781 (0.615)		2.819*** (0.001)	
Ln(Bond Index)		0.888* (0.084)		3.398*** (0.010)		0.477 (0.431)
Bond Volatility		−30.492* (0.080)		−39.826 (0.490)		−15.637 (0.446)
Interest Rate		−36.357 (0.135)		−72.342 (0.289)		−58.671* (0.055)
Post 1873	0.243 (0.278)	−0.663** (0.029)				
Post 1920	1.410*** (0.000)	1.358*** (0.005)			1.455*** (0.000)	1.115** (0.030)
Stock Securities	−0.048*** (0.000)		−0.265*** (0.007)		−0.051*** (0.000)	
Bond Securities		−0.0312 (0.326)		−0.245*** (0.005)		−0.009 (0.824)
Constant	−5.874*** (0.001)	−2.098 (0.544)	−19.351*** (0.003)	−12.229 (0.179)	−6.665*** (0.001)	0.311 (0.941)

Table 10 (continued)

	(1) 1839–1935		(2) 1839–1872		(3) 1873–1935	
	Ln(1 + Stock IPOs)	Ln(1 + Bond IPOs)	Ln(1 + Stock IPOs)	Ln(1 + Bond IPOs)	Ln(1 + Stock IPOs)	Ln(1 + Bond IPOs)
Observations	93	93	30	30	63	63
R^2	0.757	0.474	0.523	0.426	0.708	0.375
Chi^2	241.70	84.61	39.30	39.42	148.75	37.36
P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

This table presents 3SLS regressions explaining the log value of one plus the number of initial offerings, with $P > |t|$ values (in parentheses) and significance levels denoted with ***for 1%, **for 5% and *for 10%. The explanatory variables are 3-year averages. All variables are defined in Table 2

Table 11 3SLS for determinants of initial public stock and bond offerings, with financial firms included

	(1) 1839–1935		(2) 1839–1872		(3) 1873–1935	
	Ln(1+Stock IPOs Fin)	Ln(1+Bond IPOs Fin)	Ln(1+Stock IPOs Fin)	Ln(1+Bond IPOs Fin)	Ln(1+Stock IPOs Fin)	Ln(1+Bond IPOs Fin)
Ln(1+Stock IPOs Fin)		−0.091 (0.495)		−0.431 (0.167)		−0.018 (0.905)
Ln(1+Bond IPOs Fin)	0.066 (0.743)		−0.378 (0.252)		0.127 (0.493)	
GDP Growth	3.088*** (0.000)	2.662*** (0.001)	−0.140 (0.941)	1.317 (0.456)	3.166*** (0.000)	2.241** (0.013)
Ln(Stock Index)	1.472*** (0.000)		3.126*** (0.002)		1.474*** (0.000)	
Stock Returns	1.281*** (0.009)		0.611 (0.493)		1.378*** (0.008)	
Ln(Bond Index)		1.125*** (0.002)		2.908*** (0.000)		0.697* (0.096)
Bond Volatility		−21.055 (0.101)		−40.820 (0.287)		−17.119 (0.251)
Interest Rate		−32.164* (0.086)		−57.524 (0.246)		−53.471** (0.019)
Post 1873	0.147 (0.544)	−0.617** (0.040)				
Post 1920	1.576*** (0.000)	1.611*** (0.000)			1.583*** (0.000)	1.402*** (0.003)
Stock Securities	−0.0481*** (0.000)		−0.149** (0.035)		−0.048*** (0.000)	
Bond Securities		−0.0455** (0.040)		−0.183*** (0.006)		−0.023 (0.378)

Table 11 (continued)

	(1) 1839–1935		(2) 1839–1872		(3) 1873–1935	
	Ln(1 + Stock IPOs Fin)	Ln(1 + Bond IPOs Fin)	Ln(1 + Stock IPOs Fin)	Ln(1 + Bond IPOs Fin)	Ln(1 + Stock IPOs Fin)	Ln(1 + Bond IPOs Fin)
Constant	− 6.199***	− 3.355	− 13.165***	− 10.416**	− 6.172****	− 0.910
	(0.000)	(0.161)	(0.003)	(0.037)	(0.000)	(0.755)
Observations	94	94	31	31	63	63
R^2	0.685	0.451	0.371	0.322	0.670	0.381
Chi^2	199.95	94.58	32.14	29.38	125.05	46.66
P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

This table presents 3SLS regressions explaining the log value of one plus the number of initial offerings (financials included), with $P>|t|$ values (in parentheses) and significance levels denoted with ***for 1%, **for 5% and *for 10%. The explanatory variables are 1-year lagged. All variables are defined in Table 2

Table 12 3SLS for determinants of initial public stock and bond offerings, controlling for foundations

	(1) 1839–1914		(2) 1839–1935	
	Ln(1+Stock IPOs)	Ln(1+Bond IPOs)	Ln(1+Stock IPOs)	Ln(1+Bond IPOs)
Ln(1+Stock IPOs)		0.119 (0.412)		−0.133 (0.397)
Ln(1+Bond IPOs)	−0.270 (0.515)		0.111 (0.578)	
GDP Growth	1.764 (0.204)	0.171 (0.878)	2.984*** (0.000)	2.982*** (0.001)
Ln(Stock Index)	1.440*** (0.007)		1.322*** (0.000)	
Stock Returns	1.222* (0.073)		1.220** (0.012)	
Ln(Bond Index)		2.084*** (0.000)		1.172*** (0.002)
Bond Volatility		10.331 (0.644)		−20.807 (0.113)
Interest Rate		42.070** (0.042)		−27.932 (0.142)
Post 1873	0.025 (0.940)	−0.765*** (0.001)	0.246 (0.287)	−0.6000* (0.054)
Post 1920			1.094*** (0.007)	1.207** (0.021)
Stock Securities	−0.046** (0.011)		−0.047*** (0.000)	
Bond Securities		−0.104*** (0.004)		−0.053** (0.032)
Ln(Foundation)	0.003* (0.055)	0.001 (0.168)		
Ln(Foundation Fin)			0.0004 (0.166)	0.0004 (0.203)
Constant	−5.853** (0.016)	−11.811*** (0.000)	−5.513*** (0.000)	−3.740 (0.133)
Observations	73	73	94	94
R^2	0.593	0.703	0.704	0.410
Chi^2	122.88	184.29	212.18	84.41
P value	0.0000	0.0000	0.0000	0.0000

This table presents 3SLS regressions explaining the log value of one plus the number of initial offerings, with $P>|t|$ values (in parentheses) and significance levels denoted with ***for 1%, **for 5% and *for 10%. The explanatory variables are 1-year lagged. All variables are defined in Table 2

Stock and bond IPOs are mainly used to finance future growth. Moreover, issues are timed to coincide with favorable market conditions, and relatively more stock than bond IPOs are issued in expansionary phases of the business cycle. We also find evidence that the backlog in the number of IPOs due to political uncertainties prior to the First World War, was made up once these uncertainties were resolved in 1919.

Table 13 Determinants of initial public stock and bond offerings, controlling for deposits

	(1) 1876–1935	(2) 1876–1935	
	Ln(1 + Bond IPOs)	Ln(1 + Stock IPOs)	Ln(1 + Bond IPOs)
Ln(1 + Stock IPOs)			− 0.001 (0.998)
Ln(1 + Bond IPOs)		0.197 (0.407)	
GDP Growth	2.235*** (0.010)	2.826*** (0.001)	2.350** (0.014)
Stock Index		1.300*** (0.000)	
Stock Returns		1.559*** (0.003)	
Bond Index	0.792* (0.088)		0.668 (0.306)
Bond Volatility	− 24.235** (0.043)		− 18.664 (0.242)
Interest Rate	− 40.935 (0.146)		− 48.081* (0.055)
Post 1920	1.418* (0.066)	1.500*** (0.000)	1.383** (0.043)
Stock Securities		− 0.045*** (0.000)	
Bond Securities	− 0.020 (0.607)		− 0.025 (0.366)
Ln(Deposits)	− 0.0001 (0.597)		− 0.00003 (0.827)
Constant	− 1.926 (0.557)	− 5.259*** (0.001)	− 0.855 (0.841)
Observations	60	60	60
R^2	0.363	0.699	0.357
Chi^2		125.48	38.67
P value		0.0000	0.0000

This table presents OLS (1) and 3SLS regressions (2) explaining the log value of one plus the number of initial offerings, with $P > |t|$ values (in parentheses) and significance levels denoted with ***for 1%, **for 5% and *for 10%. The explanatory variables are 1-year lagged. All variables are defined in Table 2

Our main findings are that easing regulation for the stock market and for the establishment of limited liability firms in 1873 did not immediately affect the number of IPOs and that stock and bond IPOs were neither complements or substitutes, although stocks were more like bonds than they are today. It is a limitation of our study that we cannot account for the characteristics of individual firms and their effect on the going-public decision. For example, Pagano et al. (1998) compare for the late twentieth century two samples of Italian firms, i.e., firms that went public and that remained private. We recommend that future research in financial history

aims to find financial data of publicly listed and private firms in order to study individual firms' going-public decisions in an historical setting.

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